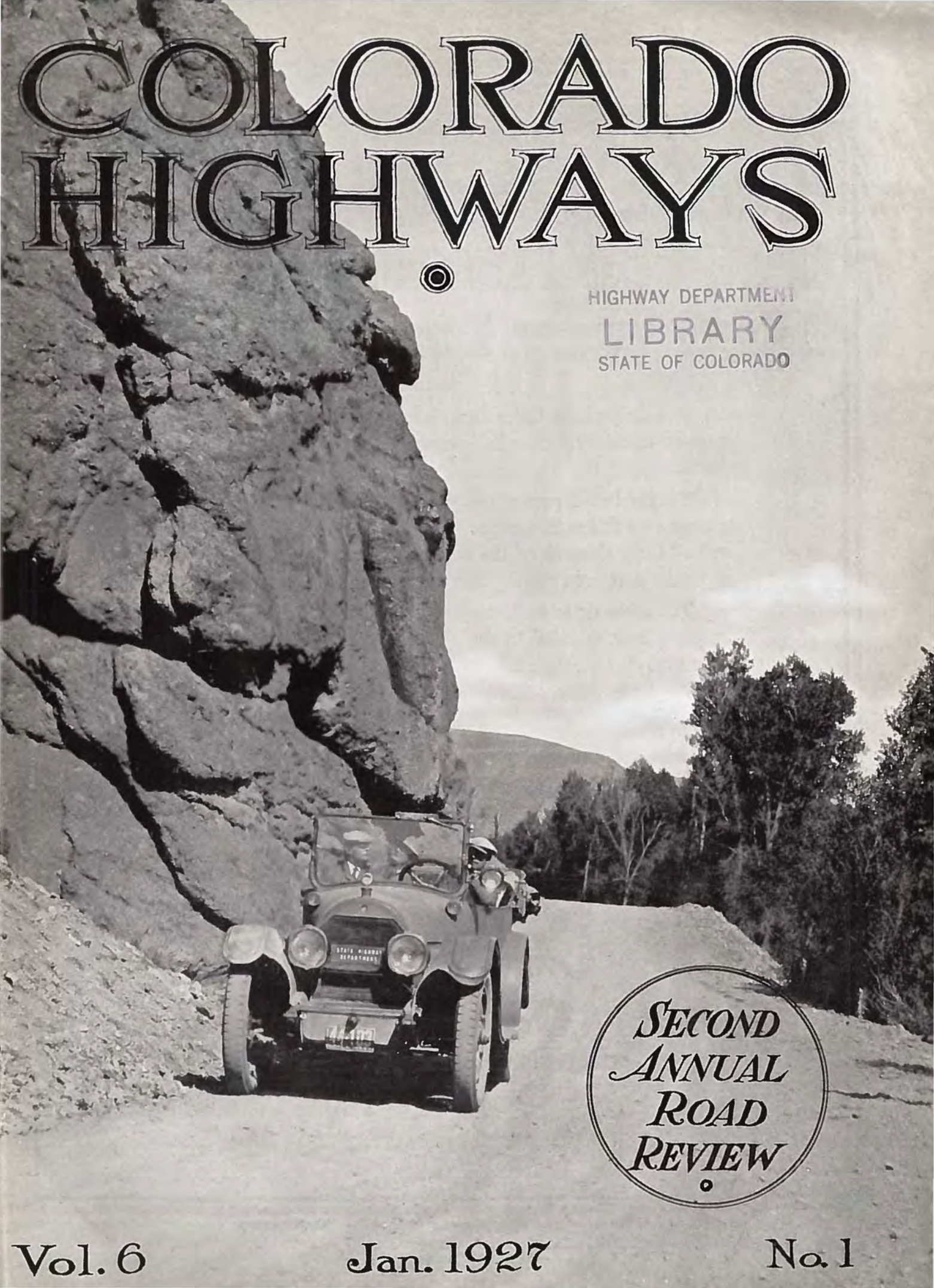
COLORADO HIGHWAYS



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Colorado Highways

"BETTER ROADS"

Official Publication of the
COLORADO STATE HIGHWAY DEPARTMENT
Denver, Colorado

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Colorado Highways
"BETTER ROADS"
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Governor Adams for Good Roads

GOVERNOR William H. ("Billy") Adams has expressed himself definitely in favor of a progressive good roads program throughout Colorado, in a general interview, the first he gave out following his election. The following ideas concerning the state's highways were voiced by the governor, in discussing the situation:

That the roads of the state must be kept up, and that the construction of new roads must continue, but that the overhead expense of the highway system has been too great.

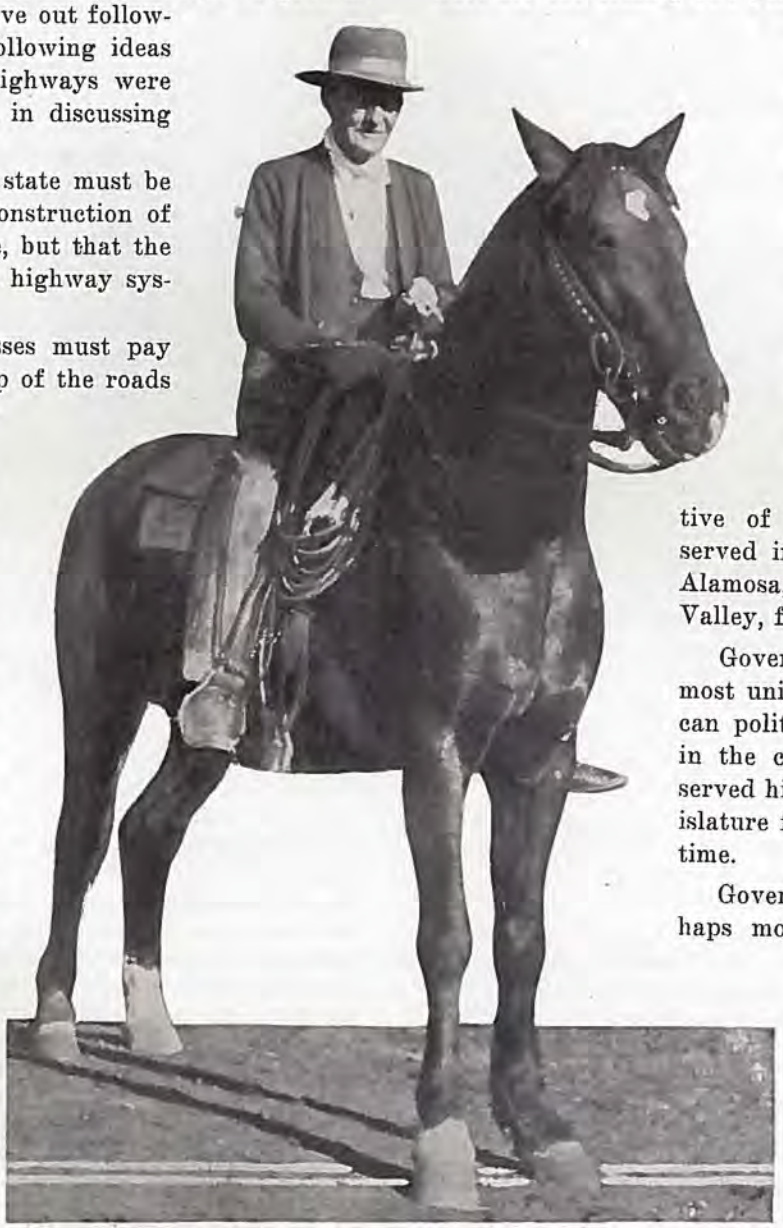
That trucks and busses must pay their share of the upkeep of the roads over which they operate.

"I think we must continue our road building program and also the maintenance of our highways to the best of our ability," said Governor Adams.

"It may be necessary to increase the gasoline tax and the auto license fees to amounts to be determined through conferences with all concerned. I believe some of the overhead expense of the highway department can be eliminated.

"My only aim," he said, "will be to give Colorado the best government it is possible for me to give her."

Governor Adams believes that every state official, whether a member of the legislature or of the executive branch of the government, will serve the state for the coming two years solely for the purpose of bettering Colorado.



Governor William H. "Billy" Adams

He knows that he himself will be there for that purpose, so he is confident affairs of state will move along with little friction.

Elected by the greatest majority of votes ever accorded a governor in Colorado's history — 70,000 majority over his opponent — Governor Adams became the chief executive of the state after having served in the State Senate from Alamosa, the hub of the San Luis Valley, for forty years.

Governor Adams is one of the most unique characters in American politics. No other legislator in the country has continuously served his constituents in the Legislature for such a long period of time.

Governor Adams knows perhaps more intimately than any other man in Colorado the needs and desires of the great mass of people which go to make the Centennial State one of the greatest empires on the face of the earth.

For he has been a ranch owner and cattleman all his life.

Some Major Activities of the State Highway Department

By J. E. Maloney, Assistant Engineer

THE Division Engineers' articles as well as those from the Office Engineer, Bridge Engineer and others, have covered the details of the Federal Aid and State Projects which were under construction during the past working season.

The season has been favorable for construction work. While it was rather late in the spring before work was actually underway, still, the progress during the year was very good.

Of all the Federal Aid Projects that have been budgeted prior to 1926, there remain thirteen under construction at this time, and one, a bridge contract, north of Colorado Springs that is still to be contracted. In the budget of 1926, some 38 Federal Aid Projects were provided for; of these, 28 have been contracted, and 4 completed, while 10 remain to be advertised and let.

The State Projects—some 40 in number—from the previous year's budget, in addition to the 94 projects in the 1926 budget, have all been completed with the exception of 38 which are in progress, and will be carried over into the 1927 season. Most of these State Projects were for small amounts, and in the nature of local improvements, such as grading, drainage and some surfacing.

The season has been free of damaging floods and construction work has progressed very favorably.

One of the notable features of the year was the contracting of the work from Lafayette to the end of the paving, south of Longmont. With the exception of a small stretch through the town of Lafayette, this will complete the grading and drainage structure from Denver to Longmont. The paving of this piece—about 6½ miles, will undoubtedly be taken up in the 1927 budget.

Between Longmont and Berthoud, contracts were let for the paving, and 7½ miles of the 10½ miles were completed this year. The balance of this work will be finished in the coming spring. With the completion of these stretches, the entire road from Denver to Ft. Collins will be paved, thus completing another long stretch of first-class paved road.

Provision was made for funds to grade the balance of our road between Denver and Colorado Springs. The grading and building of drainage structures, have been contracted and is now underway between Castle Rock and Larkspur. From Larkspur to Monument, the plans have been completed, and are now being reviewed. From Monument to the present paving at Husted, will all be under contract by early spring, and completed during the coming season. This will leave but 18 miles of surfaced pavement to be placed to complete the entire stretch from Denver to Colorado Springs, eliminating all surface railroad crossings, and giving a paved surface the entire distance.

Contract was entered into for the continuation of the paving north of Trinidad. This work is practically completed. Some finishing remains to be done—this provides an additional 4 miles of paving, and underpass of the C. & S. Railroad which will be completed during the coming year.

Probably the most dangerous stretch of road between Denver and Steamboat Springs was the very steep, narrow and sinuous piece of road between Hot Sulphur Springs and Parshall. The Department started last year to eliminate this by building through Byers Canon from Hot Sulphur Springs to Parshall. The heavy work through the Canon was completed this season.

Work is now being prosecuted upon the bridge foundations for the Colorado River crossing, and contract will soon be let to complete this piece towards Parshall, thus eliminating this former obstacle to travel between eastern and western points.

The bridge over Bear River south of Craig which has been in progress for the past season, is practically completed at this date, and represents an outstanding improvement for the roads in this vicinity.

Pavement was completed from Pueblo to Avondale during the past season, and the Santa Fe Trail is in an excellent improved condition from Pueblo east to the Pueblo county line, near Fowler.

Another very necessary improvement consisting of a new bridge over the Arkansas River, and paving through the town of Portland, was started late in the season, and is now under construction.

The overhead crossing of the U. P. Railroad at Nunn was completed, as well as the under-crossing of the D. & R. G. W. Railroad at Castle Rock, and the overhead crossing of the D. & R. G. W. Railroad near Portland was contracted and now under construction; also, by re-location of our highway north of Buena Vista, two surface crossings of the D. & R. G. W. Railroad have been eliminated.

Core-drill investigations of concrete slabs and subgrade conditions have been continued during the season. Our investigations of the road materials of the State have been in progress. On these investigations and tests, we have had the co-operation of the Colorado State Agricultural College, University of Colorado, and the Bureau of Public Roads.

On the scenic lines from Denver, I might mention that the work on the road toward Mt. Evans will be continued toward the summit during the next season.

The Forestry Department have several projects under construction which, when completed, will connect Echo Lake with Chicago Creek Road. The completion of this stretch will make available a splendid trip from Denver by way of Echo Lake, Idaho Springs, Bergen Park to Denver.

The old and the new in Colorado highway bridges—these bridges located near Dillon.

Highway Contracts Let in 1926 Totaled 3 Million Dollars

By Roy J. Randall, Office Engineer

DURING the year 1926, the Colorado State Highway Department awarded contracts for 39 Federal Aid Projects and 17 State Aid Projects, making 56 projects in all, amounting to $3,054,404.38, as represented by the totals of the contract prices. The total of the contract prices was 95.12% of the totals of the engineer's estimates on these projects, as compared to 104.71% of the totals of the averages of all bids received.

During the year, 6 Federal Aid Projects for concrete pavements were completed, making a total of approximately 21 miles of this type of construction finished this year. This included paving between Gann and Castle Rock on the Denver-Colorado Springs highway; also, the construction of a railroad underpass under the Santa Fe Railroad, just north of Castle Rock.

There was also constructed an additional 2 miles of paving east of Pueblo, near Avondale on the Santa Fe Trail, together with a short paving entrance to the city of Pueblo.

About 20 miles of grading and drainage was completed west of Ft. Morgan on the Ft. Morgan-Greeley road, and later 4½ miles of this was paved, and the balance amounting to 16 miles was given a sand surface treatment. A short stretch of pavement was laid east of Las Animas, completing the pavement over the new Arkansas River bridge, which was built about three years ago.

Twelve gravel surfaced projects were completed during the year under Federal Aid. These amounted to 50 miles of new gravel surfaced highway. Probably the most important of these is a project 16 miles long between Rifle and Grand Valley.

Another project which should receive special mention is one between Avondale and Huerfano River bridge, approximately 5½ miles. Also, an extension of the new location west from Steamboat Springs, covering 3 miles.

Some of the most expensive work done in the State, is in graded and drained Federal Aid Projects thru mountainous regions. One very important project of this type is known as the Byers Canon Project, the second section of which was completed during the past year. This section was approximately 1¼ miles in length, and cost about $79,000 per mile, being probably the most expensive mile of highway built in the State, if not, in the United States, without any surfacing.

An additional length of grading was completed between Morrison and Baileys, amounting to 5¾ miles. Nineteen and one-quarter miles of grading were completed between Nunn and the Colorado-Wyoming line. This practically completes the grading between Greeley and Cheyenne. Fifteen and one-half miles of grading were completed between Merino and Brush, and a 3-mile grading project was completed east of Palisades, toward DeBeque.

Four major bridge projects were completed, which are listed as follows:

Wild Horse Creek Bridge, west of Pueblo.

Overhead grade separation at Nunn.

Bridge over the Uncompahgre River, west of Montrose.

Muddy Creek Bridge, south of Pueblo.

The year just past was probably the most successful year the Colorado State Highway Department has ever had since its first organization. The Department awarded contracts for a greater value of work than ever before, and all existing records were broken in completing contracts on paving and other projects.

Activities of Bridge Department

By Paul S. Bailey, Bridge Engineer

PLANS for structures the past year affected 25 Federal Aid Projects, 12 State Projects, 2 County Projects, and 5 Forest Aid Projects.

Designs were reviewed, and prepared on 50 major structures, twenty foot span or greater, representing an estimated total of $500,000 for the year; of this amount, $400,000 was for Federal Aid Projects; $60,000 for State, and $40,000 for County and Forest Aid Projects.

Over two miles of Small Box culverts were included in last year's plans, culverts not exceeding six foot clear span, representing 300 culverts in all, and an estimated total of $160,000. Additional small structures amounted to $140,000, making the total amount estimated for drainage structures and railroad grade separations for the year to be $800,000.

In addition to the above, grade separation layouts have been prepared for two crossings north of Monument and plans are well started for a bridge across the Colorado River at the mouth of Byers Canon.

All structures on the State Highway system are made at least 20 feet wide, and designed according to the 1925 distribution of the A. A. S. H. O. specifications for 15 ton trucks, except in a few instances on State Projects not a part of the Federal Aid system, where funds are limited and a 12 ton truck is used.

These trucks assume 80% of the load on the rear wheel and 30% impact.

All material going into the bridges is carefully inspected by specialists in their line, and where possible at the source of supplies; for example, all treated piling and timber is inspected at treating plants, usually on the Pacific coast, and all steel for trusses, etc., is inspected at the fabricating shops and in the rolling mills. Samples are tested from every shipment of reinforcing steel, and cement entering structures at the State University and State Agricultural College laboratories and by local testing laboratories.

The foundation materials upon which all the larger abutments and piers are to rest is usually inspected by a representative of the B. P. R. or the State before the concrete is poured, to insure a suitable material within the limits of the design for that particular structure. This material is in most instances, pre-determined to a certain extent by means of soundings either by a steel rod or preferably by means of a well drilling rig. Last year over 1,500 feet of holes were dug or drilled for this purpose.

Rees Confident Legislature Will Raise Highway Funds

"GOOD roads appear to be one of the greatest issues with which the present Colorado legislature will have to contend, and there is no one thing that pays as large a dividend on the investment as good roads," declares W. L. Rees of Pueblo, the newly elected president of the Colorado Association of County Commissioners.

This statement was contained in a special interview given Colorado Highways by President Rees, who outlined briefly some of his observations regarding highway matters in an exclusive statement to this magazine.

Despite the fact that President Rees was ill during the Christmas holiday season, he was kind enough to dictate a statement from a sick bed, expressing his opinions concerning the present critical highway situation in the state.

For the past twenty years Mr. Rees has been prominently identified with road matters in Colorado. Everyone is familiar with the tremendous advance made in the construction and improvement of highways throughout the state during the past five years, by the state highway department. Mr. Rees has been one of the leaders in the extensive improvement in the Pueblo county roads during this period.

At the recent convention of the Colorado Association of County Commissioners, Mr. Rees, who is a member of the board of county commissioners for Pueblo county, was elected to the presidency of the Colorado Association, to succeed Dan Straight of Greeley.

Highlights in President Rees' statement concerning highway matters in Colorado at the present time, included the following:

"On the four divisions of government—the legislative, the executive, the state highway department and the county commissioners—depends entirely whether or not we have good roads and better highways in the state.

"It devolves upon the legislature to provide the necessary revenue to meet federal aid projects, and also to provide sufficient funds for the state highway department for the betterment of state roads.

"It devolves upon the county commissioners to provide revenue suficient to meet the state appropriations for the benefit of state highways.

"I believe that the amount of money received by the different counties from the state at the present time for maintenance and betterment of state roads is insufficient to meet the needs of the counties on a 50-50 basis and do justice to the roads. I believe the commissioners of the state would object strenuously to any change of the distribution of funds.

"It is unfortunate that the different branches of government interested in highway matters have not always been able to cooperate more efficiently for the good of the state.

"Being optimistic, I believe that the legislature and the executive which we have elected have the ability to work out a plan that will not only meet the emergency and supply funds to meet federal aid, but provide ample means also for the future.

"I also believe that the commissioners of the state have all confidence in the present legislature, and feel that they will be able to meet all the requirements necessary to provide revenue for better roads."

Year's Road Improvement Work Reviewed by Federal Bureau

FEDERAL aid highway projects completed in Colorado during 1926 represented an approximate total mileage of 158.5 miles and an approximate total cost of $2,981,545, according to the records of the office of District Engineer J. W. Johnson of the U. S. Bureau of Public Roads, in Denver. These totals include all types of federal aid highway construction.

In New Mexico, which is also under jurisdiction of the Denver office, a much larger program of federal aid highway work was undertaken during the year just ended than in 1925, largely on account of the increase in the gasoline tax in that state to 3 cents a gallon, all of which goes to the state highway department.

Considerable federal aid construction was also completed in Wyoming; the third state in this federal bureau district. Figures summarizing the extent of the construction work in New Mexico and Wyoming will be available in the near future.

Records of the office here show that $8,745,910 represents the total federal aid payments to the State of Colorado on vouchers submitted by the state highway department from the year 1918 to Dec. 1, 1926. Colorado, however, has obligated herself for considerably more federal aid money, which will be available from time to time when highway progress on various projects warrants the issuance of further vouchers.

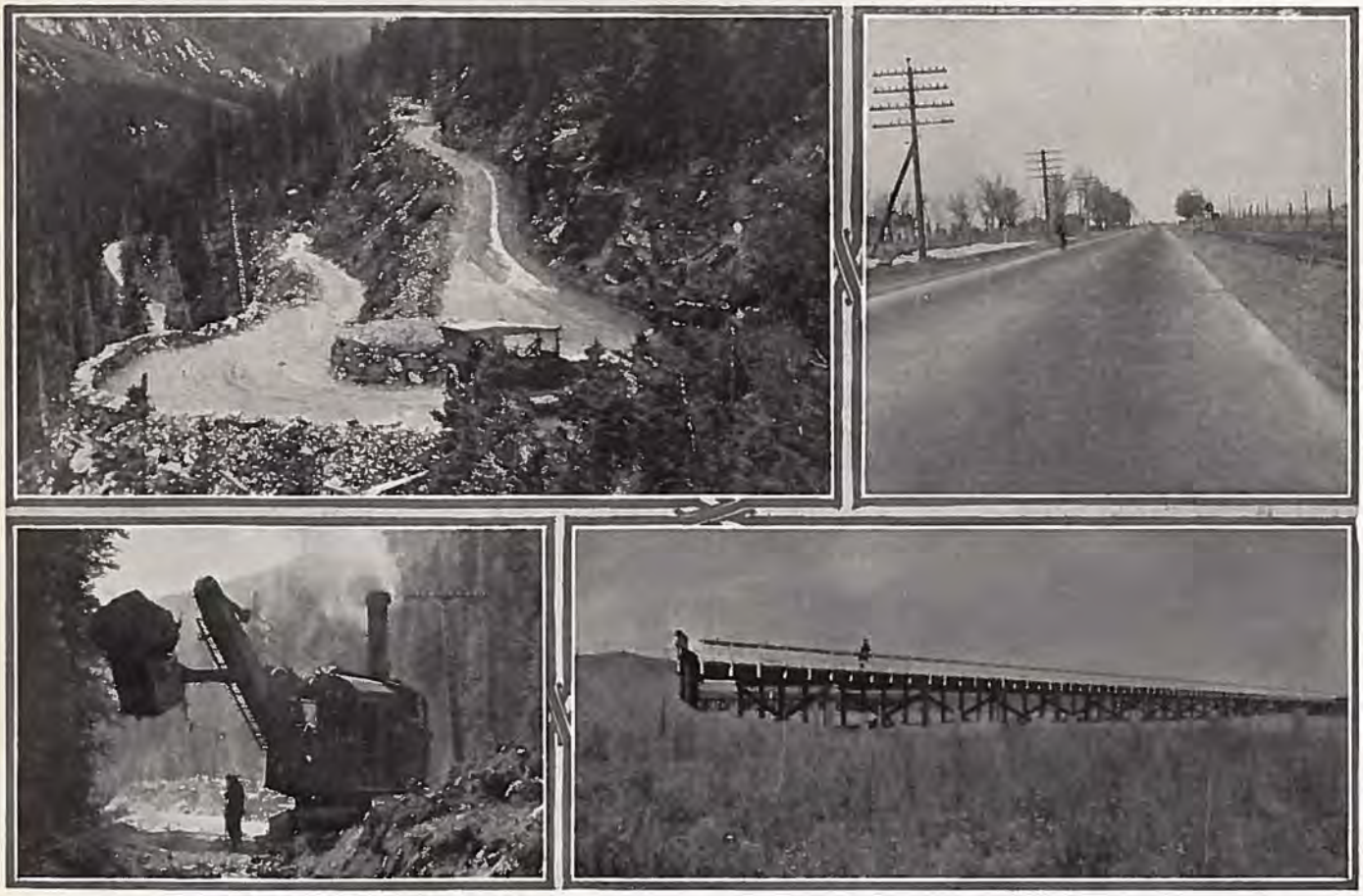
Such payments of federal aid funds to the state highway department during the last few years have totaled as follows: $1,261,461 for 1921; $1,362,801 for 1922; $1,020,426 for 1923; $1,656,901 for 1924; $1,455,071 for 1925; and $949,588 for the year 1926, up to December 1.

The bureau reports that a grand total of 926.5 miles of all types of federal aid projects have been completed throughout Colorado since federal aid was first offered the state, to December 1, 1926.

Federal aid projects in Colorado under construction and not completed on Dec. 1, 1926 represented a total of 93.2 miles and a total estimated cost of $2,248,450.

This total mileage includes 10.4 miles of grading, 21.1 miles of concrete paving, 48.9 miles of gravel surfacing and 7.1 miles of bituminous construction.

During 1926, in Colorado, the bureau reports federal aid projects completed as including a total of approximately 50.9 miles of concrete paving work, costing $1,631,930; a total of 49.8 miles of graded and drained highways costing $562,500; a total of 31.4 miles of gravel surfaced roads costing $404,655, and 18.6 miles of crushed rock work costing $186,500.



Scenes on Colorado roads: Upper left—Boulder county road near Rollinsville; upper right—East of Denver in Adams County; lower left—Steam shovel on Wolf Creek Pass; lower right—Bridge near Bennett, Colo.

Commissioners Discuss Highways, Ask Road Fund of Assembly

MEMBERS of the Colorado State Association of County Commissioners, meeting in annual convention, at the State Capitol, Dec. 14, 15 and 16, discussed in detail the present critical financial stringency faced by the state highway department, and concluded by adopting a resolution urging the state legislature to enact emergency legislation to raise required additional highway funds.

Many other mutual problems were also discussed by the county commissioners. A joint session was held with county clerks, sheriffs, treasurers, attorneys and assessors.

It was pointed out by various speakers on the convention program that unless more money was raised in the immediate future by emergency legislative action that Colorado would lose more than $1,000,000 in federal aid funds which are available for use on highways within the state, on condition that the state appropriate an equal sum for use on the same roads.

Although Governor William H. ("Billy") Adams of Alamosa, was unable to address the convention, State Senator John Tobin of Montrose stated that he was sure a way out of the present highway crisis would be found by the governor and the legislature.

Major Louis D. Blauvelt, state highway engineer, who was recently elected president of the American Association of State Highway Officials, was one of the principal speakers at the convention. A detailed account of his speech will be found in another place in this issue of COLORADO HIGHWAYS.

Commissioner Dan Straight of Greeley, president of the association during the past year, opened the discussion of the urgent need for more highway revenue with which to meet federal aid appropriations and continue Colorado's present progressive system of highway construction and maintenance.

President Straight urged the county commissioners and other county officials present to work for an adequate amount of revenue for highway purposes, to save our state from the ignominy of trailing behind the rest of the United States in road building progress.

"Colorado is on the verge of a road building 'vacation' and nothing could be more disastrous," said Mr. Straight. "It is up to the legislature and the chief executive of the state to see to it that funds are raised for building roads.

"We pay for good roads whether we have them or not. The cost of operating over bad roads would pay for good ones. In the long run we pay the highest price on those that are least improved.

"I hope," he continued, "that the legislature will realize the real importance to the whole State of Colorado of the continuation of the road building program, and appreciate fully that the question is bigger than any individual, politician, association or political party.

"The people of Colorado are vitally concerned with the improvement of their roads, and undoubtedly will back safe, sane and constructive road building legislation."

Various speakers mentioned that the defeat of the proposed "Pay-As-We-Go" plan of raising highway funds, in the November election, left the state highway department with only $1,800,000 for highway activities during 1927, compared with an expenditure of approximately $5,000,000 during 1926.

The sale and expenditure of the last of the highway bonds authorized by vote of the people in 1922, very materially reduces the income of the highway department. This makes it impossible for the state to match on a 50-50 basis the $1,350,000 in federal aid funds now available to Colorado. Another federal aid appropriation of substantially the same amount will be available to Colorado next July.

Both federal aid appropriations will be lost by the state unless the legislature authorizes emergency measures of raising additional funds, it was pointed out.

Frank Blair, chairman of the state highway advisory board; June Johnson, district engineer for the U. S. Bureau of Public Roads, and many other good roads enthusiasts also spoke.

During his address before the commisioners, Leslie Hubbard, former attorney general of Colorado, and prominent officer of the Colorado Good Roads Association, said:

'The first measure the forthcoming legislature should pass is a measure providing for a million and a half dollars for matching, dollar for dollar, the federal aid appropriation, for the continuance of federal aid highway projects throughout the state.

"Colorado is the home of the tourist, and we must have good roads if thousands of visitors are to continue to come here for their vacations.

"This necessary money must be raised immediately by the legislature to permit the state to continue its road work on a proper scale throughout the new year."

During the convention the visiting delegates were entertained at a banquet given by the R. Hardesty Manufacturing company, at the Albany hotel, and at a luncheon given by the H. W. Moore Equipment company, at its plant. Both affairs were heartily enjoyed by the commissioners from every section of the state.

Other addresses before the convention included speeches by Attorney General W. L. Boatright, E. B. Morgan, chairman of the state tax commission, and addresses by a number of the commissioners themselves.

The newly elected officers for the coming year are announced as follows:

W. L. Rees, Pueblo, president.

H. Emperius, Alamosa, first vice president; G. W. Huntley, Flagler, second vice president; G. Grigg, Brighton, third vice president.

Tony Monnell, Montrose, re-elected secretary-treasurer for the sixteenth time.

The following resolutions were adopted:

RESOLUTION No. 1

WHEREAS, It has been represented to this body that sufficient funds will not be available during the years 1926 and 1927 or thereafter with which to meet Federal Aid on our state highways:

AND, WHEREAS, It is the sense of this body that Colorado should not allow our portion of Federal money to be diverted to other channels;

NOW, THEREFORE, BE IT RESOLVED, That the incoming legislature be requested to provide emergency means for meeting the Federal requirements, either by an additional gasoline tax or by such other methods as will produce the necessary revenue.

RESOLUTION No. 2

RESOLVED, That we recommend a measure which will protect the state against loss in the collection of gasoline tax, such protection to be obtained either by the elimination of any form of credit or by the requirement of a suitable bond from the wholesaler which will insure or guarantee such tax payment.

RESOLUTION No. 3

WHEREAS, The counties of this state suffer great losses each year by the non-payment of personal property taxes;

AND WHEREAS, The optional feature of our present distraint law is embarrassing to county treasurers as well as inconvenient politically;

NOW, THEREFORE, BE IT RESOLVED, That it is the sense of this convention that the present law should be amended so as to be mandatory instead of optional.

RESOLUTION No. 4

WHEREAS, The bus and truck and the fidelity bonding bills have long been a part of our program;

AND WHEREAS, Both of these measures were almost unanimously approved by the last legislative assembly, only to be vetoed by the Governor;

NOW, THEREFORE, BE IT RESOLVED, That we recommend the re-introduction of both of these measures when the legislature next convenes.

RESOLUTION No. 5

RESOLVED, That this Association endorse all of the recommendations of the County Clerks' Association, *except* that part of same calling for the repeal of the Torrens Act, which we do not endorse.

RESOLUTION No. 6

We recommend an addition to the by-laws of the Association to read as follows:

> "Every County Commissioner of the State of Colorado who has served eight continuous years in said office shall be an honorary life member of this organization."

RESOLUTION No. 7

BE IT RESOLVED, That this convention express its appreciation to the officers and committees of this organization for their untiring efforts exerted in behalf of the County Commissioners' organization since our last meeting;

AND BE IT FURTHER RESOLVED, That we compliment our officers for their splendid conduct of this meeting and for the very interesting and beneficial program which we have so much enjoyed at this session.

Scene on Berthoud Pass—one of the finest mountain highways in the world.

Summary of Past Year's Work as Reported by Division Engineers

Division No. 1

(By J. P. Donovan, Division Engineer, Denver)

THE construction season for 1926, just completed, shows considerable progress on much important work within the limits of Engineering Division No. 1, in which are included Adams, Arapahoe, Boulder, Clear Creek and Jefferson Counties.

On the Denver-Fort Collins highway, after over a year of litigation, work was commenced on the realignment of the highway between Lafayette and Longmont, eliminating dangerous curves and cutting the mileage between Longmont and Boulder considerably, and providing a roadbed which, after the time necessary for settlement has elapsed, should make a firm base for the concrete pavement which will ultimately be built.

Another notable project was the completion of another link of the Denver-Morrison-Baileys road, reducing the maximum grade of the old road from 26% in the vicinity of Shaffer's Crossing to 6%, and providing a modern high speed traffic artery.

Exceptional also is the good progress on paving the six mile contract between Longmont and Berthoud, which will complete the pavement between those towns. The contract is about 50% completed.

The pavement between Denver and Fort Logan was finally completed in the early part of the construction season, thus providing a quick, safe connection between this city and the most important military post in this vicinity.

During the season, convicts from the state penitentiary, at Canon City, were employed on two projects, one of heavy mountain grading work on the road between Golden and Black Hawk, known as the Guy Hill road; the other project was a link in the road between Silver Plume and the summit of Loveland Pass; and neither project was completed.

To the east, twelve miles of grading were completed on the Air Line road, which is an extension of Colfax Avenue in Denver. Surfacing this project is now under way.

The most notable mountain project in the vicinity during the year was the extension of work on the Mount Evans road from Campion Pass toward the top. The survey was completed under the most difficult conditions; plans were drawn; and the contract was awarded in so short a time as to set an unquestionable record for such work in the Department. Little progress was made on construction, however, due to the unusually early inclement weather, but everything is ready for good progress next year.

Another link in the road between Denver and Arvada and Rollinsville, via Coal Creek, was completed, eliminating two bridges, steep grades, bad curves and narrow road for a distance of about 1¼ miles at the mouth of Coal Creek Canon.

A wooden pile trestle bridge was completed across Middle Bijou Creek, on State Highway No. 8, about five miles west of Deer Trail; considerable work was done on the existing road between Rollinsville and the East Portal of the Moffat Tunnel; a small appropriation was spent in widening curves on the road between Boulder and Nederland; Wadsworth Avenue, in Jefferson County, was graveled with a small appropriation; the pavement through the town of Arvada was completed partly with state money, and various other small projects were completed.

In cooperation with the Bureau of Public Roads, work was completed on one link of the road between Echo Lake and Idaho Springs, and was started on the next link; also work was completed on the Fern Cliff section of the Raymonds-Allens Park-Estes Park road; construction was started on another link of the same road; and also on a link of the Raymonds-Pleasant Park-Ward road.

This is a bare summary within a small compass of the most important work in the Division for the year, as is evidenced by the fact that during the year eight Federal Aid Projects and twenty-six State Projects had work of various sorts done on them. At the end of the year six Federal Aid Projects and fourteen State Projects are uncompleted; of these construction has been started on three Federal Aid Projects and nine State Projects, several of which are practically completed.

Division No. 2

(By John J. Vandemoer, Division Engineer, Grand Junction)

THIS Division consists of the Counties of Delta, Gunnison, Hinsdale, Mesa, Montrose, Ouray and San Miguel.

The major projects handled in the above counties during 1926 consist of the following:

In Delta County, $60,000 of Federal Aid and State Funds are being expended for the grading and graveling of six miles of State Highway No. 6, between Delta and Grand Junction. This project begins at the north end of the seven mile Federal Aid grading and graveling project, which was completed a few years ago.

One more Federal Aid project of seven miles, following the one that is already under construction, will improve this adobe road, as far as the Delta-Mesa County line.

In Gunnison County, $80,000 of Federal Aid and State Funds, have been set aside, for the grading and graveling of the first three miles west of the town of Gunnison, on State Highway No. 6. This improvement will eliminate two railroad grade crossings.

When all the Federal Aid work now on hand in Gunnison County is complete, there will be only about five miles between Cebolla and Sapinero, to connect up Gunnison and Sapinero with a Federal Aid road.

The most important State Project in this district is located in Gunnison County, and consists of the steam shovel improvement from the Montrose-Gunnison County line to the Half Way House, on State Highway No. 6.

This work has been carried on for the last two years under the supervision of the Maintenance Department.

In Mesa County, the most important Federal Aid Project consists of the grading improvement from State Bridge above Palisade, on State Highway No. 4, up the Colorado River toward the mouth of Plateau Creek.

The first unit of this project was completed early in the year.

In Montrose County, $50,000 of Federal Aid and State Funds are being expended on State Highway No. 6 between Cimarron and Cerro Summit.

In Ouray County, $25,000 of Federal Aid and State Funds are being expended for a bridge across the Uncompahgre River together with necessary grading and surfacing, just south of Kelly Trail on State Highway No. 19.

In San Miguel County, Keystone Hill, between Placerville and Telluride on State Highway No. 145 has been widened out in good shape by Steam Shovel No. 3, under the supervision of the Maintenance Department.

About 4½ miles of road were widened at a cost of $9,314.00.

In Hinsdale County, $3,000 of State Funds have been expended through county forces, in the improvement of State Highway No. 149, between Lake City and the Hinsdale-Mineral County line.

From 1920 to 1926, inclusive, 100 miles of Federal Aid road have been constructed in this division at a cost of $1,833,200, which is an average cost per mile of $18,332.00.

Division No. 3

(By J. R. Cheney, Division Engineer, Durango)

THIS Division includes eleven counties in the southwestern corner of the state and comprises the two natural geographic units known as the San Luis Valley and the San Juan Basin. The San Luis Valley is that well known spot in the state where they cannot raise pumpkins because the vines grow so fast that they wear the pumpkins out dragging them along the ground. The San Juan Basin west of the continental divide is the spot west of the Mississippi River most richly endowed by nature with an abundance and variety of natural resources.

The Division contains about 1,480 miles of State Highways, the bulk of which are on the seven per cent or Federal Aid

(Continued on Page 14)

CATERPILLAR
REG. U.S. PAT. OFF.

War Against Winter

Old-fashioned winters are out of date! Yes, there's just as much snowfall as ever—but men have discovered that they need not suffer disturbed business and delayed transportation.

"Caterpillar" Tractors and improved snow plows have provided the weapons to successfully challenge the rule of the snow. This equipment makes it possible to effectively and economically *keep the winter roads open!*

Literature on Snow Removal and catalogs of "Caterpillar" Tractors will gladly be sent to anyone interested.

Ready Power-

EVERYWHERE, whe
work call for power,
the job—*put* on the
famous records of achieveme
of their inbuilt stamina. Th
Tractor has the choice fro
types to meet a broad rang
range of power at the drawb

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CATERPILLAR
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-Steady Power

re farm, forest and highway "Caterpillar" Tractors are on job because of their world-nt; *staying* on the job because purchaser of a "Caterpillar" n a complete line—sizes and of requirements. Offering a ar from 15 to 50 horsepower.

Clinton & Held Co.

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Road Building Machinery and Contractors' Equipment

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Time Saved Is Money Earned!

"CATERPILLAR" TRACTORS

supply *plentiful* power.

In short seasons they can work overtime —at a profit.

Sure traction conquers rough or soft ground—*dependability* prevents undue time for repair or adjustment.

They pay a bonus of quicker work and better work—these things in turn mean hard cash.

New literature and catalogs will gladly be sent you.

Summary of Past Year's Work

(Continued from Page 10)

system. There were four Federal Aid Projects carried into this season from the 1925 budget. Three of these were completed as gravel surfacing jobs and one will carry over around eighty per cent complete to be finished early next season.

Of the five Federal Aid jobs in the 1926 budget one was completed, two will carry over winter about fifty to sixty per cent complete, one was just recently started and will be worked on throughout the winter when the weather will permit and the fifth being at a high altitude will not be opened up until spring.

The total mileage of gravel surfaced road completed this season and opened to travel was 8.2 miles with 19.2 miles in various stages of construction to be completed next season.

The nine Federal Aid jobs are located as follows: Two on the west slope of La Veta pass, one between La Jara and Romeo on the road to Cumbres pass, one between Pagosa Springs and the foot of Wolf Creek pass, one between Durango and Bayfield, one between Durango and Mancos and two between Mancos and Cortez. The last is located near the top of Red Mountain pass between Silverton and Ouray. Seven of them are on Highway No. 10 which is the main trunk highway leading through this division from east to west.

In addition to the above Federal Aid jobs twelve small State Projects were budgeted this year of which nine were completed, two are under construction and one will go over to next season.

Division No. 4

(By James D. Bell, Division Engineer, Pueblo)

DIVISION No. 4, consisting of the counties of Baca, Bent, Crowley, Custer, Fremont, Huerfano, Kiowa, Las Animas, Otero, Prowers and Pueblo, has seen the completion during 1926 of nine Federal Aid and eleven State Projects.

Of the nine Federal Aid Projects completed, three were hard surfacing, four were gravel surfacing and two were concrete bridges. The two concrete bridges were each 108 feet in length and replaced old bridges which had become inadequate.

Two and seventy-nine hudredths miles of concrete paving on the Santa Fe Trail east of Pueblo in Pueblo County now makes a continuous stretch of paving from the Pueblo city limits east to a point within two miles of Avondale.

A concrete paving project was completed east of Las Animas, in Bent County. Three and a half miles of gravel surfacing were completed between Walsenburg and La Veta, 2.2 miles between Trinidad and La Junta on the Trinidad-La Junta road; 5.4 miles between Avondale and the Huerfano River, including a 100 foot concrete bridge and 1.3 miles in Fremont County from the Pueblo County line west to the Beaver Creek bridge.

This last project while not long, involved a great amount of earth work and has eliminated a very narrow and dangerous side hill road, and connects with previous improvements extending to Portland. The 5.4 miles of surfacing between Avondale and the Huerfano river connects with previous improvements extending to the Otero county line.

At the present time there are five Federal Aid Projects under construction. Early in 1927, 6.7 miles of "black top" on concrete base, north of Trinidad in Las Animas County will be completed, with the exception of short pieces of paving at the bridge approaches. This project includes 4 bridges, an 80-foot steel truss, a 60-foot steel truss, a 6 -foot concrete pile and a 100 foot concrete pile. About 4.5 miles of this project was relocated to eliminate two main line crossings of the D. & R. G. W. Railroad.

Three and three-tenths miles of surfacing between La Veta and Walsenburg is under way. Four and four-tenths miles of surfacing about 20 miles south of Pueblo has just been started and a subway under the C. & S. Railroad about 5 miles north of Trinidad has been started. At Portland an overhead crossing of the D. & R. G. W. Railroad is now being constructed and paving through Portland will be laid next spring.

Of State Projects completed a 20 mile grading project, 16 mile grading and sand surfacing, and a 50 foot steel bridge, were in Baca County. In Kiowa County 26 miles of grading, 17 miles of sand surfacing and a 116 foot timber bridge, were completed. In Crowley County 10 miles of grading and sand surfacing and a concrete culvert were completed.

In Fremont county convict labor has been at work from the first of the year widening and straightening the river road between Parkdale and Salida. A 60 foot steel bridge has replaced an old timber bridge of many props and much wire in Bumback Canon about 10 miles west of Canon City. In Phantom Canon, Fremont County and the highway department have made 3 short relocations which have eliminated 6 bridges.

In Huerfano county four miles of road were straightened, graded and surfaced, from Walsenburg northwest on the Westcliffe road.

In Custer County, Jackson hill, near the Pueblo County line, has been relocated and construction is now underway. The new location will reduce the grade from a maximum 15 per cent to a 6 per cent and do away with many sharp turns.

As in previous years practically all sand surfacing has been hauled with farm teams and labor and the pay has been on a yard mile basis. This has aided farm labor and made it possible to complete the work more quickly.

The County Commissioners of the Division have heartily cooperated with the Department in every way possible.

Division No. 5

(By Ernest Montgomery, Division Engineer, Colorado Springs)

THE major project for the year was the paving on the Colorado Springs-Denver road from Husted north to Monument.

An 80 foot concrete pile bridge and three double 10x10 foot concrete box culverts were the important structures of the project.

The next project of importance was the completion of a high type graded and partially surfaced road from Hugo east to the Lincoln-Cheyenne County line.

Seven miles of this was done by contract and the remainder, about 19 miles, was done by State and County forces. This project completes the road from the Kansas State line to Limon, a distance of 108 miles of a high class graded and nearly all surfaced road and of which it is anticipated will be open all the year.

A very important project was started and carried ahead as far as the money would permit, on road No. 8 in Elbert County in the vicinity of Agate, east and west, most of it being done with State and County forces.

Another important project between Divide and Florissant was finished and opened to traffic. This consisted of rehabitulating nine miles of the abandoned Midland railroad grade, which necessitated rebuilding eighteen bridges, widening rock cuts and some minor changes of alignment.

A sixty foot steel bridge with two twenty foot approach spans was built on the Farmers Highway in Lincoln County over Horse Creek, about fifty miles east of Colorado Springs.

A Federal Aid Project in Chaffee County north of Buena Vista was contracted and much work done. This project will eliminate the two railroad grade crossings as well as improve the worst stretch of road in the division.

A new bridge, steel and concrete, was built at Cascade and much betterment work done in connection with it.

Division No. 6

(By H. L. Jeness, Division Engineer, Glenwood Springs)

IN THIS Division during the year 1926 five Federal Aid Projects and 17 State Projects have been completed.

Weather conditions this year have been such that construction work has progressed with very little delay, the season just closed being the longest working season we have enjoyed for several years.

In June Federal Aid Project No. 253-B was completed. This project is located in Routt County and extends from Brooksston to Milner, a distance of 3.063 miles, is a graded and crushed gravel surfaced project and an important link in the highway from Steamboat Springs to Hayden.

This project joins Federal Aid Project No. 253-A and completes a section ten miles in length of improved crushed gravel surfaced highway between Steamboat Springs and Milner.

There were on this project four treated timber pile bridges over the branches of Elk River.

The last of June Federal Aid Project No. 261-A was completed. This project was the longest crushed gravel surfaced project built in this Division, extending from Rifle to Grand Valley, a distance of 16 miles, and completes a section of improved highway extending from Rifle to DeBeque, a distance of 28.8 miles, 21 miles of which is crushed gravel surfaced.

This project is a very important improvement, as it serves the section of the State where extensive oil shale operations are being carried on, is on the main highway between Leadville and Grand Junction and materially shortens the running time between Glenwood Springs and Grand Junction.

(Continued on Page 16)

Summary of Past Year's Work

(Continued from Page 14)

Federal Aid Project No. 282-B was completed in October and is a grading and crushed gravel surfacing project extending through and west of Meeker in Rio Blanco County and is 2.932 miles in length.

This project is a section of the highway from Rifle to Meeker and serves traffic to the White River and Trappers Lake fishing and hunting grounds and also serves traffic to the Craig oil fields.

November 17th saw the completion of Federal Aid Project No. 254-B, which completes the last of the heavy rock work in Byers Canon in Grand County and was 1.274 miles in length.

This project consisted of some of the heaviest rock work in the tsate, being through Byers Canon of the Colorado River and is one of the most scenic highways in Colorado. Two years and one-half have been spent in the construction of the highway through this canon and it is now completed to the bridge site where a bridge is being constructed across the Colorado River.

Federal Aid Project No. 282-C completed November 30, is a crushed gravel surfaced project 4.052 miles in length in Garfield County, beginning 2 miles north of Rifle and extending north toward Meeker on the Rifle-Meeker highway. This project improves a link in a very important commercial highway, as Meeker, being without railroad connections, it is necessary that most all mail, supplies, etc., be transported over this highway between Rifle and Meeker.

State Projects constructed during the season consisted of small improvements located in the nine counties of this Division.

Division No. 7

(By A. B. Collins, Division Engineer, Greeley)

WITH ideal working conditions prevailing during the greater part of the construction season of 1926, both State and Federal Aid Projects in Colorado Highway Engineering Division No. 7 were, with one exception, pushed to early completion.

In the matter of State Projects, Division No. 7 was again fortunate in securing 100% co-operation from the Boards of County Commissioners of the various counties, and the state appropriation of $51,000 awarded to the Division was met with a like amount, creating a total fund for state projects of $102,000.

In addition to this an item of $12,500, met with an equal amount by Weld County, and designed to surface Federal Aid Project 286-B, State Road No. 3 from Nunn north to the Colorado-Wyoming line, was carried over from the 1925 budget. This created a total state fund for the 1926 construction period of $127,000.

The principal work conducted under this award consisted of grading and crushed rock surfacing of State Road No. 16, along new location, from Greeley west to the Weld County line. Due to hazardous snow conditions, the new road was elevated from two to three feet above the surrounding country. With a joint appropriation of $26,000, six and one-half miles of road was graded, of which four and one-half miles had been surfaced with crushed rock. One 65-foot 35°-skew, creosoted pile bridge, and a 50-foot clear span steel I-beam bridge, together with eight minor structures, have been completed on this work.

Another important co-operative state project completed this season was the surfacing with crushed rock of State Road No. 3, from Nunn north to the Colorado-Wyoming line, a distance of twenty miles.

On State Road No. 14, in Weld County, between Buckingham and Purcell, a joint appropriation of $25,000 was expended in grading thirty-two and one-half miles, and surfacing, with pit-run material, twenty and one-half miles of this graded section. This improvement, together with that of State Project No. 637, Sterling west to the Weld County line in Logan County, which project was provided with a total appropriation of $4,000, and consists of regrading and surfacing four miles, brings State Road No. 14 to an advanced stage towards completion.

State Project No. 638, in Morgan County, carrying a total appropriation of $9,000, and including twelve miles of grading and surfacing on State Road No. 52, from Fort Morgan north to New Raymer, joins State Road No. 14 at that point connecting two important east and west units at their central points in northeastern Colorado.

State Project No. 573, consisting of fourteen miles of grading in Sedgwick

(Continued on Page 18)

Summary of Past Year's Work

(Continued from Page 16)

County, also on State Road No. 59, under a combined budget of $4,000.

On State Road No. 63, State Projects Nos. 570 and 576, the first consisting of eight and one-half miles of surfacing south from Atwood, with a total appropriation of $5,000, and the latter, consisting of sixteen miles of grading and surfacing north and south of Akron, with a total appropriation of $12,000, form a connecting link between State Road No. 2 and State Road No. 102, which is the Kansas City Air Line, and which was improved across the entire county of Yuma, under gravel surfacing project No. 582, at a cost for which $6,000 was appropriated.

On the western side of the Division, State Project No. 562, in Larimer County, consisting of eight miles of grading, six and one-half miles of which was also surfaced, from Loveland towards the Big Thompson Canon, while not completed due to the exhaustion of the $16,000 appropriation prior to completion, constitutes an initial step towards the ultimate improvement of the principal highway into the Rocky Mountain National Park Region.

A number of Federal Aid Projects were also active in the Division this season, practically all of which were completed.

F. A. P. 283-B, consisting of over four miles of concrete paving on State Road No. 1, was constructed at a total cost of approximately $150,000, and forms a link in the permanent improvement of the road between Denver and Fort Collins.

On State Road No. 2, Greeley eastward toward Sterling, there were a number of Federal Aid Projects. 287-A, in two construction Divisions, graded, drained, and surfaced, four miles of which was concrete, approximately twenty miles of new located highway west from Fort Morgan. The combined cost on these two divisions was approximately $240,000. 287-B, consisting of seven and one-half miles of grading and drainage, together with an 805-foot, creosoted piling, concrete deck bridge, was constructed at an approximate cost of $127,000, and extends easterly from Greeley to a point two miles beyond Kersey. 287-C, preliminary surveys for which were completed this season, connects the above project with 287-A, wtst from Fort Morgan. 288-A consisting of 18.7 miles of grading and drainage between Brush and Merino, having been started during 1925, was completed this season. This improvement was supplemented this season by 288-A & B, a combined paving project of over five miles. Approximate costs on this section totaled $250,000.

On State Road No. 3, Federal Aid Projects Nos. 286-A and 286-B, the former providing for an overhead R. R. crossing north of Nunn, and the latter consisting of about twenty miles of grading and drainage from Nunn north to the state line, were completed this year. The total approximate costs of these projects was $140,000, and together with State Project No. 578, heretofore mentioned, complete the improvement of this Highway from Denver north to the Colorado-Wyoming line.

F. A. P. No. 144-A, a four and one-half mile grading and surfacing project on State Road No. 123, north and west of Fort Collins, was started late in the season. Upon completion this project will form a unit in an improvement which will ultimately provide a highway from Fort Collins to Laramie, Wyo.

An interesting feature of this Federal Aid Construction, and also the state projects, is the elevation of grades to a point where snow hazards will be at a minimum, thus providing improved highways for all-year traffic.

Following the established custom of the Department, all state projects were conducted with the joint use of state and county-owned equipment, on a cost basis, and all Federal Aid projects were contracted, determined by a competitive unit price bid.

THE SHINING EXCEPTION

"Did any of your family ever make a brilliant marriage?"

"Only my wife."

—Boston Evening Transcript.

Attorney—Where was the prisoner milking the cow?

Witness—A little back of the center, sir.

The Same

One day I chanced to pass
A beaver damming a river;
A man who had run out of gas
Was doing the same to his flivver.

COLORADO STATE HIGHWAY DEPARTMENT

Combined Statement of the Highway Fund and the Bond Funds for the Fiscal Year Ending November 30, 1926

BALANCES DECEMBER 1, 1925		
Highway Fund	$1,374,062.55	
Federal Aid Bond Fund	373.59	
County Bond Fund	2,159.89	
Total Balances		$1,376,596.03
RECEIPTS		
Half Mill Levy	$ 765,987.51	
Gasoline Tax	1,043,197.43	
Internal Improvement	93,000.00	
Federal Aid	1,136,043.19	
County Aid	53,557.84	
Excess War Supplies	10,356.08	
Highway Bonds	2,000,000.00	
Auto Theft Title Law	3,098.85	
Total Receipts		5,105,240.90
Total Balances and Receipts		$6,481,836.93

DISBURSEMENTS		
Federal Aid Projects	$3,081,297.71	
State Projects	736,239.01	
Maintenance	806,472.52	
Property and Equipment	24,913.27	
Surveys	16,204.64	
General Office Administration	67,147.13	
Engineering Administration	57,513.76	
Road Signs and Traffic Census	17,104.09	
County Bond Projects	2,159.89	
Total Disbursements		$4,809,052.02
BALANCE NOVEMBER 30, 1926		
Highway Fund		1,672,784.91
Total Disbursements and Balance		$6,481,836.93

Denver Dealers Attend Road Show at Chicago

Among the Denver dealers who attended the Chicago National Road Show were:

L. L. Clinton, of the firm of Clinton & Held, agents for "Caterpillar" tractors and Stockland graders.

Elton T. Fair, Colorado and Wyoming distributor of the famous Adams Leaning Wheel graders.

Harry P. Wilson, head of the Wilson Machinery Co., distributors for Koehring; Austin-Western; Western Wheel scraper; Byers; Buckeye Traction ditchers; Ord concrete finishers; and C. H. & E. builders equipment.

Henry Hoddle, sales manager, Herbert N. Steinbarger & Co., distributors for Bucyrus shovels; Russell road equipment; Sauerman draglines and Rex mixers.

Paul Fitzgerald, distributor for P. & H. draglines and shovels.

Barney W. Miller, local sales representative for Osgood shovels.

Tom Burnite, distributor of Smith concrete mixers.

George Meffley, general manager H. W. Moore Equipment Co., distributors for Cedar Rapids crushers and Galion graders and other road equipment in Colorado, New Mexico and Wyoming.

Wilson Machinery Company Now Blaw-Knox Distributors

With the advent of the new year, announcement is made that in the future the well known Blaw-Knox line of construction equipment will be handled in the Colorado territory by the Wilson Machinery Co., according to word given out by the Blaw-Knox company, of Blawnox, Pa.

Formerly this line was handled in this territory by the Linroot-Shubart Company.

It includes the following time and labor-saving contractors equipment: Road forms; street and side-walk forms; traveling forms; truck turntables; the Blaw-Knox inundation system; steel bins; measuring batchers and clamshell buckets.

Harry P. Wilson, president of the Wilson Machinery Company, of 1936 Market street, Denver, also announces that his firm are now handling the Sullivan Machinery Co., line of "Rotator" rock drills and compressors in this territory.

The concern also are Rocky Mountain distributors for the complete Austin-Western line of road construction machinery and the standard line of Koehring cranes, shovels and concrete mixers.

"We had one of the biggest years in the history of our business in 1926," said Mr. Wilson. "Indications are we will surpass our 1926 sales during the coming year."

Peppers Opens Display Room on Sixteenth Street

The Roy C. Peppers Engineer Sales Company have moved their headquarters to Denver and are located in spacious display rooms at 1525 Sixteenth street, across the street from the Sugar Building.

During the last month the Peppers Company have taken the general distribution of the "Cletrac," which is now manufactured in four sizes for all kinds of heavy duty pulling. They are making a special effort to interest county road officials in two of their sizes for highway construction and maintenance.

The latest product of the Cleveland Tractor Co. is their type "75," which is designed for heavy construction work.

The Peppers Company also are sales agents for Cyclone Guard wire and the Alan Wood traffic strips, which have found a large sale in this territory during the past two years, being used extensively by the counties on bridges to prevent undue wear on wooden flooring.

STILL SPEEDING

The widow and the orphans
Stand there with tearful eyes
But the speeder is still speeding
Somewhere in the skies.
(That's what we hope.)

—St. James Independent.

Meffley Visits Eastern Road Machine Factories

George Meffley, general manager of the H. W. Moore Equipment Company, Denver, recently returned from a trip to a half dozen eastern factories represented by the Moore concern in this territory. He reports that Galion Iron Works are bringing out this year a new E.Z. Lift line of leaning wheel graders. Among the factories visited were the Marion Steam Shovel Co. at Marion Ohio; the Chausse Oil Burner Co., of Elkhart, Ind.; the Wehr Company, manufacturers of Fordson graders; the Full Crawler Company, of Milwaukee, Wis.; and the Iowa Mfg. Co., of Cedar Rapids, Iowa, manufacturers of the Cedar Rapids crushers and conveyors; and the Jaeger Machine Co., of Columbus, Ohio, makers of concrete mixers.

Meffley brings back word that the Jaeger Company are now making a non-tilting drum mixer. Vast improvements have been made in the Cedar Rapids one-piece crushing outfits, he said. The Chausse Company are now making a complete outfit for laying asphalt pavements that is portable and designed for small jobs. The Marion Company are now putting out four types of shovels. Their latest product is a No. 7 in the one-yard size. The Galion leaning wheel is a patented device recently brought out.

El Paso County Official Makes Unique Road Repair

Wm. H. Bartell, county commissioner of El Paso County, is one of the oldest road builders in the state, having been connected with highway work in El Paso County for 20 years. He has always been in the van with modern methods.

Recently Mr. Bartell was confronted with the necessity of providing more drainage through a deep fill on the paved road north of Colorado Springs, which meant the cutting of the pavement and construction of a large culvert and the detouring of travel for an indefinite time.

Mr. Bartell conceived the idea of driving a large 42-inch steel culvert in a diagonal direction 72 feet through the fill under the pavement without disturbing in any way the concrete paving or interfering with traffic. This was accomplished with powerful jack screws pressing the sections of pipe into the fill while men working inside the culvert loosened the material at the head of the culvert and moved it back through the culvert.

As each section was forced in another was joined on with a connecting band, until the entire 72 feet was in place. Cement rubble header walls were built on each end, making a first-class job in every respect. The entire job was accomplished within 7 days.

BIDS OPENED

Proj. No.	Length	Type	Location	Low Bidder	Bid Price
296-B	4.351 mi.	Gravel Surface	South of Pueblo	Cole Bro., Pueblo Colo.	$ 58,061.00
134-A-1	5.861 mi.	Sand Surface	Betw. Stratton and Burlington	W. A. Colt & Son, Las Animas	40,438.00
25AC-1	.....	Piers & Abutments	2 mi. S.W. of Hot Sulphur Spgs.	Hinman Bros. Constr. Co., Denver	12,383.50
282D	2.864 mi.	Gravel Surface	North of Meeker	Winterborn & Lumsden, Grand Junction	42,135.00

PLANS SUBMITTED TO U. S. BUREAU OF PUBLIC ROADS FOR APPROVAL

Proj. No.	Length	Type	Location
254-D	3.013 mi.	Gravel Surfacing	East of Parshall
275-G	10.869 mi.	Concrete Paving	Larkspur-Monument
281-E	0.812 mi.	Concrete Paving	At Lafayette
287-C	19.447 mi.	Grading	Between Dearfield and Greeley
145-A	2.926 mi.	Gravel Surfacing	West of Glenwood Springs

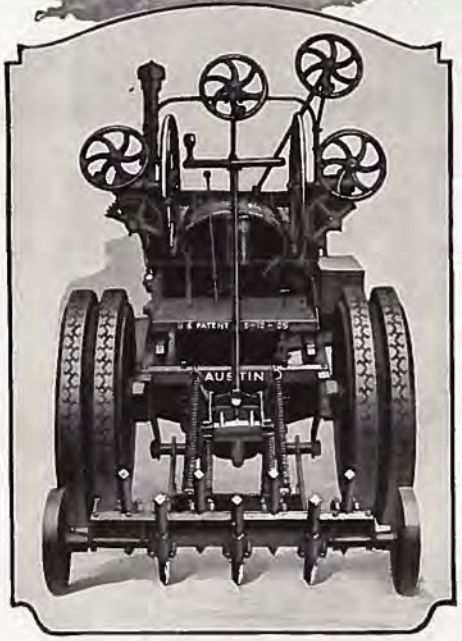
PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
2-R5	1.5 mi.	Paving	South of Aguilar
247-C	0.5 mi.	R. R. Underpass and Paving	At Swink
254-C	150 ft.	Steel Truss Bridge	Colorado River, 2 mi. S. W. of Hot Sulphur Springs
275-E	2.0 mi.	R. R. Underpass and Paving	At Monument
279-D*	0.261 mi.	Paving	At Morrison
279-E*	3.243 mi.	Grading	Conifer-Baileys
300-A	1.0 mi.	Grading	North of Chattanooga
560	3.0 mi.	Gravel Surfacing	Deer Creek-Littleton
631	120 ft.	Timber Bridge	At Trumbull

* Drafting completed.

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1926

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj No
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	$ 331,632.00	78	2-R4
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	28,882.70	0	2-R3
79-A	Big Sandy Creek, East of Simla	10 19-ft.	Spans Timber Trestle	A. R. Mackey	10,421.26	1	79-A
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	1	144-A1
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	25	157-A
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	77	213-D
242-AR1	East of Fruita	125 ft.	Steel Bridge	F. H. Knollman	19,999.00	76	242-AR1
246-E & 231-R	West of Avondale	2.454 mi.	Concrete Paving	Strange-Maguire Pav. Co.	68,083.90	89	246-E & 231-R
254-B	Hot Sulphur Springs-Parshall	1.087 mi.	Gravel Surfacing	Pioneer Const. Co.	61,071.00	100	254-B
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	91	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	31	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	0	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	56	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	21	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	10	265-B
267-B	Hoehne-La Junta	2.200 mi.	Gravel Surfacing	Central Const. Co.			
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	20	271-B
271-E	East of Portland	1.303 mi.	Gravel Surfacing	E. H. Honnen	35,815.00	82	271-E
275-C	Husted-Monument	4.795 mi.	Concrete Paving	J. L. Busselle & Co.	186,585.20	90	275-C
275-D	North of Castle Rock	0.879 mi.	R. R. Underpass	J. Fred Roberts Const. Co.	55,700.00	97	275-D
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	75	275-F1
278-B	Hugo, east	6.856 mi.	Sand Surfacing	D. S. Reid Const. Co.	17,222.00	95	278-B
279-C	Conifer-Baileys	5.772 mi.	Grading	W. A. Colt & Son	114,542.00	91	279-C
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	55	281-D1 & 251-B1
282-A	South of Craig	250 ft.	Steel Bridge	Northwestern Const. Co.	79,442.00	77	282-A
282-B	West of Meeker	2.932 mi.	West from Meeker	Winterborn & Lumsden	31,466.00	96	282-B
282-C	North of Rifle	4.052 mi.	Gravel Surfacing	Hinnan Bros.	50,200.00	95	282-C
283-B	Berthoud, south	4.2 mi.	Concrete Paving	C. C. Madsen Const. Co.	168,835.00	89	283-B
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	70	283-C
287-A2	Fort Morgan, west	4.011 mi. 16.61 mi.	Concrete Paving Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	83	287-A2
287-B	Greeley, east	7.565 mi.	Grading	A. R. Mackey	127,303.00	100	287-B
288-A	Merino-Brush	19 mi.	Grading and Surf.	Scott & Curlee			
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	13	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,645.25	69	293-B
294-B	Mancos-Cortez	1.416 mi.	Gravel Surfacing	Engler & Teyssier	21,551.40	75	294-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	10	295-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	32	297-B
298-A	Pagosa Springs, east	1.779 mi.	Gravel Surfacing	John A. Duncan	22,465.00	90	298-A
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	39	299-A



Rear type of scarifier used on Austin Motor Graders. This attachment is exceedingly useful in scarifying roads that are too hard for the grader blade, thus greatly increasing the capacity of the machine.

LEVELING OFF THE ROUGH SPOTS

THAT'S the job usually assigned to Austin-International Motor Graders—and that's exactly what they do. If it's a badly rutted gravel road the Austin-International (15-30) will cut right down to the bottoms of the corrugations leaving a smooth, hard surface once more suited for high speed traffic. Not only that but it has sufficient speed and blade length (12 ft.) to do the work quickly and inexpensively.

Leaning Front Wheels

Besides having the operator stationed at the rear of the machine, which is now generally conceded as the only logical place for him to stand, Austin Motor Graders are also equipped with leaning front wheels which overcome the side draft on the blade and hold the grader to a straight course, besides enabling it to work in ditches and on side slopes where a straight wheeled machine would be useless.

Special Equipment

Austin Motor Graders are built in three sizes using the International (15-30), International (10-20) and Fordson for their power. All three sizes may be had with plain steel wheels, rubber tired wheels, or crawler tread, and with either center or rear scarifier.

A new catalog describes Austin Motor Graders in detail. Write for your copy today.

I would like the Catalog

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THE AUSTIN-WESTERN ROAD MACHINERY CO.

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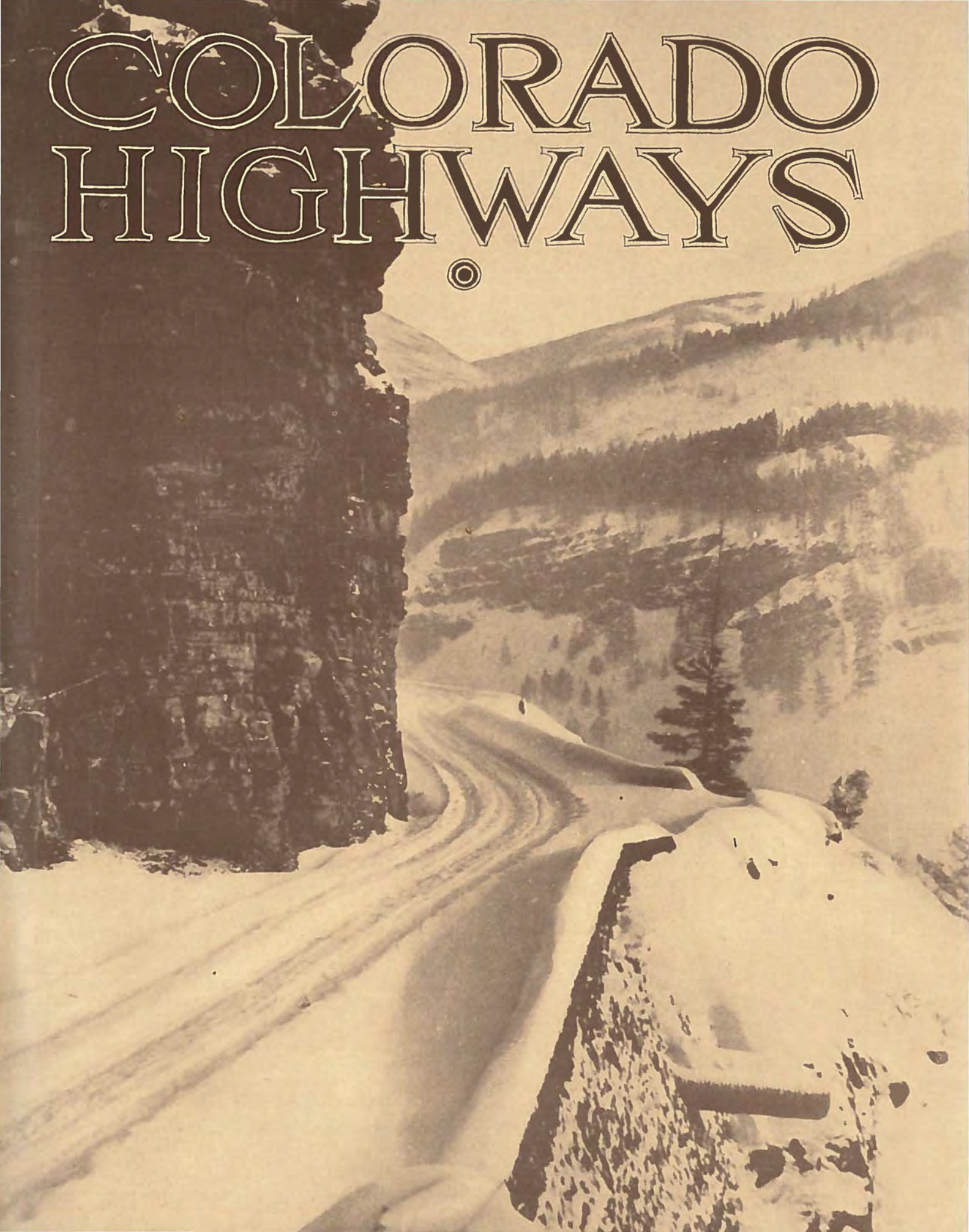
COLORADO HIGHWAYS



Colorado Highways

Official Publication of the
COLORADO STATE HIGHWAY DEPARTMENT
Denver, Colorado

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M. W. BENNETT, Editor

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10 CENTS A COPY. **$1.00 A YEAR.**

Colorado Highways
"BETTER ROADS"
VOLUME VI. FEBRUARY, 1927. NUMBER 2

Looking Into 1927

THERE is every indication that the year 1927 will be one of the greatest in the history of the road building industry. The general continued prosperity of the country insures a continuance of public work on a large scale and in the field of road building this is backed by ample funds made available by Federal aid and numerous large state and municipal appropriations. How will these huge sums be spent? Wisely—or unwisely?

There is first of all the important task of continued highway construction for many miles of new road are required to meet growing transportation needs. While the past year has seen better engineering methods applied to this class of work there is still much to be learned concerning the proper method of road construction. Machinery must also take the place of men in an ever increasing measure if costs are to be lowered. By properly co-ordinating both better roads will be built in 1927.

Again in the field of road maintenance the problem becomes increasingly important as the mileage of roads continue to increase. It has been estimated that in a very few years more money will be spent on road maintenance than on new construction and under such conditions it is necessary that the work be done economically and along sound engineering lines.

Road Building Pays Dividends

THE annual meeting of the American Road Builders' Association in Chicago, January 10-14, and the accompanying Road show at the Coliseum, again call to mind the great importance of the road building industry in the United States. Few other industries employ 500,000 men and spend $1,000,000,000 a year, but the increased use of motor vehicles from 10,000 in 1906 to over 26,000,000 in 1926 made modern road building an immediate economic necessity.

To show how important roads have become during 1925, twenty million people traveled an average distance of twenty miles apiece by railroads. Over ten times as many people or over two hundred million traveled the same average distance in motor vehicles. This data is compiled from the U. S. Government Reports.

Heavy use of highways is made for trucking milk and farm produce, commercial freight hauling and by the railroads to collect and distribute freight in less than carload lots.

Of our 3,000,000 miles of roads, only fourteen per cent is surfaced and less than four per cent has "high type" surface suitable for continuous heavy traffic. Over two-thirds of the "high type" surface is, of course, concrete.

The Bureau of Public Roads has shown by an actual survey of traffic that improved highways in Connecticut save to all citizens using them money equivalent to a 23 per cent annual dividend on the highway investment. California highways return not less than 21 per cent; Illinois roads 25 per cent. When public improvements can return 20 per cent on the investment, they are no longer luxuries but necessities.

Standardization of Highway Signs

THE importance and desirability of having uniform highway signs has long been apparent to everyone connected with the road building industry. For many years, however, this movement was in the same class as Mark Twain's famous remark about the weather. Everyone talked about it but no one did anything.

During 1926 standardization of highway signs became an accomplished fact. The history of the movement briefly started in 1924 when the American Association of State Highway Officials at their annual meeting in San Francisco requested the Secretary of Agriculture to appoint a Board to formulate "a standard system of numbering and marking highways of interstate character." The Secretary, complying with this request, appointed on February 20th, 1925, what was known as the Joint Board on Interstate Highways. On October 26th of the same year this Board submitted its final report. All during 1926 this report was reviewed and discussed by many agencies and it has now had the unanimous endorsement of the American Association of State Highway Officials and Secretary Hoover's National Conference on State and Highway Safety, besides numerous state and county organizations throughout the United States. The U. S. Bureau of Public Roads has moreover given its formal approval to the use of standardization signs on all Federal Aid highways.

Cuts Both Ways

AMERICAN motorists not only pay much less tolls than did the owners of the former horse-drawn vehicles. They get back what they do pay in the shape of saving in wear and tear. Statistics show that they are saved two and a half billion dollars a year in gasoline, tires, parts and upkeep, due to the improved condition of the highways.

The Cameron Pass Highway

By A. B. Collins
Division Engineer, State Highway Department, Colorado

Over the Pass in view of the Medicine Bow Range.

THE development of east and west highways through Colorado is complicated by an almost insurmountable mountain barrier. The Continental Divide, the "backbone of the continent," crosses north and south through practically the center of the state. In establishing communication between the eastern and western portions of the state, any route selected must cross the divide.

In selecting locations, advantage is taken of those mountain passes of lowest elevation and least serious snow hazards. In this manner Colorado highways cross the Continental Divide at fourteen different passes, which range in elevation from 8,772 feet to 12,095 feet above sea level. The Cameron Pass road crosses a spur of the main range less than ten miles from the junction of this spur with the main range at an elevation of 10,200 feet and is the seventh lowest of the passes across the mountains.

The road enters the Poudre Canyon at an elevation of 5,300 feet and, attaining an elevation of 10,200 feet in sixty miles, a maximum grade of 6 per cent has been obtained. The roadway is full 22 feet in width and offers no hazards for even the most inexperienced of mountain drivers.

When the Cameron Pass highway was formally opened and dedicated in September, 1926, Colorado witnessed the fruition of fourteen years of unremitting labor. The splendid new highway has been completed through the combined efforts of the Colorado State Highway Department, Larimer and Jackson counties and the federal Bureau of Public Roads. Its completion is "a dream come true"; the dream of the late H. A. Edwards, first chairman of the Colorado State Highway Commission, who inaugurated a movement in 1912, for the construction of a road "up the Poudre River." The results have linked an intermountain empire, larger than the state of Delaware, with the outside world, by a scenic highway which is of unsurpassed beauty.—L. D. Blauvelt, state highway engineer.

The first work on this road was performed in 1912 with funds raised by public subscription. At this time, sufficient funds were provided to extend a 14-foot road a distance of approximately five miles through the lower reaches of the canyon. On the completion of this section of the road, Larimer County appropriated $24,000 with which to extend the work, and in the fall of 1912 contract was entered into for the construction of five additional miles, the work being conducted under the supervision of the Larimer County engineer. Before the completion of this contract, surveys were extended ahead, and in 1913 a route through the canyon was formally accepted as a state highway, and the Colorado state highway department became officially active in the construction of this road.

In the fall of 1913 the highway department with the co-operation of Thomas J. Tynan, warden of the Colorado state penitentiary, and the Larimer County officials, placed a working crew of 50 convicts in the canyon, a force which was maintained at joint state and county expense for eleven years until 1924.

The convicts selected for this work were "honor men," usually with short terms or terms which were within a few months of expiration. The selection of these men resulted in a heavy labor turnover, which impaired efficiency to some extent. It is interesting to note, however, that working without guards, there were only twelve or fourteen attempts to escape in a ten-year period, during which time only two convicts escaped entirely. In addition to other time allowances, the road work carried with it a deduction against sentence, of ten days for each month spent on the roads. This, with the fact that infractions of camp rules and regulations resulted in the return of the offender to the penitentiary and the loss of earned time, was conducive to the maintenance of a reasonably efficient and tractable crew.

In conducting this work, center line stakes and grades were furnished, character of slopes, disposition of material, etc., being left to the judgment of practical road builders who had charge of the convicts. Handled in this manner, there are no reliable figures as to the yardage of material moved, but, comparing the costs per mile for finished roadway with those obtained by contract, it is evident that very appreciable savings were effected through the use of the convicts. This is particularly

true through the solid rock areas, which constituted 60 per cent of the work, necessitating hand labor.

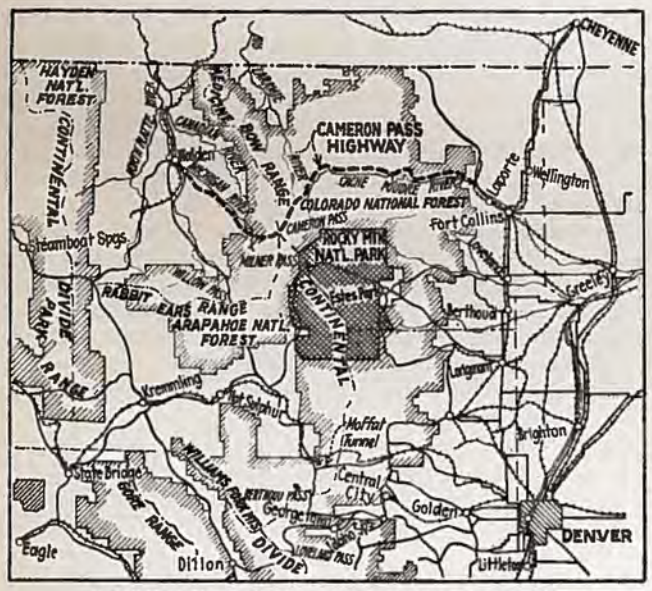
Maintaining a camp count of fifty men resulted in an effective working force on the road of about forty men, the balance providing for camp needs, such as cooks, flunkeys, laundrymen, wood choppers, and the sick list. The cost—sustenance, supervision, transportation—was $1.33 per day per man, resulting in an annual outlay for this purpose of approximately $24,000.

Powder for this work, consisting of sodatol, picric acid, and T.N.T., was taken from excess government stock at approximately 11c per pound. An average of 30,000 pounds per year was used, with an indicated efficiency of approximately one pound per cubic yard of excavation.

Over the work performed by the convicts, for a large portion of the way, lower slopes are held with dry rubble masonry. For this work Mexican convicts, who are adepts at rock wall work, were used exclusively.

Between 1913 and 1924, the convicts advanced the road west through the canyon a distance of approximately fifty miles to a point about ten miles east from the top of the Pass. At this point, Larimer County, through a reciprocal agreement with the state, assumed construction with county forces of free labor.

In the meantime, Jackson County, through state and county agreement, had constructed eastward from Walden up the Michigan River to the national forest boundary, about five miles west from Cameron Pass.



ROUTE OF NEW CAMERON PASS HIGHWAY

Scene near top of Pass on eastern slope.

In 1923, a United States Forest project was initiated, which provided for the construction of 6.45 miles of standard 22-foot forestry road from the end of the state and county work on the west, eastward over the Pass. This section of the road was completed in 1926 at a total cost of $137,000. Simultaneously with the completion of this project, Larimer County completed the section westward ten miles from the convict work, at $80,000.

From its inception, until completion in September of 1926, in excess of $500,000 has been expended on this work, an expenditure more than justified by the economic returns assured through the completion of the project. For its entire length the road presents to the traveler an everchanging panorama of lights and shadows, open glades and box-like canyons with precipitous walls; at the side and below, the turbulent and crystal clear waters of the Poudre, while ever in front, until the Pass is gained, the mountains rising majestically to the heavens present a never-to-be-forgotten picture. This everchanging panorama reaches its climax at the pass, where across the Michigan River, the Sawtooth Range with its many rugged peaks presents a view probably unsurpassed in the United States.

The Nation's Playground

By H. Brown Cannon, President
Denver Tourist Bureau

COLORADO, the nation's playground in the Rockies, was visited by 750,000 vacationists in 1926, and its residents were the gainer by $49,500.000. Of this amount $30,000,000 was expended by rail travelers and approximately $19,500,000 by automobile nomads of the gasoline trail.

Kansas! Nebraska! Iowa! Oklahoma! Texas! Missouri! California! Illinois! From all directions come automobile motorists. And a great incentive to their coming, other than scenery and climate, is the attraction of good roads throughout Colorado.

So that today's tourists are the builders of Colorado's tomorrow. They come primarily for recreation, but unless human nature is changed the banker or farmer on vacation will always be interested in an expanding country. Each thinks in the terms of measured prosperity

at all times, no matter how hard he tries to forget his own business. A cordial reception, therefore, influences him at an opportune moment. For that reason we cannot treat the traveler too well.

And the 1927 outlook for Colorado presages half a million tourist motorists! The 1926 motoring vacation count was about 400,000.

Colorado highways played a very important part in the 1926 registration of 225,027 rail and auto vacationists in Rocky Mountain National Park, the 11,356 people who visited Mesa Verde National Park, and the hundreds of thousands who enjoyed outdoor life in the seventeen national forests, the Moffat country, and western Colorado.

These vacationists helped in no small measure to consume produce and other foodstuffs raised in eastern Colorado, the northern and southern sections; in fact, generally throughout the state.

So improved highways in Colorado, built somewhat because of the surrounding scenic possibilities, have the direct compensatory feature in providing easy and safe distribution of foodstuffs to tourist centers from the heretofore remote outlying districts.

In this forward movement giving Colorado every commercial transportation facility, the State Highway Department has never forgotten the important phase of tourist travel. In fact this state department, aided by the Federal Good Roads Bureau, is the modern trail blazer for new settlers and thus induces the investment of capital in Colorado enterprises.

There is no complete check of the millions of dollars being directed by traveler-investors into real estate, land, manufacturing, mining, agriculture and other activities, but a single instance is the $4,000,000 or more that visiting motorists spent in gasoline alone while in Colorado last summer.

The combined rail and auto vacation patronage to the Estes Park region was 375,000 people, Pikes Peak region 450,000 people, while nearly a million home folks and visitors motored through the system of Denver Mountain Parks.

And the motoring phase of travel is not lessening; in fact, reports for Colorado in the year just closed indicate an increase in numbers of nearly 10 per cent over the previous year.

The desire to get back to nature by sleeping in a tented community or along a tree-lined stream has shown remarkable strides. In 1915 there were two municipal auto camps housing 4,500 motorists, and in 1926 there were 330 municipal and other auto camps with a total registration of 798,015 campers, including duplications.

The automobile motorist does not depend upon his own camping outfit as much as he did in former years. Cottage camps, apartments and private homes in 1926 housed about 50,000 motorists. Reports indicate that the principal hotels and resorts of the state reported a gross registration, including duplications, of 240,000 motorists occupying hotel rooms.

Of the tented cities for the motorist Overland Park municipal camping ground in Denver had 76,003 campers in 1926. The city administration, through Mayor Stapleton and officials of the park department, turned over the Exposition Hall in the Park to the Tourist Bureau for the education and entertainment of visiting motorists.

Thirty-five counties of Colorado availed themselves of the free exhibit space for county exhibits in the Park. These displays were visited by 39,324 motorists. A score of lecturers gave their services for the enlightment of 41,210 campers, through illustrated lectures and reminiscences of scenic and historic Colorado. The Tourist Bureau branch in the Park answered 49,562 questions and distributed 175,000 pieces of literature.

The Bureau co-operation included the service given motorists in the main office, 505 Seventeenth Street, and in its branches in Chicago, Kansas City, St. Louis, Dallas, Houston, Oklahoma City, Colorado Springs, and other cities.

More than a quarter of a million inquiries are received by the Tourist Bureau every year, and the mail inquiries about other parts of Colorado are sent from the Denver office to Chambers of Commerce and other recognized travel sources in the State without charge. The Bureau's free service also includes the distribution of resort and community literature in its thirteen offices.

Scene on State Road No. 82, north of Carbondale.

View from Mount Evans road, elevation 12,000 feet.

Congress Urged to Aid Highways

ENACTMENT of legislation concerning various highway matters was recommended to congress in several resolutions adopted at the twelfth annual meeting of the American Association of State Highway Officials at Pinehurst, N. C., in November. It was at this meeting that Major Louis D. Blauvelt, Colorado's state highway engineer, was elected president of the Association.

The resolutions not only heartily endorsed the action of congress in authorizing funds for construction of Federal aid roads in the several states, but urged congressional legislation amending the Federal highway act.

Legislation was also recommended to protect the newly erected standard interstate highway markers embodying the United States shield, and limit Federal legislation to regulate motor trucks and busses operating as interstate common carriers, to provide for joint state supervision.

One resolution was adopted which authorized President Blauvelt to appoint a committee to formulate ways and means of securing co-operation between the American Road Builders' Association and the American Association of State Highway Officials, "in the solution of the many highway problems now confronting us and in furthering the interest of the highway industry."

Another resolution proposed immediate action to reduce accidents on highways by obtaining detailed and complete reports of causes of accidents from all states, with the idea of studying the causes in order to intelligently work for the prevention of all possible accidents upon the roads.

Inasmuch as the national convention of the Association will be held in Denver during the early part of next October, the resolutions will be of especial interest to Coloradoans and westerners, as well as highway officials and students throughout the United States.

Several of the principal resolutions adopted at the Pinehurst convention are therefore printed in full herewith:

RESOLUTION NO. II

FEDERAL HIGHWAY ACT NEEDS AMENDMENTS

WHEREAS, The development of the Highway Program of the United States under the provisions of the Federal Aid road law, has shown the wisdom of certain modifications of the law, to facilitate the operation of the highway program.

NOW, THEREFORE, BE IT RESOLVED, That this Association recommend to the Congress, the enactment of legislation providing:

(1) That in the case of any state containing unappropriated public lands and nontaxable Indian lands, individual and tribal, exceeding 5 per centum of the total area of all lands in the state in which the population, as shown by the latest available Federal census, does not exceed ten per square mile of area, the share of the United States payable on account of any project which involves the construction or reconstruction of any highway which is a part of the Federal highway system of any such state, may be increased by the Secretary of Agriculture, upon request from the State highway department of such state, to any percentage up to and including the whole cost thereof, and all contracts for the construction or reconstruction of projects involving such increased Federal Aid shall be subject to approval by the Secretary of Agriculture, but the aggregate of the Federal Aid allotted on projects approved during any fiscal year for construction in any state shall not exceed the pro rata heretofore payable in such state under the provisions of this section;

(2) That the limitations on payments of Federal funds per mile be changed to permit equal participation by the Government and the state on any project, providing this participation does not exceed the Federal Aid allotment to the state, where the following conditions exist:

(a) Where topographic conditions are such that the average cost per mile for the grading and drainage structures other than bridges of more than 20 feet clear span exceeds $10,000.00 per mile.

(b) Where by reason of density of population or character and volume of traffic it may be determined by the State highway department and the Secretary of Agriculture if the width of pavement to be placed should be greater than 18 feet.

(3) That the restrictions which limit to 60 per cent of the available Federal Aid funds which may be expended upon the primary system in any state during any one year be eliminated.

RESOLUTION NO. V

CONGRESSIONAL ACTION TO PROTECT U. S. SHIELD NEEDED

WHEREAS, The Joint Board on interstate highways appointed by the Secretary of Agriculture has developed a standard marker embodying the United States shield, to be used in designating United States routes which are transcontinental or intersectional in character, and

WHEREAS, Recommendations of this Joint Board have been approved by the American Association of State Highway Officials;

NOW, THEREFORE, BE IT RESOLVED, That this Association recommend to the Congress that suitable legislation be passed which will protect the use of these markers on these roads by the several states and provide proper penalties for their misuse.

RESOLUTION NO. VI

FEDERAL LEGISLATION ON MOTOR TRUCKS AND BUSSES

WHEREAS, The regulation of motor trucks and busses used as common carriers has become a question of great importance;

NOW, THEREFORE, BE IT RESOLVED by this Association that it recommend to the Congress that Federal legislation to regulate motor trucks and busses operating as interstate common carriers be limited and providing for joint state supervision with appeal to a properly designated Federal department in case state authorities do not agree.

RESOLUTION NO. VII

ASSOCIATION WILL CO-OPERATE WITH AMERICAN ROAD BUILDERS' ASSOCIATION

WHEREAS, The American Association of State Highway Officials recognizes the value of the work done by the American Road Builders' Association, and

WHEREAS, There are many fields in which the interest of both Associations are mutual, therefore

BE IT RESOLVED, That this Association authorize the president to appoint a committee to determine the many ways and means of bringing about the co-operation of the American Road Builders' Association and the American Association of State Highway officials in the solution of the many highway problems now confronting us and in furthering the interest of the highway industry.

RESOLUTION NO. VIII

STANDARD REPORT FOR HIGHWAY ACCIDENTS

WHEREAS, This Association recognizes the immediate necessity for exerting every possible influence to reduce the accidents on the highways.

BE IT RESOLVED, That this Association request the Sub-Committee on Traffic Control and Safety to prepare a standard report form to be used by all of the states in reporting the causes of accidents on the highways, such report form to be submitted to the Executive Committee for approval and submission to the states for letter ballot, so it can be used as soon as possible.

Forest Trails

By Allen S. Peck
District Forester

WHEN the National Forests were placed under the U. S. Department of Agriculture in 1905 they were undeveloped and, with the exception of old mining and logging areas, were practically without roads and trails. Speed in reaching a fire is as important in the Forest as it is in the city and with this principle in mind, the construction of roads and trails was started almost as soon as the administration of the Forests was taken over.

Up to 1916 the funds available for road work were limited and the roads constructed prior to that date were designed for wagon travel. This is also true of the old roads built by mining companies and timber operators in the early days.

The present Development Road System for the National Forests of Colorado comprises 1,622 miles, of which about 450 are classed as satisfactory, that is, we believe they will serve the needs of the Forest Service during the next ten years, although we realize that the rapid developments in transportation make it difficult to look even that far into the future.

