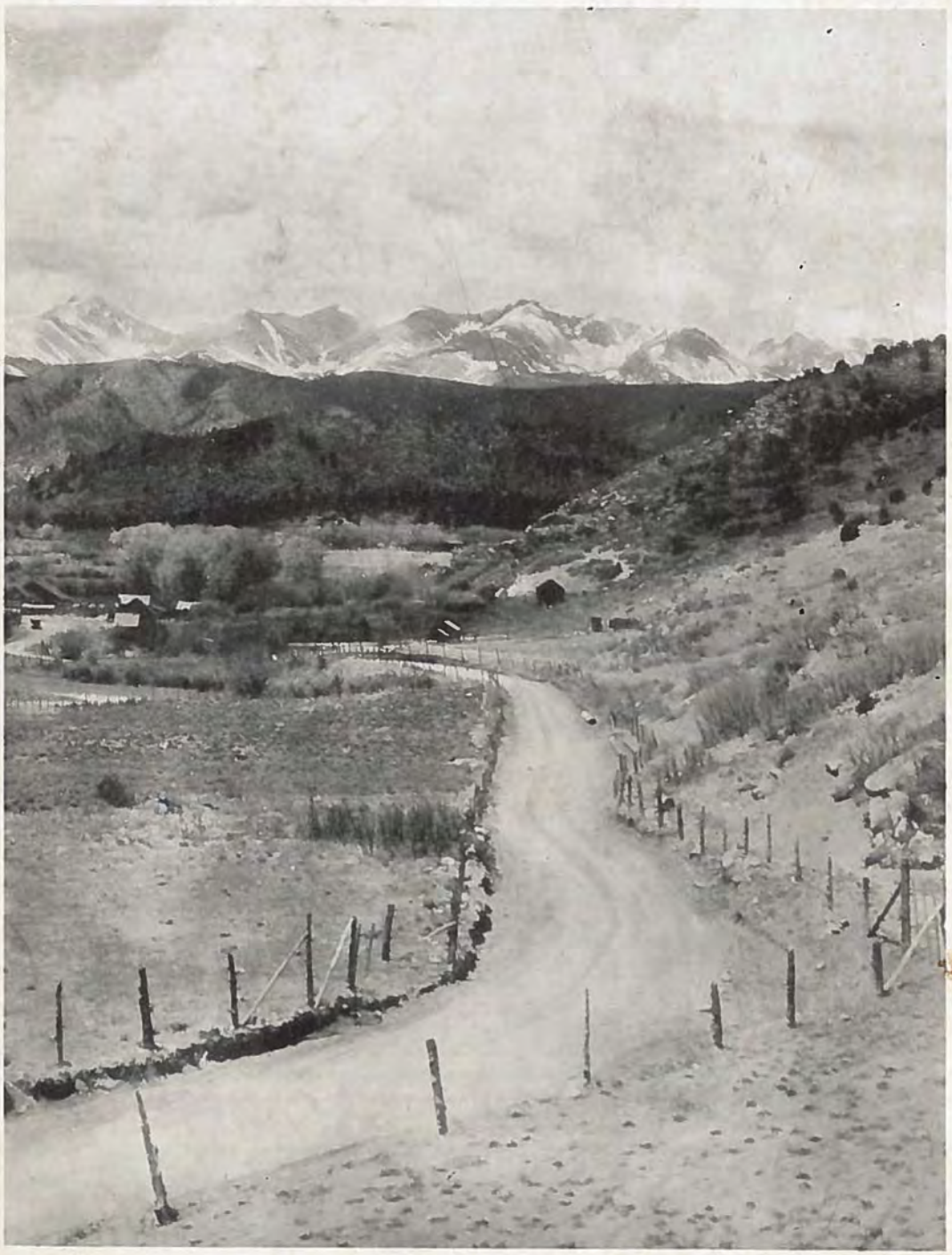
COLORADO HIGHWAYS



Vol. X February, 1931 No. 2

» » ALL STEEL « «
WASHING PLANTS
PORTABLE AND SEMI-PORTABLE

WASHTENAW ROCK PRODUCTS CO.
MANCHESTER, MICH.

This plant has a 10 hour capacity of 500 tons but has often produced more than twice that amount in the 10 hour period. It has belt conveyor feed, is electric driven, produces 4 sizes of materials, and bins are arranged for car and also truck loading. Complete in every detail.

This view below shows another CEDAR RAPIDS plant with belt conveyor feed, but with gasoline power and stock pile loading arrangements only. An inexpensive yet a very efficient washing plant that is semi-portable. You will make no mistake if you, too, will specify CEDAR RAPIDS when you buy a washing plant.

MORRIS COUNTY SAND & GRAVEL CO.
NETCONG, N. J.

LARSON-ERLING COMPANY
MILES CITY, MONTANA

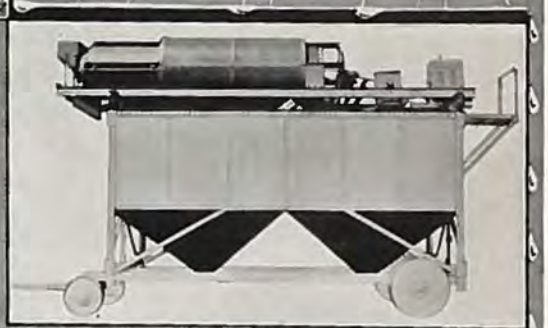
Up in the Rockies in Montana stands this 350 ton all-steel plant that has far exceeded its rated capacity every day it has been in use. Bins are raised to permit the attachment of batcher. It is portable as the entire plant except foundation can be easily moved. Efficiency plus.

This shows our Portable Cedar Rapids Washing Plant which can be used as a separate washing plant or as an attachment for any Portable Crushing, Screening, and Loading plant. Features of this unit are the 2 compartment — 40 cubic yard bin, speed reducer drives, screen and scrubber construction and the ease of transporting it from one pit to another. An efficient yet low priced unit. This is the same plant as pictured above.

STANDARD CEDAR RAPIDS PORTABLE WASHING PLANT LOWERED ONTO TRUCK READY FOR TRANSPORTATION

COLGROVE SAND & GRAVEL COMPANY
COLGROVE, OHIO

Standard 200 Ton All Steel Washing Plant built for slack line Feed



Whatever your washing plant requirements may be there is a CEDAR RAPIDS plant that will do the work better. Our line of portable and semi-portable all-steel Washing plants are built for the efficient and economical production of specification aggregates as we know that PERFORMANCE IS WHAT COUNTS. Before you install a new plant or change your present equipment, let us tell you more about CEDAR RAPIDS efficiency. Our Engineering Department will be glad to submit a proposal to you which will cover our recommendations as to the proper plant to best suit your requirements.

If you buy a steel plant you will SAVE MONEY; you will INCREASE PRODUCTION and you will CUT COSTS.

» » MATERIAL HANDLING EQUIPMENT « «

Made by

Iowa Manufacturing Company
Cedar Rapids, Iowa

Sales Representatives

H. W. MOORE EQUIPMENT CO.

120 West 6th Avenue, DENVER
Phone Tabor 1361

Colorado Highways

Official Publication of the
COLORADO STATE HIGHWAY DEPARTMENT
Denver, Colorado

GOVERNOR WILLIAM H. ADAMS, Chief Executive

CHAS. D. VAIL
State Highway Engineer

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10 CENTS A COPY. $1.00 A YEAR.

Our Cover Picture

"Over in the Stonewall Country," might well be the title of the picture which we run on this month's cover page of COLORADO HIGHWAYS. The view is of State Road No. 12 in Las Animas county. This is in the district of Chairman I. B. Rogers. The road leads to Stonewall, where it connects with the new road being constructed over Whiskey Creek pass, to connect with San Luis across the range in Costilla county. Photo by courtesy Trinidad Chamber of Commerce. It was taken by Aultman's Studio.

HANGING UP NEW RECORDS

IN ELEVATING GRADER EFFICIENCY

WHEN an ADAMS Elevating Grader goes on the job, dirt moves quickly and at low cost. Pictured above is one of Mullen & Reinman's machines loading stiff, heavy gumbo day and night on Mississippi River levee work near St. Joseph, La. "The worst gumbo we've ever handled in our 40 years of building levees," says Mr. Mullen.

New and exclusive features give ADAMS exceptional efficiency and capacity. Anti-friction bearings throughout result in exceptionally light draft. New shaft and gear driven carrier eliminates chain troubles. New belt protection prolongs belt life. New all-welded frame construction produces enormous strength and rigidity with least weight. The 42-inch carrier is driven either by power take-off or auxiliary motor, making carrier operation independent of tractive conditions. Write today for complete information.

Elton T. Fair Co.

1611 WAZEE STREET DENVER, COLO.

"COST LESS IN THE LONG RUN ALWAYS"

ADAMS

ELEVATING GRADERS

Colorado Highways
"BETTER ROADS"
VOLUME X. FEBRUARY, 1931 NUMBER 2

Highway Emergency Fund Put to Work

BY THE middle of March the state highway department will have more than two million dollars worth of new construction work under contract. These projects will absorb the greater part of the $3,000,000 allotted to Colorado from the $80,000,000 appropriated by congress for special highway construction to relieve unemployment. This work must be completed before September 1, if the state is to draw the special federal aid.

Included in the contracts to be let within the next three weeks will be two concrete paving projects between Kersey and Wiggins on the Greeley-Fort Morgan highway. When finished the new projects will give a continuous ribbon of pavement from Denver to Sterling.

"Every possible effort is being made to get as much work under contract as our known funds will permit, so that every man possible can be employed early in the spring," said Highway Engineer Chas. D. Vail. "An effort is being made to distribute the work as widely as possible in all sections of the state.

"Several of our grading projects already are under way. Paving projects will have to wait for the pouring of concrete until about the first of May. Where it is possible steam shovel jobs will get under way about April 1.

"We have asked the contractors to start hiring men and getting materials and equipment ready immediately after the contracts are let. This will give some men employment immediately."

Surveys, plans and specifications for eighteen projects are now under way. These projects total more than $2,000,000 worth of construction.

Paving projects include two miles between Trinidad and Starkville; and four miles of paving between Eaton and Ault on the Greeley-Cheyenne, Wyo., highway.

Surfacing projects include four miles west of Tabernash in Grand county; and four miles on Wolf Creek Pass, south of South Fork in Rio Grande and Mineral counties.

Other surfacing projects up for early letting include nine miles east of La Junta, fourteen miles west of Mack in Mesa county, twelve miles northwest of Fort Collins in Larimer county, seven miles east of Denver and three miles north of Hamilton in Moffat county.

All of these projects are important links in the Federal Aid system in Colorado, which statistics show serves 80 per cent of the total traffic in the state. They are roads used by the people of the state in their everyday travel and are important tourist routes, being used extensively throughout the summer months by Colorado visitors.

All of the projects mentioned above will be constructed with 100 per cent Federal funds, and will be paid for from the special Federal Aid funds which were alloted to the state for the relief of unemployment.

Forty Per Cent of State Roads Improved

IMPROVEMENT of 300 miles of state highways during the last year has brought the total mileage of completed state highways in the Colorado federal aid system of roads to 1,343. Inasmuch as the entire Colorado federal aid system of roads embraces 3,434 miles, the completed mileage constitutes practically 40 per cent.

Federal aid roads are interstate highways that contact with similar roads in adjoining states and form part of a nationwide road system. The United States government contributes approximately one-half of the cost of their construction. They are of the very highest type of roads, the government compelling the states to build up to a certain standard, with certain maximum grades, curve radius, width and the like.

Figures reported Saturday by the engineering division of the state highway department disclose that at the close of the 1930 construction season the completed mileage of federal aid roads in Colorado was as follows:

Concrete pavement	377 miles
Asphalt pavement	15 miles
Oil-process pavement	149 miles
Graded and graveled roads	802 miles
Total	1,343 miles

Included in the graded and graveled road mileage are 143 miles that were not constructed by the state highway department. These 143 miles are in forest reserves and were constructed for the forest service by the United States bureau of roads, mostly across the high mountain passes, such as Tennessee, Monarch and Berthoud. The famous Million-Dollar highway between Silverton and Ouray is also included in the list. The 143 miles of road are part of the federal aid system but the state had nothing to do with their construction.

The year 1930 saw the expenditure of about five million dollars for new road construction. With the exception of a comparatively small amount that went for improvement on state highways not included in the system, the money was spent on federal aid roads. During 1930 new construction was as follows:

Concrete pavement	41 miles
Asphalt pavement	1.2 miles
Oil-process pavement	75 miles
Graveling	130 miles
Grading	52 miles
Total	299 miles

The year 1930 saw the linking of many scattered projects executed since 1921 when the highway department was reorganized and given sufficient funds to meet the federal aid appropriations. Demands of motorists for immediate improvement of some especially bad stretches of highway in widely separated sections of the state resulted in the highway department improving numerous stretches of road here, there and everywhere in the state.

To cite a few instances:

With the exception of comparatively short stretches of highway in Chaffee, Garfield, Eagle and Grand counties, the automobilist can now drive on a good road from Holly, at the Kansas-Colorado line, up the Arkansas and over Tennessee pass to the Utah line west of Grand Junction. He can travel from Eaton, north of Greeley, to Pueblo on concrete pavement. An enormous amount of work has been done on the Victory highway west of Denver and on the highway entering the state at Julesburg and following the Platte river up to Denver.

Scene on Highway No. 11, above Stonewall, on Whiskey Creek Pass, in Las Animas County. Photo by Aultman, Trinidad.

The highway budget for 1931 follows the 1930 linking-up program. Before the end of the year many more improved sections of road will be connected. The 1931 budget differs from its predecessors chiefly by the fact that instead of many small projects a comparatively small number of sizable projects have been provided for.

With the emergency road appropriation provided for by congress, Highway Engineer Charles D. Vail expects to carry out the largest road construction program in the state's history during 1931. Completion of the Denver-Limon, Greeley-Sterling, Fort Collins-Tie Siding and many other important highways is scheduled for this year.

And independent of the state highway department the United States bureau of roads will construct many more miles of road, notably the new highway through the Rocky Mountain National Park which has just been added to the federal aid system, along with the road between Greeley and Loveland and the highway from Loveland up the Big Thompson canon to Estes Park.

Annual Budget for the Year 1931

nowing amounts to be expended in each of six districts in Colorado for new construction on Federal Aid and State Projects. Budget approved by Gov. William H. Adams on January 22.

ESTIMATED RECEIPTS

%—4c Gasoline Tax	$4,533,000
ederal Emergency Advance Funds	1,507,300
ederal Aid	3,421,000
0% Federal Aid for Federal Lands Highway Project	130,857
U. Bus Tax	60,000
ternal Improvement Fund	60,000
iscellaneous and County	85,000
Total	$9,797,157

ESTIMATED DISBURSEMENTS

Federal Aid Projects	$6,842,000
Federal Lands Highway Project (100% Federal Aid)	130,857
State Projects	709,300
Maintenance	1,800,000
Surveys	25,000
Signs and Traffic Census	20,000
Property and Equipment	30,000
Compensation Insurance	30,000
Administration	210,000
Total	$9,797,157

DETAIL OF EXPENDITURES

District No. 2—Federal Aid Projects

5-C	Rd.	4	Rifle East, grading and graveling	$ 410,000
2-D-E	Rd.	4	Colo.-Utah line East, grading and graveling	250,000
8-AR	Rd.	4	Bridge across Lewis Waste	10,000
8-J	Rd.	6	Cerro Summit West, grading and graveling	100,000
9-AR	Rd.	6	Bridge across Alkali Creek	6,000
9-B	Rd.	6	Gunnison-Parlin	200,000
				$ 976,000

District No. 2—State Projects

Delta County:				
0-B	Rd.	65	Cedaredge-Austin, graveling	$ 1,000
0-B	Rd.	92	Crawford-Hotchkiss, graveling	3,000
1	Rd.	135	Paonia-Hotchkiss, graveling	3,000
Eagle County:				
6	Rd.	4	Guard rail, Battle Mountain	5,000
Garfield County:				
9	Rd.	82	Bridge across Cattle Creek	4,000
Gunnison County:				
4-G	Rd.	6	Monarch Pass (Shovel)	4,250
4-H	Rd.	6	Blue Mesa	1,000
3	Rd.	92	Black Mesa (Shovel)	1,250
Mesa County:				
2-B	Rd.	141	Bridge at Gateway	4,000
2	Rd.	141	Whitewater South (Reimbursement to County)	7,500
Montrose County:				
8	Rd.	92	Connection with Forest Project	3,000
8-B	Rd.	145	Redvale, graveling	3,000
Ouray County:				
0	Rd.	62	Dallas Divide	4,000
Pitkin County:				
9-D	Rd.	82	Independence Pass	5,000
9-E	Rd.	82	Bridge near Aspen	5,000
0-C	Rd.	104	Carlton Highway	4.000
Rio Blanco County:				
1	Rd.	64	Meeker-Rangely	5,000
1	Rd.	139	Fruita-Rangely	3,000
San Miguel County:				
2	Rd.	62	Dallas Divide	7,000
2	Rd.	145	Lizard Head Road	3,000
Summit County:				
3-B	Rd.	9	Hoosier Pass	4,000
0	Rd.	91	Loveland Pass	30,000
				$ 110,000
				$1,086,000

District No. 3—Federal Aid Projects

2-R-11	Rd.	1	Trinidad South	$ 100,000
2-R-12	Rd.	1	Aguilar-Walsenburg	200,000
298-E	Rd.	10	Wolf Creek Pass	200,000
270-E	Rd.	10	Del Norte-Monte Vista	74,000
71-C	Rd.	10	Hesperus, East and West	60,000
265-E	Rd.	10	Bayfield, West	115,000
263-C	Rd.	10	La Veta Pass, East	55,000
298-F	Rd.	10	Yellow Jacket Hill	95,000
68-B	Rd.	15	To complete F. A. P. 68-B	37,000
295-E	Rd.	17	Alamosa, South	120,000
				$1,056,000

District No. 3—State Projects

Alamosa County:				
758	Rd.	158	Alamosa-Las Sauses	$ 10,000
Archuleta County:				
607-B	Rd.	10	Catchpole's Grade to Ranger Station, graveling	5,000
Conejos County:				
515	Rd.	136	Graveling	6,000
664	Rd.	142	Graveling	6,000
Costilla County:				
759	Rd.	152	San Luis-Stonewall	20,000
Dolores County:				
779	Rd.	10	Dolores-State Line	5,000
517	Rd.	145	Improvements, Rico South	6,000
Hinsdale County:				
518-B	Rd.	149	Improvements	4,000
Huerfano County:				
666	Rd.	69	Improvements	9,000
780	Rd.	111	Improvements	2,000
Las Animas County:				
780	Rd.	111	Improvements	2,000
759-B	Rd.	152	San Luis-Stonewall	20,000
Mineral County:				
521-C	Rd.	149	Bridge (5 Mile)	5,000
521-B	Rd.	149	Improvements, Fir Creek	3,000
Montezuma County:				
781	Rd.	10	Dolores-Lewis	5,000
782	Rd.	10	Graveling, Cortez East	10,500
Rio Grande County:				
783	Rd.	10	To reimburse Rio Grande County for oiling into Monte Vista	7,000
Saguache County:				
522-B	Rd.	114	Improvements, Cochetopa Pass	8,500
522	Rd.	114	To reimburse Saguache County for work on Cochetopa Pass	3,500
San Juan County:				
528-C	Rd.	19	To reimburse Maintenance Dept. for bridge across Lime Creek	2,500
				$ 140,000
				$1,196,000

District No. 4—Federal Aid Projects

296-D	Rd.	1	Pueblo, South	$ 125,000
296-A,B,C	Rd.	1	Greenhorn North, paving	260,000
245-C	Rd.	6	Hadley to La Junta	120,000
272-F	Rd.	6	Rocky Ford-Manzanola	160,000
216-B	Rd.	6	Granada-Holly	100,000
57-R-3	Rd.	6	Widening bridge over ditch adjoining Lamar	3,000
248-AR, B,C	Rd.	15	Salida to Buena Vista, grading and oiling	208,000
				$ 976,000

State Projects

Baca County:

525	Rd.	100	Pritchett-Utleyville, graveling	$ 8,000

Bent County:

784	Rd.	6	Las Animas-Hadley, oiling	10,500

Bent and Prowers Counties:

785	Rd.	6	Las Animas to Lamar, oiling	35,100

Chaffee County:

733-B	Rd.	4	Repair two bridges, Trout Creek	4,000

Crowley County:

527-B	Rd.	96	Gravel surfacing	8,000

Custer County:

529	Rd.	96	Reimbursement to County	10,000

Fremont County:

614-C	Rd.	67	Repairs, Phantom Canon	3,500
786	Rd.	69	Bridge and road repairs	2,500
787	Rd.	120	Bridge over Six Mile	5,000

Kiowa County:

532-B	Rd.	96	Sheridan Lake West	5,000
532-C	Rd.	96	Graveling, Haswell	3,500

Pueblo County:

722-D	Rd.	96	Underpass 4 miles East of Pueblo (Two railroad companies, County and State participate one-fourth each.)	15,000
788	Rd.	6	Huerfano Bridge to East County Line, oiling	15,200
789	Rd.	181	Improvements	7,500
				$ 132,800
				$1,108,800

District No. 5—Federal Aid Projects

79-B or 158-A	Rd.	4	East or West of Colorado Springs	$ 524,000
134-D-BR	Rd.	4	Continuation of F.A.P. 134	110,000
158-B	Rd.	4	Wilkerson Pass	150,000
278-D	Rd.	8	Continuation of F.A.P. 278, westerly	152,000
149-H	Rd.	8	Elbert County Line to Limon	310,000
				$1,246,000

State Projects

Cheyenne County:

535-B	Rd.	59	Kit Carson South, graveling (County to do all grading, drainage and spreading.)	$ 3,500

Douglas County:

672	Rd.	67	2 miles West of Sedalia, bridge	800
536-D	Rd.	83	Bridge South of Cherry	1,000
536-E	Rd.	83	South of Russelville, surfacing	500
762	Rd.	86	Franktown West, drainage, surfacing and realignment	800
721	Rd.	105	6 miles South of Sedalia, bridge	2,900
721-B	Rd.	105	10 miles North of Palmer Lake, bridge	1,800
761	Rd.	177	Arapahoe County Line, South	5,000

Elbert County:

705	Rd.	86	Bijou Bridge (County to put in balance to complete 200 ft. steel structure and approaches.)	6,000

El Paso County:

584-F	Rd.	4	Colorado Springs-Adams Crossing, oiled road	12,
676-B	Rd.	50	Bridge, 4 miles East of Monument	2,
738	Rd.	115	Betterments	4,
764	Rd.	122	Betterments	1,

Kit Carson County

679	Rd.	51	Surfacing	2,
790	Rd.	59	Surfacing	2,

Lake County:

510-D	Rd.	104	Guard rails, tunnel, and improvements	6,

Lincoln County:

680	Rd.	63	Arriba North, surfacing	1,
681-A	Rd.	71	Limon North, surfacing	1,
681-B	Rd.	71	Limon South, surfacing and elevating at Forder	2,
682	Rd.	94	Betterments	
765	Rd.	109	Surfacing	2,

Park County:

683-D	Rd.	9	Fairplay-Alma, Betterments	1,
739	Rd.	77	7 miles East of Jefferson, bridge	1,
739-B	Rd.	77	Improvements	5,

Teller County:

546-B	Rd.	4	Improvements	8,
706-D	Rd.	67	Cripple Creek-Victor, fill and bridge	1,
706-E	Rd.	67	Four Mile Hill	2,
706-F	Rd.	67	Cripple Creek-Victor, cattle pass	1,
706-B	Rd.	143	Improvements and bridge	1,
				$ 82,
791			Changing roads in Park County due to Eleven Mile Canon Reservoir construction	20,
				$ 102,
				$1,348,

District No. 6—Federal Aid Projects

181	Rd.	2	Idaho Springs East	$ 50,
189-C	Rd.	2	West of Hayden to County Line	148,
150-C	Rd.	2	West of Craig	150,
138-D	Rd.	2	Steamboat Springs East	100,
254-B,C	Rd.	2	Graveling, Byers Canon	25,
151-B	Rd.	2	Tabernash-Granby	70,
251-D	Rd.	7	To complete underpass, Boulder Road	15,
211-B	Rd.	13	South to Craig	91,
144-F	Rd.	14	North of Fort Collins to complete F.A.P. 144-F	35,
144-G	Rd.	123	Northwest of Fort Collins, to complete grading and oiling F.A.P. 144-D, to State Line	350,
				$1,034,

State Projects

Boulder County:

792	Rd.	119	Boulder Canon	$ 4,
548-B	Rd.	66	Longmont-Lyons	5,

Clear Creek County:

550	Rd.	91	Loveland Pass, to reimburse County	1,
552-E	Rd.	119	Idaho Springs toward Russell Gulch	4,

Gilpin County:

552-D	Rd.	119	West of Rollinsville, Improvements and rebuilding two bridges	2,

Jackson County:

629-C	Rd.	14	Continue work (surfacing) toward Walden	10,

	Jefferson County:		
93	Rd. 73	Evergreen Bridge	10,000
94	Rd. 93	Mt. Vernon Canon to Red Rocks Park	10,000
32	Rd. 126	Pine Grove to Buffalo	15,000
59-B	Rd. 175	Fence, Coal Creek Road	2,000
	Larimer County:		
66	Rd. 14	East of Fort Collins	25,000
	Routt County:		
34-B	Rd. 131	To reimburse County	10,000
88	Rd. 131	To continue work	140,000
			$ 114,000
			$1,148,000

District No. 7—Federal Aid Projects

88-AR	Rd. 2	Brush, grading, paving and overhead	$ 175,000
87-AR-CR	Rd. 2	Between Kersey and Fort Morgan, paving	471,000
86-E	Rd. 3	Ault-Eaton, paving	120,000
49-D, E,F,G	Rd. 8	Denver-Limon, grading and surfacing	670,000
79-I	Rd. 8	Alameda Avenue, paving	18,000
15-B	Rd. 14	Extension East of F. A. P. 15-B, grading and surfacing	100,000
			$1,554,000

State Projects

	Adams County:		
35	Rd. 102	Improvements	$ 2,500
	Arapahoe County:		
17	Rd. 83	Cherry Creek Drive, oiling	10,000
11-B	Rd. 87	Bridge over Big Dry Creek	10,000
36	Rd. 102	Improvements	2,500
95	Rd. 177	South University Avenue, oiling	10,000
	Logan County:		
96	Rd. 2	Grading and surfacing	4,500
37	Rd. 14	Sterling West, Improvements	1,250
55	Rd. 113	Bridge	1,750
97	Rd. 154	Grading and surfacing	5,000
	Morgan County:		
67	Rd. 54	Brush East, surfacing	7,500
	Phillips County:		
72	Rd. 51	Improvements	1,500
83	Rd. 59	Improvements	1,500
98	Rd. 154	Grading and surfacing	4,000
	Sedgwick County:		
74	Rd. 51	Improvements	2,000
73	Rd. 59	Improvements	3,000
	Washington County:		
75-C	Rd. 54	Grading and surfacing	10,000
76	Rd. 63 / Rd. 71	Improvements	4,500
36-B	Rd. 102	Improvements	4,500
	Weld County:		
80-C	Rd. 52	Hudson East	15,000
	Yuma County:		
94	Rd. 51	Improvements	3,000
41	Rd. 59	Improvements	2,000
36-C	Rd. 102	Improvements	4,500
			$ 110,500
			$1,664,500

Maintenance

Non-Federal Aid Road Counties on 50-50 Basis, State and County.