Road standards must keep pace with changing conditions and roads which were considered satisfactory a few years ago are decidedly unsatisfactory today. Of the remaining 1,182 miles on the Forest Development Road System, about 800 miles are existing old roads which, because of excessive grades, lack of drainage, poor alignment, etc., will not meet the needs of today and must be improved or reconstructed. The other 382 miles are nonexisting and their construction will, in many cases, be rather expensive.

During the past year about 100 miles of 9- and 12-foot roads were constructed or improved at a cost of $141,000, or about $1,500 per mile. About $8,000 in co-operative funds is included in the total. The total expended to date on the Development roads of the Colorado Forests is $787,931, which includes co-operation to the extent of $94,415.

The estimated cost of completing the entire system for Colorado is around $3,000,000, or an average of something like $3,000 per mile. Roads to open up big interior regions to facilitate fire protection and the marketing of timber products are being given special attention.

"Summit Lake" on the Silverton-Ouray Highway, altitude 11,200 feet. Red Mountain in background.

The Service endeavors to contract the construction of Forest roads whenever practicable, but there have been many small projects in isolated parts of the country in which contractors could not be interested which the Service has been forced to build as day labor jobs. Several fair-sized jobs will be advertised next spring if contractors can be interested.

The maintenance of National Forest Development roads is a big item and the cost for Colorado at present is about $25,000 a year. Total maintenace expenditures to date are $153,649, which includes $29,542 co-operative funds.

A network of trails penetrating the most remote and inaccessible parts of the National Forests is essential to their protection and administration, and trail building has always been one of the Forest Ranger's major activities. For many years the funds were limited and

(Continued on page 20)

An Old Time Pack Train—Yes, times have changed in Colorado.

How Improved Roads Aid Farmers

By Tolbert R. Ingram
Deputy State Commissioner of Immigration

THE economic value of good highways in rural districts in the development of the argicultural resources of a commonwealth is becoming more pronounced year by year. This is due to the steadily increasing use of motor vehicles for the movement of farm products to the markets. It is apparent to the casual observer that the increased use of motor vehicles creates an insistent demand for better roads, and the construction of more substantial highways, in turn, extends the facilities for transportation for the farmer.

The progress of the agricultural industry is so closely interwoven with the question of good roads that the two can not be separated.

Before the advent of the motor vehicle the most prosperous farming districts were located in narrow strips along the rights-of-way of the railroads. A farmer could not raise and market profitably crops from land situated more than 15 to 20 miles away from railroad transportation or local markets. There might be a few exceptions in crops that run in large values in proportion to their weight such as wheat, and other grain crops, but the farmer who has to limit the use of his land according to his marketing facilities is placed at a disadvantage.

The increased use of the motor vehicle is changing this condition. The narrow strips of farmed land along the railroads are being broadened out until their limits are no longer defined by the fixed lines of steel rails but by the condition and quality of the highway that leads to the rails. In fact, farming areas are being profitably developed in regions where there are no railroads when they are provided with highways sufficiently improved to meet the requirements.

One of the results of this changed condition is that if the agricultural industry of the state is to continue to expand, the rural districts must be given good roads over which to operate motor vehicles. This brings up the question of economical transportation. If the roads are unimproved and in a poor condition, the weight of loads must be reduced proportionately and more time consumed in marketing products of the farms and the profits are correspondingly decreased. The reverse is equally true. Substantial highways that permit the hauling of larger loads with greater rapidity for longer distances have the effect of increasing the farmer's opportunity to profit by his labor.

Within the past few years freight motor vehicle transportation has augmented the shipping facilities of the farmers. There are now 24 of these routes in operation in the state opening up between 1,200 and 1,500 miles of transportation facilities. While some of these lines serve territory adjacent to the railroads, most of them do not conflict with the steam roads.

The introduction of motor transportation over the highways has almost doubled the transportation facilities of the farmers. To this should be added the transportation facilities of the farmers themselves in the form of trucks and smaller motor vehicles.

Highway transportation depends for efficiency upon the condition of the highways. The demand for more and better roads has increased with the greater need and this has put a larger burden upon the highway construction agencies. While railroads are a public utility, they are privately owned and are operated for the profit of the owners. On the other hand, the highways are publicly owned and operated solely for the benefit of the public. That makes it necessary for the public to become interested in highway construction and to back up such a program with its support both moral and financial.

The increasing importance of highway conditions in agricultural districts is illustrated by the decision of the Department of Commerce to make special inquiries in that direction in the taking of the agricultural census of 1925.

This census revealed some interesting facts regarding Colorado farms as related to the highways. Of the 58,026 farms in Colorado in 1925, only 800 were located on concrete or brick road and 71 on macadam road. There were 8,051 on gravel roads; 24,961 on improved dirt roads, and 22,245 on unimproved dirt roads, the remaining 1,898 being all others including those not reported.

A little more than one-third of the farms in the state are, as shown by this report, located on unimproved roads.

The figures show that the task of meeting the requirements of modern progress is far from being completed and calls for a more united stand upon the part of the public in providing the means with which to carry on the work.

Boulder county's snow removal outfit, consisting of caterpillar tractor and power-lift snow plow.

Complete Co-operation Reported in Federal Aid Highway Work

FOR the first time the States now are giving 100 per cent co-operation in the Federal aid highway improvement work of the Bureau of Roads of the Department of Agriculture according to Thomas H. MacDonald, chief of the bureau. Montana, the one State which had failed to take up its share of the obligations, he said, has now joined in the participative work and is financing its part of the Federal aid program in its domain.

"Our main work now is to build roads with the co-operation of the States in the populous sections of the country," he said. "For example, we are today making transportation surveys to determine the flow of traffic on interstate channels of travel. By these surveys which have been going on for the past fortnight, we will not only locate the flow of traffic but what types of roadway improvement are needed and where the first construction or reconstruction should be inaugurated to make available the best systems for the most traffic.

"The question we are continually confronted with is what might be called the emergency aspect—the determination of which particular channels of interstate roadway travel most need improvement out of the funds we have available for the year. We are trying to find the main stems of traffic and to furnish the greatest benefit to most people.

"Meantime the states also are working under their own funds, in addition to the co-operative aid activities.

"The Federal aided roads are approximately one-half of what the States themselves are building with their own independent projects. During 1925, for instance, the Federal aid mileage completed—that is the road completed by co-operative financing of the Federal and State highway departments during the same year reached a total of 23,164 miles.

"This means that the road construction by State and Federal co-operation was 49 per cent of the total mileage of roadway construction in the United States. The mileage of Federal aid road construction during the year ended, June 30, 1926, runs to a little higher figure than for 1925.

"Federal assistance is a very important factor in the Mountain States where the Federal aid roads constitute from two-thirds to three-quarters and more of the annual program of construction.

"In the Middle Atlantic and East Central States, the percentage of roads built without Federal assistance is the highest. It is more than two-thirds of the annual program in each case in these latter States, whereas for the country as a whole the Federal aid program is practically half of the annual construction program carried on under the State highway departments.

"While the Federal aid is shown by our figures of results to be in all States a considerable factor invaluable to some and helpful to others, the fact that in all groups of States from a fifth to two-thirds of the highways improved under the supervision of the State highway departments are built with State funds entirely without Federal participation indicates that the offer of Federal assistance has not had the effect of inducing the States to spend more money for highway improvement than they would otherwise have found expedient.

"Federal aid is going on along the main roads as reconstruction. The area of most congested population in the United States, with the exception of that area in the immediate vicinity of New York and New Jersey, is in Massachusetts, Connecticut and Rhode Island and in both those regions we are doing a great deal of work now in co-operation with the States."

Federal Aid

FEDERAL aid was placed on a substantial basis by the Federal Aid Act of 1921, when a seventy-five million dollar annual appropriation was made. The recent Congress has continued a similar appropriation through 1928, and 1929. The Legislation which continues the appropriation passed by a large majority in both the House and the Senate. There was a small minority from the densely populated eastern states, which objected to the appropriation, but the vast majority of the states were for the continuation of the Federal aid.

Federal aid has been a great stimulus toward efficient highway design and supervision. Many of the State Departments date their beginnings with the Federal Aid Act of 1916. For ten years the Bureau of Public Roads has been able to give added service to the states in their highway programs and the continuance of this service will be a boon to all the states.

One of Mesa county's road maintenance stations, located near Palisades.

Road Work Reviewed by U. S. Bureau

FEDERAL-AID road projects completed during the fiscal year 1926 contributed a net addition of 9,417 miles to the mileage of improved roads in the Federal-aid system, according to the annual report of the Bureau of Public Roads of the United States Department of Agriculture. Added to the mileage improved with Federal assistance in previous years, the above brings the total length of improved Federal-aid roads up to 55,902 miles.

At the close of the year construction was in progress on 10,962 miles and projects involving the improvement of 2,469 miles additional had been approved. Including the mileage of projects in these latter stages, all of which are included in the Federal-aid system, the total mileage improved or in process of improvement with Federal aid was 69,334.1 miles. With the exception of a few hundred miles improved prior to the designation of the Federal-aid highway system in 1921, all of this mileage is included in the system.

The system now has an aggregate length of 182,134 miles. All this mileage has been selected by the State and Federal highway officials as essential links of a system adequate for the accommodation of interstate traffic.

The report states that the improvement of several transcontinental routes is approaching completion. There is now a route extending from Washington through St. Louis, Texarkana and El Paso to San Diego which is 97 per cent improved. The route from Atlantic City, N. J., to Astoria, Oregon, is seven-eighths improved and from Boston to Seattle through the northern tier of states is 73 per cent improved and 69 per cent surfaced.

Twenty-five states have continuously improved highways entirely across them in at least one direction and 16 of these have completed trans-State arteries in two directions.

The report contains a short discussion on National Forest road construction, the relation of Federal-aid and forest road work, and also a review of the more conspicuous accomplishments in highway research. Among the investigations which have been of most practical value is that which was directed toward the increase of efficiency of various road construction operations, a field in which savings of from 25 to 35 per cent in earth-moving costs have been shown to be generally possible and in which it has been found that as much as 20 per cent can be saved in the cost of grading on some jobs, effected almost entirely by changes in design of grades.

It has been shown that in concrete paving operations the daily output on most projects can be increased 25 per cent and sometimes 50 or even 100 per cent, some contractors having been able to reduce their bids surprisingly after having adopted improved methods suggested by the bureau.

Traffic surveys to show the utilization of various highways have been made in Connecticut, Maine, Pennsylvania, Ohio, California, and Cooke County, Illinois, and similar surveys are to be made in New Hampshire and Vermont. As a result, valuable information is being collected as to weight and volume of traffic in all parts of the areas concerned, which with the traffic-flow maps enables highway administrators to prepare scientific budgets and to plan properly the improvement of the highway system. Such information places the highway program on a scientific basis.

Co-operative investigations are being carried on with various universities and State highway departments. Several of these aim to develop a suitable type of cheap surface for rural highways. Others aim to determine the tractive resistance of various types of highway surface, to measure the wind resistance of automobiles, and the tire wear of various surfaces and pavements. The bureau also carries on continuously examinations of highway materials for the purpose of checking the work, and various improvements have been made in testing instruments and in methods of testing.

Total cost, Federal-aid and mileage of Federal-aid roads completed to June 30, 1926, by states:

State	Total Cost	Federal Aid	Miles*
Alabama	$ 20,752,585.99	$ 9,883,424.48	1,415.7
Arizona	11,529,325.07	6,250,194.69	767.1
Arkansas	20,257,932.75	8,543,898.76	1,418.5
California	30,235,379.81	14,558,628.81	1,169.7
Colorado	15,225,844.16	7,801,628.50	797.0
Connecticut	5,977,829.01	2,273,863.66	127.1
Delaware	4,918,052.29	1,781,665.60	124.3
Florida	7,989,517.80	3,878,287.87	249.7
Georgia	27,704,198.26	13,109,068.58	1,975.5
Idaho	11,780,741.23	6,325,103.42	773.7
Illinois	46,638,676.52	21,878,422.04	1,467.1
Indiana	22,596,658.46	10,900,346.83	687.2
Iowa	30,191,682.82	12,432,933.15	2,177.0
Kansas	34,446,612.82	13,356,124.78	1,263.6
Kentucky	21,319,134.37	8,742,516.65	687.4
Louisiana	14,281,859.04	6,359,336.43	1,069.8
Maine	8,747,552.76	4,192,507.39	303.6
Maryland	10,924,943.10	5,112,991.22	423.3
Massachusetts	19,217,639.13	6,898,383.20	385.7
Michigan	27,354,859.45	12,474,303.21	995.8
Minnesota	37,850,763.95	15,912,616.56	3,249.2
Mississippi	15.716,707.96	7,699,843.80	1,158.9
Missouri	37,571,342.54	17,289,927.52	1,795.7
Montana	11,914,279.06	6,607,530.55	1,071.5
Nebraska	14,379,018.01	6,868,788.86	2,021.2
Nevada	9,315,505.61	6,659,890.11	710.1
New Hampshire	5,260,569.51	2,510,351.32	244.6
New Jersey	17,680,844.26	5,378,452.37	307.9
New Mexico	13,200,059.12	7,851,157.91	1,490.5
New York	45,457,079.79	18,626,087.19	1,231.8
North Carolina	30,689,430.76	12,741,518.72	1,343.1
North Dakota	13,512,576.29	6,602,989.10	2,275.7
Ohio	49,367,650.24	18,074,453.82	1,422.6
Oklahoma	28,915,946.93	13,484,856.58	1,201.5
Oregon	17,612,858.41	8,945,203.93	961.6
Pennsylvania	74,812,072.67	25,106,966.83	1,435.2
Rhode Island	4,320,206.69	1,672,904.06	94.3
South Carolina	17,188,668.82	7,779,376.11	1,536.9
South Dakota	18,190,591.85	8,948,632.65	2,345.8
Tennessee	23,140,785.61	10,995,924.33	835.3
Texas	71,403,346.64	28,461,138.70	5,055.8
Utah	9,054,232.80	5,691,043.97	622.6
Vermont	4,273,969.26	2,028,484.51	135.2
Virginia	23,410,491.32	10,972,568.65	1,050.1
Washington	17,078,511.63	7,782,909.46	668.6
West Virginia	10,258,141.20	4,491,428.66	414.5
Wisconsin	25,353,034.20	10,638,396.73	1,619.1
Wyoming	12,383,388.08	6,977,481.63	1,225.1
Total	$1,051,403,098.05	$463,554,553.90	55,902.8

*Mileage is of original improvement only.

A Motorist's Paradise!

—Just a quartette of views taken on a jaunt over Colorado's magnificent mountain-and-plain highway system.

The Huerfano river concrete highway bridge—five 80-foot spans.

Looking east from Boulder, showing newly completed concrete pavement.

One of the beautiful lakes on Midland Trail near Carleton tunnel.

Scene on Durango-Silverton highway, with Sawtooth range in background.

First Annual Colorado Road Conference Held at Boulder

ON January 13 and 14, 1927, a Highway Engineering Conference was held at the University of Colorado in Boulder. This conference was held under the auspices of the Civil Engineering Department and the Extension Division of the University with the active co-operation and support of the U. S. Bureau of Public Roads, The Colorado State Highway Department, and the City and County of Denver. The program was of particular interest to Highway Engineers, County Commissioners, County Surveyors, Road Superintendents, Contractors, and others interested in highway construction.

Since the meeting at the University was the first of what is hoped to be a series of annual conferences, it was deemed advisable to limit the sessions to two days and to deal in the program, with the broad general aspects of highway design and construction. At later conferences it is expected that various phases of highway work will be discussed in a more detailed manner and that it will be possible for contractors to take a more active part in the conference.

The papers presented at the conference were of exceptionally high quality, carefully prepared and given by men well qualified by experience and professional attainments to discuss their respective subjects with authority.

The discussions, due to the shortness of time available, were often extemporaneous, but in some cases prepared discussions were given. The discussions were entered into with spirit and brought to light many interesting side lights on the various subjects included in the program.

The session on Thursday morning opened with Dean H. S. Evans of the College of Engineering presiding. Dr. George Norlin, President of the University of Colorado, in his delightful manner which always seems to fit the occasion, welcomed the visitors and pledged co-operation of the University to the Highway Department and any other Departments of the State which the University can serve. Mr. Dan C. Straight of the Weld County Commissioners, and during the past year president of the State Association of County Commissioners, responded to Dr. Norlin's welcome and urged the continuance of the program of construction and maintenance of good roads.

Mr. J. E. Maloney, Assistant Engineer, Colorado State Highway Department, then took the chair and presided during the remainder of the morning session.

Mr. A. E. Palen, Senior Highway Engineer, U. S. Bureau of Public Roads, then presented a comprehensive paper on "Highway Location and Design" which was followed by an interesting discussion.

Mr. J. W. Johnson, District Engineer U. S. Bureau of Public Roads, presided during the afternoon session. Mr. John G. Rose, Highway Engineer U. S. Bureau of Public Roads, presented a paper on "Value of Testing Highway Materials." Professor O. V. Adams of the Colorado Agricultural College and Professor H. J. Gilkey of the University of Colorado, and others discussed Mr. Rose's paper.

Mr. J. E. Maloney, Assistant Engineer, Colorado State Highway Department, gave a paper on "Cost Accounting as Applied to Road Construction" with emphasis on the Field Engineer's point of view. Mr. Edwin Mitchell, Auditor Colorado State Highway Department, then presented the Auditor's viewpoint on this interesting subject. General discussion followed.

On Friday, Professor Fred R. Dungan, University of Colorado, and President of the Colorado Section of the American Society of Civil Engineers, presided. At the morning session Mr. R. L. Downing, instructor of Civil Engineering, University of Colorado, presented a paper on "Construction and Maintenance of Graded and Gravel Surfaced Roads." The tendency toward heavy equipment, the effectiveness of the drag and the necessity for constant maintenance were strongly emphasized in the paper and in the discussion which followed.

Mr. A. V. Williamson, Senior Highway Engineer, U. S. Bureau of public Roads, opened the afternoon session with the presentation of a masterly paper on "Construction and Maintenance of Concrete Surfaced Highways." This paper brought extended discussions by Messrs. J. P. Donovan, C. R. Lugton, John Crook, Mr. Williamson, and others.

Mr. A. K. Vickery, City Engineer of Denver, Colorado, then presented an outstanding paper on "Bituminous Road Construction and Maintenance." Mr. A. S. McMaster, instructor in Engineering Mathematics and formerly City Engineer of Paris, Texas, led the discussion on Mr. Vickery's paper. The closing paper of the conference was read by W. Johnson who presented a written discussion prepared by Dr. L. I. Hewes, Deputy Chief Engineer and Director of the Regional Office of the U. S. Bureau of Public Roads in San Francisco. Dr. Hewes discussed in scholarly manner the "Construction and Maintenance of Bitumen or Penetration Macadam Roads."

It was the unanimous opinion of those present at the closing session that the conference was very much worth while and that it should be repeated next year.

NEWS OF THE MONTH

Current Events in the Field of Highway Engineering and Transportation—State, County and Municipal Activities

State Completes Thirteen Big Road Projects in January

Thirteen state highway road projects were completed by contractors in Colorado during the month of January. The total cost of these projects was $953,695. Most of the projects were started in the early part of 1926. The projects are as follows:

F. A. P. 246-E, 2.454 miles concrete paving west of Avondale, completed by Strange-Maguire Paving Co., at cost of $68,083.

F. A. P. 254-B, 1.087 miles gravel surfacing between Hot Sulphur Springs and Parshall, completed by Pioneer Construction Co., at cost of $61,071.

F. A. P. 271-E, 1.030 miles gravel surfacing east of Portland, completed by Ed. Honnen, at cost of $35,815.

F. A. P. 275-D, 0.879 mile railroad underpass, north of Castle Rock, completed by J. Fred Roberts & Sons Construction Co., at cost of $55,700.

F. A. P. 278-B, 6.856 miles sand clay surfacing, located east of Hugo, completed by Dan S. Reid Construction Co., at cost of $17,222.

F. A. P. 279-C, 5.722 miles grading, located between Conifer and Baileys, completed by W. A. Colt & Son, at cost of $114,542.

F. A. P. 282-A, 250-foot steel bridge, located south of Craig, completed by Northwestern Construction Co., at cost of $79,442.

F. A. P. 282-B 2.932 miles gravel surfacing, located west of Meeker, completed by Winterburn & Lumsden at cost of $31,466.

F. A. P. 282-C, 4.052 miles of gravel surfacing, located north of Rifle, completed by Himan Bros., at cost of $50,200.

F. A. P. 283-B, 4.2 miles of concrete pavement, located south of Berthoud, completed by C. C. Madsen Construction Co., at cost of $168,835.

F. A. P. 294-B, 1.416 miles gravel surfacing, located west of Mancos, completed by Engler & Teyssier at cost of $21,551.

F. A. P. 287-B, 7.565 miles of grading, located east of Greeley, completed by A. R. Mackey at cost of $127,303.

F. A. P. 298-A, 1.779 miles of gravel surfacing, located east of Pagosa Springs, completed by John A. Duncan, at cost of $22,465.

INCREASED AUTO TRAFFIC FORCES STATES TO BUILD WIDER ROADS

Communities, especially the larger ones, in every part of the country, are wrestling with the problem of revising their highway systems to accommodate increased traffic. The large number of projects, either completed, under way or proposed, that call for the widening of existing highways or the construction of new wide highways is an indication of the widespread need for traffic surfaces of adequate width.

A few of the projects of this nature are listed as follows:

New York: Sections of the Albany Post Road and the Boston Post Road have been rebuilt 40 feet wide.

The Erie County Boulevard, a wide concrete pavement encircling Buffalo is partly built.

Connecticut: Sections of the Boston Post Road have been widened to 40 feet.

Pennsylvania: The Lincoln Highway from Philadelphia to Chester is to be widened to 55 feet and from Chester to Harrisburg to 40 feet.

Street widening is planned in Philadelphia to provide approaches to the Camden Bridge.

New Jersey: The White Horse Pike from Camden to Atlantic City is to be widened to 40 feet.

Michigan: All roads on the Wayne County highway system to be widened to a minimum of 40 feet. Super-highways in Wayne, Oakland and Macomb Counties to be built with 88 feet of traffic surface on 204-foot right-of-ways.

A 40-foot concrete pavement is to be built from Pontiac to Saginaw. It will connect at Pontiac with the Wider Woodward Avenue Super-highway to Detroit.

Illinois: Four lane highways are planned for important roads in Cook, DuPage, Kane and Lake Counties in the Chicago Regional Area. Bond issues totaling $15,045,000 for widening streets and building important bridges in Chicago was voted April 13.

Wisconsin: Milwaukee, Racine, Kenosha and Waukesha Counties are planning or undertaking the construction of four lane pavements, either as 40-foot roadways or as two 20-foot roadways separated by a park strip.

Indiana: The Ideal Section of the Lincoln Highway, 40-foot wide, shows the type of highway needed today. A movement is under way to widen the Dunes Highway to 40 feet.

California: There is a great deal of activity in Southern California in wide highway and street construction. Examples are Pico Boulevard, 75 feet wide; Cahuenga Pass Road, 72 feet wide and the Foothills Boulevard widened to accommodate three lanes of traffic. The Coast Highway leading south from San Francisco has been widened to accommodate the traffic it bears.

Estimated Expenditures for Highway Construction and Maintenance in Eleven Western States During 1927

	Total Funds Available*	Funds for New Construction†	Amount of Federal Aid	Funds for Maintenance
Arizona	$ 3,450,000	$1,355,000	$1,395,000	$ 700,000
California	18,000,000	.....	3,000,000	.....
Colorado	4,856,202	3,765,000	1,354,000	1,597,000
Idaho	2,736,589	600,000	936,580	600,000
Montana	5,380,000	1,920,000	4,000,000	275,000
Nevada—(Not Avail Until After Legislative Session)				
New Mexico	2,585,000	300,000	1,185,000	1,000,000
Oregon	10,500,000	4,500,000	1,200,000	2,800,000
Utah	2,100,000	1,600,000	782,505	500,000
Washington	11,500,000	.....	1,130,000	.....
Wyoming	2,730,000	550,000	1,330,000	600,000

* Includes Federal Aid.
† Does not include Federal Aid.

Highway Expenditures in Western States During 1926

	For New Const.	Federal Aid	For Maintenance
California*	$10,626,563.74	$3,287,067.83	$4,367,133.51
Colorado	3,600,000.00	1,350,000.00	1,540,000.00
Idaho	1,292,000.00	775,000.00	600,000.00
Montana	1,693,299.07	1,409,363.57	129,965.04
Nevada	4,000,000.00	3,000,000.00	550,000.00
New Mexico	350,000.00	1,500,000.00	1,000,000.00
Oregon	4,250,000.00	1,265,000.00	2,300,000.00
Washington	8,242,798.00†	1,125,000.00	.....
Wyoming	1,480,000.00	783,634.00	630,000.00

* From July 1, 1925 to June 30, 1926.
† Includes funds spent for maintenance.

Southwest Road Show And School Progress

Some of the foremost authorities of road and construction material and highway construction in the United States are on the program of the Second Annual Southwest Road Show and School, which will be held in Wichita, Kansas, February 22-25, 1927.

Among the outstanding experts who will speak at these school sections are: W. E. James, U. S. Bureau of Public Roads; T. J. Donahue, Wisconsin State Highway Engineer; H. P. Lee, San Francisco engineer; H. P. Clemmer, New York engineer; Prof. C. W. McNown, Kansas University; Prof. R. L. Conrad, Kansas State Agricultural College, and others. These speakers are leaders in highway administration construction and maintenance, and have specialized in the study of the subjects they will present. Each has a message to present which most engineers, commissioners and contractors cannot afford to miss, if he considers the interests of his municipality or firm of prime importance.

The Good Roads School program is arranged by the co-operation of the Kansas State Highway Commission and Kansas State Agricultural Engineering Division, with the co-operation of the Southwest State Highway Engineers and Bureau of Public Roads.

The United States Department of Agriculture will send their latest good road exhibit to the Southwest Road Show and School, and manufacturers and distributers of machinery and equipment used in construction work; road building and maintenance of all types of roads, especially along the motor and construction equipment and materials will have at this show and school the largest array of exhibits consisting of construction, road building, maintenance machinery, trucks, accessories, materials, etc., which has ever been displayed at any one time in the southwest.

No admission will be charged to the Road Show and School, and an attendance of 50,000 or more is anticipated by the management from the central and southwest states.

Inventor of Ord Concrete Road Finisher Dies in Los Angeles

William Ord, for many years associated with the designing and manufacture of road building and contractor's machinery, died suddenly at Los Angeles, Calif., on Sunday, December 12. Mr. Ord was widely known in civil engineering and road building circles and was the inventor of the Ord Concrete Road Finisher. Since 1922 and at the time of his death, Mr. Ord was sales manager of A. W. French & Co., Chicago, manufacturers of the Ord finisher and other contractor's machinery.

Test Road Materials Under Actual Weather Conditions

Materials used in federal aid highways in Kansas are being tested under actual weather conditions in the laboratory of the State Agricultural College. A special Frigidaire electrically refrigerated cooler capable of maintaining a temperature of 32 degrees below zero F. has been installed.

Stone, gravel, and cement going into concrete for road work, will be given various tests at even colder temperatures than will be experienced in actual use. The cooler has a capacity of six cubic feet and is so constructed that materials can be under observation at all times.

AUTO MAN MAKES ROAD AID PLEA TO HOUSE BODY

Washington—The 3,678,327 automobiles and 474,923 trucks built last year, if placed on a road at 20-foot intervals, would extend 25,417 miles, or around the world at its equator.

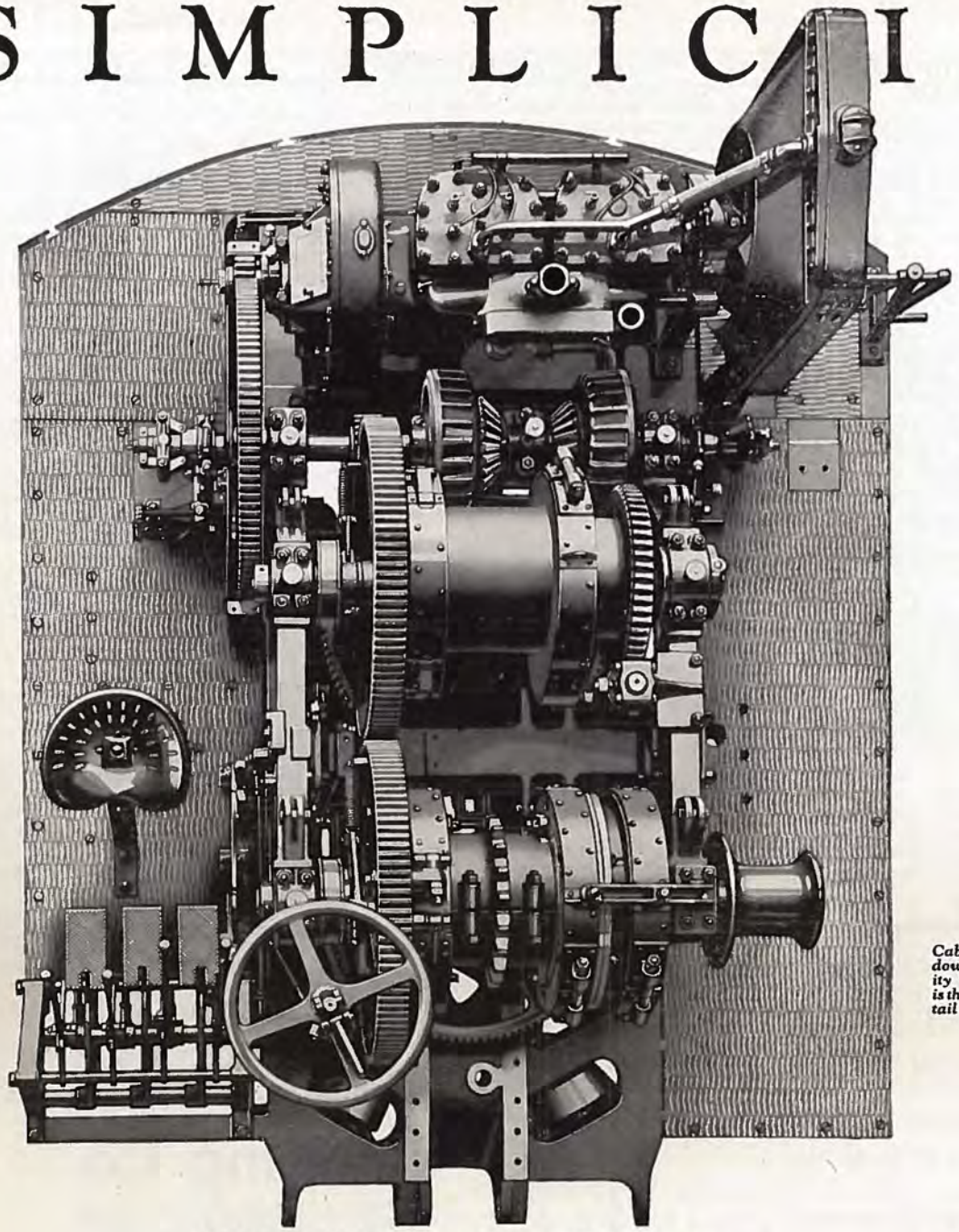
The house road committee was given this information recently by H. H. Rice of the National Automobile Chamber of Commerce, in an argument for continued large Federal road aid appropriations.

"There can be no question about the attitude of the public toward continued highway development," Rice said. "The mere fact that there are 20,000,000 motor vehicles on the streets and highways of the nation today constitutes a straw vote of tremendous significance."

Nearly $2,000,000,000 a year is being spent for automobiles, and three times that amount for gasoline, tires and repairs, he said.

The annual authorization of $75,000,000 by congress for Federal aid makes up only 8 per cent of the total spent on highways, Mr. Rice said, adding, however, that the Federal aid has great value in upholding high standards and promoting co-operation.

SIMPLICITY



Proved Machines Again Improved

Cab removed—looking down. Note accessibility The compact layout is the reason for the short tail swing. Gear covers removed.

OPERATORS say that P&H Excavators are the simplest, most accessible and easiest machines to keep clean and in perfect operating condition of any machines built.

The illustration above shows the truth of this statement.

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UNIT CAST STEEL CONSTRUCTION

SNOW STATES REPORT OPEN ROAD PROGRAM

Highway officials in 36 "snow states" report a program of open roads for the snow season of 1926-27 aggregating 92,756 miles. In the winter of 1925-26 the road mileage cleared of snow in these states was about the same, compared with 62,165 miles in the winter of 1924-25. Their expenses for snow removal work last winter were in the neighborhood of $4,000,000. The 36 snow states in 1925 had 375,774 miles of surfaced rural roads, and 16,139,859 registered motor vehicles.

Costs of snow removal vary in different localities. The frequency, general direction and strength of the prevailing winds are important factors. An area in such a position as to be protected from heavy winds, or having its main roads parallel with the general direction of the wind, may keep the cost of snow removal to the minimum. Areas in open country with main roads running in a direction that makes drifting inevitable, may have much heavier costs. Whether the snow is moist or dry is another cost factor, dry snow being naturally cheaper to remove. Snow falling to a depth of 7 inches without wind can be removed at low cost before it has settled or become packed.

MORE BUSSES ARE IN USE

The number of sightseeing, tourist, and contract busses has increased more than 66 per cent in the last year. The number of busses in this classification in use on January 1 throughout the United States is estimated at 2,500, and compares with 1,500 on the corresponding date a year ago, a survey just completed by Bus Transportation shows.

The largest group of such busses is operated in the national parks, approximately six hundred being in use in this service, including a small minority of touring cars.

Widespread use of sightseeing and touring busses is reported in New York City, where 367 cars are employed in this work. Other cities with sightseeing activities of major importance are Los Angeles, Den-Washington, Boston, Chicago, Philadelver, Washington, Boston, Chicago, Philadelphia, Baltimore, Detroit, and Atlantic City.

GASOLINE CONSUMPTION INCREASES

Gasoline consumption in 32 states, as indicated by reports of distributors in various states under provisions of gasoline tax or inspection laws, for seven months ended with July, 1926, totaled 2,370,817,000 gallons, against 2,039,881,000 in the same period of 1925, an increase of 16.2 per cent, according to the American Petroleum Institute. Gasoline consumption in the same thirty-two states in July totaled 424,705,000 gallon, against 376,058,000 gallon in July, 1925, an increase of 12.9 per cent.

Good roads has done much to give the American farmer his opportunity as a business man and to increase his profit on the farm.

Civilization rests on transportation and acquaintance. Good roads give both.

"Colorado's Diadem of Gold"

Dawn breaks, comes the awakening of the hills,
Silvered skies reflect in lakes and rills.
Portrayed, we see before our wondering eyes
Colorado enthroned; God's Paradise.
Granite peaks few human feet have trod,
Pierce the very portals of our God.
Sunbeams kiss the mountains as in play,
Speed on and on toward their endless day.

Rugged pinnacles stand in mystic forms,
Sentinels of time, scarred by winter's storms.
Trickling rills swell the flowing streams;
Nature's wonderland, fulfilling an artist's dreams.
Forested slopes reach toward the crest;
Silvered rays brighten the golden west.
Restless streams rush on toward the sea
Guided by unseen hands that rule Eternity.

Mellowing rays bespeak of quieting hours,
Clinging rays color the mountain flowers.
Sloping sunbeams scatter the gathering mist;
Colorado glorified, the mountains rainbow kist.
Ever westward fly mellowing rays of light;
Crimson shadows herald the coming night.
Farflung hills tenderly then enfold;
The kiss of sunset: Colorado's diadem of gold.

J. C. Glassford.

Forest Trails

(Continued from page 8)

we repaired and used many miles of trails built by mining companies, stockmen and prospectors. A great deal of this mileage was unsatisfactory because of steep gradient, rocky tread and poor location, but we were forced to use it until a better system could be provided.

In the protection of the Forests, trails are of even greater importance than roads and since our ideal is to reach any and all fires within two hours after they are reported, it is essential that the location of trails be well planned and that they may be traveled at a maximum speed for saddle and pack stock. In the mining regions and also in old cutover acreas, many miles of old roads which are unfit for auto travel are being used as trails.

Definite standards for trail construction have been established and the work is now progressing in a systematic manner. Main trunk line trails which are heavily used are classed as "Primary" and are carefully located, cleared and graded. The same location standards apply to "Secondary" trails in order that they may, if travel warrants it, be converted into primary trails by additional grading.

The greatest need, particularly on the fire Forests, is a network of "Ways" which will enable Forest Officers to get men and supplies to a fire as quickly as possible. Since these ways are used only occasionally, we are not warranted in constructing to a high standard, and the work consists principally of clearing out down material, brush, etc., and grading in a very few cases.

The Trail System as now planned for the National Forests of Colorado comprises about 10,500 miles, of which 20% (1,000 miles) is Primary, 50% (5,500 miles) is Secondard, and the remaining 30% (4,000 miles) consists of ways through the Forests. To date the Service has spent a little over $280,000 in trail construction and about $100,000 more will be required to complete the system. About 8,500 miles are considered satisfactory and the remaining 2,000 miles are unsatisfactory old trails or nonexisting proposed projects. Last year Forest Officers of Colorado built about 580 miles of trail at a cost of approximately $40,000, which includes $3,000 in co-operation.

Changing conditions will require changes in the trail plans and it is not at all probable that the point will ever be reached where no new trails are needed and where all existing trails are satisfactory. However, the trail program is being rushed to completion as fast as possible and it now seems that we will be pretty well caught up by the close of 1928.

If these trails are to provide the proper protection to the Forests, they must be well maintained and the keeping of these 10,500 miles of trail in repair is no small job. At present the trail maintenance bill is about $20,000 per year and the total will probably be around $30,000 per year when the entire system is completed.

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

New Half Yard P&H Excavator

In answer to the many requests by contractors for a small, light P&H excavator, the Harnischfeger Corporation has just brought out a new ½ cu. yd. capacity machine, called Model 300. The same high standard of quality which has earned for the larger models their reputation, will also be present in a smaller model.

These machines are built specially for the contractor who specializes in small jobs, such as basement excavation, etc., where exceedingly short tail swing, ability to travel in close quarters, power, speed and reliability are deciding factors. With a tail swing of 7 ft. 1½ in., a swing speed of 5¼ r.p.m., powered with a 50 hp. gas motor, a hoist independent of the swing, a corduroy that can be turned in the tightest places, it can be readily seen that this model 300 is the ideal machine for the smaller contractor. It can be used with the following attachments: shovel, dragline, clamshell, crane pile driver, or magnet. For clam service, etc., it is equipped with a 30-ft. boom.

Like all larger P&H models, this model 300 is also equipped with the P&H patented power clutch control. Only 4½ lb. pressure is required to work the levers —the motor does the rest.

Austin-Western Builds New Cab For Snow Grader

With the increasing use of motor graders for this work of snow removal, the Austin-Western Road Machinery Company has designed an all-steel cab for their Austin-International Leaning Wheel Motor Grader, that gives protection to the operator and does not hamper his control of the levers for running the machine in any way.

The leaning front wheels on the Austin-International grader is said to be an exclusive feature, designed to eliminate side slippage when used on an embankment. These wheels can be adjusted to suit the occasion, and because of there being no pulling force in the front, the tendency to sideslip is great. If the wheels were straight, the blade would have to be so adjusted that the force on the front would not be great, reducing the work being done, and wasting considerable time. With the adjustable leaning front wheels, it is claimed by the manufacturer that the maximum of work can be accomplished without side slipping.

Chain Belt in New Home

Chain Belt Company, Milwaukee, has started work on a new engineering building at its West Milwaukee Works. The building will house the steel fabricating and assembly departments, drafting room, and general contract engineering offices. This is the third major unit to be erected on the 59-acre West Milwaukee site, and is part of the general plan to gradually move the Milwaukee plant, located at Sixteenth avenue and Park street, to the larger tract in West Milwaukee. When the engineering building is completed approximately half of the organization will be located at the West Milwaukee works.

FWD Announces New Truck

The Four Wheel Drive Auto Company, Clintonville, Wisconsin, has just placed on the market a 1½-2 ton four-wheel driven truck, to be known as the Model H. This is not a replacement of an older model, but is an addition to the company's present line.

It is being placed on the market after more than a year's development, the truck having been thoroughly tested in South America under severe operating conditions, as well as in the United States. The Model H is constructed along the same general lines as the company's standard Model B, but has the motor in front of the dash instead of under the seat. The Model H is built for general hauling, light road maintenance, snow removal work, and power line construction utility work.

Koehring Shovel With Power Dipper Trip

A power dipper trip has recently been brought out by the Koehring Company, Milwaukee, manufacturers of pavers, mixers, gasoline shovels, cranes and draglines, and has been made optional equipment on Koehring heavy duty gasoline shovels. It conforms to the Koehring principle of finger-tip control and is so constructed that one finger can move the lever which trips the dipper. The operator is able to trip it swiftly and without effort.

J. D. Adams Establishes Spokane Factory Branch

Whereas adjustable leaning wheel graders until recently were sold in Western Washington by a distributor, they with other Adams road equipment are now sold in that territory by direct factory representatives working out of the J. D. Adams and Company banch office at Spokane, Washington, according to a recent announcement.

Speeder Crane Dealer Joins Snow Company Staff

D. G. Irions, formerly representative of the Speeder Machinery Corporation, manufacturers of gasoline shovels, cranes and draglines, at Denver, Colo., has resigned to become manager of the Portland, Ore., office of the L. A. Snow Company, according to an announcement emanating from the Speeder company.

John Fink will represent the Speeder company in the Denver territory.

Stockland Whippet

The Stockland Road Machinery Company, Minneapolis, Minn., manufactures a Whippet grader which it claims to be the only one-man power patrol of its kind on the market of the pull type. It is said to be attachable to practically any type of tractor on the market, and is instantly detachable from the tractor. Big reduction gears and cam auxiliary spring lift makes the hand wheel easy to work.

A new ½-yard Excavator designed for small contract jobs, recently placed upon the market by the Harnischfeger Corporation.

Backfiller Machine Designed For All Light Crane Work

While it is primarily a backfiller, the machine recently designed by the Buckeye Traction Ditcher Co., Findlay, Ohio, can also be used for all light crane work such as handling pipe, batch boxes, forms, stone and steel, rehandling loose material with a clamshell, etc. It has a full circle swing and an adjustable boom which increase its adaptability to many purposes. It utilizes full length crawler traction. The operator faces the work at all times and the machine travels and is easily controlled with the boom facing in any direction.

Traffic Signals—The Interflash Signal Corporation, 120 Broadway, New York City, has issued a circular illustrating the various uses of its interflash traffic signal.

RECENT PUBLICATIONS

The following trade publications of interest to highway officials, engineers and contractors have been issued recently. Copies of them can be obtained by addressing the firms mentioned:

Lime in Earth Road Construction and Maintenance—The National Lime Association, 918 G St., N. W., Washington, D. C., has issued a buletin describing the use of lime in earth road construction and maintenance. It contains descriptions of experimental roads and the results obtained fro n the use of lime. A table showing the amount of lime required for various conditions is included.

Truck Mounted Mixers—A line of truck mounted mixers, a new product of the Chain Belt Co. of Milwaukee, manufacturers of Rex high speed mixers and pavers, is described in full in a bulletin recently issued by that company. This bulletin is entitled "Faster Mixing on a Faster Moving Basis" and it features the kinds of work a truck mounted machine can do.

Snow Plows—The Good Roads Machinery Corporation, Kennett Square, Pa., has just issued a catalog illustrating and describing its complete line of Good Roads Champion snow plows. Complete description of the various plows and their uses are given, and numerous illustrations of snow removal work are included.

Shunk Manufacturing Co., Bucyrus, Ohio, have just published a pamphlet showing their improved methods and facilities for manufacturing road grader blades. This interesting pamphlet shows the manufacturing of grader blades from the raw material to the finished product. Copies of the pamphlet may be obtained upon request to the above company.

Galion Iron Works and Mfg. Co., Galion, O., has put out a new bulletin illustrating the "Galion mono-veyor." It is said, the Galion mono-veyor is the foremost development in the Monorail conveyor field. The company has also put out the Galion master 4-cylinder motor roller. Galion master rollers are sold through Galion branches and distributors located in all parts of the U. S. A., and the Galion master roller stands competent, loyal and efficient. On request a copy of this bulletin may be obtained.

PLANS SUBMITTED TO U. S. BUREAU OF PUBLIC ROADS FOR APPROVAL

Proj. No.	Length	Type	Location
145-A	3.807 mi.	Gravel Surfacing	West of Glenwood Springs
279-E	3.243 mi.	Grading	Schaffers Crossing and Baileys
276	.....	R. R. Overpass	North of Colorado Springs
275-G	10.869 mi.	Grading	Larkspur and Monument

PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
2-R5	1.5 mi.	Paving	South of Aguilar
138-A	5.0 mi.	Surfacing	North of Kremmling
247-C	0.5 mi.	R. R. Subway & Paving	Swink
254-C Div. 2	150 ft. Bridge	Steel Truss Bridge	Southwest of Hot Sulphur Springs
275-E	2.0 mi.	R. R. Underpasses and Paving	Monument
258-E Extension	1.5 mi.	Gravel Surfacing	Cimarron
560	3.0 mi.	Gravel Surfacing	Deer Creek-Littleton
631	120 ft. Bridge	Timber Bridge	Trumbull

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1926

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	$ 331,632.00	80	2-R4
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	28,882.70	6	2-R3
79-A	Big Sandy Creek, East of Simla	10 19-ft. Spans	Timber Trestle	A. R. Mackey	10,421.26	75	79-A
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	51	134-A
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	22	144-A1
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	63	157-A
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	82	213-D
242-AR1	East of Fruita	125 ft.	Steel Bridge	F. H. Knollman	19,999.00	79	242-AR1
246-E & 231-R	West of Avondale	2.454 mi.	Concrete Paving	Strange-Maguire Pav. Co.	68,083.90	100	246-E 231-R
254-B	Hot Sulphur Springs-Parshall	1.087 mi.	Gravel Surfacing	Pioneer Const. Co.	61,071.00	100	254-B
254-C Div. 1	2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	59	254-C D. 1
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	92	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	39	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	22	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	62	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	56	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	21	265-B
267-B	Hoehne-La Junta	2.200 mi.	Gravel Surfacing	Central Const. Co.			
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	86	271-B
271-E	East of Portland	1.303 mi.	Gravel Surfacing	E. H. Honnen	35,815.00	100	217-E
275-C	Husted-Monument	4.795 mi.	Concrete Paving	J. L. Busselle & Co.	186,585.20	90	275-C
275-C Div. 2	East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,966.00	0	275-C D. 2
275-D	North of Castle Rock	0.879 mi.	R. R. Underpass	J. Fred Roberts Const. Co.	55,700.00	100	275-D
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	64	275-F1
278-B	Hugo, east	6.856 mi.	Sand Surfacing	D. S. Reid Const. Co.	17,222.00	100	278-B
279-C	Conifer-Baileys	5.772 mi.	Grading	W. A. Colt & Son	114,542.00	100	279-C
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	77	281-D1 251-B1
282-A	South of Craig	250 ft.	Steel Bridge	Northwestern Const. Co.	79,442.00	100	282-A
282-B	West of Meeker	2.932 mi.	West from Meeker	Winterborn & Lumsden	31,466.00	100	282-B
282-C	North of Rifle	4.052 mi.	Gravel Surfacing	Hinnan Bros.	50,200.00	100	282-C
283-B	Berthoud, south	4.2 mi.	Concrete Paving	C. C. Madsen Const. Co.	168,835.00	100	283-B
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	51	283-C
287-A2	Fort Morgan, west	4.011 mi. 16.61 mi.	Concrete Paving Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	92	287-A2
287-B	Greeley, east	7.565 mi.	Grading	A. R. Mackey	127,303.00	100	287-B
288-A	Merino-Brush	19 mi.	Grading and Surf.	Scott & Curlee			
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	19	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,645.25	75	293-B
294-B	Mancos-Cortez	1.416 mi.	Gravel Surfacing	Engler & Teyssier	21,551.40	100	294-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	38	295-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Cole Brothers	58,061.00	17	296-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	91	297-B
298-A	Pagosa Springs, east	1.779 mi.	Gravel Surfacing	John A. Duncan	22,465.00	100	298-A
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	52	299-A

KEYSTONE CULVERTS

Meet the Requirements of

U.S. Bureau of Public Roads
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U.S. Indian Service
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"The first KEYSTONE Culverts installed in this section are still in service today, and from their present excellent condition they will be in service for many years to come.

"No stronger evidence is possible."

ECONOMICALLY SERVING UNDER HIGHWAYS IN THIS TERRITORY

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KEYSTONE COPPER STEEL

The **COLORADO CULVERT AND FLUME COMPANY**

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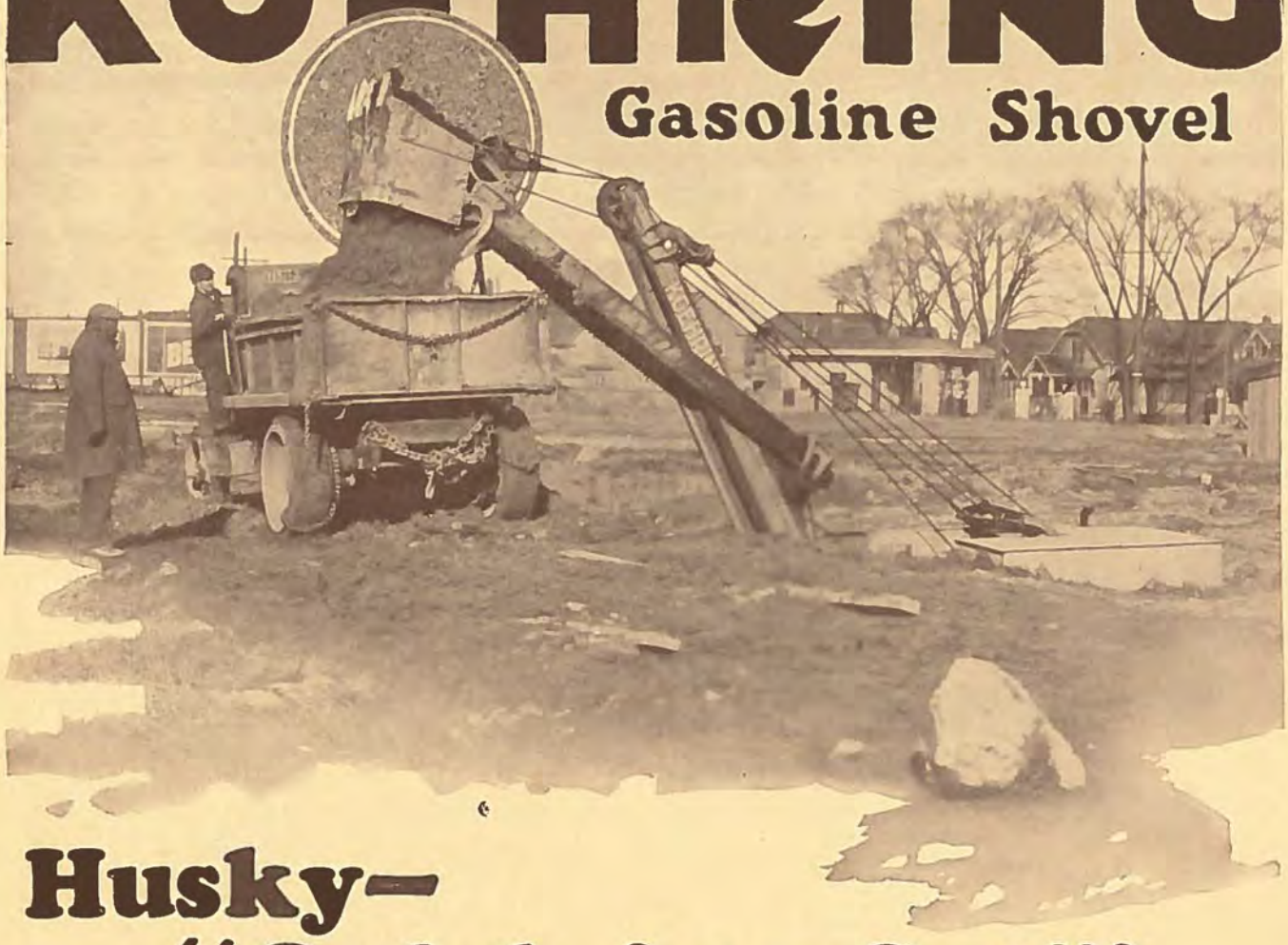
KOEHRING

Gasoline Shovel



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"Quick As a Cat!"

RUGGED — built to endure — but there's nothing ponderous in its *action!* It's amazing how the strong boom, stout sticks and dipper leap to their work! Active! Agile! Eager! Those words describe Koehring action!

Independent crowd permits bucket to be crowded above and beyond the end of the boom! A low dig or a high, shallow one — level stripping or high bank work — a deep, close-in gouge, perhaps to pry out a rock — the Koehring meets every situation at the instant command of the operating levers!

—and it doesn't take big man-power to operate the Koehring! Finger-tip ease of operation and smooth fast responsiveness give the operator a chance to make a record every day — *teases* him to race his records!

—and then — don't forget that the Koehring in every gear and detail, from multiplanes to boom tip is strictly designed for internal combustion engine power. The result is smoothness of action that minimizes wear and strains, and together with Koehring Heavy Duty construction, means long service life, and season-to-season dependability. *Know the Koehring!*

Shovel Capacities

No. 1—¾ cu. yd. dipper, struck measure, on 19 ft. 6 in. boom, with 16 ft. dipper sticks; 4 cyl. 5¼ x 6½ in. gasoline engine, 1000 R. P. M.

No. 2—1⅛ cu. yd. dipper, struck measure, on 20 ft. 7 in. boom, with 16 ft. dipper sticks; 4 cyl., 6 x 7 in. gasoline engine, 925 R. P. M.

Write for Shovel Bulletin No. S. 19

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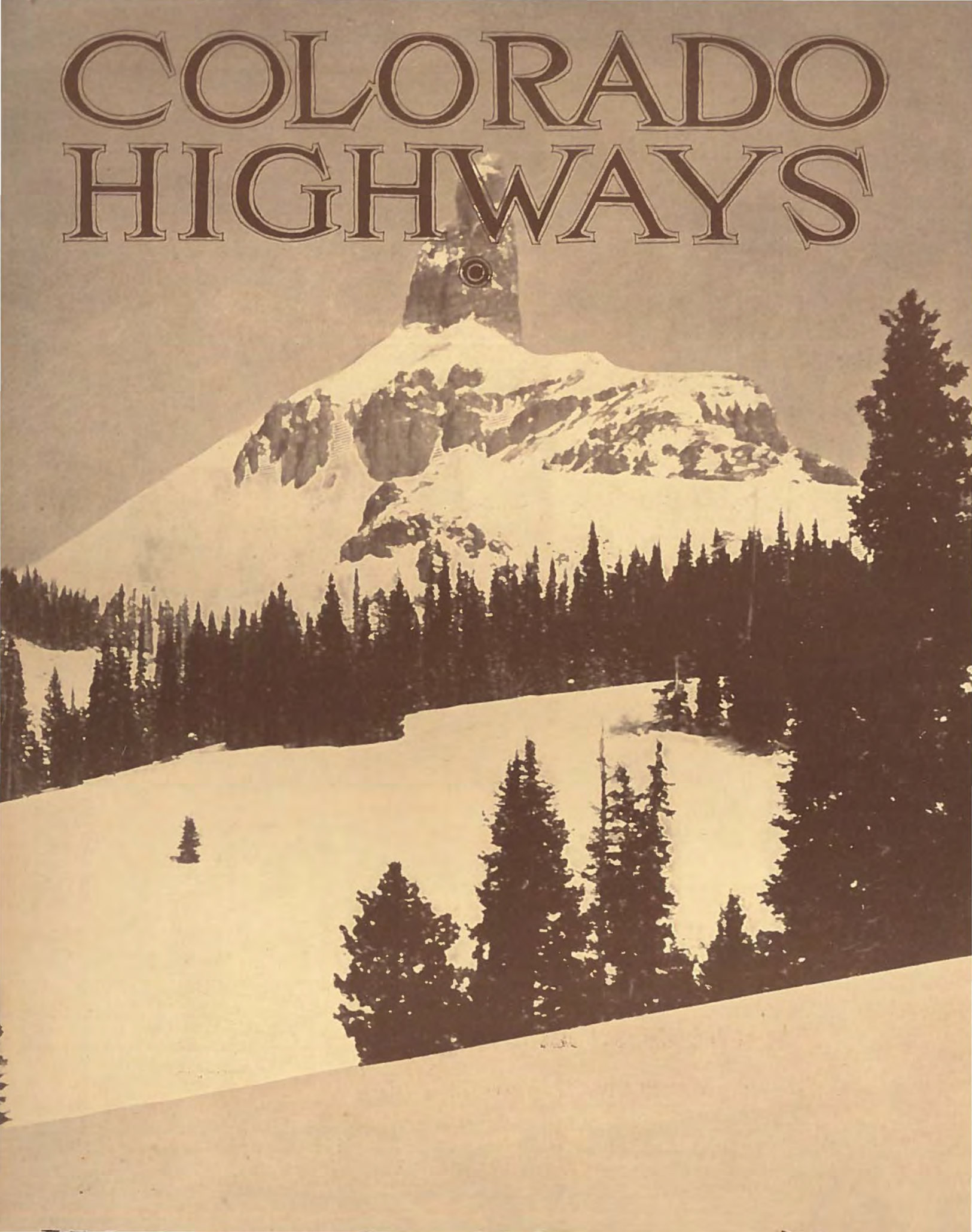
COLORADO HIGHWAYS



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You, too, can use "Caterpillar" track-type power to do your work BETTER, QUICKER, CHEAPER.

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15,000 OWNERS ARE PROVING THAT CATERPILLAR TRACTORS DO THE WORK BETTER, QUICKER, CHEAPER.

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Colorado Highways

"BETTER ROADS"

Official Publication of the
COLORADO STATE HIGHWAY DEPARTMENT
Denver, Colorado

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State Highway Engineer.
OLIVER T. REEDY,
Senior Assistant Engineer.

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M. W. BENNETT, Editor

Articles on the subject of road building and highway development in the West are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible. Manuscripts not found available will be returned promptly.

10 CENTS A COPY. **$1.00 A YEAR.**

Colorado Highways
"BETTER ROADS"

VOLUME VI. MARCH, 1927. NUMBER 3

Modern Highway Systems

THE increasing trend toward motor vehicle transportation has intensified the necessity of intelligently planned highway systems. The plan of state highway improvement may materially alter the economic and social development of a people as a whole, or any section. Dr. J. G. McKay, of the bureau of public roads, points out that the location and improvement or lack of improvement of a given route is of vital importance not only to the traffic of the immediate locality, but also to the traffic of larger areas. He says:

"The development of a system of highways should be considered in terms of the movement of people and goods. The planning and construction of a connected system of highways deal with the destiny of localities and states, their agriculture, their industries, the growth of suburban areas adjacent to centers of population, and the social activities of the people. This is a tremendous responsibility. There can be no question concerning the necessity of developing sound plans for highway improvement over a period of years in the several states, and of providing the necessary money to carry out economically the proposed plans of improvement."

Road construction is not now the problem that it was. The immense tractors and our heavy road machinery take the place of hundreds of men and horses formerly necessary, and minimize possibility of labor troubles; to say nothing of making it possible to complete a given job in much less time.

Our main through-highways must be paved with some material requiring little maintenance, and which can be repaired, when necessary, while the highway is in use—eliminating costly detours with their waste of time and inconvenience.

Blowing Away Our Roads

DURING the past summer the State Highway Commission of Virginia endeavored to solve the dust problem. Asphaltic oil or calcium chloride was placed on sections of road in front of every store and church on the state highway system.

The chairman of the highway commission says that dust is getting to be the greatest problem the highway department has to deal with. Not only does it cause great personal discomfort and material damage, but, being wafted away by every passing wind, it leaves the roadbed in deplorable condition.

In every state, it will be necessary to build ten miles of county roads for one mile of heavier paved state highway. The problem of maintaining old gravel and macadam roads, and eventually surfacing them with a suitable waterproof surface at a minimum of expense, must occupy the attention of our road builders.

The rapidly moving automobile throws dust for several hundred feet on each side of the highway, thereby damaging crops and fruits to such an extent that the products are often unmarketable. Now is the time to consider this problem, before "next summer" is here.

Roads Transform Farm Life

MODERN highways and motor transportation have made the isolation of the farm a thing of the past. Modern highways are transforming farm life over the entire nation, relieving it of its loneliness and placing it in contact with all that is going on in the world. Good roads present more than a pathway for tourists or trucks. The better picture is that of rural homes linked together with community gatherings, and the men, women, and children of the farms mingling with those of the farm and city. Farms are brought nearer together, social life is increased, problems are now discussed and solved. Rural life which has been the joke of city people for many years, has changed. The people in the great open spaces are now being envied for their freedom and happiness. This has been brought about by the development of good roads.

Motor Vehicle Transportation

THE Highway Department is not building highways and maintaining them for the sake of highways, but because they form an important link in the state's transportation scheme. Transportation is probably the best measure we have of industrial development, and some would put it the best measure of civilization. The highways with their accompanying vehicles are becoming an increasingly important part of transportation.

The state has assumed responsibility for 8,800 miles of the public highways and the Department's duty is to make these great streets of the state and nation, as efficient in carrying their part of the motor transportation as possible. They must be connected, usable and efficient travel ways, and the people of the state should trust the Department with the needed funds to make the state highways what they should be.

Two Views Showing Construction of Pavement North of Colorado Springs With Gold Ore.

Colorado's Golden Highway

Precious Metal Goes Into Pavement on Five-Mile Project

A MATERIAL that adds greatly to the richness of the concrete was tried out recently by the Colorado State Highway Department on a Federal Aid project on the Denver highway north of Colorado Springs. Every mile of this 5-mile project contains $3,000 worth of gold which found its way into the pavement by reason of the fact that the crushed rock used making the mix was shipped from the ore dumps of the Cripple Creek gold fields. The gold content in this material is assayed at $1.50 per ton and in each mile about 2,000 tons of stone are used, thus accounting for the $3,000 in gold. Whether or not this gold shows up in the surface of the pavement is not stated by V. H. Littlefield, resident engineer of the State Highway Department, who sent this article to Successful Construction Methods.

Apart from its gold content, this job is of interest because of the fact that it was handled from a central mixing plant which is illustrated in the photographs on the opposite page. The mixed concrete was hauled from this plant to the paver in 1-ton Ford trucks, a fleet of ten of these trucks being kept busy.

The contractor on this job was J. L. Busselle & Company of Colorado Springs. The work of laying concrete began September 1st, the dirt work and grading having been in progress since last April. About 110,000 cu. yd. of excavation was necessary before paving began.

The sand used on the job is obtained at pits less than two miles from the plant and was of such even grade that the regular pit run was used after a preliminary washing.

The contract price for the work was $200,000 and 50 men were employed. Russell Dunn was the superintendent in charge for the contractor.

The job included one 80-ft. bridge and about 35 culverts of various kinds. Ernest Montgomery was the division engineer in charge for the Colorado State Highway Department.

Collection and Disposition of Motor Vehicle Funds

By Henry R. Trumbower, Economist,
Bureau of Public Roads

DURING the calendar year 1925 the gross receipts derived from motor-vehicle license fees and gasoline taxes in the United States amounted to $406,648,561. These figures refer only to the revenues collected and received by the several states and by the District of Columbia; they do not include any of the collections made by cities and municipalities on account of local license fees or gasoline taxes. The gross receipts resulting from motor-vehicle registration fees, licenses, permits, fines, etc., amounted to $260,619,621; the total tax earnings on gasoline and motor-vehicle fuel, after deducting all refunds, amounted to $146,028,940. The registration fees, according to these figures, constituted 64 per cent of the total motor-vehicle revenues collected by the states, and the gasoline taxes 36 per cent. The relation of the license fees and the gasoline taxes to the total motor-vehicle revenues for each of the years since 1920 is set forth in Table 1.

Table 1.—Total gross receipts from license fees and gasoline taxes 1920 to 1925.

Year	License Fees		Gasoline Taxes		Total Motor-Vehicle Revenues
	Amount	Per Cent	Amount	Per Cent	
1920	$102,546,212	99	$ 1,475,136	1	$104,021,348
1921	122,478,654	96	5,302,259	4	127,780,913
1922	152,047,823	93	11,923,442	7	163,971,265
1923	188,970,992	84	36,813,939	16	225,784,931
1924	225,492,252	74	79,734,490	26	305,226,742
1925	260,619,621	64	146,028,940	36	406,648,561

In 1925 the total motor-vehicle revenues were practically four times as great as in 1920; and in the same period the number of registered motor vehicles in the country slightly more than doubled. In 1920 the total motor-vehicle revenues, including license fees and gasoline taxes, averaged $11.27 per vehicle; in 1925 the average had risen to $20.27 per vehicle. The increase in total motor-vehicle revenues was, therefore, due to two causes—an increase in the number of motor vehicles from which license fees were collected, and an increase in the average receipts per motor vehicle on account of the rapidly extended application of the gasoline tax and increases in the fees charged for licenses. The license fees in 1920 averaged $11.18 per vehicle; in 1925 the average was $13.06. The gasoline taxes in 1925 amounted to more than the total license fees collected in 1921 and almost as much as the 1922 license fees. Constituting, in 1925, 36 per cent of the total motor-vehicle receipts whereas in 1920 they were but 1 per cent, it is evident that the gasoline tax revenues have become a substantial part of the country's total motor-vehicle revenues.

These motor-vehicle revenues collected by the States, when compared with the country's total annual expenditures on rural highways, make a very impressive showing. Our rural highway expenditures, according to the best estimate that can be made, amounted in 1925 to $1,288,939,707. It follows, therefore, that the amount collected in the form of license fees and gasoline taxes was equivalent to 31.5 per cent of the total rural highway expenditure. This ratio has been increasing from year to year.

Part 1. Receipts From Motor-Vehicle Registration Fees, Licenses, Permits, Fines, Etc.

The figures presented herewith cover the total funds received by State and county officials in connection with the operation of the motor-vehicle license laws. The total receipts are recorded by all the States but there are still a considerable number which do not report the detailed sources of receipts. It is hoped that in the future reports more complete details can be presented.

Officers in charge of registration and license fee collection.—In each of the States a state officer or department is made responsible for the collection of the license fees and supervises the enforcement of the motor-vehicle registration laws. In a majority of the States this officer is the secretary of state. There are, however, a number in which the legislatures have created separate motor-vehicle departments and there are others in which the collecting and registering function is delegated to the respective state highway departments. At the present time there are 22 States in which the secretary of state is the responsible officer. These are Arizona, Colorado, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Maine, Michigan, Minnesota, Missouri, Nevada, Ohio, Oregon, South Dakota, Utah, Vermont, Washington, Wisconsin, and Wyoming.

In nine States there are separate motor-vehicle departments, the administrative heads of which are known as commissioners of motor vehicles or registrars. The States of this group are California, Connecticut, Maryland, Massachusetts, Montana, New Hampshire, New Jersey, North Dakota, and Virginia.

There are seven States in which the respective highway departments supervise motor-vehicle registrations and the collection of license fees in addition to their regular duties of constructing and maintaining the State highway systems. These are Arkansas, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Texas, and West Virginia.

In the States of Alabama, Kentucky, New York, and Tennessee the state tax commissions have charge. In Florida and New Mexico the duty is performed by the state comptroller. In Idaho the bureau of law enforcement is responsible; in Mississippi it is the auditor of public accounts; in Nebraska the department of public works; and in North Carolina the commissioner of revenue.

Although there is a state officer or state department

[1] Report of the highway finance committee, Highway Research Board, National Research Council, presented at the annual meeting of the board at Washington, D. C., December 3, 1926.

responsible for the collection of the motor-vehicle license fees in each of the States, there are 16 States where the laws provide that certain county officers shall make the collections and distribute the registration plates. In five States—Iowa, Kansas, Nebraska, South Dakota, and Washington—the county treasurers make the direct collections. In Arizona, Idaho, and Nevada it is the county assessor who collects the license fees in the first place. The clerk of the county court is the collecting officer in Kentucky, South Carolina, and Tennessee. In Mississippi and Texas the county tax collector collects the motor license fees, together with the other local taxes. The probate judges are the local collecting officers in Alabama and the county sheriffs in Arkansas, and the state comptroller in Florida is authorized and directed by law to establish county agencies to collect the fees in each locality.

Collection Expenses Vary Widely

Collection and administrative expenses.—The gross receipts from motor-vehicle registration fees, licenses, permits, fines, etc., and the amounts reported by the several States as spent for collection and administration are set forth in Table 2.

Thirty-four States and the District of Columbia reported that their collection and administrative expenses incurred on account of the registration and licensing laws amounted to $8,696,709 for that year. The total gross receipts for these same States which reported their collection and administrative expenses were $155,199,173. In these States, therefore, the collection and administrative expenses averaged 5.6 per cent of the total receipts. Among the individual States, however, there is a wide variation in this ratio, as shown in the table. In Arkansas the reported collection and administrative expenses were only $12,000, or 0.4 per cent, of the receipts; in Rhode Island they averaged 16.5 per cent. These are the two extremes.

In making such a comparison it must be borne in mind that certain items of expense are probably charged to this account in some States, whereas in other States similar expenditures are provided for by other funds or sources of revenue. In a number of States, as already pointed out, the actual collection of the fees and the registration of the motor vehicles is carried out by local county officers, such as sheriffs, county clerks, treasurers, or assessors. In such cases it is likely that a large part of the expenses connected with the administration of motor-vehicle licensing laws are borne by the local units of government, and that the reported expenses refer only to the administrative costs incurred by the State officials, who furnish the license plates and have but general supervision over the registration and licensing. In Tennessee, for instance, where the reported collection and administrative expenses amounted to only 1.8 per cent of the gross receipts, the county clerks collect the license fees from the car owners in their respective counties and charge each applicant in addition a fee of 50 cents, which the law authorizes as their compensation in full.[2]

In other States, where the ratio of collection and administrative expenses to gross receipts appear large and considerably above the average, services are rendered by State motor-vehicle departments and costs are incurred which are not found to the same extent in other States. In States like Maryland and Massachusetts, for example, the function of enforcing all provisions of the

[2] Motor Vehicle Laws of Tennessee, art. 5, sec. c., passed April 16, 1919.

Table 2.—Relation of collection and administrative expenses to gross receipts from license fees, etc.

State	Gross Receipts	Collection and Administrative Expenses: Amount	Collection and Administrative Expenses: Per Cent of Gross Receipts
Alabama	$ 2,511,129	-------	---
Arizona	405,592	$ 18,000	4.5
Arkansas	3,150,000	12,000	.4
California	7,816,298	951,076	12.2
Colorado	1,430,299	71,515	5.0
Connecticut	5,644,247	-------	---
Delaware	680,700	-------	---
Florida	3,645,628	261,220	7.2
Georgia	3,010,415	98,297	3.3
Idaho	1,192,587	-------	---
Illinois	12,969,754	-------	---
Indiana	4,649,663	205,681	4.4
Iowa	9,741,103	713,036	7.3
Kansas	4,610,090	230,505	5.0
Kentucky	3,780,062	132,105	3.5
Louisiana	3,400,045	40,000	1.2
Maine	2,182,135	-------	---
Maryland	2,576,301	250,000	9.7
Massachusetts	9,843,901	921,514	9.4
Michigan	14,526,002	300,000	2.1
Minnesota	9,744,834	-------	---
Mississippi	1,530,000	45,900	3.0
Missouri	7,267,098	432,023	5.9
Montana	915,253	32,000	3.5
Nebraska	3,936,458	98,411	2.5
Nevada	209,197	10,584	5.1
New Hampshire	1,736,094	114,610	6.6
New Jersey	10,515,323	1,177,057	11.2
New Mexico	457,874	31,991	7.0
New York	25,506,245	-------	---
North Carolina	8,359,844	149,761	1.8
North Dakota	1,083,573	150,000	13.8
Ohio	13,147,231	-------	---
Oklahoma	4,576,572	-------	---
Oregon	5,370,202	200,000	3.7
Pennsylvania	21,926,972	-------	---
Rhode Island	1,863,955	306,492	16.5
South Carolina	2,366,076	187,729	7.9
South Dakota	2,445,112	21,511	.9
Tennessee	3,060,948	54,243	1.8
Texas	13,477,931	476,146	3.5
Utah	554,235	-------	---
Vermont	1,497,146	82,037	5.5
Virginia	4,300,950	-------	---
Washington	4,980,026	240,059	4.8
West Virginia	3,354,247	264,386	7.9
Wisconsin	7,896,210	380,000	4.8
Wyoming	482,857	-------	---
District of Columbia	291,207	36,820	12.6
Total	$260,619,621	$8,696,709	---

Steam Shovel Working on New Road at the West End of Byers Canon—Federal Aid Project

motor-vehicle laws relating to the use of the highways rests with the State motor-vehicle departments to a much greater degree than it does in many of the other States. Maryland's expense ratio is 9.7 per cent, and in Massachusetts it is 9.4 per cent. Somewhat similar conditions prevail in New Jersey, where the ratio is 11.2 per cent.

There are still other States in which the State departments are required to examine all applicants for licenses as to their ability and fitness to drive. Where such provisions are in effect and where the costs of this additional service are borne by the motor-vehicle departments and charged against the department's gross receipts, the ratio of expenses to receipts is naturally higher than in States where such services and costs are not involved.

A number of States, although permitting the deduction of collection and administrative expenses from the gross receipts, place limits upon expenses of this character. Arizona fixes the maximum at $25,000, North Dakota at $150,000. The California law provides that the motor-vehicle department's administrative expenses shall be kept within 20 per cent of the gross amount collected in license fees; Georgia limits it to 15 per cent; in New Mexico the limit is 5 per cent; and in North Carolina the administrative expenses may not exceed 10 per cent of the collections. The Rhode Island legislature has limited the state board of public roads which registers the motor vehicles and collects the license fees to an annual expenditure of $30,000 for plates, $89,000 for clerical salaries, and $30,000 for other expenses.

If the expense ratio which has been found to exist in these States, which have reported their respective collection and administrative expenses, is applied to the total gross license fee receipts of all of the States the resulting estimate of total collection and administrative expenses amounts to approximately $14,500,000. The remaining $246,100,000 is available for highway purposes and other uses. In most cases where no collection and administrative expenses are reported the legislatures make definite appropriations to meet such costs and all of the total receipts are turned over to the State treasurer's department, usually to the credit of certain highway funds.

In discussing these variations in administrative expense ratio it must be observed that one of the reasons for them is the variation in the fees charged. For example, no more labor or expense is necessary in registering cars where the license fees average $10 per car than where the average is but $5. The expense ratio will differ, however, in direct proportion to the amount of fees charged.

Collection Costs From 7 Cents To $3 Per Car

The collection and administrative expenses of the States which reported this item amount to an average of 70.4 cents per motor vehicle registered. These States in 1925, reported a total registration of 12,266,460 vehicles. When the collection costs are averaged over the number of cars registered in each of the reporting States wide variations are also noticed. In Arkansas these administrative expenses amounted to 7 cents per registered vehicle; that is the lowest. The highest average is found in Rhode Island, $3.02 per vehicle. It would appear that both of these averages are not only extreme but abnormal. The registration of automobiles in Rhode Island is in the hands of the state highway commission, and it is quite possible that the figures which were reported as the expense resulting from the administration of the motor-vehicle registration law may contain other items of expense incurred by the commission which pertain to other functions and duties of the commission.

Table 3.—Relation of collection and administrative expenses to number of cars registered

State	Number of Cars Registered	Collection and Administrative Expenses: Amount	Collection and Administrative Expenses: Per Car Registered
Alabama	194,580	-------	----
Arizona	68,029	$ 18,000	$0.26
Arkansas	183,589	12,000	.07
California	1,440,541	951,076	.66
Colorado	240,097	71,515	.30
Connecticut	250,669	-------	----
Delaware	40,140	-------	----
Florida	286,388	261,220	.91
Georgia	248,093	98,297	.40
Idaho	81,506	-------	----
Illinois	1,263,177	-------	----
Indiana	725,410	205,681	.28
Iowa	659,202	713,036	1.08
Kansas	457,033	230,505	.50
Kentucky	261,647	132,105	.51
Louisiana	207,000	40,000	.19
Maine	140,499	-------	----
Maryland	234,247	250,000	1.07
Massachusetts	646,153	921,514	1.43
Michigan	989,010	300,000	.30
Minnesota	569,694	-------	----
Mississippi	177,262	45,900	.26
Missouri	604,166	432,023	.72
Montana	94,656	32,000	.34
Nebraska	338,719	98,411	.29
Nevada	21,169	10,584	.50
New Hampshire	81,498	114,610	1.40
New Jersey	580,554	1,177,057	2.00
New Mexico	49,111	31,991	.65
New York	1,625,583	-------	----
North Carolina	340,287	149,761	.44
North Dakota	144,972	150,000	1.04
Ohio	1,346,400	-------	----
Oklahoma	424,345	-------	----
Oregon	216,553	200,000	.93
Pennsylvania	1,330,433	-------	----
Rhode Island	101,756	306,492	3.02
South Carolina	168,496	187,729	1.11
South Dakota	168,028	21,511	.13
Tennessee	244,626	54,243	.22
Texas	975,083	476,146	.49
Utah	90,500	-------	----
Vermont	69,576	82,087	1.18
Virginia	282,650	-------	----
Washington	328,442	240,059	.73
West Virginia	217,589	264,386	1.22
Wisconsin	594,386	380,000	.64
Wyoming	47,711	-------	----
District of Columbia	103,092	36,820	.36
Total	19,954,847	$8,696,709	----

Disposition of License-Fee Receipts

In the preceding tabulations a figure of $8,696,709 is used as representing the collection and administrative expenses incidental to the licensing of motor vehicles in 34 States and the District of Columbia. The reports, made by several other States indicated that certain expenditures were made for license-fee collection and other miscellaneous administrative purposes. As the two kinds of expense were not separated in the reports, these were not used in making the foregoing analysis. In determing what portion of the total gross receipts was used for highway and other related purposes in the following study all these reported expense items have been deducted, thus leaving balances available for other purposes. Excluding the District of Columbia it is found that the total gross receipts amounted to $260,328,414 and that the sum reported by the various States as the collection and administrative expense item was $11,955,927. Ten of the States did not report any administrative expense items for the reason that their motor-vehicle departments are maintained by definite appropriations from the general funds, thus making it unnecessary to make deductions from the license receipts in order to carry on the affairs of the departments.

(Continued on page 18)

The Santa Fe Trail

By Ralph C. Taylor, Pueblo, Colorado

ON June 1, 1862, the first road work in Pueblo County and one of the first highway projects in the West was started. It was completed in a day, but it marked the first road work. Since then Pueblo County has pioneered and "experimented" with roads and bridges until today it has probably the best system of roads and bridges in the West.

The first highway project in 1862 consisted of straightening a schooner trail east of Pueblo. O. H. P. Baxter, one of the temporary county commissioners, was authorized to do the work by the board of county commissioners. Baxter plowed a furrow with a team of oxen along the proposed route. The furrow served as a guide. The first wagon train hauling in supplies was piloted along the new route marked by the furrow and the work of changing the trail was complete. The road was moved from the Arkanass river bottoms to the bluffs through what was then called John Gill's claim about three miles from Pueblo.

When this road pioneering was done Pueblo County was newly organized territory which came into being during the Civil war without any prominence. The territorial legislature of Colorado organized Pueblo County in 1861 and Governor Gilpin appointed Baxter, Richard L. Wooten and William Chapman as county commissioners to act until the next election. Pueblo County then included what is now Pueblo, Huerfano, Las Animas, Otero and Bent Counties.

The first meeting of the county commissioners was held on Feb. 17, 1862, when a location for a county seat was chosen. The county seat was staked out as the beginning of Pueblo and the minutes of the meeting described it thusly, "Beginning on the Arkansas river, 140 paces from the bridge owned by A. F. Bercaw, this being the southeast corner, then running due north 200 rods, thense west one-half mile, thense south to the Arkansas river to J. D. Jenks claim, thense east to the Arkansas river at or near the old Pueblo fort, thense down said river to the place of beginning."

The site for the first court house was also staked out following the initial meeting of the commissioners. The minutes of the meeting provided that the building should be "near Eastman ditch" and the clerk was ordered to issue notices for proposals for building the court house of "hewed logs, 24 feet long by 18 feet wide, one window to be in each side of this house and one door in one end. Said house should be ten feet high between floor and ceiling, with good hewed joists three feet apart. Roof of split puncheons and well covered with three inches of mortar and four inches of dirt; also a spout to carry off water from the roof, and a log above the eaves of the roof to hide the dirt of the roof." The court house was built early in March for $300 by John Eastman and was the first of the several Pueblo County court houses leading up to the present million dollar structure.

The county and state developed highways down through the years until January 12, 1912, the Colorado Good Roads Association met in Pueblo for its second annual conference and adopted a resolution linking Colorado more completely with the Santa Fe Trail. The resolution provided: "The new Santa Fe Trail and the Rainbow Route and that portion of the north and south highway running from Pueblo south to the state line and connecting with the New Mexico Camino Real, be recommended to the state highway commission as the Colorado link in the trans-continental highway and that the north and south road, including the portion thereof from Pueblo to the north line of the state of Colorado, together with the said link of the Trans-continental highway, be constructed."

Robert H. Higgins, county commissioner of Pueblo County and now superintendent of maintenance for the Colorado state highway department, was elected president of the Colorado Good Roads Association and from that meeting the enthusiasm of the various counties was aroused and road work was started on a larger scale.

The Santa Fe Trail was started on May 15, 1824, when eighty men left St. Louis, Missouri, with a wagon train loaded with goods for Santa Fe, New Mexico. From Kansas City the caravan took a course which was later staked out and used as the roadbed for the Atchison, Topeka and Santa Fe railroad. At a point where Las Animas now stands, the wagon train turned away from the Arkansas river and took a southwestern course. The return trip to Missouri was completed in September of the same year. There were not so many men nor as many wagons in the train, but those who did return had considerable money and $10,000 worth of furs.

Because of its historic value, this trail was marked by the Daughters of the American Revolution.

The more commonly traveled Santa Fe Trail, however, was the branch which continued up the Arkansas river from Bent's fort to Pueblo. It was this section of the Santa Fe Trail which was designated by the good roads convention in 1912 as the Santa Fe Trail. It is now regarded as the Santa Fe Trail by the majority of tourists and is traveled by most of them because it is the most highly improved section of the Trail.

The Pueblo branch became prominent after 1840

A Fine Stretch of Gravel Surfacing on Santa Fe Trail, Located East of Pueblo--on Right, New Steel and Concrete Bridge Over the St. Charles River, Constructed by the State Highway Department with Federal Aid Funds.

when Pueblo was established with the erection of a fort at the junction of the Fountain and Arkansas rivers. The fort was established as a trading post for white trappers and fur buyers of the American Fur Co. The fort soon became an important point because so many trails crossed there. At the end of four years 100 persons lived in the fort and farming was started.

It is often contended that Lieutenant Zebulon M. Pike established the Pueblo branch of the Santa Fe Trail long before the wagon train of Missourians shoved westward. Lieutenant Pike and his band of soldiers followed what later was designated as the Santa Fe Trail up the Arkansas river in 1806. After Lieutenant Pike discovered the peak which was named for him he took a course through the Wet Mountain and San Juan valleys to reach Santa Fe.

The same route up the Arkansas valley to Pueblo was traveled in 1819 by Major Long, in 1822 by Fowler, in 1843 by Fremont and in 1822 by Colonel Bent who established his first fort and trading post at the mouth of the Hardscrabble river near the present site of Florence.

As the years wore on the fords were replaced by cottonwood bridges and some attempts at drainage were made to make the roads more suitable to travel.

The first move toward hard surfacing the Santa Fe Trail was made in 1909 when the county commissioners contracted with Thomas Tynan, warden of the Colorado penitentiary, for thirty-five convicts to be sent to Pueblo County for "experimental road work." This was not only the beginning of a new era in road building but also saw the birth of the "honor system" of placing convicts outside the penitentiary to do road work.

The hard surfacing experiment was started at the eastern city limits of Pueblo. The adobe roadbed was graded for drainage and then a foundation of smelter slag was rolled into the roadbed. The finishing surface of gravel was soaked and rolled. Wooden boxes were replaced by corrugated iron culverts and placed below the road level to eliminate bumps in the road. The rivers were spanned with concrete and steel bridges and the Pueblo County section of the Santa Fe Trail became the most modern section of the highway in the West at that time.

It was presumed that Pueblo County had built the best bridges that could be designed to span creeks and rivers on the Santa Fe Trail, but the Pueblo flood of June 3, 1921, swept out every one except the five-span concrete bridge over the Huerfano river. It was the Pueblo flood that made it necessary for Pueblo to build different kind of bridges which places it in a class by itself. Longer bridges with fewer piers and obstructions and higher spans to allow ample clearance were built and securely anchored to rock bottom.

The Santa Fe Trail in Pueblo County is now paved with concrete from Pueblo to Avondale and gravel surfaced to the county line. Pavement and hard surfacing makes the Santa Fe Trail the best highway from Colorado and through Kansas.

As a result of its unique series of road pioneer projects, Pueblo County has one of the best highway and bridge systems in the United States. Several million dollars are invested in the highways which total 2,500 miles in Pueblo County. Of the total, 205 miles are paved or hard surfaced with shale and gravel.

The men who have helped make the highways of Pueblo County outstanding are the present commissioners, including W. L. Rees, now president of the Colorado Association of County Commissioners; O. G. Smith and Hurb H. Wilson.

Here's the formula for good roads given by Smith, who is chairman of the road and bridge committee: "Good roads do not remain good long unless you keep them up. We keep the highways in good condition by maintaining them regularly after they are improved. We have eight one-man maintainers which are kept busy on the roads when the weather is suitable. Regular maintenance keeps the road surface smooth by filling in the ruts and cutting out the chug-holes.

"If someone reports a broken culvert or a bad place in a road, we consider it a favor and not a complaint. We encourage the people who use the highways to notify us when there is something wrong on a highway. This kind of co-operation makes it possible for us to repair the place promptly."

Highway Expenditures of Country Must be Doubled

By Howard L. Clark, in Manufacturer's Record

BEFORE we can make money in business we must spend money for plant facilities. When these plant facilities become inadequate to meet the increasing demands upon them we must pay more money for improvements and additions, in order that continued operation may show a profit and greater savings be obtained. Therefore, we have the paradox of spending money in order to save money. Industry and transportation are meeting this situation.

In railroad transportation alone it is estimated that $1,000,000,000 a year for the next ten years will be necessary to supply facilities to take care of the growing demands of traffic. Likewise in our waterways systems, which recent discussions have shown are now beginning to earn a substantial dividend and savings to the American people on the $1,250,000,000 expended for their improvement, the National Government is spending for river and harbor improvements over $60,000,000 a year and millions more will be needed before we are to secure the greatest advantage of our water routes.

The same situation today faces the highways of the country, only in a more pronounced form. In proportion as the railroads of the country are more numerous and reach more people than waterway facilities, so the country's highways are in greater numbers and offer a more universal service to the public than any other form of transportation. Our country in the rate of progress it is making and that it may not be hampered in its normal growth, must utilize every effort to see that transportation facilities, whether rail, highway, waterways or airways, are keeping pace with the country's transportation requirements. Highways are vital factors as feeders to railroads and inland waterway carriers and, with the fuller use of the motor bus and motor truck, are themselves becoming a great artery through which the life-blood of the nation's commerce is carried.

Government figures show that there are 3,001,825 miles of roads in the United States. Of this total mileage 275,658 miles, or less than 10 per cent, have been improved to the degree of grading and drainage, and under bad weather conditions many of these roads prove a delusion and a snare to the motorist; 521,915 miles, or less than 18 per cent of all roads, are surfaced, and but 75,388 miles, or 14 per cent of surfaced roads, or 2.5 per cent of all the roads in the country, are bituminous, asphalt, concrete or brick. Over $1,288,000,000 was spent in 1925 on all roads of the country, and the amount will be even greater for 1926. In 1914 the United States expended or invested $240,264,000 for highways. The United States is now investing annually about four and a half times similar expenditures of eleven years ago. During this period the number of motor vehicles have increased from 2,000,000 to 20,000,000, or ten times. Preliminary figures compiled by the National Automobile Chamber of Commerce indicate that there are now 22,000,000 motor vehicles in the United States. We are now making in one year more than double the motor vehicles in the country in 1914. In fact, highway expenditures in the Southern States, amounting to approximately $400,000,000 annually, are now $150,000,000 in excess of what the country spent in 1914, while the motor vehicles registered in this section alone in 1925, numbering 5,153,000, are over 3,000.000 more than were in the United States in 1914.

No one can say that there is no need for more highways or improvements in widening existing roads. Such an assertion would mean a belief that the United States has reached its ultimate development. In the more thickly populated sections of the country the roads built only a few years ago are found to be inadequate to handle the present-day motor traffic. Instead of one narrow road it will not be many years before there will be constructed roads double the width of those at present, which are hampering the free movement of traffic, and probably in the more congested areas a separate truck-line highway for slow, heavy truck traffic and another paralleling it for fast motor bus and automobile passenger traffic. Then, too, the expenditures for road repairs and upkeep, if we expect to maintain what has been invested, must be greatly increased in order that our highways may continue to give the most profitable transportation service. In practically every State highway expenditures could be doubled and still be far behind actual needs to insure adequate facilities for motor traffic in the next few years.

In the beginning much of the mileage was a one-track road, and in isolated sections in thinly populated States this condition still exists; a little later roads of 14 feet and then 16 to 18 feet wide were exceptional, but in Illinois 20 feet is now the minimum width, with 40 feet at intersections.

Let us not lose sight of the fact that in this vast expenditure on road building every dollar for construction and maintenance cost is an investment paying substantial dividends in savings to the American people. Every mud or sand road eliminated, every hill cut to grade, every crooked road straightened, every crowded highway which is being widened to enable motor traffic to move more freely and thus save time between given points, adds to the savings of our hauling costs and increases the efficiency of American business. The time saved and reduction of wear and tear on motor vehicles represent in dollars and cents an amount which would more than cover the cost of these improvements. In addition there is an added investment created by the building of improved highways to the adjacent property values of all sections through which such roads pass. This amount alone is probably in excess of the nation's highway expenditures. The building of good roads and the automobile made possible our great suburban developments, which have added billions to the nation's material wealth and been of untold value from the health standpoint.