County	Miles	State's Share
Denver Mountain Parks	74	$ 35,000
Baca	234	7,500
Crowley	64	5,000
Custer	96	5,000
Delta	91	5,000
Gilpin	36	6,000
Hinsdale	49	5,000
Jackson	133	5,000
Kiowa	146	6,500
Mineral	39	6,000
Pitkin	88	9,000
San Miguel	143	13,000
Teller	82	4,000
	1,275	$ 112,000
Berthoud Pass	30	20,000
Cameron Pass	20	5,000
Cumbres Pass	....	15,000
Independence Pass	....	10,000
Wolf Creek Pass	40	20,000
Sugar Creek-West Creek-Deckers	....	8,000
Dillon-Climax	....	6,000
Ouray-Durango	64	9,000
		$ 93,000
3,528 Miles Federal Aid Roads		$1,270,000
Maintenance Equipment		270,000
261 Miles Forest Service Projects		55,000
		$1,595,000
Total		$1,800,000

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More than 50,000 miles of new highways are built annually. Of this mileage between 8,000 and 9,000 is improved with federal aid.

District No. 4—Federal Aid Projects

296-D	Rd.	1	Pueblo, South	$ 125,000
296-A,B,C	Rd.	1	Greenhorn North, paving	260,000
245-C	Rd.	6	Hadley to La Junta	120,000
272-F	Rd.	6	Rocky Ford-Manzanola	160,000
216-B	Rd.	6	Granada-Holly	100,000
57-R-3	Rd.	6	Widening bridge over ditch adjoining Lamar	3,000
248-AR, B,C	Rd.	15	Salida to Buena Vista, grading and oiling	208,000
				$ 976,000

State Projects

Baca County:

525	Rd.	100	Pritchett-Utleyville, graveling	$ 8,000

Bent County:

784	Rd.	6	Las Animas-Hadley, oiling	10,500

Bent and Prowers Counties:

785	Rd.	6	Las Animas to Lamar, oiling	35,100

Chaffee County:

733-B	Rd.	4	Repair two bridges, Trout Creek	4,000

Crowley County:

527-B	Rd.	96	Gravel surfacing	8,000

Custer County:

529	Rd.	96	Reimbursement to County	10,000

Fremont County:

614-C	Rd.	67	Repairs, Phantom Canon	3,500
786	Rd.	69	Bridge and road repairs	2,500
787	Rd.	120	Bridge over Six Mile	5,000

Kiowa County:

532-B	Rd.	96	Sheridan Lake West	5,000
532-C	Rd.	96	Graveling, Haswell	3,500

Pueblo County:

722-D	Rd.	96	Underpass 4 miles East of Pueblo (Two railroad companies, County and State participate one-fourth each.)	15,000
788	Rd.	6	Huerfano Bridge to East County Line, oiling	15,200
789	Rd.	181	Improvements	7,500
				$ 132,800
				$1,108,800

District No. 5—Federal Aid Projects

79-B or 158-A	Rd.	4	East or West of Colorado Springs	$ 524,000
134-D-BR	Rd.	4	Continuation of F.A.P. 134	110,000
158-B	Rd.	4	Wilkerson Pass	150,000
278-D	Rd.	8	Continuation of F.A.P. 278, westerly	152,000
149-H	Rd.	8	Elbert County Line to Limon	310,000
				$1,246,000

State Projects

Cheyenne County:

535-B	Rd.	59	Kit Carson South, graveling (County to do all grading, drainage and spreading.)	$ 3,500

Douglas County:

672	Rd.	67	2 miles West of Sedalia, bridge	800
536-D	Rd.	83	Bridge South of Cherry	1,000
536-E	Rd.	83	South of Russelville, surfacing	500
762	Rd.	86	Franktown West, drainage, surfacing and realignment	800
721	Rd.	105	6 miles South of Sedalia, bridge	2,900
721-B	Rd.	105	10 miles North of Palmer Lake, bridge	1,800
761	Rd.	177	Arapahoe County Line, South	5,000

Elbert County:

705	Rd.	86	Bijou Bridge (County to put in balance to complete 200 ft. steel structure and approaches.)	6,000

El Paso County:

584-F	Rd.	4	Colorado Springs-Adams Crossing, oiled road	12,[illegible]
676-B	Rd.	50	Bridge, 4 miles East of Monument	2,[illegible]
738	Rd.	115	Betterments	4,[illegible]
764	Rd.	122	Betterments	1,[illegible]

Kit Carson County

679	Rd.	51	Surfacing	2,[illegible]
790	Rd.	59	Surfacing	2,[illegible]

Lake County:

510-D	Rd.	104	Guard rails, tunnel, and improvements	6,[illegible]

Lincoln County:

680	Rd.	63	Arriba North, surfacing	1,[illegible]
681-A	Rd.	71	Limon North, surfacing	1,[illegible]
681-B	Rd.	71	Limon South, surfacing and elevating at Forder	2,[illegible]
682	Rd.	94	Betterments	[illegible]
765	Rd.	109	Surfacing	2,[illegible]

Park County:

683-D	Rd.	9	Fairplay-Alma, Betterments	1,[illegible]
739	Rd.	77	7 miles East of Jefferson, bridge	1,[illegible]
739-B	Rd.	77	Improvements	5,[illegible]

Teller County:

546-B	Rd.	4	Improvements	8,[illegible]
706-D	Rd.	67	Cripple Creek-Victor, fill and bridge	1,[illegible]
706-E	Rd.	67	Four Mile Hill	2,[illegible]
706-F	Rd.	67	Cripple Creek-Victor, cattle pass	1,[illegible]
706-B	Rd.	143	Improvements and bridge	1,[illegible]
				$ 82,[illegible]
791			Changing roads in Park County due to Eleven Mile Canon Reservoir construction	20,[illegible]
				$ 102,[illegible]
				$1,348,[illegible]

District No. 6—Federal Aid Projects

181	Rd.	2	Idaho Springs East	$ 50,[illegible]
189-C	Rd.	2	West of Hayden to County Line	148,[illegible]
150-C	Rd.	2	West of Craig	150,[illegible]
138-D	Rd.	2	Steamboat Springs East	100,[illegible]
254-B,C	Rd.	2	Graveling, Byers Canon	25,[illegible]
151-B	Rd.	2	Tabernash-Granby	70,[illegible]
251-D	Rd.	7	To complete underpass, Boulder Road	15,[illegible]
211-B	Rd.	13	South to Craig	91,[illegible]
144-F	Rd.	14	North of Fort Collins to complete F.A.P. 144-F	35,[illegible]
144-G	Rd.	123	Northwest of Fort Collins, to complete grading and oiling F.A.P. 144-D, to State Line	350,[illegible]
				$1,034,[illegible]

State Projects

Boulder County:

792	Rd.	119	Boulder Canon	$ 4,[illegible]
548-B	Rd.	66	Longmont-Lyons	5,[illegible]

Clear Creek County:

550	Rd.	91	Loveland Pass, to reimburse County	1,[illegible]
552-E	Rd.	119	Idaho Springs toward Russell Gulch	4,[illegible]

Gilpin County:

552-D	Rd.	119	West of Rollinsville, Improvements and rebuilding two bridges	2,[illegible]

Jackson County:

629-C	Rd.	14	Continue work (surfacing) toward Walden	10,[illegible]

Jefferson County:			
793	Rd. 73	Evergreen Bridge	10,000
794	Rd. 93	Mt. Vernon Canon to Red Rocks Park	10,000
382	Rd. 126	Pine Grove to Buffalo	15,000
659-B	Rd. 175	Fence, Coal Creek Road	2,000
Larimer County:			
766	Rd. 14	East of Fort Collins	25,000
Routt County:			
634-B	Rd. 131	To reimburse County	10,000
788	Rd. 131	To continue work	140,000
			$ 114,000
			$1,148,000

District No. 7—Federal Aid Projects

288-AR	Rd. 2	Brush, grading, paving and overhead	$ 175,000
287-AR-CR	Rd. 2	Between Kersey and Fort Morgan, paving	471,000
586-E	Rd. 3	Ault-Eaton, paving	120,000
149-D, E,F,G	Rd. 8	Denver-Limon, grading and surfacing	670,000
279-I	Rd. 8	Alameda Avenue, paving	18,000
15-B	Rd. 14	Extension East of F. A. P. 15-B, grading and surfacing	100,000
			$1,554,000

State Projects

Adams County:			
735	Rd. 102	Improvements	$ 2,500
Arapahoe County:			
717	Rd. 83	Cherry Creek Drive, oiling	10,000
711-B	Rd. 87	Bridge over Big Dry Creek	10,000
636	Rd. 102	Improvements	2,500
795	Rd. 177	South University Avenue, oiling	10,000
Logan County:			
796	Rd. 2	Grading and surfacing	4,500
537	Rd. 14	Sterling West, Improvements	1,250
655	Rd. 113	Bridge	1,750
797	Rd. 154	Grading and surfacing	5,000
Morgan County:			
67	Rd. 54	Brush East, surfacing	7,500
Phillips County:			
572	Rd. 51	Improvements	1,500
583	Rd. 59	Improvements	1,500
798	Rd. 154	Grading and surfacing	4,000
Sedgwick County:			
574	Rd. 51	Improvements	2,000
573	Rd. 59	Improvements	3,000
Washington County:			
575-C	Rd. 54	Grading and surfacing	10,000
576	Rd. 63 / Rd. 71	Improvements	4,500
636-B	Rd. 102	Improvements	4,500
Weld County:			
580-C	Rd. 52	Hudson East	15,000
Yuma County:			
694	Rd. 51	Improvements	3,000
641	Rd. 59	Improvements	2,000
636-C	Rd. 102	Improvements	4,500
			$ 110,500
			$1,664,500

Maintenance

Non-Federal Aid Road Counties on 50-50 Basis, State and County.

County	Miles	State's Share
Denver Mountain Parks	74	$ 35,000
Baca	234	7,500
Crowley	64	5,000
Custer	96	5,000
Delta	91	5,000
Gilpin	36	6,000
Hinsdale	49	5,000
Jackson	133	5,000
Kiowa	146	6,500
Mineral	39	6,000
Pitkin	88	9,000
San Miguel	143	13,000
Teller	82	4,000
	1,275	$ 112,000
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Cameron Pass	20	5,000
Cumbres Pass	....	15,000
Independence Pass	....	10,000
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Highways Play Important Role in Economi Development of San Juan Basin

By J. R. CHENEY
Division Engineer, Colorado Highway Department

THE PROGRESS of civilization has been mainly dependent on two great sources of development; namely—cultural development which hinges upon education used in its broad sense; and industrial development which hinges upon education used in its broad sense; and industrial development which is primarily dependent upon transportation. These United States are an outstanding example of the rapid development of a nation that has held transportation to be the ground work of its growth. We could live for centuries as a nation without modern transportation facilities, but we could attain only a fraction of our present industrial and cultural standard.

We have as a people been committed to a program of transportation almost from the beginning. It early took the form of shipping, as all settled sections were on the Atlantic coast. Then came the pushing westward of wagon trains, as the settlement of the lands took place. Close on the heels of this western drift of population came the development of rail transportation. Then the advent of the motor car made highway improvement imperative, and we are now in the midst of a highway development program which dwarfs into insignificance any previous effort in the world's history to make communication between people easy and rapid. What then are the factors which determine the value of this highway development program upon which a vast amount of money has been and is being expended?

The value of any road can be measured only by its service to the users thereof, who are the taxpayers.

An improved road tends to increase cultural standards, due to increased contacts between people.

There are also recreational features in the service of an improved highway which bulk large in the scheme of our national life, but which cannot be measured by any financial yardstick.

The elimination of hazard to life and car is another feature which it is difficult to appraise.

In the economic movement of men and goods, on business missions, however, the service of an improved road can be measured in dollars and cents. Professor Agg of Iowa has by exhaustive study of traffic determined a definite saving to the car operator on various types of improved highways over the original earth roads. Taking year around travel in all sorts of weather he has found that the saving is approximately one cent per car mile on a gravel road over the original dirt road, and approximately an additional cent if higher types of pavements are used. On this basis the annual saving between Durango and Mancos, assuming a daily traffic of 300 cars per 24-hour day, would be approximately $32,800. This will pay all maintenance costs and a very good rate of interest on the investment. Higher types of improvement would be economically sound only when traffic is sufficiently heavy to warrant the improvement. The only basis, therefore, on which the improvement of a highway can be figured within economic limits is by means of a traffic record, determined by actual count at different seasons of the year. Such a traffic count is being taken throughout the state, and is influencing the allotment of funds to the various sections.

There are, in the San Juan Basin, approximately 3[illegible] miles of state highways on the 7% or Federal Aid system—98 miles of this have been graveled to federal standard, and about 30 miles have been improved various degrees under purely state projects. This has entailed an expenditure on Federal Aid Projects, during the past ten years, of $1,500,000, with an addition of $150,000 of State Funds on State Projects. The next few years will undoubtedly see the closing up of many gaps in the system, and the completion of gravel surfacing on the Federal Aid system in this basin is in sight.

The past few years a state wide maintenance organization has been in operation, covering the Federal Aid system of highways only, and the duties of this branch of the service are increasing from year to year, as replacement of worn out graveled surface becomes necessary. It is only by co-ordination between the two departments and the proper allocation of funds to each that the highway system may be kept to the standard which the volume of traffic and the available funds warrant.

In the last analysis, the thing most needed for the economic development of this basin, and the thing which we are striving to produce, is a transportation artery which will serve the needs of the community.

The longest paved motor road in the world is said to be U. S. Route 40, from Wilmington, Delaware, to St. Mary's Kansas, a distance of 1,254 miles.

New stretch of gravel surfaced road south of Minturn recently completed with Federal Aid funds. Photo by H. L. Jenness.

Clippings, Letters and Comments

Wider Highways Essential to Modern Traffic

This is from the *Colorado Springs Gazette:*

Smooth, all-year highways have been built connecting city with city, but the traffic problem is as acute as ever. The motorist can go almost anywhere these days without encountering roads impassable with mud, but he cannot approach a large city or drive far on Sunday or a holiday without finding roads nearly impassable because of traffic congestion.

Highway construction in recent years has gone on at a rapid pace in every section of the country, with half a dozen states boasting of their completed road systems, but few highways are wide enough to meet present traffic needs. That route is rare that can carry peak traffic without congestion.

On an eighteen or twenty-foot roadway, with one line of traffic in each direction, a car traveling twenty miles an hour can hold up a long line of cars for miles. If traffic in the other direction is heavy, cars coming from the rear of a slow-moving vehicle cannot pass without endangering life and traffic. The answer may be made that the slow-moving vehicle should be banned from the through highway, and probably it should. But it is apparent that, even with this police regulation, two-track roads are not adequate for present-day needs. In the motor age they occupy the same place as the one-track road of the horse age.

With the number of vehicles constantly increasing, with cities constantly growing, with the movement of express and freight by motor truck and of passengers by bus constantly expanding, it is becoming evident that new highways must be of not less than three-track width and preferably four. The state which, acquiring new highway right-of-ways, or realigning old, does not secure sufficient property for the dual road system the future will demand is following a short-sighted policy; and the state which confines itself to highway construction according to ten-year-old specifications is not providing the needs of present-day traffic.

Protect Our Road Fund

In commenting upon the alleged abuses of the gasoline refunds to farmers and others, the *Rocky Mountain News* had the following to say:

The *News*, which has repeatedly pointed out the alarming loss of highway revenue caused by steadily mounting gasoline tax refunds, has no quarrel with the reported decision of Governor Adams to oppose repeal of the refunding provisions.

Probably it is right that the farmers, who already have many handicaps to overcome, should be refunded the tax on that gasoline used in tractors and other farm machinery.

But it is not right that they should use tax-free gasoline in their pleasure automobiles and bootleg it to their neighbors—a condition which has been so freely rumored and charged that its existence is practically certain. The rapid growth in refunds—a growth much greater than agricultural development could possibly have caused—is further proof that the refund provision is being improperly used on a large scale.

In short, the theory of the refund seems to be proper; but if it is to be retained, then its misuse should be stopped.

One of the ways to do this, it would seem to us, would be to register every farmer who claims refunds and to require that he furnish information as to the number of gasoline-driven machines which he uses and the size of his farm. If this were done, it could easily be seen whether or not he was seeking exorbitant refunds.

As things now stand, there is apparently no careful check and a host of abuses have sprung up.

Also, it is doubtful whether the farmer should be given complete exemption from gasoline taxes even on farm vehicles. After all, he greatly profits from good roads. Highways materially enhance the value of his land and enable him to farm more profitably. That being the case, should he not contribute something toward them, even from his farm vehicles, just as business men in other lines contribute?

Probably a reduced tax, plus adequate safeguards to see that illegal refunds are not paid, is the answer to the problem.

More Federal Aid for Western Roads

The following is from the *Berthoud Bulletin:*

It is said that a bill will be introduced in the next session of congress to double the existing appropriation for road work. If the bill passes, $350,000,000 will be available for Federal aid.

The unemployment situation and the midwestern drought have stimulated the good roads movement. The construction of roads gives employment to thousands of farmers and others who at present have little or no source of livelihood, at the same time providing the nation with an invaluable asset. Long after the present "depression year" is forgotten the roads will remain, paying dividends in the form of year-around transportation, increased tourist travel, business for small town merchants and lower motor vehicle operating costs.

The United States is fairly well supplied with main highways, but in large agricultural areas roads are almost the same as in the horse-and-wagon days. Mud, slush and snow are still barriers between the farmer and the outside world.

Agricultural areas are entitled to good roads. States should follow the lead of the Federal government and encourage by every practical method the construction of year-around, farm-to-market roads.

Colorado Association Will Act on Road Program

The *Telluride Journal* printed the following article:

As the result of recent activities, it is expected that a fundamental road program which will receive wide support from business men of the state will be determined by the Colorado Association within the next few weeks.

To facilitate the work of the association's large highway committee of 100 members from all sections of Colorado, Fred A. Sabin, of Pueblo, chairman, has appointed a small executive committee of that body. Last week the executive committee met in Denver, organized and began consideration of recommendations for a progressive, consistent highway program to advance the interests of the state. When these recommendations are adopted by the smaller committee they will be submitted to the larger one for discussion and approval. In this way it is hoped that a fundamental, businesslike highway plan will be accomplished.

A winter scene on "Million Dollar" Ouray-Silverton road. Photo by J. A. Clay.

Relations Between Increased Highway Expenditures and Employment

Simpson's Rest Road with Fisher's Peak in the background in La Animas County. Photo courtesy Trinidad Chamber of Commerce.

BY C. E. MYERS

President, City Officials' Division and Director of Transit, Philadelphia

A discussion presented at the Contractors' Session of the Convention of the American Road Builders' Association on Tuesday, January 13

IT is probable that the expenditures for pavements in cities during 1931 will be well in excess of $1,000,000,000, judging by expenditures in past years. Expenditures by years for city streets in cities of more than 30,000 population, according to U. S. Bureau of Census figures, were:

1922	$299,048,894
1923	324,606,952
1924	374,442,412
1925	450,712,261
1926	483,946,930
1927	552,161,174
1928	548,523,612
1929 (ARBA Estimate)	550,000,000
1930 (ARBA Estimate)	560,000,000

Expenditures in some 4,000 cities of less than 30,000 population in the United States are probably in excess of the total of the 225 cities of more than 30,000 population. The rate of increase in expenditures over the past 10 years is much larger than that shown in the ARBA estimate for 1930.

The impoverished condition of the cities of the United States due to the demands for money occasioned by their rapid growth in the past decade makes it difficult for cities to raise emergency funds for the alleviation of unemployment. As a temporary measure, the borrowing from local banks of funds based on anticipated taxes is possible, where cities have not already borrowed up to their limit. Emergency funds loaned or given from county, state or national sources would help mightily; it seems highly probable that the Federal funds made available by Congress for public construction under the direction of President Hoover will, in a large measure, be expended in or near cities.

There are sound economic reasons for the expenditure of unemployment relief funds in cities. In the first place, unemployed men and women flock to cities looking for jobs, and a tremendous burden is placed the city charitable organizations. Men out of wo cannot travel long distances to get jobs, and the mon paid to them should not be dissipated in travel co but rather should go to pay for food, clothing and re Pavement construction and snow removal are types work that absorb readily men from industries temp rarily inactive. Finally, public works in cities, esp cially pavements, benefit more people than in oth areas.

The value of snow removal work in cities as means of relieving unemployment has long been kno and used. In fact, practically every city in the sn belt has an appropriation for such unemployment lief available each year in the best of times; there always some unemployment in cities in the win months. The expansion of these funds from outsi sources such as the Federal government is one of t simplest forms of unemployment relief.

Traffic on city streets is almost beyond control most of the cities of the United States due to the t mendous increase in the number of vehicles using t streets, and the inability of the cities to find funds ad quately to meet the situation without excessive tax tion. It is certain that an increase in city taxes is n desirable, nor is it hardly possible at this time. Fun for traffic control might well be taken from local ga line taxes or allotments from the state or county which the city is located.

It is estimated that in excess of 5,000,000,000 peop are out of work in the United States, and most of the live in cities. One of the many advantages of count life is the relative low cost of food and rent, which a high in cities and are expenses that must be m promptly. Reports from labor unions show that in cities 22% were unemployed in November, and pa time work was on the increase. It is highly probab that the peak of unemployment will come in Februar

ith the beginning of spring there should come some ecrease in unemployment, just how much only a rophet can foretell, and I am neither a "prophet nor ie son of a prophet."

In conclusion, the true solution of the unemployent problem is to set to turning the wheels of industry. But until that time arrives, the simplest and ost easily applied measure for the alleviation of unnployment is the public expenditure of money for avement construction and maintenance, snow removal nd the installation of traffic control devices or the nstruction of grade separations to eliminate intertion traffic congestion. I feel that the day is close hand when a program of grade separation at street tersections in both large and small cities and, since reets cannot sometimes readily be widened at reasonble expense, that will be followed by systems of elated roadways in congested areas similar to those w under construction in New York City. The great ed is more money; engineers know how to meet the affic situation.

One of the State Highway Department's maintenance outfits working east of Sterling.

Public Works and Unemployment

BY MAJ. W. A. HARDENBERGH, Vice-President,
Public Works Journal, New York City.

THE immediate responsibility for meeting the present unemployment needs by increasing public works construction is primarily local. While Federal and state agencies should cooperate to the fullest xtent in increasing needed construction work, the reponsibility can be fully met and the problem solved nly by an employment of the comparatively flexible ocal agencies that exist in every community. Our form f government is based on the ability of our local peoles to govern themselves, and any workable plans r relieving the situation must proceed from that base. o rely upon the possibility of a huge governmental ond issue, or to await other federal or state aid is utile. The immediate relief so vitally needed can be rovided most quickly, most efficiently and most ecoomically through local sources.

This means that the funds for this work to be done the immediate future must come from local sources, nd cannot be procured from outside agencies. The roblem of raising these funds is one that must be aced and solved by local officials if they are to do heir share to meet the needs of today.

The major sources of income for public work conruction are taxes, bond issues and assessments. Of hese the most important source available for early contruction work is tax money. Much of this has already een (or is now being) duly authorized in the 1931 budets, and no further action is necessary to start the ork—except to make the money immediately available. It is of the greatest importance to do this for wo reasons. One is the present great need for work o relieve unemployment and hasten the return of prosperity; and the second is, that if we do not spend it oon—and very soon—on needed improvements, it is ore than likely to be spent on unneeded ones. I shall iscuss this more at length a little later.

If tax money is not yet in hand, as is often the case, money can generally be borrowed from local banks at a fair rate of interest in anticipation of the receipt of taxes. Local banks have a close interest in the welfare of the community in which they do business and with rare exceptions will cooperate fully. A financial statement setting forth both income and expenditures of the city, and a clear outline of what is planned, with reasons for the expenditure, will usually be all that is necessary.

Temporary loans may sometimes be arranged between different departments of the city. For instance, the water department may at this time have funds banked that can temporarily be made available for paving work, provided adequate provisions are made for timely repayment.

To raise money by bond issues or assessments requires generally a considerable period of time—two or three months at the very least. Unless initial steps have already been taken, the result will be that work financed by these means cannot be undertaken before spring.

If each of our four or five thousand communities can begin now the work they have planned for in 1931 budgets—or a sufficient amount of it to meet the local unemployment situation—the great need will be met. It is not so much a question of increasing the volume of planned construction—though every effort should be made to carry on the maximum amount of needed work—as in getting work under way at the earliest possible moment.

The cooperation of national and state agencies in increasing construction should, and will, be given most fully, but the machinery for making this work available is not so flexible, and more time is required to get work under way. It is the duty and the privilege of

each locality to carry the burden until state and federal aid roads, river and harbor improvements and public building work can be transformed from plans on paper to projects under way. Our individual communities are, and should be, the first line of defense in such emergencies.

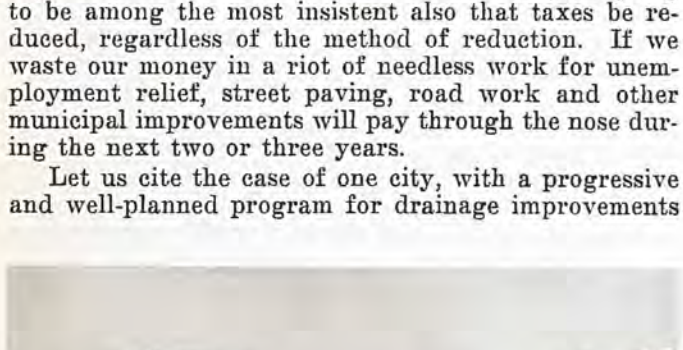
To facilitate the work, engineers must cut red tape so that work of a basic and fundamental character can be expedited. There is a real danger that in the scramble to make work available—any kind of work—the real needs of the communities will be lost sight of. In too many places the special unemployment committees have been made up of those who feel a greater degree of responsibility for the relief of unemployment than for the needs of the community. Earnest and honest though they be, they are often not capable of outlining policies that will produce work, and still serve the taxpayers of the community, giving them dollar for dollar value for their money.

What will happen too often is that work of no real value—unneeded and even useless work—will be set under way. Perhaps the reason will be that the engineer, not quite awake to the situation, is not able to pull from his desk a completed plan of some much-needed work. Or such needed works may require a little more time to start, or will not employ quite so many of the unemployed, or are not susceptible to the right kind of publicity.

The result may be that many communities will find themselves in the spring with construction funds spent, in debt and nothing tangible in the way of needed improvements. The paving scheduled for the year, the street or drainage improvements, will have to lie over because the money will have been spent on some other and perhaps less needed improvements.

The situation is the more critical, as one prominent and able city engineer has put it, because of the general feeling everywhere for the reduction in tax burden. People who are insisting that public funds be provided for taking up the slack in unemployment, regardless of the need or benefit of the work, are going to be among the most insistent also that taxes be reduced, regardless of the method of reduction. If we waste our money in a riot of needless work for unemployment relief, street paving, road work and other municipal improvements will pay through the nose during the next two or three years.

Let us cite the case of one city, with a progressive and well-planned program for drainage improvements



View of newly completed gravel surfaced road near the top of Muddy Pass in Grand County. Photo by H. L. Jenness.

GOOD ROADS BY STATES

Indiana leads with 51,314 miles of improved hi ways. Ohio is second with 48,503 and Minnesota th with 35,501. This record was compiled by the A. A.

	Miles of Surfaced Highway		Mile Surfa High
Maine	5,777	West Virginia	4,
New Hampshire	2,784	North Carolina	29,
Vermont	4,983	South Carolina	17,
Massachusetts	9,324	Georgia	14,
Rhode Island	1,025	Florida	15,
Connecticut	3,572	Kentucky	17,
New York	32,713	Tennessee	15,
New Jersey	9,077	Alabama	18,
Pennsylvania	26,145	Mississippi	16,
Ohio	48,503	Arkansas	7,
Indiana	51,314	Louisiana	11,
Illinois	21,375	Oklahoma	4,
Michigan	25,143	Texas	26,
Wisconsin	2,785	Montana	3,
Minnesota	35,501	Idaho	8,
Iowa	18,021	Wyoming	1,
Missouri	13,074	Colorado	7,
North Dakota	3,592	New Mexico	2,
South Dakota	6,147	Arizona	3,
Nebraska	5,364	Utah	4,
Kansas	5,685	Nevada	2,
Delaware	1,180	Washington	16,
Maryland	5,714	Oregon	12,
Virginia	12,327	California	25,

over a period of several years, which improveme are a requisite to the growth and development of t city. The officials of this city were urged into the pu chase of a large tract of unimproved land, so that t unemployed could be set to work cutting brush a clearing.

In all probability, there will be no money left drainage work this year, and likely none for next ye Needed improvements will be delayed.

Certainly there is a real need for immediate spe ing up of public work construction. But let us u brains with sentiment, and make even the relief doll do double duty—aiding the needy and at the sa time giving full value to the taxpayer. And enginee as the leading technical officials of our cities, charged especially with the responsibility of seei that public funds are spent on justifiable projects, a at the earliest possible moment.

Apportionment of $9,500,000 in forest highway fun this year to twenty-nine states and two territories making possible rapid road construction in the natio forests, the United States Forest Service says. In m of the regions receiving the funds, it is pointed out, t allocated amount will be more than double that of t last fiscal year. For five years the annual Federal a propriation for forest highways has been $4,500,000. U der provisions of the Oddie-Colton law, an additio fund of $5,000,000 became available for the first ti last July, to be used in the current fiscal year.

In addition the forest service is urging early comp tion wherever possible, planning to have many of t projects completed by next July.

A Highways Engineer's Reverie

By J. R. Cheney, Div. Engr.

WHAT is undoubtedly the favorite project in this Division developed in this wise. A rippling mountain stream found its way down through the center of a beautiful little valley. The valley was dotted with well kept farms and bore the air of peace and prosperity. The Highway serving this section, however, seemed not in keeping with the development of the valley as it meandered along the hillside with much unnecessary grade and curvature and in wet weather was utterly impassable. There had been a good deal of complaint about it and we had discussed in the office the urgent need of graveling the section.

We estimated that a five-mile stretch would cover the most needed work and figured the cost at about $50,000.00. The following year's budget came out with $60,000.00 for the job which pleased us greatly as it assured plenty of funds to do the job ship shape without any need of pinching the work to get the required distance. A resident engineer who seemed to have a peculiar knack for location was delegated for the job. Fortunately he had no family ties or social relations to interfere with his freedom of action so he went into camp on the job. By working early to late he came back to the office in three weeks and platted up a beautiful piece of line with practically no adverse grade and long sweeping curves. He reported a rather unusual condition in that the farmers along the route seemed so delighted with the prospect of an improved road that they made no objection to the line cutting across their fertile fields and in fact had frequently invited the crew to chicken dinners at noon.

We worked up right of way sketches for the County Commissioners and without undue discussion, they hastened right out and were greatly pleased to find that the farmers along the route gladly signed options for the needed right of way without cost to the county and agreed to take care of their own ditch changes and fencing.

The plans were pushed to early completion in the division office and forwarded to Denver for final draughting. Inasmuch as it seemed desirable to get an early spring start on the work we were more than delighted to see the work advertised for bids three weeks later. When the bid sheets came out after the letting it developed that one of our most efficient and dependable contractors was low on the work and there was no delay in getting the contract signed up.

The contractor moved on the work a week later with ample force and a complete layout of new equipment. The work was handled throughout in a business-like manner and the results of proper management and good organization soon showed its effect as the work went along smoothly with structures in place well in advance of the grading crew and always a liberal amount of subgrade finished in advance of the surfacing. The contractor had preserved the original slope stakes throughout the job and had started work at one end of the job and carried his work uniformly through to completion. It was such a job as is a pleasure to handle and the resident engineer had frequent occasion to commend the contractor on his methods and the results obtained. The work was finally brought to a close and I had been asked to go over it the following day and make final inspect

It was a day which I could contemplate with pl ureable anticipation and was turning over in my m some of the favorable things which I could include my final report to Denver, when my reverie was turbed by the tinkling of a distant bell. It roused into more complete consciousness and I realized it was the phone. I struggled up and into a bathr drowsily noting in the meantime that it was five th A. M. and hearing the gentle patter of a summer sho on the window. On reaching the phone I was qui brought to earth by the voice of a contractor wondered if we could not come out in the rain that m ing early to set him slope stakes on eight hundred of work which had already been staked three times which he had advised me the day before would not needed for a couple of weeks.

It then dawned upon me that our favorite pro was the result of a disturbed imagination stimulated a quarter section of fat apple pie which had been voured at a late hour the previous evening and stern realities of a workaday world had to be met.

VIRGIN GOLD USED TO BUILD HIGHWAY

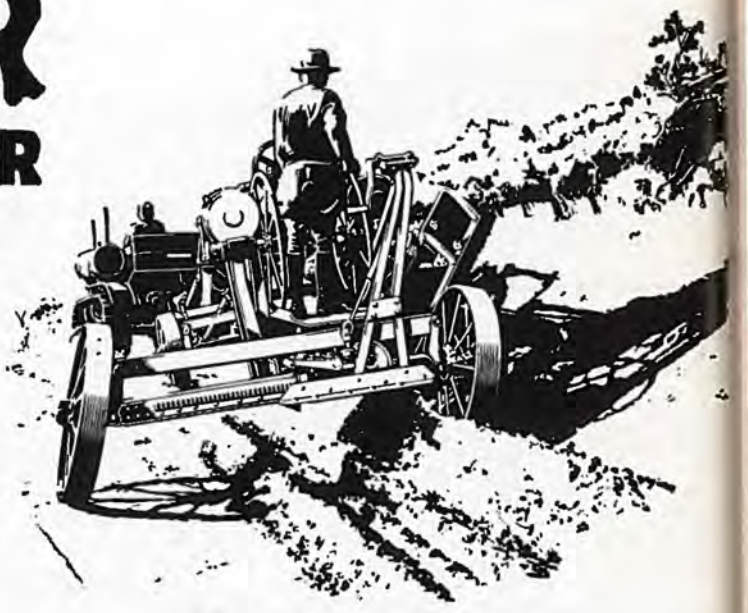
One of the strangest and most expensive highw in the world is a five-mile stretch in the southern p of Colorado. It contains $15,000 worth of virgin g $3,000 worth for every mile.

The precious metal found its resting place by rea of the fact that the crushed rock for the cement was shipped from the ore dumps of the Cripple Cr gold field. The gold in this material assayed $1.50 the ton, and 2,000 tons were used for each mile of highway.

Showing a stretch of oil processed highway northwest of F Collins near Virginia Dale.

CATERPILLAR
REG. U.S. PAT. OFF.

TRACTOR and GRADER MACHINERY



This is the new "Caterpillar" Leaning Wheel Grader

Just What Is Dependability?

THE first "Caterpillar" SIXTY was built twelve years ago. (The first "Caterpillar" was built in 1904.) This tractor has been working an average of 225 days each year on a hillside farm near Collinsville, California—and is still doing it!

—But there are other reasons you don't see—materials made to exacting specifications, special heat treated steels, precision methods of manufacture, and a "know how" that comes from doing one job better each year for 26 years. These things add to economy of upkeep. Add to this the economy of power because of sure-footed traction and you have the reasons why "Caterpillar" is *better, quicker and cheaper.*

Check this up with "Caterpillar" owners.

WHEN automobiles were first coming into gene use there was a jest on many tongues, "It's the original cost—it's the upkeep." But it was any joke to the man who owned one of those first au mobiles. It was the truth that hurt.

The remark is still a good basis for judging a tract Ask the next "Caterpillar" owner you meet about upkeep.

— Prices for 1931 —

"CATERPILLAR" TRACTORS

Model 60	$4,415.00
Model 30	2,495.00
Model 20	1,995.00
Model 15	1,525.00
Model 10	1,155.00

"CATERPILLAR" GRADERS

Model 42 Giant Elevating Grader, weight 12,780 lbs., F. O. B. Denver, $2,270.

Model 60 Elevating Grader, weight 13,595 lbs., equipped for rear power takeoff, F. O. B. Denver, $2,560.

"CATERPILLAR" GRADERS

	Weight	Cut	
60 Leaning Wheel	11,320 lbs.	12-ft.	$2,060.00
30 Leaning Wheel	6,670 lbs.	9-ft.	1,242.00
Super Mogul	10,235 lbs.	12-ft.	1,585.00
Super Reliance	9,145 lbs.	12-ft.	1,470.00
Super Special	6,000 lbs.	9-ft.	930.00
Twenty	4,915 lbs.	8-ft.	765.00
Fifteen	3,740 lbs.	7-ft.	585.00
Ten	2,970 lbs.	7-ft.	460.00

All blade Graders equipped with enclosed gears and Timken roller bearings.

All Prices F. O. B. Denver.

State and County Funds Invested in "Caterpillar" Equipment Are *Soundly* Invested

Clinton & Held Co., Denver, Colo

When writing advertisers, please mention Colorado Highways.

New Highway Equipment and Materials

Orders for twelve Quick-Way truck shovels have been placed with the H. W. Moore Equipment Co. for spring delivery. Shops of the Quick-Way Shovel Co. are working three shifts daily in order to meet the requirements of purchasers. One of these shovels was purchased by Las Animas county. It will be used on several miles of new construction work on Whiskey Creek pass. The Quick-Way shovel is a Denver product, which already is gaining national recognition. John Jay, formerly head of the Iowa Mfg. Co., is the president of the concern.

One of the sales of the Moore concern during the month included three Bates tractors equipped with Baker maintainers sold to Otero county. A new Cedar Rapids crushing outfit also went to Las Animas county. It will be used in Commissioner Frank Patterson's district this spring.

George Meffley, general sales manager of the Moore concern, announces a new Buda motor for General excavators; new models in Bates tractors; new models in Wehr graders and a new model McCormick-Deering powered Galion motor patrol grader.

Among those who attended the National Road Show held in St. Lou's in January from Colorado were: C. D. Vail, Colorado highway engineer; I. B. "Red" Rogers, Las Animas county commissioner; Charles Hallenbeck, John Bertrand, Howard Pigg, Robt. Haines, Elton T. Fair, George Meffley, John Moore, E. E. Montgomery, M. W. Bennett, H. P. Wilson, Ray Corson, Tony Monnell, Richard Carlson, C. G. Lund, Arthur Costello, R. E. Smuck, L. L. Clinton, A. J. Held. Eleven guests of the Moore Equipment Co. shared a special car to St. Louis, and from there to Chicago, Joilet and Cedar Rapids. Factories of the International Harvester Co., Bates Tractor Co. and the Iowa Manufacturing Co., makers of Cedar Rapids crushers, were visited.

A group of Colorado "road men" snapped in front of the Chicago tractor works of the International Harvester Co. Left to right—Art Costello, John Moore, M. W. Bennett, Clair Lund, Chas. D. Vail, Colorado highway engineer, I. B. Rogers, Las Animas county commissioner, and Geo. C. Meffley, sales manager H. W. Moore Equipment Company.

Sales of the Liberty Trucks & Parts Co. during January included a Rotary Snow King plow to Jackson county. It was mounted on an FWD truck. Logan county joined the FWD family a second time during the month of January. The order called for a 3½-ton capacity FWD with balloon tires, coupe cab and dump body. J. H. Hankins was the salesman on the job.

A Pioneer gravel crushing outfit preparing surfacing material for ten miles of new grading on Tennessee Pass, near Redcliff.

Roy Atchinson, well-known f number of years in the Denver equipment field, has joined the s force of the Thompson Mfg. Co. is now engaged in the sale of rugated culverts. He handles contractors field.

Clinton & Held company hel tractor school during January, att ed by 775 tractor owners and o ators on two days. M. F. Ande and George Plenty from the Ca pillar factory conducted the cla First showing of the new Caterpi No. 30 leaning wheel, power con grader, was made at the school.

Elton T. Fair announces his pointment as general representa of the Madsen pre-mix asphalt p in the Denver territory. Fair represents in this section Ad graders, Pioneer portable gr crushing plants and the Ma asphalt plants.

Toncan metal culverts are manufactured in Denver by the In state Culvert & Mfg. Co., with off at 45th and Josephine streets. H of the firm are J. B. Stark, and F Egan, formerly with the Hard Mfg. Co.

STATE HIGHWAY DEPARTMENT

Financial Statement—January 31, 1931

BALANCES		
State Treasurer	$ 885,930.15	
County Time Warrants	10,333.42	
Revolving Fund	9,500.00	
Total Balances		$ 905,763.57
RECEIPTS		
U. S. Government	$ 18,840.79	
Gas Tax	268,987.69	
Internal Improvement	5,300.00	
Highway Receipts	98,104.24	
Total Receipts		$ 391,223.72
Total Balances and Receipts		$1,296,987.29

DISBURSEMENTS		
Federal Aid Projects	$ 67,552.97	
State Projects	6,027.19	
Maintenance	46,847.95	
Maintenance Equipment	7,045.00	
Property and Equipment	6,948.15	
Surveys	303.35	
Traffic Signs and Census	510.26	
Administration	13,316.70	
Total Disbursements		$ 148,551.57
BALANCES 1-31-31		
State Treasurer	$1,128,602.30	
County Time Warrants	10,333.42	
Revolving Fund	9,500.00	
Total Balances		$1,148,435.72
Total Disbursements and Balances		$1,296,987.29
3% SPECIAL GAS TAX FUND		
Balance 1-31-31	$ 94,180.10	
Receipts	11,743.11	$ 105,923.21
Disbursements		14.31
Balance		$ 105,908.90

A new bulletin (No. 3012) describing and illustrating the General line of excavating equipment has reached the H. W. Moore Equipment Co.

Two new models in Allis-Chalmers tractors are announced by the H. P. Wilson company, local distributors. They were shown at the St. Louis exhibition. By the way have you noticed the jump in Allis-Chalmers stock on the New York stock exchange. Must be orders back of the sudden rise.

Two new publications interesting to road builders are issued by the International Harvester Co., Chicago. One is called "International Trail" and deals with motor trucks, while the other is titled "Powertrax," and carries articles relating to the many uses of McCormick-Deering power in industry. Both publications are liberally illustrated and carry a wealth of valuable information. Write for your copy.

Andy Anderson, western representative of the Wehr grader company, was a visitor in Denver during the first week in February. He was honored with a reunion of the "St. Louis gang" at the Cosmopolitan. He went away with orders for three new model Wehr motor graders.

9,349 MILES OF FEDERAL-AID ROADS COMPLETED IN FISCAL YEAR 1930

The 48 states and Hawaii, with the aid of Federal funds, completed improvements on 9,349 miles of Federal-aid highways during the fiscal year 1930, according to records of the Bureau of Public Roads, U. S. Department of Agriculture, which co-operates with the states in highway development. At the end of the year, 9,915 miles were in process of improvement, and 3,469 miles were approved for construction. The amount of federal funds disbursed during the yea all active road and bridge projects amounted to 880,963, about $6,200,000 less than for 1929.

In the Federal-aid system at the close of the there were 193,049 miles of highways, 84,912 mile which had been improved with federal aid. federal-aid operations have resulted in the improve of less than half of the system, and the states other agencies with local funds have been simult ously improving roads in the system so that to nearly all of it is improved to some degree.

PLANS BEING DRAFTED

Proj. No.	Est. Length	Type	Location
144-G	13 mi.	Gravel Surfacing	Northwest of Ft. Collins
245-C	10 mi.	Graded	East of La Junta
149-D	7 mi.	Gravel Surfacing	East of Watkins
211-B	3 mi.	Gravel Surfacing	North of Hamilton
263-C	4 mi.	Gravel Surfacing	East of La Veta Pass
272-F	4 mi.	Concrete Pavement	West of Rocky Ford
242-E	4 mi.	Gravel Surfacing	West of Fruita
278-D	15 mi.	Gravel Surfacing	West of Cheyenne Wells
149-G	10 mi.	Gravel Surfacing	East of Peoria
189-C	6 mi.	Gravel Surfacing	West of Hayden
296-D	8 mi.	Gravel Surfacing	South of Pueblo
181-A	2 mi.	Concrete Pavement	Idaho Springs
2-R11	6 mi.	Gravel Surfacing	South of Starkville

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
15-B	East of Sterling	18.553 mi.	Grading & Surfacing	Bedford & Woodman, Inc.	$237,781.55	0	15-B
78-R	Near Minturn	0.709 mi.	Gravel Surfaced	J. Fred Roberts & Sons	96,342.90	94	78-R
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	20	91-AR
122-R2	Bet. Sedgwick & Nebr. State Line	10.122 mi.	Gravel Surfacing	J. Fred Roberts & Son Const. Co.	18,438.30	85	122-R2
97-R2 168-AR1 216-AR1 273-R1	Betw. Lamar & Kas. State Line	21.764 mi.	Oil Processed Surfacing	Hamilton & Gleason Co.	122,216.20	83	97-R2 168-AR1 216-AR1 273-R1
134-AR&C	West of Burlington	11.174 mi.	Oil Procesed Surf.	H. C. Lallier Const. Co.	111,217.20	11	134-AR
138-C	South of Muddy Pass	4.184 mi.	Gravel Surfaced	C. A. Switzer	103,270.20	81	138-C
144-E	North of Ft. Collins	1.286 mi.	Concrete Paving	F. C. Dreher Const. Co.	99,187.55	91	144-E
144-F	Northwest of Ft. Collins	10.386 mi.	Gravel Surfaced	Blanchard Bros.	144,180.80	52	144-F
149-B	East of Aurora	7.911 mi.	Oil Processed Surf.	Chas. B. Owen	134,611.10	89	149-B
150-A	West of Craig	8.227 mi.	Gravel Surfaced	Gardner Bros. & Glenn	93,477.35	99	150-A
150-B	West of Craig	4.630 mi.	Gravel Surfacing	N. M. Monaghan	73,181.65	0	150-B
151-A	Between Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	0	151-A
165-R1	East from Canon City	9.325 mi.	Oil Processed Surf.	C. V. Hollenbeck	50,548.30	99	165-R1
175-A	Between Sterling and Ovid	41.979 mi.	Graded	Cole Bros.	193,055.75	100	175-A
175-A2	Between Sterling and Ovid	41.979 mi.	Gravel Surfaced	Chas. B. Owen	60,690.00	100	175-A2
189-B	Between Hayden and Craig	2.567 mi.	Gravel Surfaced	C. A. Switzer	91,497.00	25	189-B
248-B	South of Buena Vista	2.766 mi.	Gravel Surfacing	J. Finger & Son	51,979.50	69	248-B
251-D	East of Boulder	0.284 mi.	Paving	Collier-Latimer	25,598.50	0	251-D
258-I	Between Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	37	258-I
262-D	West of Walsenburg	1.764 mi.	Gravel Surfacing	Mountain States Const. Co.	22,576.50	61	262-D
262-J	Betw. La Veta & La Veta Pass	2.724 mi.	Surfacing & Bridge	Mountain States Constr. Co.	39,659.85	100	262-J
265-D	Wilson Gulch	1.930 mi.	Bridge & Approaches	Grant Shields	29,455.50	25	265-D
271-F	East of Florence	0.593 mi.	Viaduct	Mountain States Const. Co.	57,583.40	31	271-F
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc.	116,829.21	0	278-AR
279-H	Betw. Kenosha & Webster	1.691 mi.	Grading	Anderson, Sheldon & Miller	76,636.12	75	279-H
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	26	282-I
292-D	Between Wolcott and Avon	9.834 mi.	Graded Surface	Utah Construction Co.	159,143.40	11	292-D
295-A	North of La Jara	5.703 mi.	Oil Processed Surf.	Driscoll Construction Co.	49,210.50	100	295-A
297-C	Southwest of De Beque	9.953 mi.	Gravel Surfaced	Hinman Bros. Const. Co.	312,453.50	96	297-C
297-D	South of DeBeque	4.198 mi.	Surf. & Bridge	Hinman Bros. Const. Co.	185,230.50	57	297-D
298-C	Bet. Twin Bridges & South Fork	3.780 mi.	Gravel Surfacing	H. C. Lallier Const. & Eng. Co.	116,864.50	78	298-C

KOEHRING

Heavy Duty Performance!

DO you ever find yourself up against a fine grading job? Koehring Independent Crowd and Hoist enabled the 501 on the job shown above easily and quickly to shave the subgrade with an accurate four-inch slice.

All other kinds of tough jobs are Koehring jobs too. Deep excavations requiring a high lift with dipper beyond and above the end of boom, rock handling and quarry work, and regular highway grading — on all kinds of shovel work you meet the conclusive fact that the Koehring is, outstandingly, the *Heavy Duty* shovel!

— built for heavy duty operation and long, dependable service life.

Shovel Capacities—*Line-of-Plate struck measure. Shock absorber on boom. Quickly convertible to crane, dragline or pull shovel. Other dipper sizes on proportionate stick lengths.*

No. 301—¾ yd. dipper on 16 ft. stick, or 1 yd. (light) on 14 ft. stick. Wisconsin 75 H.P., 4 cylinder gasoline engine, 5¼" x 6½", 1060 R.P.M. (Mfr's. rating).

No. 401—1 yd. dipper on 16 ft. stick. Wisconsin 100 H.P., 6 cylinder gasoline engine, 5¼" x 6½", 1075 R.P.M. (Mfr's. rating). M.A.N. 94 H.P., 4 cylinder Diesel engine, 6" x 8" (Mfr's. rating).

No. 501—1¼ yd. dipper on 16 ft. stick. Wisconsin 100 H.P., 4 cylinder gasoline engine, 6"x7", 1075 R.P.M. (Mfr's. rating). M.A.N. 105 H.P., 4 cylinder Diesel engine, 6½" x 8¼" (Mfr's. rating).

No. 601—1½ yd. dipper on 16 ft. stick. Wisconsin 128 H.P., 6 cylinder gasoline engine, 6" x 7", 925 R.P.M. (Mfr's. rating). M.A.N. 115 H.P., 4 cylinder Diesel engine, 6½" x 8¼" (Mfr's. rating).