Another source of wealth creation, for which the automobile and good highways are responsible, comes from the improvement in the diversification of crops in the farming sections where roads have become improved and made passable throughout the year. This means that the farms are more valuable, because their earning power is greater, and it also means that the community or city consumers are benefited by the farmer being able to bring his products to them, increasing the price the farmer receives and reducing the cost to the consumer.

Traffic surveys indicate that in general the roads being built today are inadequate to care for the demands made on them by the constantly increasing number of passenger cars, trucks and motor buses. A motor trip over any of the hard-surfaced roads of the main highway routes proves the congested conditions existing, retarding the free movement of highway traffic and endangering lives and property.

Twelve States of the forty-eight have approximately 300 miles each of hard-surfaced roads, and many of these States are seeing their proper development retarded and are thus penalizing millions of people, because income is cut down and the wealth of the nation reduced in proportion.

One State highway authority believes that if we do not begin shortly to relocate some of our present-day highways built years ago, principally for horse-drawn traffic, and remove some of the safety devices we are now using and make the highways really safe without their use, we will find ourselves in the same position that the cities and towns are finding themselves in with regard to the parking situation. Traffic must be speeded up, and the only way to insure some degree of safety is to rebuild many existing roads and make the new ones wider and of heavier construction.

At our present rate of road building it has been said that between 3,000,000 and 4,000,000 carloads of material are going into new highways each year. At the new rate, if the materials can be supplied, the total probably will run to 10,000,000 carloads a year, and that, if shipped all at once, would crowd every other item of freight off the railroads for a period of nearly ten weeks every year. This illustrates the magnitude of the work before us in supplying the material, to say nothing of the additional equipment that will be required.

In ten years the number of automobiles has increased from 2,500,000 to over 22,000,000. Motor trucks are today more numerous than all motor vehicles were in 1915.

The number of surfaced roads is about twice as great as it was ten years ago. During this period it has been necessary to reconstruct and widen a large part of the mileage previously constructed.

There are being built by county and local authorities and State highway departments, in conjunction with Federal aid, about 9,000 miles of bituminous, concrete, asphalt and brick highways. There are being turned out by the nation's automobile factories about 4,500,000 cars and trucks a year. If these new cars were all placed in double file on the hard-surfaced roads completed last year, they would be spaced scarcely five feet apart. The sum of $1,300,000,000, which is spent a year on highways, will not suffice. We must begin to make immediately greatly increased expenditures, running as high as 300 per cent in some sections, if hopeless congestion is to be avoided in the not distant future. Our highway expenditures will at least have to be doubled in the next five years or we will lose almost as much, because it will be impossible for traffic to move freely and efficiently.

The Charleston Gazette recently stated that "a people can be excused for failing to catch the true vision of the aeroplane. That has not reached the point where it can be said to be practical, except for a limited passenger service and light freight. But the motor car and trucks are now competing with railroad traffic, and anyone ought to see that any city which is on hard roads, that are part of interstate systems, is very shortsighted in failing to put the same store upon that fact as has heretofore attended the building of new railroads into such cities."

As railroad transportation increased, the light railway construction and bridges were rebuilt, and then as heavier and heavier rolling stock was required and traffic increased, the double tracking and still better railway facilities were added. And that is the evolution which highways and motor vehicles are undergoing. First, the building of good roads. Then the present stretch of modern highway construction, with better bridges and better automotive equipment, and later followed by the widening of highways. We are rapidly coming to the time when double tracking of our highway systems will be imperative to handle the motor-vehicle traffic.

Secretary W. M. Jardine of the Department of Agriculture, under which the Bureau of Public Roads operates, recently stated that in contemplating the future he was impressed with the necessity for making adequate provision for the increasing service expenditures of the highways. Great as has been the increase in motor vehicles in the past ten years, there is no reason to believe that the increase will be abruptly halted, although some falling off in the rate of increase may be expected. Highway service must be capable of expansion to meet the needs of growing traffic, and we can only increase our highway service by spending more money in the building, widening and improving of our roads, which with the motor vehicle, are becoming the country's greatest transportation medium.

One of the Modern Steel and Concrete Bridges Recently Completed by the State Highway Department, Spanning the Arkansas River on the Santa Fe Trail.

The Selection, Use and Care of Maintenance Equipmemt

By W. H. Root
Maintenance Engineer, Iowa State Highway Commission

THE discussion of these problems in this paper will be confined to state equipment. The same general principles apply to county or township machinery, but not all of the detailed recommendations are applicable in the smaller units of government.

The selection of maintenance equipment is a twofold problem. (1) The type of equipment must be determined, and (2) the particular make must be chosen. The general maintenance problem of every state is to maintain its state system satisfactorily at a minimum cost. This cardinal principle should always be kept in mind when equipment is being purchased or used. When in the development of your maintenance plans it is apparent that new machinery is needed, you should first make a careful study of the future development of the road upon which the equipment is to be used. Otherwise, you may have very satisfactory results for a year or two, and then find yourself with an expensive white elephant on your hands. You should also be sure that the type selected will fit in with the other equipment already on hand in that particular maintenance unit. In other words, co-operation of equipment as well as co-operation of men is essential.

Selection of Equipment

In choosing an equipment type, the most important consideration is that the equipment selected must do the job that you have for it, and that it must continue to do this job over a reasonable period of years. I mean by that that the type must be proven. A particular type machine has not established its right to serious consideration until it has been operated under typical conditions for a year or more. Do not construe from this that the purchase of new designs is undesirable. Every state should buy new developments of machinery adapted to their work, but such purchases should be limited to a few experimental outfits until the machine has proven itself. Personally, I do not look with favor upon so-called demonstrations. I never yet saw a machine fall down on a demonstration. A clever operator and a wisely selected road will put over any machine for a few days or weeks.

When you have determined the type of machine best adapted to your work, your problem is only half solved. Whose machine are you going to buy? Don't let the salesman do all of the talking. Ask a few questions yourself. Don't allow yourself to be sold by a salesman, but rather be sure you are sold on the machine.

It isn't necessary that you buy the lowest priced machine, but you should be sure that the machine you buy is not over-priced. Some machines are priced for trade-ins. This fact is not hard to determine, and if you find it to be the case, don't pay cash at trade-in prices. You should also look into the matter of parts, prices and service. Any machine will require new parts occasionally, and these should be furnished at a reasonable price, and they must be furnished promptly. Delays due to poor service on repair parts are expensive.

Power An Important Factor

Also look to the power of any equipment you are considering. Horse power ratings are not always reliable and an under-powered machine is a constant expense and irritation. The fuel cost is another item which should be investigated. It is not enough that the machine do the work required of it, but it should do this work at an economical operating cost.

Then last but not least, in determining the dealer from whom you will make your purchase, keep in mind that it is always desirable to deal with a well established firm. Our junk yards are full of useless orphaned machines. The amount of money represented by this junk is a tremendous sum, and in my mind is one of the few public road expenditures which is open to criticism. In this day of rapidly changing conditions and methods, it is a problem for any machine company to keep its equipment abreast of the times. Machines are continually developing weaknesses, and proving unequal to the constantly increasing tasks to which they are put. These so-called "bugs" require study and adjustment. If when a machine is sold, the seller considers the deal closed, that machine is an undesirable purchase. Be sure the company you deal with is one that takes an interest in its sales, not only until your name is signed on the dotted line, but continuously thereafter through the entire life of the machine.

Care of Equipment

For the purpose of this paper it is not necessary to enter into any extensive discussion of the use of maintenance equipment. This subject in itself might readily be expanded to cover the whole field of road maintenance. In this connection, I simply wish to say that maintenance equipment should be used often, and should be used hard. However, it should not be abused. Use a machine for what it is designed plus a reasonable overload. This word "designed" is used advisedly. Some machines are designed to do certain work, while others are manufactured to sell. If you are a good buyer you will not have on hand any machines of the latter class.

All maintenance equipment should be properly cared for. If you will recall how you mothered your first Ford for a month or two after its purchase you will have an idea of how you should treat your road machinery, but this careful attention should not be allowed to lapse as soon as the paint wears off. Road maintenance equipment should be kept painted. This not only preserves the equipment against the weather, but it has a good psychological effect on the operator and upon the public. An operator is less apt to abuse a well painted machine than he is a rusty, weather-beaten one. Also the public will judge you somewhat by the appearance of your equipment.

HIGHWAYS--the Universal Language

By Roy D. Chapman, Vice President
National Automobile Chamber of Commerce

LESS than twenty-five years ago the first automobile successfully negotiated the trip by highway from Detroit to New York City.

It took a full week to get there.

A complete set of replacement parts had to be carried with the car, since service stations did not exist.

Early in the trip the tires fell into the habit of deflating at from 10 to 15-mile intervals.

Time and again the road stretched away into seemingly bottomless mud.

Frequently extra horse-power was required to extricate the vehicle from difficulty.

The direction of the road to New York was uncharted. For that matter, the road to points but from 25 to 30 miles distant was unknown to a majority of those questioned as to directions.

Mail Delivered Over 1¼ Million Miles of Highway

Today the same trip is made comfortably in three days without a stop for repairs, assistance out of mud holes, or delay in seeking directions.

This year more than half a million motor vehicles left the factory under their own power for delivery by highway to all parts of the United States.

More than 110,000 motor cars carried visitors into the National Parks from every state in 1925.

Ten thousand cars daily from every part of the country joined the pilgrimage to the Nation's Capital during the summer vacation season.

Thousands of cars are every day converging toward the sunny playgrounds of the South and West.

Uncle Sam is delivering mail each day on nearly one and a quarter million miles of these highways.

Recent surveys in Ohio indicated that passenger cars from other states varied from 9% of the traffic to 30% on through routes. At one point 60% of these foreign cars were from Pennsylvania, West Virginia, Kentucky, Indiana, Michigan and New York. The remainder represented other states from California to Maine, as well as the Dominion of Canada.

Uniform Highway Policy

A uniform national highway policy has been very largely responsible in making possible an easy flowing, nterchange of motor vehicles between different sections of the country.

County lines have been erased. State lines do not exist for the motor vehicle. The improved highway speaks a language common to all.

In point of time we have only just emerged from the "dark ages" of highway building in the United States.

In point of actual accomplishment we are centuries removed.

Federal Aid System Embraces 200,000 Miles

We have today 3,000,000 miles of highways, ranging from mere trails to the highest type of improved road.

Half a million miles have some type of surfacing.

A central system of highways has been established —the Federal 7% system of approximately 200,000 miles.

State highway systems are closely co-ordinated and largely co-extensive therewith.

Both State and Federal governments are putting every energy behind the early completion of this system. More than 60% of it is now improved to some extent.

Some 80,000 miles on the Federal aid system have been selected in co-operation with the states for uniform danger and direction sign posting. Soon the motorist starting on No. 1 highway at Portland, Me., can follow that number through Boston, New York, Philadelphia and Washington, southward to Miami—almost the entire distance on improved roads.

Surveys Save Millions of Dollars

The enactment of the Federal Aid Act of 1916 marked the re-entrance of Uncle Sam into highway building.

When he started to help the states in the construction of a national system of highways he insisted that they also maintain departments to centralize work on the main roads of the state.

Since then co-operative economic surveys between the U. S. Bureau of Public Roads and State highway departments are saving road taxpayers millions annually by pointing out trends and requirements of traffic.

Research studies by the Federal Bureau point the way to economies in construction.

Uniform types of construction and methods of maintenance have been largely agreed upon and accepted.

What's Ahead?

Our highway program seems to be well stablized at approximately a billion dollars a year.

(Continued on page 16)

A Fine Example of Gravel Maintenance in Teller County, Located Between Victor and Cripple Creek.

How Road Plans are Drafted

PREPARATION of plans for highway construction is one of the principal duties in the drafting room. After field plans or notes are received and thoroughly checked, the final plans are prepared on tracing cloth sheets which are of uniform size. Standard title and summary sheets are added, standard or special structure sheets pertaining to the project are included, and the sheets are all arranged and indexed in a uniform manner. A detailed estimate of the cost of the project is prepared in connection with the palns. The object of these plans is to show definitely what improvements are proposed, and to support a set of quantities for which prospective contractor can submit comparable bids.

Other activities include filing of plans and notebooks, computing tabulation of bids, blue printing, drafting or military maps and right-of-way plats and compiling details of state highway mileage.

The records of the Co-operative Road Materials Survey are indexed and filed in the drafting room. The reports cover gravel, crushed rock and clay deposits from locations over the whole state, and represent an estimated quantity of over twenty-nine million cubic yards of material.

The information contained in the pit reports and test reports are used in preparing estimates for new construction. Also the file is available to anyone interested in road material deposits.

During the past two years the Department has been conducting a subgrade and core drill survey on paving projects. The records of this survey are on file in the drafting room. A slab record showing cracks and general condition of each section of pavement, a record of each core taken giving location, thickness of pavement, condition and character of subgrade for a depth of about three feet below each core, record of subgrade samples taken on route of proposed paving projects, together with test reports from the laboratory covering all of the above samples, are filed in such a manner that they can be referred to easily.

Under a co-operative agreement with the Colorado Agricultural College, the testing of samples submitted by this survey is done at the college. Also Mr. O. V. Adams, testing engineer at the college, and J. G. Rose of the Bureau of Public Roads are assisting the Department in a study of the subgrade and pavement core tests, with a view toward increasing the life of highway improvements in this state.

A Billion for Roads

A HUGE highway construction and maintenance program entailing more than $1,000,000,000 in the United States during 1927 was planned and urged by the American Road Builders' Association at their 24th annual convention held at Chicago, January 10 to 14, which was attended by 35,000 road men from every state in the United States and many North American countries. The need for speedy closing of gaps in the network of Federal aid highways was urged upon state highway commissioners by Thomas H. MacDonald, chief of the United States Bureau of Public Roads.

Traffic congestion on the highways demand that a third of the country's roadway be improved.

Congressional appropriations make $85,000,000 available for distribution among the state commissioners this year, he pointed out. Of the 182,000 miles of highway called for in the government program approximately 140,000 have been completed.

Mr. MacDonald lauded the progres of modern road making, asserting that the arteries being spread out today are far superior to the much-sung roads of ancient Rome.

Charles M. Upham, managing director of the association, said:

"Automobile registration is increasing thirteen per cent annually. At this rate we can expect fifty million motor cars to be in use in this country within twenty years. That will mean that the point of saturation in ownership has been reached—about one car for every three individuals.

"Construction of a super-highway system to take care of the traffic at that date will be urged at the convention with a view to instituting construction so that the system can be well along toward completion within a decade."

Mr. Upham did not venture any suggestions as to means of financing, nor as to the type of road. The plans recommended by the convention, he said, would be submitted to the people of the country as a suggested solution to the problem which will arrive. "The decision is up to them. We'll tell them only how we think it can best be accomplished."

The possibility that construction of such a system would lead to decentralization of population was advanced by the engineer: "It is to be expected," he said, "that the construction of such a system will reverse the movement from country to city, due to the desirability of country residence.

"The type of road to be constructed would probably vary with the conditions of the location. In some places the roads would necessarily be of a width of 200 feet or more to take care of traffic at the saturation point.

"There is now only one such road in the country, that between Detroit and Pontiac, Michigan, which is 204 feet wide."

"The demand for more improved highways and for the widening and improvement of those already built was never greater in the history of the world," stated P. G. Shirley, of Richmond, Va., president of the association.

He further stated: "When the United States has completed a system of modern highways connecting the various cities in each state with trans-continental trunk lines, a great era of prosperity will be in effect.

"The influence of a system of highways properly constructed and maintained is so great that each of us has a responsibility to see that they are used for the betterment of mankind."

Mr. Shirley, who is chairman of the Virginia state highway commission, commended the gasoline taxes levied in many states as the best system for raising highway funds.

Highways—the Universal Language

(Continued from page 13)

It is the largest public works job the world has ever known—and the freest from corruption.

There are, however, large problems demanding attention.

Congestion of traffic is not prevalent on the rural highways. Most frequently it occurs at the gateways to the cities. The arterial highways leading into large cities frequently pass through neighboring satellite centers. The traffic is more than local, yet local control remains. There is a gap here which must be bridged by closer co-ordination between the several groups. Arterial highways in these metropolitan areas must be built, but this can only be done by united action.

Hardly less important is the situation existing with reference to the 3,000 county highway organizations. Half of all available funds are spent by them on roads of secondary and local importance. Diversity of practice in construction and maintenance prevails. States have had the benefit of Federal co-operation in working out uniform standards but co-operation of this character has too infrequently existed between county and state.

Closer Contact Needed Between County and State

Because of the vast sums involved it is essential that closer attention be given to working co-operation between county and state, to the end that the funds may be conserved and the secondary roads be built with a view to future requirements of the whole nation.

Other questions of scarcely lesser moment remain.

Many primary state highway systems are largely surfaced. But we are now facing the larger problem of handling the traffic flow which these roads have attracted.

Wider roads between the larger centers of population must now be undertaken. This is more particularly true in the Eastern states where primary road systems have been largely surfaced.

Straightening of roads, and elimination of curves, bad bridges, and grade crossings are essential to the future efficiency of this new transportation.

Secondary roads must be improved and brought up to standard to take the overflow and handle their own increasing traffic.

Greater utilization of highway transportation is the chief solution of distribution costs and difficulties.

Co-operative marketing and the intensive development of farm areas contiguous to urban markets finds its greatest asset in improved highways. These offer a real solution to farm market problems.

Recreational Use Growing

Recreational use of the highway is growing amazingly. Municipal golf links; state parks; national parks; lakes and rivers for fishing and hunting are made accessible to rich and poor alike over the highway.

Task Well Begun

Our highway program is well begun. Genuine economy demands that we complete the task we have undertaken. To do so means the creation of new wealth, the opening of new production areas and the greater enjoyment of life made possible by the higher standards of living to which highways contribute so largely.

A. B. Wilder Acquires Control Of Stockland and Lyle Companies

Control of the Stockland Road Machinery Company and the Lyle Culvert Company, both of Minneapolis, Minn., has been acquired by A. B. Wilder, pioneer road equipment manufacturer of that city, with the recent purchase of the interests of J. D. Fraser, formerly secretary and treasurer. Associated with Mr. Wilder in the active management of both companies is Cal Sivright, present vice-president and general manager of the Stockland Company, and vice-president of the Minnesota State Fair Association. Aggregate assets of both companies total over $1,500,000.

Black & Decker Mfg. Co., Towson, Md., has put out a circular describing their new Black & Decker "Drive on" loadometer. It has been said that the new loadometer, due to its accuracy, simplicity, portability, ease and quickness of operation, is of vital interest to everyone concerned in the building and maintenance of highways, bridges and city streets. Anyone interested may receive one upon request to the company.

Waste Is Bugbear in Road Building

ROAD construction as practiced today is a highly specialized business. Good, permanent construction insures years of earning power and the saving of millions of dollars in transportation costs. Poor construction means waste that mounts into almost countless figures.

Foremost among the possible sources of waste is the construction of roads of lower type than justified by traffic. Tests conducted in many parts of the country have proved that a road should be built according to its maximum requirements rather than to its minimum. A dirt road carrying a traffic of 110 tons per day, in general, will pay for gravel in 10 years by the saving in operating costs. Traffic on a dirt road exceeding 610 tons per day or traffic on a gravel road exceeding 1450 tons per day will, in general, pay for a concrete, brick or asphalt road in 15 years by the saving. These figures, established by the Iowa Highway Commission, are today being taken as standard for determining the type of surface justified.

The Bates road tests, perhaps the most comprehensive yet conducted, now have made it possible to build a road which is permanent and able to stand up under any given volume of traffic if properly maintained. Through research the public is now protected against building road pavements too light for the volume of traffic which will use the road and which break down under traffic.

Similarly, after having determined the volume of traffic, road builders need not build a pavement too heavy for the traffic the road will carry. This saves over-investment in road pavements.

Collection and Disposition of Motor Vehicle Funds

(Continued from page 7)

After deducting the collection and administrative expenses as reported there is left a balance of $248,372,487. The disposition of this total amount is the subject of our further study. For the country as a whole it was as follows:

Purpose	Amount	Per Cent of Total
Construction and maintenance of State highway system	$177,452,200	71.5
Construction and maintenance of local roads	48,396,471	19.5
Principal and interest payments on State and local highway bonds	19,124,014	7.7
Transfers to general funds	478,183	.2
Expenses of highway departments	618,655	.2
Traffic control and patrol	770,391	.3
Other Purposes	1,532,573	.6
Total	$248,372,487	100.0

In studying this disposition of the motor-vehicle license receipts, it is significant to note that after a deduction of the reported administrative expenses 91 per cent of the balance is devoted directly to the construction and maintenance of highways; 71.5 per cent for State highway system, and 19.5 per cent for local roads. This 91 per cent of the available revenues for highway construction and maintenance amounts to $225,848,671, 79 per cent of which is spent on State highway systems and 21 per cent on local roads. Of these special revenues $19,124,014, or 7.7 per cent of the total amount available, was devoted to principal and interest payments on State and local highway bonds. The license fees devoted to other purposes constituted but 1.3 per cent of the total amount available.

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

Western Wheel Scraper Puts Out "50 Years of Service" Booklet

A beautifully illustrated catalogue covering the full line of the Western Wheel Scraper Company, is now being distributed by the Wilson Machinery Company, 1936 Market street, Denver. It is entitled, "50 Years of Service."

Deliveries are now being made on the Monarch 6-ton Tractor, according to Harry P. Wilson, president of the Wilson Machinery Co., Colorado distributors for the Monarch Tractors Corp. This is a new size of Monarch, according to Mr. Wilson, which has been designed to meet the needs of road officials, contractors and industrial users.

The Byers Machine Co. has added two new models to their line this year, the 27 and 27-R, embracing several new innovations of the popular "all-purpose, one-man crane." Literature on the new models is now available through the Wilson Machinery Co.

Steinbarger Returns From Long Vacation Spent in California

Herbert N. Steinbarger has returned to Denver after spending the winter in California with relatives. He announces that his firm has taken the distribution of Meta-Form products, Butler Bins and Williams dragline buckets in the Rocky Mountain territory. During the absence of Mr. Steinbarger the affairs of the H. N. Steinbarger Company were in charge of H. H. Hoddle, sales manager.

Spherical Warning Torch

A new type of warning signal for use on all road obstructions has been developed and produced by The Toledo Pressed Steel Co., of Toledo, Ohio.

This new warning signal embraces the use of an open flame in a novel manner. The device is a torch made entirely of pressed steel, being spherical in shape and so counterweighted with cast iron to insure its always remaining in an upright position.

The torch, called by the makers, "The Toledo Torch," is made of two pressed steel hemispheres with flattened ends, and is double-seamed together to form a single sphere. The bottom half contains a cast iron counterweight, fastened securely to the shell by electric welding. The top half is equipped with a burner which holds the wick.

Paul Fitzgerald, U. S. National Bank Bldg., Denver, is the Rocky Mountain sales agent for this spherical torch, which has found a wide sale among contractors in this territory.

Portland Cement Association

The Portland Cement Association announces the following appointments in its general office staff: C. R. Edge, manager of advertising and publication bureau, succeeding H. C. Campbell, resigned; G. S. Eaton, assistant manager, advertising and publication bureau; W. E. Hart, manager highways and municipal bureau (formerly highways bureau); F. R. McMillan, manager structural and technical bureau (formerly structural bureau); T. J. Harris, manager general educational bureau.

Snow Removal

A recent booklet has been published by the American Automobile Association, of Washington, D. C., considering all the phases of snow removal in highway and streets. The booklet is written in such a way that everyone can readily appreciate the problems confronting the men in charge of highway maintenance. Several articles are presented that reveal the problems that confront the different sections of the country, and solutions are given for the various problems.

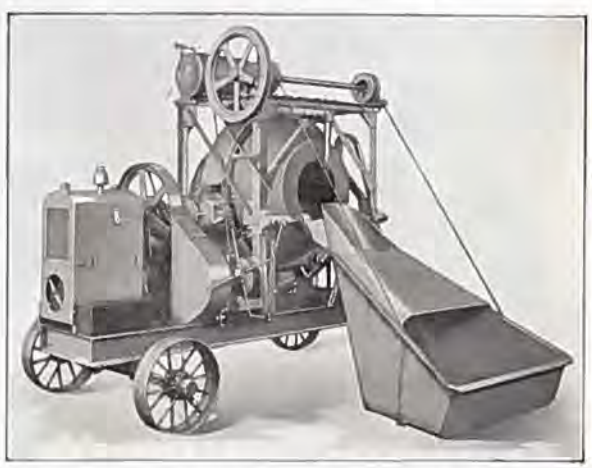
The booklet is well illustrated with the different types of snow removal machinery, and some equipment in actual operation in clearing the highways. The advice is given, that each highway engineer should keep in constant contact with his closest weather bureau, in order that he may be prepared for any inundation that may occur.

Copies of this attractive and comprehensive booklet can be secured by addressing the American Automobile Association, Pennsylvania avenue at 17th street, Washington, D. C.

Speeding Up Concrete Work

The development of a mixer especially designed to speed up work on concrete of 1-2-4 proportions has been recently announced by The T. L. Smith Company of Milwaukee.

This is a 10-S machine (10 cu. ft. mixed capacity) and while it has been designed to handle a two-bag batch up to 1-2½-4 proportions it has been especially built with very compact construction so that it may be as easily handled as mixers of smaller capacity. The mixer, shown in the illustration, is equipped with power loader and water tank—discharges in 8 seconds and has a daily capacity of from 100 to 150 cu. yds.



Smith 10-S Tilter with Power Loader and Water Tank.

Koehring Subgrade Planer Proves Valuable in Paving Work

A subgrade planer designed by the Koehring Company is one of the valuable labor and money-saving units developed during the past season in concrete paving work.

This planer, which is connected to the paver, moves along automatically, cutting down the high spots and filling in the low places. In this way the subgrade is finished to the correct level just before placing the concrete.

Indiana Truck Corporation Publishes New Bulletins

Two very interesting bulletins have recently been placed in the mails by the Indiana Truck Corporation of Marion, Indiana. They show a number of illustrations of fleets of Indiana trucks in use by numerous coal companies for delivery of coal, and also fleets in use by other companies. A comprehensive list of companies owning fleets of Indiana trucks is given and covers the entire country. Copies of these bulletins can be secured by writing to the Indiana Truck Corporation, Marion, Indiana.

Speeder Shovels Are Featured in Brochure—A complete description of Speeder Model B-1 half-yard shovels, cranes and draglines is contained in Bulletin J26 now being distributed by the manufacturers, the Speeder Machinery Corporation of Fairfield, Ia. Correct design and low first cost, combined with economy of operation and maximum efficiency, the brochure points out, are the features responsible for Speeder popularity in excavation and road construction work

Here's to your car
And my car—
May they never meet.

Our Cover Picture

On the front cover of this issue of COLORADO HIGHWAYS is a view of Lizard Head Peak, altitude 13,156 feet, located in San Miguel County in southwestern Colorado, as seen from State Road No. 145, blanketed with its winter covering of snow. This photo was taken by George L. Beam, and is printed through the courtesy of the Denver & Rio Grande Western R. R. Through an error a description of last month's cover was not printed. The view shown on the February issue was of the new highway over Battle Mountain, taken during January by one of the engineers of the U. S. Bureau of Public Roads.

Flivvers on a Flivver

From Here and There

Drunken driver,
Street car,
Three killed,
There you are.

Heavy rain,
Slippery road.
Fast driver,
In new abode.

Deep river,
Curve 'round;
Speedy flivver;
Four drowned.

Touring car,
Bright light,
Sudden crash,
Good night.

Sharp curve,
Shaky hand;
He's now in
The Promised Land.

Moonlight night—
Shady lane,
Parked car—
Goodbye, Jane.
—Now dash off a few of your own.

BIDS OPENED

Proj. No.	Length	Type	Location	Low Bidder
275-G	10.869 mi.	Grading	Larkspur and Monument	Monahan & Cunningham
276	.....	R. R. Overpass	North of Colorado Springs	
279-E	3.243	Grading	Between Schaffer's Crossing & Baileys	
548	44 ft.	I-Beam Br.	1 Mile South of Lyons	

PROJECTS ADVERTISED FOR BIDS

Proj. No.	Length	Type	Location	Bids Opened
145-A	3.807 mi.	Gravel Surfacing	West of Glenwood Springs	3-24-27

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

Proj. No.	Length	Type	Location
258-E, Div. No. 2	1.402 mi.	Gravel Surfacing	Cimarron
281-E	0.812	Paving	Lafayette

PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
2-R No. 5	1.5 mi.	Paving	South of Aguilar
138-A	5.0 mi.	Surfacing	North of Kremmling
247-C	0.5 mi.	R. R. Subway & Paving	Swink
254-C Div. No. 2	150 ft.	Steel Truss Bridge	Southwest of Hot Sulphur Springs
275-E	2.0 mi.	R. R. Underpass and Paving	Monument
287-D	0.5	R. R. Underpass and Paving	East of Kersey
290-D*	2.954	Paving	Las Animas-Fort Lyon
300-A*	1.008	Grading	Chattanooga
560	3.0 mi.	Gravel Surfacing	Deer Creek-Littleton
631	120 ft.	Timber Bridge	Trumbull

*Plans finished

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj No
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	$ 331,632.00	80	2-R4
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	28,882.70	6	2-R3
79-A	Big Sandy Creek, East of Simla	10 19-ft.	Spans Timber Trestle	A. R. Mackey	10,421.26	75	79-A
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	69	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	0	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	31	144-A1
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	63	157-A
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	82	213-D
242-AR1	East of Fruita	125 ft.	Steel Bridge	F. H. Knollman	19,999.00	79	242-AR1
254-C Div. 1	2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	86	254-C D. 1
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	0	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	92	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	39	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	22	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	63	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	85	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	23	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	61	271-B
275-C	Husted-Monument	4.795 mi.	Concrete Paving	J. L. Busselle & Co.	186,585.20	91	275-C
275-C Div. 2	East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,966.00	0	275-C D. 2
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	67	275-F1
275-C2	E. of Monument	0.625 mi.	Grading and Bridge	W. A. Colt & Son	34,966.00	0	275-C2
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	0 / 81	281-D1 / 251-B1
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	0	282-D
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	54	283-C
287-A2	Fort Morgan, west	4.011 mi. / 16.61 mi.	Concrete Paving / Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	92	287-A2
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier C. Eng. Co. Scott & Curlee	159,950.85	0	287-C1-2
288-A	Merino-Brush	19 mi.	Grading and Surf.	H. C. Lallier Constr. & Eng. Co.	92,571.80	19	292-A
292-A	North from Minturn	6.417 mi.	Grading	Geo. F. Wear	21,645.25	75	293-B
293-B	Colona-Ridgway	80 ft.	Steel Bridge	John A. Duncan	32,316.80	58	295-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	Cole Brothers	58,061.00	37	296-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	98	297-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	52	299-A
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing				

SEVENTEEN YEARS ago some were skeptical, but this Keystone Corrugated Culvert is still serving under the Pueblo-Canon City Highway—just one of the many examples we can show of the economy of *Keystone Culverts.*

BUILT TO
SERVE
SATISFY
and
SURVIVE

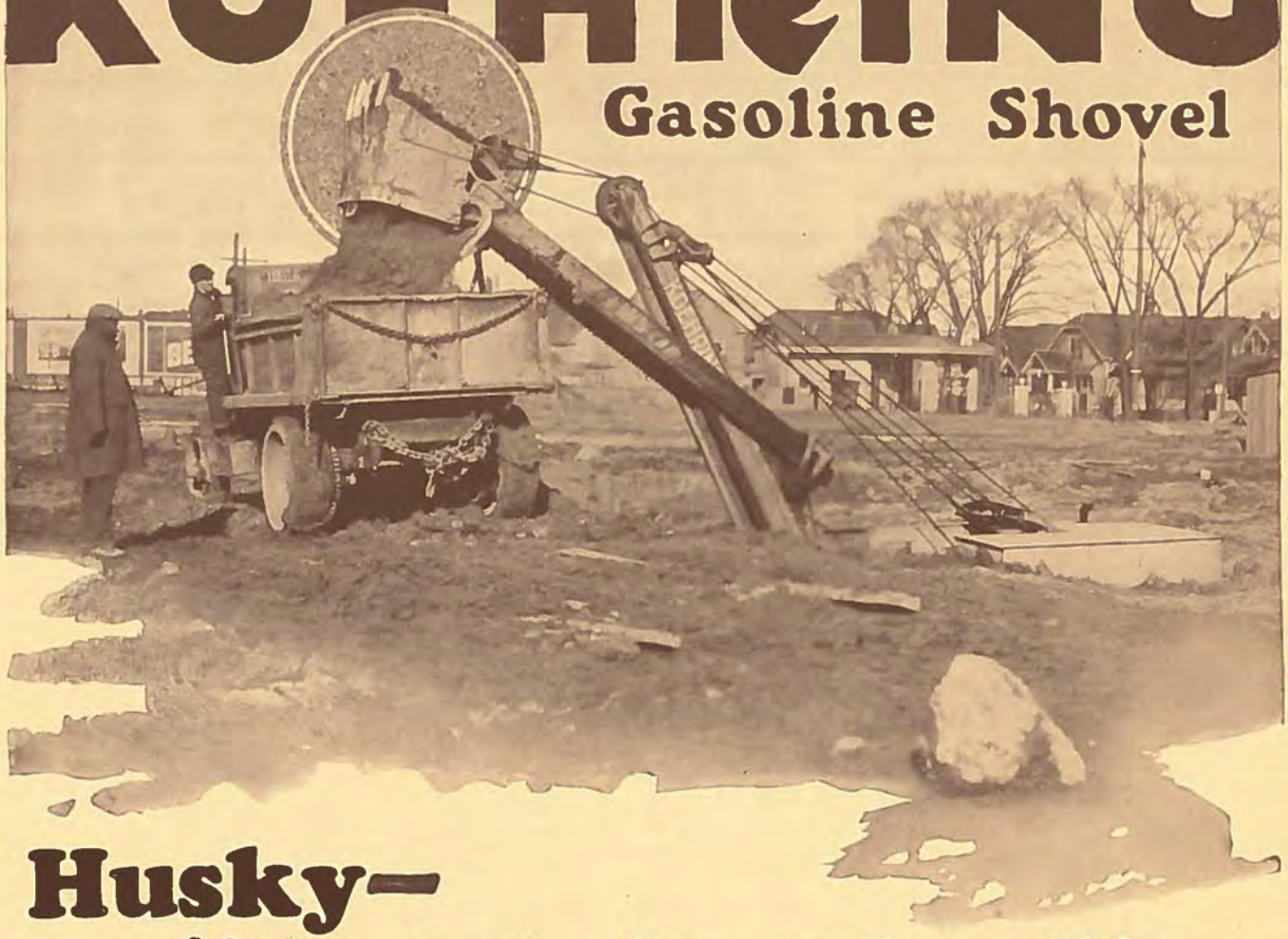
KEYSTONE
COPPER STEEL

COLORADO CULVERT AND FLUME CO.

PUEBLO

KOEHRING

Gasoline Shovel



Husky—
"Quick As a Cat!"

RUGGED — built to endure — but there's nothing ponderous in its *action!* It's amazing how the strong boom, stout sticks and dipper leap to their work! Active! Agile! Eager! Those words describe Koehring action!

Independent crowd permits bucket to be crowded above and beyond the end of the boom! A low dig or a high, shallow one — level stripping or high bank work — a deep, close-in gouge, perhaps to pry out a rock — the Koehring meets every situation at the instant command of the operating levers!

—and it doesn't take big man-power to operate the Koehring! Finger-tip ease of operation and smooth fast responsiveness give the operator a chance to make a record every day — *teases* him to race his records!

—and then — don't forget that the Koehring in every gear and detail, from multiplanes to boom tip is strictly designed for internal combustion engine power. The result is smoothness of action that minimizes wear and strains, and together with Koehring Heavy Duty construction, means long service life, and season-to-season dependability. *Know the Koehring!*

Shovel Capacities

No. 1—¾ cu. yd. dipper, struck measure, on 19 ft. 6 in. boom, with 16 ft. dipper sticks; 4 cyl. 5¼ x 6½ in. gasoline engine, 1000 R. P. M.

No. 2—1¼ cu. yd. dipper, struck measure, on 20 ft. 7 in. boom, with 16 ft. dipper sticks; 4 cyl., 6 x 7 in. gasoline engine, 925 R. P. M.

Write for Shovel Bulletin No. S. 39

KOEHRING COMPANY, MILWAUKEE WISCONSIN

PAVERS, MIXERS—GASOLINE SHOVELS, CRANES AND DRAGLINES

Sales Offices and Service Warehouses in all principal cities

Representative: Wilson Machinery Company 1936-38 Market Street DENVER, COLO.

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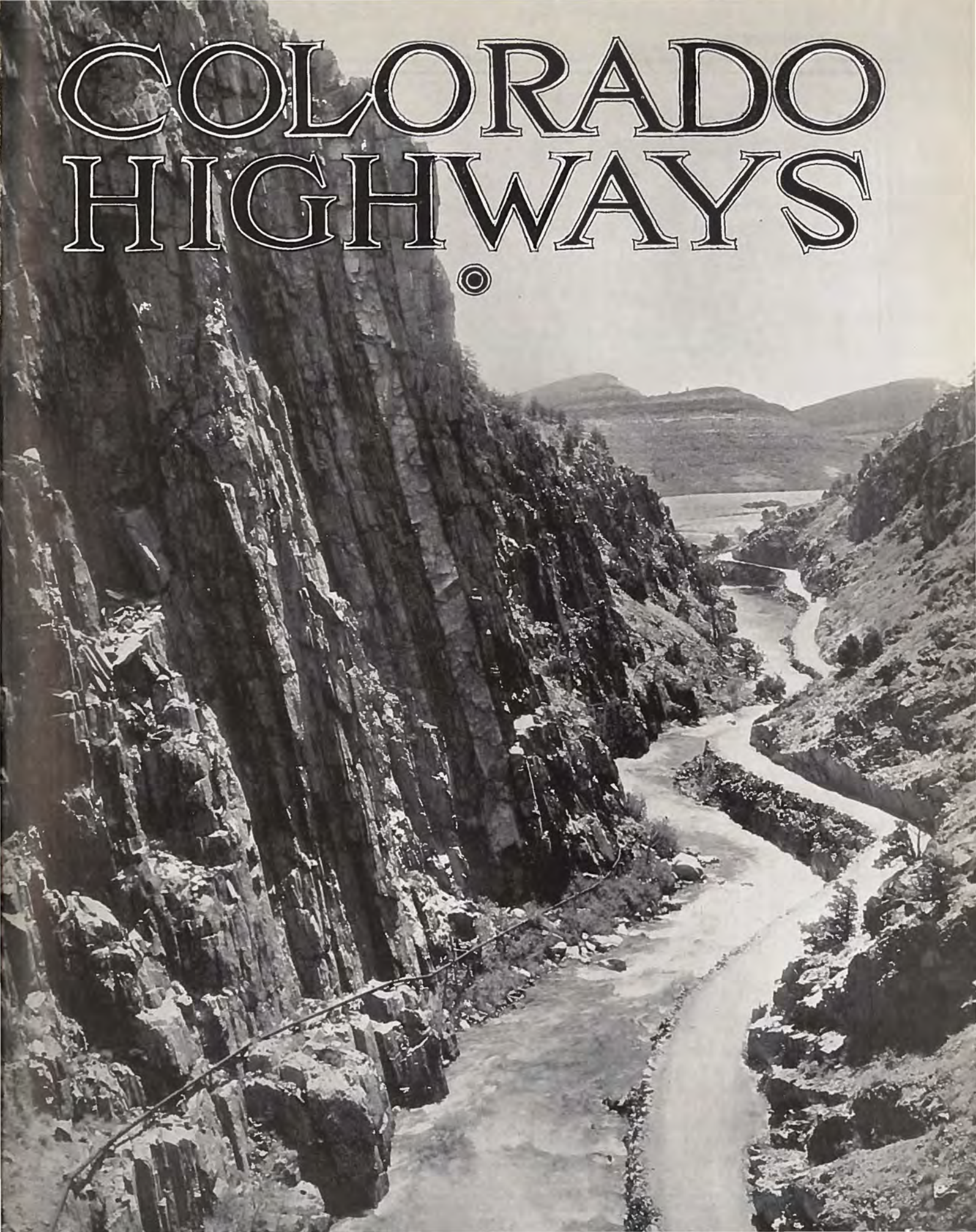
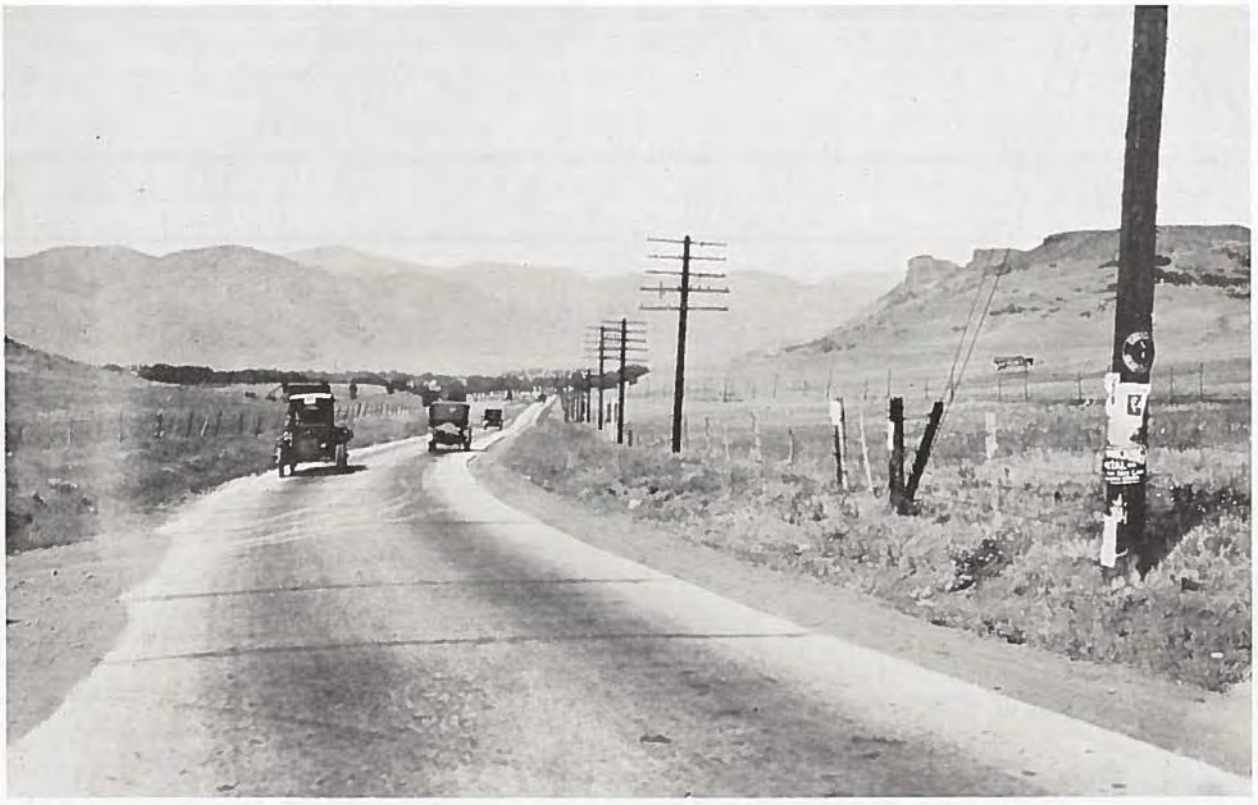
THE BRADFORD-ROBINSON PTG. CO., DENVER

COLORADO HIGHWAYS





DENVER-GOLDEN ROAD, JEFFERSON COUNTY, COLORADO

When the "Light Traffic" Argument Fails

Too often it is believed that traffic on a certain road is too light to justify Concrete pavement.

The answer to this is that any improved highway increases traffic. Frequently it changes light traffic into heavy traffic almost over night.

"Facts About Concrete Roads," an illustrated booklet, tells the whole story. Ask for your free copy.

Portland Cement Association

Ideal Building, Denver, Colorado

A National Organization to Improve and Extend the Uses of Concrete

OFFICES IN 31 CITIES

Colorado Highways

"BETTER ROADS"

Official Publication of the
COLORADO STATE HIGHWAY DEPARTMENT
Denver, Colorado

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State Highway Engineer.
OLIVER T. REEDY,
Senior Assistant Engineer.

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M. W. BENNETT, Editor

Articles on the subject of road building and highway development in the West are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible. Manuscripts not found available will be returned promptly.

10 CENTS A COPY. **$1.00 A YEAR.**

Colorado Highways
"BETTER ROADS"

VOLUME VI. APRIL, 1927. NUMBER 4

Tremendous Road Programs Started

MANY remarkable road improvements have been made during the past few years in Colorado. And we have plans for future development that will further increase our highway facilities. In carrying out these improvements we sometimes overlook the rapid strides along the same lines being made in other states.

Each summer thousands of tourists all over the world come to see the scenic wonders of Colorado. These motorists constitute a tremendous traffic over our roads. They are big spenders—it is calculated that the occupants of each car spend not less than $10 per day while on the road. Experts tell us $50,000,000 yearly is spent by tourists in Colorado.

Our average expenditures for upkeep and construction of new roads on the state highway system is about $5,000,000 annually. This is a large sum of money. But it is insignificant when compared with the expenditures of some of the other states—hardly any of them receiving the returns from tourists that Colorado enjoys.

That other states are awakening to the possibilities of tourist travel is revealed from the figures on the expenditures now being made on highways in Florida, Arkansas, Louisiana and other southern states. Where we cater to the summer travel, these states make a drive for winter visitors.

An example of this is to be found in the state of Florida, where the widely advertised collapse of the "boom" has led many people to think development of every kind had come to a standstill there. Quite to the contrary, Florida right now is pressing forward the largest program of highway construction in the entire south, more than $20,000,000 being involved in projects now under way.

The Florida system embraces 5,654 miles, of which 2,479 miles are known as Preferential Trunk Lines, and are being permanently surfaced throughout the mileage before attention is given to less important thoroughfares. Already six main roads into and through the state, east, west, north and south have been completely surfaced, and half a dozen more will be finished during the year.

Annual revenues of the Highway Department of Florida are approximately $15,000,000, the money coming from a one-mill ad valorem tax, a four-cent gasoline tax, and one-eighth cent oil tax, the automobile license tax, county donations and Federal aid.

The State has also recently adopted a model title registration law which, in addition to giving the Highway Department augmented revenue from automobiles, makes their theft in Florida a practical impossibility, and reduces anti-theft insurance rates approximately 20 per cent.

The early completion of trunk line highways in Florida has made the state more than ever attractive to tourists, and business there is reaping the harvest that comes from tourist trade during the winter months, when highways of other states are out of commission.

As an extra inducement to the motorist, speed laws are sanely and conservatively administered, on many open stretches of state highway the speed limit being raised to 45 miles.

Backing up the road program, many thousands of dollars are being spent by the state in publicity, newspaper advertising, attractive booklets and other advertising matter, which calls attention to the advantages of the climate, resources and laws to be found there.

The High Cost of Unpaved Highways

FEW motorists driving over our highways have a real conception of the cost of travel. If there are no annoying blowouts and breakdowns, probably the cost of gasoline and oil will denominate the damage to one's pocketbook. This is the direct cost and the one brought forcibly to mind, therefore we are impressed by it. But the wear and tear on the tires and the car which are or must be paid for, and the road which must be paid for in taxes, representing an indefinite cost that must be figured out and is not available for immediate consideration, is thought of merely as plus this or that and not counted.

Blaine S. Smith has a very interesting article in Forbes magazine on the cost of paved and unpaved highways. In speaking of Pennsylvania's experience Mr. Smith says: "This state paid an average of $2,333 a mile in maintaining stretches of the Lincoln highway between Philadelphia and Pittsburgh in 1921. After pavement was laid the repair cost dropped to less than $200 per mile." Mr. Smith also figures that it will cost in tires $14.40 more per 1,000 miles over macadam than it does over good pavement.

It seems to be pretty well established that paved roads are economical.

Echo Lake as seen from the Mount Evans Highway.

Colorado's Great Gift to Nation

COLORADO, which has given to America precious and magnificent gifts—its gold and silver, its oil, coal and timber, its prodigal wealth of food products—is about to make the people of the United States another great gift—

The highest automobile highway in the world!

The Harding highway to the summit of Mount Evans, 14,260 feet above the sea!

Blasted from solid rock; winding around the shoulder of the patriarchal peak, emerging at last upon a broad, level pinnacle in the diamond-clear air of the Rockies' topmost reaches, the Mount Evans highway will be the greatest scenic road on earth.

There is no other mountain from whose summit such a view is to be had as will become the property of the American people when the Harding highway has been completed.

Construction of a modern automobile highway to the summit of Mount Evans, highest peak in the front range of the Rockies, was first suggested by the Denver Mountain Parks Commission, that body of public-spirited men entrusted with the care of the world-famed Denver mountain parks system.

It was in 1915 that the members of this commission conceived the idea of constructing the highest auto boulevard in the world to the summit of the mountain. The city had but a few years before established its system of mountain parks and built the world-renowned highway up Lookout and Genessee mountains. The members of the commission, from personal acquaintance with the mountain country beyond the Denver parks, from the first realized that a highway to the top of Mount Evans was the one thing that more than any other would bring fame to Colorado as the playground of the nation.

Three years passed after the road had first been suggested before any money was available to permit the beginning of construction, but the three years that intervened were not lost. Reinforced by far-sighted residents of Denver who realized what a road to the summit of Mount Evans would mean, the mountain parks commission urged construction of the road, until not only the city government of Denver but high officials of the Federal Government and of the state of Colorado became enthusiastic supporters of the project.

Altogether a quarter of a million dollars has been spent on the highway since the first steam shovel was started upward from Bergen park. The city of Denver, the Federal Government and the state of Colorado, all have contributed to make the dream a reality.

The city has spent $90,000, the Federal Government $125,000, and the State $135,000, with $40,000 more available by the latter for pushing the highway from its present terminus to the very summit.

Originally the plans called for a highway to the summit only, but as construction work progressed and the beauties of the country west and south of the mountain unfolded themselves, the plan to make the summit the high point of a one-day circle trip out of Denver suggested itself.

It is at Bergen park that the Mount Evans highway proper begins. A twenty-mile drive through entrancing forest and mountain vistas brings the tourist to Echo lake, since completion of this stretch of the road acquired by the city as an addition to the mountain parks system. From Echo lake to the summit of the peak is a fifteen-mile drive, making the distance from Denver's business district to the summit exactly sixty-three miles.

From the summit down, the plans of the highway department provide for a retracing of the uproad for a distance of about four miles. After the tourist has descended for four miles he will find himself on the saddle between Mount Evans and Mount Epaulet, Evans' nearest neighbor.

It is from this saddle that the descent toward the Denver-Fairplay road begins. The first three-quarters of a mile down calls for some of the heaviest rock work ever undertaken by the State Highway Department. In order to get the necessary grade and avoid deep cuts in solid rock the engineers have provided for the construction of three short tunnels in the first mile down the hillside. Once this first mile has been finished, construction is comparatively easy. Generally speaking the route surveyed runs in a southwesterly direction until it meets a road, built some years ago as a lumber road in what is known as Deer Park creek valley in Park county.

The plans worked out by the Highway Department propose to utilize this lumber road, which is in very good condition, for a distance of nine miles. This road connects with the Denver-Fairplay road at a point about three miles southwest of Shaffer's crossing. From this junction a veritable boulevard will carry the tourist to Conifer and Morrison and Denver.

The trip back to Denver from the summit by way of Deer Creek park, Conifer and Morrison is exactly a mile less than that up to the summit by way of Bergen park.

The highway engineers, in laying out the route, always had in mind the comfort and safety of those making the trip. A standard width of twenty feet, with wide curves, has been provided and nowhere will the grade exceed 6 per cent, a grade that any automobile can negotiate without difficulty.

On top of Mount Evans the surveys provide for a large loop directly beneath the highest point. Nature provided a large flat space on top which makes possible the construction of this loop and enables a large number of automobilists to park their cars. From this loop to the very top is less than 300 feet.

Construction on the road has reached a point less than four miles from the summit. The present terminus of the highway is at a point 3,300 feet above the saddle between Mount Evans and Mount Epaulet. It has progressed 3,300 feet beyond the point where the descent into Deer Creek park valley will begin.

City and Uncle Sam Co-operate On Road

The city of Denver started construction work at Bergen park in 1918. It financed the highway to the top of Squaw pass, a distance of ten and one-half miles from Bergen park. The city stopped construction work at Squaw pass because at that point the highway enters the Pike national forest. Altogether Denver spent $90,000 on the construction of its part of the highway.

The next stretch, from Squaw pass to Echo lake, was built by the United States Bureau of Roads for the United States Forest Service, which has control of the Pike national forest. This stretch is 9.36 miles long and cost $125,000. The road passes around Warrior mountain at an elevation of 11,060 feet, but drops down to 10,600 feet at Echo lake.

At Echo lake the state of Colorado took up the construction work. During the past three years the road has been pushed from the lake upward until less than four miles of comparatively easy work remains to be built until the summit is reached. Three years were required to advance the road a little less than eleven miles.

There is not a road in Colorado, and that means in the United States, which offers such construction difficulties as the stretch between Echo lake and the saddle between Mount Evans and Mount Epaulet. Not more than three months in the year are available for construction work. The work is located above timber line, where the rareness of the atmosphere makes hard work difficult.

Sufficient money is on hand to complete the road to the summit before the snow puts a stop to work next fall. The contract for the work has been let, and unless wind and weather forbid, the highway will be finished in 1927. Unless there is some unforeseen delay, the first machines may travel to the summit next Labor day.

At present tourists may safely drive to the saddle between Mount Evans and Mount Epaulet. Even at this point, some 800 feet below the summit, a view that beggars description will reward him for his trip, but this view is as nothing when it is compared with that from the summit, 14,260 feet above the level of the sea and almost 100 feet higher than Pike's peak.

A Nation on Wheels

NOW that the automobile experiences of 1926 are but memories—sweet and bitter, according to the variations—we are permitted to review the figures issued by the American Automobile Association on the great tin can hegira and to reflectively digest them.

No less than 12,000,000 Americans—one out of every eight or nine—took to the roads at one time or another during the year, determined to see America and Americans first. It was the greatest overland movement in history—literally a nation on wheels.

It is safe to assume that the motorists spent on the average ten dollars a day for food, gasoline, shelter. That in itself is an item of some moment, one that should have left its impression on villages, cities and whole sections of the various states.

The tourist business has come to be something of a power commercially. The various oil companies have placed it first in their sales program. Thousands of garages scattered from New York to the wilds of Arizona and beyond into the sophisticated center of California depend on the seasonal exodus for half or more of their business. Hotels have expanded their facilities for welcoming the stranger. Hot dog stands, delicatessens, chicken dinner palaces, barbecues cater to the tourist trade and no other. Traveling has come to be business as well as pleasure.

Dusty Pages of Past Revealed in History of Million Dollar Highway

The town of Ouray, one of the most beautiful "mountain towns" in America, at one time a leading mining center.

By J. A. CLAY
President, Western Colorado
Chamber of Commerce

THE Million Dollar highway extends south from Ouray, whose elevation is 7,700 feet, then it climbs to Red mountain, where it reaches an elevation of 11,086 feet dropping down to Silverton to an elevation of 9,300 feet. From Silverton it climbs to the top of the divide at Molas lake, elevation 10,800 feet and down again to Durango, with an altitude of 6,500 feet.

The majestic mountains and towering cliffs, rising thousands of feet to meet the sky, are without peer for pure rugged grandeur. Hillsides, green-clad with spruce, wild flower beds of exotic beauty, sparkling streams, and a new picture around each turn bring thrill after thrill to the motorist who drives over this highway.

Vasquez Coronado in 1541, with 1,150 men, in his march from Mexico in search of Quivera, the City of Temples, adorned with gold and silver, was the first invader into the San Juan basin. His scribes told of the ruins and cliff dwellings that are now known as Mesa Verde National Park. Also these early explorers were impressed with the luxuriant grasses and the abundance of water that was found in the wide valleys. Later in 1776, Padre Francisco passed through this country seeking a route from Santa Fe to the coast of upper California. Escalante gave our rivers the musical Spanish names they now bear—Dolores, Los Pinos, Florida, Rio De Los Animas, La Plata, Mancos, Piedra, San Juan, Rio Grande, etc.

By the Guadalupe Hidalgo treaty, Feb. 2, 1848, this land was bought from Mexico by the United States. About this time Fremont came into the San Juan section, but his men and animals were largely killed off by the Indians, and he made a strategic retreat back through the San Luis valley to New Mexico.

Another adventurous soul, John Baker, in 1860, came from the east into the park where Silverton is now located. The Indians succeeded in forcing Baker and his party to leave. He succeeded, however, in giving his name to the park.

Approximately ten years later prospectors began to trickle into the San Juan mountains from the east and many of the now famous claims were staked between 1870 and 1880. In 1881 the country around Red mountain was prospected, and in 1882 the famous Yankee Girl mine was discovered.

This was the beginning of large scale operations, and the rapid development of this section made the demand for better transportation facilities. About 1877 a company was organized and built a road from Ouray north toward Montrose. A year later the Ouray-San Juan Wagon Road Company was organized and started construction on a road from Ouray south toward Red mountain and up Poughkeepsie gulch. In 1883 the county took over the road and expended around $42,000 for its completion.

Additional funds were then advanced by Otto Mears who was a transportation pioneer in this section. He completed the road and operated it as a toll road for several years. The toll rates were $5 for team and wagon, with $2.50 additional for each extra span of horses, $2.50 for a trail wagon and $1 for saddle animals. The first president of the San Juan-Ouray Wagon Roal Company was Ira Munn and the stockholders were mainly local merchants and miners. They had done much work and advanced considerable money. When Otto Mears took over the road and operated it as a toll road there was considerable agitation, as they felt that he was getting more than his share of the "gravy" and the tolls were exorbitant.

The road was officially taken over by the county and state in 1887. Just previous to the official act, it was unofficially opened by some earnest exponent of lower taxes, who was driving a six-horse wagon up the canon. He dropped a chain over the toll gate bar

as he passed through and went up the canon taking the bar with him.

This road was built primarily as a means of getting ore out and supplies into the rapidly developing mining center around Red mountain. The road was narrow with sharp turns and grades of 15 per cent to 20 per cent, but it serves until the present as the shortest connecting highway link between the Uncompahgre valley and the San Juan basin.

In 1916 the state and Ouray county expended $8,000 on the first two miles out of Ouray.

In 1920 the state and Ouray with Federal aid built 1.15 miles below Bear Creek falls at a cost of $75,000. In this stretch there is a 200-foot tunnel which was located and built under the supervision of Dick Whinnerah of Ouray. Excepting the mile of road in Byers canon, this is probably the highest priced mile of road in the state. Work continued and large sums were expended between Oruay and Silverton, and today we have the present wonderful highway.

Until 1918 there wasn't an open road from Silverton to Durango, and all cars coming into Silverton from the north had to be shipped by rail to Durango.

In 1918 the Bureau of Public Roads with some state aid started to open a road from Silverton to Durango. This work was carried on by the Government during 1919 and 1920, to its completion at a cost of approximately a half million dollars. For a time during the war it was necessary to use Navajo Indians to do the labor.

This road covered a stretch of approximately thirty-two miles from Silverton south, through a difficult country. All supplies and equipment had to be packed to the various camps so that work could be carried on at several points simultaneously. This project was handled by day labor under the supervision of the Bureau of Public Roads with Luke Smith acting as construction superintendent.

Since the completion of the road, improvements have been made every year. Curves have been widened, grades lowered and much surfacing done. The total cost of construction of this road has run well over the million dollar mark, hence its name, "The Million Dollar Highway."

Uncompaghre Peak, one of the "high lights" of the San Juan range, located near Ouray.

King Snow Dethroned

SNOW removal on highways in the 36 states in the snow belt has resulted in a saving of $40,000,000 to people of these states during the past winter, according to estimates made by the American Automobile Association.

Participating in this huge snow removal program, Colorado has saved thousands of dollars to her citizens, through comprehensive and efficient co-operation between state and county road forces. At the instance of Major L. D. Blauvelt, state highway engineer, a well-rounded program of snow removal was instituted on the various main arteries of travel.

In this work the state co-operated with the counties by furnishing one-half of the cost of the work and lending every assistance in the way of efficient supervision. Snow removal crews were employed in patrols on over 500 miles of state roads. It is estimated that the work performed by these snow crews will save the various counties thousands of dollars this spring in reduced maintenance costs.

It has been found that roads kept clear of snow during the winter months are less costly to repair in the annual spring "break-up." The surface is saved by the work of the snow crews. Washes are reduced to a minimum.

Employed in this snow removal work are hundreds of men in the snow belt. In Colorado regular crews have been kept busy the greater part of the winter. Nearly every county in the state has made purchases

Sedgwick County snow patrol clearing drift on State Road No. 138, east of town of Sedgwick.

of Caterpillar tractors and snow plows. These tractors range in size from the large 10-ton type to the small 2-ton machines. It has been found by some of the counties that very efficient work can be accomplished by the small-sized tractors, when equipped with the proper design of plows. This has been very clearly demonstrated in particular by the road commissioners of La Plata and Sedgwick counties.

During the winter several hundred miles of patented snow fence also was installed by the various counties at points where drifts have blocked the roads in the past. The installation of this fence materially reduced the amount of snow to be removed.

For several years the state has been constructing roads in the plains section of the state one to three feet above the surrounding terrain. It has been found that this materially reduces the amount of snow to be removed from the road surface. The winds keep the surface of the road clear in nearly every case.

Tractor outfit bucking snow north of Durango.

Experiments have been conducted by the State Highway Department in various parts of the state to determine the most economical method of handling the snow problem. One of the most notable experiments was conducted on Berthoud Pass, where government forces were able to keep this high mountain pass open until early January. This is the latest date on which this pass has been open to motor travel. Berthoud Pass also will be opened about three weeks earlier this year than usual.

Early in May a 10-ton Caterpillar tractor equipped with a La Plant-Choate plow will make its annual pilgrimage to the summit of Pikes Peak, clearing snow from the famous automobile highway. Forces employed by the City and County of Denver will tackle the Mount Evans highway about the same time.

During the heavy snows of January and February when Silverton and the region north of Durango was snow-bound county forces operating a Caterpillar plow kept twenty miles of this road open to traffic. Operating similar equipment highways in other sections of the county were kept free from snow.

Between Denver and Colorado Springs, Douglas and El Paso counties, operated tractors and snow plows after each snow fall, resulting in minimum delays to traffic. Boulder county also maintained several outfits on roads. Sedgwick county went in for snow removal this year, with real equipment. Yuma county also again did a good job of snow removal on her main roads, as did Washington, Lincoln and Morgan counties, just to mention a few of the high spots.

"I am more than pleased with the manner and methods employed in the snow removal campaign this year," declared Major Blauvelt. "Splendid results

were obtained in nearly every county. Of course, 1926-27 was just the beginning of the campaign. We hope to make a greater showing next year."

Highway officials in 36 "snow states" report a program of open roads for the snow season of 1926-27 aggregating 92,756 miles. In the winter of 1925-26 the road mileage cleared of snow in these states was about the same, compared with 62,165 miles in the winter of 1924-25. Their expenses for snow removal work last winter were in the neighborhood of $4,000,000. Enthusiasm for keeping roads open for winter traffic is so keen in some states that taxpayers insist on snow removal even if the funds required for that purpose curtail road construction work, according to the U. S. Bureau of Public Roads.

In a study of snow removal problems, the department discusses the economic importance of snow removal. Formerly the movement of farm products to the cities was discontinued during the winter months and necessary commodities were procured for consumption by country people in the fall. Country store keepers, especially those doing business at a distance from railroad stations, had to stock up before the first snow storm, and were saddled with a heavy investment for holding merchandise until required by consumers. This condition lasted until motor vehicles came into general use and the rural public began to call for improved roads.

It soon came to be realized that improved roads did not yield anything like the maximum possible return on the investments made in them unless they were open to traffic during the entire year. It was also felt that costly motor vehicles, without roads to carry them, tied up much capital unprofitably. The 36 snow states in 1925 had 375,774 miles of surfaced rural roads, and 16,139,859 registered motor vehicles. From 1921 to 1925, inclusive, they expended about three and one-quarter billion dollars on highway improvement and maintenance. It has also been estimated that their registered motor vehicles in 1925 involved a purchase cost of approximately fourteen and one-half billion dollars. It is obviously uneconomic to have the transportation facilities represented by this investment in road improvement and motor vehicles put out of use annually for several months by snow. In the heavy snowfall area, where snow removal is not done, the advantages of paved roads and motor vehicles may be interrupted for three or four months each winter. Progressive rural populations with a large investment in good roads and motor vehicles are becoming less and less inclined to tolerate this condition.

So strong is the demand from taxpayers for more extensive snow removal programs, that the Department of Agriculture believes it will not be many years before all paved roads and their connecting sections in the United States will be kept open for year-round traffic. Accordingly, the department is studying snow removal expense in various states to ascertain the best and cheapest methods. Straight blade and V-shaped plows mounted on speed trucks are extensively used. For opening drifts or packed sections of roadway, or for widening roads already made, powerful displacement plows with tractors, and various types of rotary plows are employed. Newly fallen snow to a depth of nine inches, and short sections of snow recently drifted but not packed or crusted, can be efficiently removed with truck plows. The Department observes that snow rarely falls at one time to a depth greater than nine inches.

Small tractor-plow cleaning streets of Julesburg.

Costs of snow removal vary in different localities. The frequency, general direction and strength of the prevailing winds are important factors. An area in such a position as to be protected from heavy winds, or having its main roads parallel with the general direction of the wind, may keep the cost of snow removal to the minimum. Areas in open country with main roads running in a direction that makes drifting inevitable, may have much heavier costs. Whether the snow is moist or dry is another cost factor, dry snow being naturally cheaper to remove. Snow falling to a depth of seven inches without wind can be removed at low cost before it has settled or become packed. After it has settled or become packed and drifted, the cost of snow removal is much greater.

Apparently, however, the communities that have gone in for snow removal consider it well worth the cost. Formerly dwellers along numerous roads were snowed in until the spring thaw. Their highways were blocked and made valueless for wheel traffic. Their motor vehicles had to be stored for the winter, and wheel traffic stopped until April or May. This handicap to business and to social life is believed to be a heavier cost than that represented by the expense of snow removal. With better roads maintained during the snow season protection from fire is afforded throughout the year. Physicians can make their calls more easily. Country merchants can maintain their stocks at a much reduced carrying expense, rural mail delivery and school attendance are facilitated and farmers are enabled to supply their markets continuously.

3-Cent Gas Tax Approved

THE Colorado Highway Department will be approximately $845,000 wealthier in 1927 than originally it would have been had not House Bill No. 153, the gas tax measure, passed the 26th generally assembly.

This measure, as blazoned forth in all state newspapers and as talked continuously during the session among state officials, was by far the most important piece of legislation before the assembly so far as the Highway Department was concerned.

As finally passed, the gas tax bill raises the state gasoline tax from 2 to 3 cents a gallon. It also changes the method of distribution. The 2-cent tax was divided 50-50 between the state highway department and the counties. The 3-cent tax will be divided 70 per cent to the department and 30 per cent to the counties.

Reduced to dollars and cents, in round numbers, the old 2-cent tax gave $1,000,000 each to the counties and to the department in the fiscal year of 1926 (Dec. 1, 1925, to Nov. 30, 1926).

The new law will go into effect at once upon signature by Gov. William H. Adams. Since approximately 60 per cent of all gasoline taxes are collected in the last six months of a fiscal year, a goodly portion of the increased tax will accrue to the department this year, despite the passage of four months under the old law.

Officials of the department, figuring on a basis of collections last year, and assuming that the gallons of gasoline sold this year will be at least equal to 1926, estimate that an additional $660,000 will be available for department use under the new law. This is on the assumption that the new law is signed on or before May 1.

Despite the fact that the counties will receive only 30 per cent of the tax under the new law, they will receive within a comparatively few thousands of the same amount they did before. The estimate of amount to be distributed through this channel in the 1927 fiscal year is $932,000.

However, the counties also will receive an additional amount from the collection of the new bus taxes. Also they will be further benefited through the acceptance of Federal Aid by the State with its share of the gasoline tax, which means that the latter's share will be doubled when it is expended on the State roads located in the various counties. The State Highway Department is the only agency in Colorado that can accept Federal Aid funds from the government. In accepting Federal Aid funds the Highway Department is required to sign a contract whereby it agrees to maintain the Federal Aid roads to a certain standard before the government will release its funds for construction of Federal Aid projects.

The new law directs the governor to amend the 1927 highway budget, in order to allot the additional funds which will be raised through the increased gasoline tax. The Highway Advisory Board will meet with Governor Adams to make recommendations as to the disposition of these funds.

Originally, the 1927 budget, as drawn by the Advisory Board, called for expenditure of $1,800,000—with no Federal Aid. Former Gov. Clarence J. Morley changed this budget, eliminating more than 100 small state projects and lumping the available money into a few Federal Aid projects. This brought the total budget to $2,340,000, taking advantage of $540,000 in Federal Aid.

If the $660,000 expected to accrue under the new law is put entirely, or almost so, into Federal Aid projects, more than $4,000,000 would be included in the resulting final budget for 1927.

Looking into the future, the approximate receipts of the Highway Department for 1928, available for budgeting, are as follows:

Gasoline tax	$2,250,000
Half-mill levy	750,000
Internal improvement	75,000
Federal Aid funds	1,380,000
Total	$4,455,000

With the new law working "full time", the year 1928 will give the counties approximately $960,000 from gasoline taxes.

Though not so important from a financial viewpoint, the enactment of House Bills Nos. 430 and 432, have nevertheless a far-reaching influence on the highway situation in Colorado. As is the case with the gas tax bill, these measures too are awaiting the governor's signature as this issue of COLORADO HIGHWAYS goes to press.

H. B. 430 is known as the "common carrier bus and truck bill" and 432 is known as the "contract carrier truck bill". They are companion measures, and are designed primarily to make the heavy busses and trucks pay for their use of the public highways in some proportion to the amount of wear they give these roads.

No accruate estimate is yet available as to just what these bills will raise in money for highway work. H. B. 430 taxes busses 5 mills per passenger mile and trucks 1 mill per ton mile on common carrier business. Sponsors of the legislation believe it will raise $75,000 annually, but officials of the public utilities commission, which will enforce the two laws, are skeptical of this amount.

Both bills were endorsed by county commissioners and by the public utilities commission, but were bitterly fought by representatives of bus and truck companies.

One of the principal arguments for the bills, and particularly for H. B. 430, was that some check is needed whereby the utilities commission will control the activities of the so-called "fly-by-night" bus companies, and certain interstate bus companies that have been accused of advertising falsely, of mistreating passengers, and generally causing untold trouble for the utilities commission and county commissioners.

Both bills are complicated, and their true effect will be known only when the utilities commission begins the enforcement and establishes rules and regulations whereby carriers must observe the new laws.

NEWS OF THE MONTH

Current Events in the Field of Highway Engineering and Transportation—State, County and Municipal Activities

Out of the Mud with Lime

Every farmer will look forward to the day when earth roads, the arteries which he must use to reach the main highways, are provided with a passably good surface all the year around; one that snows, frosts and heavy rains fail to put in such condition that his teams, trucks or pleasure cars find it difficult to get through. Today the farmer who lives a mile or more from an improved highway in many cases is forced to haul his produce over rough and rutted roads, and often over roads deep in mud, a great part of the year.

There are two million miles of earth roads in this country. Most of this mileage is unimproved and much of it never will be other than earth roads, for costly construction will be found impossible by most rural communities. These roads feed the main highways, and if a farmer finds it impossible, or even difficult, to get his produce to the main highways because of impassable dirt roads, these improved highways are of no value to him.

Two major problems are involved in earth road construction—construction itself, and maintenance. The first, if properly done, prevents the road from becoming watersoaked and rutted, while in maintenance the question of being able to restore the road to good condition is a prime consideration. This practical and inexpensive solution has been found in lime treatment.

Determination of the value of lime treatment of earth roads was made in tests conducted in the field and in the laboratory over a period of two years. The U. S. Bureau of Public Roads in conjunction with the State Highway Departments of Iowa and South Dakota, and the National Lime Association co-operating with the University of Missouri, undertook the tests in 1924. These tests solved many of the problems which are encountered in sections where hard-surfaced roads are not economical, or where maintenance must be made easier, quicker and less costly.

Earth roads must be in a reasonably good condition before being surfaced, and the lime can be added with a minimum of extra work while the road is being graded. In this way the cost of lime treatment is reduced to practically the cost of the lime alone. The lime treatment will provide a suitable foundation for further improvement, such as a gravel surface, for instance, that may be added at a later date.

When hydrated lime is mixed with the top layer, the soil loses its stickiness and does not cling to the wheels of vehicles. Because the wheels do not pick up the mud, the road remains smooth and excess water drains off before it has a chance to soak in. At the same time, the lime serves to stabilize the soil, so that wheels do not sink in when the road is wet. The road remains smooth and firm and is free from ruts during weather which would make an untreated road almost impassable. Lime treatment produces a more porous, granular structure which is so open that the surface dries quickly.

New Colorado Roads of Interest Are Proposed

Plans for making the famous Fall River scenic highway in Estes Park a "one way" road, and a suggestion that a new 100-ft. highway be constructed for both fast and slow moving traffic from the Colorado-Wyoming border to Denver, have been received with widespread interest among highway builders as well as motorists.

Instead of double tracking the Fall River road, it is announced that the Federal Bureau of Roads, which has supervision over the highways of the Rocky Mountain National Park, has made a preliminary survey for a new route from Estes Park across the front range to the Grand Lake region.

It is stated that the proposal is to make this new route and the present Fall River road both "one way" highways, using the Fall River "skyway" for west bound traffic and the new scenic drive for eastward travel.

Increased safety and the exploration of new, heretofore untraveled regions rich in scenic grandeur and wild, rugged mountain beauty, would be achieved by such an accomplishment, it is pointed out.

The proposed new route would start from the High Drive, which is now being rebuilt. It would be located considerably south of the Fall River road.

A part of Weld County's splendid maintenance organization with Caterpillar tractor equipment ready for annual spring inspection. These outfits are employed in District No. 1, under direction of Commissioner Dan Straight. Weld County has one of the largest maintenance organizations in the state.

A winter scene on the world-famous Cameron Pass Highway.

Road Work--of Yesterday and Today

By Wm. M. Jardine, Secretary of Agriculture

THE decade just past has been marked by greater improvement of the roads of the United States and a larger increase in highway transportation than any other in the history of the country. As, from our present position, we look back upon the way we have come in these ten years the progress seems truly remarkable. Coincidentally this same period covers the span of the Federal aid road legislation and its administration under the Department of Agriculture.

As we entered the decade in 1916 there were less than two and a half million motor vehicles in the entire country, and less than 73,000 of these were registered as motor trucks. Today the trucks alone are more numerous than all motor vehicles at that time, and the total has doubled and twice redoubled in the ten-year period.

In 1916 there were approximately 277,000 miles of surfaced roads in the entire country, only a small percentage of which were of the types now regarded as adequate for motor vehicle traffic. Today the mileage of surfaced roads is nearly if not quite twice as great as it was 10 years ago and more than 100,000 miles are improved with types of surface more satisfactory for service than waterbound macadam—a record of progress the more remarkable if it is remembered that during this same ten-year period it has been necessary to reconstruct a very large part of the mileage previously constructed.

While the States in accepting the Federal appropriations accepted also the obligation of keeping the roads in proper repair, the deeper obligation is that of rendering the best possible service to the public and of protecting public investment. Neither the public nor the legal obligation can be satisfied by a perfunctory highway maintenance policy. The department has endeavored to deal in a straight-forward way with its duty to enforce the law in this respect. There has been no tendency to pick flaws of a minor character or to look with unsympathetic eyes upon the efforts of the States. It is not a pleasant duty to serve a formal notice required under the law upon any State, and it is still less pleasant to withdraw Federal participation.

Ten years ago there were only five States in which there was as much as a single improved transstate highway.

They were Massachusetts, Connecticut, New York, New Jersey and Maryland—all Eastern States and all of that small group in which the movement for better highways had been begun in the nineties. Today 25 States have improved highways continuous from border to border in at least one direction and 16 of these have completed each transstate arteries in two directions.

In 1916 there were 16 States in which there was no state highway department that could be recognized as competent to administer the construction of Federal aid roads, and they had no semblance of a plan for the development of a State system of highways. Even in those States in which the recently created State agency was endeavoring to introduce scientific and businesslike methods of highway improvement there were only a few in which a connected State highway system had yet been clearly conceived. Today there is in every State a definitely designated State highway system to the improvement of which the State governments are applying their resources.

These remarkable changes, occuring within the brief period of 10 years, distinguish the last decade as the most important in highway history; but the developments which are destined to have the most far-reaching

influence upon the future are the establishment of the Federal aid policy and the elaborate and productive researches which have been carried out by the Federal and State departments and other agencies.

Of the Federal aid policy it may be said that the 56,000 miles of road which have been improved under it are of less significance than the principles upon which the policy is founded, and which are thus given nation-wide importance.

It is a first principle of the Federal aid policy that all roads, by the nature of their traffic, are stamped as of local, State or interstate importance, and that this fact should be recognized in the administration and financing of their improvement. The law has, therefore, required the designation of a definite Federal aid highway system, including those roads of interstate importance in the improvement of which the national and State governments may properly combine their efforts.

From the first it has been required that the State should, itself, participate directly with the Federal agency through a department of its government competent to assume the responsibility. In retrospect, this provision of the law appears as, perhaps, the most important Federal contribution, responsible, as it doubtless was for the creation and strengthening of highway departments in many of the States. It is a notable fact that these organizations are among the most efficient of State institutions, and it is certain that to them must be ascribed the largest measure of credit for the remarkable improvement of our highways. There is gratification, also, in the splendid co-operation which has at all times marked their relations with the Bureau of Public Roads.

The importance of the contributions to engineering science which have resulted from the research and experimentation that has been so vigorously conducted since 1920 can scarcely be over-emphasized. The Bates Road tests by the Illinois department, the Pittsburg, California, experiments and the various tests of the Bureau of Public Roads are known and studied throughout the world. By the general adoption of the thickened-edge section, a direct result of this research, the public has already benefited through increased service and lower costs, and the saving will go on as long as concrete roads are built.

Similarly the bureau's studies of grading and concrete pavement operations have pointed the way to an improvement in the efficiency of such operations as a result of which it has been found possible in some cases with the same equipment to increase production by 50 to 100 per cent.

The results of these studies are immediately apparent in reduced costs and enhanced efficiency. In other cases, as in the studies of soils to determine their characteristics as highway subgrades and in the various investigations of the effect upon roadways of traffic and climatic influences, the object sought is complicated by so many variable factors that the studies must be long continued before definite results may be expected. But these researches, penetrating as they do to the very fundamentals of highway design, are likely in the end to be the most valuable of all, and it is not only possible but probable that future generations of road builders may regard them as in the same category as those fundamental observations by which the design of bridges has been converted from a rule-of-thumb process into an exact and dependable science.

Turning from retrospection to the contemplation of the future, I am impressed with the necessity of making adequate provision for the increasing service that will be expected of the highways. If the number of motor vehicles has increased from two and a half to twenty million in 10 years, there is no reason to believe that the increase will be abruptly halted now, although we may expect some falling off in the rate. As traffic increases directly in proportion to the motor vehicles in service we must expect that the conditions for which we now build will be intensified in the future. The highway service we are now providing must be capable of expansion to meet the needs of the growing traffic as these mature.

The problem of the present is to serve as adequately as possible the present needs, keeping in mind at the same time the greater needs of the future, and making suitable provision for their accommodation when the time arrives. This is the policy of stage construction, a sound policy because it recognizes the utter impossibility of building once for all a system of highways which may be regarded as a finished product, but rather substitutes for that conception, the principle of progressive improvement.

The construction of earth roads on the lines and grades and with the drainage provisions that will be required by the pavement of the future is a recognized application of the stage-construction principle. But it has much wider applications than that. The acquisition of rights of way of ample width for the future so that, when the need arises, it will be possible without heavy expense or the injury of private property to effect the necessary improvements, is another highly important application. The same foresighted policy suggests the location of the improved highways in relation to railroads at crossings in such manner as to provide satisfactorily for separation of grades, and it applies also to provisions for the construction of future by-pass highways around cities, and for the diversion of traffic from routes of growing congestion.

To anticipate thus the needs of the future implies a knowledge of the probable traffic importance of the various roads which can only be obtained by a careful and detailed study of the present distribution and the factors inherent in the economic and physical characteristics of the State.

The highway department that has in its possession

Clearing snow from the Berthoud Pass road near Empire in Clear Creek county—using one-man outfit.

such information as these surveys supply can really plan for the future. It has substituted facts for opinions; it knows the present and probable future importance of its roads; it knows the density and also the weight of the traffic to which each road is now subjected and to which it is likely to be subjected in the near future. It can, therefore, devise a reasonable program of construction extending into the future; it can budget its funds intelligently; it can determine the order in which the various highways should be improved and give a satisfactory answer to those who favor priority for other roads; and it has in its possession an adequate basis for the necessary decision as to the character of improvement required for each road.

This is sound and businesslike administration of highway improvements. It is the reverse of the casual and haphazard procedure which too often has subjected the business of highway improvement to political manipulation, and produced discontinuous, unbalanced, and uneconomical development instead of well articulated systems of improved highways.

In the Federal aid work we feel the need of such precise information daily and I look forward hopefully to a not far distant time when it will be available in all States.

Not all the exact information it is possible to obtain, however, will suffice to provide an orderly and systematic improvement of the main roads in the States which still rely upon the financial assistance of the counties to carry out the State program. Certainly there has been experience enough to prove that complete connection of main arteries is practically impossible so long as there is dependence upon county financing. The reasons are perfectly obvious. All sections of the major State roads in the various counties are not invariably the roads in which the county interest is the greatest. By their very nature the roads of the State and Federal aid systems are the most heavily travelled highways. In many instances the traffic which demands their improvement is contributed in a smaller degree by counties through which they pass than by other counties or even other States. It is not unnatural that the authorities of such counties should be unwilling, and they often are financially unable, to assume a share in the cost of the improvement. So long as any State fails to provide State funds for such roads the development of the main State and interstate roads along strictly economic lines will be hampered.

Looking to the future also there must be a still greater improvement in the maintenance of all roads and especially of the Federal aid roads, an obligation which the Federal law places upon the State highway departments. While unquestionably there has been great improvement in this respect during the last decade, the failure to make proper provision for the repair of roads upon which large sums of public money have been invested is the sheerest of economic folly. Unless there is positive assurance that means will be available for the constant and continuous care of the roads after they are improved, I am convinced that it would be better not to improve them at all.

STATE HIGHWAY DEPARTMENT

Financial Statement—February 28, 1927

BALANCE DECEMBER 1, 1926

State Treasurer		$1,672,784.91
RECEIPTS:		
Half Mill Levy	$ 69,287.22	
Gasoline Tax	226,022.82	
Internal Improvement	25,800.00	
Federal Aid	228,389.00	
County Aid	7,367.50	
Miscellaneous Receipts	2,476.74	
Total Receipts		559,343.28
Total Balance and Receipts		$2,232,128.19

DISBURSEMENTS:

Federal Aid Projects	$323,791.55	
State Projects	58,758.58	
Maintenance	62,666.33	
Federal Aid Renewals	6,559.16	
Property and Equipment	1,602.28	
Surveys	6,275.05	
General Office Administration	13,363.67	
Engineering Administration	9,054.93	
Road Signs	23,672.83	
Total Disbursements		505,744.38
BALANCE FEBRUARY 28, 1927		
State Treasurer	$1,724,269.66	
Co. Time Warrants	2,114.15	
		1,726,383.81
Total Disbursements and Balance		$2,232,128.19

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

J. D. Adams & Co. Takes Over Sale of Stroud Elevating Graders and Wagons

Announcement is made that J. D. Adams & Company has taken over the exclusive United States and Canadian sales rights to Stroud Elevating Graders and Dump Wagons. These products will now be sold by the Adams sales organization, consisting of direct factory sales representatives and distributors throughout the United States and Canada, with branches in Spokane, Minneapolis, Kansas City, Dallas, Memphis, Harrisburg, Winnipeg and Toronto.

A new catalog, "Modern Road Building with Adams Adjustable Leaning Wheel Graders," has just been issued by J. D. Adams & Company, of Indianapolis.

An interesting feature is a historical sketch of the 42 years growth of the company, founded in 1885 by J. D. Adams. This is followed by a discussion, helpfully illustrated by photographs and diagrams, of the principles of modern road construction.

The catalog is an unusually complete presentation of the entire line of Adams Graders and explains fully the advantages of the leaning wheel design originated in 1885 by J. D. Adams himself. Sections are devoted to the Adams One-Man Road Maintainer, the recently acquired Stroud Elevating Graders and Dump Wagons and entire Adams line of attachments and maintenance equipment.

Smith Mixers in Moffat Tunnel Work

Hitchcock & Tinckler, Inc., contractors for the Moffat Tunnel, have purchased their second Smith concrete mixer from the Burnite Machinery Company for work in the tunnel. This mixer, equipped with one shot lubrication, has been found most satisfactory in damp tunnel work. The tunnel contractors also were provided by the Burnite Machinery Company with a Union Growt mixer and ejector operated by a three cylinder compressed air engine (the machine used on all New York City tunnel work) and an Haiss Creeper loader.

Caterpillar Tractor Report

The annual report of the Caterpillar Tractor Co., for 1926, in addition to the presentation of financial items of interest to stockholders, stated that more Caterpillar tractors were sold in 1926 than in any preceding year. Prices here have been reduced, and the field for use broadened. Caterpillars are now used in a great variety of work, including, in the public field, road construction and maintenance, snow removal and ash and garbage removal.

Full-Crawler Company Changes Name

The Full-Crawler Co., 500 Clinton street, Milwaukee, Wis., announces the change of its name to the Trackson Company, by which it will be known in the future. The change was made in order that the company's dealers, customers, and other friends may more easily link the company name with that of its product, the Trackson Full-Crawler for the Fordson Tractor. The Trackson Company remains a division of the George H. Smith Steel Casting Company, and retains the management, organization, and personnel of the former Full-Crawler Company.

Road Machinery

The Galion Iron Works and Mfg. Co., Galion, Ohio. An elaborate 96-page catalog describing a wide line of road machinery. Also a 4-page folder describing a leaning wheel grader, and a 12-page catalog describing the Galion International Roller.

General Manager For Indiana Truck

J. W. Stephenson, president of the Indiana Truck Corporation, Marion, Ind., announces that A. S. More has recently become vice-president and general manager of the company. With the appointment of Mr. More, Mr. Stephenson can devote more of his time and attention to various business and financial interests.

Corson Returns to Denver With Wilson Machinery Co.

After more than a year spent in the Northwest and on the Pacific coast as traveling representative of the Barber-Greene Company, Ray Corson, has again become identified with the Wilson Machinery Co., Denver.

Corson is one of the best known road and contractors machinery salesmen in the Rocky Mountain territory. A graduate mechanical engineer, Corson has made a close study of various types of earth moving equipment, and also equipment used in the building trades.

His return to Denver is a welcome addition to "machinery row," and his many friends will find him at their service at 1936 Market street.

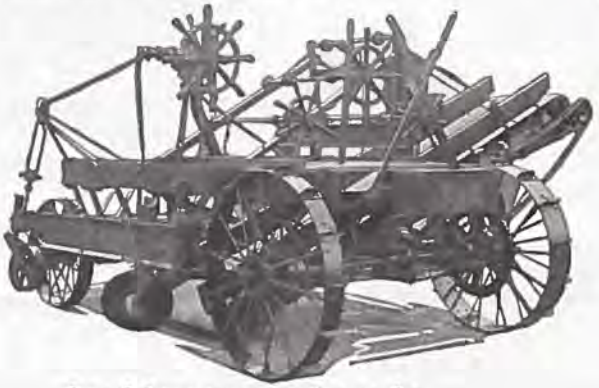
Atchinson Joins Sales Force Of Burnite Machinery Co.

Announcement is made by Tom Burnite, head of the Burnite Machinery Co., distributors of Smith Mixers, and other contractors equipment in the Denver territory, of the engagement of Roy Atchinson, to handle city and county sales in Colorado. Atchinson has been identified with machinery sales in Denver for more than ten years, and enjoys a wide circle of friends among the contractors and county commissioners.

Lakewood Engineering Co.

The Lakewood Engineering Company, Cleveland, Ohio, announces the appointment of the Superior Supply Company, Webster building, Chicago, as distributors of its equipment in the river counties of Iowa, northern Illinois and the northwest portion of Indiana. A. N. Herrick, manager of the Chicago office now closed, continues as district supervisor of the central west territory with headquarters with this company.

Stroud Contractor's Dump Wagon.



Stroud latest type elevating grader.

Our Cover Picture

On the cover of this month's issue of Colorado Highways we have a view of the "Pillars of Hercules," located near the mouth of the Big Thompson Canon, which forms one of the main entrances to the Estes Park region. This scene is on State Road No. 16 and is located in Larimer County. During the summer months thousands of motorists marvel at the scenic grandeur of this canon.

The road was constructed by the state, county and Federal government, and it is now maintained by joint supervision of the state and county.

Georgia to Have $10,600,000

The State Highway Department will have available for road work in 1927 funds amounting to $10,600,000 according to the budget for the year. Of this, $8,000,000 will be used for construction purposes and the immediate completion of paving on three main trunk line transstate highways.

One of the first projects to be completed will be the highway from Atlanta northward to the Tennessee line by way of Cartersville and Dalton. At Cartersville it will connect with the Rome Highway.

Work on the highway from Atlanta to Florida will be pushed by the immediate completion of the small portion unpaved between Atlanta and Macon. With this ready for traffic, the paving will be pushed on toward the Florida line.

Another trunk line highway on which paving will be completed is that from West Point to the North Carolina line by way of LaGrange, Newnan, Atlanta, Roswell, Dahlonega and Blairsville.

The budget also calls for the launching of a program of construction on a number of projects, including the completion of Route 38, from the Atlantic Ocean to the Alabama line, for a hard surface road from Hartwell to Macon via Athens and a highway of the same class from Atlanta to Columbus.

In six years, Georgia will have a system under this program of at least 3,000 miles of hard-surfaced roads and 3,000 miles of soil or sand clay roads.