FROM whom you buy equipment is equally as important as what equipment you buy! National Equipment Corporation lines are handled only through representatives of financial responsibility, equipped and willing to maintain localized service to N. E. C. standards.

WILSON MACHINERY COMPANY

Telephones: Tabor 0135-0136

1936 MARKET STREET **DENVER, COLORADO**

A 6201-I-R

COLORADO HIGHWAYS

Vol. X March, 1931 No. 3

Nine: "Hank, this is tough going. We will be at this for 10 years."

Thirty-Six: "Sure is, Mike, let's get the warden to order a 936 Cedar Rapids Crusher from the Iowa Manufacturing Company at Cedar Rapids, Iowa, and then we will have time for the higher things in life."

Colorado Highways

"BETTER ROADS"

Official Publication of the
COLORADO STATE HIGHWAY DEPARTMENT
Denver, Colorado

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M. W. BENNETT, Editor

Articles on the subject of road building and highway development in Colorado are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible.

20 CENTS A COPY. $2.00 A YEAR.

Our Cover Picture

FOR the errant motorist there are few more exciting roads to travel than the Durango-Silverton route—more particularly during the winter months. On the cover of this month's COLORADO HIGHWAYS we give a glimpse of the road over Lime Creek "divide" with a coating of snow. With modern snowplows this road is kept open to traffic, except for brief intervals following heavy snow storms, all-year round. During summer months this is a favorite route with tourists from all over the world. Photo by J. A. Clay.

Colorado Highways
"BETTER ROADS"

OLUME X. MARCH, 1931 NUMBER 3

Road Program to Give 5000 Work

Y the middle of April the Colorado Highway Department will have more than $2,500,000 rth of new construction work uncontract, to be paid from the l Federal Aid Emergency Fund the relief of unemployment, acding to Chas. D. Vail, state highy engineer.

t the time of going to press the artment has let contracts cover- $1,769,211 of the $3,000,000 ich has been available to the state der the terms of the Emergency nd act. Thirteen contracts on rk located in various parts of the te are included in the work aldy let.

he department is advertising for s on four additional projects, at estimated cost of nearly $800,-. Contracts for these will be le before the middle of April. It expected that contracts on an adional million dollars worth of construction will be made by middle of May, with $5,000,000 work under way by the middle June.

t the beginning of the year the ghway Department had contracts aling $1,500,000 carried over from 0. Work on these projects, as l as those already let, is now ing forward with the greatest te that weather permits. It is mated that by the middle of June re than 5,000 men will be given ployment. Statistics show that per cent of all moneys expended road construction goes for labor the field, and additional 35 per t for labor employed in the manture of materials used in conuction.

ll of these contracts are to be pleted by September 1st. How-, there will be twenty or more er contracts which will be let later in the summer, on which work will continue until winter weather forces a shut-down.

The highway budget for 1931 totals nearly $10,000,000, which means that at the present time only about 20 per cent of the work has been placed under contract. However, the amount of work contracted to date is more than 100 per cent greater than at the same time last year, with a force of engineers and draftsmen only 50 per cent larger than a year ago.

Work is now proceeding on twenty-three Federal Aid projects. These projects are located in every section of the state, providing local labor with scores of jobs which ordinarily would not be available at this time of the year.

Paving crews have started work on twenty miles of concrete pavement located between Kersey and Wiggins, on the Sterling-Greeley paved highway. Completion of this work, with the exception of a small stretch near Brush, will give a ribbon of pavement from Sterling to Denver, via Greeley, a distance of 150 miles, a matter of 4½ hours' driving time.

Completion on June first of a nine-mile extension of the oil surfaced road east of Aurora is promised by the contractor. A force of fifty men are now working on this project. In another month twice this number of men will be employed.

The department is now advertising for bids on ten miles of grading and gravel surfacing located east of La Junta, and on four miles of concrete pavement west of Rocky Ford, on the Santa Fe Trail. These projects are included in the Federal Aid Emergency allotment and plans call for their completion before September 1st. The estimated cost of the two projects is $312,000.

Contractors are now working on eleven miles of oil processed surfacing west of Burlington, and on nine miles of the same type of construction located east of Cheyenne Wells. Nineteen miles of grading and gravel surfacing is being constructed by another contractor east of Sterling.

A list of the projects with estimated cost contracted by the Highway Department under the Federal Aid emergency fund agreement follows:

Project Number	Location	Estimated Cost
15-B	East of Sterling	$266,482.66
149-C	East of Denver	135,387.90
2-R-10	South of Trinidad	120,534.81
251-D	East of Boulder	50,372.85
298-D	South of South Fork	179,760.90
151-B	West of Tabernash	69,244.78
287-AR5	East of Kersey	569,805.22
287-CR	East of Kersey	
286-E	North of Eaton	140,459.38
261-AR	Rifle Bridge	23,429.98
282-J	Rifle Bridge	22,439.98
134-D	West of Stratton	54,285.55
242-D	West of Mack	137,007.60

Projects advertised for bids:

144-G	North of Fort Collins	$292,400.24
149-D	East of Watkins	164,645.14
245-C	East of La Junta	168,666.00
272-F	West of Rocky Ford	143,126.00

Other projects on which plans are being drafted:

288-AR	East of Brush	$334,139.52
189-C	West of Hayden	148,000.00
149-G	East of Peoria	230,000.00
263-C	East of La Veta Pass	60,000.00
258-J	West of Cerro Summit	100,000.00
2-R11	South of Starkville	100,000.00
242-E	West of Fruita	110,000.00
278-D	West of Cheyenne Wells	152,000.00

Alternate projects which may be substituted in above:

296-D	South of Pueblo	$125,000.00
2-R12	North of Aguilar	200,000.00
145-C	West of Glenwood Spgs.	410,000.00
149-F	East of Bennett	200,000.00
149-H	Northwest of Limon	350,000.00

A Difficult Winter Bridge *Project*

By CLARENCE G. ALLIE
Resident Engineer

ONE of the most unusual bridge and pavement projects constructed in Colorado during the past few years is that of F. A. P. 144-E, located on the outskirts of the city of Fort Collins in Larimer County.

This project consisted of 1¼ miles of concrete pavement and a steel and concrete bridge 303 feet in length. The project was constructed by the F. C. Dreher Construction Co. on a contract with the Colorado Highway Department. The bid for the completed project was $99,-187.55, one-half of which was Federal Aid funds.

The south end of the project connects with the city limits of Fort Collins, and at the north end connects with the "fork" of the roads leading to Cheyenne and Laramie, Wyoming.

Work on the project was started July 8, 1930. The project consisted in the main of the following items as listed in the contract:

8,000 cu. yds. of unclassified excavation.
24,000 cu. yds. of common borrow.
32,000 station yds. of overhaul.
24,000 yd. mi. special overhaul on borrow.
12,610 sq. yds. of concrete pavement.
870 cu. yds. of sand cushion.
4.6 M. ft. b. m., miscellaneous untreated timber.
1,177 cu. yds. of Class "A" concrete.
547 cu. yds. of Class "B" concrete.
120,850 lbs. reinforcing steel.
407,000 lbs. structural steel.
730 lin. ft. 18" corrugated metal culvert pipe.
570 lin. ft. 24" corrugated metal culvert pipe.
500 lin. ft. wire cable guard fence.
35 cu. yds. dry rock excavation (for structure).
1,365 cu. yds. dry common excavation (for structure).
45 cu. yds. wet rock excavation (for structure).
1,440 cu. yds. wet common excavation (for structure).
4,100 lin. ft. of combination wire fence.
4,600 lin. ft. of removing fence.
7,600 lin. ft. of removing and rebuilding fence and 24 more miscellaneous items that the bid aggregated $2,591.30.

The first unusual feature encountered in building this project was that the fencing had to be done first. It should be borne in mind that this project was along an old established highway and there were lots of small tracts of land with driveway gates and post gates.

There was 2,900 feet of side drain ditch to construct to take care of seepage drain line that had emptied into the old roadway gutter for years. Also, there was waste water to contend with from the irrigation of fields adjacent to the road.

The 24,100 cubic yards of borrow had to be obtained from three pits. Pit No. 1 did not develop the amount of dirt estimated. This pit was on a state road and a cut was to be taken out and widened, but it developed that the fence lines were back on the property line, thus ing this pit short.

Pit No. 2 developed a we that slowed up output and fi had to be abandoned, thus nec tating moving to another pit. water in the Cache la Poudre where a channel change was from which the 8,000 cubic yar excavation was hauled to roa delayed operation.

Contractor was shut down on gust 10th to August 18th, inclu on account of rain and wet grade. The major portion of grading had been completed by tember 6th. Hand grading for crete paving was started about weeks previous to the laying of crete, and the entire project hand graded before any con was poured.

Paving was started October and quit November 3rd. All the ing had been laid except appr slabs to the three bridges on th that had not been built.

Showing completed Federal Aid stee concrete bridge over Cache la Poudre on State Highway on outskirts north o Collins, constructed by Colorado Hi Department. Photo by Fred C. L contractor.

...w riveting 36-inch I-beams in position, ...ing sturdy steel framework. This ...dge was constructed in "dead" of winter. ...to by F. C. Dreher.

Dry Creek, Ames Ditch and Lake nal all carried water until way e in the irrigation season. The t one mentioned ran water until er the close of the sugar cam- gn in January, thus delaying the ilding of these structures.

The bridge over the Cache la udre River at the south end of project was started in Septem- and the first concrete was ured on September 15th for the se of one of the piers and the last concrete for piers and abutments s poured November 12th. The ing of steel on this 303-foot span dge started on November 17th lowed by painting building forms floor and laying reinforcement el. The first of the floor slabs was ured December 31st and the last uary 4th. The sidewalks were ured January 7th and 8th, the ndrails were finished in January, mpleting the structure which is 3 feet long and 40 feet wide over

On the bridge over Dry Creek the first concrete was poured November 18th and the pier and abutments were completed December 11th. The floor forms and reinforcing was then laid and the floor was poured December 24th and 26th.

In order to build the box culvert where the road crossed the Ames Ditch, it was necessary to make arrangements to divert water from Ames Ditch to Lake Canal and then transfer it to Ames Ditch again. This was done, and the box culvert was built under this procedure. This transfer of water could not be obtained until about the middle of November.

The contractor expected to be able to transfer the water in the Lake Canal that was used by the Great Western Sugar Company at their sugar plant a half mile east of the job to the Ames Ditch after the box culvert had been built. This deal fell through. The contractor then built a flume to carry the water through Lake Canal and put in the base of the abutments. On account of the size of the flume required to carry the water, it was not practical to build the rest of the abutments at this time of the year. This kind of an arrangement would not lend itself to the curing of the concrete by artificial heat to keep it from freezing. This bridge was finished in February after the bridge over the Cache la Poudre had been finished and cured.

It will be noticed that concrete has been poured all during the winter, and, naturally, the question arises: How was it protected? The following method was used. A frame was built outside of the whole bridge structure as follows: At the bottom 3″x12″ floor planks, that had been used on the old bridge across the river, were set on the ground on edge, and 2″x4″ uprights about ten feet apart were erected and were fastened to form flooring at the top, where it was practical, or a brace was run in towards the center of the bridge at ground elevation, connecting these uprights, or studs at about an eight-foot spacing were placed 1″x6″ boards; this made a frame work whose sections were 8′x10′. The canvas was nailed to this frame work, using laths to nail through so that when the canvas was taken down it had no torn parts, except the holes made by nailing. The lath held all parts of the canvas tight up against the frame. Across the top, horses were used to hold the canvas up from the newly poured cement. The base board at the bottom was banked with earth; the canvas was lapped about four feet and extra 1″x6″ board run up to take care of the lap. There was also an overlap of canvas where the height made it necessary.

On the river bridge there were used six salamanders made out of

(Continued on page 16)

Two pictures showing method employed to prevent freezing of concrete. (Left) Hand rail protection against freezing. (Right) Bridge enclosed with canvas against freezing. Photos by F. C. Dreher.

Forest Road Program Shows Big *Increas*

By COL. ALLEN PECK
U. S. Forest Service

THE improvement of Colorado's forest highways during the past decade, owing to the modest amount of available funds, has been slow; however, a comparison of conditions of our roads today with those confronting the motorists eleven or twelve years ago, shows a marked improvement. Even so, progress has not kept pace with the demands for more and better roads.

The five million dollar increase for forest highways in the last session of Congress speeded up construction activities, but the late date at which the funds became available delayed letting contracts and the real benefit of this increase has not yet been felt by the motorists. There is some prospect of further increase in the forest road appropriation in order to give relief to unemployment. This seems to be a very commendable thing to do at this time, as there is no over-production of roads and the nation will not be confronted with such a condition for a long time. If the present appropriations are increased, as has been suggested, the increased funds can be expended in an orderly manner and there will be no upsetting of priorities, which have been set up for the conduct of our road work. It will mean a speeding up of construction work on projects now underway and the initiation of construction on some new projects of high priority rank. There are sufficient surveys already made to permit by the Bureau of Public Roads, our programming the increased appropriation without any delay or confusion. There are over 1,100 miles of forest highways on the approved Colorado Forest Highway System yet to be built. A limitation in the act passed last spring providing additional forest highway funds requires that a half or more of the total funds allotted to be devoted to projects which are on the Federal Aid system.

As a matter of fact, this does not change the past practice to any great extent, since 51 per cent of all of our expenditures of forest highway funds in the past has been applied to those forest roads which are on the Federal Aid system. While there are only about 150 miles of this class of road yet to be built, against 1,400 miles of forest highways which are not on the Federal Aid system, progress on the Federal Aid system is slowed down by the fact that the standards for roads of this class are higher with resultant higher costs, so that the available money does not go as far as in the case of roads not on the Federal Aid system.

During the past construction season work was completed on the second section of the Willow Creek Pass project, making a total of 8.3 miles that have been completed to a graded standard. A contract was also let for the third section on this project, having a length of 6 miles. A 7½-mile section of the Berthoud Pass project, between Empire and the foot of Jones Pass, was reconditioned and given a first surfacing course. Contract was also let in the late fall for the reconstruction of a 4.5-mile section on the west side of the pass, extending up the hill from the end of the present surfaced section. Contract was also let this fall for the reconstruction of a 9-mile section of Rabbit Ears Pass road extending west from Muddy Pass. Improvement of the Six Mile road was initiated by the letting of a contract in the late fall for the construction of 2.2-mile section extending from Deckers to near the Wigwam Club. This section also includes a bridge across the South Platte River. Improvement of the Black Mesa project was also initiated by the letting of a contract for a 5-mile section extending west from Curicanti Creek. Construction of two sections of the Dolores-Rico road, having a total length of 6.4 miles, was completed during the summer, and a 9-[illegible] section between the West Do[illegible] River and the end of the con[illegible] work was improved through be[illegible] ment of the old road. This be[illegible] ment work was undertaken so [illegible] give a service to travel at an e[illegible] date than would be afforded thr[illegible] continuation of the more expe[illegible] construction work. On the Ten[illegible] see Pass road two graded and [illegible] faced sections, having a total le[illegible] of 8.3 miles, were completed, b[illegible] ing the improvement of that [illegible] into the town of Leadville. A [illegible] facing contract was also compl[illegible] on this project extending east [illegible] the grade crossing at Redcliff.

Something over $600,000 wil[illegible] available for additional constru[illegible] work on forest highways this [illegible] ing season. More than half of [illegible] will be devoted to the improve[illegible] of U. S. 40, sometimes called [illegible] Victory Highway, west of De[illegible] This provides for the completi[illegible] the rebuilding of Berthoud Pass[illegible] more work toward the rebuildi[illegible] the Rabbit Ears Pass road to [illegible] these sections of the road up t[illegible] present Federal Aid standard. [illegible] new projects will be started o[illegible] this $600,000, but additional [illegible] will be provided for on the roa[illegible] tween Rico and Dolores, on th[illegible] Mile road between Deckers [illegible] Buffalo, and the Willow Pass [illegible] between North and Middle P[illegible] will be completed except for the [illegible] facing. A small amount of addit[illegible] work will also be done on Tenn[illegible] Pass, a large project on Fre[illegible] Pass, and some improvement [illegible] is provided for between Nede[illegible] and Ward.

Out of the Forest Develop[illegible] road funds with which the F[illegible] Service builds minor projects ne[illegible] in protection and administrati[illegible] the forests, 15 miles of new [illegible] were constructed this past se[illegible] on the Divide project on the Un[illegible] pahgre National Forest, and an[illegible] 12-mile section of the Newca[illegible]

ford road on the White River
r est was completed. It was un-
rt unately not possible to finish the
ip ple Creek road on the White
lv er because of early storms.

The securing of rights of way for
est highways is a responsibility
ich rests with the State Highway
e partment and the county commis-
ners. With a speeding up of con-
ru ction, the securing of the neces-
ry rights of way becomes of great-
importance if delays are to be
o ided. In the past there have
e n a number of instances where
n siderable delays have been oc-
s ioned through delays in securing
e necessary rights of way. The
retary's regulations for the ad-
nistration of the Forest Road Act
uire that construction shall not
undertaken until all necessary
hts of way have been secured.

In addition to the roads through
e forests which are built with For-
Service funds, there is no restric-
n upon the construction of roads
other public agencies, as the
te or county, provided prior ap-
val of the forest supervisor is
ured to the location of the road,
e clearing, and other matters
ich affect National forest inter-
ts. In case the commissioners of
y county plan new road construc-
n or change in location of a forest
d, it will be appreciated if they
ll file a map with the forest super-
sor concerned in advance of the
rk so as to give him notice of
hat is proposed to be done. There
rarely any conflict between the
ans of the state or counties and
e Forest Service.

The road using public is becom-
g increasingly interested in beauty
d this in turn is reflected in the
creasing attention being given by
ad building agencies to the matter
preserving scenic features along
r highways and preventing all un-
cessary damage or unsightly de-
lopments along the rights of way.
seems to me that all of us as road
ilders should take the lead in this
portant matter. If we don't keep
nning in front we are going to find
rselves pushed from the rear.
here is much that still can be done
the way of modifying our en-
neering standards to fit mountain
untry, in avoiding excessive clear-
g and excavating and in preserv-
g of every bit of scenic beauty
ssible along the right of way.
kewise, when roads are built, there
much that can be done by the
blic, under pressure if necessary
m the proper officials, to avoid
necessary damage. Highways are
o longer cow trails, and while roads and trails were once used for every purpose of transportation, it would seem that with the wide spread which we now find between the high-powered motor car and the slow moving cow, or sheep, or horse, a different viewpoint is in order regarding the ways to use a road. Certainly livestock on the hoof does not need a road built with the alignment, grade, width and surface to accommodate motor traffic traveling at 25 to 40 miles an hour.

Neither are such highways serving their highest purpose when occupied as bedgrounds or sun baths for cattle or horses. Nor are such highways serving their highest purpose when carrying irrigation water which has been allowed to escape from its proper ditch. Such uses, it seems to me, can well be curtailed to the mutual advantage of all concerned. Excessive loads, unsuitable to the type of road and the dragging of logs or trees in such a way as to injure the road, its shoulders or its drainage ditch, should be controlled also.

Another thing which should be very simple to control, but with which the Forest Service has had considerable difficulty, is that of advertising signs. It is the rule of the National Forests that no such signs shall be permitted and with the help of county officials we have been fairly successful in abolishing such signs from highways and trails through the National Forests. This is a matter on which the public at large is becoming increasingly sensitive and it behooves us to work together to eliminate all such blots from the landscape along our highways; the sooner the better.

It is possible that this matter can be best controlled through the licensing of billboards. This has been suggested and, I understand, will be considered by the legislature.

One important way in which road builders can aid toward making our roads more attractive is to restrict the clearing away of trees on the rights of way to the very minimum, to carefully balance the cuts and fills, and to reduce the size of the scars involved in borrow pits and the cuts to the very minimum possible.

This not only adds to the beauty of the roadside but it is very desirable from the standpoint of erosion. Roads in our mountains are a very important element in starting and aggravating gully erosion.

One of a thousand and one beauty spots in Colorado National Forests made accessible to motorists by U. S. Forest roads.

Another of the unemployment fund projects to be let by the State Highway Department went to the J. H. Miller Company, Denver contractors. This project involves the construction of two miles of concrete pavement between Starkville and Trinidad on state road in Las Animas County. The contract calls for the completion of the project by September 1. Miller's bid for the completed work was $109,000.

H. C. Lallier Construction Co., Denver contractors, were successful bidders on four miles of new construction work on Wolf Creek Pass, which the contractors agree to complete by September 1. Their bid was $164,814 for the work. The project will be gravel surfaced. The project involves 131,000 yards of excavation.

"Mixed in place" oil surfaced Federal Aid highway south of Alamosa.

Oil Roads in the San Luis Valley

By W. J. WALSH
Resident Engineer

OILED roads have come in for a great deal of discussion during the past few years, particularly the so-called surface mix type. They have commanded the attention and interest of the highway engineer and the layman alike. Probably because they are in a sense a "life saver" to the western states where funds are limited.

They are the intermediate grade between the untreated gravel road and the higher type pavements. These roads have been given wide publicity during the past few years and so much has been said and written that I feel a discussion of the technic involved in their construction is unnecessary. Projects have been widely scattered over the western states and most of you have had opportunity to become familiar with the methods used in the construction of this type of road. However, for the benefit of those who might not be familiar with the various steps of this type of road building I will outline briefly the technic involved.

For the surface mix type the roadbed is first prepared as for any other type of road; that is, it is graded and well drained. Surfacing is spread to the desired depth and should be allowed to thoroughly compact. After the surface has been compacted for the entire depth, the top three inches is loosened by means of scarifying. Oil is then applied under pressure by means of an oil distributor at the rate of one-half gallon per square yard in successive applications until one and one-half to two gallons per square yard has been placed.

Each application of oil is followed by a disc harrow which partly mixes the oil with the loose surface material. After the last application of oil is placed the material is bladed into windrows and moved from side to side of the road until it has been thoroughly and uniformly m with the soil.

When thorough mixing has obtained the material is sprea the desired cross section and lowed to compact under traffic some cases compaction is hast by means of rolling with a power roller. The immediate r is a smooth riding surface with dust nuisance a thing of the

So much for the method of b ing and the immediate result. can now pass to what happen these roads under traffic.

What Happens Under Traff

That is a very serious ques Many things are responsible for action of the oiled road under tr Many projects have stood up far yond the expectations of the e neers, some have given very s factory service, others have s wear and tear in a more or les different manner, while a few

A battery of tractors and graders mixing oil surfacing material on state route through the city of Antonito. Photo by Jackson Studio through courtesy Antonito Chamber of Commerce.

en classified as failures. The writ- has yet to see an oil processed d that, in his opinion, is not far perior to ordinary untreated shed rock or gravel.

It is not my purpose to sing the aises of the oiled surface road but ther to discuss some weaknesses at light might be thrown on the uses and that they may be studied d guarded against.

It is beyond the scope of this pa- r to discuss all of the elements, tural and artificial, that make for e success or failure of an oiled rface. Many things are baffling to e engineer. Only experience, time d study will find the cause and lution of many problems.

The obvious weaknesses of the led road are few, but the causes e many, some known and some known:

Known weaknesses are as fol- ws:

Hair cracking on the suface.

Raveling or distintegration of the rface, and pot holes.

Rolling, corrugations, or pushing d shoving of the surface.

Breaking down of the edges.

Complete failure of surface due to st boil condition.

Some of the known causes are as llows:

Hair cracking is due to incipient bgrade failure and moisture be- ath the oil mat. This condition metimes corrects itself or it may progressive, resulting in disinte- ation of the surface.

Raveling will occur if insufficient l is used or if the surfacing ma- rial was improperly graded. It ay also be caused by a breaking wn of the mineral aggregate of hich the material is composed or a chemical reaction such as ight be caused by excessive alkali the surface material.

Hot holes may start from a sepa- tion of the aggregates during pro- cessing, such as pockets of fines or coarse material forming, or foreign material may accidentally be carried into the mix. Tractors or sharp tired vehicles passing over the road will also start pot holes.

Rolls or corrugations will occur if the subgrade is soft or if excessive moisture is present under the oil mat. They will also occur if too much oil is used and sometimes from a loose subsurface. The last condition is rare, however, and the most common cause is soft subgrade and moisture.

Breaking down of the edges is obviously due to traffic running off the surface onto the shoulder. This condition can be eliminated to a large extent by adding a few extra feet of width to the surface. We have little of this in the San Luis Valley where a 20-foot surface is used.

Complete failure due to heaving in winter with subsequent breaking up in the spring is caused from frost boils. This can at once be laid to inadequate preparation of the subgrade.

We are now faced with the question of what should be done to correct these conditions and what is the highway engineer doing to prevent a recurrence of these weaknesses on future work.

The first solution is that of proper and adequate maintenance. Prompt and careful maintenance is vitally necessary. Should the surface become pot holed or show a tendency to ravel the condition should be corrected immediately. The surface must not be allowed to entirely disintegrate. One small break in an oiled surface will stand out like the proverbial "Sore Thumb," and if not repaired immediately they will grow to large chuck holes. Small pot holes should receive prompt and careful repair. They should be dug out and backfilled with the same material of which the road is built. Should the surface ravel due to a lack of fines in the aggregate or to insufficient oil the condition should be corrected by adding oil or mineral binder, or both and reprocessing.

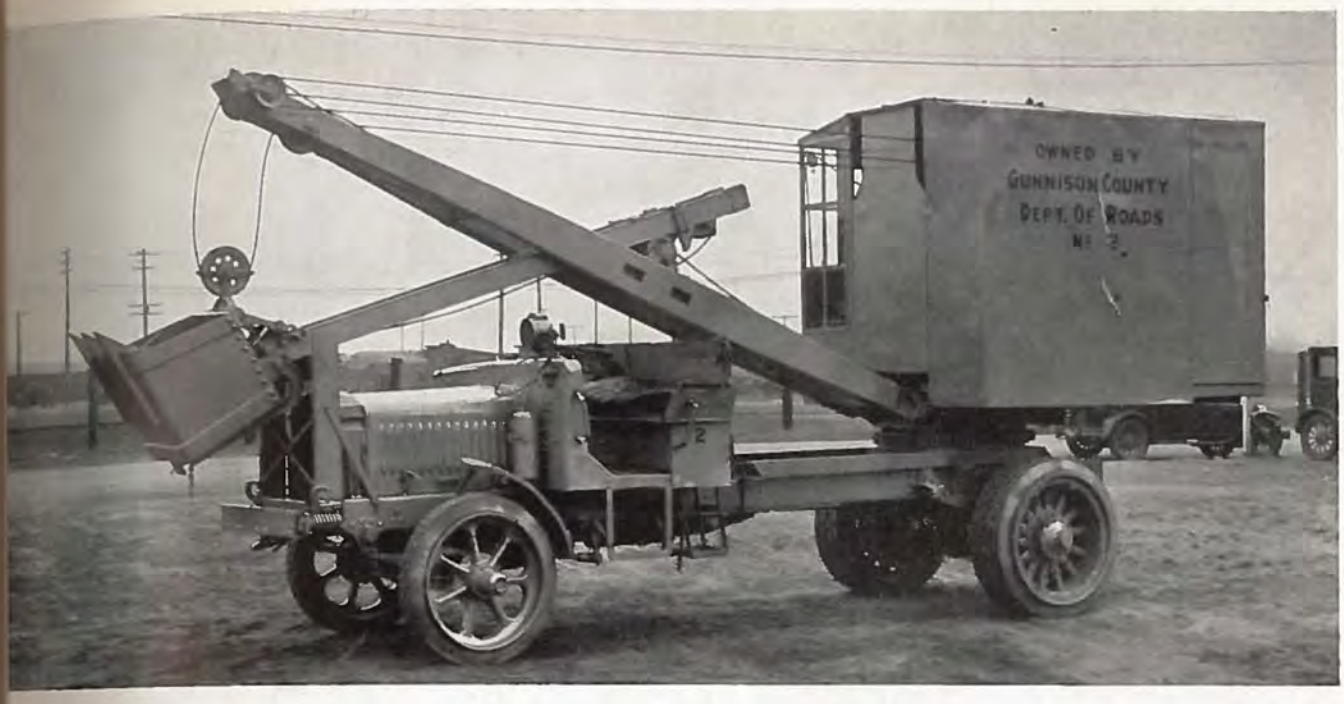
Rolls and corrugations are very easily taken out. The surface can be disc-harrowed or scarified and relayed to its original smoothness. In this operation great care is necessary not to bring any unprocessed material up from the subsurface or off the shoulders.

The same method may be followed for taking out sections that have hair cracked. If the oiled material is bladed to the side of the road and the subsurface allowed to dry thoroughly before replacing the oil mat it is doubtful if this would have to be done more than once a year. If hair cracking is not serious and no disintegration of the surface is apparent it is probably better to confine maintenance operations to patching and taking out rolled sections. The writer has in mind an extensive section of oiled roads in the San Luis Valley in which hair cracking developed within thirty days of the laying of the surface. This section held for two years with a minimum amount of maintenance. When conditions warrant the entire surface could be scarified and reprocessed adding a small quantity of oil if required. Some engineers are of the opinion that a seal coat of oil covered with sand or rock screening should be applied every few years or as needed. This idea is along the lines of constructive maintenance and appeals to the writer.

Frost boil conditions, where complete failure of the road surface oc-

(Continued on page 18)

Three Bates "35" tractors with Baker maintainers sold to Otero County.



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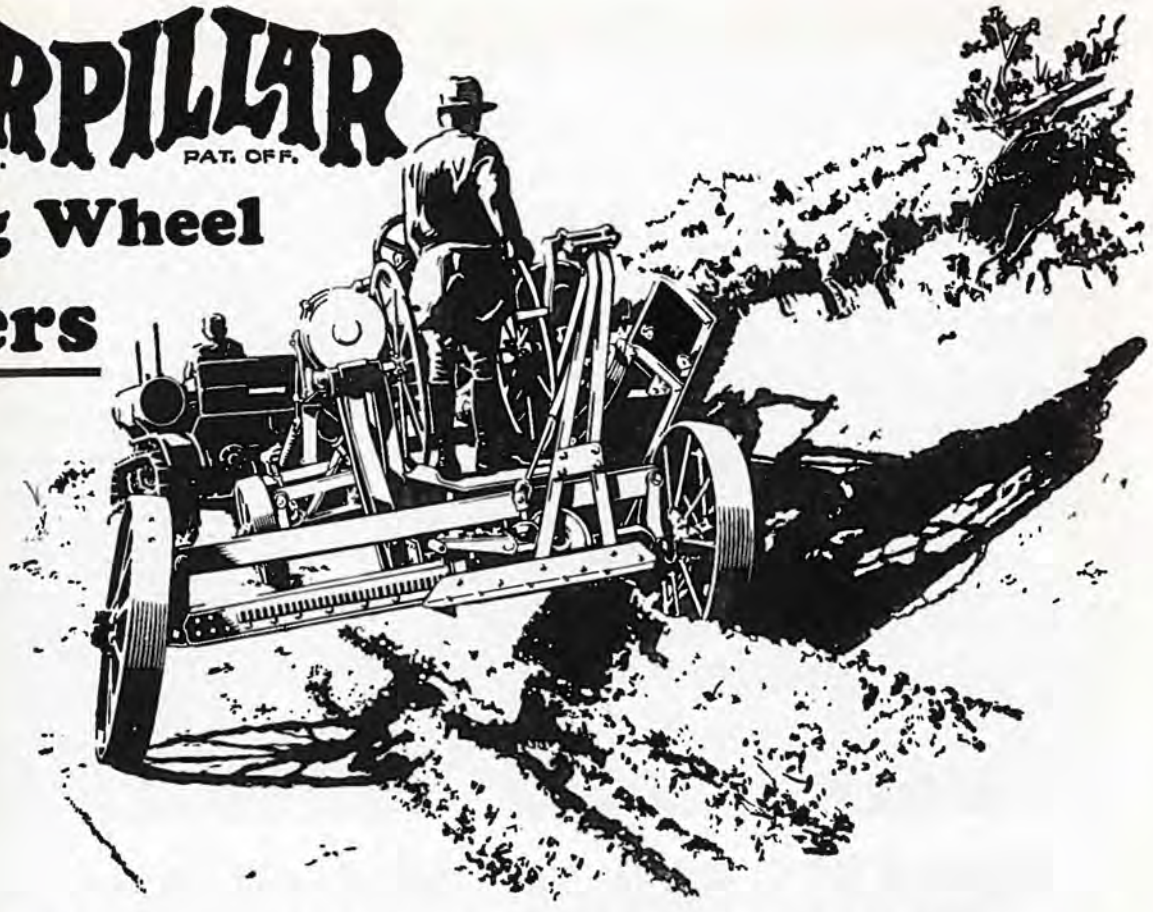
Leaning Wheel Graders

30 and 60



With new range and reach of blade—pitch and position—weight and strength

THE "CATERPILLAR" 30 *Leaning* Wheel Grader is designed to supply a balanced load to the 30 "Caterpillar" Tractor. In the same way, the 60 Leaning Wheel Grader matches the 60 "Caterpillar" Tractor. These combinations result in continuous, full drawbar pull . . . moving more yards per day per horsepower.

The two new Graders are much easier to control and to operate—and it's all done from the platform. Easier control means a better job—less time—less fuel—shorter payroll.

These Graders are another fulfillment of "Caterpillar's" incessantly repeated principle—MORE MILES OF ROAD FOR FEWER TAXPAYER'S DOLLARS.

Both in Stock in Denver.

Complete Stock of Parts in Denver.

No. 30 ..... $1,242 No. 60 ..... $2,060

F. O. B. Denver.

Twelve Examples of "Caterpillar" Dependability

1. The same special treated steels you find in all "Caterpillar" machinery.
2. THREE POINT CONTROL to hold correct blade pitch advantage.
3. Bank Cutting Blade reaches an angle of 30 degrees, with a high reach of 6½ feet.
4. Compensating Spring Lift so mounted as to equalize tension on both ends of blade and exert uniform lifting force at any elevation of the blade.
5. DRAFT DIRECT TO BLADE—no draft applied to blade through frame.
6. Seven and Nine-inch Ship Channel Frame.
7. Axle spindles drop forged.
8. Tapered Roller Bearings in all wheels.
9. Steel Wheels with cast in hub spokes.
10. Bronze Lift Gears adjustable to six points of wear, running against machine cut steel worm mounted on roller bearings.
11. ALL housed gears Machine Cut.
12. Can be equipped with INDEPENDENTLY operated scarifier.

Clinton & Held Co., Denver, Colo.

A Veteran Driver Speaks His Min

A letter to The Chicago Tribune, reproduced below, prompts this advertisement. Straightforward, earnest and dramatic, the letter comes like a warning voice out of everyday traffic.

HAPPY IS THE DRIVER WHO DRIVES AN INTERNATIONA

THIS letter, which is reprinted from the "Voice of the Traffic" column of The Chicago Tribune, sounds a note to which every owner of motor trucks and truck fleets should give heed.

Do your trucks deserve to haul your loads? Or are there antiquated models among them, hazardous to life and limb, destructive to driver-morale, and raising costly hob with your profit opportunities? Turn the obsolete trucks out to pasture and *invest in efficient new equipment.*

✱ There is a bright side to the veteran driver's letter. He admires the great modern fleet of Tribune trucks. This fleet, serving the Tribune organization, and used in the distribution of The Chicago Tribune, The New York Daily News, and Liberty, now numbers over 200 trucks, and *all of them are Internationals.*

The full line of Internationals—Speed Trucks and Heavy-Duty Trucks of new design—is ready for inspection at 182 Company-owned branches in the United States and Canada. Sizes from ¾-ton to 5-ton. Demonstration will be arranged at your request.

Above is one of the trucks this driver compliments so highly in his letter —it is one of The Chicago Tribune's large fleet of Internationals.

To the Chicago Tribune:

"I see that the Cook county police are beginning a drive against noisy trucks. Being a truck driver I believe that the authorities are taking the wrong course in warning drivers to make repairs.

The large cartage companies do not listen to the drivers' complaints, or else it is because our foremen do not inform the owners. Daily we are forced to take out patched up 10 and 15 and even 20-year old trucks, with faulty brakes, hard to shift, and still harder to steer.

As for loads, I have put a monster load of canned goods on one truck and hauled it through the city, praying all the time that no other vehicle would cut me off too close. Going at a speed of 10 miles an hour, I required 80 feet to stop, using both sets of brakes.

The speed governors on our trucks are all 'out of order,' and we are laid off if we do not make good time. It is the same if our chariots break down too often or if we have an accident, no matter how slight. It is only because we are expert drivers that we get by. I believe it really criminal to force men to drive some of the wrecks that are on the streets today.

✱ I notice (enviously, too) that the Tribune always has an up-to-date fleet of trucks, and I have yet to see one of them broken down on the street or in a serious accident."

A Truck Driver

Branches: Denver, Colorado
Cheyenne, Wyoming
Dodge City, Kansas

INTERNATIONAL HARVESTER COMPANY
OF AMERICA (INCORPORATED)
606 So. Michigan Ave. Chicago, Illinois

INTERNATIONAL

INTERNATIONAL TRUCKS

Durably Paved with Concrete, Roads Need Little Upkeep

The road which requires least maintenance is the cheapest road any state can build. Pave your roads *durably with Portland cement concrete,* and the "road fund" will buy more *new roads* instead of maintaining old roads.

Colorado Portland Cement Company

DENVER NATIONAL BUILDING — DENVER, COLORADO

Concrete for Permanence

A Difficult Winter Bridge *Project*

(Continued from page 5)

fifty-gallon oil barrels to each sixty-foot span. This made an enclosed space sixty feet in length by about forty-six feet in width and about seventeen feet in height from the ground to the top of the canvas. This gave an exposed area to the weather of about 5,800 square feet.

Regardless of how many cubic yards of concrete may have to be protected, the cost is in proportion to the area exposed to the weather, and the cubic volume that has to be heated to protect the concrete. Therefore, hardly any two structures, that may have to be protected, will have the same ratio of cost. There were 38 tons of coke used at a cost of $303 on this job. The canvas investment was about $1,000.

This brief history of this job will give anyone familiar with this kind of work a fair idea of the amount of work entailed in building this project.

Now, let us see what anyone of the motorists coming from Cheyenne, Laramie, or Poudre Canon and Cameron Pass will see as they ride over the project.

As we pass Terry Lake and encounter this ribbon of concrete ahead of us we first notice the wide six-foot shoulders. These shoulders give ample room to park a car and not interfere with traffic. Next, we notice the flat slopes going away from the shoulders which are 4 to 1. On our left is a row of cottonwood trees through which the sunlight glistens, if it is morning, and beyond this is a well-built barbed wire fence with a well-kept farm stretching off in the distance. A little further on to our right we notice small tracts with houses and well kept lawns. The fencing in front of the houses is of woven wire with metal posts, and steel gates at all walkway and driveway entrances.

The first bridge we pass is a two-span I beam bridge with a 28-foot clear roadway, as are all of the bridges on this project. At the south end of the project we are impressed with the majesty of a five-span, 28-foot road bridge, with five-foot sidewalks on each side and an artistic handrail. The 303-foot bridge over the Cache la Poudre River stands out as a thing of beauty as we enter the city limits of Fort Collins.

As we enter the city we are noticeably surprised to find that this route is devoid of any jungle district which mars the entrance to so many cities. Those leaving the city will have a pleasant sensation of gradually drifting from a city to a quiet and peaceful countryside.

To me, it seems that Fort Collins should derive a very lasting and valuable investment from this project.

An Unusual Culvert Repair Job

By JOHN P. DONOVAN
Maintenance Engineer

YOU learn something new every day! This old saying certainly applies to the highway engineer. Hardly a day passes but a new problem arises. The instance we detail here occurred south of Aguilar on State Road No. 1 last September. How the problem was handled is best described by the accompanying pictures.

Snapshot No. 1 shows a washout around a 3x3 concrete culvert underneath the concrete paving just south of Aguilar. It is possible to backfill with dirt such a washout, but a repair of that sort does n crease the size of the culvert, w is obviously needed, and alway sults in a settlement over the cu with a cracked paved slab and and a consequent bump in the ing.

Snapshot No. 2 shows the r od of repair very clearly. The inal culvert was left in place, a second-story was added to it tending clear to the pavement. second-story work did two th it increased the size of the op of the culvert which was obvi needed, and it also furnished a support for the pavement which in air on Snapshot No. 1. It is mon practice in engineering to culverts double-barreled side side, but this is the first se story culvert that I have ever and no one that I have talked t ever seen such a structure.

Credit for the idea should go N. Stewart, assistant superinten of maintenance, and the work done by Lee Williams, the b contractor of Pueblo.

MILES OF POOR ROAD

According to a report pres to the ninth annual asphalt pa conference, there are more tha 000,000 miles of unsurfaced or equately surfaced farm-to-m highways in this country.

This, it is said, appreciabl duces the earning and purch power of 27 per cent of our citi The modern farmer may radios, telephones, tractors, tricity—but so long as he has t pend for transportation on that are essentially the sam those of 20 years ago, it will b possible for him to progress prosper to the limit of his poten ties.

Experience in many states shown that secondary roads ca made passable at all times o year by the use of low-priced facings, of oil or asphaltic t Upkeep is likewise low, and an pense incurred is returned time again to the county and sta more prosperous farming c tions.

It is estimated that a billion lars will be spent in 1931 for roads. Various states are plan the most comprehensive road gram in their history. Wise u funds can, without creating one tax increases, give the farmer year-round, surfaced highways essary to his economic and s development.—Pueblo Star-Jou

COLEMAN

FOUR WHEEL DRIVE

leman leaving 47% section of grade and starting up 70% section.

leman climbing 70% section of grade. ne U. S. Army sign-board reading: "35%-70% Grade, Course No. 1."

leman held by foot brakes in middle 70% section after backing from top. uck was started from this point with- any slippage and again climbed to top of 70% section.

THE PERFORMANCE of a four wheel drive truck is determined by the capacity of the power transmission of the front drive axle, which should have a capacity equal to that of the rear axle.

Specifications issued November 24, 1930, by the U. S. Army, for four wheel drive trucks required, "That all parts of the truck, from motor to and including driving wheels must be of such size, material and design and strength as to readily transmit the full power of the motor at the different gear ratios, with a proper factor of safety, with a minimum wear on parts, and with maximum mechanical efficiency."

If a two-inch diameter drive axle is employed, which has a capacity of 175,000-inch pounds torque, and the front wheel is driven direct from the differential without reduction, the universal joint must, if consistent, have a capacity equal to that of the drive axle. Blood Brothers Universal Joint No. BW-7, is the largest joint of which they are in production, has an overall diameter of 11⅛ inches, and a capacity of 150,000-inch pounds torque.

Compare the mechanism of four wheel drive trucks with these specifications, and when purchasing, demand that they comply.

— Coleman Complies

When the old farm wagon was stuck in the mud you grabbed the spokes at the rim of the wheel—not near the hub! This same, simple principle is the secret of Coleman performance. The power is applied to the front wheel out at the felloe-band. That's why Coleman Trucks can use 150 to 1 gear ratio in low and still steer like a touring car! It's all in the front wheel!

Coleman Motors Corporation
Littleton, Colo.

Oil Roads in the San Luis Valley

(Continued from page 9)

curs, are very rare on a well designed road. However, where such a condition exists it is up to the maintenance man to dig out all unsuitable material and replace it with rock or gravel, after which the oil mat is relaid. Too much emphasis cannot be placed on the necessity for prompt and efficient maintenance.

Naturally, the engineer cannot hope to entirely eliminate maintenance, but he can strive to so design and construct the road that maintenance will be reduced to the minimum. However, he is confronted with the item of first cost. He cannot play safe as the cost of so doing would be prohibitive and the economic angle must be given due consideration. He must carefully study the conditions affecting the proposed improvements and do the best that his judgment dictates as to structural stability and sound economics.

Prior to preparing the grade for oil surfaced roads the subsoil conditions should receive very careful study. A spongy subgrade is sometimes very hard to detect. This is particularly true of a well maintained graveled road. Weak spots in an old grade that are hardly discernible on a well maintained surface are at once reflected in an oiled surface in the form of hair cracking and rolling.

Great care should be taken to adequately prepare the foundation for an oil project. If possible a careful study should be made of the old road surface during the winter months and all sections that are heaved by frost should be noted. During the spring while the frost is going out of the roadbed all spongy places should be spotted. This is absolutely the best time to detect any weaknesses in an old roadbed.

After this study has been made and all soft sections are known the grade for the new road should be laid high enough that the subsurface will not be affected by capillarity, using a material that will give the subgrade the desired stability. On certain sections of road in the San Luis Valley we raised the grade of the old road as much as two and one-half feet with base coarse gravel. A hard, dense, well compact base was obtained and this is a most essential contribution to the success of an oiled surface.

In irrigated country poorly drained, the road grade should be raised well above the natural ground level and wherever possible the water table should be lowered. It is essential that water in side ditches and borrow pits have unobstructed flow and be eliminated into drainage canals or natural streams as quickly as possible. Water is the enemy of the oil mat and every precaution should be taken to keep the subsurface dry.

The material to be oiled should be given careful consideration. It should be such that it will not readily absorb or retain moisture, or swell greatly in volume when wet. It should be well graded from coarse to fine with the maximum size passing a one-inch round screen and containing from 5 to 10 per cent of fines passing the No. 200 sieve. Colorado's specifications require:

100 per cent passing a 1″ round screen.

Not more than 60 per cent passing a ¼″ round screen.

30 to 55 per cent passing a No. 10 mesh sieve.

5 to 15 per cent passing a No. 200 mesh sieve.

In general it is well that the maximum size be not greater than 1″, but it could be smaller and not affect the quality of the road. Under certain conditions of pit run a better material could be obtained by crushing the maximum size to ½″. Good oiled roads have been built with material of ¼ minimum size. The essential thing is that the material be well graded so that it will bind into a hard tight surface. Sharp angular stones are preferable to small round gravel.

The cost of oil treatment will vary for different conditions and locations, but a fair average for Colorado is $2,500 per mile. It has been suggested that the cost of subgrade preparation should be charged as part of the cost of oil treatment. The writer does not concur in this belief. Ordinary gravel roads should receive the same preparation. Too often gravel is placed on an inadequate subgrade with the result that expensive surfacing material is irretrievably lost in the mud. When a sound foundation is laid it is available for any higher type of improvement that might be made in the future.

The oiled road surface should be regarded as a stage construction proposition. The foundation being laid for a higher type of surface against the day when traffic shall have increased to the point where a more durable surface is required. Any weaknesses in the subgrade that have not been adequately cor will be reflected in the oiled su and these spots can be strengt before a more rigid pavement i

The probable life of an oile face is a question that is often the writer. Many physical ele enter into the probable life oiled surface. The surface i jected to many agents of de tion. If the foundation has bee quately laid and the materia construction are of good qualit life of an oiled surface, carryin to exceed 1,000 vehicles per should be indefinite. This, of c assumes that the surface will r efficient maintenance. It may b essary to add a small amount every few years and any weaknesses in the original con tion should be corrected.

Oiling is well worth the tional cost above that of or gravel. In Colorado the loss o material on an untreated grave face is one inch per year on carrying 200 vehicles per day loss is proportionately great heavier traveled roads. amounts to a loss in money of $500 to $800 per year. This fig based on average costs of sur in the San Luis Valley and m greater or less, depending o cost of producing materials an amount of yearly loss. It c readily seen that oil trea would pay for itself in a few on this one item alone. Many benefits are derived from oil ment.

Maintenance costs are greatl duced. A two-man patrol w suitable truck and premixed ma can patch the breaks in an oile face at less cost than for dra and blading untreated surface

Service to the public is g improved, and these roads therefore, very popular with public. The dust nuisance is nated, smoothness of surface creased, wear on tires is reduce fuel consumption is lowered.

The cost of operating vehicles over different types o is of vital importance in dete ing the type of road to be structed.

Professor Agg of the Iowa College has developed some esting facts about the cost of vehicle operation over various of roads. From the studies ma Professor Agg we are enabled termine with fair accuracy the of operating the average car different types of road.

To make a concrete exampl cost of operating the averag

er a twenty-mile section of gravel
ad can be determined. We can
o determine the cost of operation
er a twenty-mile section of oil
cessed road such as we are now
ilding. The difference in that cost
operation multiplied by the num-
r of cars traveling that road each
gives us the daily saving to the
blic as a result of the oiling and
nishes us with a basis on which
improvement can be proved as
rth while.

Railroads have for years made im-
vements based on known savings
operating costs. They have defi-
te operating costs to work to and
can determine with great ac-
racy exactly how much they can
ord to spend to reduce a two per
t grade on any division to a one
cent grade.

Until recent years there has been
le information as to operating
ts over highways, and as a mat-
of fact it was little needed, as it
s evident to everyone that the
liminary move in road improve-
nt was to get the highways
ked up off the ground for drain-
purposes and get them graveled
ere mud conditions were bad.
That has been accomplished in
ny sections of the state and these
tions are now demanding an ad-
ced type of road. The treated gravel surface seems to be the next logical step.

To satisfy ourselves that this type of improvement is economically sound, we turn to tables worked out by Professor Agg after painstaking experiments.

His figures on difference in cost of driving over a dirt road and a high type road are based not on the difference in the two roads under favorable conditions but on a year's travel over the high type road where conditions are practically uniform and a year's travel over the dirt road where average weather conditions existed, including mud after storms.

He has averaged various types of cars from expensive automobiles down to Model T Fords and arrived at the cost of an imaginary average car over various classes of roads.

He shows an operating cost of 7.5 cents per mile over low type or dirt roads. A cost of 6.43 cents per mile over ordinary gravel roads and a cost of 5.44 cents per mile over high type roads which include paving of various kinds.

Oil treated roads in good condition would class as high type as far as riding qualities and operating costs are concerned.

Thus it runs roughly that the average car on gravel road will save a cent a mile over the same car on a dirt road in a season's travel, and on oiled or paved roads will save an additional cent over the gravel type.

We have shown that the oil road will save over the ordinary gravel road one cent per mile per car in operating cost to the public that uses it. If we take a twenty-mile section it will save 20 cents per trip per car. At 500 cars per 24 hour day it will make a saving of $100 per day or $36,500 per year. This makes a very profitable investment to the traveling public. That represents the tangible cash saving. There is also the matter of ease of travel which facilitates commerce between the towns, the elimination of dust and the saving in time which also has a cash value, but which is difficult to determine.—Address to Colorado County Commissioners Convention in Denver, December 16, 1930.

A. R. Mackey, Fort Morgan contractor, has been awarded a contract for the construction of a 17-mile detour between Kersey and Wiggins in Weld County. This work is being done preparatory to the laying of concrete pavement between these two points. Mackey's bid for the work was $11,946.

Construction crews on Loveland Pass report the construction of nearly two miles of roadway during the winter. The crew is now working on the west side of the pass above Dillon.

Work of widening the road over Monarch Pass from Salida to Gunnison will start as soon as snow is cleared from the pass in the spring. The steam shovel which the state has had on the Black Mesa for the past two years will be used in this work. It is expected that the work on Monarch will require two years to finish. Monarch is one of the most picturesque passes in the state and during the summer months is heavily traveled.

Contract for the construction of four miles of standard Federal Aid concrete pavement to be laid between Eaton and Ault in Weld County has been awarded by the State Highway Department to J. Fred Roberts Construction Co. on their bid of $126,000 for the completed work. The contract calls for the completion of the work by August 1. This project will be paid for from the U. S. unemployment emergency fund.