BIDS OPENED

Proj. No.	Length	Type	Location	Low Bidder
275-F2	5.227 mi.	Paving	Castle Rock, south	J. Fred Roberts & Sons

PROJECTS ADVERTISED FOR BIDS

Proj. No.	Length	Type	Location	Bids Opened
254-C-2	.....	Bridge	Southwest of Hot Sulphur Springs	May 10, 1927

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

Proj. No.	Length	Type	Location
258-E, Div. No. 2	1.402 mi.	Gravel Surfacing	Cimarron
281-E	0.812	Paving	Lafayette
290-D*	2.954	Paving	Las Animas-Fort Lyon
300-A*	1.008	Grading	Chattanooga

PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
2-R No. 5	1.5 mi.	Paving	South of Aguilar
138-A	5.0 mi.	Surfacing	North of Kremmling
247-C	0.5 mi.	R. R. Subway & Paving	Swink
275-E	2.0 mi.	R. R. Underpass and Paving	Monument
287-D	0.5 mi.	R. R. Underpass and Paving	East of Kersey
560	3.0 mi.	Gravel Surfacing	Deer Creek-Littleton
631	120 ft.	Timber Bridge	Trumbull

*Plans finished

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	$ 331,632.00	99	2-R4
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	28,882.70	6	2-R3
79-A	Big Sandy Creek, East of Simla	10 19-ft.	Spans Timber Trestle	A. R. Mackey	10,421.26	88	79-A
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	85	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	20	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	42	144-A1
145-A	West of Glenwood Springs	3.807 mi.	Gravel Surfacing	Winterburn & Lumsden	53,227.90	0	145-A
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	63	157-A
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	82	213-D
242-AR1	East of Fruita	125 ft.	Steel Bridge	F. H. Knollman	19,999.00	79	242-AR1
254-C	Div. 1 2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	90	254-C1
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	5	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	92	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	39	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	22	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	63	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	92	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	31	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	63	271-B
275-C	Husted-Monument	4.795 mi.	Concrete Paving	J. L. Busselle & Co.	186,585.20	100	275-C
275-C	Div. 2 East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,466.60	35	275-C2
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	72	275-F1
275-G	Larkspur-Monument	10.869 mi.	Grading	Monaghan-Cunningham Con. Co.	141,252.78	0	275-G
276	North of Colorado Springs		R. R. Overpass	J. L. Busselle & Co.	37,913.00	0	276
279-E	Schaffer's Crossing-Baileys	3,243 mi.	Grading	S. M. & S. J. Feely	54,305.60	0	279-E
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	84	281-D1 / 251-B1
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	0	282-D
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	58	283-C
287-A2	Fort Morgan, west	4.011 mi.	Concrete Paving	H. C. Lallier Const. Co.	119,016.60	92	287-A2
		16.61 mi.	Subgrade Treatment				
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier C. Eng. Co.	159,950.85	10	287-C1-2
288-A	Merino-Brush	19 mi.	Grading and Surf.	Scott & Curlee			
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	19	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,645.25	75	293-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	85	295-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Cole Brothers	58,061.00	52	296-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	99	297-B
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	66	299-A

C.H.&E.

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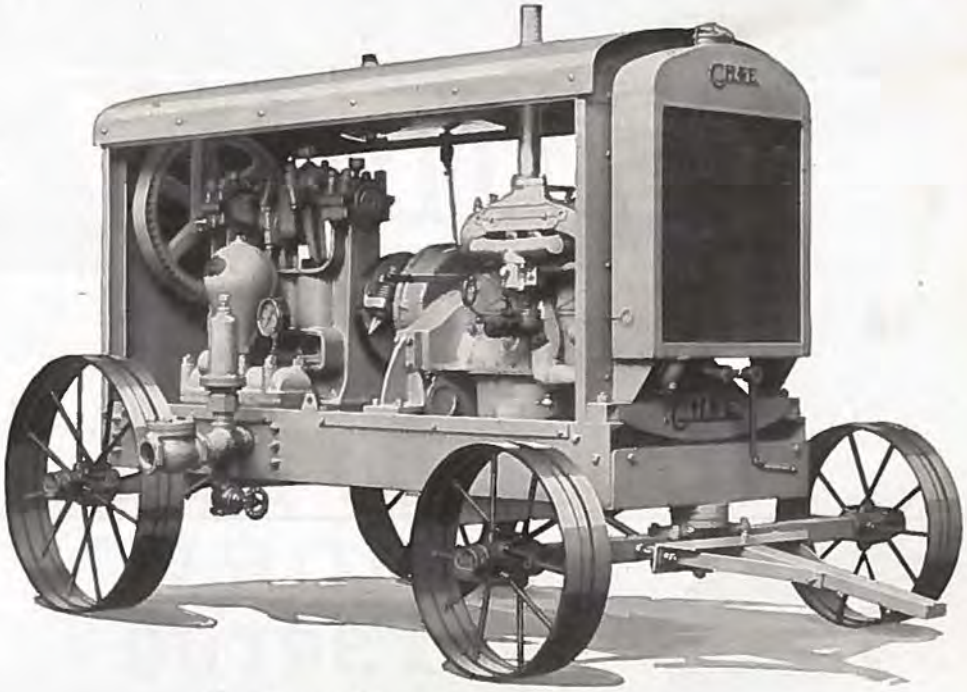
80 Gallons Per Minute at 500 Pounds Pressure



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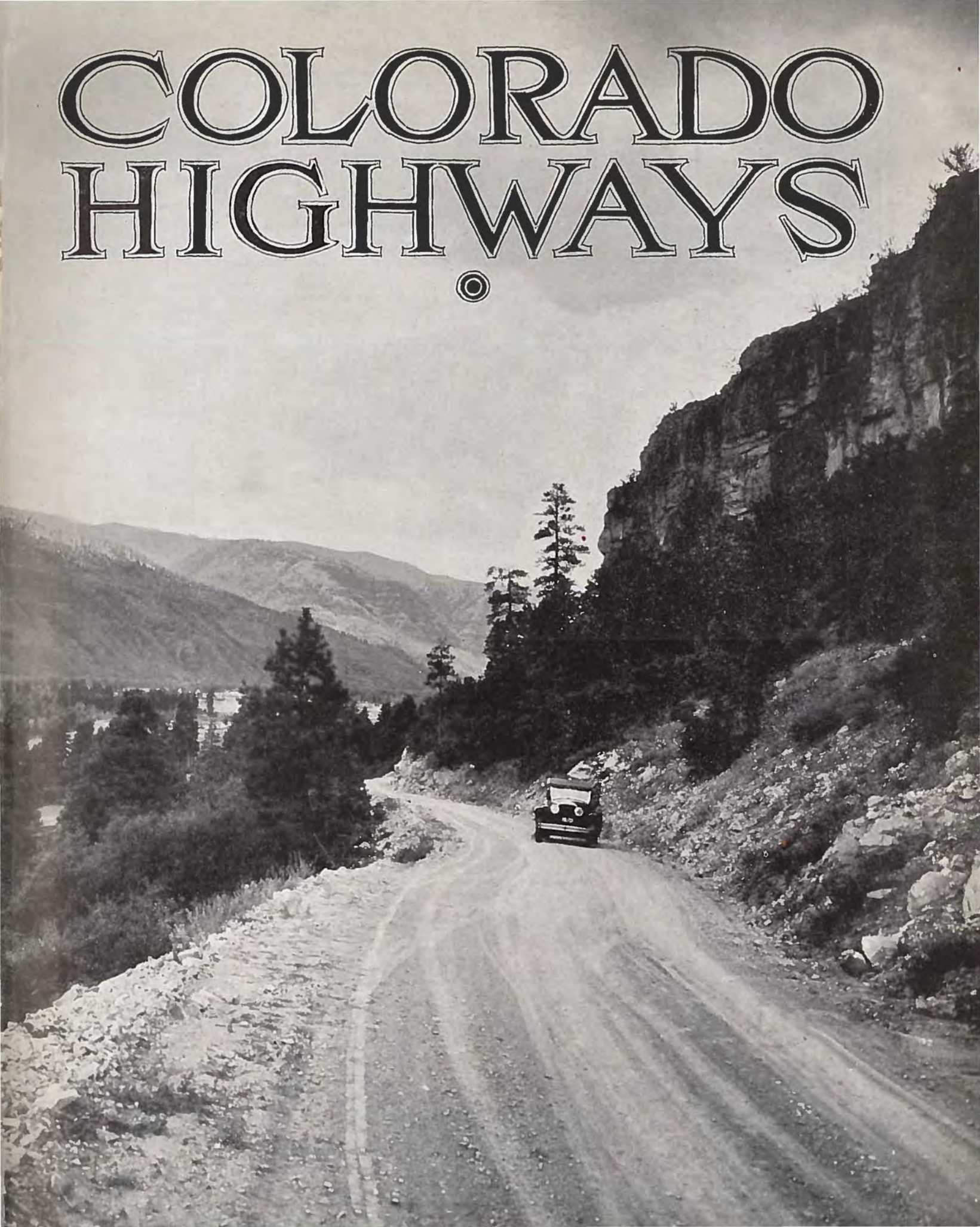
COLORADO HIGHWAYS



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Colorado Highways

"BETTER ROADS"

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M. W. BENNETT, Editor

Articles on the subject of road building and highway development in the West are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible. Manuscripts not found available will be returned promptly.

10 CENTS A COPY. **$1.00 A YEAR.**

Colorado Highways
"BETTER ROADS"

VOLUME VI. MAY, 1927. NUMBER 5

Anticipating Highway Needs

COMPETENT engineers and experience have proved conclusively that it is not possible to anticipate conditions in regard to public improvements beyond a generation. Most of us are familiar with buildings construction five and ten years ago that are now inadequate.

We seem to be unable, or unwilling, to grasp the necessities of the future. We too frequently build for the immediate present. This is particularly true in highway construction, due, perhaps, to the desire to build as many miles of improved roads as the funds available will permit, thus accommodating a larger volume of traffic. The impetus that has been given highway building had its origin in the development of motor traffic, but this form of transportation is of comparatively recent development and certainly has not reached the peak.

Generally speaking, highway engineers and road builders five and ten years ago were more or less handicapped because of lack of funds, and were forced to do the best they could with the means available. For instance, the State of Georgia appropriated for highway improvements the sum of $15,000 in 1918. Today the revenues for highways in that state total more than eleven million dollars. Of course it was impossible to accomplish very much in the way of highway improvements with $15,000. The road builders did the best they could with the funds available, and cannot be censured for their short-sightedness.

Five years ago a sixteen to eighteen-foot roadway was considered the last word in highway requirements. Today this width of roadway is a menace to the traveling public, and it seems that present traffic requires double this width in congested districts. Highways that might have been regarded as "boulevards" five years ago are not adequate for the traffic of today. We cannot build to meet future conditions of all times, because we are little better equipped now to judge of conditions ten years hence than we were five or ten years ago to foresee conditions of today.

Widening of highways and the use of more permanent materials in their construction is desirable. It necessarily follows that if highways are made wider and the roads built for traffic averaging from 1,000 to 3,000 cars daily, construction costs will mount higher and higher. But this is inevitable. Improvements cannot be secured otherwise. It takes real money to build and maintain adequate highways and they must be paid for in some way. There is no "magic" by which we can just "wish" these betterments on the traveling public. They must be paid for.

Speed and Highway Safety

Recently a questionnaire was sent out by the Pennsylvania Motor Federation asking the views of a number of experts on several traffic questions. One of the questions was in regard to speed of motor vehicles in relation to danger. The replies received were almost unanimous in saying that speed was not the greatest factor in causing highway accidents. Carelessness was considered the greatest single cause of danger. Another question was: "In your opinion, would doubling the width of a 20-foot road decrease the number of accidents?" Most of the answers gave the opinion that wider roads would decrease accidents; R. R. Stoeckel, Motor Vehicle Commissioner of Connecticut, thought that wide roads would decrease accidents only where traffic was classified, and where four lanes of traffic, fast and slow, could be handled.

It appears doubtful if speed itself is the main factor in highway danger; some drivers at fifteen miles an hour are more dangerous than others at fifty. But speed is not a large factor in relief of traffic congestion; neither will wider roads of themselves relieve traffic conditions. Something far more fundamental is needed. The solution of traffic congestion today is in the waterbound macadam stage. Just as that type of road was found unsuited to motor traffic and entirely different methods of construction became necessary, so something far more revolutionary than mere traffic control, widening of streets, or removal of speed limits, will be necessary to secure untroubled motoring over main roads.

Good Highways and Progress of Nation

Good roads have not been given the credit due them as the advance agent of civilization and human progress. The church, the public school, the printing press, the home, all these have played a part, but have not improved methods of communication accomplished even more?

Good roads built the Roman Empire. They made possible the mobilization of the French armies on the border overnight when German invasion threatened in 1914. They have solidified the people of England and filled its colleges and universities. And now they are working a miracle in the United States.

Hard surfaced highways stretching from state to state and from ocean to ocean and border to border are welding the American people into a solid, coherent nation, abolishing provincialism and sectionalism, destroying dialects and spreading tolerance and understanding everywhere.

View of State Road No. 46, from Red Cliff looking toward Tennessee Pass.

"High"-Ways

By A. H. Carhart
Former Recreation Engineer, U. S. Forest Service

THERE is a sporting element in driving your car over America's ridgepole. The high range roads present a challenge. When the car leaves the last town before the pull over the top there is just a little question about whether or not you will make it without some effort. Even with the fine existing roadways this remains true.

When a car starts crawling over the colossal backbone of America it must negotiate upgrade roads for miles and miles. The trip on the easiest passes is a test of automobile stamina.

The state of high highways is Colorado. More roads circle and zig-zag to arctic conditions of timberline in this one state than in many others combined.

Passes are the key points on the cross-range roads. The roads lead up, up until the mist robes of the high peaks often scurry around the car. Little snow storms are likely to pay a fleeting visit to the mountaineering motorist on the top of these passes any day in the year.

Of all the roads that climb across the Continental Divide in Colorado, the easiest to negotiate is over Cochetopa Pass. The road extends from Saguache to a connection with the Monarch Pass section of the Rainbow Route to the westward. This pass of the Cochetopa does not reach timberline. It is 9,998 feet in elevation and good stands of straight timber are on each side of the highest point of the road. Timberline here is at about 11,500 feet elevation. This road is excellent, being patrolled by the U. S. Forest Service. It is open early in the spring and the grades are easy but it tops the great watershed.

Berthoud Pass, west from Denver, is one of the higher passes. It is on the Victory Highway and is used much by tourists. The east side of this climb has recently been put in fine condition and there is little difficulty in getting up where the winds whistle around the low scraggy alpine fir trees that hug the ground. Berthoud Pass initiates the autoist into scaling dizzy heights via motor, for one here reaches 11,306 feet above sea leved when at the highest point on this road.

One of the most lovely highroads in the Rockies is the Monarch Pass highway on the Rainbow Route. Here one climbs even higher than on Berthoud but the pass is farther south and one does not find such severe timberline conditions. This is the highest highway pass in the state for the altitude is 11,650 feet or more than three hundred feet above any other pass on a main road in Colorado.

There are several other high roads over passes in Colorado. The Pikes Peak Ocean-to-Ocean scales the massive ridge west of Leadville, and starts the swing to the Pacific at Tennessee Pass, an elevation of 11,276. A little used road creeps up over the backbone of the Continent from Creede, Colorado, crosses Cebolla pass at 10,394 and follows an angleworm sort of a trail down over the face of the mountain to exquisite Lake San Cristobal and picturesque Lake City. Hoosier Pass is 10,313 feet above the sea at the high point. It is in a most interesting part of the Rockies, north and west from Pike's Peak and near Gray's and Torrey's, peaks which are both higher than Pike's.

A famous mountain highway on the Old Trail climbs over the top of America at Wolf Creek Pass in the Rio Grande National Forest. Steady improvement is making this mountain road as safe as any but until recently it was a road which demanded real skill in handling a machine in the mountains. The high point on Wolf Creek highway is 10,050. The views from many points on this road are magnificent.

By no means are all of the good roads which climb over high mountain passes on the Continental Divide. There is the Red Mountain road near Ouray which is

one of the most beautiful mountain highways in America, the pleasing roads over the Sangre de Cristo range at Veta and Poncha passes and a most inspiring road over the Cucharas pass near Trinidad goes through the center of one division of the San Isabel National Forest.

The Rabbit Ear Road is another example of a very interesting highway not over the top of the Continent but none the less attractive. Recent improvements on the Battle Mountain section of the Pikes Peak Ocean-to-Ocean highway have transformed what was formerly a motorists' nightmare into a much less difficult climb amid magnificient mountains.

There are several projected roads over the high ranges. One at Cumbres Pass near Antonito, Colorado, is under construction. Climbing out of picturesque Conejos Canon it tops the divide just below timberline at 10,003 feet above the sea. Another road over the top is now being built at Independence Pass near Aspen, Colorado.

Not all of the interesting high highways are in Colorado. Two-Go-Tee Pass in the Washikie National Forest of Wyoming is at once delightful and inviting. Near the high point is Brooks Lake, a lovely water mirror of the mountains.

No comment about highways that reach timberline and above is complete without mention of the famous Pike's Peak auto road. This was built by a private company under Forest Service permit and for the most part is on government land. It is operated by this company as a toll road.

In company with four friends from Boston I recently traveled this highest auto highway.

"Now, folks," said our inspired guide-driver in the sing-song of the rubberneck lecturer, "we approach the worst grade on the whole Pike's Peak Auto Highway. Here is the ruling grade of the whole trip. For a short distance this car will be compelled to negotiate a grade slightly over twenty per cent."

My eastern tourist companions gasped and gazed awe-stricken at the climbing road in front of the car. They were wholly convinced that the driver was modest in his statement. But somewhere I had heard authentic information on the ruling grade of that road and it is not even half of twenty per cent. But it looked fully twenty, as many of the mountain roads do, and the other occupants of the car were properly impressed.

The highway to the top of Pike's Peak is an excellent piece of road work, which opens up a whole kingdom of mountain scenery to the gaze of the tourist and presents as great a challenge to the mountaineering motorist as can be found anywhere.

There is a fascination in climbing to where one is often enveloped in the lower layers of high clouds or when they are low-hanging the traveler standing on a high ridge looks down to a sea of billowy mist below. Highways to timberline are not common. Practically all that reach above 10,000 feet elevation have been mentioned in this brief story. These old trails over which the pioneers toiled are now broad highways. Not many years ago they were hardly negotiable by buckboard. Today they invite every motorist to climb to the highest point on the road and look down on the vistas of canon, forest and mountains that spread before the eye. Once you try a trip to the top you will become a convert to mountaineering by motor. The highways to the heights will call you again and again.

Scene on Wolf Creek Pass, elevation 11,000 feet, showing section constructed by State forces.

"Claiming the West"

Great Caravans of Men, Women and Children Wended Their Way Westward, Claiming the Territory West of the Mississippi and Building a Vast New Empire

IN the second article of this series we told of the stagecoach period in England and hinted at the stage lines operated in the United States. In this article we will try to picture travel in the United States before the revival of road building which came in the latter part of the last century. The period is filled with romance, discovery, gold in California, the Civil War; reconstruction and national development all woven together in such a way that the times can hardly be pictured by the cleverest pen of the most gifted artist and yet we will try to tell something about highway transportation during the period.

At the beginning of the last century the West and Northwest were lands of mystery, lands beyond the knowledge of the Atlantic coast, lands obscured by great distances in the midst of the forests, mountains. and streams of the great West. The Government of the United States recognized the value of this great territory and sent expeditions into it to "spy out the land," as it were, and to take posession where we could make a claim. The Lewis and Clarke expedition reached into the Northwest territory opening up the whole West to American enterprise. In passing it must be remarked that Meriwether Lewis was a Tennessean who deserves to be known even more widely than he is and whose work had much to do with the "winning of the West."

Following the explorations of the expeditions sent out by our government, the people began to migrate to the Western territory. They began to feel the elbows of the crowd in the East and they journeyed far out into the open seeking fortune, new lands, new homes and withal giving expression to their desire for adventure. A little more than seventy-five years ago the news that gold had been discovered in California was carried back to the Eastern part of this great Eastern country of ours, and then began a migration to the far West which ultimately ended in building a great empire west of the Rocky Mountains, adding vast wealth to people of the United States. The way from New York to San Francisco was a winding path which led through difficulties, dangers and hardships only known to the workers of that day. No longer do we hear the deep breathing of the oxen as they slowly wend their way across the desert, up the mountain, across the plain, and through the rivers, until they reach the coveted journey's end on the Pacific Coast. The war cry of the native Indian has died away and in its stead we hear the noise of industry, agriculture, mining and commerce. The broad lands over which he used to roam have been turned into pastures, orchards, farms, homes, cities, with all the industry of a growing civilization. The buffalo used to travel this territory in herds that were numbered by thousands and individuals in countless numbers, but now the race is almost extinct except for a few remnants which have been placed in reservation for their protection. The day of the vast herd is gone and it will never come again.

In the wake of these changes has come a new land, a new era, a new civilization. The vast open spaces are being claimed by a growing population and it has been made possible by the development in means by transportation. Where the long, winding trail used to feebly bind communities together there has come bands of steel that make distance a fable, double the accomplishments of a lifetime, and so bond the whole together that the nation has become one people, under one flag, having the same ideals, worshiping at the same shrines, speaking the same language and making the greatest Nation on earth.

Modern transportation has played an important part and is playing an important part in our national life. Not only has modern transportation played a part but transportation at all times has done her part in the development of the Nation. The long train of heavily laden wagons plodding along the trail from the Mississippi to the gold fields were as essential as any other part of the equipment of the time. Let us imagine the piles of gold heaped higher and higher without an outlet, without a market. Within a few months the mines would have been abandoned and their owners would have roamed the wilds looking for food. The wagon train meant food, clothing and market for

Arrival at Santa Fe
(From "Down the Santa Fe Trail," Yale University Press.)

the gold—all were essential for the operation and neither could have been furnished without transportation.

Travel over these areas took many forms. The ox team slowly wended its way from civiliatizon to the far reaches of the continent, daily adding a few miles to the distance between the home in Kentucky, Tennessee, North Carolina and the other Eastern states, and the great unknown land where the traveler hoped to make a new home and live in greater prosperity and happiness. Thousands of vehicles were pulled by the lowly oxen over the long miles of plain, mountain and desert. The emigrant bands would assemble in great groups for the long journey. They found strength in numbers, and the foe was not only exposure, difficult journey and hunger but behind each turn in the road, each cluster of trees, or across stream there might lurk the original inhabitants of the soil who recognized that their land was being taken and many of them resented it to the point of hostility. Many are the stories of attack by Indians, resulting in bloody battles in which no quarter was asked or given, and sometimes resulting in the annihilation of the whole band of travelers. In spite of the hardships, the dangers and the exposure the hardy settler with his yoke of oxen traversed the area, settling where the land was good, finally pushing to the shores of the Pacific, claiming a great empire and adding untold wealth to the United States.

The ox team was usually accompanied by horseback riders, and perchance by vehicles drawn by horses. The horse-drawn vehicles could move more rapidly than the ox-wagons and were used by the leaders of each band. Men and women knew how to spend day after day in the saddle thus giving more flexibility to their travel over the long journeys which occupied many weeks of arduous toil. The Arab looks upon his horse as a special gift of the gods and we can imagine that the traveler had a similar feeling toward the steed which carried him out of danger and made it possible for him to accomplish his journey in safety.

As the trails became known and commerce between the East and West developed there came into being a mode of travel long to be celebrated in song and story. Stagecoach lines were projected from the Mississippi Valley to the Pacific Coast, vehicles were placed on schedule, and then was opened to the traveling public a method of transport that was only superseded by the Pullman car drawn by horses of steel and over rails that bound this vast country into one great whole. The need was so strong that great companies were organized to transport passengers and freight to and from the new areas. The overland coach lines reached a development that showed enterprise, endurance, and a management that approached genius in its personnel, and which accomplished results that were truly remarkable.

Mark Twain, in his inimitable way in his book, "Roughing It," tells of his journey from St Joe, Missouri, to the gold fields and to California. He tells of the coach with its cargo of mail, passengers, and freight; its worthy conductor and its famous driver.

A Buffalo Hunt
(From "Down the Santa Fe Trail," Yale University Press.)

How the passengers stowed themselves among the bags of mail, trying to sleep at nights, trying to keep cool during the day, on the top of the coach in the open air, and how they tried to amuse themselves as the days stretched into weeks before the journey was ended.

He says the driver was looked upon as a hero. The employes of the company catered to him as if he were the high mogul of the line, laughing at his stale stories, repeating his crude witticisms, bowing deference to him as he strode about the coach, and overlooking his boorish conduct as he handled them with contempt. The drivers recognized their importance and many of them deserve great credit for the care with which they accomplished their tasks of bringing the coach over the route without mishap or hindrance.

The vehicle was commodious for conveyance of the day, giving passengers enough room to travel with some comfort and at the same time of such weight that they could be drawn over the poor roads and at a considerable rate of speed. Had the railways not been developed it is probable that the stagecoach would have been developed to a point where it would have compared favorably with the modern highway vehicle in appointments and comfort. Its days were numbered and now it is a thing of the past, a vehicle of history, gone never to be revived again.

Section of Ouray-Silverton Highway, near the town of Ouray.

Maintenance outfit used by La Plata County on Mancos route.

The Maintenance of Gravel Roads

Methods and Equipment Used in Certain Sections of Michigan Described in Paper Presented at Highway Engineering Conference, University of Michigan

By J. T. Sharpensteen
Maintenance Supervisor, Michigan State Highway Department

THE conclusions which follow are based largely on the experience of maintaining more than 600 miles of state trunk line gravel roads in thirteen counties located in the northwestern part of the lower peninsula. It is not assumed that all the ways and means found effective on these roads may be applied with the same results in every locality, although it is believed that many of the methods used are applicable to gravel road maintenance in general.

Character of the Roads.—To fully appreciate the reasons for doing a number of things that have been done, it is desirable to understand the character of the roads being discussed. A large percentage of the mileage was improved as state reward roads with grades ranging in width from 16 to 24 ft. and gravel surfaces varying from 9 to 16 ft. in width. The narrow widths predominated and bank run gravel was used extensively in construction. A portion of the mileage was improved under state trunk line specifications but consists very largely of one-course construction. The balance of the mileage which appears to have been improved has been built up under maintenance by adding a small amount of gravel each year. A light, sandy soil is common to practically the entire territory. Gravel secured from local deposits, which is the main source of supply, has a sand filler and cannot be compacted so that it will withstand traffic and varying degrees of moisture.

On account of the gravel having a sand filler and the light sandy soil of which the roadbed was constructed, it was inevitable that the one would become mixed with the other, further reducing the possibility of maintaining a consolidated metal surface. To reduce the loss from loose gravel being thrown into the ditch, high shoulders were built and maintained. With loose gravel in dry weather there was some justification for high shoulders for retaining purposes, but in rainy weather the roads presented a canal-like appearance until the water had had time to soak into the roadbed, except in hilly sections water flowed down the inside line of the shoulders to low points, causing serious washouts. Under these conditions travel by automobile was slow, tiresome and expensive. Accidents were frequent and the loose gravel furnished a perfect "alibi" for every accident regardless of the cause.

In order to keep the investment in equipment as low as possible, it is necessary to secure equipment that can be used the year around. It is evident that certain equipment used in winter cannot be used in the summer. On the other hand, a major portion of the summer equipment, such as trucks and heavy tractors, can be used in snow removal work. There are special gravel road maintenance units that give satisfactory results when used for the purpose for which they are designed but for snow removal in this locality are of little or no use.

Effect of Winter.—Beginning with the spring breakup snow and ice are removed from the road as rapidly as possible. On roads which have been kept open for wheel traffic the ice covering disappears with the first few warm days of spring. On those roads not maintained for wheel traffic, during the winter a much longer time is required to clear away the snow and ice. On such roads, at points where there has been little or no drifting, the snow covering disappears in a short time, inviting automobile traffic to start using the road. By this time the drifts have settled down, mak-

ing it possible to drive on top of them, resulting in the formation of ruts which soon wear down to the gravel surface. These ruts are filled with water and, with the concentration of traffic in them, soon extend deep into the gravel surface and, in many cases, into the subgrade, often rendering sections of the road impassable while the frost is leaving the ground. When the ice and snow have melted sufficiently to permit floating, the ruts have reached such depths that scarifying is really the only effective and sure way of removing them. On roads where snow removal is undertaken, floating can be started much earlier and the formation of ruts prevented. Snow removal is therefore an aid to summer maintenance and the added cost of putting a road, from which the snow has not been removed, in a satisfactory condition would go a long way toward keeping it open throughout the winter.

Early Spring Work. — For the purpose of early spring cutting a 10-ton tractor and a heavy grader are used. High shoulders are cut down so that water falling on the road may reach the side ditches without delay. The crown of the road is reduced to about ¼-in. to a foot width of road. The metal surface is spread out to a width of 20 ft. if possible. The outer edge of the widened metal surface is often quite thin but has been found of sufficient strength to give fairly satisfactory service in dry weather.

Floating with what might be called light equipment is started at the same time heavy cutting is begun.

Both 10 and 12-ft. spring blade attachments have been used and it was found that the 12-ft. length could be handled satisfactorily by a 3-ton truck and, in most cases, the entire width of gravel surface covered with one round trip..

Eliminating Loose Gravel. — An effort was made during the past year to eliminate loose gravel. This was accomplished in a few instances by depositing it on the shoulders to remain there until late in the season. As a temporary expedient, this method was effective but has the same disadvantage as high shoulders and was used only as the last resort. The most satisfactory results were obtained from adding sufficient binder to consolidate all, or nearly all, of the loose material. Clay being the only local material having the desired binding qualities, it was used extensively. The application of binder was carried on by thirteen different organizations and, as might be expected, uniform results were not always obtained; however, with the exception of a few isolated cases, all loose material in the gravel surface was consolidated, ending a dangerous condition of long standing. Definite instructions for applying clay cannot be given on account of the clay in the different deposits not having the same characteristics and on account of no two miles of the same road requiring the same treatment. The success of the application depends very largely on the judgment of the man in immediate charge of the work. From ½ to 2 yd. per 100 ft. of road is the amount ordinarily used. It should be spread uniformly over the entire gravel surface and mixed with the loose material by harrowing or frequent floating. Following the first rain, intensive floating with both heavy and light equipment should be done until the surface has dried sufficiently to prevent its being cut up by heavy loaded vehicles.

Resurfacing — There has been a practice of doing as much resurfacing each year as funds would permit. This work was usually performed in the summer when traffic is heavier than at other seasons of the year and increased, instead of abated, the loose gravel menace. Light resurfacing, if done in the early spring or late in the fall, improves the road but it is believed that the same amount of money used in a different way will result in more satisfactory maintenance.

By stocking gravel at convenient points along the road and using it at places where there is an obvious need for additional gravel, a considerable saving can be made over a general resurfacing. All maintenance organizations are instructed to emphasize patching in rainy weather to the exclusion of all other work except possibly floating. All available trucks are loaded from stock piles and the gravel is placed wherever water is standing on the road. Roads dry up very quickly in the summer and, for this reason, it is imperative that the work of filling holes and low places be pushed as rapidly as possible. Frequently this work is performed while it is raining and, whenever possible, is done in advance of floating. Not all the necessary patching can be done in wet weather but, by doing as much as possible with each rain, the need for patching at other times is not of serious consequence.

Distribution of Traffic — To secure an absolutely uniform distribution of traffic over the entire width of the metal surface is probably impossible, but the basic idea kept in mind at all times is to approach this condition as near as possible. The attainment of this end involves a low crown and a surface in such condition that the driver of a motor vehicle cannot, consciously or unconsciously, follow in the tracks of vehicles that have preceded him.

An operator of a motor vehicle experiences difficulty in driving over a loose gravel road that has just been floated. Succeeding drivers find less difficulty because they followed in the tracks already made by preceding vehicles. This means a high concentration of traffic on from 10 to 15 per cent of the metal width. The degree of concentration varies directly with the depth of loose material present.

An estimate of the wear of gravel must take into consideration the amount of loose cover used for maintenance. It is self-evident that the loss from the erosive action of wind and rain, the abrasive and throwing action of traffic, the air currents created by rapidly moving vehicles, varies directly with the quantity of loose material acted upon by these forces. Therefore, in order to reduce wear to a minimum, it is necessary to reduce cover material accordingly.

The Final Test.—The final test for gravel road maintenance is the class of service furnished the traveling public. The amount of money required to furnish good maintenance depends on the class and quantity of traffic accommodated. With modest allowances every effort has been made to economize and yet, at the same time, there has been a constant public demand for better maintenance. To get by, so to speak, the employment of methods, that in some instances conflict with well-established usage, has been made necessary. Improvement is often the result of abandoning ideas that have served useful purposes and it is believed that the ultimate solution for gravel road maintenance will be found in keeping the surface in such condition that floating or scraping can be dispensed with except in wet weather.

Colorado Launches Big Road Program

THREE outstanding road projects are on the way to speedy completion by the State Highway department during 1927.

These consist of seven miles of pavement on the Denver-Fort Collins highway; twelve miles of new graded roadway on the Denver-Colorado Springs highway; and the construction of a steel and concrete bridge over the Colorado river near Parshall.

The last link in the pavement between Denver and Fort Collins will be laid this year. Contractors will start work on the strip of one mile through the town of Lafayette early in June, while a second strip of six miles north of Lafayette is now under construction.

In constructing this new piece of roadway north of Lafayette the department follows an entirely new survey, which eliminates all right angle turns north to Longmont. A short distance west and north of Lafayette the new pavement will connect with the pavement which extends west to Boulder. At this corner the members of the American Legion of Boulder plan to construct a war memorial. Later it is planned to plant trees for the entire distance of ten miles to Boulder.

At present there is a thread of 55 miles of concrete pavement completed between Denver and Fort Collins. Also there are 52 miles of pavement open to traffic between Denver and Colorado Springs, leaving twenty-three miles to be paved. Eleven miles of the twenty-three have already been graded and drained ready for paving. Contractors are now busy grading eleven miles more of this strip, preparatory to paving. Contracts will be let this year for this paving, but it will probably be the early part of next summer before the pavement is open to traffic. Funds already have been made available for these improvements. The work has been entrusted to reliable contractors, thereby insuring the public against unnecessary delays.

Grading on the first ten miles of the road south of Castle Rock was completed this spring by J. Fred Roberts. Work is now progressing on 10.8 miles of grading between Larkspur and Monument, which is under contract to Monahan & Cunningham. Their bid for this was $141,252. The second lowest bid on this project was only $112 higher than the low proposal.

The new graded road will be on a new survey which will eliminate grade crossings and straighten out many of the curves which now exist. The old road will be used during the construction of the new project, thereby eliminating the necessity of constructing unsatisfactory detours.

This grading project will represent the final link in the most traveled road in the state. Almost a mile of snow fence will be erected along snow hazards on this stretch. This fence will be placed along the first three or four miles south of Larkspur, where snow drifts pile high and obstruct traffic.

Travel between Denver and the Springs is always heavy, even in the winter, and winter travel has been facilitated by the concrete paving. Plans are now under way for the laying of concrete paving on the entire project from Castle Rock to Monument, where the road will pass under the railroad tracks at this point. Thirteen dangerous railroad crossings will be eliminated between Denver and Colorado Springs with the completion of the new paved highway.

When the new bridge over the Colorado river near Parshall, in Grand county, is completed, traffic will move through Byers Canon, west of Hot Sulphur Springs, which eliminates the steep, dangerous drive over Parshall Hill, which is considered the worst section of roadway on the Victory Highway in Colorado.

The distance through the canon is about two and one-half miles. Cost of this construction was about $80,000 per mile, the road being blasted from difficult rock formations. By the completion of this work the road will follow a new line between Hot Sulphur Springs and Parshall, over a broad, smooth, safe surface. Highway officials consider this one of the most important improvements made on the state road system. The work was carried out in three contracts.

With the completion of the Byers canon project, the state can boast of a boulevard from the Kansas state line to the Utah state line over the Victory highway, which is the only transcontinental memorial route which crosses the entire width of the state.

A fourth outstanding project which the state highway department will inaugurate this year is the proposed new road over Mosca Pass, connecting the Huerfano with the San Luis valley. This proposed road, which already has approval of the state, will be over a route used by pioneer settlers, taking over road No. 69 near Gardner, and connecting with Road No. 17 near Alamosa.

This road will open a domain of rare beauty. In addition, it will afford a direct route to the famous sand dunes, or mountains of shifting sands, in the San Isabel National Forest, which skirt the Sangre de Cristo

Diggin out of snow on State road near Wray.

range on the San Luis Valley side, just north and east of Alamosa.

It is planned to start surveys of the proposed route this year. Later it is possible that the U. S. Forest Service will co-operate in the construction of the road, as the greater part of it is located in the Forest domain. The route is said to afford easy grades and would be open the year around.

The government recently granted a large tract in the San Isabel to the American Legion as a national memorial park, but failed to provide means for reaching this mountain retreat. Governor Adams in the early days helped herd many cattle over the old Mosca Pass, headed for the Denver market.

Mosca Pass in the early days was a toll road used by the pioneers headed for the gold fields of the San Juan country. It was passable for a team, but after it was abandoned in 1912 as the result of a washout it became nothing more than a cow trail. But the residents along the east section of the route had so much faith in its possibilities that they banded together in the summer of 1925 and began to build a road on their own account.

Under the leadership of Senator Tim Hudson of Gardner they carried the road over the top of the pass, a mile toward the San Luis valley. Their work has made the road passable for an automobile, but even though it has been completed in this manner to the San Luis valley it could never hope to attract motorists, due to the steep grades and roughness.

Then the state has practically forty miles of grading, graveling and sub-grade treatment under contract between Fort Morgan and Greeley, with a little over four miles to be laid with pavement. These three projects should be completed during 1927.

Recently the highway department let a contract for the paving of five miles of the highway south of Castle Rock. Plans are being drafted for another link in the paving south of Aguilar, connecting with the present pavement extending north from Trinidad.

The department also is making important improvements on the road over the Blue Mesa between Gunnison and Cimarron, on the highway leading into Montrose and the western slope. This strip of roadway is now completed from Cimarron to the Halfway House. Future plans call for the graveling of this strip.

The total budget of the department this year is $4,500,000, to be expended on projects in various parts of the state. Of this sum $1,800,000 is to be expended on maintenance in the various counties.

With the completion of the roadway between Denver and Baileys, the worst stretch of road between the Capital city and the western slope will be eliminated. The department recently placed 3½ miles of this road under contract to S. M. & S. J. Feeley, a well-known contracting firm. They have a large crew now working on the project, with the expectation of completing same in the middle of the summer.

The department expects to improve 150 miles of the state's primary road system this season, according to the engineering division.

Standard Highway Marking Adopted

All the state highway departments have recently been provided with the "Manual and Specifications for the Manufacture, Display and Erection of U. S. Standard Road Markers and Signs," showing the system of signs and markers adopted by the American Association of State Highway Officials.

The system of caution signs adopted as standard for the United States are black on a yellow background, and are of four shapes, each indicating a different kind of hazard. These are:

Octagonal signs. Used only at places where the law requires a full stop, such as arterial highways and railroad "stop" crossings.

Diamond shaped signs. Used to indicate conditions inherent in the road itself which require slowing down, such as "curve," "sharp turn," "soft shoulders," "loose gravel," "steep hill," and the like.

Square signs. Used to indicate conditions adjacent to the road which require caution, such as "school," "cross road," "side road," "men working," etc.

Round signs. Used only to give advance warning of railroad crossings. These are used at all grade crossings, whether a stop is required or not. The "stop" sign, when used, is placed closer to the track.

Direction, information and restriction signs include route numbers, right and left signs, detour signs, junction signs, names of cities, rivers and lakes, tourist camps, mileage signs and similar markers.

Right to Restrict Truck Loads Upheld

U. S. Supreme Court Sustains Power of State to Limit Traffic

The right of a state to limit truck loads upon the highways was upheld in a recent decision of the United States supreme court, in a case brought against the Oregon highway commission by certain trucking companies, attacking the validity of an order reducing load limits on the Columbia highway from 22,000 to 16,500 pounds.

The court declared that the mere fact that a truck company cannot make a profit unless it can use a truck with a load weighing 22,000 pounds does not show that the regulation forbidding it is either discriminatory or unreasonable. "That it prevents competition with freight traffic on parallel steam railroads may possibly be a circumstance to be considered, though that is doubtful, but it is necessarily outweighed when it appears by decision of competent authority that such weight is injurious to the highway for the use of the general public and unduly increases the cost of maintenance and repair," the court said.

Authority to make limitations must rest with the state highway authorities, said the court, not only because of the general constitutional distinctions between the national and state powers, but also for the reason that the contract existing between the federal government and a state which has accepted federal highway aid, imposes upon the state the burden of maintenance after construction. Regulation as to the method of use of the road must remain with the state and "cannot be interfered with unless it is shown to be so arbitrary and unreasonable as to defeat the useful purposes for which Congress has made its large contributions to bettering the highway systems of the Union."

Research Projects of U. S. Bureau

By H. S. Fairbank*

THE following is a condensed statement of the status of the more important research projects of the Bureau of Public Roads current on December 31, 1926.

Motor Truck Impact Tests—The impact tests are still one of the most active researches of the bureau. Tests to determine the effect of the thickness of tread rubber on impact reaction have been completed and the data are being analyzed. Looking toward the practical application of impact studies to highway engineering design and motor vehicle regulation, the bureau is engaged in a program of field tests wherein actual pavement surfaces of various degrees of roughness are being compared in connection with the other major variables of tire equipment, load and speed. It is expected that the data obtained will give valuable practical information on the magnitudes of the impact reactions to be expected when known conditions of the four major impact variables obtain.

A study of the instrumentation is being pursued by both theoretical and experimental methods with the idea of knowing definitely the accuracy of the data under the several test conditions.

Vibrolithic Concrete Tests. — One-year tests of vibrolithic and normal concrete slabs have been completed. A report will be published shortly in *Public Roads.*

Other Concrete Tests—A series of field tests is in progress for the purpose of comparing the several methods of curing concrete pavements. In addition studies are in progress for the following purposes: To determine the effect of reinforcing on the distribution of transverse cracks; to measure the coefficient of subgrade friction; to make experimental comparison of three methods of concrete pavement curing in co-operation with the State of Maryland; to develop methods of protecting concrete against alkali and salt water with special reference to the use of water-gas tar; to investigate the water-cement-ratio method of proportioning concrete, in co-operation with the New Jersey State highway department; to make fatigue tests of mortar and concrete and tests of the expansion and contraction of concrete subjected to various moisture and temperature conditions, in co-operation with Purdue University; to study the relation between the strength of Portland cement and the strength of the concrete in which it is used, in co-operation with the State highway laboratories; and an elaborate series of tests on the effect of the type and quality of coarse aggregate on the resistance of concrete subjected to repeated frost action.

Bridge Tests. — Tests of two experimental bridge slabs constructed for the purpose of determining the value of the floor design of the Philadelphia-Camden bridge have been completed.

Stability of Bituminous Paving Mixtures—In co-operation with the American Association of State Highway officials, a series of tests is under way to determine the relative stability of compressed cylindrical specimens of bituminous mixtures at 140 degrees F., 77 degrees F., and 39 degrees F.

In addition to this an extensive survey of roads in the far western states is being conducted for the purpose of developing an intermediate-cost bituminous surface suitable for that section. The South Carolina State Highway Department is co-operating also in a study of the various bituminous surface treatments for earth roads.

* Highway Engineer, U. S. Bureau of Public Roads.

Completed Federal Aid Project located near Carbondale on State Road No. 82.

Subgrade Investigations—The most active investigation is that which has for its purpose a logical classification of soils with regard to their physical properties. The investigation aims at the development of correlated subgrade information with respect to the soil types shown on the maps of the U. S. Bureau of Soils. This will make these valuable maps of still greater usefulness to the highway engineer.

The investigation includes laboratory studies in cooperation with the Massachusetts Institute of Technology and field observations of the relationship between soil types and road surface conditions.

Highway Transport Surveys—Traffic surveys similar to those already published are completed in Pennsylvania and Ohio, and reports, now in preparation, will be published in a short time. Other surveys have been completed in New Hampshire and Vermont.

The following researches and tests are also in progress: investigations to develop and standardize certain tests for concrete aggregates; investigations to develop and standardize the direct tensile test for concrete and the stability test for bituminous mixtures; studies in cooperation with the University of North Carolina, to determine the strength of various kinds of culvert pipe under actual fills; field studies of landslides in relation to highway location, construction, and maintenance, in Ohio and West Virginia; and the effect of highway improvement on rural land values.

Probably one of the most important investigations is that aimed to discover the causes of low efficiency in road-construction methods with special reference to grading operations and the mixing and placing of concrete in pavements.

States Plan Enormous Expenditure for Highways in 1927

Road construction during 1927 in 47 states will total 26,841 miles and will cost approximately $648,483,000, according to state highway programs reported to the Bureau of Public Roads, Department of Agriculture.

Expenditures of counties and other local subdivisions of government will total approximately $421,000,000 on road improvement, bringing the total well above $1,000,000,000. The full text of the detailed announcement of state plans follows:

The construction of 26,841 miles of road and the maintenance of 239,847 miles are included in the 1927 state highway programs of 47 states, according to reports received by the Bureau of Public Roads. The programs also include the construction of a number of large bridges and the reconstruction of roads previously improved. On account of uncertainty of supporting legislation no estimate of the season's work is possible as yet in Connecticut.

In carrying out the above programs it is expected there will be expended under the supervision of the state highway departments in the 47 states a total of $648,483,000.

In addition to the state expenditures approximate estimates indicate that counties and other lesser subdivisions of government will expend during the year $475,000,000.

Of the expenditures by the state highway departments of the 47 states approximately $421,000,000 is the estimated amount for road construction and, according to present plans, more than $56,000,000 additional will be spent for new bridges. For reconstruction of existing roads it is estimated that the expenditure will be nearly $27,000,000 and for maintenance approximately $126,000,000.

The mileage of new state highway construction contemplated during the year is given below:

Alabama, 406; Arizona, 100; Arkansas, 580; California, 80; Colorado, 124; Delaware, 75; Florida, 775; Georgia, 506.

Idaho, 145; Illinois, 1,255; Indiana, 415; Iowa, 1,090; Kansas, 1,598; Kentucky, 900; Louisiana, 500.

Maine, 414; Maryland, 124; Massachusetts, 240; Michigan, 415; Minnesota, 1,007; Mississippi, 524; Missouri, 922; Montana, 251.

Nebraska, 1,310; Nevada, 149; New Hampshire, 100; New Jersey, 120; New Mexico, 179; New York, 1,006; North Carolina, 650; North Dakota, 1,042.

Ohio, 850; Oklahoma, 850; Oregon, 252; Pennsylvania, 1,300; Rhode Island, 44; South Carolina, 600; South Dakota, 450.

Tennessee, 529; Texas, 1,800; Utah, 100; Vermont, 110; Virginia, 225; Washington, 385; West Virginia, 425; Wisconsin, 1,569; Wyoming, 350.

Total, 26,841.

160,000 Persons Killed on Highways in 10 Years

THE first note in a nation-wide highway safety campaign was struck at Chicago, Jan. 20th, by Charles M. Upham, Managing Director of the American Road Builders' Association. In an address before a convention of the National Crushed Stone Association, Mr. Upham appealed to every man, woman and child in the United States to help make the campaign a success.

According to Mr. Upham, the automobile has taken more than 160,000 lives during the past ten years. In many places the fatalities are increasing faster than the number of automobiles are increasing, he said. During 1926 many metropolitan districts reported an increase of fifteen per cent in the loss of life over that of 1925.

"Final reports will unquestionably show that more than 25,000 persons were killed in automobile accidents during the year ending January 1st, 1927," Mr. Upham declared. "Most of these accidents were avoidable. The mortality can be cut in half within a short period of time if the people of this country will co-operate with the American Road Builders' Association and each other in the campaign we are putting under way this year."

Mr. Upham said that careless and reckless driving and unfit drivers are responsible for the largest number of accidents, while poor lighting, complex traffic regulations, congestion, dangerous grade crossing, sharp curves, narrow bridges and other highway defects are additional hazards.

At the national convention of the American Road Builders' Association, which has just adjourned at Chicago, the problem of fatalities on the public streets and highways was given thorough consideration. It was decided to launch a campaign, the objective of which is the reduction of loss of life on the highways.

How Highway Work Is Handled by U. S. Bureau of Roads

Road builders on the whole have rather a hazy idea of what constitutes the Bureau of Public Roads. In the annual report of T. H. McDonald, Chief of the Bureau of Public Roads and former chief engineer of the Iowa State Highway Commission, there is a brief statement covering the organization of the bureau.

Perusal of the paragraphs which follow shows that the work is divided into eight divisions or departments at the headquarters office all operating directly with the chief of the bureau. The entire territory of the United States is divided into eleven districts each in the charge of a district office.

"The organization of the highway force of the Bureau of Public Roads which is responsible for the work reported upon in this report consists of a headquarters staff of eight divisions under the chief of bureau in the Washington office. Three of these, the division of design, construction, and bridges, constitute the staff which under the chief engineer and chief of bureau are responsible for the conduct of the Federal-aid and forest-road work. The division of control is responsible for all accounting, for statistics and records, and for investigations dealing with the economy and efficiency of road construction. The division of tests and research carries on all physical researches and makes routine tests of highway materials. The division of highway transportation and economics conducts research along economic lines with particular reference to the economics of highway transportation. In addition there are the legal and editorial divisions performing obvious functions.

"In addition to this headquarters staff there is a field force through which direct contact is maintained with the several states in all matters relating to the Federal-aid and forest-road work. This force is headed by 11 district engineers with offices in Troy, N. Y.; Washington, D. C.; Montgomery, Ala.; Chicago, Ill.; St. Paul, Minn.; Omaha, Nebr.; Fort Worth, Tex.; Denver, Colo.; Ogden, Utah; Portland, Ore.; and San Francisco, Calif. The eight eastern districts report directly to the chief engineer at Washington; those with headquarters in Denver, Portland and San Francisco, report to the deputy chief engineer, whose headquarters are in San Francisco, and through him to the Washington office."

Traffic Surveys Widely Conducted During 1926

Each year sees increased attention paid to traffic or transportation surveys, indicating that highway authorities, local, state, and national, are "hewing to the line"—are taking greater precautions than ever before to see that highway funds are spent where they are most needed. The U. S. Bureau of Public Roads has undertaken several important regional transportation surveys in co-operation with the various state highway commissions. Those made in Cook County, Illinois, and in Maine and Connecticut in 1925, are completed and the detailed results have been made available.

Showing section of Monarch Pass highway, elevation 10,000 feet.

This year co-operative surveys were started in Vermont, New Hampshire, Pennsylvania and Ohio.

Seeking to reduce the number of traffic accidents the state legislature has recently declared that effective July 24th next, applicants for license to operate motor vehicles in this state must undergo an examination.

In states which have adopted similar ordinances there was a noticeable decrease in accidents and proponents of the California statute say that it will have the same beneficial effect here.

Persons applying for an operator's card may be required to submit to an examination as well as a demonstration of their ability to handle a machine. This will not be done in all cases but only where the application discloses some physical deformity or disease which might interfere with safe operation of the machine.

Where the applicant reveals that his experience operating an automobile is limited a temporary permit will be issued him which will be good for thirty days. During this period he must be accompanied by an experienced driver whenever he is operating an auto on a public highway.

It is hoped that this law will be instrumental in eliminating many of the incompetent drivers who are a constant source of danger to both pedestrians and other cars.

Of course the new statute does not attempt to reach operators who are already in possession of licenses.

Indian Tepees to Be Pitched Along with Motorists' Tents

The Indian tepee of the Navajo will be pitched alongside of the tent of the motorist this summer at Overland Park, as a part of the unusual program being arranged by the chambers of commerce in the San Juan basin.

Archuleta, Dolores, La Plata, Montezuma and San Juan counties will have representation in Exposition hall, along with other counties of the state. The county exhibits are sponsored by the City of Denver and the Denver Tourist Bureau, for the benefit of thousands of motorists who camp there. Last summer the registration totaled 76,003 autoists.

Navajo squaws will weave Indian blankets, a small aquarium will contain live trout, and specimens of precious ore from Telluride, Silverton and Durango will be shown. A large topographical map will hang on the wall and photographs and literature tell of good fishing in La Plata, Pine, Piedra and Florida rivers.

Many scenic attractions, including Mesa Verde National Park, are found in the San Juan basin. There will be a replica of the cliff dweller ruins in the exhibit.

Charles E. Moore of Durango conferred reecntly with Harry M. Burhans, secretary of the Denver Tourist Bureau, in the matter of installing the exhibit about May 1. Mr. Moore is president of the Strater hotel and also of the Durango chapter of the Izaak Walton League. Assisting in the arrangement of the display will be J. P. Channell, president, and Richard T. Nelson, secretary of the Durango Exchange, J. A. Clay, president of the Western Colorado Chamber of Commerce, and others.

An attendant will be in charge of the five-county display to direct motorists over the Durango-Ouray-Silverton highway and other roads, and to advise motorists of the agricultural and mining possibilities in the San Juan district.

A "peach day" is planned for late in August, and all during the summer live trout will be kept in a small aquarium in the exhibit. Thousands of Elbertas will be given away on peach day.

NEWS OF THE MONTH

Current Events in the Field of Highway Engineering and Transportation—State, County and Municipal Activities

Dust Problem On Washington Highways

In his report for the two years ending Sept. 30, 1926, J. W. Hoover, state highway engineer of the State of Washington, under the general head of "Maintenance Work" discusses the dust problems as follows:

"One of the big factors to contend with in maintenance is the dust problem. Traffic is continually increasing and with the advent of the balloon tire the dust conditions are likewise becoming more severe; it is a well known fact that the balloon tire causes more dust than the high pressure one. Also the increased speed at which cars now travel our highways only tend to increase the dust condition. A car equipped with balloon tires and traveling at a high rate of speed not only throws the binder to one side, but stirs up large clouds of dust. To attempt to combat this evil the highway department has been experimenting for the past two years in an effort to find an economical dust preventive. Three methods have been tried out, namely; oiling, sprinkling and the use of calcium chloride. All of these are costly and do not effect a permanent relief. This State is watching with interest the results of oiling as carried on by Oregon and California. It would appear that oiling is more effective in the more arid sections on account of the dry subgrade and road surface."

Contracting Course In North Carolina

A course in contracting is to be opened next fall at North Carolina State College, according to an announcement made by Dean W. C. Riddick, of the Engineering School. The new course is the outgrowth of a request from the North Carolina Branch of the Associated General Contractors of America, represented by H. P. Grier, a former graduate of State College, and who is now a prominent contractor in Statesville.

The course as outlined by Dean Riddick will be very similar to the contracting course now being given at Yale.

Twelve States Increase Gasoline Tax

According to recent returns, legislatures of twelve states have enacted laws increasing gasoline taxes, proceeds to be used practically all for highway purposes. The states making these increases are as follows:

Colorado, 2 cents to 3 cents; Montana, 2 cents to 3 cents; New Mexico, 3 cents to 5 cents; Arkansas, 4 cents to 5 cents; Maryland, 2 cents to 4 cents; South Dakota, 3 cents to 4 cents; Alabama, 2 cents to 4 cents; Delaware, 2 cents to 3 cents; Idaho, 3 cents to 4 cents; New Hampshire, 2 cents to 3 cents; Texas, 1 cent to 3 cents; Vermont, 2 cents to 3 cents; Wyoming, 2½ cents to 3 cents.

The state of New Jersey, until now has had no gasoline tax but this Legislature has voted a tax of 2 cents per gallon.

Up to this time all but three states, New York, Illinois and Massachusetts, have gasoline taxes in force. Four states have a 5 cent tax, one a 4½ cent tax; nine, 4 cents; two 3½ cents; twelve, 3 cents; seventeen, 2 cents, and only one state a 1 cent tax.

Tests of Highway Guards

The Engineering Department of the University of Illinois has recently conducted tests under the direction of Prof. W. J. Putnam to determine the relative safety and strength of woven wire and wood guards of highways. The tests made in the laboratory, and not under field conditions, disclosed the woven wire guard as having in excess of three times the shock absorbing qualities of a 3x12 yellow pine plank on a 10-foot span. While in case of accident the wire guard through several panels will be permanently deformed, the danger of injury to the occupants of the automobile and damage to the car is greatly reduced by its use. From the tests, it was found that the energy of a 4,000-pound automobile moving 40 miles per hour would be absorbed by seventy feet of the type of fence tested, without breaking the fabric, while with heavier cars or higher speeds, more fabric will be called into use with the same results.

Michigan Road Maintenance Equipment

During the past two years the Michigan Highway Commission has replaced practically all horse-drawn patrols on trunk line maintenance work with motorized equipment. The one-man tractor-grader and the truck with blade attachment are most favored for this work. These are supplemented at intervals by the use of heavy graders drawn by 10-ton caterpillar tractors, and this heavy equipment has been found very satisfactory for reshaping gravel roads and putting them into good condition to be maintained by lighter equipment.

Wyoming Counties Organize

Laramie, Albany and Carbon counties in southeastern Wyoming have organized an association for the development of tourist travel through that part of the state.

The association contemplates the opening of the scenic fastness of the Laramie, Medicine Bow and Sierre Madre mountains through the construction of roads and trails by the three counties in cooperation with the United States forest service. All three mountain ranges are in the boundaries of federal forest reserves.

Good roads will attract hundreds of tourists, both automobile and railroad travelers, it is believed. The Union Pacific railroad is working with the counties on the plan. The towns of Cheyenne, Laramie and Rawlins are also contemplating certain work toward perfection of the trail and highway system.

The development program will extend over a period of five years.

Motor Vehicle License Collections

Colorado counties collected $1,538,055 in motor vehicle license fees during 1926. Half of the money was returned to the counties by the state for road work. In the state there are 232,350 pleasure cars, 20,437 trucks and 1,440 motorcycles.

Denver county collected $472,581. Weld county was next with $99,351. El Paso county showed $89,696 and Pueblo county reported $80,978.

Outstanding Bonds Statistics

There are $95,125,150 outstanding bonds in the counties, municipalities and school districts of Colorado. The county bonds amount to $3,547,200; schools, $29,511,650; special improvements, $16,679,491, and general bonds, $45,386,809.

Only two of the 63 Colorado counties have no bonds. They are Lake and Mineral counties. Custer is low with $25,000 and Denver county is at the top of the list with $40,266,700.

Highway Briefs

(From The Highway Magazine.)

WISCONSIN—The snow removal program carried out during the past winter embraced nearly 1,500 miles of state trunk highways and over 1,000 miles of county roads. During the previous winter 1,400 miles of state trunk roads were kept open at a cost of $56,600.

NEVADA—This great expanse of western country is setting many other states a stiff pace in roadbuilding. At the close of the 1926 season 71.3 per cent of the Federal-aid system had been graded, or graded and surfaced, 1,075 miles in all. Nevada's population, by the way, is only about 80,000.

MINNESOTA—In six years 382 grade crossings have been eliminated from the important roads of the state.

OHIO—Over 1,800 white crosses, built of wood, mark the scenes of fatal accidents along Ohio's roads. Thirty per cent of these are at railroad grade crossings, 33 per cent are along straight sections of the road, while the remainder are at turns, hills, road intersections, and bridges. The crosses are believed to be a successful means of instilling caution in road users.

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

Jaeger "Skip Shaker" and Mixers

The Jaeger Machine Co., Columbus, Ohio, has developed a "Skip Shaker" which automatically starts to vibrate the hopper only when it is fully raised, and keeps a continual flow of materials into the mixer drum. This feature is used on both tilting and non-tilting Jaeger mixers. Other improvements in 1927 non-tilt models include 100 per cent roller bearings, and direct drive eliminating old style countershaft and sprockets. The speed reducing gears are heat treated steel running in oil. By building the mixer entirely of steel, the new 10-S, 2-bag size, for 1- 2- 5 work, weighs and costs the same as other one-bag mixers. Non-tilt mixers come in 10-S, 14-S, 21-S, and 28-S sizes. The tilting mixer has many new features also, including disc wheels with cushion tires, and auxiliary spring shock absorbers on trailers.

Talbot Sales Director For Koehring Company

The Koehring Company of Milwaukee, Wis., manufacturer of pavers, mixers, gasoline shovels, cranes and draglines, announces the appointment of K. H. Talbot as director of sales, in charge of domestic and foreign sales. For five years, from 1919 to 1924, he was associated with the company as manager of field service. Mr. Talbot resigned as manager of cement sales of the Cowham Engineering Company of Chicago to accept this appointment.

Four-Wheel Drive Auto Company

Truck sales of the Four-Wheel Drive Auto Co., Clintonville, Wis., for 1926 amounted to 52.2 per cent more than that of 1925, it was announced at the 17th annual meeting of the stockholders. Officers were elected as follows: W. A. Olen, who has been president and vice-president since the company was organized, was re-elected; Chas. F. Folkman, first vice-president; J. D. Colten, second vice-president; Frank Gause, secretary; D. J. Rohrer, treasurer. The company's products include 4-wheel drive trucks and tractor trucks from 1½ to 10 tons capacity, motor fire apparatus, line construction trucks and gasoline railway trains.

Dr. Abrams Resigns

The Portland Cement Association announces the resignation of Duff A. Abrams, for many years Director of the Research Laboratory. Professor Abrams inaugurated the present-day research in concrete when he took charge of the Structural Materials Research Laboratory in 1916. His work in concrete research is internationally known. His bulletins and scientific papers have been translated into many languages and are standard reference works in concrete technology. Prior to his connection with Lewis Institute, Professor Abrams was a member of the faculty staff of the University of Illinois, of which he is a graduate.

F. R. McMillan, Manager, Structural and Technical Bureau, Portland Cement Association, has been appointed director of research to have charge of all investigations in cement and concrete for the Portland Cement Association. H. F. Gonnerman, Associate Engineer, Research Laboratory, Portland Cement Association has been appointed director of the laboratory.

Russells for Larimer County

Road equipment of Larimer County has been added to by the purchase of two Russell road finishers from the Herbert N. Steinbarger Company. They will be put to immediate use in the elaborate construction and maintenance program of the county for 1927.

Fair Pushing Adams Graders

Elton T. Fair is on a trip thoroughly covering the Colorado and Wyoming territory and has closed several sales of Adams leaning wheel graders as well as many for Stroud elevating maintainers and dump wagons.

Northwest Crawler Crane to Aid Irrigation

The American Beet Sugar Company has purchased from the Burnite Machinery Company a Northwest crawler crane with both drag line and clam shell bucket equipment. The machine will be used in constructing irrigation and drainage canals in the Arkansas Valley.

Stockland Whippet Maintainer Makes Its Bow

The first of the new Stockland Whippet Maintainers to be used in this territory was purchased from the Clinton & Held Company by Sweetwater County, Wyoming. This is also the first case of a machine of similar design being used in the mountain regions. It will be operated with a Caterpillar two-ton tractor. Clinton & Held report business in general far ahead of that of last year.

New Policy Attracts Attention

Considerable attention has been attracted to the Caterpillar Tractor Co., of San Leandro, California, and Peoria, Illinois, during the year and a half of its existence by its advanced policy of cooperation with the various branches of industry which it serves.

Following the company's organization in the spring of 1925, as successor to The Holt Manufacturing Company and the C. L. Best Tractor Co., it embarked on an active program of educational work in many lines, with the result not only that the "Caterpillar" organization profited, but also that the various types of industry dealt with have found new ways to economical production.

FWD Auto Company Exhibit 3-Ton Truck Equipped Snow Plow

The Four-Wheel Drive Auto Company, Clintonville, Wisconsin, exhibit at the Good Roads Show consisted of one Model B 3-ton truck equipment with 40x8-inch pneumatic tires, cab, dump body and hoist and rotary snow plow.

Road Machinery

Austin Western Road Machinery Company, 400 North Michigan Blvd., Chicago, have issued their new 1927 general catalog. The style of the catalog is quite different from anything gotten out by them in the past. Besides containing a large number of operating pictures the essential features of the equipment are conveyed simply and intelligently without burdening the reader with a great lot of details. Special catalogs on all the Austin Western machines contain more detailed descriptions and complete specifications. Copies of the catalog will be sent upon request.

Motorbusses In The United States

There are now approximately 80,000 motorbusses in use in the United States. Of this total 15,332 are used by consolidated schools for transporting pupils; 7,000 are used by 344 street railways, and 510 are used by 41 steam railroads.

Rex Announces New Two-Bag 10-S Portable Concrete Mixer

A new 10-S Rex portable concrete mixer is announced by the Chain Belt Company, Milwaukee. Literature on the new mixer is now being distributed to contractors by the H. N. Steinbarger Company, Denver agents. This mixer weighs 1,000 pounds less than most other mixers of the two-bag capacity, according to the announcement. The total weight is 3,850 pounds. It is said to be lighter and more compact than many with one-half its rating. With a wheelbase of but 73½ inches, the Rex 10-S handles a full two-bag batch on a 1-2-5 mix—or three bags on a 1-1½-3. There is no heavy top frame, nothing being above the mixing drum but two winding drums and the water tank. There is no countershaft. Clutches, power takeoff and the skip hoist are assembled into a compact unit with the four-cylinder LeRoi engine. The improved 10-S is the latest of seven mixers in the Rex family, handled in the Rocky Mountain territory by the Steinbarger Company.

Our Cover Picture

"On the upper reaches of the Animas River"—that's the title of the picture on the cover of this month's issue of Colorado Highways. The picture was taken on the road running north from Durango to Silverton, in La Plata county. It forms a part of the famous "Million Dollar Highway," or D. S. O. Highway, which stretches from Durango, through Silverton, over Red Mountain Pass to Ouray. It is one of the most picturesque drives in the entire western hemisphere, and has been constructed during the past few years with State, Federal Aid and U. S. Forest Service funds, at a cost of over a million dollars. This section of the state is known as "The Switzerland of America."

PENNSYLVANIA—The department of highways has published a folder entitled "Facts Motorists Should Know," which helps motorists and truck owners utilize the state highways to the fullest. The department believes that giving aid of this kind is a public service equivalent to building many additional miles of good roads, or, looking at it another way, is equivalent to cutting down the route distance between cities—full knowledge of roads saves the user's time, and makes him more of a booster.

NEW JERSEY — Contracts have been awarded by the New Jersey highway commission for widening the White Horse Pike for 37 of the 60 miles of distance between Philadelphia and Atlantic City. The work for this year consists of constructing a ten or eleven-foot strip along the existing surfacing. With the subsequent addition of similar strips along the other side, this highway will have a width of 40 feet for its entire length. This widening has been needed since last summer when the completion of the Delaware River Bridge brought a great increase in traffic.

New Motor Rollers Announced in Sizes of 5 and 7 Tons

Because of the success that has followed the development of its 10-ton motor roller introduced about five years ago, the Huber Mfg. Co., Marion, Ohio, is this year introducing two smaller sizes of 5 and 7 tons respectively.

BIDS OPENED

Proj. No.	Length	Type	Location	Low Bidder
275-F2	5.237 mi.	Paving	Castle Rock, south	J. Fred Roberts & Sons

PROJECTS ADVERTISED FOR BIDS

Proj. No.	Length	Type	Location	Bids Opened
254-C-2	.....	Bridge	Southwest of Hot Sulphur Springs	May 10, 1927

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

Proj. No.	Length	Type	Location
258-E, Div. No. 2	1.402 mi.	Gravel Surfacing	Cimarron
281-E	0.812	Paving	Lafayette
290-D*	2.954	Paving	Las Animas-Fort Lyon
300-A*	1.008	Grading	Chattanooga

PLANS BEING DRAFTED

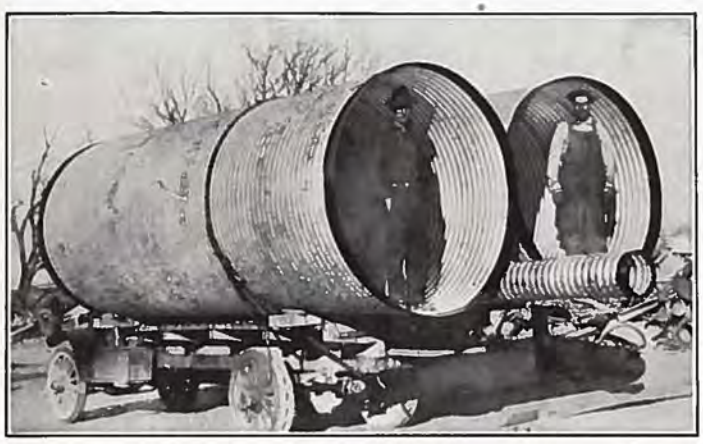
Proj. No.	Length	Type	Location
2-R No. 5	1.5 mi.	Paving	South of Aguilar
138-A	5.0 mi.	Surfacing	North of Kremmling
247-C	0.5 mi.	R. R. Subway & Paving	Swink
275-E	2.0 mi.	R. R. Underpass and Paving	Monument
287-D	0.5 mi.	R. R. Underpass and Paving	East of Kersey
560	3.0 mi.	Gravel Surfacing	Deer Creek-Littleton
631	120 ft.	Timber Bridge	Trumbull

*Plans finished

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	$ 331,632.00	99	2-R4
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	28,882.70	6	2-R3
79-A	Big Sandy Creek, East of Simla	10 19-ft. Spans	Timber Trestle	A. R. Mackey	10,421.26	88	79-A
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	85	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	20	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	42	144-A1
145-A	West of Glenwood Springs	3.807 mi.	Gravel Surfacing	Winterburn & Lumsden	53,227.90	0	145-A
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	63	157-A
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	82	213-D
242-AR1	East of Fruita	125 ft.	Steel Bridge	F. H. Knollman	19,999.00	79	242-AR1
254-C	Div. 1 2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	90	254-C1
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	5	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	92	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	39	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	22	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	63	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	92	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	31	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	63	271-B
275-C	Husted-Monument	4.795 mi.	Concrete Paving	J. L. Busselle & Co.	186,585.20	100	275-C
275-C	Div. 2 East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,466.60	35	275-C2
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	72	275-F1
275-G	Larkspur-Monument	10.869 mi.	Grading	Monaghan-Cunningham Con. Co.	141,252.78	0	275-G
276	North of Colorado Springs		R. R. Overpass	J. L. Busselle & Co.	37,913.00	0	276
279-E	Schaffer's Crossing-Baileys	3.243 mi.	Grading	S. M. & S. J. Feely	54,305.60	0	279-E
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	84	281-D1 251-B1
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	0	282-D
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	58	283-C
287-A2	Fort Morgan, west	4.011 mi. 16.61 mi.	Concrete Paving Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	92	287-A2
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier C. Eng. Co.	159,950.85		
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	19	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,645.25	75	293-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	85	295-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Cole Brothers	58,061.00	52	296-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	99	297-B
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	66	299-A

Keystone Culverts



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A bigger day's work—that's what the alert high-speed action means — and there are innumerable mechanical reasons for this distinctiveness of the Koehring!

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No. 1—¾ cu. yd. dragline bucket on 40 ft. boom or ½ cu. yd. on 45 ft. boom. 4 cylinder, 5¼ x 6½ in. gasoline engine, 1000 R.P.M.

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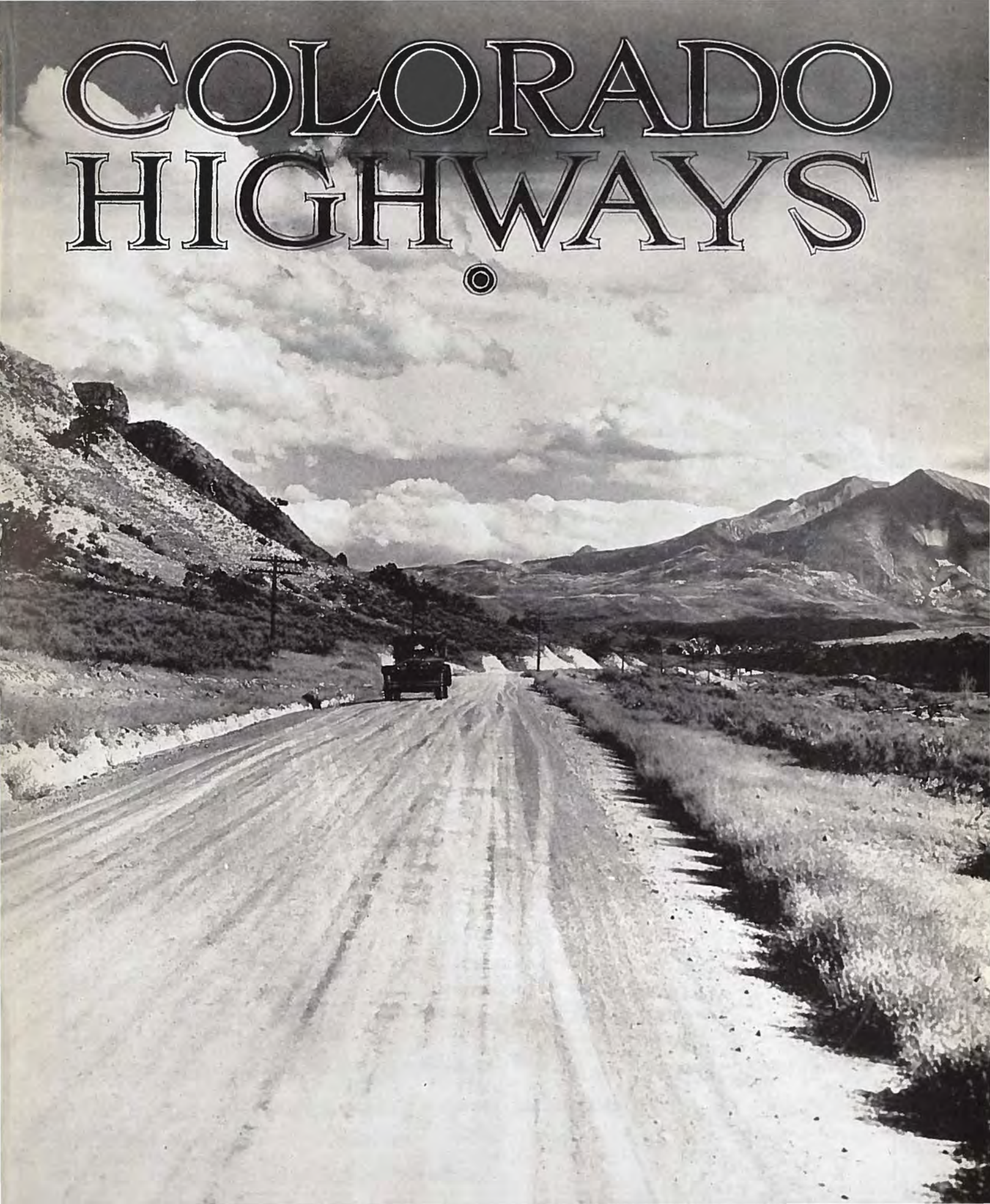

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"BETTER ROADS"

Official Publication of the
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M. W. BENNETT, Editor

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VOLUME VI. JUNE, 1927. NUMBER 6

Tourist Crop Pays Big Dividends

COLORADO'S annual motor-tourist crop has reached such vast proportions that the expenditures of those visitors while within the state boundaries now amount to more than twice the total sum spent yearly for road construction and maintenance.

While Colorado has long been proud of its popularity with vacationists from other states, few Coloradoans have realized the extent and value of the tourist business each season. Throughout the country, the proportion of motor travelers is on the increase. This state has all the scenic and recreational attractions possible to offer the vacationist but our good roads — the network of state and county highways that reaches into every section of the state—is the determining factor that brings to Colorado each season an ever-increasing number of motor tourists. In return, the visitors spend a huge sum on their Colorado vacation. Good roads are necessary for the development of our state, they are necessary for the convenience and business of our citizens. But if there were no other consideration, the dividends that good roads pay in the way of increased tourist business would more than justify continuation of Colorado's good roads program.

Last year it was estimated that the motor tourists who visited Colorado spent here approximately $22,500,000. During the same twelve months, the total spent by the state highway department, the counties and the United States forest service for road construction and maintenance was $10,248,179, or considerably less than half the motor-tourist receipts. Figures of the state board of immigration show that in 1926 the expenditures for highway construction and maintenance in Colorado were divided as follows: state highway department, $4,809,052; counties, $4,847,531; forest service, $591,596.

The estimate of the amount spent in Colorado last year by motor-tourists alone was arrived at by the following system: Figures of the Denver tourist bureau estimate the total number of visitors to Colorado last year as 750,000. The percentage of the total number of tourists that travel by motor is estimated at from 50 to 70 per cent, the latter being the estimate of the Rocky Mountain Motorists, Inc. A fair estimate would seem to be 60 per cent, or 450,000 of the tourist bureau's total figure.

Colorado is noted for its Western hospitality, and is known as "The Playground of America". People come here from all parts of the world to spend their vacations. These visitors upon leaving our State, are with very few exceptions, our staunch boosters. Our roads have gained the enviable reputation of being second to none, especially our mountain highways which are a revelation to transcontinental tourists.

Notwithstanding the above facts, there is one other thing that every citizen should continue to cultivate. That is COURTESY. It costs our citizens nothing, and in the end is well worth while, and will pay big dividends.

The world-famous hospitality of the West west founded on the bedrock of common courtesy and wholehearted fellowship. Let us not forget the traditions of the early pioneer in this respect, and the fact that a little courtesy will do much to make the visitors' stay a pleasant holiday, and will leave with them a desire to "come again!"

(Signed) WM. H. ADAMS,
Governor of Colorado.

The majority of vacationists coming to Colorado spend all, or the most, of their holiday in this state. Colorado is their destination and not, like the cases of many other states, merely passed through on the way to some other recreational center. Even in cases of motorists on an extended tour, taking in a number of western states, the minimum time they would spend here is three to five days. On the other hand, from two to four weeks is the average vacation length. Experts dealing with tourist travel give a ten-day stay as a fair average.

Then comes the question of the average amount spent daily by the auto visitors. The federal government fixes an average of $10 a day as the amount each traveler generally spends. But that is mostly for the rail tourists. Many of the motorists camp each evening, cooking their own meals and sleeping in their tents or cheap bungalow camps. But a large number stay only at hotels, spending virtually as much as the rail traveler. A fair, conservative estimate, then, according to authorities, would be $5 a day for each motor-tourist, including food, gasoline, oil and all other expenses.

On that basis, each motor visitor to Colorado will spend during his or her stay an average total of $50. Multiplied by the total number of such tourists, 450,000, the $22,500,000 figure is reached. That, of course, is only a rough estimate from the few sources of data available, but is considered as nearly accurate as possible in the absence of definite records.

The money spent by the motorists finds its way into every section of the state and into every class of business. The state and the counties take only a small portion of it back in the form of taxes for the purpose of maintaining the existing highways in good condition and adding to the system. It is one of the best dividend payers the people of Colorado have.

Colorado is peculiarly fortunate in the variety of its climate and scenery as tourist attractions. The terrain varies from the flat, level plains of the east part of the state to the great mountain ranges of the Continental Divide, with large plateaus in various sections. Roads, state and county, reach into every part of the state, making all the scenic attractions readily accessible to the tourist. Resorts for comfortable accommodation are plentiful and reasonable in price. Colorado is without a peer among the states as an angler's paradise, mountain trout being the favorite.

So great has the flood of motor travel become that virtually every city and village has established attractive camp grounds, either free or for which a small charge is made. The bungalow colonies, where the motorist for a nominal sum may rent a completely equipped cottage, are growing in popularity. A government report shows that 40,000 extra people are employed each year to "harvest" Colorado's tourist crop. The population of the state is nearly doubled by tourists during the summer months.

The Denver municipal auto camp at Overland Park, where a small charge is made for each car, is one of the largest and most complete auto camps in the country and is an example of the activity along this line. In 1926, 21,299 automobiles loaded with 76,003 tourists stopped at that camp. A branch postoffice is located there for convenience as well as a complete information service as to routes and points of interest. An official camp chaplain is provided, county agricultural exhibits maintained, supplies of all kinds on sale and free entertainment furnished.

The 1927 season promises to provide by far the largest tourist crop the state has ever seen. Thousands of advance inquiries from every state in the union and many foreign countries are flooding the automobile and tourist organizations. The Rocky Mountain Motorists, Inc., have prepared a survey of the potential tourist travelers that this state might reasonably expect to attract. It included the states of the Mississippi valley and westward to Colorado. The total number of automobiles registered in each state was added up and then a careful investigation showed that one out of four owners could be expected to drive his machine out of his state on a vacation trip. The result showed four million potential auto visitors that Colorado should attempt to attract each season. And that did not include the states east of the Mississippi.

A continuation of our "good roads" program, the careful maintenance of existing roads and the construction annually of new and improved routes, will attract more and more of these holiday seekers to Colorado with a consequent increase of prosperity to the state. Especially important is the state highway department's program for the state highways, connecting the principal points of interest and the cities, which highways are traveled more by the tourists than are the county roads.

New Maxwell Highway Taps Glacier Region in Boulder County

By C. H. Vivian

SEEKING a work of enduring nature that would fittingly honor the name of an illustrious pioneer resident, Boulder County selected a scenic highway as its ideal. Which accounts for the fact that the new forest highway which taps the outers' Elysium in the shadows of Arapaho Peaks and glacier is christened Maxwell highway.

It is especially appropriate that a road, rather than a shaft of cold stone, should serve as a monument to James P. Maxwell. For a road stands for progress. It is the pioneer of today, just as he was the pioneer of yesterday. It erases frontiers, unites peoples and carries civilization into remote areas.

There is a further and more personal reason why a road—particularly one in the section elected—should be chosen to perpetuate the memory of Maxwell. It lies in the fact that as an engineer he was closely identified with the early-day construction of roads in Boulder County and elsewhere throughout the state.

In 1864, when he was but 25 years old, he and Capt. Clinton M. Tyler built the first road connecting Boulder and Black Hawk. It traversed Boulder Canon to the foot of Magnolia Hill, which is climbed by grades up to 25 and 30 per cent. It then followed the ridge between Boulder and South Boulder Creeks westward, crossing the latter near the present site of Rollinsville and proceeded southward to Black Hawk and Central City. A portion of this crude roadway known as Maxwell pitch, is still to be seen where it was carried around a ledge by a rock wall just west of Boulder and high above the present highway which leads to Nederland.

Maxwell was the discoverer of the wonderful scenic region which the highway named for him opens up to the motorist and camper, and which the government now proposes to embrace in Rocky Mountain National Park. In October of 1874, while he was engaged in subdividing township 1, north of range 73 west, for the United States government, he ascended a high, wooded ridge from the south and beheld spread out before him Arapaho and Albion peaks, Arapaho glacier, and the glacial gorge below with its chain of beautiful morainal lakes, each in a setting of green verdure.

It is those lakes that today are the source of Boulder's water supply and it was Maxwell who was largely responsible. In 1880 he built the first trail into the Silver Lake region. The road recently dedicated closely follows the alignment of that original trail.

In 1887, in company with George Oliver of Boulder, he constructed dams at Silver, Island and Goose

Where the Maxwell Highway was built through a swamp, near junction with old road.

Typical side-hill section, looking north, showing broad, smooth gravel surface.

Lakes as a part of the Silver Lake irrigation project which has since irrigated several thousand acres of land east and north of Boulder. During the dam construction, the trail was widened to a road and extended to Silver Lake. Lumber and other materials used in building the dams were packed to the area on mules and burros.

Maxwell was a member of the city council of Boulder on July 14, 1874, when citizens of the town petitioned the govering body to issue bonds to finance the construction of a city water supply system. He was appointed to investigate and report upon the cost of constructing an adequate system. Acting upon his report, the city utilized water direct from Arapaho glacier, taking it from the lowest of the chain of morainal lakes, from which point it was piped to the city. Throughout the intervening years, Maxwell has given of his time and engineering attainments in improving, enlarging and safeguarding the water system.

In 1884 Maxwell was the leader of a colony that founded Steamboat Springs. Associated with him were Lewis Cheney, Captain Tyler, J. H. Crawford, A. E. Lee, Harry Burgess and A. J. Macky, who bequeathed the money to the University of Colorado for the magnificent auditorium on its campus that now bears his name. Maxwell was elected president of the townsite company and has served continuously since.

In 1889, while serving as state engineer under Governor Routt, Maxwell surveyed and constructed a road through the canon of the Grand River below Hot Sulphur Springs. The right of way was given over to the Moffat road by the commissioners of Grand County, in return for which the railroad built a new route for vehicles over the hills. A Federal Aid-State road now almost completed will return the highway to the canon bed, parallel to its original position. While state engineer, Maxwell also constructed a five-mile stretch of the present road between Steamboat Springs and Hayden. If the road now christened for him in Boulder County is ever extended through or over the Continental Divide, it will link up with these two stretches of roadway which he built nearly 40 years ago.

Maxwell highway is officially termed Forest Highway No. 28. It connects with Forest Highway No. 27, which runs north and south from Nederland to Raymonds, connecting with the Boulder Canon highway on the south and with the South St. Vrain road on the north. The new road leaves the Nederland-Raymond route a short distance north of Glacier Lake, near the old station of Hill Siding on the extinct Denver, Boulder & Western Railroad. Its general direction is west. It terminates at Rainbow Lakes, a region of great scenic grandeur containing ten small bodies of water.

The road is 4.63 miles in length and was constructed at a cost of $55,271. It is a 12-foot standard highway, which provides an overall width of 17 feet on sidehill sections. Throughout most of its course the maximum grade is 6 per cent, although a few stretches not to exceed 2,000 feet in length contain grades up to 7 per cent.

Constructing contractors were Jacobsen and Ehrhart, which firm consists of Nels Jacobsen, well known road builder of Boulder, and T. J. Ehrhart, former chairman of the Colorado Highway Commission. Their bid was $41,976, under condition B, which provided that the government should furnish the necessary explosives. Transitman R. W. Darling of the U. S. Bureau of Roads at Denver, was in charge of construction engineering.

The construction was done during the summer of 1924. Progress was such that it was completed in 87 actual working days, 13 days less than the contract allowance.

The road traverses glacial deposits left in the wake of the immense ice sheet that formerly covered the area and which is now represented in remnant form by Arapaho and several lesser glaciers back on the shoulders of the divide.

The soil was found to contain boulders of varying size to such an extent that 32 per cent of the material was classed as rock. Fresnos and slip scrapers were first utilized, but proved unsatisfactory in handling the mixed rock and soil. Tongue scrapers for short hauls and wheeled scrapers for long hauls were substituted and proved well fitted for the work.

In finishing the road, use was made of a scarifier attachment mounted ahead of a blade on a six-horse grader. The scarifier consisted of 9-inch teeth spaced 4½ inches apart. The engineer's report states that amazingly large boulders were uprooted by this device.

Showing how road over Hoosier Pass was cleared of snow with aid of heavy tractors and V-plows.

County Road Force Clears Snow From Hoosier Pass Highway

By John P. Donovan

HOOSIER PASS was opened to traffic on May 18th, several weeks earlier than in any previous year.

This bald statement is the fact but explains nothing of the hard unremitting work for six days that was required to buck out the miles of solidly packed snow of which the photographs above give some idea.

The work was done by co-operation of the County Commissioners of Park and Summit Counties who used a five-ton Holt caterpillar tractor and a Best 30 caterpillar working in tandem behind an A plow to buck or wedge aside most of the snow. In many places the snow was so deep that the drifts were broken up by the use of dynamite, supplemented by shoveling crews before the plow could shake its way through a foot or two at a time.

The snow on the Park County side was not particularly bad, there being but three short drifts below the upper mile which averaged a depth of about three feet of snow. The story on the Summit County side was different, there being seven miles of solid snow starting at about eighteen inches deep at the foot of the pass and gradually and steadily increasing to about five feet near the top with some drifts reaching the ten-foot mark, all of the snow being solidly packed and very heavy. On the Summit County side the work was personally supervised by Commissioner "Tony" McDougall who stayed on the job every minute from its start to its completion and who finished his job in a creditable manner in short time and at a low expense despite the usual pessimistic groans of a few wiseacres who swore that it couldn't be done.

By June 15th, every mountain pass in the state will be open to traffic. At the time this is written only Rabbit Ears pass leading into Steamboat Springs is the only pass closed to traffic. Vehicles are being routed on State road 84, via Oak Creek into Steamboat Springs and the western slope by this route.

Monarch Pass was opened two weeks earlier than usual due to the efforts of the Chaffee County road forces under the direction of J. H. Habenicht, county commissioner of Salida. This route leads to the Gunnison and Montrose country from Denver. Since early spring considerable work has been going on on this road between Gunnison and Montrose, by state maintenance forces with a steam shovel and under Federal Aid contracts.

State Highway forces are also being employed in making improvements on the Independence Pass road on the eastern slope in Lake County. The work is under the direction of Frank McQueary, foreman.

For the past month a state crew with a steamshovel have been employed in removing snow and widening the road over the Blue Mesa between Gunnison and Cimmarron. The road has been rebuilt by this outfit from the latter point to the Halfway House.

It is planned to continue this improvement work from the Halfway House to the Sapinero bridge. Later the entire twenty-mile stretch will be gravel-surfaced as funds become available.

Colorado's Improved Road Mileage Shows Big Increase in 1926

By Fred Warren

ALTHOUGH rated as one of the "younger" states, Colorado in a short period of years has developed a vast system of state and county highways that completely covers her mountains and plains.

The rapid expansion of these transportation arteries has been one of the main factors contributing to the growth and development of the state. But this work has not been accomplished without cost and it is estimated that during the period from 1910 to 1926 a total of 93 million dollars was spent on construction and maintenance of state and county highways, exclusive of city streets.

On January 1, 1927, there were 65,540 miles of state and county roads in Colorado, according to figures compiled by the state immigration department from records of the state highway department and the United States bureau of public roads. There were 8,966.6 miles of state roads and 56,574 miles of county highways.

The immigration department's report showed that in 1926 there was spent for construction and maintenance of highways within the state a total of $10,248,179, of which $4,847,531 was expended by the state highway department, $4,809,052 by the counties and $591,596 by the United States forest service. That compares with an estimated $11,538,804 spent on roads in 1925.

The state's highways on January 1 were divided as follows between county and state roads of various classes:

	State Miles	County Miles
Hard surfaced	251.8	23.9
Gravel and sand clay surfaced	3,247.5	2,425.6
Graded	5,224.6	4,516.7
Unimproved	242.7	49,607.8
Totals	8,966.6	56,574.0

A large portion of the roads listed as unimproved include mileage unclassified through failure to obtain reports and roads surfaced or graded but not to specifications.

In 1925 there were 58,026 farms listed in Colorado and an interesting feature of the immigration report was a table showing on what types of roads the farms were located. It follows:

Type of Road	Number of Farms
Hard surfaced	800
Macadam	71
Graveled	8,051
Improved dirt	24,961
Unimproved dirt	22,245
Not classified, including those not reported	1,898

Las Animas county, with a total of 6,002 miles of state and county roads had the largest highway mileage of any county. Mineral county, with 111 miles of state and county highways, had the lowest mileage. Denver, a city and county, had no mileage listed as state or county roads.