Congress has approved an appropriation of $3,000,000 for the construction of new roads in the Rocky Mountain National Park during the next two years.

PLANS BEING DRAFTED

Proj. No.	Est. Length	Type	Location
189-C	6 mi.	Gravel Surfacing	West of Hayden
149-G	10 mi.	Gravel Surfacing	East of Peoria
242-E	4 mi.	Gravel Surfacing	West of Fruita
258-J	5 mi.	Gravel Surfacing	East of Montrose
2 R11	6 mi.	Gravel Surfacing	South of Starkville
296-D	8 mi.	Graded	South of Pueblo
2-R12	6 mi.	Pavement	North of Aguilar
263-C	5 mi.	Gravel Surfacing	East of La Veta Pass
211-B	3 mi.	Gravel Surfacing	North of Hamilton
278-D	15 mi.	Gravel Surfacing	West of Cheyenne Wells
71-C	4 mi.	Gravel Surfacing	South of Hesperus
68-B	4 mi.	Gravel Surfacing	South of Saguache
208-AR		Bridge	West of Clifton
299-AR		Bridge	West of Delta
134-E	6 mi	Gravel Surfacing	East of Seibert
259-B	12 mi.	Gravel Surfacing	East of Gunnison
298-F	5 mi.	Gravel Surfacing	East of Bayfield
265-E	3 mi.	Gravel Surfacing	West of Bayfield
270-E	5 mi.	Gravel Surfacing	West of Monte Vista

PROJECTS ADVERTISED FOR BIDS

Proj. No.	Length	Type	Location	Date Bids Opened
144-G	13.204 mi.	Gravel Surfacing	Northwest of Ft. Collins	Mar. 25, 1931
149-D	8.370 mi.	Gravel Surfacing	East of Watkins	Mar. 25, 1931
245-C	8.442 mi.	Grading	East of La Junta	Mar. 31, 1931
272-F	4.097 mi.	Pavement	West of Rocky Ford	Mar. 31, 1931
149-F Det. Br.		Detour Bridge	East of Strasburg	Mar. 31, 1931

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R10	Bet. Starkville and Trinidad	2.097 mi.	Paving	J. H. Miller & Co.	$109,577.10	0	2-R
15-B	East of Sterling	18.553 mi.	Grading & Surfacing	Bedford & Woodman, Inc.	237,781.55	7	15-B
78-R	Near Minturn	0.709 mi.	Gravel Surfaced	J. Fred Roberts & Sons	96,342.90	94	78-R
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	23	91-A
122-R2	Bet. Sedgwick & Nebr. State Line	10.122 mi.	Gravel Surfacing	J. Fred Roberts & Son Const. Co.	18,438.30	85	122-R
97-R2 168-AR1 216-AR1 273-R1	Betw. Lamar & Kas. State Line	21.764 mi.	Oil Processed Surfacing	Hamilton & Gleason Co.	122,216.20	100	97-R1 168-AR 216-AR 273-R1
134-AR&C	West of Burlington	11.174 mi.	Oil Procesed Surf.	H. C. Lallier Const. Co.	111,217.20	17	134-A
138-C	South of Muddy Pass	4.184 mi.	Gravel Surfaced	C. A. Switzer	103,270.20	100	138-C
144-E	North of Ft. Collins	1.286 mi.	Concrete Paving	F. C. Dreher Const. Co.	99,187.55	91	144-E
144-F	Northwest of Ft. Collins	10.386 mi.	Gravel Surfaced	Blanchard Bros.	144,180.80	58	144-F
149-B	East of Aurora	7.911 mi.	Oil Processed Surf.	Chas. B. Owen	134,611.10	100	149-B
150-A	West of Craig	8.227 mi.	Gravel Surfaced	Gardner Bros. & Glenn	93,477.35	100	150-A
150-B	West of Craig	4.630 mi.	Gravel Surfacing	N. M. Monaghan	73,181.65	9	150-B
151-A	Between Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	0	151-A
151-B	Bet. Fraser and Granby	3.925 mi.	Grading & Surfacing	Utah Construction Co.	63,954.80	0	151-B
165-R1	East from Canon City	9.325 mi.	Oil Processed Surf.	C. V. Hollenbeck	50,548.30	99	165-R
189-B	Between Hayden and Craig	2.567 mi.	Gravel Surfaced	C. A. Switzer	91,497.00	43	189-B
248-B	South of Buena Vista	2.766 mi.	Gravel Surfacing	J. Finger & Son	51,979.50	80	248-B
251-D	East of Boulder	0.284 mi.	Paving	Collier-Latimer	25,598.50	0	251-D
258-I	Between Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	37	258-I
261-AR	Bet. Rifle and Grand Junction	0.053 mi.	Bridge & Grav. Surf.	Herbert S. Crocker	21,300.00	0	261-A
262-D	West of Walsenburg	1.764 mi.	Gravel Surfacing	Mountain States Const. Co.	22,576.50	100	262-D
265-D	Wilson Gulch	1.930 mi.	Bridge & Approaches	Grant Shields	29,455.50	32	265-D
271-F	East of Florence	0.593 mi.	Viaduct	Mountain States Const. Co.	57,583.40	53	271-F
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc.	116,829.21	6	278-A
279-H	Betw. Kenosha & Webster	1.691 mi.	Grading	Anderson, Sheldon & Miller	76,636.12	81	279-H
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	26	282-I
282-J	Bet. Rifle and Meeker	0.057 mi.	Bridge & Approaches	Herbert S. Crocker	20,400.00	0	282-J
286-E	Denver-Cheyenne Highway	4.052 mi.	Concrete Pavement	J. Fred Roberts & Son	126,032.85	0	286-E
287-AR&C5	Bet. Kersey and Wiggins	Detour		A. R. Mackey	11,946.05	0	287-A
287-AR5	Bet. Kersey and Wiggins	10.586 mi.	Concrete Pavement	Edw. Selander	251,717.00	0	287-A
287-CR1	Bet. Kersey and Wiggins	10.246 mi.	Concrete Pavement	J. B. Bertrand, Inc.	254,341.70	0	287-C
292-D	Between Wolcott and Avon	9.834 mi.	Graded Surface	Utah Construction Co.	159,143.40	15	292-D
297-C	Southwest of De Beque	9.953 mi.	Gravel Surfaced	Hinman Bros. Const. Co.	312,453.50	96	297-C
297-D	South of DeBeque	4.198 mi.	Surf. & Bridge	Hinman Bros. Const. Co.	185,230.50	69	297-D
298-C	Bet. Twin Bridges & South Fork	3.780 mi.	Gravel Surfacing	H. C. Lallier Const. & Eng. Co.	116,864.50	78	298-C
298-D	Bet. Del Norte and Durango	4.100 mi.	Gravel Surfacing	H. C. Lallier	164,814.00	0	298-D

Drain Your Sub-Grades

and
Save Your
Pavements
with

ARMCO

Perforated Corrugated Pipe

The photographs show three stages of operation. A valuable pavement was threatened by a soft subgrade. Trenches were excavated near the highway shoulders, a few inches of crushed rock placed as a porous foundation. The pipe, perforations downward, coupled, and covered with crushed rock or porous gravel to the surface. Result: a COMPLETE and LASTING REMEDY.

Hardesty Manufacturing Company

31st and Blake Streets, DENVER, COLO.

Branches—Pueblo, Colorado Woods Cross, Utah Missoula, Montana Boise, Idaho

MORE YARDS PER TRI

A new road to be cut—a new dam to be built—a new airport to be leveled—on any large hauling job which requires quick and economical completion, Allis-Chalmers Track-Type Tractors will give you the utmost satisfaction.

See an Allis-Chalmers in operation and ask the operator why he likes it bette Satisfied operators take better care their tractors and do more work—an Allis-Chalmers Tractors satisfy.

Here are two A-C "75's", each haulin two heavily loaded wagons making cu and fills on highway relocation job.

Write for further information about these low-cost, hard workers.

WILSON MACHINERY COMPANY, 1936 Market St., Denver, Co

Sales Representatives **Telephones: TAbor 0135 · 0136**

Allis Chalmers

POWER — ECONOMY — PERFORMANCE

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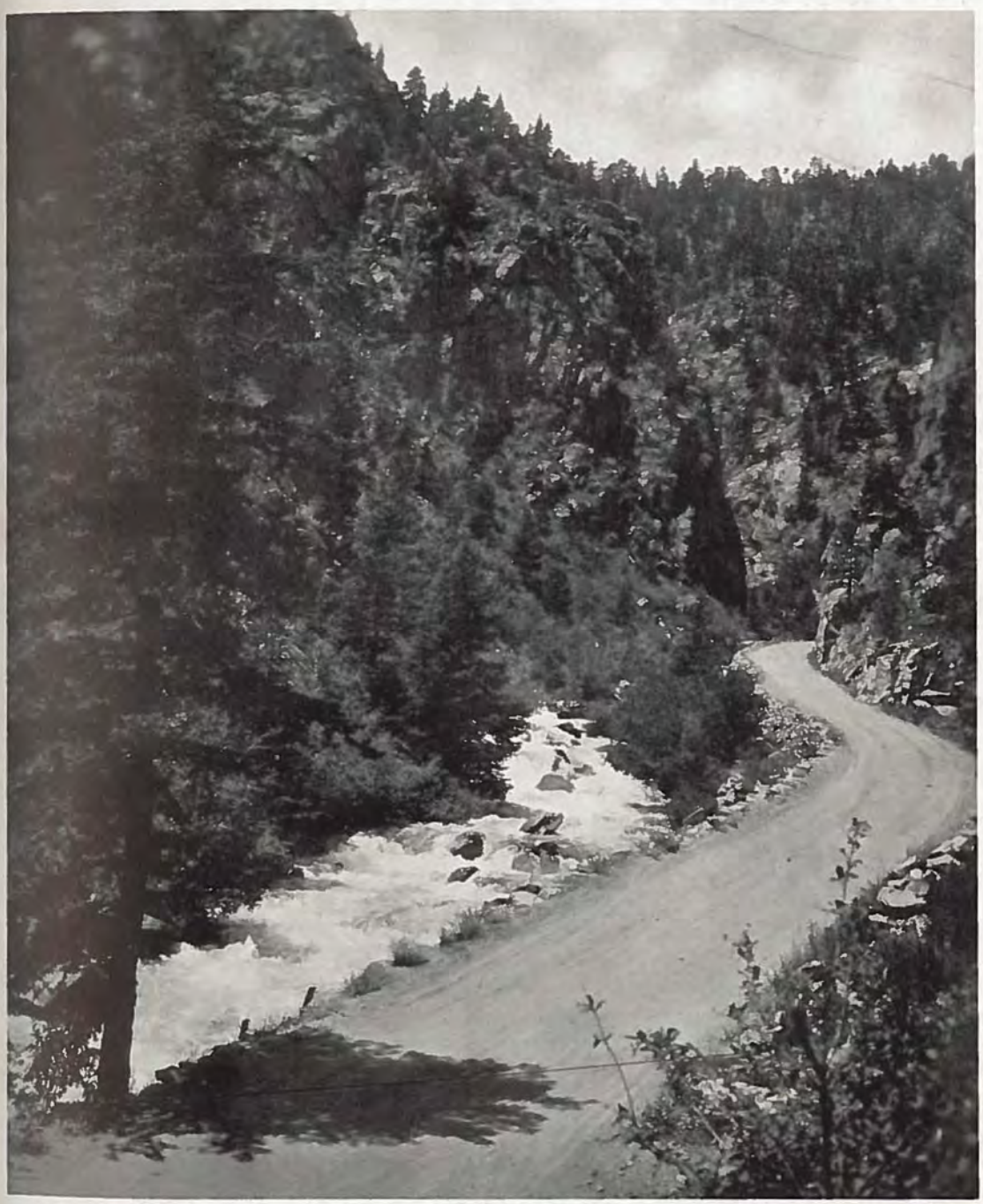
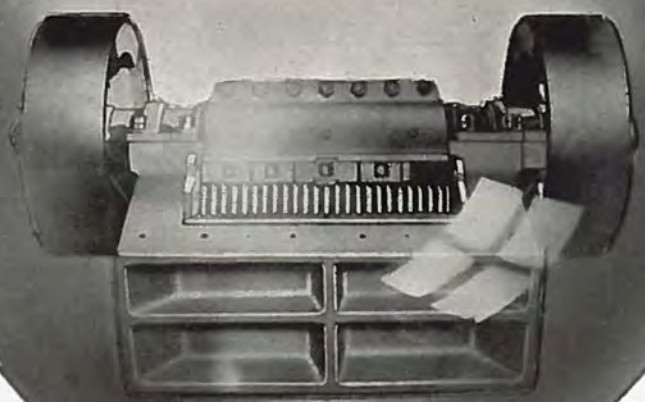
COLORADO HIGHWAYS



Vol. X May, 1931 No. 5

THEY HAVE STOOD THE ACID TEST OF TIME



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Articles on the subject of road building and highway development in Colorado are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible.

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Our Cover Picture

A CANON BOULEVARD—a view of the world-famed Boulder Canon, on the route from the city of Boulder to Nederland—that's the picture we print on the front cover of the May issue of COLORADO HIGHWAYS. This route leads to the famous Glacier region of Boulder County, and is a favorite recreational route with motorists throughout the year. It is a gravel surfaced, all-weather roadway, maintained by county forces. Photo by E. G. Fine through courtesy of Boulder Commercial Club.

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Colorado Highways
"BETTER ROADS"
VOLUME X. MAY, 1931 NUMBER 5

Better Pay for Road Workers

THE more widespread use of machinery in the construction and upkeep of roads and streets has resulted in the employment of more skilled labor to operate the machinery. This is a natural development which has been brought about by expansion of highway programs to meet in some measure the traffic demands produced by the rapid increase in motor vehicles.

Were it not for the increase in road building programs there might have been a decrease in the total number of men employed in road and street work, for modern machinery is very economical of man power. Happily, there has been a considerable expansion of employment in highway work and the rate of pay is higher and the type of worker more intelligent than ever before. This condition has been brought about through the use of expensive machinery that requires skilled workmen for operation.

Contrast the old-fashioned road crew with its horses and many men with the modern highway force using machinery. Steam shovels, tractors, trucks, power graders, concrete mixers, elaborate asphalt plants, machines for mixing and distributing asphalt and tar materials, factory-made paving brick and similar materials made under standardized conditions, all have a part in the making of roads. All of this equipment and materials require skilled labor in both manufacture and use.

The American Road Builders' Association has been engaged for a number of years in developing road programs along economical and adequate lines so that the congestion on the roads will be alleviated and the comfort, safety and economy of highway travel improved. This association has collected for the benefit of highway officials, contractors and manufacturers a wide fund of useful information that is available.

The improvement in the pay of road and street workers has been reflected in the improved working conditions of these men and a better quality of work on the highways. The old days of hit or miss road building have passed and highways are now planned carefully as to their financing, location and construction. Upkeep has been analyzed. Also, the road surfaces can be proportioned in width and strength to the traffic they are called upon to carry.

The highway industry is in a prosperous condition.

MORE ROADS OR MORE DEATHS

Motor vehicle accidents in the United States are on the increase. In 1930 there were 32,600 killed by motor vehicles, 960,000 injured and almost a billion dollars in property damage. There are either too many vehicles or too few roads.

Some alleviation of the death toll is possible through the universal enactment of the uniform vehicle code, including a drivers' license law with mandatory examination of new drivers, as prepared by the National Conference on Street and Highway Safety. It has been found that the accident hazard in cities with modern motor vehicle laws is 25% less than in cities in states without such laws.

The loss due to congestion and delay on the highways is roughly estimated at two billion dollars annually, a sum equal to about 20% of our total tax bill —federal, state and local. Much of this loss is occasioned at intersections where long lines of vehicles can often be seen waiting an opportunity to pass. The disciplining and control of traffic will accomplish much, but adequate roads must also be provided where the traffic demands. Limiting the use of vehicles, except in the case of incompetent drivers, merely serves to limit the usefulness of the roads.

WHO GETS THE TOURIST DOLLAR?

There seems to be some argument in various sections of the country among merchants as to who gets the tourist's dollar that may be spent in the community. The United States Department of Commerce has been making a study of this new industry and they give the following percentages as being about correct. It must be remembered that in some communities the actual figure will vary according to accommodations offered:

Retailer	25 per cent
Restaurant	20 per cent
Hotel or Camp	17 per cent
Garage and Filling Station	12 per cent
Transportation	10 per cent
Theatres and Amusements	10 per cent
Confectionery	6 per cent
Total	100 per cent

Usually the retailer is the first one to say that his sales are not affected by the tourist. He is overlooking the fact that in his case the money does not go from first spender to merchant. He gets his volume from the pay envelope of the employe of the filling station, garage, hotels and restaurants.

How U. S. Bureau Plans *Road Wor*

By A. E. PALEN
District Engineer, U. S. Bureau of Public Roads

UNDER several names and with a gradually evolving sphere of activity, the Bureau of Public Roads has had a continuous existence as a branch of the United States Department of Agriculture since 1893.

It was created in that year by the secretary of agriculture to carry out an act of congress that appropriated $10,000 to enable the secretary "to make inquiries in regard to the systems of road management throughout the United States, to make investigations in regard to the best methods of roadmaking, to prepare publications on this subject suitable for distribution and to enable him to assist the agricultural colleges and experiment stations in disseminating information on this subject * * *."

It was at first known as the Office of Road Inquiry.

From the date of its creation until 1912 the bureau's functions were those of investigation and education only. During this period, the bureau and a small but growing group of pioneer state highway departments redeemed the processes of road building from the depths of futility into which they had fallen in nearly a century of unintelligent direction and laid the foundations of modern scientific highway construction.

When it began its work there were only two state highway departments, and those only just created, in New Jersey and Massachusetts. Its studies of the principles of efficient highway administration convinced it of the advantages of state control and its influence was exerted constantly toward the creation of state agencies in all states. To its suggestion is due the actual creation of many of these departments.

In these years of its early history, while it was studying and investigating and teaching others how to build good roads, it was also preparing itself for the opportunity which came to it in 1912, at first in a small way, to assume the direct responsibility for the construction of roads paid for in part by the United States.

It was the Postoffice Appropriation Act for the fiscal year 1913 that launched the bureau upon its new career of responsible road building. The act provided an appropriation of $500,000 to be expended by the secretary of agriculture in cooperation with the postmaster general for the improvement of post roads to be selected by them.

It was about this time the bureau also began its activities in the West in the national forest states through supplying the engineering supervision for the first program of forest road construction made possible by 10 per cent of national forest receipts being devoted to road work. This was my first assignment in the bureau in 1913, to the Rocky Mountain Region, where I have continued with the Denver District No. 3, created in 1916, first as assistant district engineer in charge of forest and park highway activities and the last two years as district engineer.

Federal-Aid Legislation of 1916 of Far-Reaching Importance

This initial experience in the administration of large construction expenditures was of great val the bureau when, as a result passage of the Federal Aid Ro and its approval by the presid July 11, 1916, it was called up cooperate with the highway d ments of the several states larger program.

This far-reaching piece of le tion provided an appropriati $75,000,000 to be expended i years for the improvement states of roads "over which United States mails now or hereafter be transported * * *

More important than the f funds appropriated by the act certain of its other feature most important of all was i quirement that each state, to in the appropriation must first lish a state highway depar adequate in the opinion of the tary of agriculture to cooperat him in the administration of t provements provided for. As sult of this requirement the ple of state control, long adv

One of a score of wide, smooth un railroad crossings constructed in C for the protection of motorists—a w ried out in cooperation with the U. reau of Public Roads.

the bureau, was finally adopted all states.

The act contained other provi-ns, then novel, which have abun-tly demonstrated their wisdom in succeeding years. It prescribed definite mathematical formula for appointment of the federal ap-priation among the states. It ided that the money was to be ded: One-third in the proportion the area of the states, one-third the proportion of their popula-on, and one-third in the proportion their respective mileage of rural t roads and star routes. It lim-d the amount payable by the gov-ment on any road to 50 per cent the cost and not more than ,000 per mile exclusive of the cost bridges more than 20 feet in span.

t gave the states the initiative, ject to the approval of the secre-y of agriculture, to determine the ds to be improved and the char-er of the improvement. And, after provement, it demanded of the tes that they assume the obliga-n of maintenance and provided ans for insuring that the obliga-n would be carried out. In the retary of agriculture it reposed final authority to determine the equacy of the improvements and grant or withhold the federal as-ance accordingly.

n only one respect was this act terially defective. The defect lay the fact that it permitted too wide dispersion of the federal money, so t there could be no assurance of completion of connected arteries any reasonable time. This defect s corrected by the Federal High-y Act, approved November 9, 1, most important of the amend-nts of the original act, and in it-f the most significant piece of fed-l highway legislation in the his-y of the United States.

deral-Aid System Designated as Result of Legislation of 1921

The Federal Highway Act re-ed all of the outstanding features the earlier act, and added the im-tant requirement that the secre-y of agriculture and the several te highway departments should tly designate a system of impor-t interstate and intercounty roads ited to 7 per cent of the county's al road mileage, to constitute the eral-aid highway system, upon ch all future federal appropria-ns should be expended. This sys-, as designated to date, includes proximately 190,000 miles of road, which about 83,000 miles have been initially improved with federal aid and some 90,000 miles by the states without federal assistance.

By other important amendments the maximum amount payable by the federal government has been increased to $25,000 per mile under certain conditions: The proportion payable by the United States in states of whose area more than 5 per cent is federally-owned public land has been increased from 50 per cent to 50 per cent plus one-half the percentage of public land in the particular state; the states have been required to match the federal apportionments with funds under the direct control of their highway departments; and the maintenance provision has been strengthened.

Another example of Federal Aid road construction in Colorado—an oil-surfaced highway in Fremont County.

Headquarters and Field Organization of Bureau Described

When it was created in 1913, the Bureau of Public Roads, then called the Office of Road Inquiry, had an annual appropriation of $10,000, and its entire organization consisted of a special agent and engineer and a small clerical force. The functions of the office were restricted to such study as the small organization could find time for, in view of the other duty imposed upon it to disseminate the results of its studies.

Today the entire organization of the Bureau of Public Roads includes 976 persons, of whom 461 are engineers. These workers are all engaged in the highway work of the bureau, its principal activity, although there is also a division of agricultural engineering in its organization, which conducts investigations in and reports on farm irrigation, farm drainage, and the mechanical and architectural problems incident to other agricultural engineering work.

In the current fiscal year which began on July 1, the total of all federal appropriations authorized to be expended under the direction of the bureau for various road purposes only will be upwards of $140,000,000. Of this amount, $125,000,000 will be for federal-aid road construction and administration, of which 2½ per cent is available for payment of administrative and research expenses. The balance of 97½ per cent, matched by at least an equal amount of funds supplied by the state, goes into actual road work.

In the past some of the states have more than matched their allotments of federal funds for federal-aid roads, and it is probable that the $121,875,000, which in this fiscal year will be available to the states for these roads, will be matched by at least $160,000,000 of state funds.

Besides its major task of administering jointly with the state highway departments the federal-aid road program, soon to be placed on an annual budget of nearly $300,000,000, the bureau also constructs the principal roads in the national forests; cooperates with the National Park Service in the construction of the main roads in national parks; and is building the Mount Vernon Memorial Highway. To this project, involving an expenditure of approximately six million in dollars and the best of engineering talent, was assigned as construction engineer in charge, my former chief and predecessor, Mr. J. W. Johnson, well known to you all.

To solve the numerous technical problems that are constantly arising in its construction work and to extend the frontiers of the science of highway engineering, it carries on a program of highway research, the most comprehensive of its kind under any single agency, independently and in cooperation with the state highway departments, with universities and with other agencies.

In line with one of the first duties imposed upon it, the bureau endeavors at all times to disseminate promptly the results of its studies.

To this end it publishes a monthly research periodical which circulates throughout the world as one of the most authoritative journals in its field. It also publishes numerous reports and bulletins covering the whole range of its studies. Its library, which contains the most extensive collection of highway engineering literature in the country, is available not only to its own staff, but to all persons who wish to make use of its facilities for study. To carry its educational message to the public, the bureau produces motion pictures on highway subjects and develops exhibits. Its officers and engineers, in the course of a year, address numerous meetings on highways and their development.

To carry out these various lines of work, the bureau has a headquarters organization at Washington, headed by the chief of bureau. The chief engineer has charge of all federal-aid road work. Advising and assisting the chief of bureau and the chief engineer in the federal-aid administration, are staff divisions of design, construction and bridges, each headed by a chief, with headquarters at Washington.

The bureau has direct contact with state highway departments through its district organizations, of which there are 12, each in charge of a district engineer. Eleven of the districts include from two to eight states. District No. 11 covers the territory of Alaska, where the only activity is forest road construction. The bureau also maintains in most of the states, as a part of the district organization and as a still more direct contact with highway departments, a state office under a responsible engineer who works in close cooperation with the highway department. This district comprises states of Colorado, Wyoming and New Mexico and the forest and park highway work in the Black Hills region of South Dakota.

At San Francisco there is a regional headquarters for the administration of federal aid to the western states, and for national forests and national park road work, under the direction of a deputy chief engineer, to whom the district engineers of the five western states report.

For the conduct of its research work, the bureau has three divisions at Washington: The division of tests, which deals with the physical problems involved in the characteristics of road materials, and the forces of traffic and climate that affect road structure and design; the division of highway transport which deals with questions of highway finance, and the economics of highway service; and the division of management which studies the economic aspects of road construction processes with the object of reducing their cost and increasing their efficiency.

The division of control, which includes the accounting section, keeps the necessary control accounts showing the status of federal aid. These records show, day by day, the amount of aid applied for by each state, the sum allotted, and the amount paid to each state. These figures are kept strictly up-to-date.