The report showed that each dollar as expended by the state highway department in 1926 was divided as follows:

For administration	2.58 cents
For road machinery and equipment	0.52 cents
For maintenance	16.77 cents
For construction	80.13 cents
Total	100.00 cents

Of the 80.13 cents spent for construction, 58.43 cents went for federal aid projects; state projects 14.99 cents; engineering, 6.71 cents.

Two elevating grader outfits "moving dirt" on 10-mile project near Palmer Lake on Denver-Colorado Springs Highway.

A graded earth section of state road in Crowley County, completed by county maintenance crew.

More Paving for Santa Fe Trail

By Ralph Taylor

SOUTHEASTERN Colorado will be the location of approximately $300,000 in new highway construction this summer. Several important projects, both federal and state aid, are either getting under way or are planned to start soon, according to James D. Bell, district highway engineer with headquarters in Pueblo.

One of the largest jobs is the concrete paving on the Santa Fe Trail between Las Animas and Fort Lyon in Bent County. W. A. Colt & Son of Las Animas submitted the low bid of $88,979.50. Approximately three miles of new concrete will be laid.

Plans are being drawn for a mile of paving in Pueblo County to connect the Santa Fe Trail pavement with the village of South Avondale. When completed, there will be continuous paving from Pueblo to Avondale, penetrating a thickly settled portion of the Arkansas Valley and also the route of thousands of tourists. The Avondale paving will cost approximately $45,000.

Surveys are being completed for nine miles of new roadway and surfacing in the southern part of Pueblo County from Crowe to the Huerfano County line on the Pueblo-Walsenburg highway. It is estimated that $120,000 will be required to carry out the work. The only excessive grade on the north and south highway through Colorado is on this stretch of road. It is proposed to relocate the right-of-way west of the Greenhorn hill to obtain a lesser grade.

The job will start at the end of a $70,000 surfacing project completed this month between Crowe and the Hatchett ranch. Cole Brothers started the work last fall. The highway was routed over a new path which replaced the old road filled with curves and grades.

The new Baca County oil field will come in for attention this summer. There has been $16,500 appropriated for grading and partial surfacing of the 32 miles of highway from Springfield south to the Oklahoma state line.

The stretch of Kansas-Colorado boulevard from the Kansas line to within three miles of Sheridan Lake will be graveled at a cost of about $15,000. This work has been surveyed but is awaiting approval.

A 90-foot timber bridge is to be built at Arlington on the Kansas-Colorado boulevard.

The scenic mountain highway from Beulah to Rye through the San Isabel national forest will be completed and open to traffic by the middle of the summer.

Work on the last five miles of the highway was started early in June by the Pueblo county highway crew. Although the county had received bids from private contractors for the project, it rejected the bids and started the work with county equipment and men. The five miles will connect the end of the present road at the forest boundary, with the village of Rye. The work will cost about $30,000.

The new route is said to be one of the most picturesque in the San Isabel. It goes through dense growth of trees, through high walled canyons and into the heart of the mountains. Fishing streams, snow slides and summer home sites are available along the route in addition to the natural beauty of the mountains.

Our Good Roads and Tire Saving

By John Furlong

AS Automobile Owners of Colorado—many questions enter our minds in regard to the vast general improvement in our highways since 1918. As the majority of us are only familiar with our local highways, the following information may prove of interest.

Colorado's State Highway System now includes some 8,935 miles of road of which 3,360 miles are included in the Federal Aid System. Upon these Federal Aid roads, the Government participates to the extent of assuming 56.08% of the cost of all new construction work, subject to their approval.

The Federal Aid roads in Colorado cover what can be termed our main trunk line highways with a few exceptions. United States Highways, a new and nation-wide designation of interstate highways and national routes, includes some 2,737 miles of Colorado roads; these roads will in time, due to the co-operation of the various states and the sponsorship of the government, become the great arterial highways.

Of our 8,935.0 miles of state highways, the fall of this year will find 263.0 miles paved, 13.1 of which is asphalt upon a concrete base—the balance being standard 18-inch concrete pavement at an average cost of close to $36,000 per mile. excepting bridges.

The above paving figures do not consider some 89 miles of state highways existing in cities and towns over 2,500 in population, a good percentage of which is paved.

Three thousand four hundred and seventeen miles have been surfaced with "gravel", "sand-clay" or "crushed rock" in the approved manner. This surfacing with required drainage structures, excepting bridges, costs from $7,500 to $12,000 per mile dependent upon local topographical conditions.

The average car owner's tire bill if he were traveling 6,000 miles per year all on concrete pavement, should be $31.65 according to this data while if he were on gravel all the time, it should be $63.30 or in other words, his tire bill alone would be double.

Traffic observations taken during the past four years in Colorado indicate that the paved portions of our highway system carry an average yearly traffic of approximately 1,800 per 24 hour day.

Applying the Washington and Kansas research data to our 263 miles of concrete roads, we find approximately $900,000 worth of rubber a year worn away, while on our second best type of surfacing, $1,800,000 would be worn under like traffic conditions, extending this to the poorer types of surfacing in the above table, the results are startling.

Colorado's existing paving is then saving the motorist approximately $900,000 per year over a like mileage of gravel surfacing upon these roads.

Startling as the above results are, they represent four years' research by these institutions under the direction of competent engineers. The tests were made at uniform speeds, because it was found increased speed increased the tire wear. Higher temperatures also appeared to increase tire wear. It was also found that the wear on rear tires runs from 119% to 200% of the wear on front tires, the average being about 150%.

Other items—such as gas, oil and repairs are known to show even greater ratios. In tests conducted by the Washington State College in 1924, it was found that taking gas consumption of a Dodge car on a paved concrete road at 100%, a good western type macadam road required 111% and 151% when in poor condition, as Colorado has found maintenance costs practically double where traffic exceeds 1,200 cars per day, pavement becomes a necessity as well as a sound investment.

Five thousand one hundred and fifty-three miles have been cleared, grubbed and graded at a cost varying from $3,000 to $90,000 per mile, including the smaller drainage structures, this wide range of cost being due to excessively heavy rock work, in some cases tunneling being required. Of this latter mileage, many miles will be found practically surfaced due to soil conditions and county work.

Some 102 miles remain to be developed at this time, such as Loveland Pass, McClure Pass and the Bardine-Carbondale route, etc.

The natural question developes—are our higher types of roads such as pavement economically worth the price? Let us apply the data published after exhaustive research by the Washington State College and the Kansas Agricultural College to our local highways considering tires only.

It was found that using 1.0 as an index number for average concrete pavement, the rate of wear on tires on other types of road surfaces were as follows: brick, 1.4; best macadam, 1.9; gravel, typical Iowa, 2.01; best bituminous macadam, 2.3; average macadam, 4.4; gravel uncrushed chert, 5.0; bituminous macadam, poor, 9.6; loose macadam, 11.

Colorado's paved roads carry traffic averaging from 1,400 vehicles per day in outlying districts to 3,700 vehicles per day around Denver. At 1,400 vehicles per day $2,660 worth of rubber a year is worn out, while on Iowa gravel which is much like ours, $5,320 worth of rubber per year would wear away. In other words pavement saves the car owners of Colorado $2,660 per mile, per year at 1,400 vehicles per day as a minimum, and $7,030 per year on roads carrying 3,700 vehicles per day.

Our Cover Picture

An unusually fine piece of roadway located west of Gypsum, near the east entrance to Glenwood canon, is pictured on the cover of this month's issue of Colorado Highways. This is one of many marvelous views to be found along U. S. Highway No. 46, in the vicinity of Glenwood Springs, a leading Colorado summer resort. U. S. Highway No. 46, in Colorado, leads from Limon to Grand Junction, via Colorado Springs, Buena Vista, Leadville, Eagle, Glenwood Springs and Rifle. (Photo by courtesy of the Denver Tourist Bureau.)

Importance of Road Drainage

By Don Heaton

I SUPPOSE that any road program would not be complete unless it included something on road drainage. Personally, however, I sometimes feel that the time allotted to road drainage could be better spent on some other topic. Not that other topics are of more importance, but because I know of no subject that is as much talked about, and as generally agreed upon, and as little practiced as road drainage. By this I do not refer to elaborately designed systems, but just the ordinary commonsense precautions that we all talk about and so often fail to carry out.

From a study of the subject it seems to me that the time spent on highway investigations and research in the last twenty years could be divided in about the following proportions:

On the design of new road surfaces, 80 per cent; on foundations, subgrades and drainage combined, about 20 per cent.

A few years ago, when heavy motor traffic first began to appear, many roads failed because their wearing surfaces did not have the necessary strength to withstand the demands of heavy traffic, even when supported on stable foundations and subgrades. Undoubtedly the failure of the early pavement surfaces has been largely responsible for so much attention being directed in late years to developing road surfaces that would support our present day traffic.

Now, however, the rather annoying regularity with which some of the strongest and best developed pavement designs have failed in very recent years would indicate that subgrades and drainage are about to receive their rightful share of attention and that the above percentages are due to be changed if not actually reversed.

One of the first problems that concerns the highway designer is some means to make the subgrade firm and strong enough to bear up the loads that come upon the road surface. For illustration, it is not hard to conceive of this being accomplished by the construction of a heavy foundation of such great thickness that in spite of poor drainage the road would not fail, due to the enormous effective depth from the surface of the road to the base of the foundation. On the other hand it is just as easy to conceive of the same stability being accomplished with an extremely light foundation and a subgrade kept dry by elaborate and expensive drainage works.

Between the two extremes there must be some economical half-way point, the determination of which will tell us how much money to spend for foundation and how much to spend for road drainage.

This is one of the road drainage problems that the highway research man will have to solve in the immediate future. I wish him easy sailing, though I don't know of a problem that involves more variable quantities than the one just stated.

Until recently no one thought much about capillary moisture as a possible cause of subgrade failures. The usual practice in draining a road is by means of side ditches, under drains of tile and stone, or both, to remove surface and ground water.

In spite of all these precautions many well designed roads have failed on account of very wet subgrades.

Repeated accounts of such failures brought on a series of experiments by the office of public roads, to determine something about capillary moisture and methods of meeting its effects by road drainage.

Briefly, the results of some experiments in this line conducted by the office of public roads are that, under favorable conditions of soil texture and temperature, capillary moisture was raised a vertical distance of sixteen inches to six feet in twenty-four hours; that horizontal capillary action is much more rapid than verti-

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A section of the new Lafayette-Longmont road, showing 100-ft. steel bridge over Boulder Creek.

One of the concrete drainage structures on Lafayette-Longmont highway, "built to stay put."

Importance of Road Drainage

(Continued from Page 10)

cal, and that water has been observed to move in a horizontal direction in distances ranging from seven to thirty-three feet in twenty-four hours. Also, that the quantity of water and the rate at which it will move depend upon the sizes of the pore spaces between the soil particles. If the pore spaces are small, the movement of water will be relatively rapid, and the amount of water held against the attraction of gravity will be relatively great. If the pore spaces are large, the vertical or horizontal movement of the water will be slow and the amount held in the soil will be small.

Even the slightest consideration of these figures and findings must leave no doubt in our mind that the natural law at work through capillarity must be faced in the design of road drainage and road subgrades.

Vertical capillarity has been successfully met in many cases by placing a layer of material of low capillary power, such as heavy crushed stone or coarse screened gravel, directly beneath the pavement.

Attempts to stop horizontal capillarity include the design of vertical concrete cut-off walls extending about three feet below each edge of the pavement. Tile drains on each side of the road, with trenches filled with broken stone, and by water-proofing ditch banks and subgrade with crude oil or tar preparations, or combinations of all three of these methods.

A mistake sometimes made in road drainage is the attempt to apply farm drainage methods to highway drainage, especially in the under-drain systems. In many respects the two call for widely different plans and considerations.

There are many cases where tile drainage is a complete success in farm land, while in an adjacent highway the tile drain might be a very questionable investment. Extreme rapidity of action in farm drains is not as essential as in road drains.

If a farm drain is so designed that the water table is lowered beyond the limit of capillary rise for that particular soil, the drain had better not be put in, as the one form of moisture essential for crop growth is capillary moisture. On the other hand, the ideal drain for a highway is one that eliminates capillarity completely.

From what I can learn, the best practice in road drainage in the immediate future is going to include extensive studies of soil conditions over the route of any proposed project. Standardized methods of drainage for mile after mile of road up hill and down, through cut and fill, will be replaced by adequate drainage plans to meet every condition of soil and moisture.

American Tourist Resorts Meet Stiff Competition from Foreign Countries

FOREIGN countries with highly advertised touring areas are making such a strong bid for United States tourist trade that some of America's best known resorts are certain to be badly hit unless they wake up and make plans to meet the competition to which they are subjected.

Such was the tenor of a statement issued from the national headquarters of the American Automobile Association recently. The statement, which was partly a warning and partly a prediction, was based on an analysis of the world touring situation made by the National Touring Board of the A. A. A.

The analysis disclosed that many foreign governments are taking an active and increasing interest in promoting and exploiting their resort areas and that the main appeal in their campaign is directed toward American prospects. Some of them have gone so far as to appropriate special funds and set up special bureaus to advertise these areas in order that their attractions may be constantly exploited and kept before the public throughout the entire year.

In addition to this, points out the A. A. A. National Touring Board, more than a score of large shipping companies are feverishly engaged in this same work of exploiting foreign touring areas, offering attractive ocean rates and better facilities for the shipment of automobiles.

"These governments, bureaus and shipping companies," the statement says, "are, of course, using good business judgment in promoting their own interests. They have every right to do so. We have no quarrel with them and our service, of course, follows our members who yield to the foreign lure.

"We are constrained, however, to point out that American touring areas are facing the stiffest and hardest kind of competition and that they must bestir themselves and acquaint the public, particularly the motoring public, with what they have to offer for amusement and recreation. They must do exactly as their foreign competitors are doing.

"Up to the present, many of our best known touring sections have been asleep on the job. For the most part, they hide their light under a bushel, so to speak. Experience has shown that when they do begin to get busy, the touring and holiday season is already underway. By this time, thousands of people have made their plans for their summer vacation and much business has been lost to the home tourist trade.

"Apart from this loss of revenue, there is another important angle to the situation. We haven't even started to know these United States and there is serious danger that the spreading of the lure of touring regions abroad may interfere with our intensive cultivation of the superb vacation areas of America. Our summer and winter resort regions can stand comparison with the best that the world can offer. Whether fancy leads to Switzerland, the Riviera or North Africa —they can all be duplicated here, while the automobile and the open roads provide the Sesame that places them around the corner."

Congress Votes $75,000,000 for Federal Aid

SOME years ago Congress took up the subject of a national highway system, and since that time there has been a vast improvement in the construction and use of the highways. In 1912 a joint committee was appointed, composed of members of the Senate and the House of Representatives, to investigate and report on the subject of what part, if any, the federal government should take in the construction of roads.

This committee made a careful investigation of the subject, and reported its findings to the House and Senate in 1915. As a result of this investigation and report, Congress enacted legislation providing for Federal aid in the construction of highways.

The first legislation was enacted and approved July 11, 1916. This legislation provided for a five-year program and an appropriation of $75,000,000.

Five million dollars became available the first year; $10,000,000 became available the second year; $15,000,000 the third year; $20,000,000 the fourth year; and $25,000,000 the fifth year.

The next legislation was passed in February of 1919 and carried an appropriation of $200,000,000, covering a period of three years. The first $50,000,000 became available immediately; $75,000,000 became available for the fiscal year ending in 1920; and $75,000,000 was available for the fiscal year ending June 30, 1921.

Up to this time the action of the government in aiding the states in the construction of roads was largely experimental.

In 1921, after a careful investigation and consideration of the whole subject, legislation was enacted providing for a comprehensive program of Federal aid in the construction of highways. This legislation provided for a program of road construction throughout the entire nation, embracing 7 per cent of the roads in each state, and this 7 per cent aggregates approximately 200,000 miles of primary and secondary roads.

This act established for the first time a definite governmental policy and program for co-operation with the several states in the construction and maintenance of a national highway system. Seventy-five million dollars was authorized for this work in the first year.

In 1922, following the general program outlined, Congress authorized the expenditure of $50,000,000 for the fiscal year ending June 30, 1923; $65,000,000 for the fiscal year ending June 30, 1924; and $75,000,000 for the fiscal year ending June 30, 1925.

In 1925 Congress authorized the expenditure of $75,000,000 for the fiscal year ending June 30, 1926, and $75,000,000 for the fiscal year ending June 30, 1927. The present bill provides for an authorization for the fiscal years ending in 1928 and 1929. Briefly, this is a review of all of the moneys authorized and appropriated by the government for Federal aid in the construction of good roads under the highway act.

Under the present law the federal government apportions these appropriations to the several states, and these funds are used in the construction of roads approved by the Secretary of Agriculture.

Federal participation cannot under the law exceed 50 per cent of the cost of construction of the roads or exceed $15,000 per mile.

NEWS OF THE MONTH

Current Events in the Field of Highway Engineering and Transportation—State, County and Municipal Activities

First National Conference of Bus Operators of the United States Will Be Held in Philadelphia June 15 and 16.

For the first time in the history of bus transportation in America, the bus operators of the country are about to get together for a discussion of vital phases of the country's fastest growing industry.

According to an announcement from the American Automobile Association today, the A. A. A. Bus Division, which is the national organization of bus operators of the country, has called its first great national convention to meet in Philadelphia at the Ritz-Carlton Hotel June 15 and 16, simultaneously with the meeting in that city of the A. A. A.'s annual convention.

Plans for the National Bus Convention have already taken shape. The wide scope of the program and the uncertainty as to the action of Congress next winter in regard to buses engaged in interstate commerce, it predicted, will make the meeting epochal in the history of highway transportation.

Nation-wide interest in the gathering is manifested through the fact that every section of the country, from the Atlantic to the Pacific, will be represented at the convention. The attendance is expected to run into the hundreds and the program has been so arranged as to permit of a free and candid discussion of all the fundamental factors that have a bearing on the future of bus transportation.

Of outstanding importance is the provision made for the extensive consideration of the relation between the motor bus and other forms of transportation, such as the steam railroads and the electric railroad lines. Out of this consideration there may come, it is anticipated, a program of harmony that will not only clear the way for Congress but help materially to develop side by side the different types of transportation, as the public interest may require.

The Motor Bus Division of the A. A. A. is the national association of bus operators and although it has been functioning for a comparatively short period of time, it has now in its ranks 1,500 operators who run 12,000 bus units, or 40 per cent of the buses used as common carriers.

The Bus Division, which is controlled by bus operators who constitute its directors, has already ironed out many kinks in the bus transportation field. It has already made such headway that before the year 1927 comes to a close, it is expected that its membership will include as many as 2,500 bus operators and 18,000 to 20,000 bus units.

One of the main items on the program of the Philadelphia convention is the election of officers for the Bus Division, as well as the election of bus representatives for the directorate of the American Automobile Association.

The list of the speakers so far completed and announced today include several of the most prominent representatives of the industry in the country. Among them are: A. J. Brosseau, president of Mack Truck, Inc., and chairman of the Highway Committee of the National Automobile Chamber of Commerce; F. J. Scarr, until recently supervisor of motor transportation for the Pennsylvania Railroad system; C. T. McConnell, vice-president of the Ohio Motor Bus Association and president of the Cleveland, Ashtabula, Conneaut Bus Line and other large northern Ohio lines; H. R. Trumbower, one of the foremost highway transportation authorities of the country; Chester Hawkins, president of the Carolina Transit Company, Columbia, S. C., and H. G. Wells, commissioner of the Massachusetts Department of Public Utilities and first vice-president of the National Association of Railroad and Utilities Commissioners.

MAINTENANCE OFFICE OF DIV. NO. 4 IS REMOVED TO PUEBLO

Headquarters for the state highway maintenance in southeastern Colorado have been moved to Pueblo from Rocky Ford. Lewis Swink, assistant maintenance superintendent, has established his office in the basement of the Pueblo county court house in quarters occupied by James D. Bell, division engineer.

The area supervised by Swink was also expanded to include sixteen counties, taking in everything southeast of Colorado Springs.

TO PLANT TREES IN FRONT OF BILLBOARDS

Maryland is considering a novel plan through the operation of which it hopes not to get rid of unsightly billboards, which are ruining the beauty of the state's highways, but to hide them from view. It has been proposed that the state, through its forestry department, plant a line of trees or a group of trees at points where they will hide the obnoxious boards from the view of travelers along the highways. While the boards would not be completely hidden, the view of them would be so obscured as to rob them of any advertising value and their further erection would be discouraged and eventually abandoned.

WHAT'S THE HURRY?

The late tourists are hurrying home but there is going to be a lot of nice driving yet to come before the cars are put into winter quarters.—Mahnomen Pioneer.

ILLINOIS CUTS NINE MILLION FROM STATE ROAD EXPENSE

Approximately $9,000,000 has been saved by Illinois in her road building program by use of the facts and information from the "Bates Experimental Road" tests in 1922.

Officials of the department estimate that as a result of the experiments $3,600 was saved on each of the 2,500 miles of hard surface road built since the tests were concluded in July, 1923. Savings consisted in using less material and eliminating several construction processes in vogue before the tests were made.

The experimental road attracted international attention at a time when information on hard surface road building was scarce. Six groups of test sections were built, each representing a different type of pavement. Each group in turn was made up of a series of sections of graduated thickness and strength and subjected to all kinds of traffic use.

CHART ARIZONA ROADS FOR NEW GUIDE SIGNS

The erection of warning and directional signs on the state highway system of Arizona is preceeding rapidly under the direction of the state highway department.

PUEBLO SCHOOL CHILDREN MUST STAND TRIAL FOR CARELESSNESS

"It is the sentence of this court that you write a 50-word essay on safety, for crossing a street without looking in both directions—"

The judge pronouncing the sentence is one of the students of Bessemer Grade School where the pupils operate their own "Safety Court" as a means of educating themselves as to safety methods. The court meets once a week in the school auditorium to take up the cases of careless pupils. It has won prizes in four national safety contests.

Children of 25 nationalities attend Bessemer school and participate in the safety court. Because the children are from the class of foreigners who work in the steel mills, the safety work is considered especially valuable.

As a part of the court there is a force of student traffic officers. Through an arrangement with the Department of Public Safety of the city, the youthful traffic officers are given badges and authority to direct traffic on the intersections near the school grounds. The traffic officers alternate the student pedestrain traffic with the vehicular traffic. The task is not small because Bessemer school is in a busy part of the city.

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

Pueblo Culvert Plant Destroyed by Fire Again in Operation

On May 19th, the Colorado Culvert & Flume Co., Pueblo, had a fire which practically destroyed the culvert factory buildings. Work was started immediately to get the plant rebuilt, and the factory was again in operation on May 25th.

Since that time the plant had been running triple-shift to catch up with orders, according to L. R. Shallenberger, general manager.

"We can take care promptly of any orders offered us," said Mr. Shallenberger. "The damage was pretty well covered by insurance, the greatest damage being to the electrical equipment as the heavy machinery and stock of material was not damaged to any great extent. The buildings are being rebuilt as rapidly as possible in the same location, but with improved construction, and will be completed within a few weeks."

According to the plans of Mr. Shallenberger and J. P. Sanderson, the owners of the concern, the rebuilt factory, when entirely completed, will be one of the best in the western territory, and equipped to take care of the culvert needs of the intermountain region.

Osgood Builds New Shovel

The demand for gasoline and electrically driven equipment is becoming greater, and guided by the success of their 1-yard gasoline and electric shovels, the Osgood Company, Marion, Ohio, has designed a 1¼-yard gasoline or electric shovel to meet the increasing demand for a larger machine.

With the economical operation which is characteristic of gasoline or electric power, Osgood has combined in this machine a remarkable clean and simple design, many refinements adding to its efficiency and above all, its great structural strength and ruggedness.

Non-Skid Asphalt Surface

With a view to lessening the danger of skidding by motor vehicles, asphalt coated screenings were used for finishing 2.8 miles of the widened and thickened trunk highway near Delano, Kern County, California. Thirty pounds of asphalt to a ton of screening was used. Screenings thus treated, it is believed, will stock and close the pavement, and at the same time leave the surface somewhat rough.

Two can live as cheaply as one—on relatives.

All Steel Frame Features New P&H Excavator Line

The Harnischfeger Corporation announce a complete new line of excavators. Every feature of these machines was designed from the point of view of the practical dirt mover.

These new P&H models (built in sizes ½, ¾, 1 and 1¼ cubic yards capacity) are all steel from the tip of the boom to the corduroy shoes. The revolving frame, car-body, drum side stands, etc., are heavy one-piece steel castings.

This heavy cast steel frame construction cannot wear out. After many years of service these castings will be as good as new.

The unit cast steel construction insures permanent alignment for all working parts—there is nothing to work loose. As a result the shafts always run true and there is less wear in the bearings and in the gears.

The purpose of this unit steel construction is to secure rigidity. To get the full benefits of this construction all castings are fully machined at the joints and bearing points.

Koehring Provides Center Joint Skip on 27E Paver

The remarkable operating adaptability of the Koehring 27E paver has been further increased by the addition of a special skip for center joint construction. An arch with a clear width of 24 inches is built into the center of the skip. With this liberal clearance for the center joint, the skip comes flush to the subgrade so that the trucks may use the skip without interference, just as with a standard skip. This skip is constructed of heavy tank steel and rigidly reinforced like the standard charging skip.

Highway Research Work

The Committee on Tests and Investigations of the American Association of State Highway Officials has under way a number of interesting research projects. These projects, which are being conducted co-operatively by its various members, include a study of the relation between the quality of Portland cement as determined by the usual specification tests and the quality of the concrete in which the cement is used, a study of stone screenings in place of sand as fine aggregate in concrete, studies of the value of rail steel as reinforcing for concrete, studies of subgrade materials and methods of testing, and studies of methods for testing the stability of bituminous mixtures. Progress reports covering the use of stone screenings as fine aggregate and rail steel as reinforcing have already been made to the committee.

Western Wheeled Scraper Co. Announce New Model 20 Grader

A new leaning wheel grader is announced by the Western Wheeled Scraper Co., through the Wilson Machinery Co., Denver, intermountain sales agents. This new grader is called "Western No. 20" and is claimed to be "the last word in grader strength and capacity." They are said to be designed for the most difficult work behind the most powerful tractors.

Specifications of the grader are as follows:

Weight	11,500 lbs.
Length over all (without tongue)	20' 6"
Wheel Base	16'
Height over all	9'
Length of blade	12'
Width of blade (including removable bit)	21"
Center to center of front wheels	4' 5"
Center to center of rear wheels	9' 7"
Rear wheels	56" high, 8" concave tires
Front wheels	34" high, 8" concave tires
Rear axle clearance	25"
Front axle clearance	15¾"
Side rails	6" Z bars
H. P. required—not more than 40.	

Tractors.—The Monarch Tractors Corporation, Springfield, Ill., has just issued a specification folder on their new 6-ton Model H. Tractor. This machine, a track-type machine powered with a 4-cylinder 60 brake H.P. motor, has been especially designed for road builders. The same company makes a 10-ton tractor for heavier duty.

Trucks. — The Indiana Truck Corporation, Marion, Ind., has issued an interesting booklet and interesting folders telling about their road building and contractors' trucks. The literature gives complete specifications and cites by letter and illustration many successful jobs on which their trucks were used in hauling materials or batches of concrete. An interesting model shown is their Model 111-X, a road builders' truck with a capacity of 1½ cu. yds.

Concrete Mixers. — The Construction Machinery Company, of Waterloo, Iowa, is distributing a new catalog of their line of tilting concrete mixers. These building mixers have a number of interesting features, and are built in sizes ranging from the little 3-S to a 14-S machine. The same concern supplies backfillers, hoists and pumps in various sizes and models.

"Better highways is the slogan of the various boards of country commissioners of the San Juan basin. Major activities, however, this summer are in Montezuma county, where several contracts have been awarded for road building during the past few days."—Durango Herald.

SEE AMERICA FIRST

With the improvement of highways, hotels, camps and other facilities for tourists, trans-continental travel has increased tremendously during the past few years.

As late as 1914 only about 10,000 automobiles were registered in the entire national park system, while in 1923 practically 300,000 cars were registered in the parks. In 1912, when the agitation first started for opening the parks to automobiles, there were only 230,000 people registered, but during 1923 they were visited by 1,280,000 persons.

The National Park Service estimates that 60 per cent of the visitors to national parks come in their own cars. Out of a total of 138,000 people who registered at the gates of the Yellowstone Park last year three-fourths came in their own cars.

One of the best examples of the trans-continental use of automobiles is shown by the entrance records of Mt. Ranier National Park in Washington. During 1923 there were 27,655 automobiles which entered the park carrying 123,708 people.

THE EXACT DIFFERENCE

"Father," said the conventional small boy, "what is the difference between a pedestrian and a jay-walker?"

"A pedestrian," returned the conventional father, "is a person who walks when you are walking. A jay-walker is a person who walks when you are driving."—The Kablegram.

BIDS OPENED

Proj. No.	Length	Type	Location	Low Bidder
290-D	2.954 mi.	Concrete Paving	East of Las Animas	W. A. Colt & Son

PROJECTS ADVERTISED FOR BIDS

Proj. No.	Length	Type	Location	Bids Opened
251-B & 281-D	5.813 mi.	Concrete Paving	North of Lafayette	June 7, 1927
631 (1926)	129 ft.	Timber Bridge	Near Deckers	June 7, 1927
509-B	32 ft.	Bridge superstructure	Aspen	June 7, 1927

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

Proj. No.	Length	Type	Location
2-R5	1.959 mi.	Asphalt Paving	South of Aguilar
275-E1	0.926 mi.	Grading and Underpass	North of Monument
258-E2	1.41 mi.	Gravel Surfacing	Cimarron
279-D	0.261 mi.	Concrete Paving	Morrison
300-A	1.008 mi.	Grading	Chattanooga

PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
504-D	3.5 mi.	Gravel Surfacing	Gunnison Co., east of Cimarron*
210-B	7.507 mi.	Gravel Surfacing	De Beque—Grand Valley*
138-A	10.0 mi.	Gravel Surfacing	North of Kremmling
247-C	0.8 mi.	Conc. Pav. & R. R. Underpass	Swink*
287-D	0.5 mi.	Gravel Surf. & R. R. Underpass	East of Kersey
560	3.0 mi.	Gravel Surfacing	Deer Creek-Littleton
550	4.0 mi.	Grading	Loveland Pass
2-R6	6 mi.	Paving	South of Aguilar
296-C	5 mi.	Gravel Surfacing	North of Greenhorn
222-C Reop.	0.4 mi.	Paving	South of Lafayette
246-F	1.0 mi.	Paving	West of Avondale
279-F	3.3 mi.	Grading	North of Balleys

*Plans finished

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj No
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	$ 28,882.70	14	2-R3
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	331,632.00	95	2-R4
79-A	Big Sandy Creek, East of Simla	10 19-ft.	Spans Timber Trestle	A. R. Mackey	10,421.26	100	79-A
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	93	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	46	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	61	144-A1
145-A	West of Glenwood Springs	3.807 mi.	Gravel Surfacing	Winterburn & Lumsden	53,227.90	6	145-A
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	63	157-A
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	89	213-D
242-AR1	East of Fruita	125 ft.	Steel Bridge	F. H. Knollman	19,999.00	100	242-AR1
254-C	Div. 1 2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	95	254-C1
254-C2	S. W. of Hot Sulphur Springs	Superstr. of	Bridge & Approaches	Northwestern Constr. Co.	48,203.50	0	254-C2
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	8	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	85	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	40	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	22	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	63	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	92	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	35	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	60	271-B
275-C	Husted-Monument	4.795 mi.	Concrete Paving	J. L. Busselle & Co.	186,585.20	100	275-C
275-C	Div. 2 East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,466.60	53	275-C2
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	75	275-F1
275-F2	Castle Rock, south	5.227 mi.	Paving	J. Fred Roberts & Sons	119,027.80	0	275-F2
275-G	Larkspur-Monument	10.869 mi.	Grading	Monaghan-Cunningham Con. Co.	141,252.78	14	275-G
276	North of Colorado Springs		R. R. Overpass	J. L. Busselle & Co.	37,913.00	25	276
279-E	Schaffer's Crossing-Baileys	3.243 mi.	Grading	S. M. & S. J. Feely	54,305.60	6	279-E
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	86	281-D1 / 251-B1
281-E	At Lafayette	0.812 mi.	Paving	J. H. Miller & Co.	27,226.00	0	281-E
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	0	282-D
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	71	283-C
287-A2	Fort Morgan, west	4.011 mi.	Concrete Paving	H. C. Lallier Const. Co.	119,016.60	92	287-A2
		16.61 mi.	Subgrade Treatment	H. C. Lallier C. Eng. Co.	159,950.85	43	
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	20	287-C1-2
292-A	North from Minturn	6.417 mi.	Grading	Geo. F. Wear	21,645.25	77	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	John A. Duncan	32,316.80	65	293-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	Cole Brothers	58,061.00	79	295-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	99	296-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	69	297-B
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing				299-A

KEYSTONE COPPER STEEL CULVERTS

Strength-Flexibility-Performance

What is it that makes ***Keystone Culverts*** last so long ....makes them so economical....so dependable?

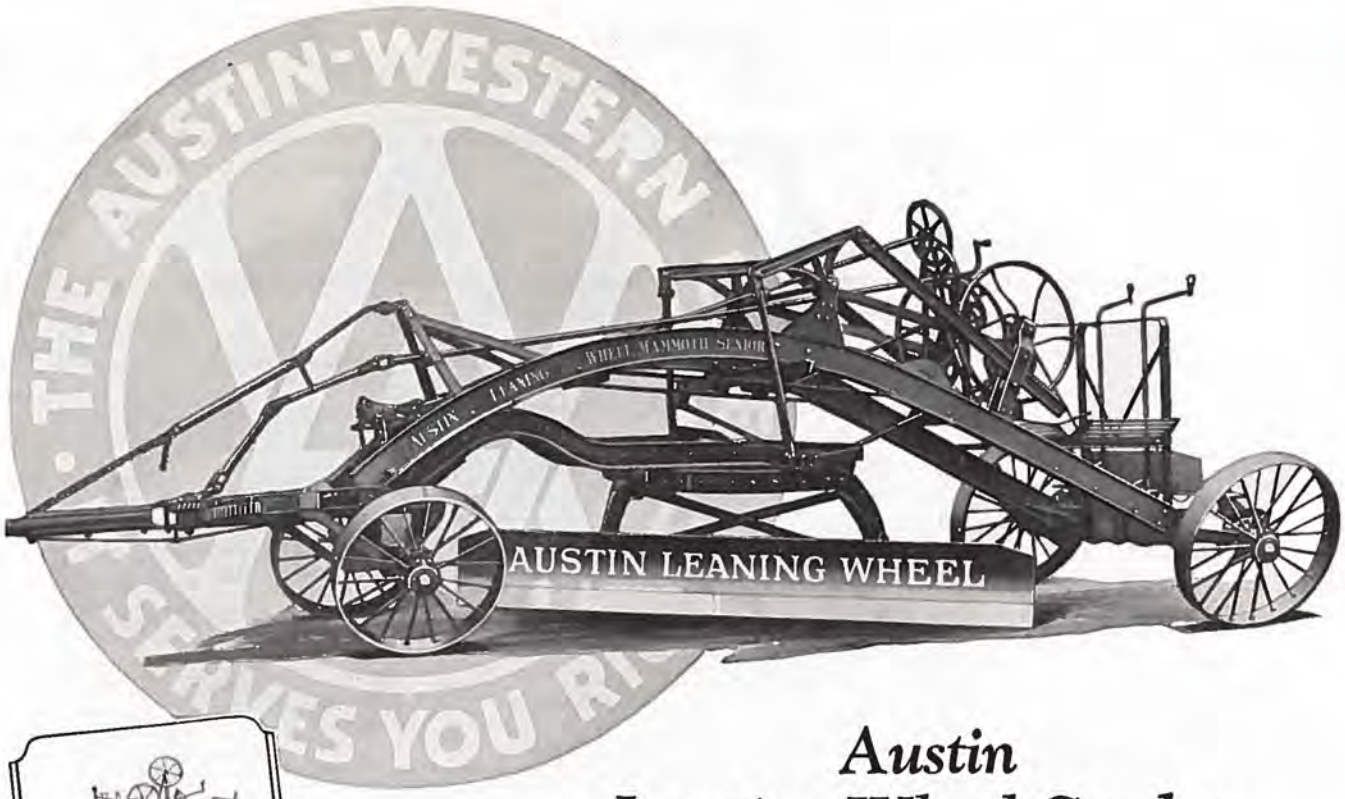
Who Knows? *Who Cares?*

It's enough to know they are giving ***absolute satisfaction*** every day in the year under actual working conditions and that they have been giving this service for over fifteen years in this territory.

Built to Serve, Satisfy and Survive

COLORADO CULVERT & FLUME CO.

PUEBLO



Austin Leaning Wheel Graders

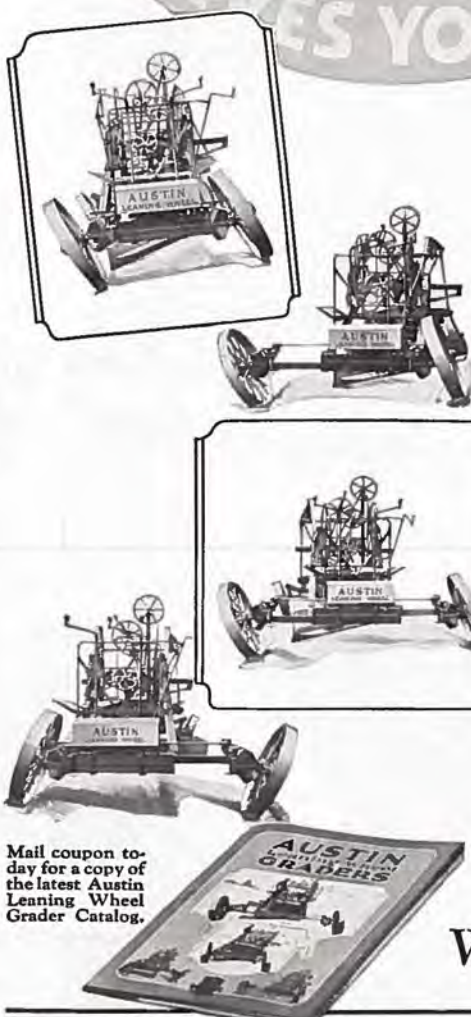
The time-tested features that have made Austin Graders the choice of experienced operators for over 40 years will all be found on the Leaning Wheel models. In addition, they are distinguished from all other Leaning Wheel graders by several improvements of great practical value. The Telescopic Rear Axle, Timken Tapered Roller Bearings and Alemite High Pressure Lubricating System are exclusive features whose value will be admitted by all impartial authorities.

The advantages of the telescopic axle are obvious. It is never in the way as a long, one-piece axle is very apt to be, and when fully telescoped has the further advantage of being much stronger than any long axle can hope to be.

Timken Tapered Roller Bearings are dust-tight and have many mechanical advantages over all other types. No other bearing is designed to stand the variable loads, or pressure, to which all grader wheels are subjected, and no other type can be taken up for wear instead of replaced.

The Alemite High Pressure Lubricating System is standard equipment on more than 250 automobiles, trucks and tractors. Its chief advantage is the fact that lubricant is forced into all bearings under a pressure of several hundred pounds to the inch, thus reaching every part of the wearing surface, and at the same time forcing out all foreign matter.

The Telescopic Rear Axle, Timken Bearings and Alemite Lubricating System are but three of the things that contribute to Austin superiority.



Mail coupon today for a copy of the latest Austin Leaning Wheel Grader Catalog.

Why take less in a leaning wheel machine?

Please send me a copy of the Austin Leaning Wheel Grader Catalog.

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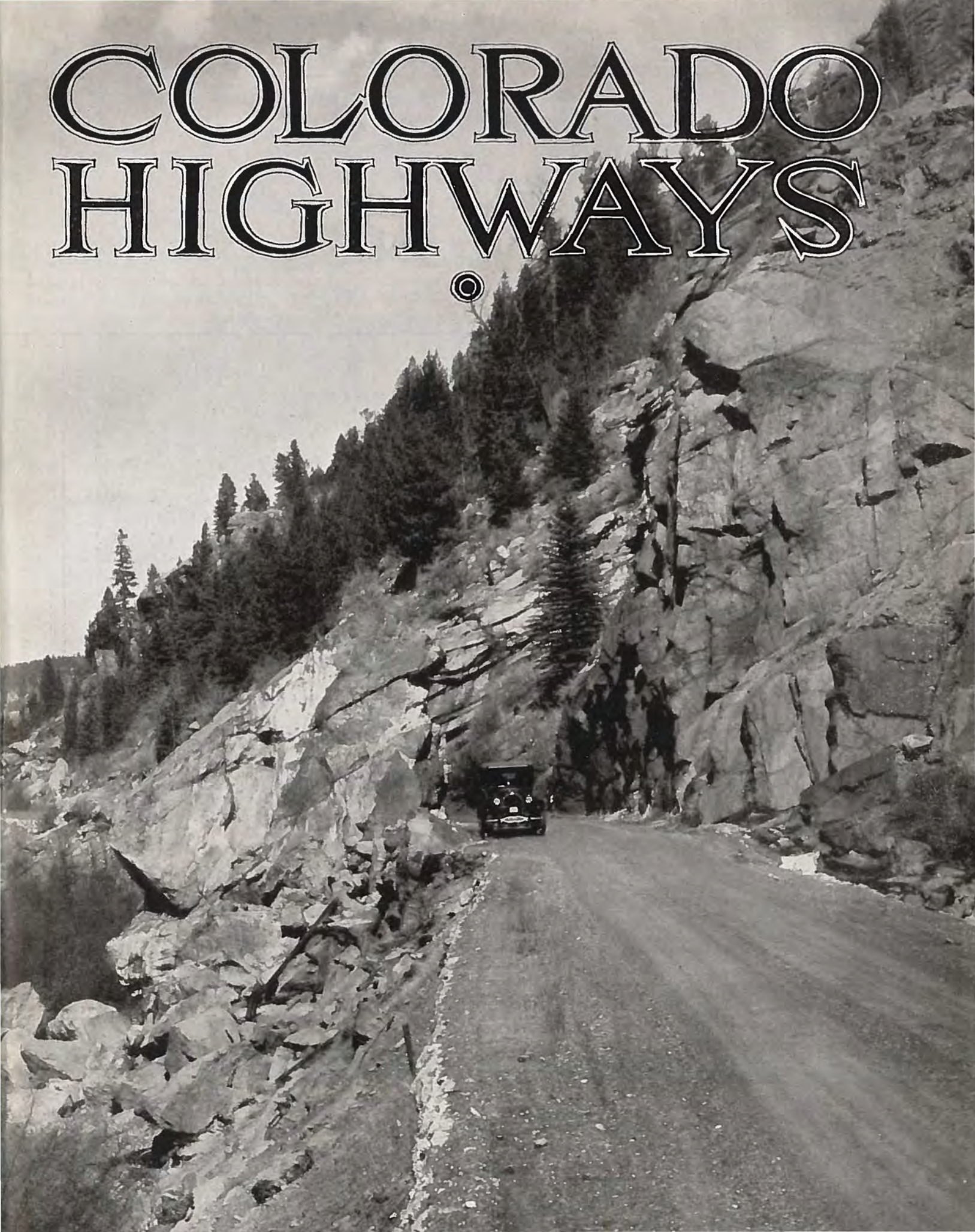
THE AUSTIN-WESTERN ROAD MACHINERY CO.

CHICAGO

Sales Representative: Wilson Machinery Company 1936-38 Market Street DENVER, COLO.

COLORADO HIGHWAYS



Pikes Peak-Ocean to Ocean Highway, Mesa County, Colorado

CONCRETE ROADS *INVITE* TOURISTS

Tourists go where the Concrete Roads go.

Invite tourists to Colorado by offering them permanent, safe Concrete Roads and the entire state will have a never-ending source of income.

"Facts About Concrete Roads", an illustrated booklet, gives the facts. Ask for your free copy.

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Articles on the subject of road building and highway development in the West are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible. Manuscripts not found available will be returned promptly.

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"BETTER ROADS"

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Colorado Motorist's Paradise

COLORADO may rightfully be named the motorist's paradise. No state in the union can match the Centennial state in scenic beauty and grandeur and a system of highways embracing more than 9,000 miles of primary state highways and some 50,000 miles of roads maintained by the counties enable the tourist to enjoy the beauties lavished upon the state by nature.

Unceasing work by the Colorado State Highway Department, the Federal Bureau of Roads, the United States Forest Service and the commissioners of each of the state's sixty-three counties during the fifteen years, combined with the expenditure of many millions of dollars, have given the state a highway system that is unexcelled anywhere. This system of highways permits the traveler to reach any part of the state in comfort and safety, except during the winter months, when snowstorms close the passes that cross the mighty continental divide at an altitude of more than 10,000 feet.

Byers Canon, located between Hot Sulphur Springs and Parshall. Completion of this costly piece of work eliminates the worst grade on the Victory Highway in Colorado.

Colorado's state highway system of 9,000 miles or more is so designed as to furnish communication between the seats of every one of its sixty-three counties. Every county seat is on a state highway and every one of these state highways has been so improved as to enable the motorist to reach it with any modern automobile.

Construction of some of the highways, notably those across the high Rockies, have offered some difficulties that at first appeared nigh insurmountable. Many miles of roads there are every foot of which has been blasted out of solid rock. The cost has been appalling. There are some highways in the construction of which the construction cost has passed $70,000 a mile. This money was spent in order to make travel by automobile safe and comfortable.

Government Aids in Road Building

The United States government participates in defraying the cost of constructing and improving the principal interstate roads, that is, roads that connect with through roads east and west and north and south. The motorist will find that these interstate roads are veritable boulevards through the Rockies, with a maximum grade of 6 per cent, a grade that is easily negotiated by all modern cars.

Rapid strides have been made toward completion of the interstate highways. With comparatively few stretches the interstate highways are now in first class shape and the exceptions are such as not to offer any difficulties to the travelers. The other state highways are also in an advanced stage of improvements and some of the county roads, that is, roads constructed and maintained by the counties alone, are as good as the interstate roads.

With the exception of some two hundred miles of state highways connecting the larger cities on the eastern slope of the Rockies, with Denver as the center, all of the state highways are wide dirt roads, surfaced with gravel or disintegrated granite. The principal cities on the eastern range are connected with hard-surfaced concrete highways. Experiments by the state highway department have disclosed that graveled roads are best for mountain travel.

Wide Roads Afford Safety to Motorists

The completed highways, even those leading into the mountain fastnesses, are anywhere from eighteen to twenty-four feet wide, affording ample room for two cars to pass, and on those highways which have not been brought up to the standards set by the highway department, numerous "turnouts" are provided to permit passing of cars. The motorist who remains on the principal highways need not be afraid of any difficulties, so far as the roads are concerned, and the principal highways will take him to all sections of the state.

While Colorado is sparsely settled and in some sections towns are far apart, the traveler will not want for ample and satisfactory hotel accommodations. Not to exceed a half a day's travel will bring him to a town

where he can spend the night in comfort and revive the inner man. All roads are marked and there is little danger of the traveler getting lost.

Colorado Rich in Scenic Wonders

Several months would be required for a traveler to view all of the scenic wonders of the state. To the tourist who wishes to make a swing around the state and can devote from one to two weeks to such a trip, so many opportunities for sightseeing trips present themselves that it is impossible to enumerate them all. Every section of the state has its attractive features.

A two-week trip that will show the traveler perhaps more of the state's wonderful scenery than any other and which will take from ten to fifteen days, according to the length of time spent at the various places, is described herewith. It starts at Denver and extends to Mesa Verde National Park in the extreme southwest corner of the state. It embraces about 1,000 miles of unmatched mountain scenery.

Old Stage Line Followed in Tour

Leaving Denver by way of the Morrison road, the traveler enters Turkey Creek canon and follows the old Leadville stage line. He reaches the Platte river at Bailey's and follows the river, affording many opportunities for trout fishing, to almost the foot of Kenosha pass. Descending from the pass, which affords a magnificent view, he traverses South Park until he reaches Fairplay. From Fairplay the route leads past Antero reservoir and over Trout Creek pass to Buena Vista, the seat of the state reformatory. For an hour or so he travels in the shadow of one of the most magnificent mountain ranges, the Collegiate range, just west of Buena Vista. An hour's drive from Buena Vista brings him to Leadville, one of the world's greatest gold camps, and two miles above sea level.

Leadville can be reached from Denver by an eight-hour drive, comfortably, and affords an opportunity to spend the night comfortably.

Glenwood Springs, with its hot springs and all-year open-air swimming pool, is the next objective. It can be reached by three different routes, each one offering wonderful scenic attractions. One road leads directly west over the famous Tennessee pass and Battle mountain and through Glenwood canon. The second leads south from Leadville to Twin Lakes, over Independence pass into Aspen, seat of the state's most noted silver mines, and thence into Glenwood, while the third follows the old roadbed of the Colorado Midland railroad through the valley of the Frying Pan river. If the traveler chooses the latter route he will experience the novelty of driving through a tunnel two miles long.

The routes via the tunnel or Independence pass are much the shorter of the three, but the Tennessee pass route will afford the traveler some thrills that are lacking on the other—notably, the crossing of Battle mountain, with the river and the Denver & Rio Grande Western railroad some 2,000 feet directly below him. Glenwood canon is unsurpassed in beauty by any canon in the state and the road is a veritable boulevard.

The next day of travel leads through what is conceded to be one of the richest fruit-growing districts of the whole United States, the valley of the Colorado river. He also passes within close proximity of the rich oil shale fields of the state which, in the opinion of experts, contain enough oil to supply the demand for gasoline for hundreds of years when well oil has been exhausted.

A drive of 100 miles from Glenwood Springs brings the tourist to Grand Junction, the largest city in western Colorado. At Grand Junction he swings south and, over an excellent highway, enters another rich farming and fruit-growing section, with Delta and Montrose the principal cities. Continuing south from Montrose, an hour's ride leads to the threshold of the San Juan mountains. In the opinion of world travelers the San Juan district of Colorado surpasses in scenic beauty and grandeur any section of similar size in the world.

"Gem of Rockies" in Small Valley

Ouray is the first stop after leaving Montrose. This town, named after a famous Ute Indian chief, has been named the "Gem of the Rockies." It is located in a small valley, surrounded on all sides by mountains from 12,000 to 13,000 feet high. Entrance to the valley can be had only through a narrow canon through which the automobile road leads. The mountain sides are dotted with gold and silver mines.

Leaving Ouray for Silverton the traveler enters upon what road experts have pronounced the finest and also the most expensive piece of highway in the United States. It is known as the "Million Dollar Highway" because it cost nearly that much money to construct the twenty-four miles of highway between Ouray and Silverton. Words can hardly describe this wonderful highway through the heart of the Rockies. It must be seen to be appreciated.

On the way to Silverton the tourist passes wonderful water falls and some of the steepest mountains in the state. The highway reaches its highest point at Red mountain, its sides dotted with mining properties which have enriched the world by many millions of dollars.

Railroad Grade Is Followed in Descent

The descent into Silverton is made over a highway following an old railroad grade, with a series of easy switchbacks and through a thickly wooded country.

Durango, the largest city in the San Juan basin, is the next stopping place. The road from Silverton to Durango affords unobstructed views of the high San Juan mountains, including the wonderful Sawtooth range. It passes Lake Electra, a large body of water used in the generation of electricity for consumption in southwestern Colorado. From Durango, a four-hour drive brings the tourist to the government camp in Mesa Verde national park.

Leaving the main highway a short distance west of Mancos the road to the park starts to climb to the top of the mesa immediately. The road leading to the park is not as wide as most highways in the state but it is a one-way road and offers no difficulties, though, due to the fact that for several miles it skirts the edge of the high mesa, it affords many thrills.

The traveler could spend a week or more at Mesa Verde viewing the ruins of the cliff dwellers' homes and places without seeing all there is to be seen, but a day will suffice to make him acquainted with the Spruce Tree house and the Cliff palace, the principal ruins. Very good accommodations are obtainable at the government camp.

From Mancos the tourist returns to Durango and starts upon his return to Denver via Wolf Creek pass.

He reaches the foot of the pass through Bayfield, in a rich farming section, and Pagosa Springs. The latter town is noted for its wonderful mineral hot springs, which are found almost anywhere within its confines.

Wolf Creek pass is one of the most beautiful in the state. It differs from most passes in that its approaches are thickly wooded with virgin timber. The road has recently been widened and is provided with ample turnouts on both the eastern and western slopes. Next to Independence, it is the highest pass traversed by an automobile road.

From Wolf Creek pass the road drops gradually until the Rio Grande, one of the state's principal trout streams, is reached. It follows this stream until Del Norte, the capital of Rio Grande county and one of the principal cities in the world-famed San Luis valley, the bottom of an ancient lake and said to be the largest valley in the world.

From Del Norte the road leads through a rich farming section northeast to Saguache, a quaint old mining town and the supply point for many big cattle outfits. Proceeding to the northeast, it reaches Poncha pass and then Salida. Traveling almost due east over the Royal Gorge road the tourist reaches Canon City, with its Sky Line and Royal Gorge drives. From Canon City to Colorado Springs, over what is known as the "cutoff" road, it is fifty-six miles. From Colorado Springs the return trip to Denver is completed over the main north and south highway.

Many Roads Lead to Mesa Verde

Mesa Verde National park can be reached by several other routes. For instance, instead of turning north into Leadville from Buena Vista and continuing to Ouray by way of Glenwood Springs, Grand Junction, Delta and Montrose, the tourist may turn south to Salida and thence proceed to cross the Continental Divide over Monarch pass. That road will lead him into Gunnison and over the Blue Mesa into Montrose where he picks up the route first described. The road over Monarch pass is one of the finest mountain roads in the state and the Gunnison river, which he follows from Gunnison to Sapinero, is one of the world's greatest trout fishing streams.

Again, instead of proceeding from Montrose to Ouray and thence to Mesa Verde park by way of Silverton and Durango, the traveler may leave the Montrose-Ouray road at Ridgeway and from that town proceed over Dalla Divide into the famous mining camp of Telluride. From Telluride the road runs in a southwesterly direction to Rico, Dolores and Cortez and thence into Mesa Verde park. The country between Telluride and Rico is a veritable scenic wonderland, well worth the trip. The tourist taking this route may complete the return trip from Mesa Verde by way of Durango, Silverton and Ouray and Montrose, crossing the Continental Divide into Salida over Monarch, instead of Wolf Creek. By taking this road, he will make the unforgettable trip over the Million-Dollar highway between Silverton and Ouray.

Other sections of interest worth visiting are the San Isabel forest, southwest of Pueblo; North Park country, reached over a fine road following the Cache la Poudre river westward from Fort Collins and over Cameron pass; northwestern Colorado and the Moffat county oil field, over Berthoud and Rabbit Ear passes and many more. The state's highway system is so arranged that circle trips can be made which will enable the tourist to make the return trip to Denver without retracing his steps.

A view of "potato patch" near Carbondale, with magnificent mountain range in the distance. Spuds from this section bring top prices in the market. Good roads make marketing of easy access to railroads.

Showing paving operations on new concrete road connecting Loveland and Longmont on U. S. Highway No. 285. Upper left —Central mixing plant of J. H. Miller & Co., contractors. Upper right—View of complete pavement. Lower left—Mixer crew pouring concrete on subgrade. Lower right—View of finished pavement, with Loveland in the distance.

Traffic Starts on Longmont Pavement

By JOHN P. DONOVAN,
Division Engineer, District No. 1

TRAFFIC moved over the six-mile stretch of concrete pavement located between Longmont and Berthoud on July 4th. Since September, 1926, traffic between these two points had been routed over a well-constructed, gravel-surfaced detour.

Officials and citizens of the two towns joined forces in a celebration of Independence Day and the opening of the concrete pavement. It was made the occasion of a "big event". Opening of this project marked the completion of a continuous ribbon of concrete from Longmont to Fort Collins, a distance of thirty-three miles.

On the 9th of June, 1927, pouring of the concrete pavement between the northern limit of Longmont and the southern limit of Berthoud was completed by J. H. Miller & Co., under their contract for the construction of Colorado-Federal Aid Project 283-C. By the middle of July the shoulders and odds and ends were cleaned up and the pavement opened to traffic, completing an unusually well organized paving job of more than average length well within contract time.

No unusual condition affected the construction of the job except that the nearest available rock for coarse aggregate for the concrete was at the Brodie quarry above Lyons, about twelve miles from the center of the job where a central mixing plant was to be installed.

The furnishing of this rock, involving the handling of nearly ten thousand cubic yards of rock through three distinct operations of hauling twelve miles, crushing and screening it, was accomplished without a hitch and at no time was there the slightest delay at the plant on account of lack of coarse aggregate. To do this, however, it was necessary to work the crushing and screening plant two shifts much of the time and as many as forty auto trucks were hauling rock at times.

Pouring concrete on the 5.79 miles of paving was started on September 27, 1926, shut down by cold weather on November 9, 1926; started again on April 21, 1927, and completed on the 9th of June, 1927, an average daily run of about five hundred lineal feet or one thousand square feet being secured per paving day.

Daily slump tests were inaugurated early in the paving operation and the average daily slump of one and a half inches produced so stiff a mixture as to require the use of two strike boards and crews to tamp and strike off this "mud". Little of the resulting con-

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Big Road Mileage Completed in Colorado

SINCE the present organization was established in 1921 there have been expended from the state highway funds for construction, improvement and maintenance, about $30,000,000. The following mileage of construction has been completed.

Graded roads	1,200 miles
Crushed rock or gravel surfacing	800 miles
Sand clay surfacing	900 miles
Pavement	225 miles

In addition to this mileage, there has probably been an equal amount that has been improved but not to so high a standard has the mileage tabulated.

The latter class of work has been done mostly through agreements with county organizations for the use of their forces and is meant to suffice for a shorter or longer time until the traffic demands and the available funds permit construction work of the higher standard.

Among the more spectacular projects constructed under the present organization are included the work on Battle Mountain between Red Cliff and Minturn. This work is through an exceedingly rugged mountainous district in the Eagle River Canon. Before the improvement it was one of the most dreaded portions of the Tennessee Pass route to Grand Junction and the western slope and since at that time it was the main route used by transcontinental tourists, that part of the road had a very bad name. The new construction work has made Battle Mountain a very attractive portion of the route.

Another spectacular piece of work is in the Gore Canon west of Kremmling in Grand County. A part of this work consists of blasting out the solid rock in the vertical walls of the canon and is the most expensive piece of work per mile of any that has ever been done by the department. The need for this construction is to cut out the very dangerous Parshall Hill.

The Sapinero Bridge across the Uncompahgre River near Sapinero on the road from Gunnison to Montrose is the highest bridge in Colorado. It is a steel arch of very imposing appearance. Probably the most important piece of work accomplished by the department during the last few years is the progress made in securing a paved highway over the principal road of the state extending between Wyoming and New Mexico.

The coming season will see completion of the pavement between Denver and Fort Collins but it will be another year before the road is entirely paved between Denver and Colorado Springs. The latter piece of improvement will eliminate the thirteen grade crossings which existed on this seventy-five mile stretch only a few years ago. Six of these crossings will be gotten rid of by relocating the highway and seven of them by overhead or underpass structures.

Co-operating with the Federal government represented by the Bureau of Public Roads and the United States Forestry Service, improvement has been carried on over five important passes of the Continental Divide. Beginning on the north the road from Fort Collins down the Poudre River past picturesque Chambers Lake and over Cameron Pass and down into Walden has recently been finished and constitutes one of the most picturesque trips to be made in the northern part of the state.

Berthoud Pass is probably one of the most heavily traveled of the mountain passes and is located on the Victory Highway from Denver westward via Steamboat Springs to Utah points. Tennessee Pass is one of the oldest of the mountain passes used for highway traffic and the Bureau of Public Roads is doing practically all of this work without co-operative funds.

Monarch Pass is located on the road between Salida and Gunnison and is a very picturesque route.

Cumbres Pass, the most southerly of the Continental Divide passes, connects with an important highway in New Mexico.

In addition to these Continental Divide passes, other construction work on forest highway projects carried on through co-operation between the Federal and State departments, include the famous "Million Dollar Highway" from Ouray via Silverton to Durango through the San Juan mountains which have frequently been called the "Alps of America". Second only to this highway from the standpoint of grandeur and scenic beauty, is the Independence Pass route between Twin Lakes and Aspen in Lake and Pitkin Counties. Connecting the Mt. Evans highway between Echo Lake and Idaho Springs, a very important and imposing piece of work is being completed. The State Highway Department, with its own funds only, is constructing a spur from the Mt. Evans highway which will reach practically to the summit of the peak so that automobiles may drive to an elevation of 14,155 feet.

Showing steam shovel "eatin' up the earth"—a "he man" road building job—located in Chaffee county, north of Buena Vista.

Surface Maintenance of Roads

By F. S. THOMPSON,

THE prevention and removal of corrugations in gravel and crushed rock roads is one of the outstanding problems confronting officials in charge of road supervision and maintenance. These corrugations caused largely by the action of the tires of fast moving vehicles, rebounding over slight inequalities in the road surface soon grow deeper and unless properly treated will render the road surface practically impassable.

MEANS OF PREVENTING CORRUGATIONS

A hard, smooth, well impacted road surface takes much longer to develop corrugations than one with many inequalities in the beginning. Past mistakes in resurfacing of former dirt roads with either pit run gravel containing a large percentage of oversize material or screened gravel containing too much fine material are largely responsible for many increased maintenance costs. Present day methods of using crushed and screened material of three-quarter or one inch maximum sizes and containing the correct amount of road metal under one-quarter inch makes a road surface that will be cheaper and more easily maintained. The development of present modern portable crushing and screening units has made possible the use of this type of surfacing material. The increased cost of the crushed product is more than compensated by the greatly reduced maintenance costs. In most cases there is also a big saving in disposing of the oversize which is necessary if not crushed. Unless the oversize is hauled away on a screening job, it quickly blocks the operation and also blocks the pit. The same is true about rejected sand. The absence of oversize material and the superior binding quality of the crushed gravel eliminates to a great extent many of the causes of corrugated, rutted and chuck holed road surfaces.

REMOVING CORRUGATIONS

There are many different methods of removing corrugations. These consist mainly of:

1. The addition of more gravel to the road to smooth out the surface.
2. The use of blade graders which take the tops off the corrugations and level out the peaks and valleys.
3. The use of combination scarifier and blade graders which removes the corrugations and redistributes the loosened material over the surface.

The first two methods are by far the most common and least efficient. They only tend to hide the true condition which still remains. It is absolutely essential that the corrugations be removed completely as indicated in the third method.

For this work a scarifier is naturally better than a blade for while the blade can produce a smooth surface it will not remove the corrugation entirely as required. The combination scarifier and blade grader removes the corrugations and distributes the loosened material over the surface.

Long wheelbase and proper distribution of weight are also essential. The scarifier attachment should be constructed so that its action is positive. Likewise the blade control mechanism must be constructed in such a manner that it is capable of exact regulation and provision made for the elimination of circle play and other objectionable looseness in control devices, only the better designed graders have these features. Weight properly distributed also has an important bearing on proper grader performance. Long blades suspended on light short wheelbase graders can do no more than cause a series of long waves in the surface. The tendency of short wheelbase graders or road drags is to follow the irregular surface and the consequent bunch of gravel is the result.

Soft spots develop in the subgrade and excess surfacing material will soon be lost in these depressions with bare spots between.

With long wheelbase graders, independently operated scarifiers, and positive blade control it is possible to place and keep gravel roads in proper condition at a minimum cost. In other words it is cheapest in the long run to buy the best equipment.

Another and probably more practical method of reshaping a road is that of scarifying sufficiently deep to go through the crust entirely. This is very commonly done where the surfacing material is of uniform size—top and bottom. The heavier scarifier should naturally be used for this work. When the road is so scarified and dressed back, the whole surface will bind itself into a solid mass and in many cases is more satisfactory than trying to fill the small depressions and cut off the high spots.

Some of the more progressive counties are installing portable crushing and screening outfits and combination scarifier and blade graders, handled with tractors, for work such as described above. There are several firms making a special feature of such equipment. Names of these can be furnished by the editor of this magazine.

New maintenance outfit in Saguache county—one of the machines used to take the wrinkles out of gravel roads.

Repair Crews Improve Methods

TO keep traffic moving twenty-four hours of the day —that's the main object of the state highway department. And this traffic must always be moving over smooth surfaces, insofar as it is humanly possible.

In line with this policy the department through its materials testing facilities this spring devised a concrete mix that would stand traffic in twenty-four hours. This mix was used in making minor repairs on the Golden and Littleton paved roads leading out of Denver, where traffic runs as high as 5,000 vehicles per day.

The mix was designed by George Pierce, head of the testing laboratories, following a series of experiments. A very dry mixture of cement, sand and gravel was used, with a close check on the water content.

By the use of this new designed mix the repair crews were enabled to remove their barricades in two days, instead of keeping one side of the road closed for a week, as has been the case in previous seasons. Maintenance crews of both Jefferson and Arapahoe counties were using the method. Motorists were inconvenienced only slightly by the work.

"It's just a part of the work of the department in keeping traffic moving right along at all seasons of the year with as little inconvenience as possible," said Robert H. Higgins, state superintendent of maintenance.

"Experiments which are constantly being made by the department are enabling us to render the public a better service. While we have been learning a lot of new things about concrete and pavement maintenance, at the same time we also have learned a lot about dirt and gravel roads. New and improved methods are constantly being adopted. The experiences of one county are being passed along to the others through the medium of our district maintenance superintendents.

"The result has been that today we have, as a whole, the best roads to drive over to be found anywhere in the western country. There are other states which have more miles of hard-surfaced roads than Colorado, but there's none in this section that can surpass us in graded and gravel mileage.

"This is due to the splendid co-operative spirit existing between state and the county road officials. Road officials generally have come to realize that the motorist is paying the major portion of the expense incident to constructing and maintaining our highway system, and therefore he is entitled to the very best service that the road man can give for the amount of money expended."

The department long ago adopted the policy of keeping detours as smooth as possible. Before work on a new project has been started the detour was first put into first class condition to handle the traffic while the new job was under construction. It has been noted in several instances that the detour was better than the old road. Numerous sections of the state have been given first class graveled roads through the medium of detours, some of them several miles in length.

And while the highway department officials have been profiting by experience—and new problems come up every day—it is to be noted that Colorado road contractors have learned a few lessons—that is those who have stayed with the game. Of course, a good many of them have long since passed out of the picture through one cause or another. We find today contractors doing better jobs at less cost and in less time than formerly. First class equipment and improved methods are employed most generally.

The materials entering the construction of concrete pavements and gravel surfaced roads in Colorado are tested by the latest methods. From the time a concrete project is surveyed until the time it is accepted from the contractor tests of various kinds are made.

First there is a survey of available sand and gravel beds. These are charted and estimates of the cost of the project take into consideration the availability of these materials. Then there are tests made of soil conditions. Design of drainage structures depend upon these tests.

Constant tests for tensile strength of concrete are being made while the concrete is being poured. The cement that goes into the job is tested. Then when the job is finished cores are taken from the pavement and these are put on the testing block. Thousands of these cores have been taken from the pavements laid on state highways.

Inspectors employed by the department are constantly on the job while concrete is mixed and put in place on the subgrade. These men save their salaries many times over, in preventing the placement of faulty materials. Colorado's investment in hard-surfaced roads is too great to allow slip-shod methods to govern their construction.

State Highway "core drilling machine" at work on pavement near Castle Rock. These cores are tested for strength of concrete.

Markham Visits Denver to Arrange for Convention

W. C. Markham, executive secretary of the American Association of State Highways Officials, was in Denver on June 10, conferring with Major L. D. Blauvelt, president of the association, regarding arrangements for the annual convention to be held in Denver in October.

Mr. Markham spent several days in the state looking over the highways of Colorado in company with Major L. D. Blauvelt. Participating in the conference arrangements for the convention were June W. Johnson, district engineer of the U. S. Bureau of Roads, and Z. E. Sevison, state highway engineer of Wyoming.

Highway experts from all states and Hawaii will attend, said Mr. Markham. Delegates are expected to number more than 300, who have charge of the spending of $1,250,000,000 a year on highway work. An extensive study of mountain road work and tunneling will be made.

Mr. Markham makes his headquarters in Washington, D. C. It was the first trip he had made to Colorado in a number of years, and was surprised at the tremendous strides made in road improvements in this state during the past five years. He was very much interested in the methods employed in the construction of our mountain highways, especially the factors of safety installed by the road engineers.

The convention of the American Highway Officials is the most important road conference of the year. Those participating in the discussions are real road builders and not "just boosters." They are the men who have the say as to how millions of road dollars are expended in every state in the Union.

This is the first time the convention has been held in the Rocky mountain region.

"State Roads Not Designed for Heavy Freight"

Governor Fisher of Pennsylvania said in a recent message: "State roads were not designed as trunk lines for heavy freight. There must be no monopoly of the people's highways and neither shall they be destroyed by improper use."

Few will dissent from this statement provided that it does not imply a decision to exclude very heavy wheel loads forever from state highways. But we fear that the governor of Pennsylvania had in mind no plan of building highways that could be used for heavy freight, else he would have mentioned the plan.

When the wheel load on a bridge threatens its destruction, of course such a load should be prohibited. And the same holds true of a pavement. But that is quite a different matter from refusing to rebuild a bridge or a pavement so that it will safely support greater wheel loads.

Hauling by motor trucks is still in its early stages of evolution; but it has already developed so rapidly as to make it necessary to increase the thickness of pavements. Who can tell where this evolution will lead, or how rapidly our present standards of pavement design should be changed?

License and Gas Tax Revenues Per Vehicle, 1926, in the Eleven Western States

	No. Autos and Trucks	Average License per Vehicle	Aver. Gas Receipts per Car	Aver. Motor and Gas Receipts per Motor Vehicle
Arizona	73,682	$ 6.35	$ 13.28	$ 19.63
California	1,600,475	5.30	10.31	15.61
Colorado	248,613	6.06	8.41	14.47
Idaho	94,760	14.63	11.84	26.47
Montana	103,958	9.90	8.38	18.28
Nevada	24,014	8.74	16.90	25.64
New Mexico	54,996	9.34	13.87	23.21
Oregon	233,568	25.76	14.27	40.03
Utah	85,380	7.43	14.73	22.16
Washington	363,279	16.67	9.59	26.26
Wyoming	49,883	10.02	11.40	21.42
Totals	2,932,608	$120.20	$132.98	$253.18
		10.92 8/11	12.08 10/11	23.01 8/11

Gas Tax Revenues in Eleven Western States, 1926

	Rate	Total Receipts	State Roads	Local Roads	Collection Administration	Other
Arizona	2	$ 2,558,651	$	$ 2,549.069	$ 9,582	$
California*	2	16,502,123	8,251,062	8,251,062		
Colorado*	2	2,091,749	1,045,875	1,045,875		
Idaho*	3	1,122,217	1,115,397		6,820	
Montana*	2	870,712	131,002	477,707		262,003
Nevada	4	405,818	202,909	202,909		
New Mexico*	3	762,851	737,423		25,423	
Oregon	3	3,333,829	3,326,136		7,693	
Utah	3½	1,258,009	1,057,159		3,750	197,100
Washington	2	3,482,093	3,482,093			
Wyoming	2½	568,589	568,589			
Totals	35	$32,956,641	$19,917,645	$12,526,622	$53,268	$459,103

* These states have increased the gasoline tax as follows: California, 2 to 3c; Colorado, 2 to 3c; Idaho, 3 to 4c; Montana, 2 to 3c; New Mexico, 3 to 5c.

License Fee Revenues in the Eleven Western States

	Gross Receipts	For State Roads	For Local Roads	Collection and Administration	Other Purposes
Arizona	$ 467,795	$ 449,295	$	$ 18,500	$
California	8,477,233	3,721,415	3,192,285	1,034,404	525,129
Colorado	1,507,379	716,005	716,005	75,369	
Idaho	1,385,930	143,178	1,242,752		
Montana	1,029,383		989,595	39,788	
Nevada	209,920	64,676	131,811	13,433	
New Mexico	513,743	317,149	158,574	38,020	
Oregon	6,017,759	4,363,319	1,454,440	200,000	
Utah	634,048	634,048			
Washington	6,056,003	4,548,424	857,692	218,071	431,816
Wyoming	499,878	499,878			
Totals	$26,788,771	$15,457,387	$8,743,154	$1,637,585	$956,945

Our Cover Picture

This month's issue of COLORADO HIGHWAYS carries a view of a stretch of magnificent mountain scenery located between Divide and Florrisant, on the Colorado Springs-Leadville Highway. For a distance of thirty miles the highway follows the line of the old Midland railroad, which was junked several years ago. The right-of-way was deeded to the state by A. E. Carlton, Colorado Springs capitalist. Following a "water grade," the new highway between these points forms a picturesque link on one of Colorado's most heavily traveled roads.

Traffic Starts on Longmont Pavement

Continued from page 6

crete showed below 2,000 pounds compressive strength at seven days and much of it showed over 4,000 pounds at 28 days.

The construction progressed at a uniformly steady rate from start to finish, not by fits and jerks, and to that is due the very successful execution of the contract under none too easy conditions.

The entire job was marked by unusually fine cooperation between the engineers of this department, C. R. Lugton being in charge in 1926 and Clyde Walters in 1927, and the contractor, whose managing partner on the job, Robert L. Hanes, was responsible for the organization and direction of the contract to a creditable completion.

To complete the concrete paving between Denver and Fort Collins, the Miller construction concern is now engaged in constructing a six-mile paving project through the town of Lafayette to a point known as "Six Mile Corner", the present terminus of the paving extending south from Fort Collins. The same personnel and construction outfit used in the construction of the Longmont-Berthoud project are now employed on the Lafayette job. The latter job consists only of laying concrete pavement, the grading for the project having been completed last year by Contractor Frank L. Hoffman.

The route of new pavement is over a new line, extending west for a half-mile of the limits of the town of Lafayette, thence due north a distance of five miles on a "straight line", thus eliminating several right angle turns and curves on the present road. The old roadway will be used while the new construction is under way.

It is expected that the new project will be completed by late fall.

What Improved Highways Have Done for North Carolina

During the last five years the State of North Carolina has probably made greater progress agriculturally, industrially and socially than any other in the union in a similar period of time, writes Frank Page, chairman of the North Carolina State Highway Commission, in a recent issue of Public Roads.

The expenditure of $125,000,000 in improving the state's highway system during this time is given by Mr. Page as the chief reason for this remarkable progress. In proof of this statement he presents an amazing array of facts and statistics. During this time the number of farms increased by 13,000, while for the country as a whole the number of farms has decreased. Forty cooperative farm-marketing associations have come into being, and by means of the roads making accessible the trunk line railways and the main waterways, hundreds of carloads of poultry, eggs, fruit and vegetables never shipped out of the region before have been sent to all sections of the country. Roadside and city markets have stimulated the production of truck produce along with the tobacco and cotton crops. Certain lost provinces, formerly inaccessible by highway, have been recovered.

Cucumbers, peaches, strawberries and potatoes are shipped out of the state in quantities nearly four times as great as those of five years ago. The development of the roads has made possible diversification of crops in North Carolina and detailed facts showing increase in number and size of crops, due to the new practicability of trucking are given.

Motor registration shows an increase of 265 per cent over 1920. Buses have taken over the business of many local railroad branches which were circuitous and unprofitable. Rural schools have been built at cost of $35,000,000 to which the children are brought by 2,000 buses operating over the new highways.

20,000,000 Motor Vehicles Registered in 1926

More than 22 million motor vehicles were registered in the United States during 1926 according to reports received from state registration agencies by the Bureau of Public Roads of the United States Department of Agriculture. The year's registration represents an increase of 10.3 per cent, or slightly more than 2,000,000 more than that of 1925.

Florida with an increase of 40.2 per cent, not including non-resident registrations, shows a greater gain than any other state. Oklahoma, with a gain of 17.8 per cent, and second only to Florida in respect to the amount of increase, was followed closely by Alabama, Idaho, Louisiana, Mississippi and Utah, all of which had increases over 15 per cent.

Of the total number of vehicles registered, 19,237,171 were passenger automobiles, taxis and busses and 2,764,222 were motor trucks and road tractors. The increase in motor trucks and road tractors amounted to 13.2 per cent, which is somewhat greater than the increase for all classes of motor vehicles, indicating a continuation of the development of commodity transportation by highway.

Receipts from registration fees, licenses, etc., amounted to $288,282,352 as compared with $260,619,621 in 1925. Of the gross receipts $190,406,060 was available for highway construction under the supervision of the state highway departments, $51,702,184 was allocated to counties for expenditure on local roads and $25,274,158 was used to finance highway bond issues. The remainder was used for payment of collection costs and miscellaneous purposes.

New steel and concrete bridge which spans Boulder Creek, on stretch of newly graded road, which is now in course of paving, located north of Lafayette.

State Highway Department—Financial Statement, May 31, 1927

BALANCES DECEMBER 1, 1926

State Treasurer	$1,657,784.86	
County Time Warrants	15,000.05	
Total Balances..		$1,672,784.91

RECEIPTS

Half Mill Levy	$ 404,651.46	
Gasoline Tax	425,022.82	
Internal Improvement	46,400.00	
Federal Aid	522,097.67	
County Aid	53,703.19	
Miscellaneous	2,939.40	
Total Receipts..		1,454,814.54
Total Balances and Receipts		$3,127,599.45

DISBURSEMENTS

Federal Aid Projects	$758,958.99	
State Projects	94,694.51	
Maintenance	230,543.43	
Federal Aid Renewals	6,559.16	
Property and Equipment	2,862.11	
Surveys	8,047.24	
General Offices Administration	25,748.00	
Engineering Administration	19,351.96	
Road Signs and Traffic Census	23,803.36	
Total Disbursements		$1,170,568.76

BALANCES MAY 31, 1927

State Treasurer	$1,954,416.54	
County Time Warrants	2,614.15	
Total Balances..		1,957,030.69
Total Balances and Disbursements		$3,127,599.45

NEWS OF THE MONTH

Current Events in the Field of Highway Engineering and Transportation—State, County and Municipal Activities

Walsenburg and La Veta, centers of population in Huerfano county, are now linked with an excellent graveled highway, with the exception of a few miles. The gap was narrowed with the recent completion of another surfacing project.

Alignment of the highway north of La Veta was made to eliminate the steep grade over Pinon hill.

The highway from La Veta to the top of the La Veta pass is in excellent condition. A project of surfacing from the summit of the pass to the west is being finished. Snow guard fences have been installed along cuts through the mountains and it is proposed to keep the highway open next winter.

Work has been started on 17 miles of new highway on the reservoir road between Alamosa and Silverton. The contract was let to Winterburn & Sundsden of Creede for $62,000. Although work was started late in June the project will not be completed this year. The new road around the Farmers' Union reservoir above Creede will be widened from the old width of seven feet to twelve feet. The river bridge will be eliminated with a change of the road through to the dam on the same side of the river.

The Monument-Eastonville highway in El Paso county is being elevated so that the winter winds will sweep it clear of snowdrifts.

This spring the county elevated the Pike's Peak Ocean to Ocean highway in the county.

Pueblo county will not accept the offer of Boone Best, warden of the Colorado penitentiary to "farm out" convicts for highway building purposes. Under the recent offer of Best, the convicts would be provided to the various counties with the provision that the counties supply their camping equipment and food.

Pueblo commissioners stated that unless there was a large project, the undertaking would be too expensive.

El Paso county also declined Best's offer with the explanation that there are too many unemployed men in the county who need work to use convicts.

Late in June the $70,000 federal aid project just west of Gunnison was opened to traffic, including two new concrete bridges. The work was done by the Lambie-Date Construction Co.

The new road into the famous San Isabel sand dunes from Alamosa will be opened during July. The new route will eliminate the rocky stretch and also the heavy sand. All gates will also be abolished. The road leads to the sand dunes, which are visited annually by thousands of tourists.

Highway improvements in Huerfano county during the summer will amount to $55,000. The principal work will be completion of the La Veta-Walsenburg highway at a cost of $50,000. An overhead railroad crossing will be constructed at Walsen.

On the Gardner highway two bridges will be built, one over Turner arroyo and the other over Williams creek. Curves in the road near the two bridges will be decreased.

B. B. Allen, state highway commissioner from the Durango district, recently returned to Durango after a lengthy recuperation from an operation performed in Pueblo.

The recently completed state and federal aid surfacing on six miles of the Alamosa-Antonito highway leading to Cumbres pass has been accepted by William Walsh, highway supervisor for the district. The $50,000 project improved the only bad stretch of road on the highway leading south from Alamosa.

State highway officials have made a survey of the road from Durango south to the New Mexico line. The preliminary survey from Aztec, N. M., to the Colorado line has also been finished by the New Mexico highway department. The survey provides for a highway from Durango to Aztec on the west side of the Animas river.

The new road will still pass over the hill above Cedar Hill, N. M., but the grades will be lessened. The road on top of the hill will be straightened.

Discussion of the matter of the Colorado river basin was taken up at a meeting of the County Commissioners' Association of the Second Highway District held June 27 in Eagle. Several prominent Coloradoans addressed the meeting.

The distance between Pueblo and Florence will be shortened three miles when proposed work in Fremont county is completed. Surveys have been made for an expenditure of $150,000 to improve the road from Rainbow park to Portland. A new right-of-way to eliminate the present railroad crossing; installation of a new overhead crossing and erection of wider bridges over creeks west of Portland are involved.

Present work near Portland includes a new bridge and viaduct over the Arkansas river and the Denver & Rio Grande Western railroad tracks, new bridges over Bear and Beaver creeks, paving from the west end of Portland to the new viaduct and considerable gravel surfacing and new smaller bridges.

Chaffee county has acquired the abandoned Colorado & Southern right-of-way between Buena Vista, Nathrop and Romley for less than $800. The roadbed will be used for a vehicular highway. An attempt will be made to secure state aid in improving the route.

Chaffee county fought to keep the Colorado & Southern. The state courts favored the county but the United States supreme court reversed the state courts.

The highway will again reopen the famous old Murphy mines, it is believed.

Members of the Arkansas Valley Association of County Commissioners on July 2 met in Canon City to discuss highway problems and to attend the rodeo program arranged by Canon City for the holidays.

Speakers included W. L. Rees, president of the Colorado Association of County Comm'ers; G. L. L. Gann, member of the state highway advisory board; T. Lee Witcher, Canon City; John B. Bald, Florence; Mrs. Dorothy L. Stevens, Canon City; Mell DeWitt, Salida; Ray McGrath, Lamar.

The next meeting will probably be held the week of the Colorado state fair in Pueblo, Sept. 5 to 9.

A new one-piece crusher recently purchased by Fremont county, has made it possible for the county to do twice as much surfacing with the same expenditure. The commissioners declare that it costs only 75 cents a cubic yard to place the crushed rock on the highways. The crusher has established a record of 125 loads a day.

The crusher is now being used on the main highway between Florence and Canon City. The work will be completed in August. A two-inch layer of crushed rock and gravel is being spread. The authorities believe that it will last for five years with only slight attention.

The road from Florence to Wetmore will be surfaced late in the summer.

Gunnison county has purchased a new portable rock crusher for general use in the surfacing and maintenance of county highways.

The scenic mountain route through the San Isabel national forest between Rye and Beulah will be opened about the middle of August by Pueblo county. Road crews are now rebuilding and surfacing the six miles between Rye and the forest boundary. The remainder of the highway has been completed with forest service funds.

CALIFORNIA TO OIL 700 MILES OF ROADS

The state of California plans to oil 700 miles of crushed stone and of gravel roads during the year at an estimated expense of $600,000.

Editor Gives Boost to Pueblo County Officials

Just a boost for the road officials of Pueblo county.

Recently we made a trip over four "spokes" of the highway system leading out of the city of Pueblo. In each case the roads were smooth and showed evidence of careful and systematic maintenance.

These roads include those leading to Walsenburg, La Junta, Canon City and Colorado Springs. Each of these roads form a part of the "state highway system" and are maintained by the patrol system. Roads such as these carry the fame of Colorado to the far corners of the country, and our summer visitors will take home with them a good word for our highway system and matchless scenery.

If every county in the state took as much pride in their roadways what a whale of a pleasure it would be for everybody who drives a car for pleasure and business. "A stitch in time surely saves nine" in this maintenance game.

The commissioners of Pueblo county are W. L. Rees, O. G. Smith and Herbert Wilson. Mr. Rees is president of the State Association of County Commissioners.

Tourist Traffic in Missouri

In order that an estimate of the expenditures by tourists in Missouri in a year could be determined a number of questionnaires in the form of postcards were handed out to tourists, over the state during August and September, 1926. Approximately 2,100 of these cards were mailed in to the state highway department by the tourists.

The 2,108 cars reporting carried 7,201 passengers and stayed in the state 22,495 days. The total expenditures reported by the occupants of these 2,108 cars was $155,364. The total mileage of the cars in the state was 1,191,252.

The following is a summary of the replies:

Expenditure per car per trip	$73.70
Mileage per can per trip, average	565.1
No. gallons gas per car at 14 2-7 mile per gallon	39.5
Amount gas tax per car per trip	$ 0.79
Average No. days in Missouri per car	10.7
Average expenditure per day per car	$ 6.90
Average No. of passengers per car	3.4
Average expenditure per passenger	$21.50
Average number of miles per day per car	52.0

Of these tourists 34 per cent camped; 38 per cent stayed at hotels; 20 per cent stayed at private homes; 8 per cent went straight through.

The count included cars from every state in the Union, also a car from Mexico and one from Canada.

Assuming the length of the tourist season as 185 days and computing from detail data collected by questionnaires and traffic count, it is estimated that $61,000,000 is spent in Missouri each year by tourists.

TOLL TAX AND GAS TAX

Statistics gathered by the Kentucky Highway Commission show that if the auto user of today were required to pay the same amount of toll, per mile, that the preceding generation paid for the use of the Kentucky highways, the gas tax in the state of Kentucky would have to be 35 cents per gallon instead of the present 3 cents per gallon. In other words, it would require a gas tax of 35 cents per gallon in order to approach the toll tax, per mile, paid by the early day Kentuckians for the use of the toll roads.

MOTOR TRUCK PRODUCTION IN 1926

Over 530,000 motor trucks were made in 1926, according to statistics of the National Automobile Chamber of Commerce. Included in this total are approximately 15,000 motor buses. The truck production in 1925 was 497,452 units; in 1924, 374,317 units; in 1923, 392,760 units.

Status of Road Work in Delaware

During 1926 the Delaware State Highway Department let 38 contracts, 35 of which were on road contracts totaling 91.95 miles, and 3 were on bridges. The total estimated cost of the work was $2,429,233.56. Of this amount, $1,959,909.04 was spent on road construction.

Types of roads for which contracts were awarded include 46.64 miles of concrete, 10.97 miles of sand asphalt, 0.8 mile of amiesite resurfacing, 22.87 miles of slag-clay secondary roads, and 10.67 miles of concrete widening to existing pavements. Work carried over from 1925 totaled 19.15 miles while work carried over into 1927 totaled 16.5 miles. Work already completed and under way provides for 16½ per cent of the total road mileage of the state, or 592 miles.

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

Agency for the celebrated Waugh portable compressors and hammers manufactured by the Denver Rock Drill Company, has been taken over by the H. W. Moore Equipment Company, Denver, for the states of Colorado and Wyoming. The Moore firm will sell to road contractors and county officials.

James Griffin and J. D. Clark have joined the Moore sales force during the past month. Griffin will travel the Wyoming territory, while Clark has charge of city sales in Denver.

Sale of a carload of Jaeger concrete mixers was announced by George Meffley, sales manager. He also reported the sale of a Cedar Rapids crusher to Delta county, a Wehr grader to Gilpin county, and a Galion easy-lift grader to Winterburn & Lumsden, who have a road contract near Creede.

All records for the sale of Adams leaning wheel graders in all the various sizes have gone by the boards this season, according to Elton T. Fair, sales agent of the J. D. Adams line in Colorado and Wyoming. "We have placed more graders this year with counties and contractors than during any previous year," said Fair. "Several of the counties have standardized in Adams graders and maintainers. Sale of Adams road maintainers for removing corrugations also has passed all of our early expectations." A new booklet on "how to maintain roads" written by experts and based upon more than 20 years experience is now being distributed by the Fair Company.

Wilson Machinery Company sold two Austin-Western graders during the month of June. Sales on Koehring mixers, both pavers and in the smaller sizes were very good, and the demand for small equipment, kept the sales force busy during the month. A Barber-Greene ditcher was one of the sales for the month. Ray Corson is now in charge of the city sales. Recently the Wilson firm took over the Colorado agency for Blaw-Knox concrete working equipment. Harry Wilson, president, reported a brisk business in this line during June.

Herbert N. Steinbarger made a sales trip over the southern Colorado territory during the month and returned to the office with a number of nice orders from county commissioners. Most of this equipment was on the Russell line of road machinery. A number of Rex concrete mixers were placed during the month. Russell recently brought out an improved portable crusher outfit that is attracting considerable attention among road officials.

The Russell Motor Patrol No. 5, is the latest of road maintenance machines made by the Russell Grader Mfg. Co., of Minneapolis. Like their other motorized patrols, it is the practical adaptation of the Russell model—blade and scarifier mechanism—this time to the Cletrac tractor.

With the "Cletrac K-20" tractor for power, this new unit is built for light and quick as also for heavy and slower work and designed to insure economy, better execution, better service and lower up-keep cost.

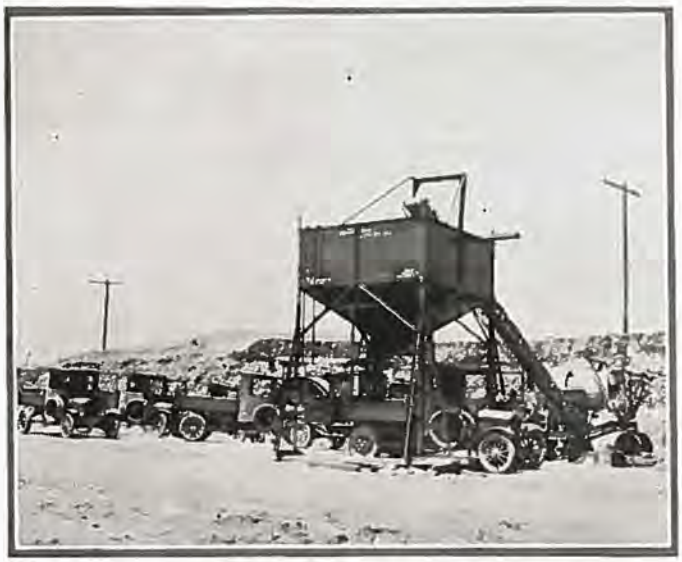
The standard length of blade with the No. 5 is 10 ft. However, other lengths are furnished. The back of the blade is reinforced by two heavy angle-irons, which support the blade. The circle supporting the blade is 52 in. in diameter, affording wide and rigid support. A clamping device on the circle locks it and prevents all play.

Monarch Tractors Corporation, Springfield, Ill., has announced a new 6-ton tractor known as the model "H," which differs somewhat in appearance from other types of tractors, having exceptionally long track members, the body of the tractor is low, and the steering wheel and column are of the truck type.

This new tractor is powered by a 4-cylinder Stearns-Monarch motor, with 5⅛-inch bore and 6½-inch stroke, developing 60 horsepower. The crank shaft is 2⅞ inches in diameter, with extra large bearings. The transmission provides 3 speeds forward, 1.86, 2.82, and 4.07 and one reverse, 3.26, but the gear ratio can be changed by installing larger transmission sprockets. Steering clutches are of the multiple disc type, and are outside of the transmission case, allowing easy adjustment.

The Koehring Company, Milwaukee, Wisc., has developed a 5S mixer which, it is claimed, embodies the latest improvements making for fast operation, along with light weight, compact design and sturdy construction. It will handle a one-bag batch of 1-2½-4 concrete. Designed for convenience and speed, the charging skip is low enough for wheelbarrow charging without building elevated runways or platforms. It is roomy and sufficiently long to chute the materials into the drum in one swift slide. The chute has a clearance of 27 inches, which allows wheelers to load barrows from the side or end according to the location of the mixer. The Koehring automatic water measuring tank is equipped with an indicator graduated in gallons for accurate and quick measurement.

Central lubrication from the operator's platform has recently been installed as standard equipment on the Smith 27-E six-bag paver, which is stated to enable the operator by simply pressing a lever with his toe, to force lubrication simultaneously to the bearing surfaces in the machine. One man is stated to be now able to do the work of 30 in a fraction of the time, and the ease with which this central system is operated not only insures perfect and consistent lubrication, but encourages frequent attention on the part of the operator.



Fremont county's new portable gravel crushing plant—showing set-up between Florence and Canon City.

$75,000,000 Highway Contract Awarded to Warren Brothers Co.

The contract for constructing the Cuban central highway has been awarded by the Cuban government to Warren Brothers Co., Boston, Mass. This highway extends from Guane at the western end of Cuba to Santiago de Cuba at the eastern end and is 750 miles in length. About 8,000,00 square yards of pavement are to be constructed of which about 7,000,000 square yards will be Warranite-bitulithic pavement. The balance will be granite block pavement. Through the towns and cities the highway is to be 25 feet wide; the remainder will be 20 feet in width. The contract amounts to $75,896,653. The Cuban government undertakes to pay for the work from funds collected in special gasoline and other taxes. Payments will be made from time to time as the work progresses. It is estimated that eight years will be required to pay for the entire job, but if through increases of taxes or by other financial arrangements the government is able to make earlier payment the work can be speeded up. The contractor, for instance, agrees to do the work in five years provided the funds are available to pay for it at that rate.

FOREST ROAD FUND APPORTIONED

Apportionment of the $4,500,0 0 forest highway fund for the year beginning July 1 has been announced by Secretary Jardine as follows: Alaska, $361,500; Arionza, $243,500; California, $575,000; Colorado, $312,000; Idaho, $462,500; Minnesota, $36,800; Montana, $361,000; Nebraska, $4,595; Nevada, $83,887; New Mexico, $186,000; Oregon, $533,000; South Dakota, $33,600; Utah, $164,600; Washington, $415,000, and Wyoming, $200,000.

The money will be expended for highways in or adjacent to the national forests, in accordance with programs for the various states adopted at conferences between state highway commissioners and officials of the Forest Service and Bureau of Public Roads.

PROJECTS ADVERTISED FOR BIDS

Proj. No.	Length	Type	Location	Bids Opened
550	5.664 mi.	Grading	Loveland Pass	July 5, 1927

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

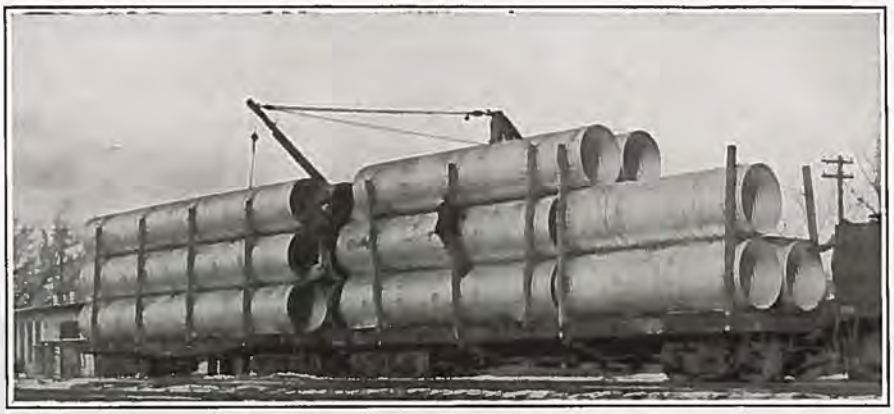
Proj. No.	Length	Type	Location
2-R5	1.959 mi.	Asphalt Paving	South of Aguilar
275-E1	0.926 mi.	Grading and Underpass	North of Monument
258-E2	1.41 mi.	Gravel Surfacing	Cimarron
279-D	0.261 mi.	Concrete Paving	Morrison
300-A	1.008 mi.	Grading	Chattanooga
210-B	7.507 mi.	Gravel Surfacing	De Beque—Grand Valley
247-C	0.8 mi.	Conc. Pav. & R. R. Underpass	Swink
222-C Reop.	0.4 mi.	Paving	South of Lafayette
246-F	1.0 mi.	Paving	West of Avondale

PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
138-A	10 mi.	Gravel Surfacing	North of Kremmling
2-R6	6 mi.	Asphalt Paving	South of Aguilar
279-F	3.3 mi.	Grading	North of Baileys
287-D	0.5 mi.	Gravel Surf. & Underpass	East of Kersey
288-A2	9.5 mi.	Concrete Paving	Between Brush and Merino
288-A3	3 mi.	Grading & R. R. Grade Separation	Northeast of Brush
296-C	5 mi.	Gravel Surfacing	North of Greenhorn
297-A Reop.	2.85 mi.	Gravel Surfacing	East of Palisade
560	3 mi.	Gravel Surfacing	Deer Creek-Littleton

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	$ 28,882.70	14	2-R3
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	331,632.00	95	2-R4
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	100	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	72	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	66	144-A1
145-A	West of Glenwood Springs	3.807 mi.	Gravel Surfacing	Winterburn & Lumsden	53,227.90	14	145-A
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	67	157-A
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	100	213-D
254-C	Div. 1 2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	100	254-C1
254-C2	S. W. of Hot Sulphur Springs	Superstr. of Bridge & Approaches		Northwestern Constr. Co.	48,203.50	0	254-C2
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	8	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	100	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	43	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	26	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	72	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	100	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	40	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	60	271-B
275-C	Div. 2 East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,466.60	53	275-C2
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	75	275-F1
275-F2	Castle Rock, south	5.227 mi.	Paving	J. Fred Roberts & Sons	119,027.80	16	275-F2
275-G	Larkspur-Monument	10.869 mi.	Grading	Monaghan-Cunningham Con. Co.	141,252.78	39	275-G
276	North of Colorado Springs		R. R. Overpass	J. L. Busselle & Co.	37,913.00	25	276
279-E	Schaffer's Crossing-Baileys	3.243 mi.	Grading	S. M. & S. J. Feely	54,305.60	20	279-E
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	100	281-D1 251-B1
251-B2 & 281-D2	Lafayette, north	5.813 mi.	Concrete Paving	J. H. Miller & Co.	146,315.00	0	251-B2
281-E	At Lafayette	0.812 mi.	Paving	J. H. Miller & Co.	27,226.00	0	281-D2
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	0	281-E
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	82	282-D
287-A2	Fort Morgan, west	4.011 mi. 16.61 mi.	Concrete Paving Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	100	283-C
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier C. Eng. Co.	159,950.85	43	287-A2
290-D	East of Las Animas	2.954 mi.	Concrete Paving	W. A. Colt & Son	88,979.50	0	287-C1-2
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	28	290-D
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,645.25	82	292-A
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	80	293-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Cole Brothers	58,061.00	100	295-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	100	296-B
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	82	297-B
							299-A



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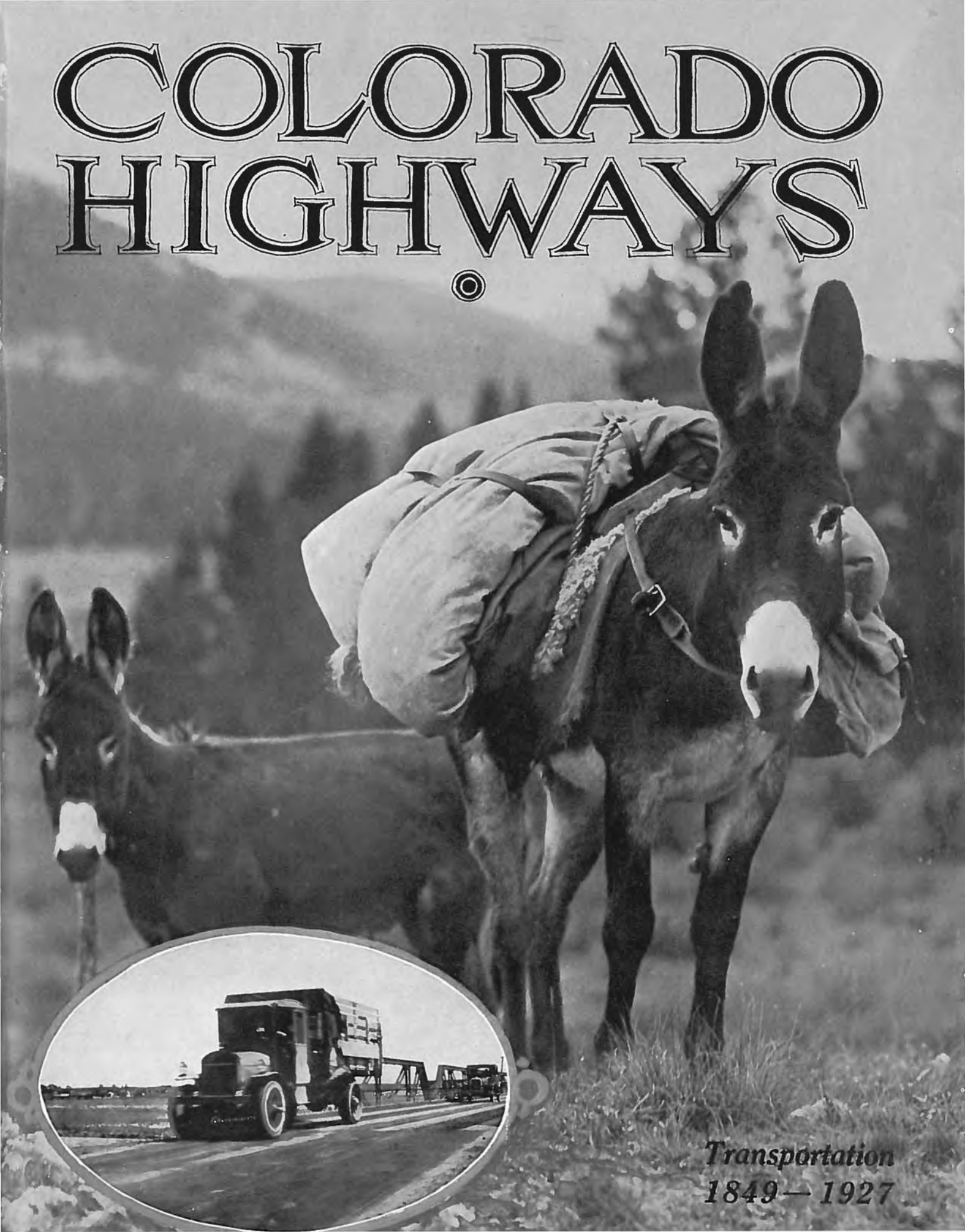

Transportation
1849—1927

Pikes Peak-Ocean to Ocean Highway, Mesa County, Colorado

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Official Publication of the
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M. W. BENNETT, Editor

Articles on the subject of road building and highway development in the West are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible. Manuscripts not found available will be returned promptly.

10 CENTS A COPY. **$1.00 A YEAR.**

Our Cover Picture

"Transportation, 1849-1927"—that's the title of Colorado Highways' cover picture this month. It illustrates the mode of travel in this western country in the days of the early gold rush, as compared with the swift movement of freight over hundreds of miles of modern concrete pavements. The picture of the pack mules is copyrighted by the Rocky Mountain Photo Co., and was taken by Louis Hollard, near the summit of Hoosier Pass.

Colorado Highways
"BETTER ROADS"
VOLUME VI. AUGUST, 1927 NUMBER 8

Editorial

SUITABLE tree planting along public highways, which greatly enhances their appearance and comfort, is most satisfactorily done by the community as a whole rather than by individuals, it is advised by the United States department of agriculture.

Interest in country highways throughout the nation has increased rapidly during the last few years.

The greater interest in rural roads is due largely to the growing automobile traffic, a large part of which is pleasure driving in which the most beautiful routes are naturally sought. The marvelous scenic grandeur of Colorado, for instance, has attracted three-quarters of a million tourists into our own state annually. About two-thirds of these visitors motor over the highways.

The traveling public has as much interest in the appearance of the road as a whole as the adjoining property holder. Sometimes it is difficult to get the property holder to approve and act on a given plan of tree planting beautification.

For these reasons, the department of agriculture says, it is best to place the planting and subsequent care of roadside trees in the hands of a public body representing some division of the state, county, town, township or parish, rather than leave the matter entirely to the individual land holders.

Community effort of any nature has a civic and cultural value which must not be overlooked.

Because of the intimate relationship between road construction and maintenance and the upkeep of the roadside, the closest co-operation between the highway department and those having trees in charge is needed.

Suggestions relative to planning for trees, planting and placing them, kinds to plant, pruning, arrangement of shrubs and perennials and other phases of the work are given in a publication which may be obtained free from the United States Department of Agriculture, at Washington, D. C.

City Auto Traffic Problem

NAMING the solution of city traffic as the next big job for highway engineers, Pyke Johnson representing the National Automobile Chamber of Commerce has set forth some major aspects of this task in his address before the Highway Research Board as given in the proceedings of that body to be issued shortly.

Opinion of the automobile industry was sought by this engineering group with respect to the problems which seem to be most pressing for the immediate future. Mr. Johnson's answer was based on a compilation of views of leaders in the business, who stated their ideas of the chief opportunities for research, as follows:

1. "Further safeguarding the lives of those who use our highways"—Roy D. Chapin.
2. "More scientific management of traffic"—A. H. Swayne.
3. "Outstanding problem is parking of cars in down town areas"—Alvan Macauley.
4. "Relating size of office buildings to street capacity"—H. H. Rice.
5. "Applying production methods to highway building to lower the cost"—Fred J. Haynes.
6. "Research into headlights, fuel economy and elimination of gear shfit"—John N. Willys.
7. "Trunk line roads which by-pass congested centers"—A. J. Brosseau.
8. "United efforts of city executives, city engineers, and property owners"—Edward S. Jordan.

Downtown freight terminals and yards of the railroads are a source of congestion today, the speaker indicated. Research into the relationship of street traffic facilities with those of the railroads and the waterways can bring about a more efficient flow of traffic at lower cost to all, Mr. Johnson asserted.

Cost of Poor Roads

An automotive engineer found that in one year the average automobile consumption of gasoline in North Carolina was reduced, by improved roads, from 521 to 454 gallons. That made a saving of $16.76 per car.

Fuel, however, is only one of the various factors involved. The poor road wears out the whole car faster than the good road. The expense thus caused is far higher than most owners suspect.

An automobile dealer in Colorado, who carefully checked up the expense of operating on paved roads and dirt roads, found that the motorists saved, on an average, 2.4 cents a mile on the hard-surfaced highways. Another investigator put the saving a little higher. The average may be 2.5 cents a mile. Motor trucks may save as much as 5 cents a mile on good paved roads as against unimproved roads.

This is many times as much as any motorist or trucker pays in the form of road taxes on gasoline or otherwise.

Future Colorado Paving Plans

By Ralph Taylor

BY 1930 the entire 120 miles between Pueblo and Denver will be paved with concrete if present plans of county officials and state highway officials materialize. The three largest cities of the state, which are the homes of half the population of the state, will then be linked with the highest type of highway.

Work is now under way on the last lap of unpaved highway between Colorado Springs and Denver. Surveys are being made for ten miles of concrete in El Paso county to extend southward from the present paving six miles south of Colorado Springs. The project will extend through Fountain. Three to five miles of paving will be laid on the highway north of Pueblo next year, according to present plans. Almost half of the distance between the two cities will be completed next year, leaving the balance for 1929 and 1930.

It is proposed to start the Pueblo county paving at the Pueblo-El Paso county line, extending southward to Pinon. This stretch of highway is the greatest distance from Pueblo and is harder to maintain. For that reason Pueblo county officials believe it should be paved first. A few years ago the northern part of the road in Pueblo county was surfaced with shale. Because of the distance from Pueblo, it was necessary to ship the shale to the nearest unloading point and truck it to the highway at considerable expense.

It is pointed out that a paved route causes motorists to driven even out of their way to enjoy it, and for that reason the three largest Colorado cities would all receive more tourist business.

A traffic census now being taken on the north and south highway passing through Pueblo shows that three out of every four automobiles entering and leaving Pueblo are out-of-state tourist cars. The survey shows that there are approximately 2,000 motor vehicles using the Pueblo-Colorado Springs highway during the daylight hours of each day. The license tags disclose that 1,500 of the cars are those of non-state residents. The traffic south of Pueblo totals about 1,200 cars daily, with the same ratio of tourists.

The new census has disclosed why the highway should be paved, according to state highway officials, who point out that with the regular state traffic the matter of maintenance would be easy with a gravel surfaced roadway, but with three times as many tourists, the only surfacing to withstand the traffic economically is concrete.

It has also been shown that the tourists bear the same proportion of expense of paving in relation to the state-owned vehicles as in the volume of traffic. With three times as many tourist cars as resident automobiles and trucks, the tourists use three times as much gasoline and in turn pay the excise tax in the same ratio.

Within a few years it is planned to have the entire north and south highway paved from Wyoming to New Mexico. The highway carries more traffic than any other state artery of travel. Although the City and County of Denver earns more highway fees than any of the other six highway districts, it does not have a single mile of federal highway within its limit upon which to apply the funds. Through its highway representatives it determines where the money shall be applied. A large portion of this money has been spent on the north and south highway north of Denver, between Colorado Springs and Denver and north of Trinidad. The same co-operation is expected to continue until the state's most important arterial highway is paved.

About 55 miles of the Highway No. 1 is through Pueblo county. The paving contemplated for next year will be the first on the route in Pueblo county. Pueblo county has in past years applied its paving money on the Santa Fe Trail because more business enters Pueblo from the Arkansas valley than through any other channel and the trail is the hardest road in the county to maintain without concrete. The trail paving is now within less than two miles of Avondale, 18 miles east of Pueblo. Work has just been started on an additional 1.239 miles of paving.

Pueblo county would have 15 or 20 miles more paving if the 1921 Pueblo flood had not dearranged the road building program. Because many of the large bridges in the county were washed away by the swollen streams, the paving funds were converted into bridge building.

The middle of October will see the pouring of the last concrete between Denver and Fort Collins on State Road No. 1, and another two or three weeks the entire stretch open to traffic.

This will be good news to thousands of motorists who use this highway, occasionally or frequently. But it will be good news also to people who never use this road, for the Denver to Fort Collins route has been one of the most expensive to keep up, and paving the route will stop this drain on maintenance funds and make this money available for use elsewhere.

View of newly finished state highway near Husted, on the Denver-Colorado Springs paved road, showing new U. S. Highway marker.

Showing newly constructed steel and concrete bridge over Arkansas River near the town of Portland.

When completed it will give a ribbon of concrete pavement 65 miles in length through one of the richest irrigated sections in the world, and will give Colorado a continuous stretch of pavement over 100 miles in length, forming an important link in the "back-bone" of Colorado's splendid highway system.

"From the standpoint of road cost alone, the paving of this route will mean a large saving to the state," Highway Engineer Blauvelt stated. "Then there is the saving to vehicle owners in time saved, wear on vehicles and tires, fuel saving, and the assurance that they have a road that will be open at all times except possibly in severe snow storms.

"But the paving of this road has greater significance. It is a connecting link between the largest market center in the Rocky Mountain west, and one of the richest agricultural sections in Colorado."

At present work is progressing on a six-mile stretch of the highway between Lafayette and what is known as "Six-Mile corner," both located in Boulder county. This work has been contracted by J. H. Miller & Co. and concrete has already been poured on nearly two miles of the project.

This is one of the most heavily traveled routes in the state—the average daily traffic running more than 1,500 vehicles. It is one of the routes where traffic is concentrated 24 hours of the day. Traffic has been so heavy on the road in recent years that hundreds of tons of gravel have been used in filling up the mud holes and keeping the surface in all-weather condition, thus adding materially to the maintenance cost.

In completing this strip of highway Colorado will have one of the longest stretches of continuous concrete in the United States. Minnesota now has the longest continuous stretch of concrete highway in the world: 135.5 miles from White Bear to the City of Duluth. The next longest concrete pavement is from Olympia, Wash., to Vancouver, 135 miles, and the third is from Kansas City to Columbia, Mo., 125 miles.

There are longer pavements, but they are of a variety of materials. The car owner can now drive from Greeley to Castle Rock, via Denver, over pavement, a distance of ninety miles, with the exception of a short strip of two miles located on York street in Denver.

The pavement already laid on these roads points very forcibly to the fact that gravel has very definite limitations. It makes an economical, all-weather road for light traffic, but with heavy traffic it breaks down in wet weather and it is difficult to keep in good condition even in dry weather. Where traffic is heavy, pavement is cheaper than gravel, figured on the cost per vehicle per mile.

With pavement perfected by the co-operative research work of many state highway departments and other agencies, the pavements now being laid form a more durable highway surface than the world has ever known before. With unusually wet weather through the fall, winter and spring—yes, and this summer—so that at times nearly all the unpaved roads were difficult of passage, the paved roads carried a heavier load last spring than they have carried in mid-summer in other years. Yet they came through this period without a serious break.

The average cost of concrete pavement in Colorado is $32,000 per mile, while the average cost of standard gravel surfaced roads is $11,000 per mile.

On August 15th the Highway Department awarded a contract to Edw. Selander, Fort Morgan contractor, calling for the construction of ten miles of standard 18-foot concrete pavement, located between Merino and Brush on State Road No. 2. The total cost of this project will be $245,043. The contractor is allowed 200 working days in which to complete the project.

The project calls for the laying of 102,750 square yards of concrete pavement, on which Selander bid $2.07 per square yard. There were five bidders on the work. With the completion of this project there will remain only two miles of unpaved roadway between Sterling and Fort Morgan. The work of paving this short strip will be carried out in 1928.

State Road No. 2 acts as a feeder for the traffic "coming off" the Lincoln Highway at Julesburg into Colorado. Grading and gravel projects now under way between Greeley and Fort Morgan, when completed this fall will find this a "boulevard" from the state line at Julesburg all the way to Greeley. Each season finds thousands of tourists from the east using this highway.

View of 6-span State Highway concrete bridge over Rio Grande Del Norte River near Alamosa.

If You Are Doing Forty-five, How Far Are You Going in a Second?

Ever Figure It Out?

Miles Per Hour	Feet Per Second
10	14.66
15	22.00
20	29.33
25	36.66
30	44.00
35	51.33
40	58.66
45	66.00
50	73.33

Sixty-six feet per second—that is the distance you are traveling every second if you are doing forty-five miles.

That is exactly the distance across the road from fence to fence.

Figures and estimates like these have vital bearing upon matters of safety on public highways in these days of high speed motor vehicles.

If you have brakes on two wheels only you can't expect to stop, according to the best records, short of 187 feet—three times the distance across the road.

If you have four wheel brakes you may be able to stop in 124 feet—twice the distance across the road.

That is the best you can expect to do with everything in perfect order, dry road, good brakes, and everything, including yourself, in tiptop A-1 shape.

If you are going fifty miles an hour you are doing 73.33 feet every second of time and it will take you, at the best you can do, nearly a city block to get stopped. At seventy-five feet per second do you wonder that you and your car can be off the road, in the ditch, upside down, and you dead, inside of a single second?

Thousands of accidents on the highways are due to poor or mistaken judgment as to speed, how fast a car is traveling and particularly to wrong guesses as to where or in what relation your own car, another approaching car, or a train will be in one or two seconds hence.

Many drivers have a faculty amounting to almost a sixth sense when it comes to estimating almost the exact spot where two approaching cars will be at the moment of passing even though each may be passing at greatly varying speeds. The same faculty, under more difficult conditions, comes into play in preparing to pass a car ahead when another car is approaching from in front. The value of this sense or faculty whatever it may be lies in so timing speed that without conscious effort the point of passing is managed so that the three cars are not passing at the same instant. When this sense or faculty fails to function properly when both a car and a railroad train are approaching a crossing at the same time, a tragedy results.

Study the table at the head of this article—get the figures for 20, 30 and 40 miles per hour in mind—then practice estimating how long it takes you to reach, for instance, a railroad crossing or a dangerous turn. You will probably be astonished at how quickly you approach such points and how quickly things may happen when you are doing just thirty miles per hour.

Two views showing snow removal on Independence Pass during month of June—making ready for early travel to Pitkin County points.

Ute Trail Highway Proposed

Historic Ute Pass trail, made by the bands of Piute Indians as they changed their hunting grounds from the prairie country to the mountain fastness with the seasons, is to be converted into a modern mountain highway on which pleasure-bent plainsmen can ride into the Colorado Rockies to hunt game, health and pleasure.

The Ute Pass highway from Manitou to Cascade is inadequate to properly serve the summer traffic, it has been pointed out by El Paso county officials and M. A. Ege, member of the Colorado state highway advisory board from the fifth district. The tourist traffic, commercial passenger carriers, regular commercial travel between the resort towns on the Ute Pass road and the through traffic on the Pikes Peak Ocean-to-Ocean highway, of which the pass is a part, is congesting the scenic road, officials report.

"The proposed highway over the Ute Pass trail has always been considered by the state highway department as a necessary project for the future after the demand for commercial highways throughout the state have been cared for," according to M. A. Ege, "but now it has become a necessary project much earlier than anticipated. Serious congestion on the present road makes some relief a matter for immediate attention.

"Popularization of such Ute Pass communities as Chipita park, Cascade and Crystola has added tremendously to the traffic already carried by the existing road to Cripple Creek and to the Pikes Peak automobile highway."

The proposed route will not be exclusively scenic but, as pointed out, will be essential. Mr. Ege will submit plans to the state highway advisory board at its November meeting when the 1928 budget will be made up, providing for opening of the trail which was first used by Indians and later by early pioneers en route to the Cripple Creek and Victor gold fields.

Preliminary surveys show that opening of the new route will be more feasible than widening of the present highway, due to the massive rock formations.

If the proposition is accepted, work on the project will be started next year. When the new road is completed, it will become a one-way highway, reducing hazards now existing on sharp curves and grades. Westbound traffic would use the new road which would be of an easier grade than the old road, which would be converted into a one-way route for downbound travel, under the proposal.

Get Parking Space Advice to Vendors

Traffic Hazard Created at Many Chicken Shacks and Hot Dog Stands

When you buy or rent land for a vegetable stand get a little extra space for parking. This is the advice in a bulletin from the State Highway department.

The department is looking into the traffic hazard created by refreshment stands that are built too close to the trunk highways. No commercial stand is permitted on the right-of-way on any trunk highway, but numerous stands have been built right up to the edge of the right-of-way. Where the traffic is not too heavy and the distance from the main traveled roadway to the edge of the right-of-way is reasonably wide, this may not do much harm, but in many cases where traffic is heavy, parking in front of stands facing the highway has created congestion which often leads to accidents. In many cases the difficulty in parking keeps customers away, and the bulletin suggests that if owners of lunch counters and vegetable stands would provide parking space off of the highway, it might add to their income.

The department is also asking the co-operation of cities and villages looking towards the gradual elimination of curb filling stations, where trunk highways pass through a municipality. Where streets are narrow these create an actual traffic hazard by causing congestion. On wider streets the danger is less, but there is a hazard due to motorists driving and stopping on the left side of the street.

Many municipalities are declining to give permits to new curb stations, and some are taking steps to remove those that are already in. Besides the traffic hazard, there is a feeling that it is unfair to give some gasoline retailers the use of the public street and compel others to use private land.

What Some Other States Are Doing in Road Improvement

ILLINOIS—The budget for 1927 of this state is $36,000,000 for the primary roads and $70,000,000 for its entire road system. Illinois now has 4,500 miles of paving on its primary roads and 1,300 miles on secondary roads. In this state there are, too, 5,966 miles of completed hard roads in the state's highway system, and 1,947 miles of grading completed.

KANSAS—Since June, 1921, more than $12,000,000 has been spent for bridges on the state and county systems. At least 50 per cent of the county roads, though not graded to standard, have wide and well-kept roadways and are generally in good condition in dry weather.

MARYLAND—Maryland's state road system was designated in 1908, and was the first system to be placed entirely under state control for both construction and maintenance.

NEW JERSEY—A program for improvements of the highways of this state, to cover approximately 1,900 miles, extending over a twelve year period at a cost of $60,000,000, is scheduled for presentation to the legislature early next year.

VIRGINIA—Virginia will spend nearly $10,000,000 for good roads this year. The state highway commission has provided for an expenditure of $8,000,000 to improve the main highways and $1,250,000 to improve feeder roads.

WEST VIRGINIA—Governor Gore has affixed his signature to the road bill of the 1927 legislature, making it possible to reissue $15,000,000 worth of bonds to carry out West Virginia's highway program.

WISCONSIN—The funds of the state highway commission for 1927 are estimated at $24,566,000 and the plans for the year include 374 miles of paving. Wisconsin has about 2,070 miles of pavement.

"The Road of Remembrance"

(By C. H. Vivian)

THE first step in selling anything stationary nowadays is getting the prospective buyer to look at it. That's why retail establishments spend thousands of dollars a year in advertising. They can't take their goods around from house to house and display them. The best they can do is to arrange their wares in the most attractive manner within stores that provide every possible comfort for the shopper, and then exert every known appeal to the public to enter the doors and view the articles on display.

In this day and age when cities are competing with one another for new residents and are spending thousands of dollars in newspaper space and lithographed booklets, it seems surprising that so little attention is paid to the approach.

For, after all, cities are rooted to the ground. They can't go out and sell themselves. The only hand they can extend in greeting to the visitor is their general outward appearance. And first impressions are vivid and lasting. If a city or town fails to appeal to us when we first enter it, our tendency is to move on rather than to remain and find out if it wears well.

In recent years municipalities have given mature thought to the general proposition of improving the appearances of those outskirts through which entering rail lines pass and much has been done toward beautifying them so that the casual traveler will say: "This looks like a nice place to live."

With the present great transition from rail to motor travel, it is unnecessary to point out the possibilities roads present for creating a favorable impression upon the traveler. Not only the condition of the approach road, but the general appearance of the section adjoining it will impress themselves indelibly upon the mind of the casual migrating motorist who is seeking a place to spend a day, a month or a lifetime. The man who has lived in that particular community for a considerable period may be oblivious to the fact that the new concrete highway passes uncomfortably close to the city dump grounds, but the stranger will notice it and will be prejudiced against the city through that fact.

Recognizing that roads comprise a powerful agency of appeal, the city of Boulder is preparing to beautify its principal approach road for a distance of nine miles from the city limits. It is going to extend its hand that distance to greet the motorist, bid him welcome and assure him that he is entering a community that wants him to stay as long as possible, even to becoming a permanent member of it.

The road in point is state highway No. 7, extending due eastward out of Boulder to meet state highway No. 1 from Denver northward to the Cheyenne line by way of Longmont, Loveland and Fort Collins.

This junction point will form the key to the whole beautification plan. Instead of a sharp right angle turn, enough land will be purchased to allow construc-

View of the concrete pavement extending east from Boulder, which will form a link in "the Road of Remembrance."

tion of sweeping curves from both the north and south, thus making the turn easier to negotiate.

The triangle which will be formed between these two arcs and the main highway will be made into a park and seeded in grass, shrubbery and flowers. Where the two arcs meet a stone gateway somewhat similar to that which guards the entrance to the Denver Mountain Parks above Golden will be erected. This particular phase of the project will be financed by the Lions club of Boulder.

Bordering the road from the gateway into Boulder will be planted trees at regular intervals. A variety which will combine beauty of outline and foliage without requiring too long to mature will be selected.

At every cross roads along the line grass and flowers will be set out, thus forming miniature garden spots. At various other points along the road where conditions are favorable, grassy parkways will be created, beckoning tourists to make a brief stop.

Several small lakes lie adjacent to the highway. These will form the nuclei for small parks. Trees and grass will be planted, benches provided, and possibly some playground apparatus for children installed. Row boats will be placed on the lakes and their waters stocked with fish.

The plan entails the construction of irrigation ditches to maintain the trees, grass, flowers and shrubbery. The right of way will be cleaned and maintained in a sightly manner. Farmers along the route will be urged to construct attractive fences and to keep adjoining fields in a state pleasing to the eye.

The psychology back of the plan is that the casual motorist traveling the main highway will be instinctively attracted by the beautified entrance to the road and that large numbers who would otherwise miss Boulder will turn their machines into the improved highway and follow it to the city.

The scenic setting for the road is ideal. The motorist who drives it has before him the vista of the foothills, with the towering, snowclad monarchs of the range rising to meet the sky behind. Included in these granite ramparts are the two Arapahoe peaks and Long's, with a number of lesser known heights scattered over a visible line of more than 100 miles.

As the trees along the roadside grow, they will form a lane of foliage through which the cars will pass. As the new superpower plant of the Public Service Company of Colorado is located close to the road four miles east of Boulder, it will be possible, if future conditions make it advisable, to construct an ornamental lighting system flanking the road, thus making it an attractive force at night.

The road will be officially known as the "Road of Remembrance," dedicated to the 1,000 men and women of Boulder county who served in the World War. The whole plan is being sponsored by Boulder Post No. 10, American Legion. Figuring a tree every 50 feet, there will be 1,000 over the whole line, and it is proposed that each shall stand as a symbol for one of the county's representatives in the war overseas.

In the center of the triangular plot in front of the entrance gateway will be placed a captured German fieldpiece. This has already been secured by the Legion from the war department, having been requested several years ago.

The Legion created a fund to go toward the road several years ago. It now amounts to over $1,000. The plan has been officially endorsed by most of the organizations in Boulder and it is expected that each will contribute toward the financial outlay necessary to place it in effect. Detailed plans for the project are now being drafted by landscape architects and an estimate of the total cost will be available upon their completion.

Five miles of the road is now surfaced with concrete and the remainder will be paved within the next few years.

Suggestion that the road be beautified was first made to Legion officials by E. B. Hill, county commissioner of Boulder county. He obtained the idea from the East, where several similar plans have been carried out successfully.

Tests Made of Non-slippery Roads

A more economical method of road construction to provide highways that will not soften under heat or be made slippery by rain, is claimed for paving invention tested out in Sweden, the department of commerce has been advised.

The new paving, which it is claimed will stand a pressure, at 19 degrees centigrade, of 6.7 tons and four times that pressure at 50 degrees, the corresponding figure for asphalt being 4.6 tons, has been invented by a Swedish engineer who has been working on the problem for 20 years.

The inventor declares his roads will be cheaper than any kind of pavement at present in use, will not be softened by heat and will not be made slippery by rain. Tests made by the Swedish States Material Testing Institute are said to verify his statements with regard to the pressure the pavement will stand.

A special machine, resembling a locomotive, to compress the material, is used.

NEW YORK CITY HAS ARMY OF SNOW FIGHTERS

New York has 700 pieces of motor-driven equipment and 1,500 trucks available for snow removal. The metropolis is planning to keep the streets clear of snow and prevent traffic tieups caused by unfavorable weather in winter.

View of state maintenance crew making temporary repairs on bridge destroyed by June flood near State Bridge, in Eagle County.

Highway Funds to Increase 400 Per Cent in Next Ten Years

From $58,175,316 in 1926 to approximately $200,000,000 in 1937.

This represents the increase in highway revenues that will accrue from the gasoline tax and license fees in the 11 western states during the next 10 years.

In 1926 the gross receipts of the gasoline tax and license fees in the 11 western states was $58,175,316, of which $26,799,071 was derived from license fees and $31,376,245 from the gasoline tax. As a result of increases in the gasoline tax voted in five of these states by the 1927 legislatures and allowing for an annual increase of 10 per cent in number of automobiles the revenue from the gas tax alone will have jumped to $46,911,988 in 1928 and the license fees to $32,326,875, a total of $83,930,061 — an increase of $25,000,0 0 over the 1926 income.

By 1937 the annual revenue from the gasoline tax and license fees will have increased from $83,930,061 in 1928 to approximately $200,000,00 on the basis of a 10 per cent annual increase in automobiles, as follows:

1928	$ 83,930,061
1929	92,323,067
1930	101,555,373
1931	111,70?,910
1932	122,871,001
1933	135,158,101
1934	148,673,911
1935	163,541,302
1936	179,?95,432
1937	198,884,975

These figures indicate that highway construction and maintenance industries have passed out of the experimental stage—not only as to design and construction practice—but also as to financing, the pay-as-you-go plan having been permanently adopted by all of the western states. The average gas tax collected by these states is now 3.1818c.

In addition to the gasoline tax and license fees other sources of revenue, such as the taxes on motor freight and passenger carriers, and federal aid funds, will add millions of dollars annually to the income for highway construction and maintenance in the western states and assure early completion and adequate maintenance of the state highway system. —Pacific Street and Road Builder.

Canada Spent $45,563,000 in 1926

During 1926 a total of $45,563,000 was spent on construction of all provincial highways in Canada, according to computations made by A. W. Campbell, Dominion highway commissioner. Of this total $29,595,000 was spent on construction and the balance, $15,978,000, on maintenance of highways already constructed. The total mileage of roads involved in this aggregate expenditure was 46,824.

Older Ontario led with a total outlay of $21,170,000, total mileage involved being 15,861. The other provinces expenditure was divided as follows—Nova Scotia, $1,90?,000, mileage 13,000; Saskatchewan, $3,925,000, total mileage, 2,400; British Columbia, $3,478,000, mileage, 4,000; Alberta, $2,140,000, mileage, 1,928; New Brunswick, $1,450,000, mileage, 1,725.

Manitoba spent $1,1 0,000, of which $950,000 was on construction, total mileage, 800; Prince Edward Island, $230,000, mileage, 700. The total mileage of highways constructed in Canada in 1926 was 5,788.

"Slow up and live." That's the idea behind this grade crossing safety device recently developed by engineers of the Florida State Road Department and installed at a crossing of the Atlanta & St. Andrews Bay Railroad at Cottondale, Fla.

An island—a half circle—at the center of the road compels the motorist to slow up to make the resulting bend in the road before crossing the tracks. The Hiway guard at the outside of the road is a heavy resilient wire link fence installed to keep the car from crashing onto the tracks in case the driver cannot slow up in time to make the bend.

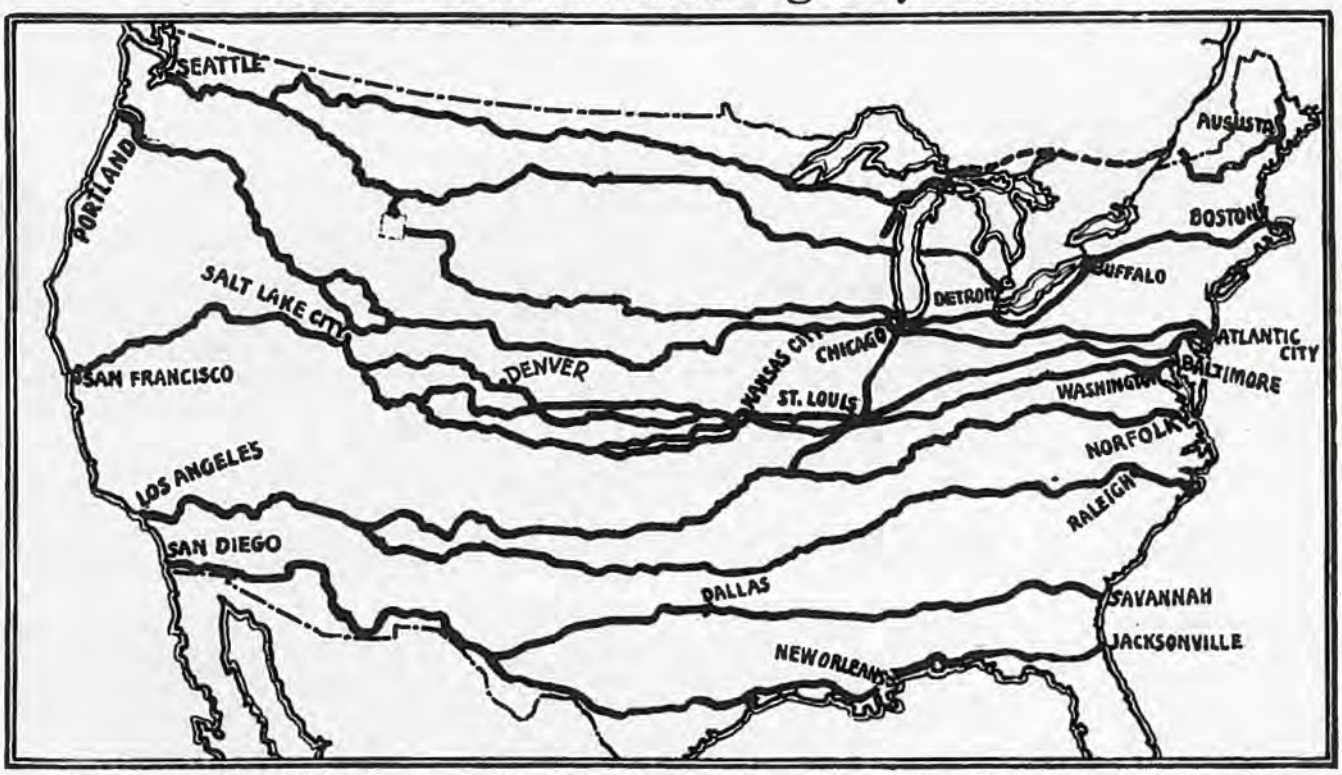
The accident toll at grade crossings since 1916 totals more than 15,000 lives in the United States. Slowing up at each crossing to look for approaching trains is a precaution highly recommended by the American Railway Association, the National Safety Council and other organizations co-operating in the grade crossing safety campaign.

Chauffeur (to slightly deaf farmer): "Can you tell me where I can get some gas?"

Farmer: "Hey?"

Chauffeur: "No, gas! This ain't a horse, it's an automobile."

Main Transcontinental Highway Routes



Map of transcontinental highway routes selected by the American Association of State Highway Officials as the basis of a uniform system of highway designation. Map is prepared and distributed by U. S. Bureau of Public Roads.

Training Maintenance Men

How a State Highway Department Instructs its Employees Described in New Mexico Highway Journal.

By E. B. BAIL
Assistant Engineer, State Highway Department of New Mexico.

The New Mexico highway department has established at Encino a department for the instruction of maintenance men.

Primarily the Highway Training School, as the new department is called, exists for the purpose of instructing new employees in their duties, but its scope will be widened to further train men who are already with the department in special phases of maintenance, such an operation of crushing plants and other special equipment.

Torrance county was decided upon as offering the most suitable location for the school. This county is centrally located with respect to the rest of the state and has within its confines practically every type of road and road material. The eastern part of the county has large deposits of caliche; the western half extends into the Manzano mountains; here are clay roads with their attendant difficulties of maintenance and here are great gravel deposits for surfacing purposes. The southern half is perponderantly sandy.

During the winter months drifting snow is the largest factor to be dealt with; in the spring blow-sand must be fought in the country around Mountainair. To sum up, every difficulty a maintenance department must face, is met in Torrance county and students will be trained to cope with all of them.

The school assumed working form when L. C. Tucker arrived at Encino Feb. 18th to take active charge. The state had previously acquired a machine shop and garage at Encino, and repairs were at once started on the patrol equipment in the district. Three 10-ton tractors with heavy graders, together with several F. W. D. trucks and necessary equipment, are being used by the student employees.

At present twenty-five men are in training. These men are from all sections of the state, Spanish-Americans predominating.

Under present practice the district engineers select the men they wish trained. The men bring their bed rolls and pay their transportation. They are furnished steel cots on arrival at the school. Bunk houses are provided and those who wish to do their own cooking are allowed the use of cook stoves for which they must themselves furnish the fuel. They are paid $2.50 per 9-hour day.

Ordinarily the district engineers advise the school superintendent what, in their opinion, the men they send are best qualified for; as truck driver, grader, runner, patrol foreman, etc.

However, all students are first introduced to the grader, this machine being an indispensable part of every patrol's equipment. They are thoroughly familiarized with the operation of the machine. At this stage of their instruction two or three students are assigned to each grader. After a week of this work in which time they have come to know the purely mechanical part of the operation they are taken singly and given a stated section of road to build, repair, or widen. Right at this point it will become apparent whether or not a man can be made into an efficient grader runner. A grader is an innocent looking affair and it would appear to the casual observer that nothing could be simpler than to operate one. But to operate one properly, to get a good job, one must have an "eye," as the expression is and not all men are so gifted. Men without the "eye" can be made into "so-so" runners, but the resulting product is not worth the expense.

Men unable to qualify as grader runners are tried out on trucks; if they cannot demonstrate ability to look after such equipment properly they are classed as common labor and released from the school.

For rating purposes the school classifies men who complete the training as truck drivers, tractor drivers, grader runners and patrol foremen. A good patrol foreman should be able to fill any of the above mentioned positions, except that he need not necessarily be an expert tractor driver, although he should understand tractor operation and know when he is getting results from this sort of machinery. In addition to being able to do the things enumerated above, the patrol foreman must be able to handle men and to get the most out of labor under his supervision. He must be energetic and ready and willing to get his crew onto the roads when weather conditions demand it, and he must be able to keep them there while favorable working conditions exist regardless of Sundays, holidays and regular working hours. Men of this type are hard to get; the school cannot insure that the men it turns out are of that type; a man may be able to perform all the mechanical operations efficiently and yet fail in the test of actual maintenance because he lacks that essential requirement which may be briefly described as "guts."

No definite period has as yet been settled upon as being the minimum time in which a student can be trained; naturally the time required will depend on the individual. It is believed that thirty days should be the shortest time given a student. It is felt that if a man show sufficient interest in the work to pay his transportation to the school and put in nine hours a day for the small wage paid he is entitled at the least to a fair try out, and if he evidences a willingness to work after he gets there he should have at least thirty days to demonstrate his ability.

It is believed that, to get the maximum of individual instruction the school should not have under training more than thirty men at any one time, as this number represents about all that can be handled on the equipment required to carry on the regular maintenance work of a district the size of Torrance county.

Men who display a more than usual aptitude for handling equipment will be selected for training as tractor drivers, for these heavy machines require a closer supervision and a more intelligent class of operators than are apt to be found on the average patrol.

Repairs to equipment required for the school are handled in Encino shop, which is being equipped to handle promptly all types of trucks and fractors in use in the state.

Showing Pueblo County truck-grader maintenance outfit at work on Pueblo-Canon City highway.

Control of Truck Traffic Advocated by Road Officials

In a recent article, a writer in one of the leading newspapers of the country comments favorably on the fact that the Indiana Supreme Court has knocked out the law passed by the legislature of that state which sought to impose restrictions on the size of trucks and also provided license fees for freight-carrying vehicles utilizing the public highways.

This writer says that such legislation is of the same reactionary sort as that which proposes to limit the height of buildings.

This attitude of mind is one that is frequently reflected and shows a complete lack of conception of the paramount rights of the public in situations where the public interest, convenience or comfort is at stake.

Like most generalities, the idea that the individual has the right to utilize anything that belongs to him in any way that he sees fit is perfectly sound up to a certain point, but the soundness of it comes to an end when it reaches the point that such use may become harmful to other individuals or to the public.

Thomas Jefferson's Maxim

Certainly, we would make great progress on both sides of this question if we would bear in mind the logic of Thomas Jefferson's maxim that "the prime function of government is to prevent one man from doing things which are an injury to another."

The newspaper writer we have quoted has chosen a rather bad comparison for the strength of his argument.

For the law to prescribe the kind, type and size of building that a man may put up on a piece of land which he individually owns is one thing. It is quite a different thing for the law to prescribe what kind, type or size of vehicle a man may drive on a public highway, created for the use of and at the expense of the general public.

If, as this writer contends, the regulation of the size of vehicles permitted the use of highways is flying in the face of economic progress, what is to prevent the man who, for his individual purposes, finds it profitable for him to do so, from building a truck with a body of the dimensions of a freight car and running it over the roads?

If one man finds that the character of his loadings is such that he can economically use a body eight, nine or ten feet wide, and regulation in defense of the public interest is denied, what is to prevent a man who finds a fourteen or sixteen-foot body economical from using a vehicle of such size?

With the growth of invention in new methods of the application of power for driving vehicles, it is perfectly obvious that there will be a constantly increasing tendency to enlarge the size of the individual vehicle in order to develop labor economies in the handling of loads.

Regulation Absolutely Essential

This is laudable, and under proper regulation may be worked out to very great advantage of the public, but without such regulation it is apt to lead to very disastrous consequences.

Vehicles of too large a size may very easily be a greater detriment to good traffic conditions than vehicles of excessive load.

THAT'S WHAT CAESAR DID

When Caesar took a westward ride
And grabbed the Gauls from Rome,
What was the first thing that he did
To make them feel at home?
Did he increase the people's loads,
And liberty forbid?
No! he dug in and built good roads—
That's what old Caesar did.

He built good roads from hill to hill,
Good roads from vale to vale,
He ran a good-roads movement
Till Rome got all the kale;
He told the folks to buy at home,
Build roads their ruts to rid,
Until all roads led up to Rome—
That's what old Caesar did.

If any town would make itself
The center of the map,
Where folks will come and settled down
And live in plenty's lap,
If any town its own abodes
Of poverty would rid,
Let it go out and build good roads—
Just as old Caesar did.

NEWS OF THE MONTH

Current Events in the Field of Highway Engineering and Transportation—State, County and Municipal Activities

The San Luis valley will be moved forty miles closer to Pueblo, Colorado Springs and Denver by opening of the Mosca pass. The state highway department has started surveys for the proposed Mosca pass highway, which will provide an all-year roadway with an easy grade. It will also open up a new scenic country which is said to equal the best of the Rocky Mountain region.

The Mosca pass road was formerly operated as a toll road and was the first mail route to the San Luis valley. After the Denver & Rio Grande acquired the La Veta pass, Mosca pass gradually fell into disuse. While passable, it is not in condition for commercial use at the present time.

The survey, being made under supervision of Charles Cheney, state highway engineer and William Walsh, San Luis valley representative of the highway department, runs from Gardner to Alamosa. Most of the pass road is within the San Isabel national forest. The forest service has kept a check on the snowfall in the region for several years and records show that the Mosca pass is the best all-year pass connecting the San Luis valley with the regions east of the mountains.

The national playgrounds of the American Legion are located in the section of the San Isabel to be opened through construction of the road.

The commercial and civic organizations of Pueblo, Walsenburg, Canon City and Florence, as well as those of Alamosa and other valley towns, have been agitating the project for several years. They have been aided by residents of Westcliffe, Gardner and other towns on the eastern range of the Sangre de Cristo mountains, lead by Senator Tim Hudson. The American Legion, both in the state and in Washington, has been assisting.

The various groups have united with the state and forest service to give southern Colorado a new mountain highway that will bring the residents of the east and west ranges of the Sangre de Cristo mountains in close touch and at the same time establish a new commercial and social relationship between Alamosa and other sections of the San Luis valley with the principal markets of Colorado.

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Work started early in August at Avondale, in Pueblo county, on concrete pavement of 1.239 miles of the Santa Fe Trail. The work is being done by Strange-Maguire Paving Co. of Pueblo at a cost of $37,850.

It is expected to have the improvement ready for use before cold weather. The project will extend the Trail paving almost to Avondale from Pueblo, a distance of 18 miles. The stretch of road carries the heaviest traffic of any highway in southern Colorado.

In response to a request from the civic organizations of Canon City and Florence to the state highway department for an increased expenditure of public money for the betterment of the public highways of Fremont county, particularly for the hard-surfacing of the main traveled roads, a public meeting was held recently in Canon City.

G. L. L. Gann of Pueblo, district representative of the state highway advisory board, pointed out that it is impossible to procure funds during 1927 in addition to appropriations already made. No new highway development projects can be undertaken by the highway commission this year except those provided in the budget, Gann said.

Gann submitted figures showing that Fremont county is getting its proportionate share of highway appropriations.

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The road through Taylor park to Tin Cup, a ten mile stretch near Gunnison, has been rebuilt by the forest service. The new road has made the park more popular with sportsmen.

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Warnings of dangerous intersections on the Pueblo-Colorado Springs highway will be flashed by a series of traffic beacons to be installed in El Paso county.

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Officials of the Pikes Peak Ocean-to-Ocean highway passed over the Colorado section of the trans-continental route late in July on an inspection tour which is being punctuated with banquets, addresses and other means of centering public attention on the P. P. O. O. as the most direct and convenient route from coast to coast.

The route passes through fourteen states and more than 300 cities, although it does not traverse conjested streets of the larger cities. It goes near enough to the large places to make them convenient. There are more than 9,400,000 inhabitants in the 93 counties through which the highway passes.

The officials on August 11 arrived in Los Angeles and celebrated the completion of a continuous section of more than 1,500 miles of hard surfaced road from New York City into Missouri. More than 1.400 miles of the transcontinental route has been constructed during the past seven years at a cost of $30,000,000. Within two more years the entire length will be hard surfaced.

After praising the Colorado link in the system, H. D. Judson, general manager of the highway association, said that the route is: "The shortest route from New York to Los Angeles; has the finest mountain passes, easiest grades and direct alignment, its historic shrines all along the route are unsurpassed and its tourist camps are the best. It is well marked all the way and is 100 per cent hard surfaced from New York City west for 1,500 miles. It is the backbone of the entire system of national highways."

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Riley Cass, forest service engineer, accompanied by a corps of assistants, has started staking out the new road which will connect the county road from Hillside to the Cloverdale mines and Rainbow lake in the San Isabel national forest. The road will open up the mining community as well as make trout fishing and resort development interesting.

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William Walsh, state highway supervisor, recently acted in behalf of the state in accepting the newly finished stretch of state and federal highway south of La Jara. The work was started last fall and included improvement of six miles of the Alamosa-Antonito highway leading to Cumbres pass at a cost of $50,000.

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The highway from the Montrose county line near Cimarron is being improved by E. G. Odom who was awarded the state project.

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A new scenic highway may be built from Midland to the Cripple Creek highway and then to circle Edlowe on the Colorado Springs road. E. S. Keithley, supervisor of the Pike National forest, has asked support of the Cripple Creek Motor and Commercial club and other interested organizations in carrying out the project.

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New and attractive road signs have been erected at all important highway crossings in the Gunnison region to direct motorists.

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Residents of Vona have started a movement to have the highway from Haxton to Lamar designated as a state highway. The road passes through Yuma, Joes, Vona, Kit Carson, Eads, Wiley and Lamar. All of the towns have endorsed the undertaking.

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The new concrete bridge over the Arkansas river at Portland will be opened late in August. New paving in the town of Portland has been completed.

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A crew of 85 workmen and considerable equipment has completed the three-mile stretch of highway connecting two ends of improved road near Riverside, eight miles north of Buena Vista.

Motor Car Version

Lives of motorists should remind us
As their trails we often see,
Not to leave tin cans behind us,
Paper, food and such debris.
—Motor News (Detroit)

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

The Wehr Grader Manufacturing Co., Milwaukee, Wis., has been awarded the contract for furnishing the government all one-man graders for use in the nineteen national parks and thirty-two national monuments.

According to Les Prothers, traveling salesman of the concern, who has been traveling the Rocky Mountain territory for the past few weeks, reports that twenty Wehr one-man graders have been delivered on the contract so far this season. Seven of these machines went to the Yellowstone National Park; three to Glacier National Park and one to the Mesa Verde National Park in Colorado.

Forty of these machines are now used by Colorado counties. There are about 6,000 in use throughout the country.

The Wehr company recently brought out a three-wheel industrial tractor, designed for industrial work where the standard four-wheel Fordson cannot make turns.

The big seller of the Wehr company is the "truck-tractor", equipped with a dump body. This is a three-wheel tractor with the worms reversed.

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To the Smith line of Non-Tilting Mixers there has recently been added a new 5-S machine especially designed to speed up work on concrete of 1-2-4 and 1-2 1/2-4 proportions. This is a companion to the Smith Tilting Type 5-S.

The frequency with which architects and building contractors are specifying concrete of these proportions now-a-days particularly recommended the development of this speedy one bag machine. The details of construction are similar in ruggedness and facilities for ease of handling and fast work to the features which have made the larger Smith Non-Tilting Mixers so popular throughout the field. The Smith 5-S Non-Tilter can be furnished with four cushioned rubber tired wheels when desired, and because of its compact construction and comparatively light weight is highly portable.

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Work is progressing rapidly on the $2,000,000 addition to the Cleveland Public Auditorium where the Convention and Road Show of the American Road Builders Association will be held next January.

The size of the present structure is approximately 200 ft. by 500 ft. and is located in the center of the block between St. Clair and Lakeside avenues. The addition to each end of the present structure will make the Public Hall one block long. This will provide about 45 per cent more exhibition space than the Association had at the Coliseum in Chicago.

The addition to the north end will be used to house conventions, etc., not large enough to warrant the use of the main building while the addition to the south will be used for small theater groups.

The general contract for this work was let to the Hunkin-Conkey Construction Company of Cleveland at a cost of approximately $2,000,000. The excavation, which involves about 47,000 cubic yards, was sublet to Frank J. Smith also of Cleveland at a cost of approximately $40,000.

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Two Koehring gasoline shovels have been sold by the Wilson Machinery Co., to Colorado contractors during the past sixty days. One of the shovels was delivered to J. Finger & Son, Longmont contractors, for use on an excavation job for the State Highway Department near La Junta. The other shovel was purchased by W. A. Colt & Son and is in use on a heavy grading job near Allen's Park in the Rocky Mountain National Park. Both of these machines are of the heavy duty type, and the sales were made by Ray Corson of the Wilson sales force, after the keenest of competition. There are now fourteen Koehring shovels and draglines in use in Colorado territory. All are giving the best of service, says Corson, whose motto is: "Ask the man who operates a Koehring."

Sales of several Koehring Dandie mixers also was reported by H. P. Wilson, as well as two Austin-Western graders to counties. Sales of road equipment to counties took a 30 per cent increase during the month of July, he said.

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T. B. Burnite of the Burnite Machinery Company reports summer business better than usual with inquiries coming in strong. The C. F. & I. Co. has purchased its tenth Smith non-tilting mixer from the Burnite company showing entire satisfaction with the machine. The City of Denver has recently purchased the third Elgin motor driven pickup sweeper and the City of Albuquerque has acquired its second sweeper of the same make.

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Road-builders all over the country are reading with great interest the latest catalog of the Blaw-Knox Company, entitled, "Inundation and Central Mixing Plants."

The book is considerably more than a catalog, offering a complete exposition of the inundation system that has so revolutionized the mixing of cement concrete.

The book can be had on application to the Blaw-Knox Company.

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The new No. 501 Koehring shovel-crane-dragline recently perfected and brought out by the well known producers of road-building and material handling equipment, is pictured in a 40-page catalog devoted entirely to the statement of the facts regarding the new unit.

The No. 501 has met with instant approval from roadbuilders because of many profit-producing features it offers. These features are told in the catalog which may be had on application to the Koehring Company.

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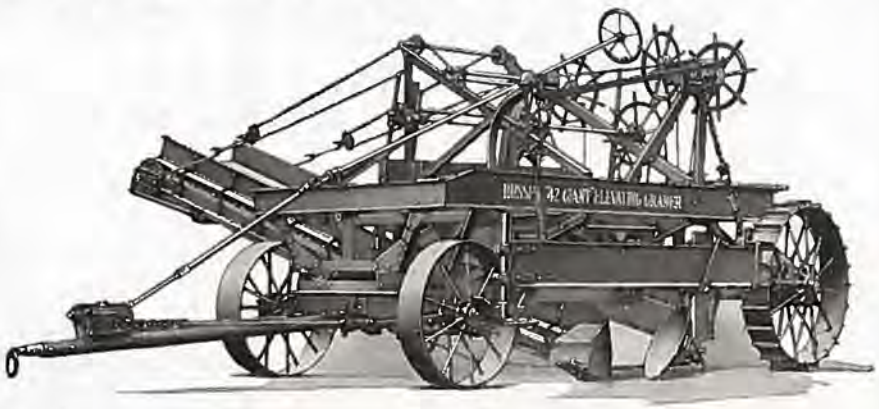
The newest member of the Russell Motor Patrol family is the No. 5 which is powered with the Cletrac K-20. This machine is a practical adaptation of the popular Russell Motor Patrol and the combination makes an ideal one man unit for either maintenance or construction.

The Cletrac with its wide range of speed, versatile power and ease of control makes an excellent combination for either light maintaining jobs at good speed or heavy construction work at slower speeds. The scarifier is independently adjustable from the rear platform, working either with the blade or independent of it. Full particulars can be had on application to the Russell company or at any of the Russell distributors.

The state highway police force, operated by the state of Delaware, cost, from Jan. 1, to Dec. 1, 1926, a total of $80,123.06. Fines received after arrests by the force during that period totaled $37,577.00. Thus it can be said that each patrolman cost the state $117.17 per month.



Improved Russell elevating grader now being shown by H. N. Steinbarger Co., sales representatives.

Montana Adopts Measure That Will Provide Regular Yearly Funds

Like most of the states, Montana has been collecting automobile license fees and a gasoline tax from automobile owners. But unlike most of the other states, only a small portion of the funds thus collected have gone into the construction of highways; in fact, only 15 per cent. As a result, Montana has lost some of the Federal Aid money to which it was entitled and highway development has been practically at a standstill.

This situation was remedied at the November general election, however, when a new initiative measure was passed. This measure increases the gasoline tax to three cents and provides that all the revenue derived therefrom shall go to the state highway department. This measure, however, fails to alter the present distribution of the vehicle license fees.

It is estimated that $25,000,000 will be provided in the next eleven years through the new measure for completing Montana's highway system. During this time the state will receive approximately $15,000,000 of Federal aid money, providing Federal aid is continued as at present.

Passage of this measure assures the state highway department of Montana a steady and increasing income each year for highway construction and maintenance.

The kind old gentleman met his friend Willie in the street one very hot day.

"Hello, Willie," he exclaimed, "how is your Grandpa standing the heat?"

"Ain't heard yet," said Willie. "He's only been dead a week."

Less Gasoline Needed On Improved Highways

Undoubtedly, improved highways bring about a material reduction in the consumption of gasoline; they reduce maintenance and repair costs, lessen the rate of depreciation in automobiles, buses and trucks and at the same time add immeasurably to the progress and prosperity of every community through which they are built.

Especially is this apparent in those states which adopted the "pay-as-you-ride" program of building improved highways.—The Louisiana Highway Magazine.

"What is your car, a five-passenger?"

"Yes, but I can get eight in it if they are well acquainted."—Selected.

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

Proj. No.	Length	Type	Location
2-R5	1.959 mi.	Asphalt Paving	South of Aguilar
258-E2	1.41 mi.	Gravel Surfacing	Cimarron
279-D	0.261 mi.	Concrete Paving	Morrison
300-A	1.008 mi.	Grading	Chattanooga
222-C Reop.	0.4 mi.	Paving	South of Lafayette

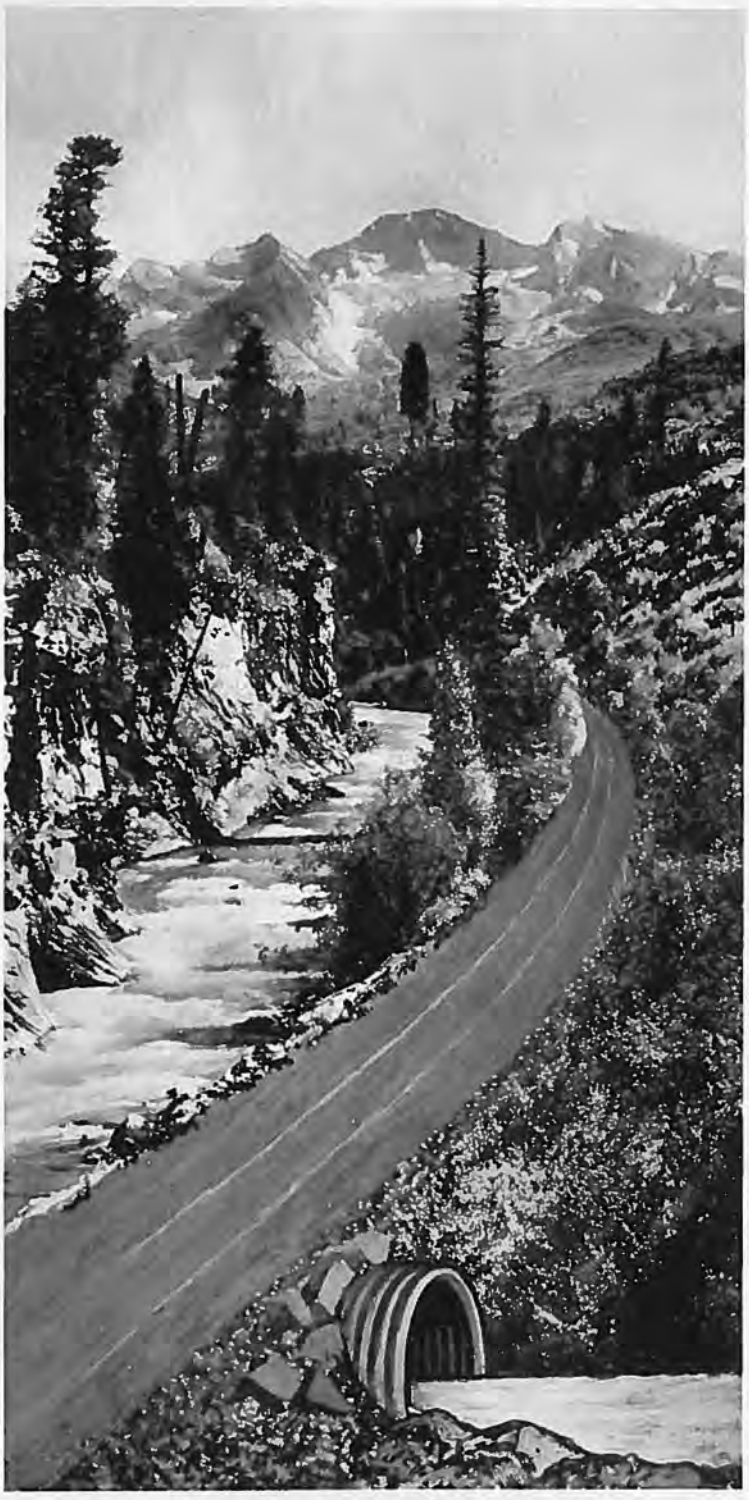
PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
138-A	10 mi.	Gravel Surfacing	North of Kremmling
2-R6	6 mi.	Asphalt Paving	South of Aguilar
279-F	3.3 mi.	Grading	North of Baileys
287-D	0.5 mi.	Gravel Surf. & Underpass	East of Kersey
288-A2	9.5 mi.	Concrete Paving	Between Brush and Merino
288-A3	3 mi.	Grading & R. R. Grade Separation	Northeast of Brush
296-C	5 mi.	Gravel Surfacing	North of Greenhorn
297-A Reop.	2.85 mi.	Gravel Surfacing	East of Palisade
560	3 mi.	Gravel Surfacing	Deer Creek-Littleton

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	$ 28,882.70	34	2-R3
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	331,632.00	100	2-R4
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	100	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	100	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	78	144-A1
145-A	West of Glenwood Springs	3.807 mi.	Gravel Surfacing	Winterburn & Lumsden	53,227.90	41	145-A
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	90	157-A
210-B2	De Beque-Grand Valley	7.507 mi.	Gravel Surfacing	Fred Kentz	37,475.00	0	210-B2
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	100	213-D
246-F	West of Avondale	1.0 mi.	Paving	Strange-Maguire Pav. Co.	37,847.00	0	246-F
247-C	Swink	0.8 mi.	Conc. Pav. & R.R Underpass	J. Finger & Son	62,559.58	0	247-C
254-C	Div. 1 2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	100	254-C1
254-C2	S. W. of Hot Sulphur Springs	Superstr. of Bridge & Approaches		Northwestern Constr. Co.	48,203.50	0	254-C2
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	51	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65.374.00	100	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	49	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	52	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	81	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	100	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	62	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	71	271-B
275-C	Div. 2 East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,466.60	61	275-C2
275-E	North of Monument	0.926 mi	Grading and Underpass	F. L. Hoffman	41,905.20	0	275-E
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	81	275-F1
275-F2	Castle Rock, south	5.227 mi.	Paving	J. Fred Roberts & Sons	119,027.80	91	275-F2
275-G	Larkspur-Monument	10.869 mi.	Grading	Monaghan-Cunningham Con. Co.	111.252.78	74	275-G
276	North of Colorado Springs		R. R. Overpass	J. L. Busselle & Co.	37,913.00	70	276
279-E	Schaffer's Crossing-Baileys	3.243 mi.	Grading	S. M. & S. J. Feely	54,305.60	51	279-E
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	100	281-D1 251-B1
251-B2 & 281-D2	Lafayette, north	5.813 mi.	Concrete Paving	J. H. Miller & Co.	146,315.00	12	251-B2 281-D2
281-E	At Lafayette	0.812 mi.	Paving	J. H. Miller & Co.	27,226.00	86	281-E
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	40	282-D
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	88	283-C
287-A2	Fort Morgan, west	4.011 mi. 16.61 mi.	Concrete Paving Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	100	287-A2
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier C. Eng. Co.	159,950.85	70	287-C1-2
290-D	East of Las Animas	2.954 mi.	Concrete Paving	W. A. Colt & Son	88,979.50	10	290-D
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	52	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,645.25	82	293-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	100	295-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Cole Brothers	58,061.00	100	296-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	100	297-B
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	95	299-A

KEYSTONE CULVERTS



Preferred by every Engineer and Road Contractor

Meets the requirements of
U.S. BUREAU OF PUBLIC ROADS
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U.S. FOREST SERVICE

NOTHING BUT TESTED RESULTS - *YEARS OF ACTUAL USE* - WOULD BRING THIS PREFERENCE

Colorado Culvert & Flume Co.
PUEBLO

WESTERN-AURORA

The Jaw Crusher that is Different!

INSTEAD of following the design of the old original Blake type machine as do all other jaw crushers, the Western-Aurora provides a continuous double stroke movement whereby some part of the jaws is crushing at all times. While the top is opening to receive new stone, the bottom closes to crush; and then when the top closes, the bottom opens to discharge the finished product. There is also a slight vertical movement which prevents a dead center. This two-blow stroke has the threefold effect of increasing capacity, lessening vibration, and economizing on power.

A cross-sectional view of the Western-Aurora Crusher appears in the above insert. Notice the absence of all springs and toggles that are so frequently the cause of annoying and expensive breakdowns.

Not only are Western-Aurora Crushers of a unique and superior design, but the very best of workmanship and material is also used in their construction. The main frame and all other castings are made of the best quality steel, and the remainder of the plant is built according to the same high standard.

A special catalog describes in detail the complete line of Western-Aurora Crushers.

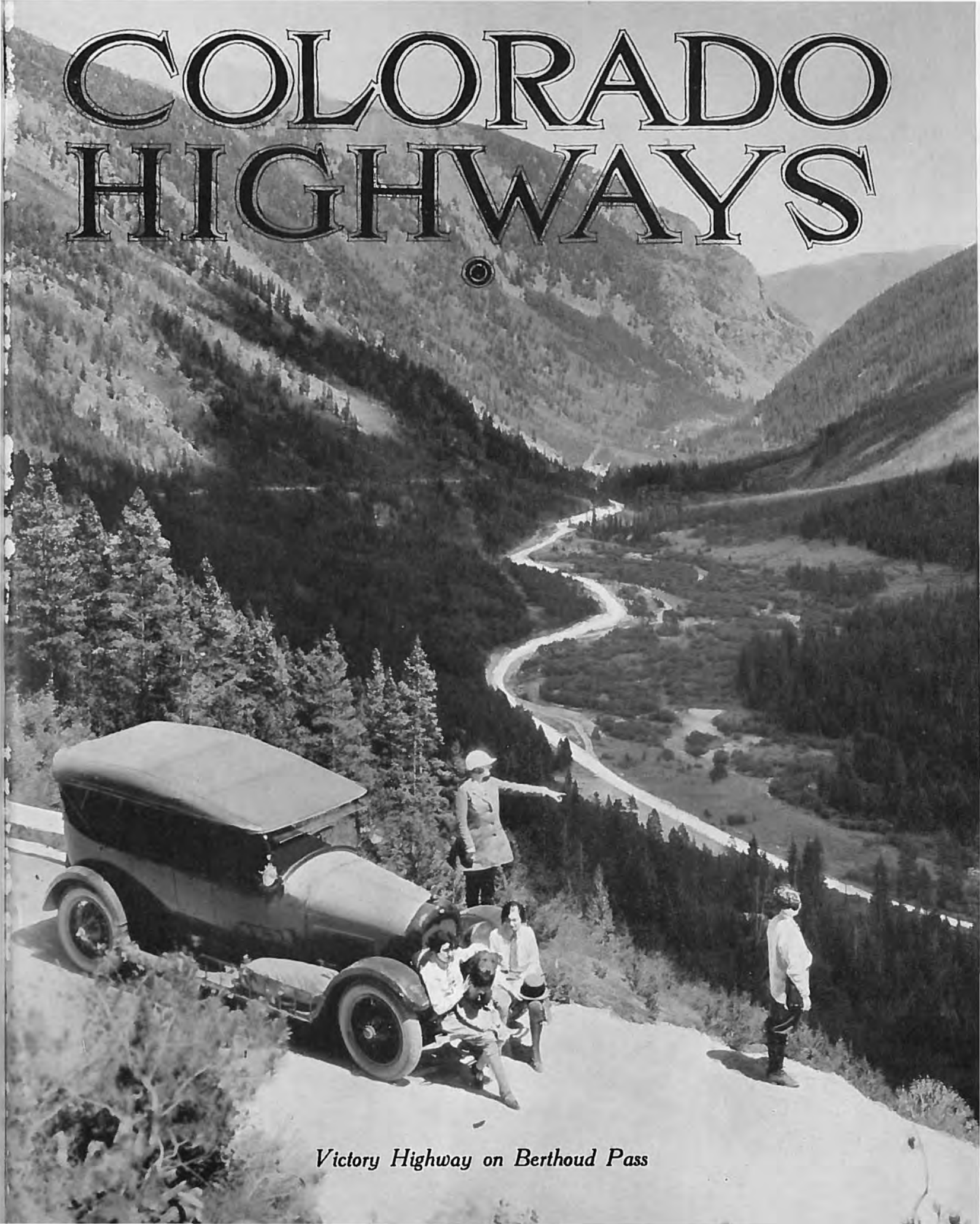
Write for your copy today!

THE AUSTIN-WESTERN ROAD MACHINERY CO.

400 North Michigan Avenue, Chicago, Illinois, U. S. A.

WILSON MACHINERY COMPANY, Sales Agents, 1936 Market St., DENVER, COLO.

COLORADO HIGHWAYS



Victory Highway on Berthoud Pass

These Arizona Concrete Roads Earn $1,000,000 Every Year

All Maricopa County is talking about the returns from its most profitable investment—330 miles of county roads paved with Concrete.

These are paying large dividends to farmers, ranchers, and the people of Phoenix, Arizona, the county seat and state capital.

After the roads were concreted—

The Maricopa Creamery Company hauled 30 per cent more products at 25 per cent less cost.

The Arizona Storage & Distributing Company reduced its hauling costs 33 per cent, and passed this saving on to patrons by charging one-third less for hauling over concrete than over dirt roads.

Lin. B. Orme, farmer, operating 200 acres, found his smallest draft team could pull 7,500 pounds on concrete; its limit on dirt roads used to be 4,000 pounds. His automobile tires now average 15,000 miles; they barely averaged 3,500 miles when the roads were dirt.

The Bartlett-Heard Land & Cattle Company, operating 2,500 acres, paid 10 cents per ton mile for grain haulage in 1923 over concrete roads; in 1918, over dirt roads the cost was 20 cents per ton mile.

These examples are but a small part of the story. Reliable figures, vouched for by Maricopa County taxpayers, prove the $1,000,000 per year earnings. Figures will gladly be given upon request.

Portland Cement Association

A National Organization to Improve and Extend the Uses of Concrete

Ideal Building, Denver, Colorado

OFFICES IN 32 CITIES

Colorado Highways

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COLORADO STATE HIGHWAY DEPARTMENT
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Articles on the subject of road building and highway development in the West are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible. Manuscripts not found available will be returned promptly.

10 CENTS A COPY. **$1.00 A YEAR.**

Our Cover Picture

Colorado Highways' cover picture this month is an unusually spectacular view of Clear Creek valley, rich with memories of pioneers prospecting for gold. The picture shows a stretch of the famous Victory highway leading to Berthoud Pass, which crosses the crest of the Continental Divide at an elevation of 11,200 feet, sixty miles west of Denver. It is one of the important "show roads" of the Rockies.—*Courtesy Denver Tourist Bureau.*

Colorado Highways
"BETTER ROADS"

VOLUME VI. SEPTEMBER, 1927 NUMBER 9

Welcome, American Highway Officials

WELCOME, members of the American Association of State Highway Officials—Denver, and all Colorado, greets you sincerely and cordially, on the eve of your thirteenth annual meeting.

The latch string is out, and the hand of western good fellowship is extended to you, one and all.

You come, distinguished ambassadors of modern civilization, to plan new conquests against the stubborn resistance of inadequate highway systems, and the extreme importance of your mission is understood and appreciated by every forward thinking person.

Success will undoubtedly crown your efforts during the meeting, and the contacts made with fellow members of your organization will prove helpful in solving the problems of the future.

The publishers of this magazine join the Colorado State Highway Department and the entire citizenry of the state in hoping that every moment of your stay in Denver and Colorado will be profitable and enjoyable.

While you are here you will see something of the picturesque scenery of this region; you will be braced and exhilarated in one of the most salubrious climates in the world; you will realize the true meaning of western hospitality, and it is felt that extending to you an invitation to return, whenever the opportunity presents itself, would be entirely superfluous.

Nation's Road Builders to Meet in Denver

PLANS for the thirteenth annual meeting of the American Association of State Highway Officials, to be held at the Hotel Cosmopolitan here, on October 3, 4, 5 and 6, are practically complete, L. D. Blauvelt, president of the organization, and Colorado State Highway Engineer, has just announced.

More than 300 state highway department executives from forty-eight states and Hawaii and Canada—men who supervise the spending of more than a billion dollars annually, for the construction of highways—will be in Denver for the convention, which the program indicates will be one of the most important in the history of the organization.

Those forming the Canadian delegation are not members of the association, but are attending the meeting as guests of the organization, to study American methods of financing and constructing modern highways.

A program which gets underway at 8:30 o'clock on Monday morning, Oct. 3, and runs through Thursday afternoon, is packed with interesting subjects, and the list of speakers includes the most prominent state highway executives in the country.

Delegates will begin registering Monday morning at 8:30 o'clock. At 10:30 o'clock Governor William H. Adams and Mayor Benjamin F. Stapleton will extend a welcome to the distinguished visitors, and Chief Justice H. P. Burke of the Colorado supreme court, will deliver an address. President Blauvelt will respond, and deliver the president's annual address, after which W. C. Markham, Washington, D. C., executive secretary, will submit his annual report.

L. D. BLAUVELT
President, American Association of State Highway Officials.

Features of the program planned for the meeting, which is being held west of the Missouri river for the second time in the organization's history, include an address on Tuesday afternoon, by Thomas H. MacDonald, chief of the Bureau of Public Roads, Washington, D. C. MacDonald will cover the national highway situation in general, and is expected to take up flood control in relation to highway construction.

Following the speaker from Washington, Pyke Johnson, representative of the National Automobile Chamber of Commerce, and a former Denverite, will talk on "Federal and State Control Over Interstate Busses and Trucks." This address, and the discussion it will stimulate, it is believed, will be of utmost importance, and one of the highlights of the convention. At the time he was in Denver, several years ago, Johnson was the first editor of the Colorado Highway Bulletin.

G. C. Dillman, State Highway Engineer, Lansing, Mich., will talk on "State Highway Department Responsibility In the Protection of Life and Property," while "Traffic Control and Safety," will be covered by A. H. Hinkle, Indiana.

Other topics to be taken up in formal addresses and informal discussions include highway construction and maintenance, research activities, selection of materials, bridges and structures, administration and co-operation with contractors.

One of the highly interesting facts to be brought out during the meeting is that 7,500 miles of concrete, asphalt and brick roads will be built in the United States during the present year. Other improved roads to be built will bring the total of new highways constructed in the United States during 1927 up to approximately 28,850 miles.

This is the program of the forty-eight state highway departments, co-operating with the National Bureau of Roads, and the total expenditure will be approximately $648,500,000. In addition to this program, it is pointed out that about $477,000,000 will be spent by counties and other political subdivisions of the states.

More than a billion dollars in 1927 for good roads in the United States!

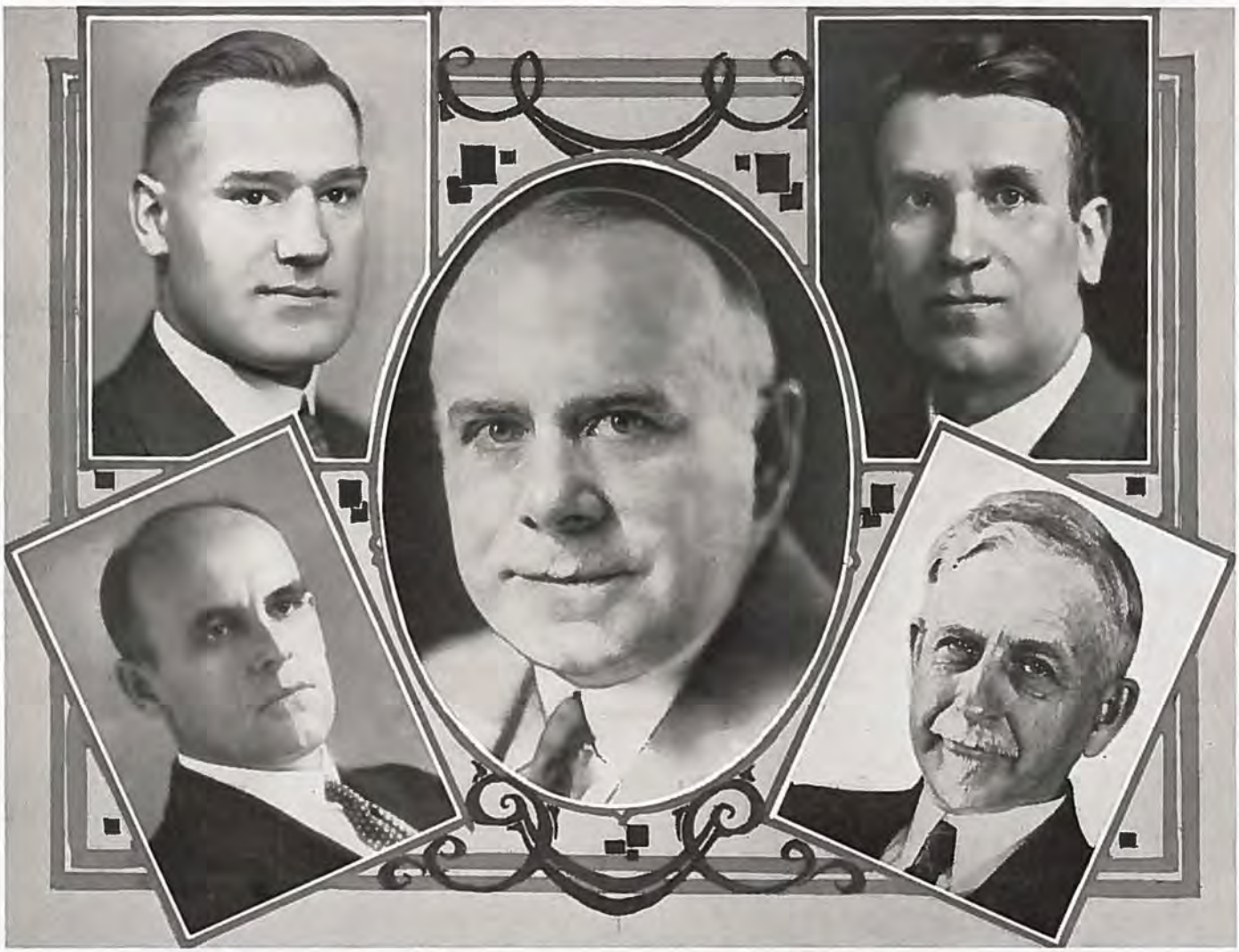
The entertainment program outlined for the meeting includes two banquets, the first to be held at the Hotel Cosmopolitan on Monday evening at 6 o'clock to afford an opportunity for the delegates to become acquainted. The second dinner, at which members of the association will be guests of the Golorado Good Roads Association, will be held at the hotel on Tuesday evening at 6:30 o'clock.

Speakers at the second dinner will include several governors, and members of the United States senate and house of representatives.

Another important entertainment feature is a seventy-mile automobile drive over the scenic highway through the Denver Mountain Parks, in the Rocky Mountains adjacent to the city, scheduled for 2 o'clock Wednesday afternoon.

On this trip the delegates will see specimens of oiled gravel and concrete highways, and they will go over the famous Lookout mountain drive, which, with its switchbacks and picturesque general location is one of the finest pieces of mountain road engineering in the world.

In addition to these entertainment features, many of the delegates plan to remain in Denver and Colorado



OFFICERS OF AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS

Upper left—Frank T. Sheets, Chief Highway Engineer, Illinois, vice-president. Upper right—J. N. Mackall, Chairman Highway Commission, Maryland, secretary... Center—Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads. Lower left—W. W. Mack, Secretary of Highway Commission, Delaware, treasurer. Lower right—W. C. Markham, Washington, D. C., executive secretary.

after the close of the convention, and a number of interesting trips to other parts of the state have already been planned by individuals and groups.

The complete program follows:

MONDAY, OCTOBER 3, 1927

Morning

President Louis D. Blauvelt, Colorado, Presiding

8:30—Registration of Delegates.

10:30—Prayer.

Address of Welcome to Colorado by Governor William H. Adams.

Address of Welcome to Denver by Mayor B. F. Stapleton.

Address by Honorable H. P. Burke, Chief Justice, Supreme Court, Colorado.

Response and President's Annual Address by L. D. Blauvelt, State Highway Engineer, Colorado.

Annual Report by W. C. Markham, Executive Secretary.

Testimonial to Past President Frank Page, Chairman State Highway Commission, North Carolina, by Vice-President Frank T. Sheets, Chief Highway Engineer, Illinois.

Roll Call by States.

Afternoon

1:30—Meeting of all Standing Committees at Hotel Cosmopolitan.

(Each delegate is invited to attend any committee meeting in which he is interested.)

Evening

6:00—Informal Dinner. This dinner is intended to afford an opportunity for the delegates to become acquainted and special entertainment features will be given bearing this in mind. Tickets for this dinner **must** be secured at the time of registration. Delegates are entitled to secure tickets for members of their families at the same price.

TUESDAY, OCTOBER 4, 1927

Morning

John D. Williams, Indiana, Presiding

9:00—"State and Federal Court Decisions Affecting Highways" by Hugh Stephens, Vice-Chairman State Highway Commisson, Missouri.

"Bituminous Treatment of Gravel anl Crushed Stone Roads" by T. E. Stanton, Assistant State Highway Engineer, California.

"Suggested Changes In Bonding and Contracting Practices On Highway Construction" by W. R. Neel, State Highway Engineer, Georgia.

Afternoon

John W. Gardner, Kansas, Presiding

2:00—"State Highway Department Responsibility In the Protection of Life and Property" by G. C. Dillman, State Highway Engineer, Michigan.

"Consderation of Suggested Changes In the Constitution and By-Laws of the Association," presented by the Executive Committee.

Address by Thomas H. MacDonald, Chief Bureau of Public Roads, Washington, D. C.

"Federal and State Control Over Interstate Busses and Trucks" by Pyke Johnson, Representative of the National Automobile Chamber of Commerce at Washington, D. C.

Evening

6:30—Dinner, at which the delegates will be the guests of the Colorado Good Roads Association.

WEDNESDAY, OCTOBER 5, 1927

Morning

G. F. Schlesinger, Ohio, Presiding

9:00—"Personal Selection and Training," by T. Warren Allen, Chief Division of Control, Bureau of Public Roads, Washington, D. C.

Reports of Standing Committees.

Administration, Charles M. Babcock, Minnesota.

Traffic Control and Safety, A. H. Hinkle, Indiana.

Uniform Accounting, G. G. Clark, Bureau of Public Roads, Washington, D. C.

Co-operation with Contractors, W. R. Neel, Georgia.

Highway Transport, Thomas H. MacDonald, Bureau of Public Roads, Washington, D. C.

Afternoon

2:00—The members and their families are invited to take a seventy-mile automobile ride through the Denver Mountain Parks in the Rocky Mountains adjacent to the city.

Evening

The entire evening is at the disposal of the members.

THURSDAY, NOVEMBER 6, 1927

Morning

C. D. Buck, Delaware, Presiding

9:00—"Recent Developments In Highway Research," V. L. Glover, Engineer of Materials, Division of Highways, Illinois.