The legal division, in addition to its advisory functions in connection with administration of bureau activities, handles details of preparation and execution of contracts and of related matters pertaining to federal-aid and forest road construction work, and also makes studies and gives advice concerning state and federal highway legislation.

The division of information is the agency through which information is given to the public in various ways—through correspondence and bulletins, through exhibits, motion pictures and other means. The division is also responsible for the editing and publication of the bureau's research magazine, "Public Roads," referred to above.

District Organizations Keep in Close Contact with Federal-Aid Construction

The organization established by the Bureau of Public Roads in the different geographical districts of the country for the purpose of carrying out the provisions of the Federal Highway Act are in charge of district engineers who are administrative and technical heads of organizations. A district orga tion consists of a headquarters and, where necessary, state o in each of the states embraced i district.

The headquarters office is di into administrative and engine sections. The administrative se consists of the clerical perso necessary in preparing corresp ence, reports, accounts, et cete connection with the work. The gineering section is made up of ferent groups of engineers perfo ing related tasks. The bridge sion is charged with the respon ity of reviewing and passing u all matters relating to structure federal-aid projects. Similarly, plans division is responsible fo viewing and passing upon all de in connection with the roadway tion of federal-aid projects, inc ing the examination of estimat cost, specifications and contract

Other general office activities in charge of an office engineer exercises general supervision the work of a materials engine statistical engineer and the cle personnel. The work of the m rials engineer has to do with th cation, selection, examination maximum utilization of avail construction materials; while th the statistical engineer consist gathering and assembling of i mation from the various state h way departments and political divisions of the state concer highway activities, finance, struction, etc. (Continued on pag

An example of gravel surfaced highw cated near Avon in Eagle County, structed under Federal Aid specifica Photo by H. L. Jenness.

Smooth Roads Reach Mountain Wonderland

By E. M. LE VEQUE

FROM paved automobile boulevards which stretch away mile on mile over undulating plains before the motorist, to precipitous one-way drives in the higher mountain reaches — from a highway which, during the coming years, will be dedicated to those of Boulder County's youth who offered their services to their country during the World War and who in some instances gave their all before German gunfire, to another highway which will be constructed in the sole interest of making accessible another portion of the county's inimitable mountain wonderland — between these ranges Boulder County's 1,000 miles of constructed highways offer a variety of location and setting seldom equalled.

And in the history of their building may be traced, with some degree of accuracy, the outline of the county's industrial development, the ever-changing advance of civilization being plainly evident in their chronology. In the earlier days, when the lure of the gold nugget or of the rich silver vein drew thousands upon thousands of hardy pioneers to the western frontier, then it was that first attention was drawn toward securing means of ingress to the highland fastnesses. Then followed the establishment of lines of communication between the mining camps and the fast-growing cities of the plains, when attention was devoted to the timber possibilities of the forest lands and the first crude logging trails were built.

The modern age of fast-moving vehicles has again diverted notice to the nationally-traveled arteries, with their permanent road-surfacing projects, and at the same time the cry of America for summer playgrounds has attracted the attention of local, state, and national governments alike to the necessity of improving automobile routes in the mountains.

All phases of construction are involved today in the development of Boulder County's road system, and there is every indication that the future will see even more concentrated effort to make accessible all points

Lindbergh Peak—a sentinel of the Rockies, in the Hell Hole region, Boulder County—Fair Glacier at left and Peck Glacier at right. Photo by E. G. Fine.

in the area whose demand, either from an industrial or scenic standpoint, warrants.

Unique among the projects of Boulder County's highways is the nearly completed Road of Remembrance eastward for eight and one-half miles, utilizing what was known as Arapahoe Road, of the Denver-Boulder highway. The Road of Remembrance idea has been woven out of the insistent demand on the part of local residents for a memorial, fitting and permanent, to the county's soldiery during the years 1917 and 1918.

The plan of converting Arapahoe Road into a Road of Remembrance was first suggested by Commissioner E. B. Hill, of Boulder County. The idea won instant favor and resulted in the formation of a general committee, representing various civic and veterans' organizations in Boulder, to sponsor the movement. Mr. Hill was made chairman of the committee. Shortly after his appointment and creation of the working body, Boulder Post No. 10, American Legion, voted $100 out of its treasury toward the project, following this contribution up with an additional $300 realized early in 1924 through a vaudeville show which the Post staged in a Boulder theater.

Treatment of the highway included the laying out of a triangular park at the intersection of the Road of Remembrance with the Lincoln Highway, in which was placed a captured German artillery fieldpiece, erection of an archway over the Road of Remembrance a short distance westward from this park, and the planting of trees from the intersection of the two highways westward to the city limits of Boulder. With the aid of federal funds this highway will be completed this summer, the last section being a concrete paved railroad underpass at Goodhue Junction. The road is surfaced with standard 18-foot concrete pavement from the Lincoln Highway a mile north of Lafayette to the city limits of Boulder.

Plans are now under way for the planting of trees, placed in line and at uniform distances along the highway. On each will be placed a metal nameplate, bearing the name of one Boulder County war veteran.

During the past ten years many important road projects have been carried out in Boulder County. One of the most notable is the Nederland-to-Ward skyline drive to Rainbow Lakes, lying but four miles east of the Arapahoe Glacier, the largest living ice-sheet on the front range of the Rocky Mountains in the United States. This road opens to the world an area of beautiful mountain playground, lying but a short distance below timberline, rich in swift-running streams and shimmering lakes, and at the very portal of the Boulder County Glacier Region.

Other road building projects include the scenic drive over Flagstaff Mountain, one-half mile west of Boulder, which rivals in beauty the far-famed Lookout Mountain drive; the construction of a new road from Ward to Brainerd Lake, which lies

but a short distance east of the Isabel and Fair Glaciers.

A summary of Boulder County's highway system will show, as stated heretofore, practically 1,000 miles of roadway. Of this mileage, approximately one-seventh, or 130 miles, are state highways, the greater portion of which are designated as "seven per cent" roads by the federal government, and as such, subject to Federal Aid construction projects.

State Route No. 1 traverses the county on the east, extending north from Broomfield to a point near Berthoud on the north. This road is paved for the entire distance in the county. Likewise there are ten miles of pavement extending west from the War Memorial arch to the city limits of Boulder. These roads were constructed with state and Federal funds, costing over $1,500,000.

The amounts of money to be expended by the state, county and government in Boulder County during 1931 are as follows:

The county budget for maintenance and general upkeep for county roads is $190,000. This does not include any particular project, according to Chairman E. B. Hill. In addition to this sum the State Highway Department, in connection with the Bureau of Public Roads, is now spending about $40,000 on the underpass about four miles east of Boulder.

The Bureau of Public Roads, in connection with the U. S. Forest Service, is spending about $31,000 on improving the road from Nederland to Ward. Also an additional $30,000 is being expended on widening and improving the road on Raymonds Hill, leading from South St. Vrain to Allenspark. This is on State Road No. 7.

The county and the state highway departments are participating in a project of oil surfacing the road from Longmont to Lyons, which will possibly cost in the neighborhood of $40,000 when completed. The county's share of this project will be deducted from the $190,000 referred to above.

State highways in the county are maintained by state crews, while the county roads are maintained by county patrol crews.

The most important and the heaviest traveled route is State Road No. 1, which traverses the county, entering a few miles north of Longmont, passing through that city and continuing southward through Lafayette and Broomfield, leaving this county a short distance out of the latter community.

Highways radiate out of Longmont to the smaller coal mining camps of the county, westward to Lyons and the North and South St. Vrain canon roads, and south and west to Boulder through Niwot, Hygiene, and other rural communities. From Boulder two main routes lead to Denver—one southward through Marshall and via the Everman cutoff which strikes the Lincoln Highway a short distance south of Lafayette; the other over Arapahoe Road due east eight and one-half miles to the Lincoln Highway.

Major canon highways in the county are the North and South St. Vrain and the Boulder canon routes. From Nederland, on the latter, the sky-line drive to Ward, thence to Raymond's on the South St. Vrain, northward again to Allenspark from where it continues past Long's Peak Inn and on into Rocky Mountain National (Estes) Park furnished perhaps the most beautiful mountain drive of the entire county.

Out of Nederland run several roads, touching Rollinsville, on the Moffat railroad, Eldora, a tourist resort to the west of Nederland, Caribou, famous silver mining camp of the earliest Colorado days, and other points rich in history and scenic attractions. Another such network extends outward from Ward, with a direct canon route to the plains along Left Hand creek.

In the fact that within the confines of Boulder county lie the Colorado National Forest, embracing over 1,000,000 acres; the Boulder County Glacier Region with its four famous ice-sheets—the Arap Isabel, Fair, and St. Vrain—an southern extremity of the R Mountain National Park, ther ample reason to believe that co years will witness an even mor tense effort to create and offer t state and to the country one o finest road systems to be found where. Every demand is being on present highways with coal farm products hauling and gested passenger car traffic pre ing a nice problem to mainten and construction engineers. Sum months result in the severe tests of the wisdom of present r building programs, but throug all Boulder county's highways emerged with a record of bein level and as smooth as any t found in the state.

There is much in store in th ture—there will probably arise r projects which will make insi cant the present scenic drive commercial roads—but for the ent Boulder county realizes through the efforts of the Col State Highway Department, t S. Forest Service, and its own missioners it has been accord vast network of communication transportation lines which, proper development, will cons adequate basis for developme the years to come.

The Boulder county commis ers are E. B. Hill, Sanford Bu and William Mitchell.

Boulder Canon highway, on route fro of Boulder, Nederland and the Glac gion. This road, constructed by conn bor, offers one of the most beautiful tain drives in Colorado. Photo by E. G.

Highways and Vehicles Valued at 30 Billions

THE value of highways and motor vehicles is now around thirty billion dollars, according to figures of the American Road Builders' Association, exceeding the reproduction value of twenty-six billion dollars for railroad roadbed, terminals and rolling stock. The annual highway operating cost is believed to be in excess of eight billion dollars. This puts highway activities in first place with double the annual volume of expenditures of the national government.

Analyzing the figures, the cost of reproduction of pavements, grading and bridges on roads and streets is estimated at $14,771,000,000. Federal Aid and state highways (208,000 miles) are valued at $4,550,000,000; surfaced county and local roads (454,000 miles) at $4,540,000,000; unimproved dirt roads (2,363,000 miles) at $1,181,000,000; city streets (200,000 miles, estimated) at $4,500,000,000.

The cost of right of way, estimated as the cost of obtaining easements only, is around a billion dollars.

Vehicles and garages are estimated at present value. The 3,400,000 motor trucks, valued at $500 each, amount to $1,700,000,000; 23,100,000 automobiles at $400 each amount to $9,240,000,000; garages and terminals are estimated at $4,000,000,000; total, $14,940,000,000 for motor vehicles and garages.

The total for highways, right of way and vehicles is $30,711,000,000.

The annual operating cost of highway transportation to the users is believed to be around eight billions. This is divided into registration fees, $348,000,000; gasoline consumption of fourteen billion gallons at 15 cents a gallon, $2,100,000,000; depreciation at around 15 per cent annually, $1,641,000,000; oil, insurance, interest, tires, etc., estimated at $4,000,000,000; total, $8,089,000,000 annual expense to users of motor vehicles, or $300 a year for each vehicle.

To the public, the highway operating cost of maintenance, administration and interest, deducting $800,000,000 taxes paid by motor vehicle users, is not more than $200,000,000 annually.

New construction of roads and streets (betterments) appears to be around $1,500,000,000 annually added to the highway investment.

There are state, county and city highway bonds outstanding amounting to $3,700,000,000.

Based on an average gasoline consumption of 12 miles per gallon, motor vehicles run over 168 billion miles annually; average annual mileage, about 6,300. If one vehicle could travel to the sun, ninety-three million miles away, it would make 903 round trips each year to equal the mileage of motor vehicles in the United States.

Isabel Glacier, clinging to the slopes of Apache Peak, is one of the famous icesheets of Boulder County. Automobile roads run to within six miles of Isabel, via Ward and Brainerd Lake. Photo by E. G. Fine.

Pennsylvania leads all the states in highway department expenditures in 1930 with $81,835,000, followed by New York with $57,100,000. Louisiana will have more than $30,000,000 increase this year. Only a comparatively few states show a decrease for 1931.

There are 44 legislatures in session this year and road legislation has been active in most of them. In North Carolina all the roads in the state, including 45,000 miles of county roads, have been placed under the supervision of the state highway commission. This is an innovation in state management. Several states have increased the gasoline tax rate. A number of attempts to divert the gasoline tax to purposes other than roads appears to have been unsuccessful for the most part. The motorists this year will pay more than a billion dollars in special taxes and this money will be used almost entirely for highway development.

The legislatures have completed their work in many states. New highway systems have been outlined and state road mileage increased in some states. State aid to counties has received considerable attention and, in a number of instances, the amount of aid has been increased. South Dakota allows the counties to retain 78% of the automobile license fees collected. A few states are proceeding with bond issues for roads; among them are New Jersey, Louisiana, West Virginia, Wyoming, and Nevada. Some routes through cities in New Jersey are being improved by the state highway department.

Employment for labor on the highways as well as the demands of traffic for better roads have stopped attempts to divert the gasoline tax to purposes other than highways in most states, according to Chas. Upham, engineer-director.

"Since the days in Boston when the horses were decorated with covers proclaiming 'I want good roads,'" commented Mr. Upham, "there has been developed a demand for road improvement so great that automobiles do not have to be decorated with similar signs."

A number of states have diverted the gasoline tax, but the total is less than 3% of the amount collected. Money has been used for all kinds of things not related to roads. Kentucky is buying Mammoth Cave with gasoline tax money; Maryland supports a conservation department busy with oyster propagation. Flor-

ida, Georgia and Texas diverted in 1930 a total of $13,404,200 to the support of schools — the largest single item of diversion. Mississippi built a sea wall to the amount of $207,440. New York City receives 5% of the gasoline tax to go in the general fund. Idaho and Michigan are building aviation fields, using $44,000 of gasoline tax money, but they are collecting a tax on airplane gasoline that partly covers this diversion. Louisiana is building a port with $155,000 of the gasoline tax money in 1931.

"The present need for providing work for the unemployed and the readiness with which men from all classes of industry can be absorbed in road building work," continued Mr. Upham, "seems to be known and legislatures generally recognize these facts. The needs of the highways are apparent to all motor vehicle drivers. The 32,500 people killed in 1930 by motor vehicles and the 962,000 injured, not to mention nearly a billion dollars property damage, clearly indicates the need for more and better highways and streets.

"This will be the greatest road building year in history," he continued, "and coming at a time when other work is decreased, much distress will be relieved through employment given by road contractors and officials. The public will gain because roads can be built more economically in a period of comparatively low prices."

The forthcoming Proceedings of the American Road Builders' Association, which is now on the press, will contain a new idea in the publication of such books. The Association believes that the book will be more useful than ever before.

The new idea is this: Summaries of each report consisting of an introduction, a resume of the report and conclusions will be presented for each of the committees. These summaries give all the important facts condensed to make easy reading and to convey the maximum of information. Only useful facts are presented.

The conclusions have the approval of the various committees and, as in past years, they represent the opinions of leaders in the highway industry—state, county and city officials, contractors, manufacturers.

The complete reports with supplementary data collected by the research staff of the Association will be printed in a series of bulletins. These bulletins will appear in a uniform style with a standard cover. The bulletins will be distributed free to members.

The Proceedings are available free of charge to members of the American Road Builders' Association; to others the price is $5. The book will contain about 400 pages, fully illustrated with halftone cuts, diagrams and tables, and will be bound in the standard blue leather cover adopted several years ago.

The Proceedings of the American Road Builders' Association ontains the latest standard practice in the financing, construction, maintenance and use of roads and streets. The conclusions have been quoted and referred to by many eminent road builders as being highly useful and giving the most recent ideas about road and street practice.

Snow removal work in South Park ne town of Fairplay on April 1—showing maintenance forces clearing highway feet of snow. Photo by Victor Baker.

MOTORISTS BUY ROADS, TRAVEL MUCH FARTHER

By E. E. DUFFY

MOTORISTS of today are covering two-thirds more distance in a year than they did a decade ago.

The U. S. Department of Agriculture recently announced that in 1930 the total usage of gasoline increased 3½ per cent over that of 1929, even though there were only a few more cars.

In 1930 the average consumption of gasoline per vehicle was 556 gallons, as compared with 538 gallons in 1929. Estimating that the average car travels 15 miles per gallon, motorists in 1930 averaged 8,340 miles of travel. Ten years ago motorists averaged little more than 5,000 miles yearly.

This sharpened appetite for travel has come about through improved roads, which motorists themselves have paid for through vehicle license fees and gasoline taxes. Although road incomes are augmented other sources, funds contribute rectly by motorists have largely responsible for the cons tion of continuous, interlo highways which allow the mot to cover lengthy mileages at wi

Last year the net revenue the gasoline tax was $494,683 The average gasoline tax rate 3.35 cents per gallon. Road buil consider this a bargain price to for motoring facilities because o lowered cost of operating aut biles, increased speed, driving c fort and the lowered road ma nance cost; a cost borne in one or another by taxpayers.

Automobile license fees the c try over averaged $13.41 ann and this, added to the average g line tax payment of $18.62, b the total to $32.03. The average tor car owner can figure out for self what he gets for his motor expenditures. According to widely accepted Iowa State Col figures, hard-surfaced pavem save more than two cents a mil car operating costs over dirt r and at least one cent a mile in operating costs over roads of in mediate types. The motorists, th fore, who in 1930 drove 8,340 m over concrete rather than over in mediate type roads saved $83.40 more than $50 over his motor outlay.

Gas tax income is being wi used for road bonding purpo Bond issues financed by gasoline income impose no additional bur on the motorist and at the same they permit immediate construc of needed highway improvement

Our Roads Rich in *Historic Lore*

An old woodcut of Coronado, the Spanish explorer, and his entourage in search of the seven cities of Cibolla in 1541, passing through a section of Colorado.

By HON. LEE KNOUS

WE HAVE devoted a whole lot of energy, a whole lot of money and a whole lot of time to the development of a public road system in Colorado, with a view of attracting to this state tourists from the surrounding states during the tourist season, and with the further and further object that some of them be induced to stay and settle in our state of Colorado.

Several other states have adopted a road program of that sort, have attracted tourists to their boundaries, and this is usually by means of capitalizing the history and the historical traditions of those states.

Today, in New England, practically every farmhouse, practically every hamlet has a traditional history which is attractive to tourists, which is attractive to any visitor, and which is exploited for the purpose of attracting people to that community.

California, in the West, is a notable example of the success of capitalizing historical traditions. They have their missions, they have their Spanish roads, they have that historical background which I believe appeals to anyone who goes to that state.

We in Colorado are inclined to think of this state as being one comparatively new in the states of this public, as being a state without such historical background, whereas as a matter of truth and fact, there is no state which has a more interesting history, a history which appeals to visitors, than that of our state of Colorado, when we realize that nearly a hundred years before there was an English settlement established on the Atlantic coast, nearly a hundred years before a single English-speaking inhabitant resided in Plymouth, or any of those early colonies, that there had been white men in Colorado; that south of us had been founded Santa Fe, the second oldest community in the United States today; that as early as 1541 Coronado, the Spanish explorer, seeking the seven cities of Cibolla, in the territory we now call the Colorado river, had either passed through Colorado or very near its boundaries; that even in those early days, when those early Spaniards had been at Santa Fe and looked to the north and saw the red of the setting sun on the white-capped mountains in southern Colorado, they named that range the Sangre de Cristo Mountains, and it was so recorded on their maps and charts which today rest in the museums in Santa Fe. That as early as 1706, a man by the name of Uribarri came into what is now Las Animas county and named the Spanish Peaks, that great pathway from New Mexico into Colorado, and out here in what is known as Cheyenne county, at a place called El Quarteljo, formally took possession, with the ceremony the Spaniards usually adopted, that of posting a tablet, surmounted by a flag, claiming this territory for the rulers of Spain. That in 1719, the governor of New Mexico, a man by the name of Val Verde, came into this territory for the purpose of punishing the Comanche Indians, who resided down around the section now occupied by Pueblo county, and who went up the Arkansas river to the point where Fountain creek enters that stream, near the present site of Pueblo, and there, in 1719, built an earthen fort, which evidence shows remained built many years afterwards. This I might say was long before there had been any incursion into California by the Spanish from the south, except for casual exploring expeditions.

In 1720 the first Spanish expedition came as far north as we are today. A man by the name of Villasuer came up to the Platte river. I might say, in those days, practically all of these streams on the eastern slope here had Spanish names. On the western slope, those streams have usually maintained their Spanish designations, but here, because of other influences, of which I shall speak, the names have generally been changed.

And in 1776, at the time when our representatives were attempting the Declaration of Independence, when we were throwing off the yoke of England, there was, on the very day that was signed, on July 4, 1776, a Spanish settling expedition on the western slope of Colorado, near

what is known as the Dallas Divide, and they made a very complete record of that trip, which can be followed to this day.

In 1779 a Spanish commander by the name of De Anza came up to chastise the Indians coming through the San Luis valley, over what is now Cochetopa pass. He found the Indians on the Arkansas river, near where Salida is at present situated. That was in the middle of the winter. He had a number of armed men. He followed the Indians down the river to the Green Horn mountains, and a bloody battle took place, in which the Spanish were successful; and one of the circumstances which has changed the names of places in this state, which is very interesting, I think, is that the name of this Indian chieftain was Cuerna Verde, meaning in Spanish, green horn. That is the tough horn of an animal. As a consequence, that mountain was named in Spanish, "Cuerna Verde," and the Green Horn mountains, as we know them today, were named earlier "Cuerna Verde." Later, when some Yankee trapper came down in that country, he changed the name of the mountains to the Green Horn mountains. I think most of you gentlemen, when you have heard that name, have thought probably that it originated by reason of some tenderfoot coming out here and mistaking the height of the mountains, or something of that sort, but, as a matter of fact, it came from the name "Cuerna Verde," the name of a Comanche chieftain who died on the slopes of that mountain.

In 1806 the first American expedition came out here, the famous trip of Lieutenant Zebulon Pike, at which time Pike's Peak was discovered. All of these early exploration trips centered at the influx of Fountain creek on the Arkansas river. Practically every trail, every road, led to that point. There had been very little travel to the north of that, and that was the highway into this country. At the point where the city of Pueblo is located, practically every one of these expeditions made a camp.

Pike made his first camp in Colorado on the site of the present town of Rocky Ford, on November 17, 1806. On December 14th he was in Florence. He built a fort there, just for temporary protection, which, of course, has long since been obliterated.

Perhaps all of us do not remember back in the days of our school history about the Burr conspiracy, about the time that Dr. Wilkerson decided to form a great republic in the western part of the United States, and by the widest stretch of imagination, little do we connect the history of Colorado with that affair, but practically all of the evidence points to the fact that Lieutenant Pike's trip out here into Colorado was made for the purpose of furthering the Burr conspiracy, and was made for the purpose of bringing back to that group, who decided to form a country out here, cutting out a portion of Mexico, a portion of the Spanish territory, information in regard to the topography and the resources of this section.

That, of course, failed. Lieutenant Pike was accused of complicity in the venture, but for lack of evidence available at that time, no further steps were taken.

In 1829 Long came here. Pike called what we know as Pike's Peak the highest peak, the peak that he thought was the highest of any along this range. Long came here with a fragmentary map that Pike had made of his exploration, only he came a new route—instead of coming up the river to the point where Pueblo is now located, he came through what is now known as Julesburg, straight west towards the mountains, and as he came up through this section, he saw a tall peak also, and it is the peak we know today as Long's Peak; but he thought it was the peak that Pike had climbed, and recorded in his journals the location of what he also called the highest peak; and for many years, until Fremont's expedition, there was a great confu the maps of this territory as t location of this peak, as you can see, the real Pike's Peak bein the south, and Long's Peak t north. So many parties were th off their way in following direc based upon the location of this est peak.

The newly completed Million Dolla way, between Ouray and Silverton, route followed by a Spanish settlin in 1776, and later the scene of one richest gold strikes in Colorado.

Another interesting thing i name situation: The Spaniards before had named Huerfano r down in Huerfano county, me in Spanish "Wharf." Long h French guide. The French tra had been through the northern of the state—and several name remain up there—the Poudre St. Vrain creek, and several o some of which were named l but this Frenchman did not u stand the Spanish language, n did Long, and when they down to Huerfano creek. Frenchman told him that the S iards called it "Wharf creek, Long very interestingly recit his notes, and on the map whi made at that time, that the reason he could see for calling "Wharf creek" was because banks were cut straight up down.

In 1821—prior to this, I s say, there had been several tra expeditions here, in which furs bought from the Indians, bu first real commercial enterpris

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Pictured at the left, the new "QUICK-WAY" TRUCK SHOVEL being delivered to Montrose County — a purchase made for all 3 districts in Montrose County,

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parently that came into Colorado was in 1821, when what is known as the Glenn-Fowler expedition — a two-man expedition from St. Louis —came up the Arkansas river. They built a permanent house at the site of what is now Pueblo on January 16, 1822, and that was the first permanent settlement in that particular section; the present location of Pueblo, as we know it, having been later established, and being called in the early days "The Pueblos," as distinguished from the word "Pueblo," as we call it now, was made in 1842, and at that time, during the early history of Colorado, up until the gold rush, was the principal point of commerce in the state of Colorado. Many historians, practically everyone who participated, during that interim, made a record of the location of these "Pueblos," giving very detailed accounts of the life there, of the cultivation of the surrounding places, and the like.

In 1824 Bent Brothers, who have left their record here in Colorado, by the fact that Bent county has been named after them and by the fact that a fort of a permanent character, which is generally well known, was built by them on the Arkansas river—came to Colorado. They built two forts. The first fort was built just a little ways above the present site of Pueblo. Its exact location I don't believe is known. But the second and more famous fort was located eight miles above the mouth of Purgatory river, and the site is still available.