Report of the Committee on Resolutions.

Reports of the Committee on Standards, E. W. James, Bureau of Public Roads, General Chairman.

Bridges and Structures, E. F. Kelley, Bureau of Public Roads, Chairman.

Materials, H. S. Mattimore, Pennsylvania, General Chairman.

Non-Bituminous Testing Problems, F. C. Lang, Minnesota, Chairman.

Bituminous and Chemical Testing Problems, H. M. Milburn, Bureau of Public Roads, Chairman.

Road Design, O. L. Kipp, Minnesota, Chairman.

Afternoon

President L. D. Blauvelt, Presiding

2:00—Road Construction, C. H. Moorefield, South Carolina, Chairman.

Maintenance, C. S. Mullen, Virginia, Chairman.

Equipment, Jacob Hagin, New Jersey, Chairman.

Highway Research Activities, V. L. Glover, Illinois, Chairman.

Roll Call.

Reading of Minutes.

Report of Treasurer, W. W. Mack, Delaware.

Report of Executive Committee, L. D. Blauvelt, Colorado, Chairman.

Report of Auditing Committee.

New Business.

Election of Officers.

Announcements.

Adjournment.

Closing the Gaps

By Thos. H. MacDonald
Chief of the U. S. Bureau of Public Roads

Approximately 26,000 miles is the estimate of the roads to be constructed this year under the supervision of the state highway departments. Probably more than 21,000 miles will be on the Federal-aid highway system, and somewhat less than half of this improvement will be carried on with Federal aid. The year's addition to the Federal-aid system will bring the mileage of that system initially improved up to practically 150,000 miles, leaving only 35,000 miles of the road thus far designated to be constructed in order to complete the initial improvement of the system.

More rapidly than most of us realize the main highway system of the United States is being brought to a condition of continuous improvement. We are still a long way from the condition that will ultimately be required but we are moving toward it at a surprisingly rapid rate. Roads we are now improving with gravel and other low-type surfaces will eventually have to be further improved. Narrow present surfaces will need widening; bridges which suffice for the present will need replacement; grade crossings tolerated in the initial improvement must be later eliminated; and the whole system as originally constructed must be combed over to root out of it the danger places, the congestion breeders, and the failures of one sort or another inevitable in a construction work of such magnitude. These are refining processes and they will continue indefinitely; but the fact remains that we are now rapidly approaching the time when we shall have a continuous net-work of main state and inter-state arteries improved throughout to some degree at least, and all of it under maintenance by the state highway departments.—The Highway Magazine.

A Modern Highway Project

By A. K. Langridge

FEDERAL Aid Project No. 145, beginning at the west end of the city limits of Glenwood Springs and continuing for a distance of about three and eight-tenths miles down the canon of the Colorado river toward the town of Rifle is the start of a contemplated road improvement from Glenwood Springs to Rifle, a distance of approximately twenty-nine miles.

The contract has recently been let to Winterburn and Lumsden of Grand Junction, and they are using the most modern of equipment, including a heavy power shovel, a fifteen-ton steam roller, an air compressor and complete set of drills, together with graders, crushers and a complete screen plant for manufacturing gravel for surfacing. The plant has a capacity of 150 yards daily. A fleet of trucks is also being used to transport earth removed and gravel.

In the handling of this piece of work, as in other cases, it is apparent that it is the desire of the State Highway department to eliminate as rapidly as possible, the inconvenience necessitated by all road improvements.

The general demand of the day is for good roads, accompanied usually, with a protest at the taxes demanded and required for their execution. In spite of this, however, the close observer cannot help but be impressed with the change in facial expression and verbal comments of the average road traveler when he leaves the twisting curves of the old "snake trail" and finds himself on a completed stretch of state highway.

He settles back in his seat in comfort, at peace with the world, as he admits that he is "getting a run for his money."

And he is!

Compare the difference yourself the next time you bump along over some improperly constructed, worn out road, dodging in and out, first around the nose of a promontory, then, within a few rods, into the bed of a small canon and out again on a curve that almost demands a universal joint for your car. Then suddenly you sweep into a stretch of finished highway with its broad traveling surface and wide graceful curves! It gives you what Claire Briggs, the famous cartoonist would so aptly describe as "A Grand and Glorious Feeling."

State highway engineers, in their efforts to effect straightways, as opposed to the old "worm gear" road at present in use between Glenwood Springs and Rifle, were forced to establish a fill, requiring the handling

Portion of Completed Federal Aid Project No. 145 West of Glenwood Springs

of more than 7,000 cubic yards of earth and rock. The fill is 105 feet wide at the base, with a twenty-six foot driveway at the crest. It is about 150 feet long and forty feet high.

Under ordinary circumstances the fill would have been of minor importance, but because of the nearness of the Denver and Rio Grande Western railroad right of way, special protection to prevent the flow of the filling material overriding the right of way, was necessary.

This condition called for close study by the engineers. Final consultation developed the adoption of a system of reinforced cribbing, based broadly on the theory and practice of old style log cribbing.

The wall being constructed is a double retaining wall six feet apart. This cribbing is composed of reinforced concrete logs twelve feet in length and twelve inches square grooved and the ties between walls are some five feet six inches long, lugged to interlock the main groved logs (the system being patented), the space between is filled with rock and earth tamped in to form a solid retaining wall.

This cribbing will be twenty feet high and is bedded to a "batter" of two inches to the foot.

From this point westerly the new highway enjoys a liberal strength of straightaway until it again encounters a difficult piece of construction, in the cutting away, to the depth of twenty feet, a promontory of solid rock, that practically overhangs the railroad right of way.

To remove this, and at the same time protect the railroad right of way from damage, or delay in train transmission more than ordinary care is called for in blasting the rock.

Some valuable agricultural land had to be acquired for this project and it had to be promptly refenced as the right of way was put into use by the department.

Another of the needs to meet the requirements of the Highway Department, was the acquiring of the necessary material for the finished road surface, after the subgrade has been brought to the needed grade and rolled with a fifteen-ton roller.

This calls for six inches of crushed gravel, passed through a trommel screen with three-quarter-inch round orifices, which the department engineers carefully scrutinize and frequently sample to establish the percentage of crushed rock, gravel, sand and clay; it being desired and required that the component parts shall conjointly form a bonded material capable of withstanding the abrasion and thrust of all classes of road transport.

It is hoped this project will be fully completed and available for traffic this coming November.

It is assumed that with available funds further Federal Aid projects down the Colorado river canon will be carried forward, to finally complete an improved highway to the town of Rifle. This will prove of great value to the entire community, and will add materially to the enjoyment of the rapidly increasing tourist travel in this part of the state.

Texas Claims New Paving Record

Highway engineers of South Texas claim a new paving record on the La Port road out of Houston. One crew on May 26, in 14 hours and 44 minutes laid 1,613 lineal feet of 20-foot, 9-6-9 inch pavement, or 3,584.4 square yards, according to a late issue of Western Construction News.

Upper—Reinforced Concrete Cribbing on Federal Aid Project 145. Lower—Showing Heavy Excavation Above Railroad Tracks

Gravel Roads Predominate in Federal Aid System

Gravel roads predominate in the 55,903 miles of Federal Aid roads constructed through the country, according to percentages recently published as follows:

Bituminous concrete	2.4	1,341.67
Gravel type	35.5	19,845.56
Graded and drained	23.2	12,969.50
Concrete pavement	22.0	12,298.66
Sand clay	8.1	4,528.14
Bituminous macadam	5.6	3,130.57
Water bound macadam of brick	3.2	1,788.90
Total	100.0	55,903.00

During the past year there were improvements on 9,400 miles of the Federal Aid System, bringing the total improved highways in the system to 55,903 miles.

North Carolina's Road Bonds

The North Carolina General Assembly has authorized the issuance of $30,000,000 worth of bonds for continuation of the state's highway program.

This authorization brings the total road bond issues authorized by the North Carolina General Assembly since the state's road building program started to $115,000,000.

California has issued a total of $73,000,000 in bonds.

Colorado's bond issues for roads totals $11,000,000, nearly one-third of which has been retired from motor vehicle receipts.

On the Open Road

By Gene Lindberg

AUTOMOBILE touring, most popular of 20th century outdoor sports, is a game in which a man and his pocketbook pit tough rubber and gasoline against soft dirt and hard gravel. The score is counted on the speedometer.

When we left Denver one morning recently we considered ourselves automobile tourists. We felt that way all the way to Salt Lake City. We still felt that way until the day before starting home for Denver.

Then we met a big sedan. The license plate said Honolulu. We had hardly backed out of the garage.

Motoring is something like golf. There is more to it than good driving. You have to have a fairway or a highway. That's why the Colorado state highway department spends so many thousands of dollars annually —why the federal government chips in and goes 50-50. They want to give us motorists a square chance to play the game.

Even the state highway department and the federal aid engineers can't keep things rolling smoothly, however, unless the weather man does his part. For a week before we were ready to go, he had been letting rain in on the roads all over Colorado and eastern Utah.

I wanted to drive out over the Victory highway, but the young lady in the Denver Tourist Bureau shook her head.

"Go out over the Lincoln," said she. "The scenery's terribly flat that way, but the road happens to be dry. We'll try to have the road from Vernal, Utah, to Craig, Colo., washed and ironed before you start back."

She put a red pencil on the map and started pushing me north to Cheyenne, mostly over pavement. Then she sketched me westward through Laramie, Medicine Bow, Rawlins, Green River, Granger, Fort Bridger and through the Wasatch range into Salt Lake City.

Scenery on the Lincoln highway is pretty fair, the width of the road. Beyond that, it is an endless variety of the same thing. The continental divide, in Wyoming, is completely covered with sagebrush. It's just a line on the map, at right angles to the Union Pacific railroad.

A Section of the Famous Ouray-Silverton "Million Dollar" Highway, Showing Heavy Rock Retaining Wall.—Courtesy of Denver Tourist Bureau

Wyoming towns have honest names, though. The desert is red at Red Desert. Wamsutter looks like it sounds, and the water in Green River is green. I had one puncture going out.

Salt Lake City is actually worth driving through Wyoming to see. But the best part of the trip is coming home through Colorado.

Before starting back, we conferred with the information bureau of the Utah Auto club, in the basement of the Hotel Utah.

"Victory highway's O. K." was the verdict. "After you hit Colorado, it's in fine shape."

The road from Salt Lake to Provo was pavement. A smooth federal aid road winds through the Wasatch range, following Provo canon to Heber. Some day, the road from Heber to Vernal, Utah, is going to be a fine highway. We could tell by the detours. A detour is the longest distance between two points. It is probably good road right now. They were working it hard. Despite a late start the morning of August 8, we made Vernal at dusk.

Next morning, we crossed Green river and rolled into home ground over the prairies of western Colorado. The road from Vernal to Craig varies with the weather, but we found it dry, freshly dragged and smooth as a city pavement.

When graveled and graded, this road one day will be an all-weather highway, carrying transcontinental motor traffic over the Victory, one of America's greatest scenic highways. We reached Craig in the early afternoon, the last miles of the journey over an improved highway of finely crushed rock. The sun was still high when we rolled into Steamboat Springs Tuesday evening. We spent the night in the Cabin hotel.

Rabbit Ear pass, over the Gore range, rises skyward immediately east of Steamboat. We climbed it in the sunny coolness of early morning. The ascent from the west was smooth as if sanded and swept with a broom. Rabbit Ear is a steady climb in second gear. Our six cylinders purred smoothly. The radiator did not boil. Several cars passed, descending, with plenty of room to spare.

At the summit of Rabbit Ear, the tourist is reluctant to go on. There is virgin forest, wild as the Indians left it, ribboned with icy little streams that invite the angler. But the main range of the Rockies, blue in the east, beckoned us, and the road was good.

After leaving Kremmling, there was a bit of rain, then sunshine again. A few miles west of Hot Sulphur Springs the road leaps suddenly into Pryor's canon over one of the finest stretches of graveled highway in all Colorado. This road is carved from the canon wall high above the roaring waters of the Grand river. It cost $90,000 a mile, and replaces a steep winding drive, once a terror to the motorist.

We left the main highway just west of Granby, and saw Grand lake at sunset. Thursday morning, we started on our final run. Roads better than city streets welcome the tourist all the way.

Colorado highway engineers have doubled the beauty of Berthoud pass, which starts just as the motorist passes beneath the trestles at West Portal of Moffat tunnel. The mountains seem doubly beautiful because all the danger of mountain driving has been eliminated.

It is almost twice as wide as actual traffic demands, and even Cæsar's legions never built a finer roadbed.

At Idaho, we were on old familiar ground, climbing back up Floyd hill, through Denver's mountain parks, down Lookout to the pavement and so into Denver.

The speedometer record showed 1,376 miles, including 159 miles driven in and around Salt Lake. That was 664 miles going out, and 653 returning. And the pocketbook? We started with $100 on board. We had $10 left when we reached home. My daily expense book can account for but $79 of the $90 we spent. But, of course, I smoke!

More Permanent Highways

COLORADO has made remarkable progress in building graveled highways during the past few years, but the demand for more permanent roads becomes insistent as the days go by. It has been demonstrated to the satisfaction of capable and experienced engineers that graveled highways cannot "stand up" when the daily traffic is in excess of five hundred to one thousand motor vehicles daily. The up-keep of such highways is too great. As a matter of fact, the average graveled highway is built for a daily average of approximately 500 motor vehicles. They are considered admirable for traffic not in excess of that number of automobiles daily.

But when the average is in excess of 1,000 motor vehicles daily, it is practically impossible to maintain graveled highways up to standard without the expenditure of an excessive sum of money for maintenance.

On many of the highways of Colorado the daily traffic averages from 1,000 to 3,500 motor vehicles. As a matter of fact, there is one highway on which the record shows 7,000 cars daily.

The upkeep of the highways on which the traffic is excessive is a problem that must be solved. The cost is too great, and some means must be discovered whereby the highways may be maintained up to standard without the expenditure of large sums for maintenance. This, it seems, can only be accomplished by substituting more substantial materials for gravel. The first cost will be less. This problem is worthy of the serious thought of the best minds of the State and Nation.

Arizona Highway Pays for Itself

An eighty-two mile section of Maricopa county pavement in Arizona, paid its entire cost in one year, nine months and nineteen days, according to Ira L. Wood, in Arizona Highways.

Mr. Wood uses 2.6 cents a mile as the saving in gas and oil, tires, depreciation and repair bills on the average car, between a paved road and a dirt or gravel road. As authority for this figure he quotes H. G. Borden, former Dean of the College of Engineering, Ohio Northern University.

The Maricopa county road, going east and west from Phoenix, last year carried the equivalent of 816,000 vehicles its entire length. Multiply by 81.9 miles and you get 66,830,400 car miles. At 2.6 cents a mile, the saving to vehicle owners in one year is $1,737,590.40. The road cost $2,866,500 and after adding 5 per cent for interest it was found that the highway paid for itself in less than two years.

A Forest Service Contract

ONE of the most important forest highway projects to be completed recently in the state of Colorado is Section 2 of the South St. Vrain forest highway route No. 26. The entire project runs from Lyons in a westerly direction through Raymond and Allens Park to Estes Park, a total distance of thirty-seven miles. The route is a part of the Park-to-Park system, coinciding with State route No. 7 out of Lyons.

During 1925 what is known as the Ferncliff section of the road was constructed, and Section 2 was done in 1926. It begins one mile east of Allens Park and ends near Copeland Lodge, three and a half miles south of the Boulder-Larimer county line, in the Colorado National forest, and covers a distance of about four miles.

Five bids were received on the work, and were opened on June 2, 1926. On July 3, 1926, the contract was awarded to W. A. Colt and Son, Las Animas contractors, who submitted a low bid of $60,193.00.

Section 2, which was completed between July 6, and December 9, 1926, and is earth-graded, fourteen-foot standard roadway, with proper super-elevation on all curves.

The construction costs of the project were paid for entirely from Federal funds apportioned to the state of Colorado for the fiscal year 1927. The agreement called for maintenance by the Bureau of Public Roads for a period of two years after the completion of the project, and thereafter the maintenance is to be done by the state.

In order that no serious damage would be incurred through such a thickly population area, three curves of less radius than called for in the standards were used, and the only one of these really being excessive was the 100-foot radius blind curve in Allens Park, where considerable property damage would have occurred had a lighter curve been used.

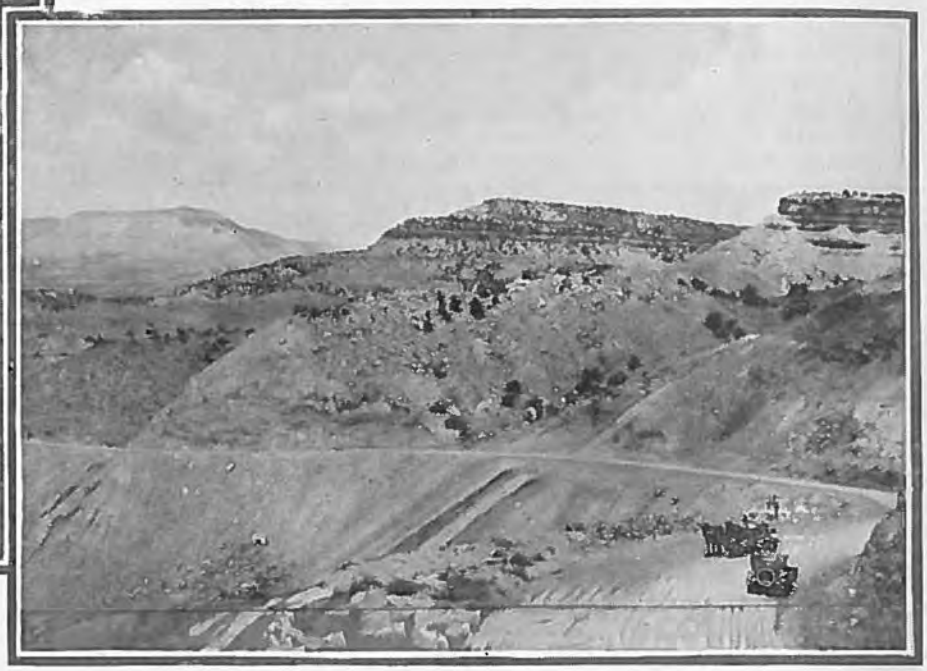
A clearing crew began work on July 6, and a grading crew, consisting of twelve men, thirteen teams, five five-foot Fresnos and two plows started work on July 13, and was gradually increased. It was evident, after the first few days, that in order to complete the project on time, a powerful shovel would have to be used, as considerable more rock and boulders were encountered than had been expected, practically stopping the team work.

View of Finished Forest Service Project Near Allens Park, Leading to Rocky Mountain National Park

Views of Colorado's Ma

Leading to Sections Rich in Nature's Ma
on Fine Roads, with Public Camps,

Independance Pass, Elevation 11,000 Feet, showing Heavy Rock Cut, Near Aspen



A Mountain of Oil Shale, with Heavy Side-hill Excavation, Near De Beque

A Picturesque Scene Near Summit of Mount Evans Within Easy Reach of Denver

Steel and Concrete 400-Foot. Bridge Ove

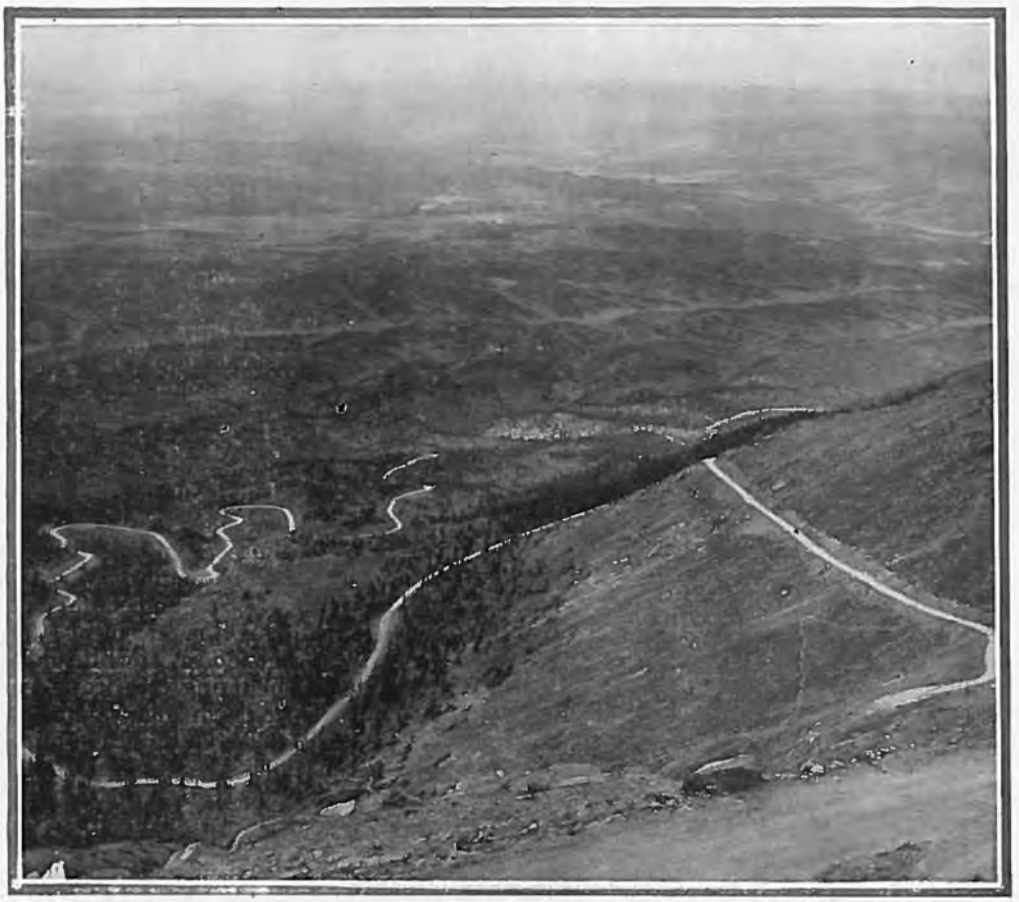
...rvelous Highway System

...Marvels, Accessible to Motoring Tourists ...s, and Near the State's Teeming Cities

View of Concrete Pavement on U. S. Highway No. 285, Near Loveland

A Section of Gravel Surfaced Roadway in Eastern Colorado, Near Wray

...Over Rio Grande River, Near Alamosa



Spectacular Highway, as Seen from the Summit of World Famous Pikes Peak

On August 6 a one and a quarter-yard 75 Thew-Loraine gas shovel, one seventy-five horsepower air compresser and two jack hammers were purchased at a total cost of $16,000.

After this equipment was secured the grading crew was divided, a portion of it remaining with the shovel, while the balance went ahead, opening up, and making fills for the shovel to travel on. Five men worked as a drilling and powder crew.

Excellent weather was experienced until the latter part of October, when a heavy snow storm, followed by a severe cold wave, caused a delay of a week. On December 6 another snow storm started, and was still raging when work was abandoned on December 9, with all but a few minor details complete.

Section 2 of the project is through one of the most magnificant scenic areas in the state, and tourists are rapidly realizing that the climate and scenery along the route are seldom surpassed. Tourist travel along the road has increased approximately twenty-five per cent during the past two years, and many people return the second and third time, spending their entire vacation at modern hotels, cabins and free camping grounds that fairly dot the mountain sides along the route.

A portion of the report of S. J. Caperton, chief of the road survey party which directed the work, showing that it was highly approved by the department, follows:

"The contractor sustained losses on only four items for a total of $1,841.77 ($1,755.00 of which was on finishing, due to probable faulty segregation of grading and finishing costs), and made a profit on the other twelve items of $9,309.21, or a total profit of $7,467.44 on the entire project.. Attention is called to this cost data, as it is a demonstration of the fact that high efficiency can be maintained on any job if properly organized and energetically administered. The equipment was new and the organization was based on a thorough going conception of the principles of scientific management. W. A. Colt, senior member of the firm to whom the contract was awarded, having devoted more than thirty years of his life to road construction."

Caperton pointed out in his report that considerable time elapsed between the opening of bids on June 2 and the awarding of the contract on July 3, and explained that had the contractor been able to start his operations two or three weeks earlier he could easily have completed everything, before being forced to abandon the project because of the weather.

The Bureau of Public Roads is to maintain Section 2 of the Saint Vrain project for a period of two years. This maintenance, the state highway department believes, should be kept up until late autumn.

It is the plan of the state highway department to complete the remaining units in the project, with the co-operation of the government, as rapidly as funds for the work are available.

Features of the entire project will include the elimination of excessive grades, dangerous curves and poor alinement, and completion of the work will provide a first class road bed and traveling surface for the vast throng of tourists who drive over the route between May and September each year.

Upper—Shows Completed Road Through Fern Cliff
Lower—Section of New Road Near Allens Park

CALIFORNIA'S OILING SYSTEM

ONE of the outstanding developments in California highway maintenance this year is the successful treatment of gravel and rock-surfaced highways with oil which will result in tremendous savings in maintenance, solve the acute dust problem, conserve materials, and provide a smooth, well-compacted wearing surface free from corrugations.

California has a large mileage of secondary type roads, improved during recent years. With the rapid increase in traffic a real problem in maintenance and dust control on these roads has faced the state highway organization. In some instances the loss of material has been as high as an inch annually, representing a loss of from $500 to $1,000 per mile. The dust problem has also become an acute one, having resulted in several instances in severe accidents, because of inability of the drivers to see through the clouds of dust.

A number of experiments have been made to solve this dust problem and conserve the road materials, but none has shown promise of success of the present system of oiling. Up to a recent date there was a total of 374 miles of highway oiled since April 1st at a cost of $510,000. On several sections extra amounts of road materials were used adding at least two inches to the thickness of the road and providing a smooth surface that will last until funds for paving are available.

The comments concerning road results obtained and the manner in which the traffic was handled over roads being oiled reflect considerable credit upon the depart-

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California's Oiling System

(Continued from page 14)

ment. Early in the spring the maintenance department formulated a set of rules for its employes, as well as notices requesting co-operation from the traveling public. All employes handling oiling jobs were impressed with the importance of reducing the inconveniences to autoists and judging from reports from various sources success attained their efforts. Two automobile associations of the state have stated that they have this season received very few complaints and that the department is to be congratulated upon working out a plan that has reduced motoring inconveniences to the minimum.

Getting that smooth finish on an oiled highway has become a real science with California highway workers and with the "mixing" method it takes three days of constant working to secure the best results. Immediately after the mix has been "laid down" a 7-foot grader drawn by a small tractor begins working the road behind the traffic for the purpose of keeping the surface smooth during compaction. When traffic first moves over the finished roadway a light car will sink into the surface as much as an inch. Within three hours the same makes no impression and in three days a 22,000-pound load will leave only faint marks which are quickly ironed out by following traffic. The blade is kept steadily working until no further material can be moved, this stage usually being reached about the third day. For this work it is desirable that a rubber-tired tractor be used to avoid cutting up the surface.

Vialog tests on Division VIII oiled highway demonstrated it to be smoother than any type of road in the California highway system and this includes cement concrete, asphaltic concrete and bituminous macadam, and after nine months' service no wear is apparent.

Using the same force of men at the oiling this season that "learned the game" last year has enabled a number of the divisions to not only attain a more satisfactory finished roadway but to do the work at a lesser cost. In Division VIII oiled highways cost $1,600 per mile last year but this year better results were obtained for $1,025.

COLORADO OPENS NEW SCENIC ROUTE

By Ralph Taylor

WITH the completion of the Beulah-Rye mountain highway in the San Isabel national forest, a new scenic route has been added to the Colorado road system. The last six miles of the highway were completed and opened to traffic early in September by Pueblo county.

The Beulah-Rye highway penetrates one of the most picturesque parts of the San Isabel. It links together the two principal mountain resorts of southern Colorado with Pueblo in a circle trip of only 90 miles. It passes through one of the most primeval portions of the large forest reserve and diverified scenery.

Entrance to the highway from Beulah is gained through the beautiful Squirrel Creek canon. Squirrel Creek cascades down the canon which frequently narrows

(Continued on page 18)

Colorado Opens New Scenic Route

(Continued from page 16)

so that there is hardly enough room for both highway and stream. Sheer walls of solid rock alternate with steep mountain sides covered with stately pines.

From Squirrel creek the new route passes between two ridges of mountains where the atmosphere is 40 degrees cooler than in Pueblo. In places the road clutches to the sides of mountains, circling into more open territory where grass covered mountain meadows broaden into fertile head lettuce and potato farms. The open spaces are fringed with millions of georgeously hued flowers. The natural beds of flowers wander off to meet the timber growth which carries the scenic grandeur skyward up the mountain sides.

The St. Charles, Willow Creek and other mountain streams are painted into the stupendous mountain picture, with hundreds of accessible places where fishermen may cast for trout.

From the St. Charles the highway plunges into a wilderness of vegetation which at times threatens to smother the passage. The aspens meet above the roadway and form natural tunnels for great distances.

The animal life of the region is as wild as the country. Deer, bears and mountain lions inhabit the territory adjacent to the road.

Tops of the mountains are frequently covered with snow, large snow slides making snow perennial. The rugged country meets sea blue skies on which lily-white clouds ride.

It is the last six miles of this highway, from the San Isabel forest boundary to the resort of Rye, that the road crews of Pueblo county have just completed. It connects with the forest section which was completed last year by the forest service. The former difficult mountain trail has now been converted into an easy automobile road which is expected to become one of the most popular drives in the state.

The Pueblo county section of the Rye-Beulah route will be surfaced with shale next season. Lack of funds, due to washouts throughout the county, caused postponement of the surfacing. It is planned to have the shale in place in time for the 1928 tourist season. The forest portion of the road is surfaced with decomposed granite.

The Rye-Beulah highway was finished through the efforts of the Pueblo county commissioners, W. L. Rees, chairman; O. G. Smith, road commissioner, and Hurb H. Wilson and Charles Stepp, road superintendent.

Concrete Roads

No type of pavement surface has shown the tremendous increase that concrete has. Practically unknown except to a very small part of the population in 1909, it is now so much a part of every community that "hard roads" and "concrete" have become synonymous.—California Highways.

NEWS OF THE MONTH

Current Events in the Field of Highway Engineering and Transportation—State, County and Municipal Activities

Construction of the Monument undercrossing of the Denver-Colorado Springs highway is expected to get under way in September. The work has been delayed because of improvements being made by the Denver & Rio Grande Western railroad which will change the railroad right-of-way.

Fred Kentz, Denver contractor, has started work on graveling of eight miles of the main highway east of De Beque. Completion of the road will establish a gravel highway to Grand Valley from De Beque.

Bridge and highway washouts in Pueblo county depleted Pueblo county's road fund to $50,000 on September 1, necessitating the discontinuance of all road work except maintenance and emergency projects for the balance of the year. The road crews were cut from 97 to 30 men.

The county has replaced many bridges which were washed out by high water in all parts of the county. The commissioners have asked the state highway department for $2,500 to place an 80-foot steel truss across Rock Creek on the Siloam road to replace a partially destroyed pile bridge.

The 28-foot span which was added to the west bridge over the Arkansas river at La Junta was completed and opened in August.

Opening of the new North Nevada avenue bridge over the Rock Island cut at the northern edge of Colorado Springs is slated for October 1.

W. D. Corley, Colorado Springs millionaire, has submitted to the department of agriculture in Washington, D. C., a new proposal for construction of a "high gear" automobile highway to the summit of Pikes Peak. His proposal provides that after five years from date of the issuance of the permit the road will be turned over to the public and at the same time his Corley Mountain highway to Cripple Creek would also be made a public route. During the five-year period both routes would be conducted as toll lines.

Crushed rock has been placed on the Sante Fe Trail between the Fowler and Manzanola paving, improving the stretch of highway.

Oil soale as a road surfacing material is being tested out at Grand Junction by the state highway department, Mesa county and oil shale interests. Two carloads of pure oil shale have been placed on North Twelfth street in Grand Junction. It was provided by the Index Oil Shale company of De Beque and was spread at a two-inch thickness.

It is claimed that oil shale is superior to macadam or concrete, will not get slippery in wet weather, will not cut into ruts, has a long wearing life and requires but little maintaining. The claims will be proved or disproved with the Grand Junction test.

After three years of work the Ten Mile highway through Ten Mile canon has just been completed and opened to traffic between Leadville and Breckenridge. Part of the new route is the abandoned right-of-way of the Denver & Rio Grande Western railroad between Leadville and Dillon. It was conditioned by the forest service. The road is wide enough in most places for three cars to run abreast. The grade is easy. The highway will be free of snow earlier each season than the old road which it replaces, highway men declare. It passes through a new scenic section of the state.

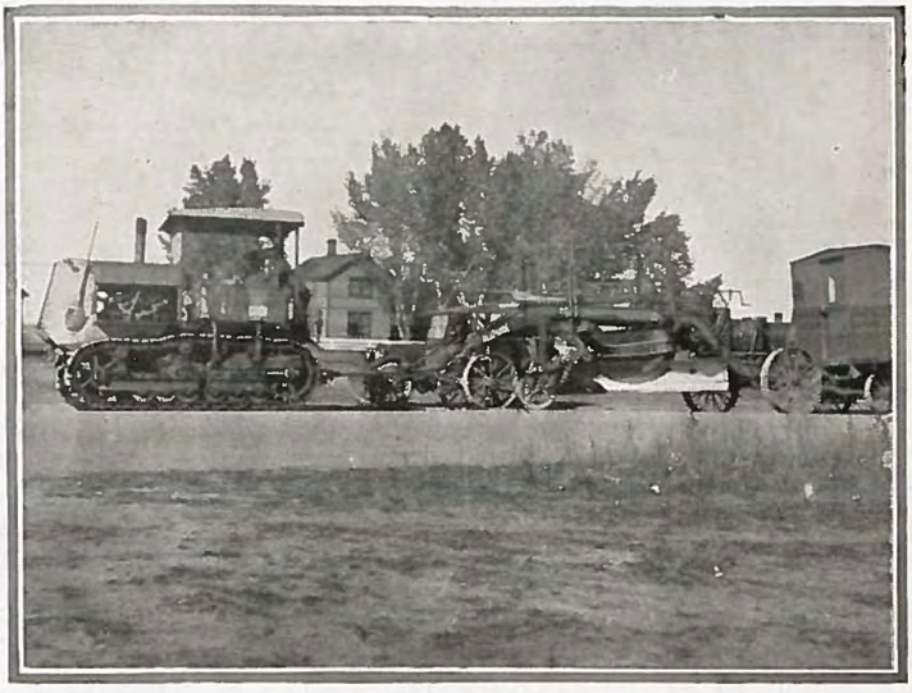
The 350-foot concrete bridge and viaduct at Portland in Fremont county was opened early in September by H. M. Fox, the contractor. The work required a year to complete. Railroad tracks are spanned by five arches, each 40 feet in length. The span over the Arkansas river is 150 feet in length. A width of 30 feet provides ample room for vehicles to pass on the bridge.

A mile of new paving in the town of Portland has just been completed and in connection with the old paving, it gives the town almost 100 per cent paved streets.

Federal highways radiating north, east, south and west from Pueblo were recently marked with highway signs by C. B. Furlong, highway engineer and Charles D. Stepp, Pueblo county road superintendent. Danger and warning signals were erected, as well as some new road number signs.

La Manga pass highway leading to Cumbres pass was completed late in August by Shields & Kyle, contractors. It is a link in the route to Mesa Verde national park by way of Durango

Members of the Spanish Peaks' Playground association are urging completion of the scenic auto highway from the Blue Lakes resort near Cuchara Camps to the lakes, a mile up the canon. It is proposed to have Huerfano county build the road at a cost of $6,000 at once and receive compensation from the federal government in 1928.



A Modern Maintenance Outfit Operated by Arapahoe County

County Road Officials Hold Meet in Pueblo

Members of the Arkansas Valley Association of County Commissioners met in Pueblo September 9 to attend the Colorado state fair and discuss mutual problems. The commissioners were interested in the respective county exhibits which they fostered at the fair.

Highway discussions centered on methods of handling roads during periods of excessive rains and floods which all southern Colorado counties experienced this summer. W. F. Tarbox of Crowley county, George B. Neibuhr of Huerfano county and John Lamberson and J. O. Walker of Kiowa county, led the discussion.

Hal Barnes of Las Animas county and O. G. Smith of Pueblo talked on the duties of the county health department.

Origin of the county health office was outlined by E. L. Weitzel, Pueblo county attorney, and J. Arthur Phelps, district attorney of the tenth judicial district.

An outline of time saving methods in handling automobile licenses in the rush season was presented by William Barber, Pueblo county clerk.

The marking of the National Old Trails from Kansas City to Los Angeles with the same continuous number was advocated at the annual meeting of the National Old Trails association held September 2 in La Junta. Members voted to urge the government to complete the marking of the historic route. The meeting was attended by delegates from all states involved. Harry S. Truman of Independence, Mo., presided.

The Hayden pass road near Alamosa may again be used after years of abandonment. The old wagon trail was used 60 years ago by pioneers. The entire road over the Sangre de Cristo range is about six miles. It would probably be an all-year pass and would shorten the distance between Canon City and Alamosa by 35 miles. Highway officials are investigating the proposal.

A moster celebration is scheduled for September for the official completion of La Veta pass and its acceptance by the state highway department. The improved La Veta pass connects Alamosa and Walsenburg with a roadway of moderate grades and curves, which is free from snow blockades the entire year. Gov. W. H. Adams, state officials, county authorities and members of the Rotary clubs of Pueblo, Walsenburg, Trinidad, Monte Vista and Alamosa will take part in the celebration at the top of the pass.

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

Proj. No.	Length	Type	Location
279-D	0.261 mi.	Concrete Paving	Morrison

PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
138-A	10 mi.	Gravel Surfacing	North of Kremmling
2-R6	6 mi.	Asphalt Paving	South of Aguilar
279-F	3.3 mi.	Grading	North of Baileys
287-D	0.5 mi.	Gravel Surf. & Underpass	East of Kersey
288-A2	9.5 mi.	Concrete Paving	Between Brush and Merino
288-A3	3 mi.	Grading & R. R. Grade Separation	Northeast of Brush
296-C	5 mi.	Gravel Surfacing	North of Greenhorn
297-A Reop.	2.85 mi.	Gravel Surfacing	East of Palisade
560	3 mi.	Gravel Surfacing	Deer Creek-Littleton

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj No.
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	$ 28,882.70	34	2-R3
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	331,632.00	100	2-R4
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	100	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	100	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	78	144-A1
145-A	West of Glenwood Springs	3.807 mi.	Gravel Surfacing	Winterburn & Lumsden	53,227.90	41	145-A
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	90	157-A
210-B2	De Beque-Grand Valley	7.507 mi.	Gravel Surfacing	Fred Kentz	37,475.00	0	210-B2
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	100	213-D
246-F	West of Avondale	1.0 mi.	Paving	Strange-Maguire Pav. Co.	37,847.00	0	246-F
247-C	Swink	0.8 mi.	Conc. Pav. & R.R Underpass	J. Finger & Son	62,559.58	0	247-C
254-C	Div. 1 2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	100	254-C1
254-C2	S. W. of Hot Sulphur Springs	Superstr. of Bridge & Approaches		Northwestern Constr. Co.	48,203.50	0	254-C2
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	51	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	100	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	49	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	52	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	81	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	100	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	62	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	71	271-B
275-C	Div. 2 East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,466.60	61	275-C2
275-E	North of Monument	0.926 mi	Grading and Underpass	F. L. Hoffman	41,905.20	0	275-E
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	81	275-F1
275-F2	Castle Rock, south	5.227 mi.	Paving	J. Fred Roberts & Sons	119,027.80	51	275-F2
275-G	Larkspur-Monument	10.869 mi.	Grading	Monaghan-Cunningham Con. Co.	141,252.78	74	275-G
276	North of Colorado Springs		R. R. Overpass	J. L. Busselle & Co.	37,913.00	70	276
279-E	Schaffer's Crossing-Baileys	3.243 mi.	Grading	S. M. & S. J. Feely	54,305.60	51	279-E
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	100	281-D1 251-B1
251-B2 & 281-D2	Lafayette, north	5.813 mi.	Concrete Paving	J. H. Miller & Co.	146,315.00	12	251-B2 281-D2
281-E	At Lafayette	0.812 mi.	Paving	J. H. Miller & Co.	27,226.00	86	281-E
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	40	282-D
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	88	283-C
287-A2	Fort Morgan, west	4.011 mi. 16.61 mi.	Concrete Paving Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	100	287-A2
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier C. Eng. Co.	159,950.85	70	287-C1-2
290-D	East of Las Animas	2.954 mi.	Concrete Paving	W. A. Colt & Son	88,979.50	10	290-D
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	52	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,645.25	82	293-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	100	295-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Cole Brothers	58,061.00	100	296-B
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	100	297-B
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	95	299-A

KEYSTONE COPPER STEEL CULVERTS

Strength-Flexibility-Performance

What is it that makes ***Keystone Culverts*** last so long ....makes them so economical....so dependable?

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COLORADO CULVERT & FLUME CO.

PUEBLO

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Re-mixing Action

ONLY the Koehring sends materials through the mixing action, and then returns them to the charging side of the drum, and sends them through the mixing action again, and again — *a clean cut, fast re-mixing action!*

Every grain of sand, every fragment of stone is thoroughly coated with cement

Koehring re-mixing action is alone made possible by the Koehring construction which pivots the discharge chute far enough inside the drum so that, in reversed position it scatters and sprays material *back to the charging side* of the drum, as materials are violently projected down upon it from the pick-up buckets at the drum top!

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This means security against extended mixing period when concrete is under rigid inspection, and when mixing time is fixed according to uniformity, plasticity and strength of concrete!

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And Besides the Koehring Is Fast! Fast As a Unit!

Fast in the high speed succession of batch after batch through the mixer! Fast in second-saving control! Beyond all question the Koehring is the *High Speed Paving Unit* — the extra yardage mixer for record-breakers!

SIZES

Pavers—7-E, 13-E, 27-E. Auxiliary equipment and choice of power to suit individual needs. Complies with A. G. C. Standards.

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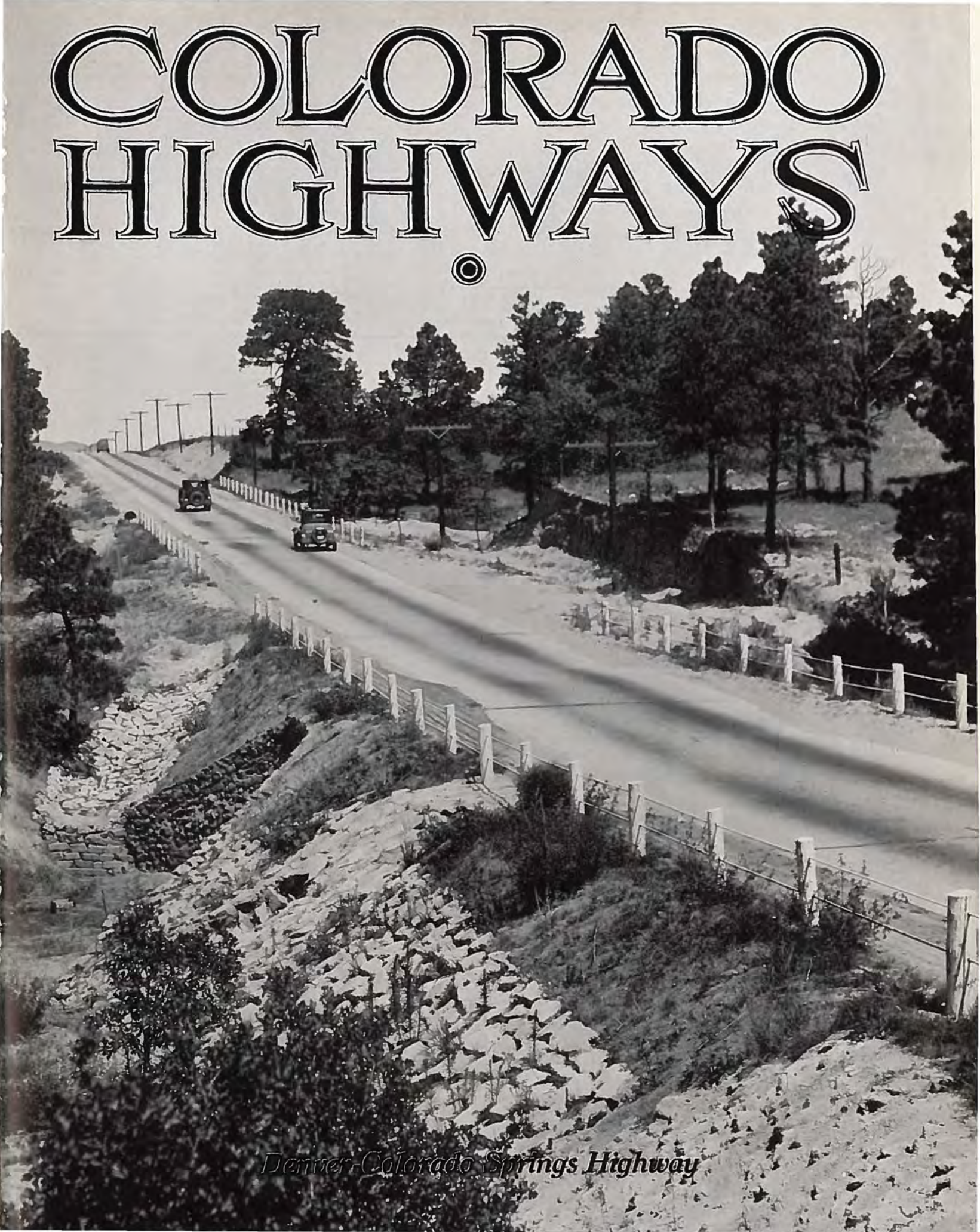
COLORADO HIGHWAYS



Denver-Colorado Springs Highway

These Arizona Concrete Roads Earn $1,000,000 Every Year

All Maricopa County is talking about the returns from its most profitable investment—330 miles of county roads paved with Concrete.

These are paying large dividends to farmers, ranchers, and the people of Phoenix, Arizona, the county seat and state capital.

After the roads were concreted—

The Maricopa Creamery Company hauled 30 per cent more products at 25 per cent less cost.

The Arizona Storage & Distributing Company reduced its hauling costs 33 per cent, and passed this saving on to patrons by charging one-third less for hauling over concrete than over dirt roads.

Lin. B. Orme, farmer, operating 200 acres, found his smallest draft team could pull 7,500 pounds on concrete; its limit on dirt roads used to be 4,000 pounds. His automobile tires now average 15,000 miles; they barely averaged 3,500 miles when the roads were dirt.

The Bartlett-Heard Land & Cattle Company, operating 2,500 acres, paid 10 cents per ton mile for grain haulage in 1923 over concrete roads; in 1918, over dirt roads the cost was 20 cents per ton mile.

These examples are but a small part of the story. Reliable figures, vouched for by Maricopa County taxpayers, prove the $1,000,000 per year earnings. Figures will gladly be given upon request.

Portland Cement Association

A National Organization to Improve and Extend the Uses of Concrete

Ideal Building, Denver, Colorado

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10 CENTS A COPY. **$1.00 A YEAR.**

Our Cover Picture

This month's issue of Colorado Highways carries on its cover a splendid view of a stretch of the Denver-Colorado Springs pavement, located eight miles north of the latter city. A traffic count conducted by the State Highway Department in August showed an average of over 2,000 vehicles per day travel over this north-south highway.

Colorado Highways
"BETTER ROADS"

VOLUME VI. OCTOBER, 1927 NUMBER 10

President Blauvelt's Annual Address to Nation's Road Builders

Delivered at the American Association of State Highway Officials Convention at Denver, Colorado, October Third

SINCE our meeting at Pinehurst, North Carolina, last November, I have often wondered why, at that time, it seemed to be the unanimous opinion of this association that our next annual meeting should be held at Denver, Colorado—an association consisting of representatives of forty-eight states selecting a place so far removed from the center of wealth and population of these United States. Colorado is but a small state when reckoned by its wealth, population, and achievements in its road-building program, but it is indeed great when measured by the patriotism, loyalty and ambition of its people; and I trust you may, at the end of your long journey through many states, have profited by instructive lessons pertaining to the work in which we are engaged, so that your trip may be considered worth while. We of the Highway Department of Colorado extend to you a most cordial and sincere welcome, trusting that by your presence, and through the influence of this association, our people may be further imbued with the imperative necessity of continuing the work of highway improvement. I cannot express to you what your presence means to our Highway Department, to this state, and to the future development of its resources by means of added highway transportation facilities.

In view of the changes in the personnel of the various state highway departments, it might be pertinent to briefly refer to the organization and objects of this association, which today, national in its scope and international in its influence, represents, together with the United States Bureau of Public Roads, the greatest construction agency of modern times. During the period 1907 to 1913, regional highway associations were in existence, and the states, through Congress, were interested in obtaining Federal co-operation in road construction. It was believed that state highway departments, being conversant with local requirements for road improvements, should be organized into a national association, and definite plans formulated leading to Federal co-operation with states in road construction. At Washington, D. C., in December, 1914, a meeting was held by representatives of the highway departments of sixteen states and the United States Office of Public Roads, resulting in the formation of an organization called the American Association of State Highway Officials. Its purposes, in part, as set forth in its constitution, were to promote a closer relationship between state highway departments with a view to establishing a uniform system of administration, construction, maintenance and legislation, for the purpose of conserving the capital invested in highway construction and maintenance by producing the highest possible efficiency, and to co-operate in every way possible with the United States Office of Public Roads, or similar Federal organization, in the consideration of road problems. Of those present at that first meeting of the association, we are honored in having with us, today, its first president, Mr. H. G. Shirley of Virginia, as well as its first treasurer, Mr. Frank F. Rogers of Michigan, whose interest in the success of the then infant organization has never ceased. From this beginning in 1914, to the present time, this association has been instrumental in initiating and furthering national legislation toward Federal co-operation with the states in the development of their road construction program; without which co-operation, so generously afforded, the brilliant achievements effected during this period of highway development could not have been made possible.

On January 1, 1927, of the 184,000 miles comprising the Federal-aid highway system of the United States, 68,000 miles were completed or under various stages of construction with Federal and state funds. In addition, there were completed or under construction, on the Federal-aid system, 65,000 miles improved without governmental aid, making a total of 133,000 miles of the total system of 184,000 miles in various stages of improvement; and it seems reasonable to assume that with a continuing Federal appropriation by Congress of from seventy-five to eighty million dollars per year, that the remaining 28 per cent of the Federal-aid system of roads would be under stage construction by the year 1933. Then we would only have reached the beginning of the added future requirements for additions and refinements in types of surfaces and maintenance as demanded and necessitated by our constantly increasing motor vehicle transportation requirements. The immensity of this task of road improvement yet to be achieved would seem to be appalling, were it not for the encouragement afforded by the wonderful accomplishments of the past few years. When one is asked the question, "When will this enormous expenditure for road improvements stop?" the reply can only be, "When the taxpaying public fail to realize the enormous dividends returned from their investment." Benjamin Franklin is quoted as having said, "We are taxed twice

as much by our idleness, three times as much by our pride, and four times as much by our folly, as we are by our government.'' This is pertinent as applying to the one who votes against good roads measures under the erroneous impression that he is making a saving by being relieved of paying so-called taxes, which in reality are such in name only. The loss to which we are subject by the continued use of bad roads is many times greater than the tax necessary to build good roads.

The past Congress authorized Federal funds, to co-operate with the states, to the extent of seventy-five million dollars a year for two years, and it is now a matter of great public concern that the incoming Congress continue this program. We, the states of the West (and speaking of Colorado in particular), depend for our very existence on improved transportation facilities, such facilities serving as an accurate barometer indicating the growth of our agricultural, industrial and mineral development. Some of the vast and most productive sections of our state only await modern highway and rail transportation to develop their wealth. We have large areas of public, or government, land within our boundaries, rich in potential values. In the improvement of our transportation facilities with the aid of Federal funds, we feel that the benefit derived by this state from the receipt of such funds in road construction is equally reflected to the credit of the government in the enhanced valuation afforded its holdings within the state. We are strong supporters of Federal-aid, and are duly appreciative of its benefits; and our senators and congressmen have always been loyal in their support of the measures affecting road legislation in Congress, and as endorsed by this association.

The marked advancement made by the several states in the past few years in road building is, in a large measure, due to the splendid co-operation existing between the several state highway departments and the Federal government, resulting in uniformity in road construction and maintenance, and in the adoption of uniform danger signals, safety devices, and highway directional signs, together with the vast knowledge made available to all states through co-operative traffic and research studies. As the members of Congress have publicly acknowledged the value of the work of this association to be paramount in accomplishing all the work above referred to, it is imperative that the state highway departments and the Bureau of Public Roads continue their leadership for further development along these lines.

During the last session of the Sixty-ninth Congress, the attention of the whole nation was called to the fact that efforts were being made by private parties to erect toll bridges at strategic points on our interstate highway system, and Congress was flooded with requests for franchises along this line. A number of bills were passed, however, through the strenuous efforts of this organization, following the very emphatic steps taken at our meeting last year in Pinehurst, a bill was introduced through our Washington office to meet this grave situation. The condition of legislation was such that it was not possible to get consideration; but I believe that this bill should be re-introduced and every effort made to protect the general public against excessive tolls, when highways are presumed to be free. State and Federal funds will finance the construction of these important links in our road improvement program, and, if it were necessary to resort to bond issues, reasonable tolls could be exacted by the highway departments themselves, extending over a limited time, to provide for the refunding of construction and operating costs and interest, the structure thereafter to be made free to the public use. It is interesting to note that probably one of the reactions of our agitation before Congress was the fact that the following six states, in their legislation during the past year, passed remedial laws covering the control of toll bridges, namely, Arkansas, California, North Carolina, Pennsylvania, Tennessee and Washington.

A modern gravel surfaced state road located east of Grand Junction.

Another legislative field with respect to which this association is giving serious consideration, is that of state and Federal regulation of commercial bus and truck transportation. This matter will be presented by an official of the National Automobile Chamber of Commerce at one of the sessions of this convention.

In the matter of financing our continued road improvement program, whether the states desire to build a large mileage of roads at once through the issuance of bonds, or to carry forward a plan year by year according to receipts from indirect taxation, it is to be noted that the general trend of highway financing is becoming more and more deflected along lines favoring the ''pay as we go'' plan. It is quite evident that the use of automobile license fees and gasoline tax has become a popular method of securing a large portion of the funds for the retirement of bonds or the direct payment of construction and maintenance costs. It is worthy of note that twenty-four, or one-half, of the states have *increased* their gasoline tax during the past year, and in no instance was there any serious effort made in any state to reduce or eliminate the gasoline tax as a source of income for road construction. This is another indication that the work of the highway departments of the various states, by comparison of their experiences, has brought about general uniformity of action throughout the country in reference to financing highway improvements.

In conclusion, it is fitting that due apprecaition be expressed to all associations which have co-operated in furthering the development of road improvements of the nation, as carried on by the respective state highway departments; also for the earnest work of the various committees of this association, which form the very essence of its existence, and whose work in the past is reflected in the success that this association has attained.

McDonald Outlines Work of U. S. Bureau of Public Roads

Before the Thirteenth Annual Meeting of American Association of State Highway Officials

By THOMAS H. MCDONALD, Chief, U. S. Bureau of Public Roads

THE highway situation is constantly changing in detail and in its broad trends. As the opportunity has come each year to me to address this conference of the American Association of State Highway Officials, it has been approached with the thought of placing before the highway executives of the nation a definite, forward-looking, but not radical expression, upon some of the matters which appear at the moment to be of major importance both for the present, and for the future, which notwithstanding changing conditions, will be so materially influenced by what we do now. Even more it has been approached with the hope of correctly interpreting the Bureau of Public Roads to you that the present cordial relationships may be guarded against misunderstandings. Perhaps this is too meagerly phrased to indicate the full significance to highway progress of harmonious and concentrated effort by the state and federal highway forces. Highways are characterized by, and inseparable from, their community interests. Whether considered from the state, national, international or local viewpoint, whether from that of the road builder or the road user, the common interests must first be served, since, together, they are the most important. To me, this "community of interests" aspect of highways contain a constantly growing appeal as not only their direct, but even more, their indirect influences become more and more apparent. Through these influences we enjoy the real opportunity to lift the dead level of the day's work toward the higher objective of progress in government and thus contribute, each one as he is able, to the common good.

Progress In Federal Aid Highway Construction

For the fiscal year ending June 30 under the Federal Aid program, 9,683 miles of projects were completed.

Visiting highway officials were thrilled at this view on Mount Evans highway.

Eight thousand, three hundred and seven miles were new construction, and 1,376 miles additional construction of projects on which preliminary work had already been done, that is, that were additional stages of construction. While 2,537 miles of graded and drained roads were built as original construction during the year, the mileage in this stage increased by only 1,145 miles. This was the result of the further improvement of previously graded roads as stage construction. This is a decided advance which indicates the turning toward the more adequate improvement.

Three thousand, two hundred and ninety-nine miles of gravel were built, a decrease of 862 miles below the previous year, and 2,971 miles of pavements of bituminous and cement concrete, a decrease of 518 miles below the preceding year.

In these figures the evidence is clear that the Federal highway funds accumulated during the war and immediately following have been largely used and we are approaching the annual production that will be possible with the current authorization.

The total of Federal-aid projects completed, under construction, or approved for construction as of July 1, was 76,708 miles, divided as follows:

		Miles
1.	Stage construction, graded and drained	15,500
2.	Sand clay and gravel	34,474
3.	Waterbound macadam	1,431
4.	Bituminous macadam	4,307
5.	Cement concrete	18,009
6.	Brick	832
7.	Bituminous concrete and asphalt	1,923
8.	Bridges	232

National Highways and Metropolitan Area Roads

As little as five years ago it was thought that the national highway problem lay in the necessity for the building of transcontinental routes. Our knowledge of traffic flow and highway utilization has changed materially in that time, and today transcontinental traffic is far better provided for than is the weekly peak traffic, particularly in metropolitan areas. This is not boasting about transcontinental routes. A great deal remains to be done, and now that we have agreed upon a system of interstate routes we need to demonstrate that the principle of co-operation between the states and the nation when assisted by Federal aid funds, can expedite the improvement up to an adequate utility standard of each major national traffic route from east to west and from north to south. Weak links in the east to west transcontinental highways lie largely between the 90th and 117 meridian or, roughly, between the Mississippi river and the eastern boundaries of California, Oregon and Washington. North to south there is a potential traffic between the Great Lakes and the Gulf Coast which is now held back by weak links on the U. S. system, largely south of the Ohio river.

Transcontinental traffic has been thought about from the earliest days in terms of east to west traffic. There is a potential north to south traffic that will develop quickly into now unguessed dimensions following the completion of adequate routes. Why not agree between ourselves upon a policy of using at least 50 per cent of the Federal aid allotments in the closing up of the gaps in these main thoroughfares, and realize within the next two or three years a consummation of

Stretch of gravel surfaced roadway on state highway system near Holyoke.

the representations that have been continually made by both the Bureau of Public Roads and the states that it is possible under the present plan to secure an adequate national system of highways more quickly than in any other way.

As highway officials we do not want to confess at the close of another year that we do not have as yet a completely improved highway route across the country. By a recognition on the part of only a few states that they do have an obligation to their sister states and to the national plan of highways, such confession will not be necessary. Political differences ought to be adjusted in a few states so the highway situation would not be in continual jeopardy from improper administration. How each state administers its own funds and internal affairs is very much its own affair, but how any state administers the Federal highway funds is quite a different matter. The Bureau is now prepared, failing to obtain co-operation from the completion of these important thoroughfares, to insist upon a recognition of the requirements of the law which provides for expediting the completion of these routes. The Attorney General of the United States has ruled with special reference to the reconstruction of the interstate bridge at Memphis that in order to expedite the completion of interstate routes, the Secretary of Agriculture has full authority to withhold his approval of other projects.

In connection with the interpretation and enforcement of the Federal highway legislation, the thought is continually before the Bureau of the community of interests between the states which are tied together by their highways. Thus, in insisting upon the completion of gaps, the Bureau is endeavoring to bring about in full measure a compliance with the community interests. It requires no boldness to assert that a

twisted perspective of states' rights exists. The rights in this instance are all with the states which have met the needs of the public service and all against the tardy and reluctant states. There can be no rights which are wrongs to the majority of the whole community.

Balancing Highway Budgets With Highway Needs

It has become more and more apparent, particularly as the discussion of annual budget has become common, that there are two kinds of budgeting; the budget that is prepared with reference to the expected income, and the budget that is prepared with reference to the physical condition and necessities of the highways. They might be termed, the fiscal budget and the physical budget. The first type of budget is open to a great deal of mismanagement no matter how correct the fiscal information. The second type of budget is the only plan that eventually will work for economy. It is apparent that a great many state highway departments do not have the information in sufficiently accurate form, relative to the physical condition and necessities of the highways, to prepare the kind of a budget that will eventually lead to a system of roads uniform with the necessities of traffic. This lack of information is evident in budgets improperly balanced between reconstruction and new construction on extensions. It will always be a temptation to add to the mileage of state routes. During the year 1926, 13,000 miles of road were added to the state systems, and it is this tendency that definitely pointed out to the Bureau the necessity for requesting that the first state construction projects be lifted to a higher degree of improvement at a rate to wipe out the roads of this class within a very few years. The policy of approving stage construction projects will be limited in the future to a definite period, and more for the purpose of handling the first stage of construction efficiently than for the purpose of deferring the greater expenditure necessary to provide a utility surface.

Motor Truck and Bus Regulation

One of the most peculiar and unintelligent reactions to a progressive policy of weight regulation was manifest in the consideration accorded legislation proposed last year to permit the use of 6-wheel trucks. Only two states adopted legislation providing for such use, and it was definitely turned down in other states, in one or two cases on the recommendation of the highway officials. All of the available information indicates that the way to approach the handling of the heavier loads on the highways is by multiplying the wheels and limiting the concentration of load per wheel. This principle will undoubtedly be accepted eventually, but it is a principle that should find vigorous support from the highway officials where so far it has failed to receive justifiable support. The question of what wheel concentration should be permitted is, of course, debatable, but there is no room for questioning the principle of increase of wheels and decrease of wheel concentration. By this is meant, not so much the matter of wheel concentration legally permitted, as the actual concentration which exists.

Highway Safety

The problem of highway safety is one that can only be met by co-operation. There is much over-working of the word, and a greater disregard of its meaning. The lack of correlation between the traffic officers and those responsible for street and highway improvements, particularly within the city areas in distressing in the extent to which it exists. Also the growth in the installation of automatic stop lights is a tribute to salesmanship rather than to engineering intelligence. There are limited areas in cities where traffic is equal and constant, where there is a large amount of pedestrian as well as vehicular traffic, and where the stop and go control is necessary and, so far, the only developed means of meeting the situation. It is certain that a large amount of fundamental research and investigation, and probably trial plans, must be undertaken in order to prevent the loss of perhaps the most valuable element which the motor vehicle has brought; that is, the saving of time to the individual.

Grade Separation

Of intimate connection with the general question of highway safety, is that of railroad grade crossing elimination. It is apparent from the negotiations which come to the attention of the Bureau from time to time that there is too much of an effort being made by many states to place a greater percentage of the cost of grade crossing elimination upon the railroads than is now justifiable. This attitude comes down from the time when the use of highways was incidental; when the largest financial benefit in grade crossing elimination was the decrease of liability to the railroads.

Ultimately the public will pay for the grade separations, whether in the first instance the cost is paid largely by the railroads, or from highway funds. About the only accomplishment then, in attempting to require the railroads to pay an undue percentage of the cost, is in preventing altogether, or delaying, an improvement in which safety to the public, and particularly the time saving element, are much greater than the decreased liability to the railroads. The time has come for an adjustment of the old established participation in the costs of such improvements.

Highway Research

The problem of design and construction are perhaps becoming more simplified and their proper handling better understood by the research and investigation which go forward constantly. It is doubtful if there is a sufficiently rapid assimilation of the results of research in actual design and construction. At least it seems worthwhile to call to the attention of the highway officials the desirability of changing or modifying practices along the lines which appear to be sound technically and supported by real evidence. The problem of the secondary highway is acute and must be met in a greater degree than now. So the field ahead for this organization and its members is growing larger rather than smaller. Unquestionably the state highway organizations could now be of the greatest benefit by exercising at least general administrative and engineering direction over the more important local roads, but we must find through research and experiment more effective methods and processes than have yet been developed. In the necessity for the improvement of the secondary roads exists an almost limitless field for extending the usefulness of the state highway departments.

How Tests Are Made Maintain Standard of Concrete Roads

By JOHN P. DONOVAN
Division Engineer, Colorado State Highway Department

DURING the past few years literally hundreds of thousands of tests of the components of Portland cement concrete paving mixtures have been conducted by many agencies in the United States; notable among these agencies are the Portland Cement Association, the United States Bureau of Public Roads, many state highway departments, and various colleges and universities. The results of these tests have been carefully studied, and it is not too much to say that by reason of this study our knowledge of Portland cement concrete, which before was largely based on opinion, is now rapidly advancing to the point—which is almost, but not quite, now reached, whence it will be possible by control of the various components, to surely design and produce a concrete of any desired strength from the most logical available supply of stone.

By far the larger part of these tests has been made in laboratories, but many thousands of tests have been made of concrete, and its component parts, during production on the job, and studies of the results of the laboratory tests have been closely followed up by a study of concretes as they were manufactured in mass in accordance with the principles deduced from the laboratory tests.

It is fairly well decided along general lines now that the strength of concrete in compression—that is its ability to withstand vertical loads—is the simplest method of defining the quality of concrete for a given task. Therefore, knowing from the results of these hundreds of thousands of tests how concrete must be manufactured under laboratory methods in order to attain a given strength, it is simple to specify within relatively narrow limits the kind and quality of the components, and the method of manufacturing concrete from those ingredients in order to secure the desired compressive strength.

The ingredients of Portland cement concrete are four, viz.: water, cement, sand and stone. The stone may be composed either of particles of crushed ledge rock, of particles of natural gravel, or of a combination of the two. The crushed rock may be produced by crushing particles of natural gravel which are larger than the maximum size permitted in the concrete.

Taking up the quality of the ingredients in order—we first specify tests for the water. It is sufficient for the purpose of this outline to state that the water should be fit to drink.

The tests of the next ingredient—Portland cement—are not as simply stated. Some of the important tests of Portland cement concrete are: First, that not less than 78% of the cement shall pass a standard No. 200 mesh sieve. A 200 mesh sieve has about 40,000 openings to the square inch, hence it will readily be seen that this specification provides for an extremely finely ground product.

A second important test of cement is the soundness test, and one of the requirements of the soundness test is that a pat—which is about 3 inches in diameter, ½ inch thick at the center and tapering to a thin edge, and composed of cement and water—is placed on a clean glass plate and stored in moist air for 24 hours. At the end of those 24 hours the pat on the plate is placed one inch above boiling water and kept there while the water is boiling for five hours. If the pat is distorted—if it shrinks, cracks or disintegrates, the cement is rejected as being unsound.

A third important test of Portland cement is the determination of the time of setting. It can readily be seen that if cement should harden too quickly, it would be impossible to give it the proper finish, or if it should harden too slowly, it would be impossible to maintain the proper finish. The test is made by the use of a loaded wire needle—the needle test, in one of the standard tests for initial set, is made by the use of a needle 1/12 inch in diameter loaded to weigh ¼ of a pound. When the cement will stand up under this needle without appreciable indention the initial set is said to have been attained. The final set is determined with different

Core drilling machine used by Colorado State highway department in testing concrete pavement.

needles, but in a similar manner. A fourth important test of the cement is the determination of its tensile strength. This is made by pulling apart, in an extremely delicate machine, carefully moulded specimens of mortar made of definite proportions of a standard test sand which is produced at Ottawa, Illinois, of cement and of water. The moulded specimens are roughly dumb bell shaped, and at the narrowest part their cross section is exactly one square inch. When tested by the machine the number of pounds weight used to pull apart these moulded specimens is therefore the tensile strength of the mortar in pounds per square inch.

The next ingredient is sand. Under the Colorado State Highway Department specifications, the sand is tested first for size, which must be such that it shall all pass, when dry, a screen having meshes ¼ inch square —not more than 20% shall pass a sieve having 50 meshes per linear inch, and not more than 5% shall pass a sieve having 100 meshes per linear inch. These fineness specifications mean roughly that the sand is shaken through sieves of varying sizes of openings in much the same way that the housewife sifts flour, with the addition, however, that the sizes of the wires making the meshes and the sizes of the openings are very carefully determined, and a set of standard sand sieves is not by any means an inexpensive item of testing equipment. These percentages are specified as a result of the study of many tests made in Colorado and elsewhere, and are intended to produce a sand which is reasonably graded between fine and coarse particles.

In addition to the test for sizes, the sand is tested for its clay or loam content, and it is specified that not more than 2½% of the sand by weight shall be removed by the standard elutriation test. This elutriation test is roughly described as being made by repeatedly washing the sand with water. The different waters are saved, and after nothing but clear water results from washing the sand, all of the saved wash water is evaporated to dryness, and the weight of the residue is the weight of clay and loam in the sand. The sand is tested for weight, and specific gravity, both of which are self explanatory; and also tested to show that it is free from injurious vegetable or other foreign matter. This last test is given by immersing the sand in a 3% solution of sodium hydroxide in water in a bottle which is then corked up, shaken thoroughly, and allowed to stand for 24 hours. At the same time a standard color solution of tannic acid, alcohol, sodium hydroxide and water is prepared, and the color of the liquid standing above the sand in the bottle is compared, visually, with the color of the standard color solution. If the color of the liquid above the tested sand is darker than the standard color the sand is rejected on account of organic impurities.

The next and final component of the concrete is the rock component. The important tests of the rock are, first its size. The sizes specified by the Colorado State Highway Department are that 100% must pass a 3 inch circular mesh screen; from zero to 20% passes a 3 inch circular screen, and is retained on a 2 inch circular screen; from 35% to 55% passes a 2 inch screen and is retained on a 1 inch screen; from 35% to 55% passes a 1 inch screen and is retained on a ¼ inch screen; and from zero to 5% may pass a ¼ inch screen.

A second important test of rock is the abrasion test, which gives an indication of its resistance to wear. This test is briefly described as being made by placing 50 pieces of rock loosely in a steel cylinder, which is then rotated 10,000 times at about 30 revolutions a minute. The material worn off by friction of the rocks against one another is screened through a 1/16 inch mesh sieve and weighed, and if this amounts to 5% or more of the original weight of the 50 pieces, the rock is rejected.

A third important test of the rock is for soundness. This test is given by immersing the sample of rock in a saturated solution of sodium sulphate for 20 hours, after which the sample is baked in an oven for 4 hours. This test is repeated five times on the same sample. Samples which show severe checking, cracking or disintegration are considered as indicating that the rock is not sound enough for use in paving.

Other important tests of rock samples are the tests for weight and specific gravity, the reasons for which are so obvious as to require no further explanation.

This terminates a brief description of some of the quality tests of the component parts of paving concrete in accordance with the specifications of the Colorado State Highway Department.

The next regulation is that of quantity. The quantity of water for the pavement is limited to six United States gallons of water per sack or cubic foot of cement used in the mix. This does not mean that six gallons of water is poured into the mixture for each sack of cement used. It is the total amount of water which can be used per sack after allowance is made for the water absorbed during the period of 30 minutes by the sand and rock used in the mixture. The amount of this absorbed water, of course, varies with the characteristics of the sand and rock. In addition a further correction is applied by determining the amount of water actually contained in the sand and rock as it is discharged into the mixer—that amount of water being sometimes surprisingly great —which is deducted from the six gallons of water maximum allowed by the specifications. The quantity of cement used must be not less than one sack or cubic foot of cement to 5½ cubic feet of sand and rock measured separately, provided that the ratio of the rock to the sand shall not be less than one, nor more than two. The quantities of sand and rock are measured carefully as they are discharged into the mixer.

All quantities used in the field are reduced to terms of standard dry loose measurements, and an inspector is on duty at all times while the concrete is being mixed to see that, among other things, the specified proportions are exactly followed. After components corresponding to the specifications as to quality and quantity are produced, trial mixtures are made until by variation of the proportions of water to cement, and of sand to crushed rock there is produced a mixed product that corresponds to the specified consistency for mixed concrete. This consistency is measured under our specifications by the slump test. The slump test is made briefly by filling a truncated cone eight inches in diameter at the bottom, four inches in diameter at the top, and one foot high with the mixed concrete. Immediately after this cone (which is made of heavy galvanized iron) is filled with concrete, the cone is removed by its handles from the concrete. The concrete not being confined by the sides of the cone naturally sinks down or slumps. The Colorado specifications provide that the height of this slumped concrete shall be between nine and eleven inches. All of the tests required

(Continued on page 11)

How A Colorado Contractor Handles Concrete Paving Job

HEREWITH is given an outline of how a Colorado contractor is handling a quarter of a million dollar concrete paving project located between Merino and Brush.

The work is being done by Edward Selander, contractor of Fort Morgan, Colo. The project is No. 288-A-2, being 9.71 miles, of Bates section concrete, 18 feet in width, 9 inches at the shoulder and 6½ inches in depth at the center.

The project is being carried out under the supervision of A. B. Collins, district engineer; W. A. Lewis, resident engineer, P. T. Clemens, grade engineer, and J. Hammond, inspector, and L. J. Hessler, employed as superintendent for the contractor.

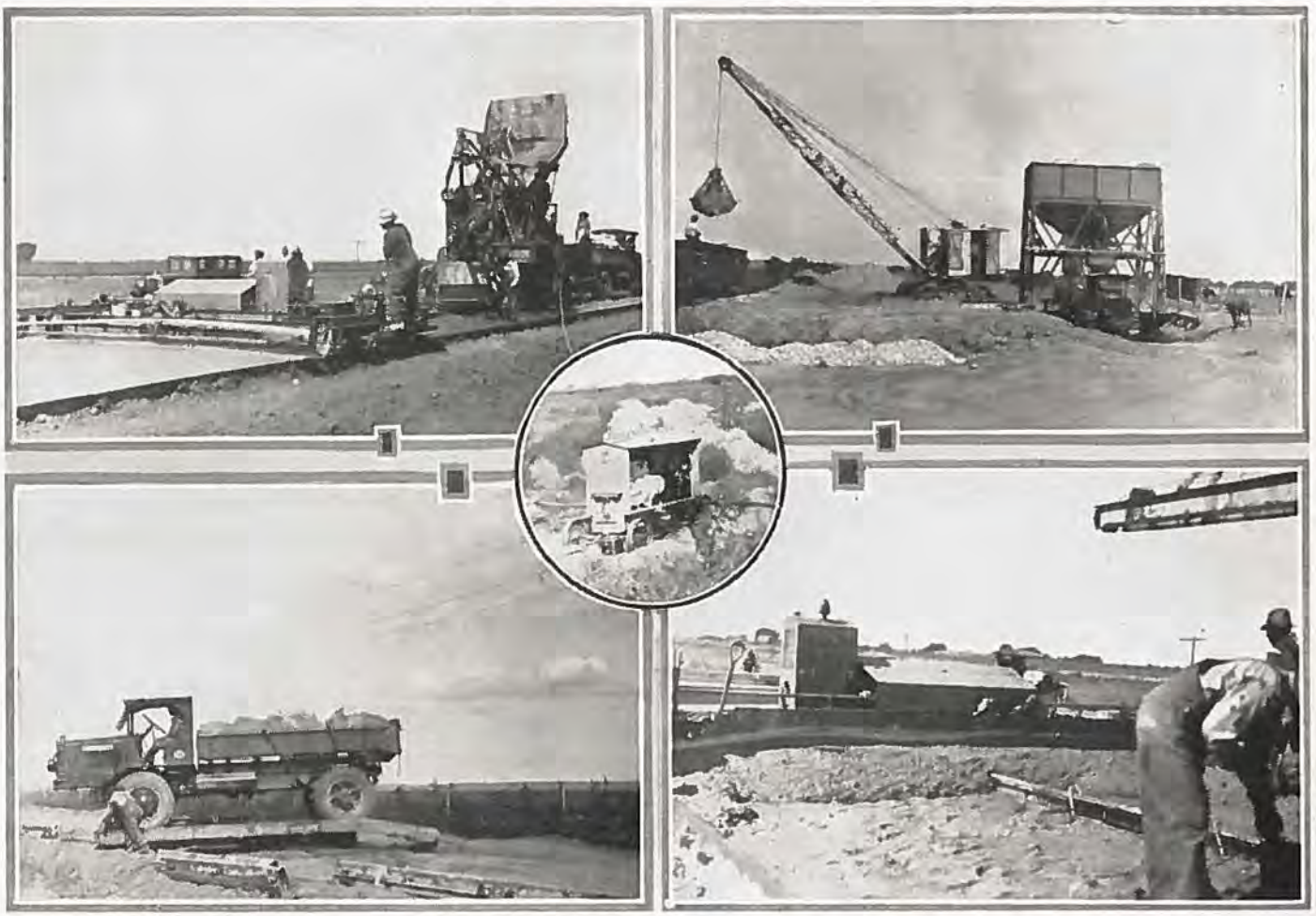
The sand for both cushion and concrete are taken directly from the South Platte river near the job. The cement is furnished by the Colorado Portland Cement Company. The course aggregate, consisting of crushed stone, was furnished by M. R. Deacon Stone Co. of Lyons; the latter using a Barber-Greene conveyor and bin for loading the material.

The sand is taken from the river by means of a Sauerman half-yard drag bucket; emptied to a platform under which trucks take their load through a cut-off gate. This sand is used for the cushion and also for the mix without any further washing, other than what it receives while being dragged from the river bed.

The sand is hauled to a stock pile adjacent to the measuring hoppers and bin. The sand for the cushion is hauled direct to the grade. Sand that is hauled to stock pile is then picked up with a Koehring crane as shown in one of the accompanying pictures and placed in bin ready for batching. This bin and crane are located on a spur approximately three miles from mixer. The crushed stone is unloaded from cars directly to bin.

Three batch trucks equipped with Heil hoists are used in hauling the materials to the mixer on the grade. The designated number of sacks of cement are added to the truck loads at a siding at Hillrose, about one and a half miles from the batching plant.

We now follow the truck on its trip to the mixing plant and one of the accompanying photos shows truck



Showing various pieces of equipment described in the accompanying article at work on Merino-Brush paving project—Edw. Selander, contractor.

with its load on a Blaw-Knox turntable being turned preparatory to backing up to skip of mixer for charger.

Picture No. 4 shows the method of holding the center steel plate, which carries a cap, in place so as not to disturb it while concrete is being dumped on grade. It also shows the sand cushion that is used under the slab. This varies from two to four inches, depending upon the amount specified. This finishing machine is also shown in this cut just after it has completed its operation on a section of concrete, and waiting for another section to work. This is the first machine of its kind employed on a Colorado highway project.

Picture No. 1 gives another composite view of the business end of the job, showing the Ord finishing machine in operation. It also shows the method of setting the forms, which on this job are Blaw-Knox and Metaform.

The sand cushion was struck off by a strike-off board riding on the rails and pushed by the mixer. The exact location of this strike-off board is between the front of the mixer and caterpillar and skip. The method of setting forms, deviated somewhat from the standard practice. Due to the fact that subgrade was cut quite low, due to sand cushion, it was necessary to build up three or four inches to place forms on just under form line. As this was more or less soft, loose dirt, it was found advisable to insert a piece of two by six about two feet long under all form joints. By doing this no trouble was experienced with settlement in forms while finisher was working on same.

A team and drag sled was the method used in moving forms ahead daily. Although somewhat slow this was about the only way it could be done due to the type of ditches and ground. In picture No. 2 is shown the C. H. & E. pump set-up. The water is taken from an irrigation ditch. Some water will be taken from drilled wells as the work progresses.

The hauling of material to mixer and sand cushion was let to the Coleman Motors Corporation of Littleton, Colo., who placed E. F. Parrish in charge of trucks on this job.

Some other details of construction were as follows:

Due to the use of a screened finisher, such as the Ord, on this job, the working of the traverse joints was one item that was taken up and finally solved. By submerging complete joint about one-quarter inch (¼″) below finished surface of pavement, holding it in place with a three-eighth inch (⅜″) iron template while finisher worked directly across it, the road was compacted and iron templates were removed, after which the joint was pulled up about one-half inch (½″) with a pair of large tongs and then finished with a split float. The center joint was edged on both sides and cap was removed. Some difficulty was experienced at first in holding the center joint perfectly true, but was gradually eliminated as the work progressed and the workmen became more familiar with the details.

Curing was taken care of by a semi-ponding and covering method; pavement completely covered with dirt with a heavy bank along either end and water was allowed to continually flow on same until saturated.

Although the contractor got a late start on this work, yet at the present time it is progressing very favorably with an average of eight hundred feet (800′) or so a day and if weather permits he expects to complete about four miles this season before being closed down by winter weather.

How Tests Are Made Maintain Standard of Concrete Roads

(Continued from page 9)

by the specifications as to quality and quantity, proportions and consistency, are made first in the laboratory to determine that it is possible to secure in the field from the available materials a concrete which will satisfy the minimum requirements of the specifications, which now provide for a strength in compression of 1,800 pounds at seven days, and of 3,000 pounds at twenty-eight days. This compressive strength is measured by subjecting concrete cylinders six inches in diameter and twelve inches in height to the action of an extremely complicated machine, which, in brief, applies weight vertically to the cylinders until they fail. These cylinders are made from concrete as manufactured both in the laboratory and in the field—and in the field from four to twelve of these cylinders are made every day for checking the finished product.

In addition to these daily tests of cylinders, which give a check on the quality of concrete being turned out in the field, not less than one test of sand for size is made every day. A test is made in the field whenever the moisture content of the sand shows a variation. Not less than one test a day is made of the rock component of the concrete, and not less than two slump tests are made daily of the consistency of the concrete. This description of tests seems elaborate, but really only skims the ground to be covered.

On all of the paving jobs in the immediate vicinity of Denver, the services of not fewer than two inspectors on the job are required at all times. The work of these inspectors is checked by the resident engineer in charge of the work. The work of the resident engineer is checked by other engineers from the Colorado State Highway Department, and by engineers from the United States Bureau of Public Roads.

In addition to the field tests which are limited to those which do not require elaborate equipment, laboratory tests are made by the University of Colorado, the Colorado Agriculture College, Colorado College, and the Pierce Testing Laboratories who maintain a large commercial laboratory in Denver. In general the field tests are not refined, but the necessary exact tests are made on all jobs by the laboratories.

In addition to all of the tests made of the concrete cylinders as cast in the laboratory and in the field, the Colorado State Highway Department maintains a core drilling machine mounted on a truck. This machine goes over the pavement after it is finished, and drills therefrom cores which are afterwards tested to destruction in the laboratories, affording a further and final check on the strength of the concrete.

This description of tests, and the reasons for tests, seems very long, but as a matter of fact merely skims the surface of the subject which covers a large field and many minute details. The cost of the equipment used for field and laboratory tests runs well up into the thousands of dollars. The tests are given in accordance with certain elaborate standard detail tests worked out by the American Society for Testing Material. The details of the tests are constantly being revised as experience and study indicate the need. An indication of the work involved in tests on a routine paving job in Colorado may be gained from the fact that on a six mile paving job recently completed, 163

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American Highway Officials Hold Annual Meet in Denver

A BILLION-DOLLAR CONVENTION! The thirteenth annual meeting of the American Association of State Highway Officials, held in Denver Oct. 3, 4, 5 and 6 was all of that, and for several reasons. It brought together the men whose brains direct the spending of American billions for good roads. It helped these men exchange ideas and further plans that may, in the long-run, save many millions, if not billions, for the taxpayers of the nation.

What's more, it was the biggest, most successful convention the association has ever staged anywhere. Every delegate who came to Denver had a "billion-dollar" time!

The convention met in the convention room of the Cosmopolitan hotel, Denver. Maj. L. D. Blauvelt, president of the association, Colorado highway engineer, presided.

During the convention, the many phases of national highway construction and maintenance were touched upon by nationally-prominent speakers. On the final day, three resolutions of outstanding importance were passed by the convention. There were:

That on construction designed to eliminate dangerour grade crossings, railroads be required to pay 50 per cent of cost, since the railroads benefit even more than the states by such construction.

That congress continue the annual $75,000,000 federal appropriation for roads.

That the United States increase the annual appropriation for forest road construction.

Important changes were made within the association. Under the old system, Frank T. Sheets, of Illinois, vice-president for 1926-1927, automatically succeeded Major Blauvelt as president. By vote of the convention, the automatic succession will be discontinued next year, when the presidency becomes strictly elective. Four vice-presidents were chosen here. They are John N. Mackall, Maryland; Charles H. Manfield, South Carolina; John W. Gardner, Kansas, and Henry H. Blood of Utah.

W. W. Mack, Delaware, was elected treasurer and W. C. Markham, Washington, D. C., continues as executive secretary.

A large portion of the convention program, this year, was devoted to discussion of furthering highway safety. The engineers gathered here were interested in making national highways safer, as well as longer, smoother and more numerous. In the annual report of the traffic control and safety committee, A. H. Hinkle, of Indiana, chairman, moved for abolition of grade crossings, and of warning signals placed in the center of highways.

The 300 and more delegates who came here from all parts of the U. S. for this convention were a practical lot. While they are interested in highway theory, they are even more interested in *concrete* examples.

Colorado supplied them with examples of concrete highways in abundance—graveled highways, too. As one of the entertainment features of the meeting, the delegates were taken on a 70-mile circle tour of Denver's Mountain Parks, including the Lookout Mountain drive and the Bear Creek highway.

On another trip, they were driven to West Portal of Moffat Tunnel by way of Idaho Springs and Berthoud pass. In Berthoud pass, they witnessed the "show highway" of America—one of the finest pieces of road engineering in the world.

Colorado's splendid mountain roads, carrying hundreds of thousands of motorists annually over the immense barriers of the Rockies, evoked the surprise and admiration of every delegate.

The visiting engineers, however, were quick to appreciate the arguments of their Colorado brothers. The Colorado men told their guests that in mountain country such as ours, only the best of roads are good enough, and pointed out the tremendous quantity of work and money still required to make all corners of the state available to motor travel.

These arguments were emphasized by convention speakers who urged hastening of improvements on the Victory highway, through northwestern Colorado into Utah. Once fully improved, this highway is expected to surpass all other transcontinental motor routes because of its scenic beauty.

Nation's Road Builders Loud in Praise of Colorado Roads

At Moffat tunnel, the delegates were shown through the inner workings of the tunnel, which, as engineers, they could appreciate in full. They were guests of the tunnel commission there.

On another trip, they were taken to Colorado Springs and ascended the marvelous Pikes Peak highway. Again the delegates expressed surprise at the ease with which automobiles ascended 14,000 feet above sea level over the easy-graded Colorado roadways.

Thomas H. McDonald, chief of the U. S. Bureau of Public Roads, Washington, attended the convention. He is a native Coloradoan. He told of his interest in Colorado good roads, particularly in the development of state roads serving national parks and forests of Colorado. He urged the speedy ceding of jurisdiction of Rocky Mountain National Park to the government by this state so the government can complete its plans for road improvements within the park.

At the opening of their convention, the delegates were welcomed to Colorado by Lieutenant Governor George Corlett, and to Denver by Mayor Benjamin F. Stapleton. The Hon. H. P. Burke, chief justice of the Colorado Supreme Court, addressed them. Major Blauvelt responded and delivered the president's annual address.

On Tuesday evening, members of the association were guests of honor at a dinner given by the Colorado Good Roads Association.

One of the big high-lights of the convention was the paper on "Bituminous Treatment of Gravel and Crushed Stone Roads," by T. E. Stanton, Assistant Highway Engineer, California.

For a number of years engineers all over the country have been looking for some method by which roads carrying traffic up to 500 vehicles per day can be kept smooth and at the same time eliminate dust.

Experiments have been conducted in California and other states during the past two years, which it is believed will successfully solve this problem. These experiments have been made with asphalt base oils. Mr. Stanton told the engineers that the construction of the oil road is practically the same as that of a concrete road, with the difference of the oil surfacing.

Highway safety was also stressed by the engineers. Charles M. Upham, director of the American Road Builders Association, addressed the convention on this subject. He advocated a campaign of safety among the school children of the nation.

"We are striking at the core of the trouble," said Mr. Upham, "when we educate the school children. Teach them caution and courtesy, and our task is half completed. Two-thirds of the people injured in automobile accidents are pedestrians, and among those pedestrians are a great number of school children. All blame cannot be placed on the motorist. It is our task to educate the man on foot as well as the man at the wheel."

An address on the subject of "Federal and State Control Over Busses and Trucks" was made by W. Pyke Johnson, representative of the National Automobile Chamber of Commerce of Washington, D. C. Mr. Johnson was formerly editor of Colorado Highways. He said that the motor car manufacturers are improving the design of trucks annually so they will permit the carrying of heavy loads over the roads without undue abuse.

Thos. H. McDonald, chief of the U. S. Bureau of Public Roads, outlined the progress of the Federal department. Mr. McDonald was born near Twin Lakes, Colo., in 1881.

"I am very much interested in good roads for the state of Colorado," said Mr. McDonald. "Particularly the roads leading to the national parks and forests in this state should be developed.

"I have a program in mind that concerns the southwest and the northwest parts of the state. The idea is for a great through-highway leading into the state of Utah and Salt Lake City and another connecting up the heart of Colorado with the scenic beauty of the Mesa Verde country and Zion National park."

Transportation for the various motor trips made by the visiting engineers was provided by volunteer owners of cars. The work of directing the cars was in charge of Capt. John P. Donovan of the Denver state highway office.

How Tests Are Made Maintain Standard of Concrete Roads

(Continued from page 11)

tests of sand, and 94 tests of crushed rock were made in the field; 296 cylinders of concrete 6 inches in diameter and 12 inches long were made in the field and crushed in the laboratory of the Colorado Agriculture College; 90 complete sets of tests of cement were made in laboratories; 24 sets of tests on sand and crushed rock were made in the Pierce Testing Laboratories, and this included the construction and destruction of from four to twelve concrete cylinders for each set of tests. In addition to this, numerous other routine tests covering steel reinforcement, structural steel, galvanized metal pipe, sand cushion, water, etc., were made, but a description of those tests would enormously lengthen this already long description.

All of this testing and retesting may seem excessive on its face, but to the trained eye of an engineer, experienced in concrete paving, the improvement year by year in strength and riding qualities of pavement being built by the Colorado State Highway Department fully repays its expenditure in time and money for tests.

Owners of fleets of large trucks in Colorado are planning to test House Bill No. 432 passed at the last assembly and which provides that in 1928 and thereafter truck owners must pay in addition to the regular fee $25 for a one-ton truck and $15 for each additional ton capacity. The owners contend that the fees are excessive and propose to take the matter into court in an attempt to have the law set aside.

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All arterial highways in the state should be declared right-of-way roads and all vehicles should be compelled to come to a dead stop before entering or crossing them, it is advocated by H. G. DeTienne, sheriff of Pueblo county.

There would be fewer accidents, Sheriff DeTienne believes. He suggests the erection of regulation signs at a reasonable distance from each main highway to warn the driver.

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Proposed rerouting of the main highway between Pueblo and Colorado Springs so that it will run four blocks west of the town of Fountain, is being attacked by the Fountain residents who demand that it pass through the town as at present.

Highway engineers state that the new road would eliminate four railroad crossings and save the state at least $160,000 in undercrossings which would have to be built before the highway is paved. The amount needed to build underpasses will build four or five miles of paving, engineers declare.

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Because the Women's club thought that every street in Rocky Ford should be plainly marked, the town now has new and attractive street signs which the club donated to the city.

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Work may start soon on replacement of two of the four steel spans of the Arkansas river bridge north of Fowler which were washed away August 15. The temporary bridge was completed in September to serve until the permanent structure is completed.

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If Pueblo business men will sponsor an extensive road paving program east and south of Pueblo, the trade territory will be expanded 100 per cent, Ira K. Young recently told Pueblo business men. He particularly urged support of the proposed road over Mosca pass which will cut the distance to the San Luis valley about 50 miles.

State Highway Department Financial Statement, August 31, 1927

BALANCES, DECEMBER 1, 1926

State Treasurer	$1,657,784.86	
County Time Warrants	15,000.05	
Total Balances		$1,672,784.91

RECEIPTS

Half Mill Levy	$ 547,520.82	
Gasoline Tax	1,084,651.20	
Internal Improvements	59,600.00	
Federal Aid	796,303.23	
County Aid	59,396.84	
Miscellaneous	4,083.78	
Total Receipts		$2,551,555.87
Total Balances and Receipts		$4,224,340.78

DISBURSEMENTS

Federal Aid Projects	$1,519,923.31	
State Projects	234,987.84	
Maintenance	553,801.90	
Federal Aid Renewals	6,559.16	
Property & Equipment	8,712.23	
Surveys	8,405.04	
General Office Administration	41,559.95	
Engineering Administration	31,023.37	
Road Signs and Traffic Census	26,228.78	
Compensation Insurance	19,784.30	
Total Disbursements		$2,450,985.88

BALANCES AUGUST 31, 1927

State Treasurer	$1,770,110 35	
County Time Warrants	3,244.55	
Total Balances		$1,773,354.90
Total Disbursements and Balances		$4,224,340.78

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

Growth of Adams Business Causes Enlargement of Both the Office and Factory

A new building at the plant of J. D. Adams and Company, Indianapolis, Ind., in course of construction, will increase the Adams plant area and facilities a full 25 per cent. It was but four years ago when this company rebuilt practically their entire plant due to a very destructive fire. The new plant was 44 per cent larger than the old one and this new addition means an increase of 84 per cent over their old plant of four years ago.

The company announces that the new addition is to permit expansion in all departments to take care of its steadily increasing business but more particularly, is the machine department to be enlarged to accommodate new machinery required by the machine work now put on Adams Adjustable Leaning Wheel Graders. During the past two years practically every working joint in Adams graders has been redesigned and now is machine finished to a very close fit in order to prevent lost motion and to prolong wear. Among the parts referred to are close-fittings, machine-cut lifting gears, machined lift arm bearings, machined ball and socket lift link connections, close fitting, machine-finished reversing circles to eliminate wabble in the circle, ball and socket moldboard connections, and machine-finished wheel boxes (either plain bearings or roller bearings are furnished). All of these machine finished joints are adjustable to compensate for wear so that there never need be any looseness in the blade control. This is especially valuable in maintenance work as it insures smooth, clean cutting instead of the chatter or blade jumping which results from a loose fitting blade lifting mechanism.

The company has also just moved into an addition to their office building which increased the office space 125 per cent. With practically every building built and equipped within the last four years (on account of the fire) J. D. Adams and Company now have what is probably the most modern plant in the road machinery industry and the largest plant in the world devoted to the manufacture of road graders.

As a contribution to highway safety, the American Road Builders' Association is sponsoring a Highway Safety Campaign to begin October 1st. The association will be assisted by several hundred newspapers and magazines throughout the country, as well as governors, mayors, city managers, civic associations, educational organizations, churches and others interested in this great movement, which is costing the lives of 25,000 people yearly, not to mention the 700,000 accidents. There has been shown exceptional interest throughout the entire country in the organization of this highway safety campaign.

In order to increase the interest and to collect ideas that will be of value in solving the highway safety problem, the American Road Builders' Association is offering $1,000 in prizes for the best ideas for increasing street and highway safety. The contest is open to everyone and full information is contained in this bulletin. From studies of the highway safety problem, it is quite evident that the individual holds the key to the solution and this contest is for the purpose of securing ideas from the individual.

A contestant may submit a complete thesis on Highway Safety or a description of an individual idea, so it is open to everyone who may have a suggestion regarding Highway Safety.

A complete report compiled from the plans of the contestants will be presented at the convention of the association to be held in Cleveland, January 9-13, 1928, and the awards will be announced by radio and through the press at this time.

Southwest Road Show and School Expanding

Fourteen or more states instead of nine will be covered by the Southwest Road Show and School, which will be held in Wichita, Kansas, February 21-24, 1928. This expansion is justified and made necessary by the large number of inquiries and large interested attendance at previous shows, from the central and western states, which was not anticipated at the time this Road Show and School was first started.

With the additional publicity in these 14 states and surrounding territory, and taking into consideration the success and favorable comment of the prior shows, the interested attendance at the 1928 Road Show and School will undoubtedly be increased two-fold or more.

Conditions in the central and southwest territory at this time, and prospects for road building and construction in 1928 are very favorable. A good deal of the credit for this condition is due to the educational program that has been and is being put out, which is making an exceptional demand for good roads in the territory covered by this show.

The H. W. Moore Equipment Company Caravan demonstrating the 1928 line of maintenance equipment will demonstrate the Wehr Center Control and the Galion Rear End Control one man graders and maintainers at the following towns in Colorado the week beginning October 17th. Place for demonstration to be selected by those most interested in seeing the demonstration.

Monday, October 24—At city of Fort Morgan, Morgan county, 9 a. m.

Tuesday, October 25—At city of Akron, Washington county, 9 a. m.

Wednesday, October 26—At city of Sterling, Logan county, 9 a. m.

Thursday, October 27—At city of Holyoke, commissioners from entire district, 9 a. m.

Saturday, October 29—At city of Burlington, Kit Carson, Lincoln, and Cheyenne county officials, 9 a. m.

Paving of 1.2 miles of the Santa Fe Trail near Avondale in Pueblo county will be completed by November 1, by Strange-Maguire Paving Co.

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The San Luis valley of Colorado and the state highway department of New Mexico should co-operate in building arterial highways leading from one state to another, it was brought out at the October meeting of the New Mexico state highway commission held in Santa Fe and attended by a Colorado delegation.

Traffic from the valley to New Mexico and Texas points has increased every season and it was pointed out at the meeting that it will be to the advantage of both states to build roads in harmony.

The Colorado highway department is now finishing the surfaced highway from Antonito to the New Mexico line where it connects with the Santa Fe main road. The New Mexico bureau has completed a survey for continuation of the improvement, eliminating grades and curves in that state.

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Surveys for a new highway into the San Luis valley from Trinidad have been ordered by the state highway department after a year of solicitation from the Trinidad Real Estate Exchange.

The road will be a direct route from Trinidad to the Stonewall country and over the range into the San Luis valley. At present the closest route to the valley from Trinidad is over La Veta pass by way of Walsenburg.

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Surveys have been completed for widening and extending the roads through Red Canon park, scenic region five miles north of Canon City. The area was given to Canon City by the government and a few years ago the first roads were built through public subscription.

Volunteer labor and donated funds will be used in the present program with Canon City merchants and laborers from the Fremont county, Canon City municipal and state penitentiary departments furnishing the assistance.

BIDS RECEIVED FOR FOLLOWING PROJECTS

Proj. No.	Length	Type	Date Bids Opened	Low Bidder
F. A. P. 279-D	0.264 mi.	Pavement	Oct. 10, 1927	M. E. Carlson
State P. 552-C	0.299 mi.	Graded	Oct. 10, 1927	Axel Swanson
State P. 560	2.525 mi.	Gravel Surfacing	Oct. 10, 1927	J. Fred Roberts & Sons
State P. 580-C	16.673 mi.	Graded	Oct. 10, 1927	A. R. Mackey
State P. 664	0.095 mi.	Timber Br. & Approaches	Oct. 10, 1927	C. A. Sweitzer

PROJECTS BEING ADVERTISED FOR BIDS

Proj. No.	Length	Type	Date Bids Opened
F. A. P. 258-E Dis. #2	1.487 mi.	Gravel Surfacing	Oct. 17, 1927

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

Proj. No.	Length	Type	Location
138-A	10.916 mi.	Graded	North of Kremmling
287-D	0.921 mi.	Graded & R. R. Underpass	East of Kersey

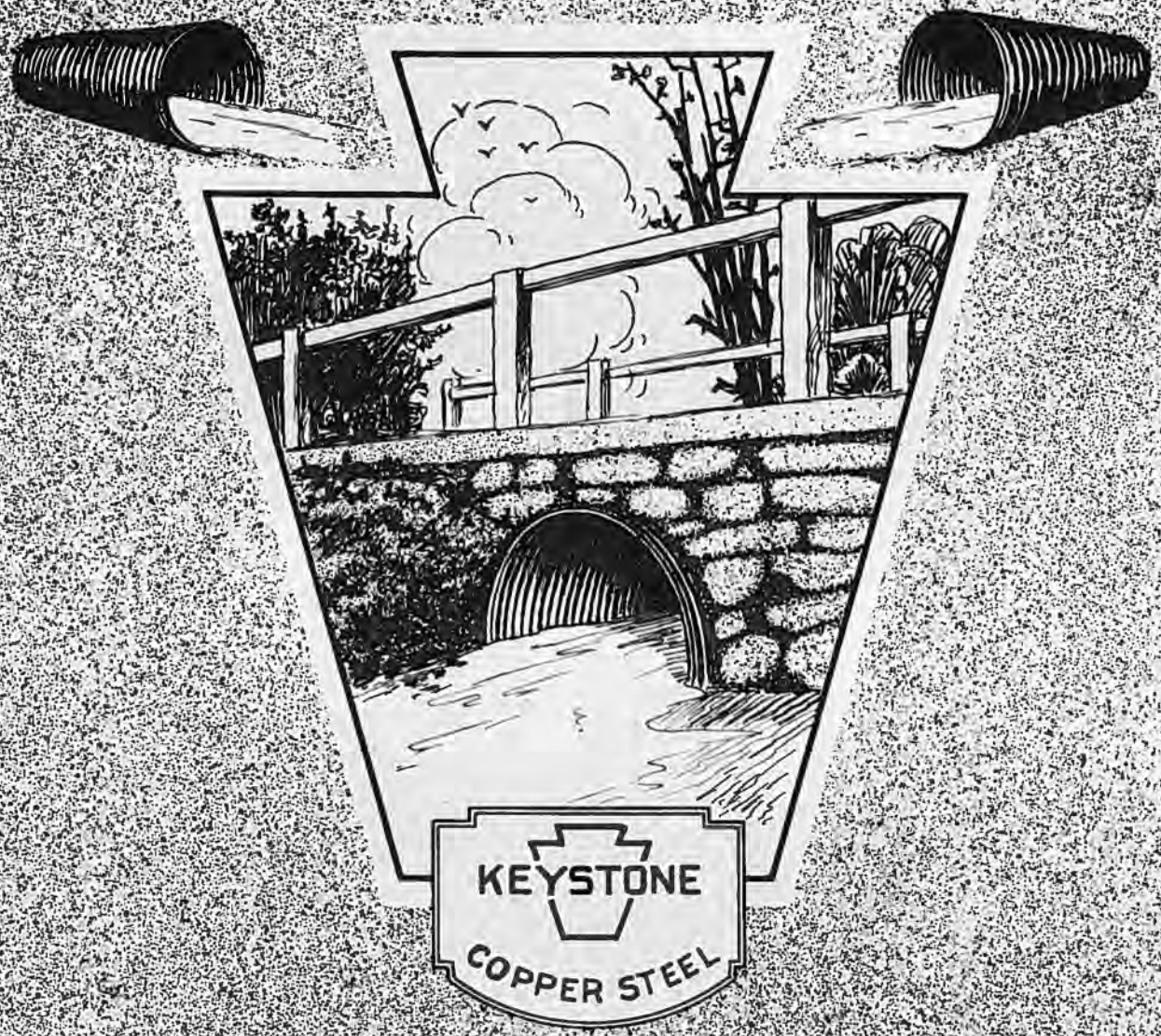
PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
* 2-R#6	2.75 mi.	Pavement	South of Aguilar
144-B	3.5 mi.	Gravel Surfacing	Northwest of Fort Collins
147-A	15 mi.	Gravel Surfacing	South of Cortez
208-B	0.2 mi.	Gravel Surf. & R. R. Overhead Crossing	East of Grand Junction
258-F	5 mi.	Gravel Surfacing	East of Sapinero
277-B	3.5 mi.	Pavement	South of Colorado Springs
*279-F	3.25 mi.	Grading	North of Baileys
288-A3	3 mi.	Grading & R. R. Overhead Crossing	East of Brush
292-B	0.5 mi.	Grading & R. R. Overhead Crossing	South of Minturn
295-C	4 mi.	Gravel Surfacing	North of Antonito
296-C	5 mi.	Gravel Surfacing	North of Greenhorn

*Plans finished.

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	$ 28,882.70	100	2-R3
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	331,632.00	100	2-R4
2-R5	Bet. Trinidad and Aguilar	1.959 mi.	Paving	W. A. Colt & Son	72,122.50	0	2-R5
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	100	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	100	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	89	144-A1
145-A	West of Glenwood Springs	3.807 mi.	Gravel Surfacing	Winterburn & Lumsden	53,227.90	50	145-A
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	90	157-A
210-B2	De Beque-Grand Valley	7.507 mi.	Gravel Surfacing	Fred Kentz	37,475.00	1	210-B2
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	100	213-D
222-CR	South of Lafayette	0.375 mi.	Paving	J. H. Miller & Co.	12,834.75	100	222-CR
246-F	West of Avondale	1.0 mi.	Paving	Strange-Maguire Pav. Co.	37,847.00	69	246-F
247-C	Swink	0.8 mi.	Conc. Pav. & R.R Underpass	J. Finger & Son	62,559.58	22	247-C
254-C	Div. 1 2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	100	254-C1
254-C2	S. W. of Hot Sulphur Springs	Superstr. of	Bridge & Approaches	Northwestern Constr. Co.	48,203.50	0	254-C2
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	68	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65.374.00	100	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	75	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850 50	85	258-E
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	100	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	100	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	77	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	71	271-B
275-C	Div. 2 East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,466.60	100	275-C2
275-E	North of Monument	0.926 mi	Grading and Underpass	F. L. Hoffman	41,905.20	20	275-E
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	81	275-F1
275-F2	Castle Rock, south	5.227 mi.	Paving	J. Fred Roberts & Sons	119,027.80	87	275-F2
275-G	Larkspur-Monument	10.869 mi.	Grading	Monaghan-Cunningham Con. Co.	141,252.78	91	275-G
276	North of Colorado Springs		R. R. Overpass	J. L. Busselle & Co.	37,913.00	69	276
279-E	Schaffer's Crossing-Baileys	3.243 mi.	Grading	S. M. & S. J. Feely	54,305.60	77	279-E
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	100	281-D1 251-B1
251-B2 & 281-D2	Lafayette, north	5.813 mi.	Concrete Paving	J. H. Miller & Co.	146,315.00	42	251-B2 281-D2
281-E	At Lafayette	0.812 mi.	Paving	J. H. Miller & Co.	27,226.00	100	281-E
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	48	282-D
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	100	283-C
287-A2	Fort Morgan, west	4.011 mi. 16.61 mi.	Concrete Paving Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	100	287-A2
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier C. Eng. Co.	159,950.85	75	287-C1-2
288-A2	Bet. Merino and Brush	9.741 mi.	Paving	Edw. Selander	245,043.50	18	288-A2
290-D	East of Las Animas	2.954 mi.	Concrete Paving	W. A. Colt & Son	88,979.50	21	290-D
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	51	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,645.25	100	293-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	100	295-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Cole Brothers	58,061.00	100	296-B
297AR	Northeast of Palisade	2.848 mi.	Surfacing	O. J. Dorsey	15,043.00	9	297-AR
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	100	297-B
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	100	299-A
300A	Bet. Chattanooga & Red Mt.	2.277 mi.	Grading	Winterburn & Lumsden	59,480.80	2	300-A



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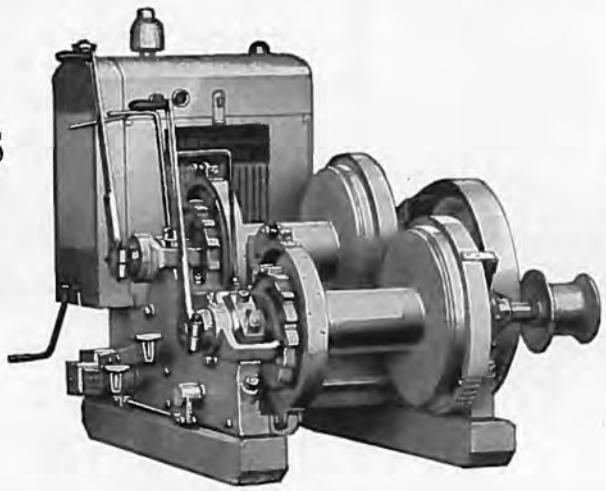

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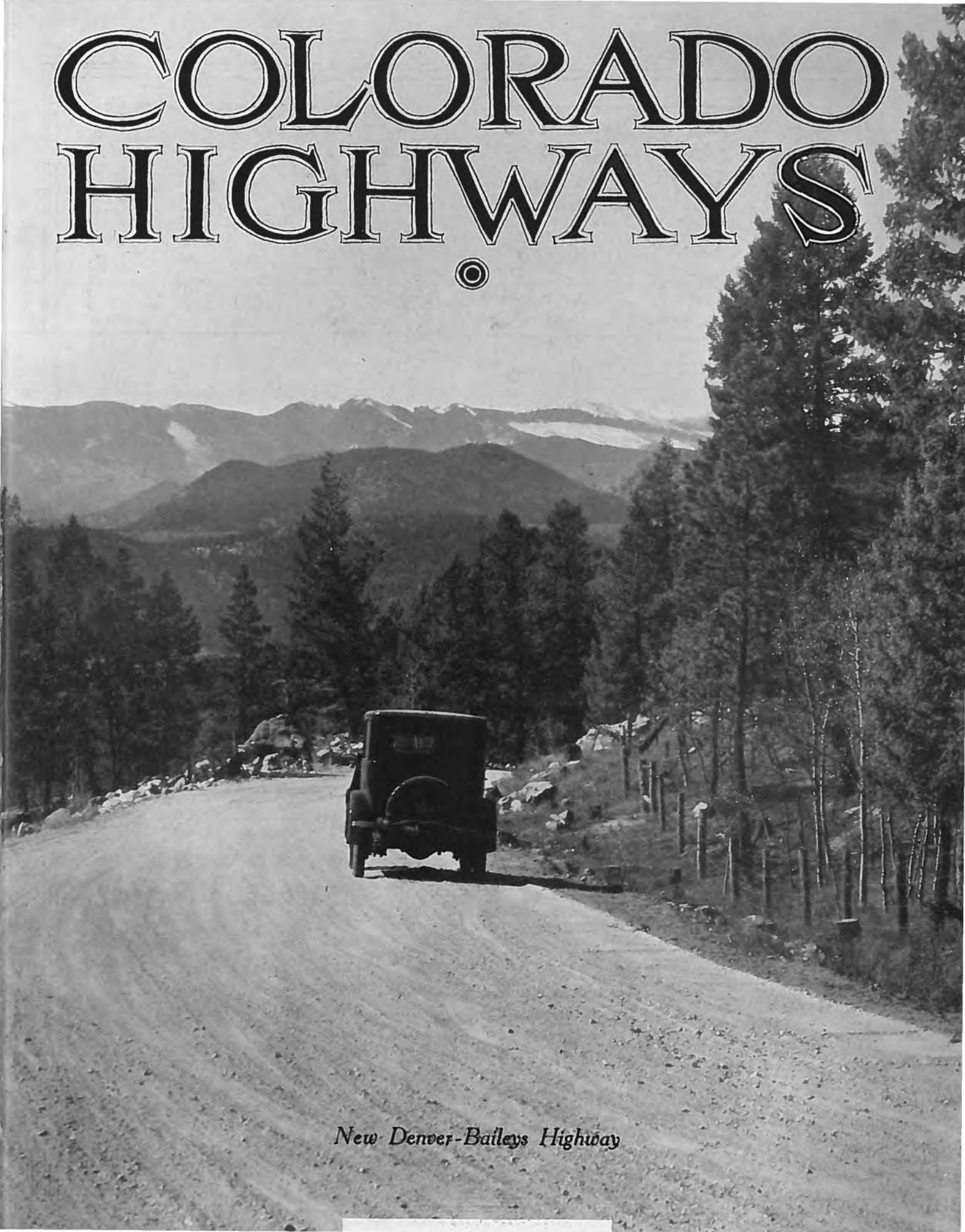
COLORADO HIGHWAYS



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Colorado Highways

Official Publication of the
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Denver, Colorado

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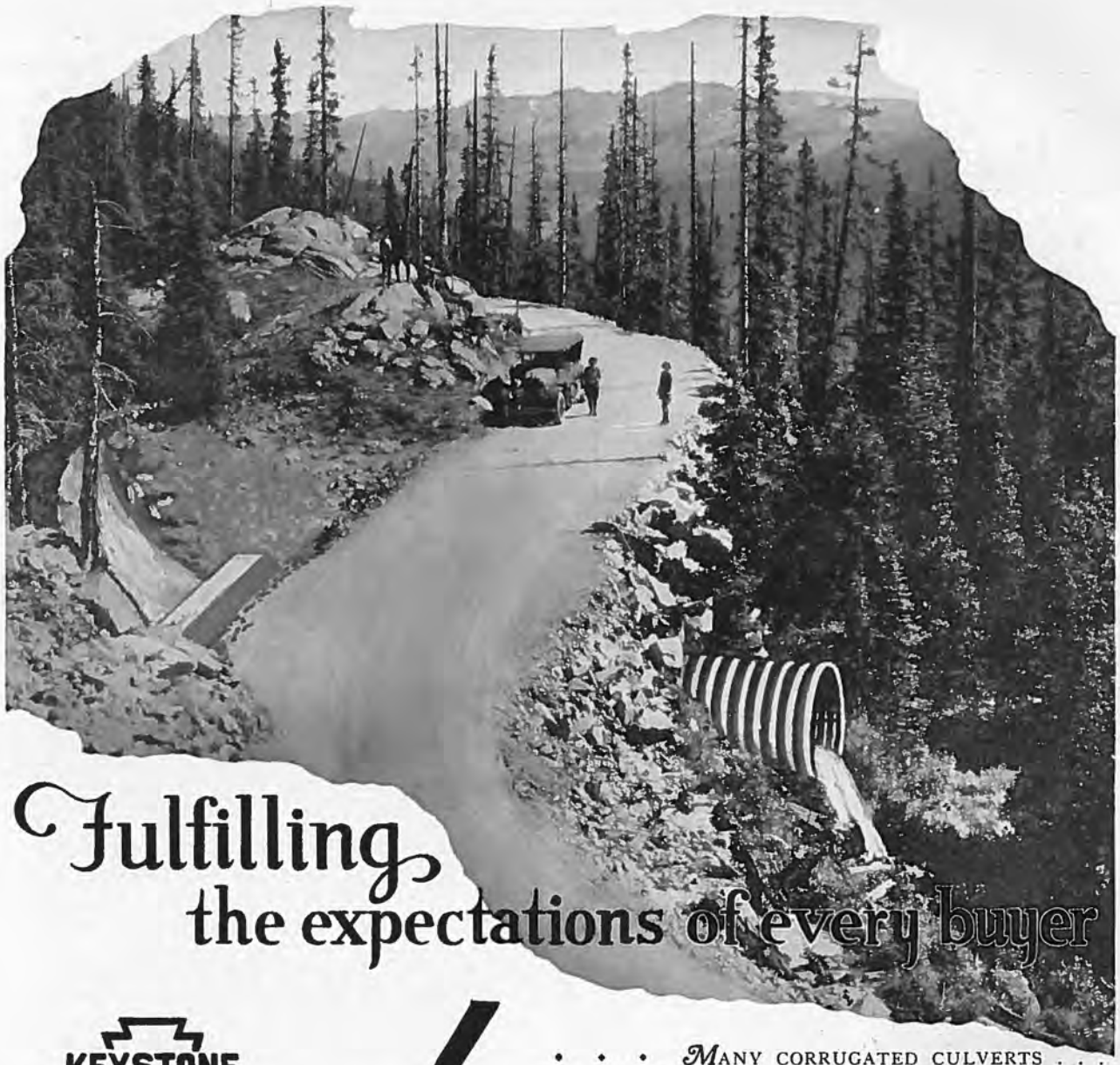
Articles on the subject of road building and highway development in the West are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible. Manuscripts not found available will be returned promptly.

10 CENTS A COPY. $1.00 A YEAR.

Our Cover Picture

On the cover of this month's issue of COLORADO HIGHWAYS is shown a view of a portion of the newly completed Federal Aid highway near Baileys in Jefferson County. This route carries a large portion of the traffic between Denver and the Western Slope. Another link in this improvement will be made in 1928, extending the new graded roadway into the town of Baileys. Photo by courtesy Denver Tourist Bureau.



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Colorado Highways
"BETTER ROADS"

VOLUME VI. DECEMBER, 1927 NUMBER 11

The Nation's Highways

By CHARLES C. GATES, President, Rocky Mountain Motorists, Inc.

Address at the Annual Meeting of the American Association of Highway Officials Held at Denver, Colorado, October 6-9, 1927

IT seems to me when the history of this particular period in which we live has been written, that it will be set down as the era of transportation. I do not believe that any other period in the future can possibly make as large a contribution to the diversity of transportation methods, or to the improvement of established systems of transportation, as have been made just in this generation of time of which we are a part. If you search the map of the Old World, you will not find any single region of the extent of this area that we refer to as the Rocky Mountain region, possessed of equal cultural and commercial possibilities and activity, that is situated so far from navigable water, and just because of that fact we are intensely interested in all kinds of overland transportation; and we are perfectly aware of the fact, too, that just to the extent that we can energize the development and modern efficiency of overland transportation, just to that extent will this great community of ours keep pace with the competitive influences that are at work, and where every year we are more in competition with all the world.

Not very long ago business was largely individualistic in character; each man proposed and provided his own ways and means, and only just now, in the last 20 years, has the individuality of the city taken the place of the man, and today, as competitive forces face us, we are very largely depending upon the instruments of business provided for us in the community in which we operate, and transportation is a very essential part, surely, of business success, whatever field of endeavor you may undertake.

As basic producers of wealth in this region, of which we have great and diversified abundance, and aspire to greater industrial benefit from these raw materials, we realize that without the advantages of lower cost of water transportation we have an exceedingly difficult problem with which to deal, and because of that we are then disposed to put a great deal of thought and much of material substance back of a program that will successfully advance the transportation of this region.

As the United States becomes more industrial in character, we are more dependent for the maintenance of our prosperity upon our ability to successfully market our exportable surplus, and because of that fact we can see being formed today new industrial and original activities. We recognize that just east of here is the great Mississippi Valley. There is coming into consciousness of being an understanding that that great valley, running in a north and south direction, is a common objective, and there is taking form a project to improve as an internal waterway the great Mississippi and establish an artery of transportation north and south from Chicago to the Gulf. Only a few days ago the mayor of the City of Chicago visited us in the City of Denver to emphasize the importance of insuring the great Mississippi Valley against a repetition of the recent flood and improve it as a transportation artery in the middle of the nation. We are in sympathy with that idea; but while it is being undertaken, we fully recognize that that is also to give a north and south direction to the movement of materials on their ultimate course to the markets of the world.

As I came to the door, I looked at those maps over there and recognized the fact that the principal transportation system of the United States, both highway and rail, has been dominantly in an east and west direction, sweeping from the Atlantic across to the Pacific. And there is a reason for that. The country was opened in that direction, emigration and movement of people were from east to west, and naturally as they moved they extended their transportation system ahead of them.

And there was another reason, too, and that was a climatic reason. It has been disclosed comparatively recently by psychological laboratory investigation that the human mind functions best at a mean annual temperature of 40 degrees Fahrenheit. It has also been disclosed that the physical body functions best at a mean annual temperature of 60 degrees Fahrenheit, and in between those two isometrical limits around the world there is a mean of 50 degrees Fahrenheit, and it is interesting to know that as you run them across the map of the United States and continue them around the world, that the great industrial interests in the whole world, whether in the northern or southern hemisphere, are closely confined to a zonal area not more than 2½ degrees of that mean annual temperature distant from that mean of 50 degrees Fahrenheit. That has also been operating to give general east and west direction to the movement of people who have been disposed, because of their increased productivity, to remain within that area and stay within that area in order that they might more successfully meet the competition of the world. But there has come a time now when, through the development of the increased amount of mechanical appli-

cation to business, that no longer is industry dependent upon the human element to the extent that it was only a few years ago, and therefore we see today going on a zonal diffusion of industry. The great textile business is moving southward; we see other industries following in the same way because of labor conditions, and to place themselves more closely in proximity with the raw materials and the ultimate markets they serve. All of those things, therefore, are creating considerable diffusion in the movement of material from one place to another, and it seems probable that this dominant directional force in the transportation systems from the east to the west may give place to other transportation systems moving north and south, of which that in the Mississippi Valley is a most excellent example. In the State of Colorado we do have a highway extending north and south through the state, extending from Glacier Park as the scenic attraction on the north, to the Grand Canon on the south, and the State of Colorado is quite fully aware of the resource value of its scenic attractions. But scenic resources is a rather unique characteristic. The other resources of our community, such as soil resources, the great extent of irrigated land and grazing land and the rich mining area up in the hills have all made their contribution to the establishment of this community, but each one of them is giving up year after year materially of its total substance, and when you have exhausted them there is less real value remaining. The permanent resource at present is the scenic resource of this West, and the more thousands of people that come out here to enjoy the pleasures of the mountains, the more times the lens of the camera clicks, to take back home a picture of their summer vacation, the more value has been added to the resource that remains. There is no other single resource that has that characteristic. It has been evident in Switzerland for a long time, and it will be increasingly evident as the scenic attractions of the West become better known to the people of America. Not very long before he died, Theodore Roosevelt made the statement that the Rocky Mountains would ultimately be the playground of America, and we are taking that into consideration in the building of the road system of the West.

After all, the building of roads is largely a personal matter. We look upon it as a public affair, but very largely the driving force back of it is personal desire.

I was interested the other day to calculate from the consumption of gasoline in the State of Colorado, just how many hours the average owner of a motor car spends behind the steering wheel, and I was surprised. I find that last year in the State of Colorado, which has a registration of approximately 250,000 cars, we used a little over 100,000,000 gallons of gasoline, and if we assume that the average car drives 15 miles per gallon, then the average owner of a motor car drove 6,000 miles in the State of Colorado last year, and if he were driving at the rate of 30 miles an hour, then he spent 200 hours of his time last year using up that 100,000,000 gallons of gasoline. That is the time the average owner of a motor car in the State of Colorado spent back of the steering wheel. Then he is vitally concerned, intimately and personally concerned, with the highway system of the State of Colorado, and he will continue to be personally concerned with it if he is made aware, not only of his convenience and pleasure as the driver of a motor car, but of the fact that it also pays dividends to him as the owner of a car.

I was interested in what Lieutenant Governor Corlett had to say with reference to the lack of publicity, the lack of public interest in regard to the building of highways, and I was somewhat surprised when I picked up this program and ran through it hurriedly to find there is no committee constituted for public education. I do not believe that there is any organization interested in the advancement of the road program of the nation that is better qualified to undertake the education of the public than is this organization of the American Association of Highway Officials, and it seems to me you might very properly give place on your program for a committee on public education. The average individual, the businessman, has but very little opportunity these days to interest himself in the diversity of ecomonic affairs that make up the activity of state and nation. He is vitally concerned first of all with the selfish interests of his own business, and he is very apt, of necessity, to pursue his business so intensively that he has little or no opportunity to go deeply into things like this, and therefore it would seem quite appropriate that this national organization should undertake in some form or other to better educate the public to both sides of the account of public roads. The average individual sees very clearly and is constantly reminded every time a bond issue is to be voted on, or some affair demands a larger appropriation for road-building, and particularly in these days of tax assessments the average man sees only the expense account of road-building. But equally and more important than that is the income account of road-building. It is clearly possible to put before a businessman a statement of income as well as a statement of expense of the building of highways.

As a matter of interest, just a few months ago, for my own personal satisfaction, I did compile such a statement, drawing upon those sources of information as far as they were available to establish the economies that flowed out of the building of a better road system in the State of Colorado, and here are some of the fundamental facts that came to my attention, that seem to me if they were brought properly to the attention of the average businessman, would convince him that in investing in roads he is making the most profitable investment that it is possible for him to make. And I will say this, men, that if it were possible for an individual to undertake the building of a highway system for a state, and that enterprise offered itself, I would select

View of heavy side-hill cut on Denver-Colorado Springs road

it in preference to any other business enterprise I know of today, if I could be privileged only to take as my portion of the economy one-half of the saving in tangible form resulting from the building of good roads, and I would not insist on payment for the saving of time or for the intangible thing of greater satisfaction, too; I would only ask for half of the actual economy in returns over the highways of this or any other state.

Here are some of the facts that came to my attention. At the time there were 239,000 automobiles. According to the American Automobile Chamber of Commerce, the average value of an automobile at that time was $865.00, then the ownership of automobiles in Colorado represented a private investment of $200,000,000 that was dependent for its welfare, for its economical operation and for its cost of maintenance upon the condition of the highways of this state. The manufacturers of automobiles tell us that at least 65% of the cost of maintaining, operating and upkeeping an automobile is dependent upon the condition of the highway over which it operates. Then for this state we reach a basis for consideration of the income account resulting from the expenditure for good roads. In the past ten years prior to the time I made this statement, there had been invested in the road system of Colorado $27,500,000. Then I computed the cost of maintaining that road, which represented interest on investment of 5% for maintenance cost, amortization over a period of 17 years, and making no account of the residual value of the completed highway, but assumed that the entire expense of the highway system was to disappear in 17 years, and I found from that a total cost of approximately $5,000,000 annually for the maintenance and operation of the highway system of the state.

Now, let us turn for a moment to the income account. That is the important thing, that is the invisible, the intangible thing to the mind of the average man who does not have time to pursue this subject. I drew for my information upon such sources of information as the Bureau of Public Roads, the college at Ames, Iowa, the State College of Washington, the American Automobile Chamber of Commerce. A great many tests have been made and found to determine the efficiency of a car operated over a hard surface road, over a gravel or macadam road, and over an ordinary dirt road. I found there was information available as to the relative tire wear in moving a car over those kind of roads, and found from this calculation that the gas saving as the result of using improved highways in the State of Colorado on an investment of $200,000,000 was $6,400,000 a year; that was the saving to the motorists of Colorado as the result of using improved highways. The State College in Washington has made some exhaustive tests on this subject, disclosing this fact, that any highway over which travel as many as 500 cars will justify its cost, will reimburse its cost annually in the saving of tires and gasoline. Then I estimated the saving on tires on the investment of $200,000,000, and I found that the income account for the road system of the State of Colorado was annually over $13,800,000. That represents the income from an investment that represents an annual cost of only about $5,000,000, or is paying a return on the investment annually of almost 300%. Then there is reason why I would select in preference to anything else the enterprise of building a highway system for a state, if I could have only just one-half of the economy that results from its utilization by people who own motor cars, and the registration of motor cars is increasing, the magnitude, the size of that dividend is increasing annually.

Only ten years ago there were two and one-half million cars on the roads of America; today there are 20,000,000. The reason for that is a perfectly human reason. From the days when the savage plodded along the trail and down to the present time, every living human being has been wanting to go somewhere sitting down (laughter); and the automobile has provided that means in a most excellent fashion.

And then we are about to realize a most unusual thing, which I am sure the vision of no man had ever anticipated—we are about to fly sitting down, and no bird ever dreamed of a possibility of that kind (laughter). But we are certainly making great strides.

Frequently you hear people say that the saturation point in the automobile has about been reached. I do not believe it. I do not believe that the saturation point has yet been approached. I believe that the saturation point in the distribution and ownership of automobiles will be reached about the time that we reach the saturation point in clothing; and sometimes I think, but I am not sure, that we have reached the saturation point in clothing, and we are about to reverse ourselves (laughter).

But, men, this subject of public education, it seems to me, as an ordinary businessman, needs and deserves your consideration, because the average man who is called upon in one way and another to make contributions to the considerable expense that is involved in building this great national system of highways needs to know something about the other side of the balance sheet. You can provide that information, I know it. The data is at hand, it only needs popular interpretation, it only needs to be set down in the kind of language that he can understand and in the kind of terms that will apply to the individual ownership of the car which he possesses.

Last year I am told we had a national income of $10,000,000,000 more than we required for the maintenance of our present standard of living. No nation in the history of all the world has ever dreamed of such an income, and that income is available today to us as businessmen, and is inviting us to make use of it in the form that will create the largest return to the lender and that will provide the largest increased income and improved welfare for those who use it. And then as an organization we are invited to make use of that sum and to apply it in a way that our convictions lead us to believe can be easily done.

It is certainly a privilege to have lived in an age like this. Perhaps if you opened the newspaper this morning, up at the top of one of the Denver papers you found a statement, "It is a privilege to live in Colorado." It appears there every single day. I will add to that, with even greater emphasis, that it is a privilege to have lived in this age of ours, and while we are living, there is no instrument of modern business that has contributed more to national unity nor has made a larger contribution to our ability to meet world competition than that of transportation, and there is no single space-burning force that will do more in the future to hold this great nation of ours together than transportation. The dominant factor of this thing of which you are such a great part is unchallenged by any man as a nation-welding force, and every man and member of this organization can be justly proud to have a part in it.

"Bituminous Treatment of Gravel and Crush Stone Roads"

By T. E. Stanton
Assistant State Highway Engineer of California

TREATING roads with asphaltic oil is not a development of recent years.

In California where an abundance of asphaltic oil is available locally at a low cost, we have been oiling our roads with more or less success for over 30 years.

Many states can undoubtedly produce evidence of similar practice.

Most of the early work of this nature, however, was allowed to deteriorate through lack of proper and intelligent maintenance, with the result that oil surfacing of natural soil or gravel roads came to be looked upon by the general public as more or less of a failure and the tendency has been to replace these oil roads with expensive hard surfaced pavements as rapidly as traffic requires and funds are available.

As motor traffic has increased and highway engineers have come to realize the great economic waste involved in permitting waterbound gravel and crushed rock roads to be loosened and blown away through the joint action of vehicle and winds, a strong movement has set in all over the country towards sealing the surface so as to make it impervious to such destructive agencies.

Instead, however, of using the haphazard methods of the past, the engineer has come to the conclusion that the proper solution of the problem is deserving of as much scienific and intelligent study as had been applied to the more expensive types of hard surfaced pavements, and as a natural corollary we have the rapid strides towards a full understanding of the problem which have been made in recent years.

To Oregon must go the credit in the west of being the first state to go extensively into the use of an asphaltic oil, relatively low in asphalt content (60 per cent to 70 per cent), locally known as "fuel oil," in surfacing the gravel and crushed rock roads of the state by what is known as the surface treatment or penetration method; and to California the credit for most of the progress which has been made to date in the so-called "oil mix" method.

The present extensive use of fuel oil on the Pacific coast is the direct outcome of experimental work conducted in 1923 by the Oregon State Highway Commission followed in 1924. 1925 and 1926 by several hundred miles of bituminous treatment. Success in the Oregon experiments in 1923 and of later work was due in a large measure to the prior development of an efficient maintenance organization.

The favorable results in Oregon in the preservation of modern crushed rock and gravel surfaces by the use of fuel oil led to similar experimental work in California in 1925, followed by the construction of 245 miles of oiled state highway in 1926 and over 600 miles in 1927.

The Washington and Idaho State Highway Departments also constructed experimental oil treated sections in 1927, using methods adopted from Oregon practice.

So important does the Bureau of Public Roads consider this matter that it last year, in co-operation with the California State Division of Highways, initiated a special investigation of the subject, through the Regional Office, San Francisco, in charge of Dr. L. I. Hewes, deputy chief engineer.

As a result of this investigation a complete and valuable report has been drawn up by Mr. C. L. McKesson, materials and research engineer of the California Division of Highways, and Mr. W. N. Frickstad, highway engineer of the Bureau of Public Roads.

Much of the data on which this article is based was obtained as a result of the above investigation and will be found set forth in detail in the report of the investigating engineers.

Surface Treatment

Oregon uses the "Surface Treatment" method almost exclusively. In California probably 75 per cent of the roads oiled to date received the surface treatment and on the balance the oil mix method was used. There is no doubt, however, but that the oil mix method will be used to a greater extent in future work.

Surface treatment with light oil as conducted in California contemplates impregnation of the surface crust of a compacted road, with asphaltic oil.

The type of rock surface which lends itself most readily to a good job of this type is the fine crushed rock surface, using rock of maximum one (1) inch size, which can be thoroughly bladed and worked to secure a perfectly smooth surface of uniform texture prior to oiling.

To secure a good job by the penetration method it is essential that the surface be thoroughly sound and well compacted before oiling.

Harrowing oil into surface

The first step therefore, is the preparation of the base. If it has become rough and pitted under traffic, it is lightly scarified and trued up with a road grader, then sprinkled, dragged, and sometimes rolled if there is too much loose material on the road.

When firm and smooth, the surface is thoroughly swept with a power broom supplemented by a hand broom if necessary. All loose material and fines are removed and the rock in the surface is exposed.

The oil is then applied under pressure at the rate of one-quarter to three-tenths of a gallon per square yard and, when traffic can be detoured, allowed to penetrate without covering, the time required for penetration depending upon the texture of the surface and viscosity of the oil. Two or three days are usually sufficient, although frequently practically full penetration is secured in from 8 to 10 hours. It is generally necessary to carry traffic through the work. In such cases the usual procedure is to oil one-half of the roadway at a time, handling traffic under control. Immediately after oiling one side, the oil is covered lightly with clean dustless screenings applied at a rate of from 50 to 150 cubic yards per mile of full width roadway, the amount depending on the width, nature of material, traffic, etc.

As soon as the road is screened, traffic is diverted to the side just oiled and the opposite side then oiled and screened.

Following the first application of oil, the surface of the roadway is bladed and the oil coated screenings are dragged into depressions in the road surface, in order that minor inequalities in the road may be smoothed out. The oil collects in the minor depressions and furnishes sufficient cementing material to take up the screenings. Where large amounts of screenings are used and the traffic is carried through the oiling the blade should be operated continuously until the oil has dried up or has been absorbed by the cover material. If necessary, imperfections in the surface are repaired with pre-mixed oil and mineral aggregate.

The second application of two-tenths to one-quarter of a gallon of oil per square yard is spread as before and if possible, traffic kept off so as to allow for absorption. The road is then screened again before throwing open to traffic. High viscosity oils require more screenings than the thinner oils. Clean screenings only should be used as fine material including dust absorbs the oil before it can penetrate the base, with the resulting formation of a thin oil mat on the surface which lacks adhesion to the base and will not stand up under traffic.

When traffic can be detoured entirely off the work the screenings are not applied until after the second application of oil as we have found by experience that the same results as regards smoothing up, correcting defects, etc., are secured by covering and dragging after the second application of oil as are secured by covering and dragging after each application and it is usually found possible to get by with materially less screenings when made in one application than in two with resultant lower cost.

An alternate method to the use of light oil for both applications is to use light fuel oil (60 to 70 per cent) on the first application in order to secure penetration and a heavy asphaltic road oil (90 per cent to 95 per cent) on the second application. This latter application requires a special heating plant. In some cases emulsified heavy oil is being used, thus making it unnecessary to install a heating plant. The emulsified liquid contains 50 per cent of asphalt and 50 per cent of water so that when the same amount of liquid per square yard is spread there is only one-half as much asphalt, the reduced quantity of asphalt thus at least partially offsetting the cost of emulsification. A number of miles have been oiled in California in this manner and the process is under close observation. The advantage to be gained by this process, if any, is the ability to spread light applications of heavy asphaltic oils without the use of expensive and troublesome heating equipment.

First blade operation

No recommendations can be formulated as yet on this special treatment method, though the results secured thus far have not been unsatisfactory.

Maximum penetration of the oil into the compacted road surface should be one of the principal objectives. This penetration results in a gradual transition in texture of the top one or two inches of the crust from the rather rich condition of the surface to the lean condition found at the maximum depth of penetration without any distinct binding plane or plane of separation which is unstable under traffic.

After the surface oiling operations have been completed it is essential that thorough and incessant maintenance set in immediately. Scarred places should be thoroughly cleaned, broomed out by hand and swabbed with oil followed by a dash of screenings. Each scar no matter how small should be so treated.

If it is not possible to immediately treat scarred places they will soon develop into pot holes. In such cases a premixture of oil and rock should be thoroughly tamped into the pot hole after cleaning it out thoroughly and swabbing it lightly with oil.

Traffic

On heavily traveled roads it is generally found necessary to carry traffic through the work. This is not an unmitigated evil, however, as the traffic passing over the oiled surface, especially over the first or primary coat, reveals any weak places which can be immediately repaired.

When traffic is allowed through the work, however, the cars are liable to become spattered with oil and the irate motorist is inclined to severely criticize the department. In order to reduce the criticism to a minimum, printed cards are handed each motorist as he approaches the work warning him that the road is being

oiled and requesting that he maintain a speed through the work of not to exceed five miles per hour.

(Sample Card)

PLEASE HAND TO TRAFFIC OFFICER AT OTHER END
ONE WAY TRAFFIC
KEEP OFF THE OIL
EXCEPT WHEN PASSING STALLED CARS
FIVE MILES PER HOUR
WHEN ON THE OIL
FOLLOWING THESE RULES WILL KEEP OIL OFF YOUR CAR
ALSO EXPEDITE OUR WORK
THANK YOU!

(Sample Card)

ATTENTION!
THIS ROAD IS BEING OIL TREATED
PLEASE EXTEND YOUR COOPERATION BY
DRIVING SLOWLY AND COMPLYING WITH
SIGNS

Oil Mix

Surface oiling is only successful where the base is firmly bound and all loose material on the surface can be eliminated by brooming. The base can be placed in a properly bound condition only when the rock from which it is made has cementing qualities of a high order or there is suitable material which has a high binding value.

In many of the arid and desert regions of California no good cementing base rock is available, nor is there any suitable local clay or other binding material. In these sections it is impossible to secure a base sufficiently stable to enable the surface oiling method to be adopted with any success.

We were forced in such cases to either abandon the use of oil altogether or to adopt some other method. As a result, the oil mix method was developed. The use of this method, while particularly adapted to sections where there is no good binder available, is being extended to cover crushed rock roads in other sections of the state where, even though good binder may be available, it is desired to immediately oil a base in such rough condition that it must be scarified several inches in depth in order to properly smooth up or where it is desired to oil a new road surface before traffic has had time to thoroughly compact the base and surface material.

Those who have become expert in this method of oiling prefer it to the oil surface method, as a smoother riding surface can be secured and the resultant maintenance cost under average conditions is somewhat less, owing to the fact that when the work is properly done practically no surface patching is necessary.

Where the grading of the base material shows in excess of 50 per cent fines passing the 10 mesh approximately one-half gallon of oil per square yard per inch of depth is required when the mixing method is used, or a total of one and one-half gallons for a three-inch mat, as against approximately one-half gallon total in the case of the oil penetration method. the cost of oiling being increased to this extent. On the other hand, an appreciable saving is made in the cost of screening, which is found unnecessary in the oil mix method.

The mixing method produces a layer of mineral aggregate and bitumen closely akin to asphaltic concrete. The same principles of grading affect its stability. Skilled workers can produce an oiled surface which is smoother than the surface ordinarily attained with asphaltic concrete.

The method of construction is briefly described as follows:

If the existing road has a rough or unequal surface it is first scarified lightly and then smoothed by grading or dragging loose material into depressions.

After this preliminary smoothing the road is scarified to a uniform depth of 2 inches to 3 inches, according to the thickness of bituminous surface desired.

Sixty per cent to 70 per cent fuel oil is applied in two or three applications, each consisting of about one-half gallon per square yard.

The oil is mixed with loose material after each application by means of a disc harrow, sometimes followed by a spring tooth harrow.

As soon as the oil distributor starts the disc harrow pulls in behind and begins mixing, going back and forth over the section oiled until the distributor returns with another tank load of oil. This harrowing operation can not be overdone.

The second and third oil applications are disc-harrowed in the same manner as the first application.

The material is then bladed from the side to the center of the road with a road grader, the first trip with the grader lining up the edge in a straight line and throwing the material toward the center. A second trip with the grader flattens out toward the center the ridge thrown up by the first trip. The third trip windrows toward the center the material flattened out by the second trip. Two adjacent windrows at the center are the result after the completion of the third trip on both sides of the road. The fourth trip with the grader lays one windrow on top of the other and the fifth trip splits this windrow in two, flattening out the material which is now on its way back to the edge of the road. The process is then repeated, usually with a ten-foot grader. Sometimes the mixing is done with a Best tractor, pulling two graders with the blades set in opposite directions.

The final mixing is entrusted to an experienced man who has learned by experience the proper color which must be obtained for best results. The amount of mixing and number of trips depends somewhat on the temperature, character of material being mixed and the viscosity of the oil. The process of mixing is continued until the rock is thoroughly coated with oil and until the entire mixture has attained a uniform brown color. The material is sometimes turned over from thirty to forty times.

Cost

There is not a great deal of difference between the average cost of oiling by the penetration method and the cost by the oil mix process, although the cost of specific projects by either method vary widely.

The average cost of oiling some 426 miles by the penetration method during the current year was $1,103 per mile. The minimum cost was $577 per mile on a six-mile section where only 10 tons of screenings per mile were used for covering the oil. The maximum cost was $1,582 per mile for oiling 125 miles in our District No. 1 where 0.66 gallons of oil per square yard and 252 tons of screenings were used.

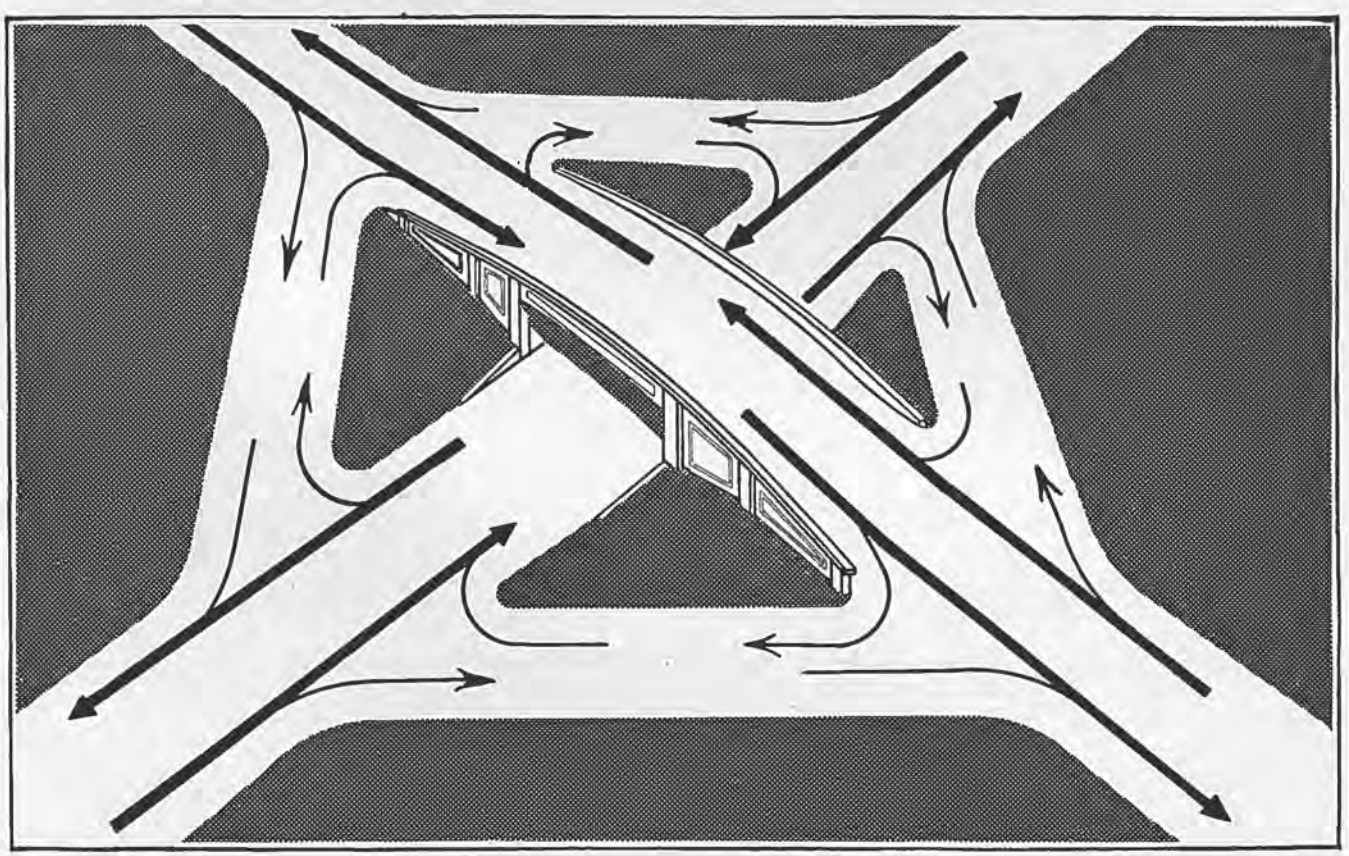
Grade Separations--No Left Turns

REDUCTION of traffic congestion, increase in traffic efficiency of each street, decrease in the cost of motor operation, saving in time for the users of busy thoroughfares, and elimination of the familiar intersection accident all result from the replacement of important vehicular crossings by grade separations or overpasses. The grade separation at the intersections of two major streets or highways has succeeded in accomplishing what no other traffic or street building device has attempted. It permits the use of the intersection by two lines of cross traffic in such a way that neither can possibly interfere with the other although both use the intersection at the same time. The "No Left Turn" is thus built into the street.

The stop-and-go regulation, while necessary with single-level crossings, allows each intersecting street to be used much less than half the time because there must be a more or less complete pause of all use of the crossing while the change from one direction to the other is being made. The grade separation on the other hand, requires neither pause nor retarding of vehicle speed. Capacity of streets in the city of Detroit was increased four-fold at one over-pass, according to Col. Sidney D. Waldon, president of the Detroit Rapid Transit Commission. The separation permitted movement of traffic at the rate of 2,000 vehicles per hour, while on a street of the same width two blocks north, where stop-and-go regulations prevailed, the capacity was less than 500 vehicles per hour. New York's experience is similar. Rush-hour traffic on Fifth avenue between 34th and 42nd streets averages less than 3 miles per hour, according to Ira M. Lewis, executive engineer of the Regional Plan Association of New York. With grade separations at important intersections a speed of 30 miles an hour or more, or 10 times that on Fifth avenue, is possible and with even greater safety than at the slower speed.

By promoting unimpeded travel, elimination of grade crossings also substantially cuts the cost of motor operation. Authorities estimate that the increased consumption of gas amounts to 15% or more, that fresh oil is more frequently needed, that tire wear is greater and that depreciation of the vehicle is more rapid in city travel as compared with unimpeded highway travel. Of course, all this increased cost is not due to stops made at grade crossings, but such crossings are an important factor in the increase.

Grade separations save annually millions of dollars in valuable time for owners of trucks, busses, taxicabs and pleasure cars. Delays at single-level intersections increase the delivery expense of merchants, manufacturers and jobbers, which in turn increases the price of the goods to the consumer. In addition, a vast amount of time is wasted by individuals who drive or ride in passenger cars.—Roads and Streets.



Cost of Governing Colorado

THE Department of Commerce announces a summary of the financial statistics of the State of Colorado for the fiscal year ending November 30, 1926.

The full text of the Department's statement follows:

The payments for maintenance and operation of the general departments of Colorado for the fiscal year ending November 30, 1926, amounted to $10,205,575, or $9.66 per capita. This includes $842,897, apportionments for education to the minor civil divisions of the state. In 1925 the comparative per capita for maintenance and operation of general departments was $10.52, and in 1917, $3.53. The interest on debt amounted to $578,273; and outlays for permanent improvements, $5,046,275. The total payments therefore, for expenses of general departments, interest, and outlays were $15,830,123. Of this amount $16,142 represents payments by a state department or enterprise to another on account of services. The totals include all payments for the year, whether made from current revenues or from the proceeds of bond issues.

GOVERNMNET COSTS—Of the governmental costs reported above, $5,590,510 was for highways, $1,679,991 being for maintenance and $3,910,519 for construction.

The total revenue receipts of Colorado for 1926 were $15,295,976, or $14.47 per capita. This was $4,512,128 more than the total payments of the year, exclusive of the payments for permanent improvements, but $534,147 less than the total payments including those for permanent improvements. These payments in excess of revenue receipts were met from the proceeds of debt obligations. Of the total revenue receipts $16,142 represents receipts from a state department or enterprise on account of services. Property and special taxes represented 44.5 per cent of the total revenue for 1926, 44.3 per cent for 1925 and 56.9 per cent for 1917. The increase in the amount of property and special taxes collected was 141.6 per cent from 1917 to 1925, but there was a decrease of 3.2 per cent from 1925 to 1926. The per capita property and special taxes were $6.44 in 1926, $6.91 in 1925, and $3.23 in 1917.

Earnings of general departments, or compensation for services rendered by state officials, represented 12.9 per cent of the total revenue for 1926, 10.4 per cent for 1925, and 14.6 per cent for 1917.

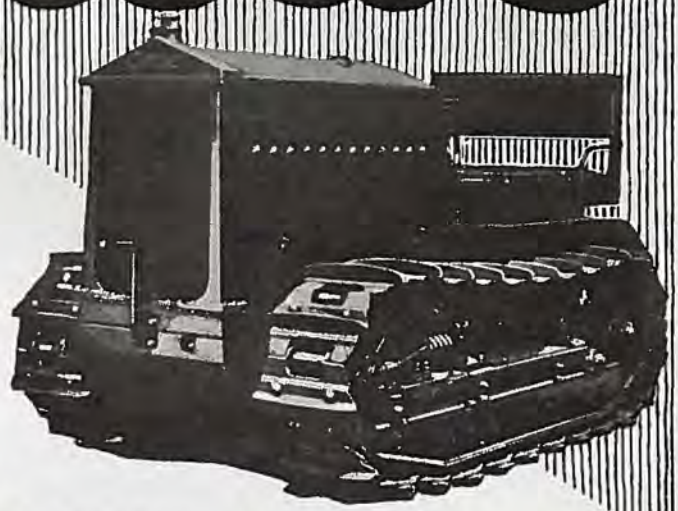
REVENUE FROM LICENSES—Business and nonbusiness licenses constituted 25.3 per cent of the total revenue for 1926, 22.4 per cent for 1925, and 10 per cent for 1917.

Receipts from business licenses consist chiefly of taxes exacted from insurance and other incorporated companies and of sales tax on gasoline, while those from nonbusiness licenses comprise chiefly taxes on motor vehicles and amounts paid for hunting and fishing privileges.

For 1926 the assessed valuation of property in Colorado subject to ad valorem taxation was $1,546,830,046; the amount of state taxes levied was $5,676,866; and the per capita levy, $5.37. In 1925 the per capita levy was $5.60, and in 1917, $4.13.

Scene along newly laid concrete pavement north of Lafayette in Boulder county

Cletrac



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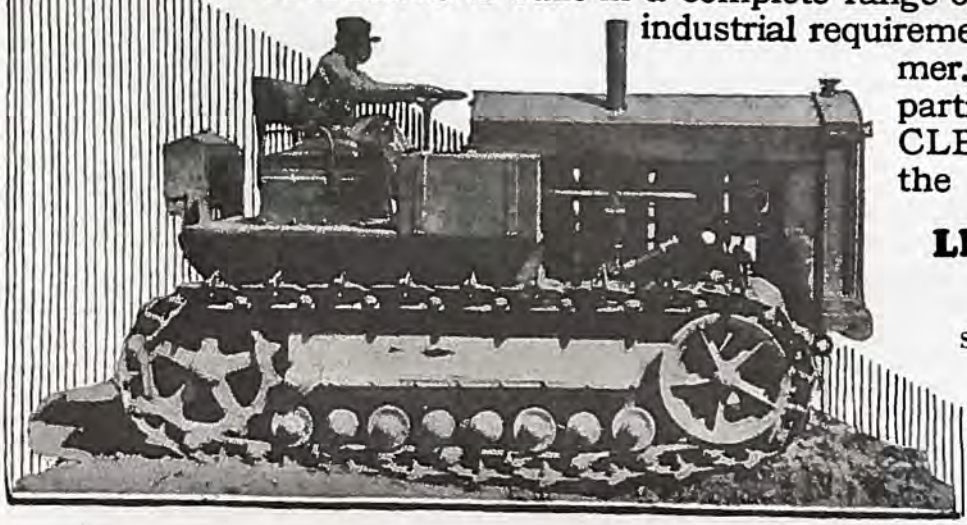

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Variation in Taxation of Motor Vehicles

One of the most important problems of highway building has to do with the distribution of costs. Present day conditions seem to call for an adjustment or compromise between the old idea of a pike paid for by users in the form of tolls, and the later idea of free public roads available to anyone for any purpose. The taxation of motor fuel and the collection of registration fees for motor vehicles are the most common attempts toward such adjustment.

During 1926 $1,500,000,000 was spent in the United States for the construction and maintenance of streets and highways. Motor vehicle revenues collected by the states contributed more than one-fourth of this amount. The increase of gas tax in many states during the past year indicates that still greater revenues will be derived from this source in the future.

A comparison of the rates of motor vehicle taxation according to states reveal a surprising lack of uniformity. This fact seems to prove that the data available at the present time is altogether inadequate as a basis for taxation schedules. There is a great need for research and investigation in this direction.

A few instances will illustrate how great is the variation. A five-passenger car of certain type is licensed in California, under the 1926 schedule, for $3. Oregon charges a fee of $40 for the same car. A still wider range is observed in the case of motor bus license fees. A 20-passenger bus is licensed in Missouri for $10.50 while Maryland collects $1,428.57 for the same type of vehicle. Taxation of gasoline ranges from none at all to five cents per gallon. The ratio between gasoline tax and registration fee is variable, some states making both charges fairly high, while others reduce the registration fee when they add a gasoline tax. In some states automobiles are exempt from personal property tax and in others are not.

There is a great need for more exhaustive research in this field. There should be data to establish the relationship which weight, speed and type of tire bear to the wear on road surface. We need schedules which will be fair to all adjusting the costs chargeable to heavy commercial carriers on one hand, and privately operated business or pleasure cars on the other.

Why New York Has No Gasoline Tax

The New York Assembly at their last session defeated a measure providing for the collection of a 2-cent gasoline tax in that state.

In a recent trade paper an official of the New York Automobile Merchants Association explains why his organization persistently fought the measure.

He states that raising funds for highway construction and maintenance by means of registration fees and gasoline tax, set at a figure proportionate to the highway budget, is fair and reasonable. The objection his association had to the New York program was that *only half* of the funds raised were to be spent for highway improvement, the balance to be used for other purposes.

New Mexico's Maintenance Program

By W. C. Davidson, State Highway Engineer

MAINTENANCE of the state highway system, consisting of 5,000 miles of road, will be concentrated under four main districts, the actual direction of operations being in charge of the district engineers. An approximate equal division of the state has been made, so that each of the four districts has about 1,250 miles of road to be maintained. One county involving 250 miles of road has been excluded from the district maintenance operations; this for the purpose of establishing a highway training school. The county in question is Torrance, and the headquarters of the training school is at Encino.

Organization—In each district, there will be a district engineer and from one to two assistants. Maintenance operations will be directed by this personnel. In addition to the engineering force, there will be a corps of maintenance foremen who will be in direct charge of the patrol or maintenance crews.

Equipment—Insofar as possible an effort will be made to standardize the types of equipment to be used on maintenance. The reason for this is to maintain uniform maintenance methods as well as uniform methods in the care and repair of equipment. The use of heavy trucks (army types) will be discontinued as rapidly as possible and modern equipment substituted therefor.

What appears to be the ideal complement of equipment for the average forty to sixty mile patrol division is as follows: two 5-ton tractors, one heavy drag or maintainer, one 7- to 8-foot grader equipped with extension blades, and a 1-ton truck. Supplementing this equipment, would be the heavy maintenance equipment previously mentioned; this latter equipment to be used only occasionally.

The complement of heavy equipment would be as follows: one 10-ton tractor, one 12-foot road grader equipped with scarifier attachment and back slope attachment. The use of such equipment would, of course, not be restricted to a single patrol, but would be used over a large number of patrols, possibly covering two or three counties.

District Shops—At each district headquarters there will be maintained a general repair shop. This shop will be equipped both as to men and machinery for the repair of any and all equipment of the district. The major overhauling jobs will be taken care of at these shops, as also the overhauling and assembling of various units such as motors, transmissions, and other minor units of a truck or tractor. A crew of men consisting of a shop foreman, four to five mechanics in the shop, and a general field mechanic will, as a rule, service all the equipment in any particular district.

The time of the field mechanic will be spent almost entirely in the field in the matter of minor repairs and adjustments to equipment, installation of motors, transmissions and other units which have previously been repaired in the shop, and other work of a minor nature not requiring the use of general shop equipment.

Federal Aid Construction In July Reviewed

Federal Aid highway construction work completed in July cost $6,613,527.78, of which $2,977,277.03 was supplied from federal funds, according to the monthly report of progress on construction work contained in the September issue of Public Roads, a journal of highway research issued by the Bureau of Public Roads.

Projects were completed in 28 states with a total of 337.7 miles. The greatest mileage of road work completed in the month was in Nebraska where 80.3 miles were improved at a cost of $634,855.62, of which $314,090.57 was paid by the Federal Government.

Texas completed 30.8 miles of road construction at a cost of $1,043,207.81, of which the federal aid fund supplied $449,844.91. South Dakota's mileage was 29.1, costing $109,739.28, with a federal-aid allotment of $57,825.99.

Missouri completed 22.9 miles of construction, costing $531,938.13, with a federal aid allotment of $221,824.30. Other states completing projects of over 10 miles were Georgia, Montana, California, New York, Utah, Kansas and Louisiana.

Approximately 13,685 miles of construction work is under way in the several states and Hawaii. The estimated total cost of these projects is $347,772,183, of which the Federal Government will be called upon to pay $145,671,480.

The greatest value of work in progress is in New York, where the estimated cost of the projects now under way is almost $38,000,000. Projects under way in the following states, in order of amounts, range in estimated cost from $17,371,715 in Pennsylvania to $10,050,040 in Wisconsin, Pennsylvania, Indiana, Iowa, Texas, Kansas, Nebraska, Michigan, Ohio, Illinois and Wisconsin.

Work approved for construction but not under way in all states except New Mexico will cost a total of approximately $56,992,630, of which $22,299,450 will be paid from the federal aid allotments. The balance remaining in the federal aid fund available for other new projects for the fiscal year ending June 30, 1928, is $63,544,100.09.

Convention and Road Show

January 9, 1928, will mark the beginning of the convention and road show of the American Road Builders' Association, at Cleveland, Ohio, where over 300 car loads of road building and maintenance materials and equipment will be on exhibition for the 25,000 highway engineers, contractors and officials who will attend. At the same time, the convention will bring together engineers and officials from all parts of the United States and from several foreign countries and there will be presented reports and papers on the subjects that are commanding eager attention in the highway industry.

Tuesday, January 10, will be "Governors' Day" and all state governors and past governors who were identified with large programs during their terms of office will be invited to attend.

Wednesday, January 11, will be "Pan-American Day" and the great record of that day last year and the additional plans for this year already assure great success. There will be a good attendance from Pan-American countries. The Pan-American countries are being invited to send exhibits as was done last year. This will increase the international interest. Although the exhibits will be primarily in a highway nature, still the countries are privileged to send as complete exhibits as they desire.

Thursday, January 12, will be "County Highway Officials' Day" and the program will be given over to county problems and officiated over by county officials of the County Highway Officials' Division.

Already eight standards committees have been appointed and their chairmen will present reports or papers based on the findings of the committees. In addition to this, there will be presented on this day a complete report on "Low Cost Road Construction." Eighteen months have been taken in collecting the data for this report and it will be both interesting and instructive to all interested in highway work.

Many of the sessions of the convention will be divided into two sections—the one for the engineers and officials and the other of special interest to the contractor.

COLORADO'S GASOLINE TAX LAW VALID

Colorado's 3-cent gasoline tax law is constitutional according to a ruling made by Judge Francis E. Bouck.

By the ruling Judge Bouck sustained a demurrer of the state to a suit of the Rio Oil and Supply Company which attacked the constitutionality of the law. Attorney Charles T. Mahoney, who represented the oil company, asked and was granted sixty days in which to file a bill of exceptions. He indicated he would take the case to the supreme court.

New Highway Equipment and Materials

A Section Devoted to What the Manufacturer Is Doing for the Engineer and Contractor

WORTHAM JOINS MOORE EQUIPMENT SALES FORCE

John Wortham, formerly county engineer of Weld County and more recently associated with the R. C. Peppers Engineering Sales Company, has joined the sales force of the H. W. Moore Company and will represent them in eastern Colorado, northwestern Nebraska and Wyoming.

J. J. Diamond, for a number of years associated with the firm, but on a year's "leave of absence," has returned to the fold after spending a year trying to coax more milk out of a bunch of dairy cows. He has been made assistant sales manager.

CLINTON AND HELD,

distributors of "Caterpillars," had exhibits of roadbuilding and agricultural equipment at several of the Colorado county fairs in September. Among them was the fair at Del Norte, in the San Luis Valley; a fair at Hugo, and one at the Converse County fair at Douglas, Wyo.

THE ROY C. PEPPERS

Engineering Sales Company has removed from Denver to Hudson, Colo., effective October 1. Mr. Peppers formerly operated from Hudson and still maintained his warehouse there, opening the Denver office shortly before the first of the year. The firm has given up the agency for the Cletrac, which has been taken over by the Liberty Trucks and Parts company, 1532 Sixteenth street.

Mr. Peppers will continue with the distribution of Havelock Maintainers, Cyclone Wire Guard, A. W. Traffic plates and Snow Fencing.

NEW POWER SCRAPER USES 20-K CLETRAC

A new model of the Miami One-Man Power Scraper has been produced for use in connection with the Model 20-K Cletrac Tractor by the Miami Trailer-Scraper Co., Troy, Ohio. The photograph on this page shows the scraper and tractor in actual use.

The Miami One-Man Power Scraper is exactly as the name implies, a power scraper whereby one man or the tractor driver loads, transports and automatically dumps a full three-quarters of a yard of earth each and every trip without stopping the tractor. The above is the water level capacity of the scoop pan. The scoop pan can be filled with a full rounded load of earth running from 21 to 24 or 25 cubic feet, say the manufacturers.

KOEHRING BRINGS OUT NEW SHOVEL-CRANE-DRAGLINE

The Koehring Co., Milwaukee, manufacturers of pavers, mixers, gasoline shovels, cranes and draglines, has just issued a 40-page catalog on its new No. 501 machine, copies of which are available upon request.

The No. 501, which is built as either a shovel, crane, or dragline, as specified, is a machine with capacities ranging from 1½ to 1 cubic yards of material.

An innovation in this machine is the method of rating the shovel.

INSTALLS NEW ELECTRIC HOIST FOR LOADING KEYSTONE CULVERTS

The method of loading culverts on to cars has always been a problem. Culverts loaded by hand, or by any method that makes it difficult to get them to the proper elevation and center them gently, not only have a tendency to break the spelter but is expensive.

The electric culvert hoist of the Colorado Culvert and Flume Company, shown in the group, is a horizontal arm which can be swung quickly to any position in the storage field. An electric crane moves along the horizontal arm and as a single culvert or a nest of culverts is raised it carries the culverts clear of any obstruction around to the car and loads them so that the possibility of damage is eliminated.

Little effort is necessary to raise the pipe from the track level to a position 12 or 14 feet above the flat car floor. The method of raising the culverts, as shown in the photographs, permits any diameter of culvert to be handled with ease. When culverts are loaded by this method the only labor involved is the swinging of the horizontal arm and the unloosening of the culvert chain by the man who supervises the loading of the car.

The demand for Keystone culverts has increased to such an extent during the past two years that it was absolutely necessary to install an electric hoist in order to give that "right now" service so characteristic of this concern.

SPEARS-WELLS MACHINERY COMPANY ENLARGE PLANT

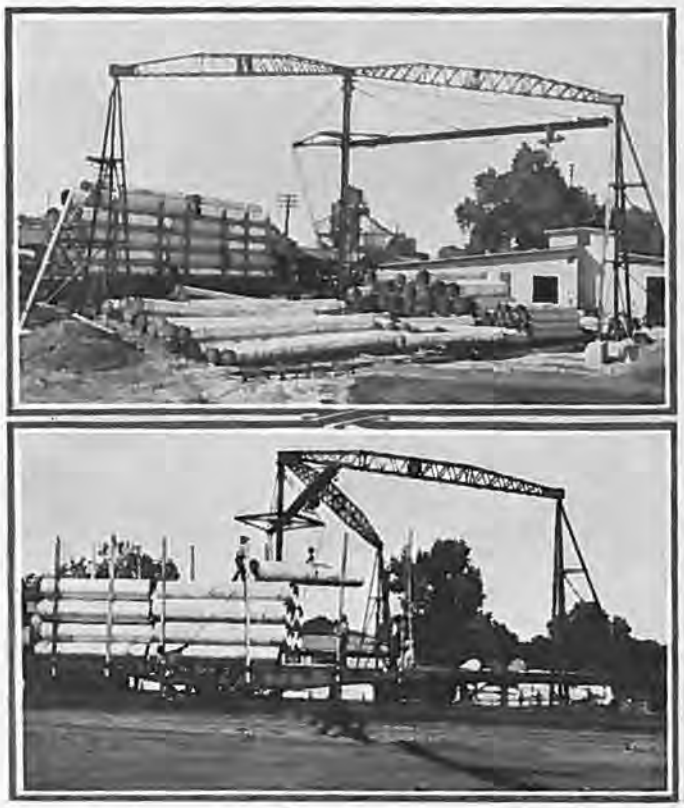
Spears-Wells Machinery Company of Oakland, California, have enlarged their plant by the addition of 6,000 square feet of floor space, which will be used primarily, for the present at least, for assembling machinery.

Due to the addition they will be able to increase their output 30 to 50 per cent.

The extension was made necessary by the natural growth of their business, and in anticipation of increased highway activities due to the passing of the gasoline tax.

HIGHWAY EQUIPMENT

Russell Grader Mfg. Co., Minneapolis, Minn., in its catalog No. 27, devotes 48 pages to its road equipment. Although devoted largely to the company's complete line of graders of various types, such other equipment as crushing plants, steel bins, draglines and conveyors are illustrated and described. A comprehensive 2-page table gives comparative specifications for all Russell graders.



BIDS RECEIVED FOR FOLLOWING PROJECTS

Proj. No.	Length	Type	Date Bids Opened	Low Bidder
F. A. P. 279-D	0.264 mi.	Pavement	Oct. 10, 1927	M. E. Carlson
State P. 552-C	0.299 mi.	Graded	Oct. 10, 1927	Axel Swanson
State P. 560	2.525 mi.	Gravel Surfacing	Oct. 10, 1927	J. Fred Roberts & Sons
State P. 580-C	16.673 mi.	Graded	Oct. 10, 1927	A. R. Mackey
State P. 664	0.095 mi.	Timber Br. & Approaches	Oct. 10, 1927	C. A. Sweitzer

PLANS SUBMITTED FOR APPROVAL TO U. S. BUREAU OF PUBLIC ROADS

Proj. No.	Length	Type	Location
2-R56	2.75 mi.	Pavement	South of Aguilar
138-A	10.916 mi.	Graded	North of Kremmling
279-F	3.444 mi.	Graded	North of Bailey
287-D	0.921 mi.	Graded & R. R. Underpass	East of Kersey
277-B	4.866 mi.	Pavement	South of Colorado Springs
144-B	3.201 mi.	Gravel Surfacing	Northwest of Fort Collins
258-F	5.692 mi.	Gravel Surfacing	East of Sapinero

PLANS BEING DRAFTED

Proj. No.	Length	Type	Location
147-A	15. mi.	Gravel Surfacing	South of Cortez
208-B	0.2 mi.	Gravel Surf. & R. R. Overhead Crossing	East of Grand Junction
253-C	5. mi.	Gravel Surfacing	West of Milner
262-D	2. mi.	Gravel Surfacing	West of Walsenburg
266-C	4. mi.	Gravel Surfacing	South of Bondad
288-A3	3. mi.	Grading & R. R. Overhead Crossing	East of Brush
292-B	0.5 mi.	Grading & R. R. Overhead Crossing	South of Minturn
295-C	4. mi.	Gravel Surfacing	North of Antonito
296-C	5. mi.	Gravel Surfacing	North of Greenhorn

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT, 1927

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R3	North of Trinidad	0.553 mi.	Pav. Underpass	Strange-Maguire Pav. Co.	$ 28,882.70	100	2-R3
2-R4	North of Trinidad	6.66 mi.	Asphalt Paving	Strange-Maguire Pav. Co.	331,632.00	100	2-R4
2-R5	Bet. Trinidad and Aguilar	1.959 mi.	Paving	W. A. Colt & Son	72,122.50	6	2-R5
134-A	Betw. Stratton and Burlington	5.861 mi.	Sand Surfacing	W. A. Colt & Son	40,438.00	100	134-A
134-A2	Stratton-Burlington	5.313 mi.	Sand Surfacing	F. Kentz	15,265.68	100	134-A2
144-A1	Near Ingleside	4.694 mi.	Gravel Surface	Orley La Nier	31,564.50	100	144-A1
145-A	West of Glenwood Springs	3.807 mi.	Gravel Surfacing	Winterburn & Lumsden	53,227.90	87	145-A
157-A	North of Buena Vista	3.997 mi.	Grading	E. H. Honnen	47,545.00	100	157-A
210-B2	De Beque-Grand Valley	7.507 mi.	Gravel Surfacing	Fred Kentz	37,475.00	19	210-B2
213-D	Durango, west	3.877 mi.	Gravel Surfacing	Shields & Kyle	47,692.00	100	213-D
222-CR	South of Lafayette	0.375 mi.	Paving	J. H. Miller & Co.	12,834.75	100	222-CR
246-F	West of Avondale	1.0 mi.	Paving	Strange-Maguire Pav. Co.	37,847.00	69	246-F
247-C	Swink	0.8 mi.	Conc. Pav. & R.R Underpass	J. Finger & Son	62,559.58	31	247-C
254-C	Div. 1 2 mi. S.W. of Hot Sulphur Springs	150 ft.	Steel Truss Bridge	Hinman Bros. Constr. Co.	12,383.00	100	254-C1
254-C2	S. W. of Hot Sulphur Springs	Superstr. of Bridge & Approaches		Northwestern Constr. Co.	48,203.50	48	254-C2
254-D	Parshall-Hot Sulphur Springs	3.013 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	37,124.18	93	254-D
258-B	S. W. of Gunnison	2.727 mi.	Gravel Surfacing	Lambie-Bate Const. Co.	65,374.00	100	258-B
258-D	Iola-Cebolla	4.426 mi.	Gravel Surfacing	H. C. Lallier Const. Co.	52,739.80	84	258-D
258-E	Cimarron-Cerro Summit	3.898 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	49,850.50	95	258-E
258-E	Dist. 2, F. A. P.	1.487 mi.	Gravel Surfacing	Hinman Bros. Const. Co.			
262-G1	Russell-La Veta Pass	5.014 mi.	Gravel Surfacing	Central Const. Co.	44,822.00	100	262-G1
262-H	Walsenburg-La Veta	3.296 mi.	Gravel Surfacing	Central Constr. Co.	34,788.00	100	262-H
265-B	Durango-Bayfield	3.831 mi.	Gravel Surfacing	Engler & Teyssier	52,134.55	87	265-B
271-B	At Portland	0.778 mi.	Paving, grav., bridge	H. M. Fox	58,802.65	100	271-B
275-C	Div. 2 East of Monument	0.625 mi.	Concrete Paving and 150 ft. Bridge	W. A. Colt & Son	34,466.60	100	275-C2
275-E	North of Monument	0.926 mi	Grading and Underpass	F. L. Hoffman	41,905.20	33	275-E
275-F1	Castle Rock-Larkspur	10.303 mi.	Grading	J. Fred Roberts & Sons	132,679.00	82	275-F1
275-F2	Castle Rock, south	5.227 mi.	Paving	J. Fred Roberts & Sons	119,027.80	90	275-F2
275-G	Larkspur-Monument	10.869 mi.	Grading	Monaghan-Cunningham Con. Co.	141,252.78	92	275-G
276	North of Colorado Springs		R. R. Overpass	J. L. Busselle & Co.	37,913.00	86	276
279-D	Morrison	0.264 mi.	Paving	M. E. Carlson	23,266.80	6	279-D
279-E	Schaffer's Crossing-Baileys	3.243 mi.	Grading	S. M. & S. J. Feely	54,305.60	83	279-E
281-D1 & 251-B1	Longmont-Lafayette	5.813 mi.	Grading	F. L. Hoffman	99,631.50	100	281-D1 251-B1
251-B2 & 281-D2	Lafayette, north	5.813 mi.	Concrete Paving	J. H. Miller & Co.	146,315.00		251-B2
281-E	At Lafayette	0.812 mi.	Paving	J. H. Miller & Co.	27,226.00	80 100	281-D2 281-E
282-D	North of Meeker	2.864 mi.	Gravel Surfacing	Winterburn & Lumsden	42,155.00	86	282-D
283-C	North from Longmont	5.79 mi.	Concrete Paving	J. H. Miller & Co.	196,703.90	100	283-C
287-A2	Fort Morgan, west	4.011 mi. 16.61 mi.	Concrete Paving Subgrade Treatment	H. C. Lallier Const. Co.	119,016.60	100	287-A2
287-C1-2	Greeley-Fort Morgan	19.447 mi.	Grading	H. C. Lallier C. Eng. Co.	159,950.85	75	287-C1-2
288-A2	Bet. Merino and Brush	9.741 mi.	Paving	Edw. Selander	245,043.50	40	288-A2
290-D	East of Las Animas	2.954 mi.	Concrete Paving	W. A. Colt & Son	88,979.50	83	290-D
292-A	North from Minturn	6.417 mi.	Grading	H. C. Lallier Constr. & Eng. Co.	92,571.80	76	292-A
293-B	Colona-Ridgway	80 ft.	Steel Bridge	Geo. F. Wear	21,845.25	100	293-B
295-B	La Jara, south	6.622 mi.	Gravel Surfacing	John A. Duncan	32,316.80	100	295-B
296-B	South of Pueblo	4.351 mi.	Gravel Surfacing	Cole Brothers	58,061.00	100	296-B
297AR	Northeast of Palisade	2.848 mi.	Surfacing	O. J. Dorsey	15,043.00	44	297-AR
297-B	Northeast of Palisade	2.237 mi.	Gravel Surfacing	Winterburn & Lumsden	30,581.24	100	297-B
299-A	Northwest of Delta	5.888 mi.	Gravel Surfacing	Strange-Maguire Pav. Co.	51,582.55	100	299-A
300A	Bet. Chattanooga & Red Mt.	2.277 mi.	Grading	Winterburn & Lumsden	59,480.80	19	300-A

"Caterpillar" *opens* the Road!

NEVER mind the blizzard that yesterday threatened an old-fashioned blockade!

The Road is open! The "Caterpillar" Tractor did it—pushing a big plow.

Big buses run on a regular schedule. Pleasure and business proceed as usual. The community that owns a "Caterpillar" track type tractor has disowned fear of the Snow Bogy!

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Write for 64 page ... book on ... Snow Removal

...*Prices*...

2-TON	$1850
SNOW SPECIAL	$2100
Peoria, Illinois	
THIRTY	$3000
SNOW SPECIAL	$3450
Peoria or San Leandro	
SIXTY	$5000
SNOW SPECIAL	$5500
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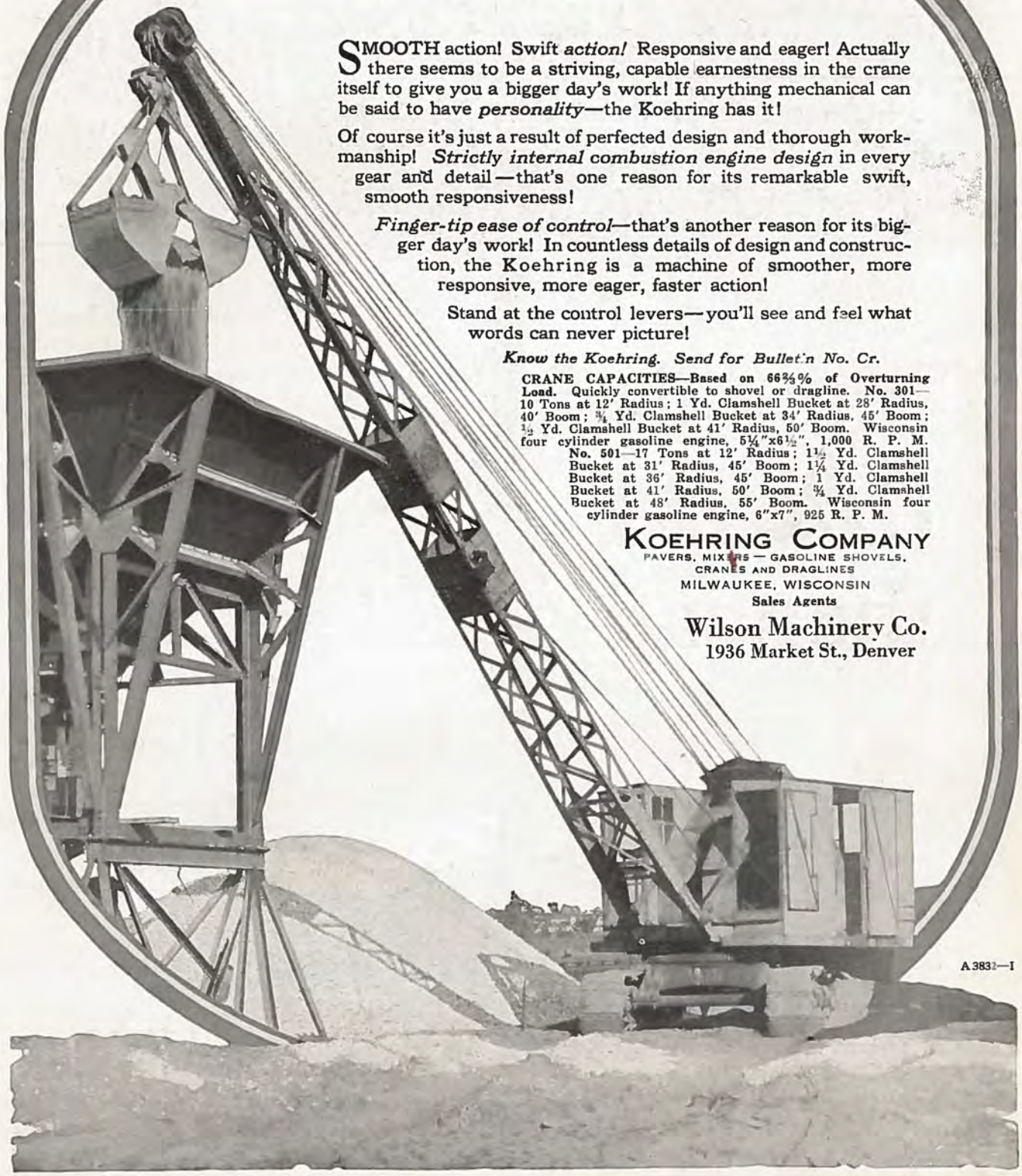
better quicker cheaper

CATERPILLAR

REG. U.S. PAT. OFF.

KOEHRING

Action!



SMOOTH action! Swift *action!* Responsive and eager! Actually there seems to be a striving, capable earnestness in the crane itself to give you a bigger day's work! If anything mechanical can be said to have *personality*—the Koehring has it!

Of course it's just a result of perfected design and thorough workmanship! *Strictly internal combustion engine design* in every gear and detail—that's one reason for its remarkable swift, smooth responsiveness!

Finger-tip ease of control—that's another reason for its bigger day's work! In countless details of design and construction, the Koehring is a machine of smoother, more responsive, more eager, faster action!

Stand at the control levers—you'll see and feel what words can never picture!

Know the Koehring. Send for Bulletin No. Cr.

CRANE CAPACITIES—Based on 66⅔% of Overturning Load. Quickly convertible to shovel or dragline. **No. 301**—10 Tons at 12′ Radius; 1 Yd. Clamshell Bucket at 28′ Radius, 40′ Boom; ¾ Yd. Clamshell Bucket at 34′ Radius, 45′ Boom; ½ Yd. Clamshell Bucket at 41′ Radius, 50′ Boom. Wisconsin four cylinder gasoline engine, 5¼″x6½″, 1,000 R. P. M. **No. 501**—17 Tons at 12′ Radius; 1½ Yd. Clamshell Bucket at 31′ Radius, 45′ Boom; 1¼ Yd. Clamshell Bucket at 36′ Radius, 45′ Boom; 1 Yd. Clamshell Bucket at 41′ Radius, 50′ Boom; ¾ Yd. Clamshell Bucket at 48′ Radius, 55′ Boom. Wisconsin four cylinder gasoline engine, 6″x7″, 925 R. P. M.

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PAVERS, MIXERS — GASOLINE SHOVELS, CRANES AND DRAGLINES
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