In 1830, as more trading parties came out here, forts on the South Platte, between here and Greeley, were first built. Fort Lupton was built at a point about a mile north of the present town in 1836, and was known as Fort Lancaster. This fort was built by a young lieutenant who had been out here, and who later returned to go into trapping on his own responsibility. Up here at Platteville, within a few feet of the paved road, is a fort which was built in 1837, and is perhaps one of the sites most available by observation.

Fort St. Vrain, up in the Longmont country, was built in 1838. Over on the western slope, Fort Robidoux was built, at the present site of Delta, about the point where the Gunnison and Uncompahgre rivers come together, in 1824, and for years was the principal commercial point in that section.

In 1837, over on the Green river, Fort Davey Crockett was built.

I merely point out the great number of historical associations which we have here in Colorado, with this in view: That I believe that within the next year or so, in conjunction with the great program which is now being put on for the purpose of attracting tourists to Colorado, there will be a movement to mark these fort sites, and to mark these places of historical interest, as has been done in other states.

I have just touched the high spots. It can be demonstrated without very much argument. But I might say that back of all this, and intertwined with all of these expeditions, are matters of local interest—matters of location which are interesting to anyone who is cognizant of the subject, and which will bring to Colorado a great many tourists who are interested in tracing the lines of these old expeditions.

I might say, in that connection, that we all know the Mormons crossed Colorado when they went to Salt Lake City, at least some parties of them. There has been a lot of search made of the records at Salt Lake City, which detail the course of their travels, and yet today there is no certain known route which they followed. Some people think they went through North Park, over through that country; others think that they went across the present Colorado river near the site of Grand Junction today.

All of these things can be developed, and I submit that it is interesting to anyone when he is driving along a road to say, "There is a sign here. Here is where Kit Carson joined the Fremont expedition in 1846." "This is the point where Lieutenant Pike camped on the occasion that he discovered the [illegible] which now bears his name."

The Daughters of the Amer[illegible] Revolution for several years [illegible] done a very laudable work in m[illegible] ing these historical sites. But [illegible] yond that they have been limi[illegible] because of financial reasons, [illegible] some agency is going to take [illegible] of this proposition, if it has [illegible] merit. I assume that the ma[illegible] will be agitated within the next [illegible] or three years, and in view of [illegible] fact that you gentlemen have [illegible] your hands the policy of the v[illegible] ous counties of the state with r[illegible] ence to these things—and I m[illegible] say that there is not a county [illegible] Colorado—you may know it, [illegible] you may not have heard of it— [illegible] a very little investigation will [illegible] close there is not a county in [illegible] state which has not a histor[illegible] background which is worthy of [illegible] ploiting and calling to the publ[illegible] attention, and I believe that as [illegible] develop and bring to Colorado th[illegible] tourists, in conjunction with [illegible] great program on the part of [illegible] railroads and on the part of the [illegible] sociation devoted to that purp[illegible] for which a large amount of mo[illegible] is being spent in a national adver[illegible] ing campaign, that we should [illegible] velop this side of our scenic attr[illegible] tions, so that people may come h[illegible] not only for the purpose of view[illegible] the wonders and grandeurs for[illegible] in this state by nature, but as [illegible] for the satisfaction of pursuing th[illegible] intellectual musings, and find t[illegible] the early history of the West [illegible] the early history of this entire [illegible] tion, most of which is written in [illegible] annals of the state of Colorado.

Comparative Statement
COLORADO STATE HIGHWAY DEPARTMENT
For the Month of April, 1930 and 1931

RECEIPTS	1930	1931
U. S. Government	$ 28,089.55	$179,871.1[illegible]
Gas Tax	331,100.00	316,500.0[illegible]
Internal Improvement	8,700.00	7,300.0[illegible]
Highway Receipts	181.77	3,618.3[illegible]
	$368,071.32	$507,289.5[illegible]
DISBURSEMENTS		
Federal Aid Projects	$223,662.04	$547,802.0[illegible]
State Projects	32,407.71	65,498.1[illegible]
Maintenance	87,155.85	94,542.9[illegible]
Maintenance Equipment	74,294.82	4,416.1[illegible]
Property and Equipment	5,341.88	5,037.7[illegible]
Surveys	1,055.62	2,432.8[illegible]
Traffic Signs and Census	1,130.39	724.1[illegible]
Administration	16,681.44	14,963.3[illegible]
	$441,729.75	$735,417.2[illegible]

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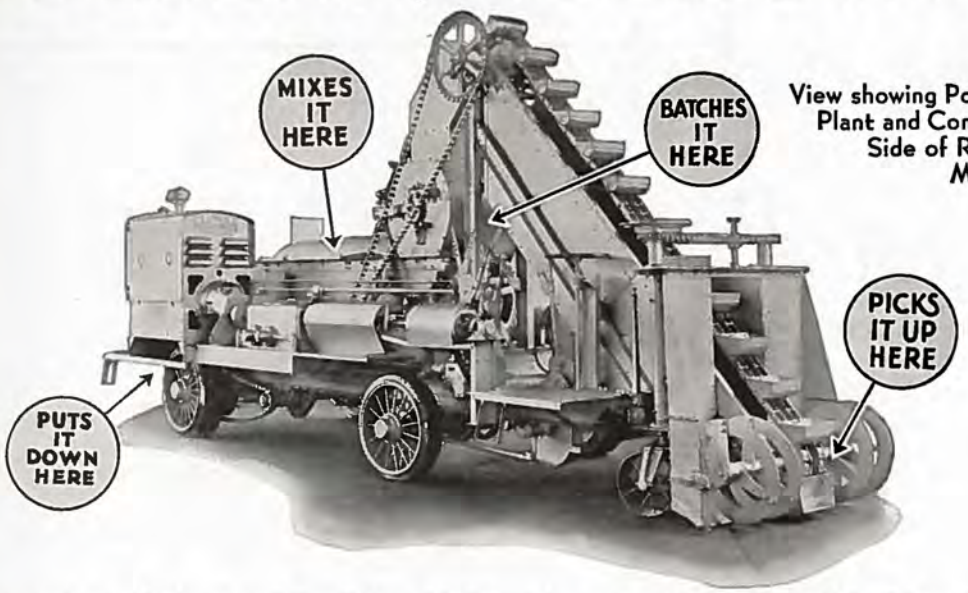

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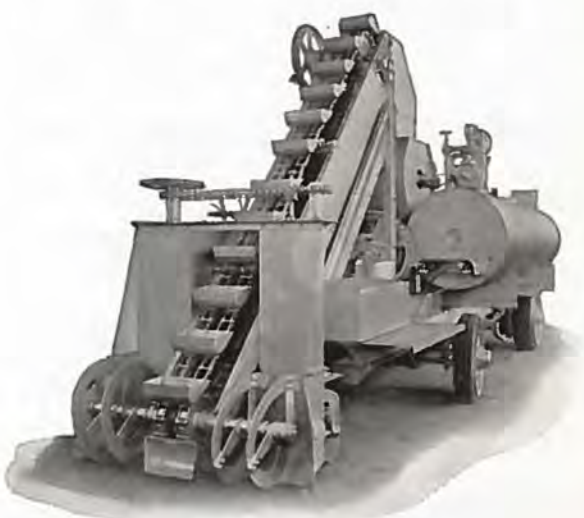
View of Road Mixer Showing Heaters and Bitumen Storage Tank



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FOR EVERY PURPOSE

NEWS OF THE MONTH

For a contract prize of $84,815, the Cole Bros. contracting firm have agreed to grade and gravel surface eight and one-third miles of new roadway extending south from the city limits of Pueblo. This work is being done preparatory to future paving. The project involves 98,000 cu. yds. of excavation and 19,920 tons of crushed rock surfacing material. The contractors agree to finish the project before September 1. It is an emergency federal-aid project. Bids for the project were opened May 7. Driscoll Const. Co., Pueblo, and J. P. O'Connell, Denver, contractors, were second and third low bidders. Several bad curves and steep grades will be eliminated on the new route.

The highway department opened bids April 24 on the construction of six miles of new road between Cimarron and Montrose on State Route No. 6, being a continuation of the heavy road work which has been under way on this road between Gunnison and Montrose for the last several years. The Lumsden-Hall Const. Co., of Grand Junction, were the low bidders on this project. Their bid price was $107,000 for the completed project, which calls for 163,000 cu. yds. of unclassified excavation and 27,000 tons of crushed rock surfacing. The engineer's estimate was $127,000 for the project. It will be constructed with federal aid funds. The Utah Const. Co. and Cole Bros., who recently completed a project on the same road, were second and third low bidders. The contract calls for the completion of the work before September 1.

Phelps Bros., of Fowler, have a contract for the construction of a treated timber bridge located on State Route No. 6, about ten miles northwest of Delta. Cost of the bridge is to be $8,600. The project includes an 83-foot bridge and a detour. The same contractors are constructing a similar bridge located five miles east of Grand Junction on State Route No. 4. The contract price on the latter project is $7,300.

Operating with three large shovels and seventy-five men, Lallier Const Co., contractors, are completing the gravel surfacing work on four miles of newly graded road on Wolf Creek Pass. Maintenance crews of the state highway department expect to have the pass open for traffic by June 1.

With less snow to move than last year, J. O. Francisco, division maintenance superintendent, expects state snow removal crews to have Rabbit Ears pass ready for travel by June 1. State crews have kept Berthoud pass open throughout the winter for the first time in history. The department has found it cheaper to keep men and equipment on the pass throughout the winter than to move heavy equipment on the pass in the spring.

Congressman Ed Taylor reports that the Bureau of Public Roads has given a federal aid designation to the Dove Creek-Naturita highway. This designation paves the way for the improvement of the famous Slick Rock hill with federal aid funds.

Something new in Colorado highway construction, a gravel roadway 34 feet wide, will be found in the six miles of new highway to be built this summer east of Montrose on State Route No. 6, according to State Highway Engineer C. D. Vail. At the present time nearly all gravel roads being built in Colorado have gravel surfacing for a width of only 26 feet. Traffic conditions at this point prompted the engineers to design the wider road.

Over $1,000,000 will be spent on the highways of Colorado during the month of May. This is the estimate of highway department officials. Charles D. Vail, highway engineer, has ordered every project in the 1931 budget be started as soon as possible. At the present time 42 federal aid and scores of minor state and county road building projects are under way. Plans are being drafted on 22 more federal aid projects and soon there will not be a section of the state without scrapers and steam shovels, teamsters and laborers, busily engaged in improving Colorado's highway system.

On May 10, Contractors J. B. Bertrand and Edw. Selander had poured five miles of concrete pa ment on the Greeley-Wiggins ro A check on the progress of this w shows the two contractor outfits pouring cement at the rate of 2 feet per day. At the rate the fits have been going this 21-m stretch of pavement should be c pleted by July 15, forty-five d ahead of schedule.

Like progress is being made o score or more of other projects cated in various sections of state.

So far this year the expenditu of the highway department h been averaging 50 per cent gre than in any other year in the hist of the state. Expenditures dur April were $736,000 and by J should be nearly $1,500,000, acc ing to Engineer Vail. Colorad 1931 state highway budget calls the expenditure of $9,797,157. B gets of the 63 counties total o $11,000,000 for the year.

Three eight-hour shifts of m are employed by the Morris Knudsen Company on their 11-m grading project northwest of F Collins in Larimer county. A b tery of huge floodlights are used the men on the night shifts. S enty-five men and a large amount extra heavy excavation equipment employed on the project.

Preparations are under way to r sume work on the Trail Ridge ro from Estes Park to Grand Lake. T new road to the top of Fall Riv pass on the east slope has been f ished. When finished, which w be sometime in 1932, the new r will be one of the finest scenic hig ways in the world. For sever miles the new road will follow t Continental Divide.

Four and one-half miles of c crete pavement located north Aguilar on State Route No. 1 w be laid this summer. Bids for t paving will be opened by the st highway department on May 14. is estimated this project will c $125,000. The new project will c nect on the south of the twen miles of pavement now in use nor of Trinidad.

BUILDING THE HIGHWAYS OF PENNSYLVANIA

THIS is a story of roads in Pennsylvania—a story of International Trucks. Pennsylvania knows full well that no state can afford to neglect her roads. She has gone on extending the vital arterials so that commerce may flow unobstructed and free. During 1930 over eighty million dollars were invested in major construction, replacement, and maintenance work by the Pennsylvania Department of Highways.

During 1930, over seven hundred International Trucks helped to build the highways of this state alone—a surprising total, indicating the vogue of International haulage among construction men.

Whatever the emergency, Internationals fill the bill and add to their reputation. Everywhere their owners attest their sterling performance and economy. Entrust your own hauling to trucks like these—they will give you both speed and stamina in good measure.

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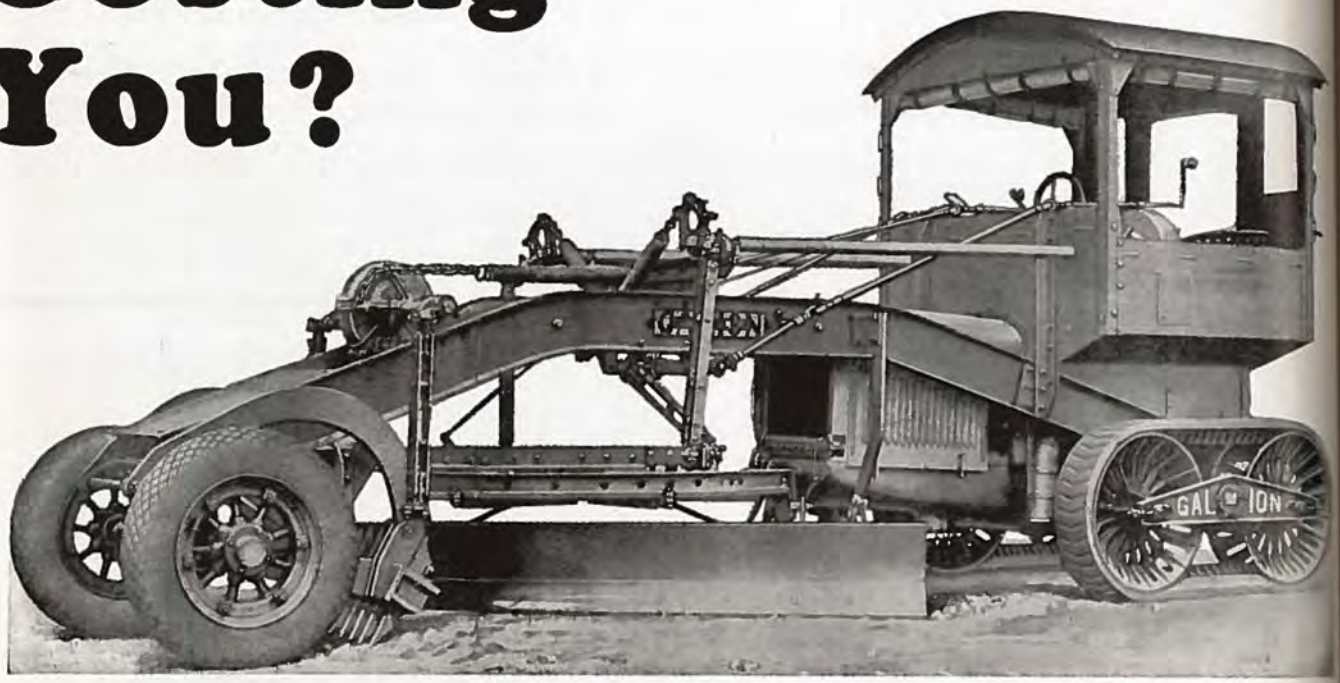
How Much Is Your Maintenance Costing You?



Galion McCormick-Deering E-Z Lift Motor Patrol Grader with Sure-Trac Rubber Crawlers and Pneumatic Front Wheels. Can also be furnished with pneumatic tires in rear or with Steel Crawlers in rear and steel wheels in front, or solid rubber tired wheels front and rear, and with or without cab.

Figures prove not only in Colorado but other states as well that Galion plus McCormick-Deering power have made possible the lowest cost per mile in the history of road maintenance with power—and it's the type of maintenance that gets results. Either type, with Round Wheel or the new Sure-Trac Rubber Crawler, will be demonstrated any time, any place, upon request.

IN STOCK FOR IMMEDIATE DELIVERY

H. W. Moore Equipment Co.

120 WEST 6TH AVENUE · TABOR 1361 · DENVER, COLORADO

"Colorado's Largest and Oldest"

GALION

WHY DO GALION E-Z LIFT LEANING WHEEL SKEW AXLE GRADERS SERVE YOU BEST?

We have all sizes in Denver stock for immediate delivery.

First—Because Galion is one of the largest and oldest builders of road equipment in the world and "knows" the hows and whys of building graders from experience in the field.

Second—Because they are more sturdily built than most graders of the same blade length and are built heavier where the strain comes.

Third—Because "Galion Graders" are the best serviced graders sold in Colorado—and we'll prove it.

H. W. MOORE EQUIPMENT CO. **Denver and Grand Junction**

How U. S. Bureau Plans *Road Work*

(Continued from page 6)

The state offices are in charge of senior highway engineers with one or more engineering assistants and clerical help. They were established to facilitate the selection of routes, to assist in the preparation and approval of plans, to enable a greater measure of general supervisory control to be exercised over construction work on federal-aid projects and to better determine whether completed projects were being properly maintained.

The initial experience in the administration of the Federal Aid Road Act demonstrated the desirability of establishing close contacts with the states in the formulation and preparation of plans for the work to be undertaken with federal cooperation. Such contacts enable virtual agreements to be reached in regard to all controversial matters before detailed plans have been prepared. There is a considerable waste of time and energy in making changes in plans after they have been completed. Except for the close relationship existing between the representatives of the district offices of the bureau and the state highway departments, it would be necessary for them to proceed with the selection of routes and preparation of plans and risk the possibility that exception would be taken to certain features and revisions required upon submission to the bureau for approval. These difficulties are obviated and the procedure speeded up by maintaining bureau representatives in the state, who have authority to agree on general features of location and design which are in conformity with established engineering practice.

Differences between the states and the state representatives of the bureau are referred to the district office for decision. Representatives from the state offices of the bureau made frequent inspections of construction work on federal-aid projects to determine the amount of work done for reimbursement and its conformity with the specifications. Regular inspections are also made of completed work to insure adequate maintenance. The engineering assistants in the state offices receive instructions from the engineers in charge of the states to perform any work required by regulation or special assignment.

The principal functions of the district organizations are to administer the federal highway act under which the national government cooperates with the states in the improvement of highways on a designated system of highways within the states and undertakes the construction of roads within the national forests and parks. Their lesser functions are to gather and assemble information concerning the highway activities of the various states and their political subdivisions, to collect and prepare information on highway legislation, sources of highway revenues, motor vehicle registrations, methods of financing used by different states, to cooperate with the states in the location and utilization of materials which may be suitable for road building purposes, and, upon request, to advise state and county officials on the solution of highway problems. The district organizations were established for the purpose of exercising close administrative control over the personnel of the bureau assigned to work in the different states and to pass upon routine matters concerning administrative and general engineering matters without reference to the Washington office. The states are permitted to proceed with construction on federal-aid projects on the recommendation of approval of plans by the district engineers. eral funds may be used to pa work done after the recomm tion of approval is given. Th trict organizations exercise g supervisory control over all fe aid work undertaken in the re tive districts and are guided by nite administrative and gener gineering policies. They cont to the successful carrying out Federal Highway Act by rend prompt service and decisions matters which arise without th lay incident to referring such ters to the Washington office.

The district engineers est frequent personal contacts wit administrative officials of the highway departments in the di and endeavor to adjust all ences of opinion which may concerning the applications o Federal Highway Act. The a istrative officials of a number state highway departments ar ject to frequent changes. changes often bring into office viduals who are new to hig problems. The district org tions often render a real servi these officials in supplying inf tion concerning sound princip administration and construction maintenance practices of p value.

An example of mountain road construction on Tennessee Pass near the town of Redcliff —constructed as a Forest Aid project. Photo by C. E. Learned.

Construction of National F Highways an Important Activ

Another important activity western districts is the constru of forest highways and for wh this district, together with the struction of national park high the greater portion of the org tion is required. Except for t per cent fund, previously menti regular federal funds for the struction of forest roads and became available for the first upon the passage of the Federa Road Act and its approval b president on July 11, 1916. S 8 of this act provided an appr ation of one million dollars pe num for ten years to be "exp under the supervision of the tary of agriculture, upon requ the proper officers of the state ritory or county for survey, struction and maintenance of and trails within or partly w the national forests when nece for the use and development o sources upon which commun within and adjacent to the na forests are dependent."

Construction of forest roads ceeded under the authority o

(Continued on page 26)

60 out of every 100 FWD orders come from FWD users

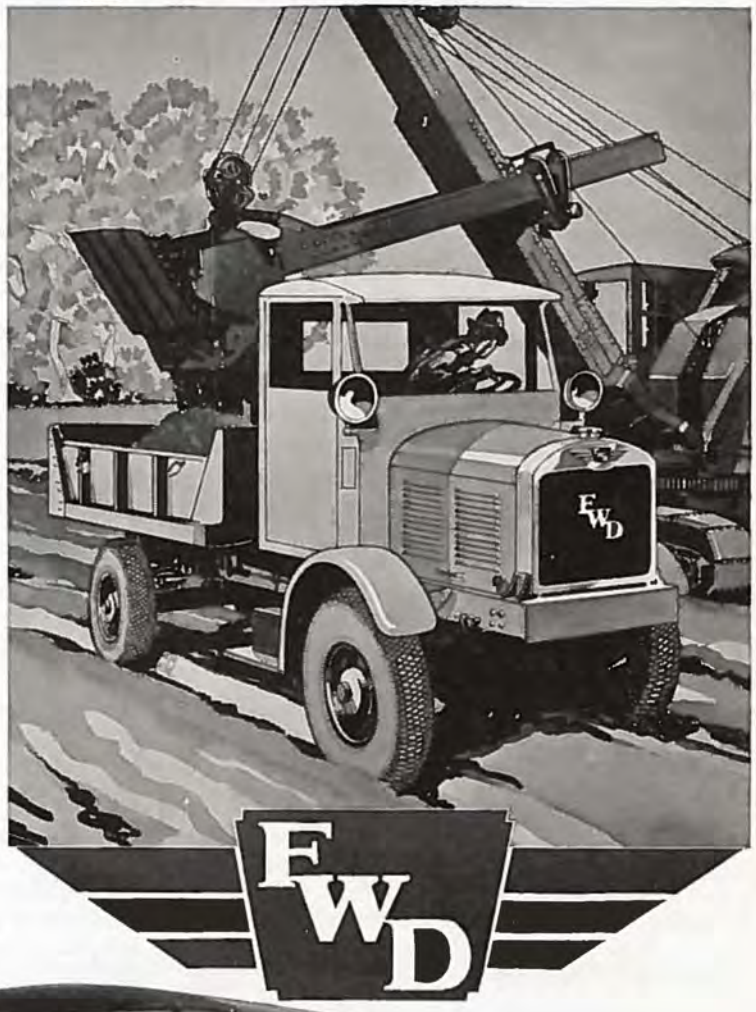
THE FWD Truck is widely accepted in the Highway and Building Construction fields—60% of FWD orders during the past five years came from FWD users — a high tribute to the design and construction of the FWD Truck.

In the FWD you have four *live* wheels to grip and pull through the toughest kind of going, and under *capacity* loads!—four *live* wheels—to speed FWDs over any kind of road swiftly and with real transportation savings! The FWD principle of power and pull on all four wheels gives positive traction.

The FWD Truck is different in principle . . . it distributes the power equally to each of the four wheels . . . This principle of propulsion gives the truck greater power . . . because it puts all of the power developed to actual use.

The load is distributed on all four wheels. This distribution of the load reduces the strains which would otherwise be concentrated on one section of the chassis. Consequently the load is not carried on the rear wheels only but is divided between the rear wheels and the front wheels and the truck becomes the easiest power unit of its capacity upon road surfaces and dependable, sure-footed in rough going.

Let us send you bulletins describing FWD Trucks and the *reliable, economical* transportation they afford. Write today!



The Liberty Trucks and Parts Co.

Colorado Distributors
150 West 6th Ave., Denver, Colo.
Phone Tabor 5711
Largest Truck Parts Department in the West

FWD 2 Ton Truck equipped with underbody scraper.

BACKED BY NATION-WIDE SERVICE

How U. S. Bureau Plans *Road Work*

(Continued from page 24)

act until the close of the World War when congress, in order to provide employment for returned veterans, amended the Federal Aid Road Act and appropriated an additional three million dollars a year for three years for forest road construction. This amendment, which was approved February 28, 1919, authorized the secretary of agriculture to proceed in the survey, construction and maintenance of forest roads and trails without cooperation of the local authorities provided the work was necessary for the proper administration, protection and improvement of national forests or that the work was of national importance. It also provided for the transfer and use in forest road construction of war surplus material, equipment and supplies, suitable for the purpose.

Responsibility for the survey and construction of forest roads authorized under these acts was delegated by the secretary of agriculture to the Bureau of Public Roads which developed an organization adequate to handle the work economically and efficiently.

The Federal Highway Act, approved November 9, 1921, provided an increase in the annual appropriations for forest roads and made provision for the designation and approval by the secretary of agriculture of two distinct classes of forest roads, namely, forest development roads and forest highway, and established a basis upon which future appropriations should be apportioned for these two classes.

Roads and trails of primary importance for the protection, administration and utilization of national forests or for the use and development of the resources upon which communities within or adjacent to the national forests are dependent, were designated forest development roads.

Roads of primary importance to the state, counties, or communities within or adjacent to the national forests were designated forest highways.

Appropriations for forest and road construction are divided between these two classes as follows: Fifty per cent, but not more than three million dollars of the appropriation authorized for any year, is apportioned to forest development roads and the balance of the appropriation is apportioned to forest highways.

The total of all funds authorized by congress for expenditure in the construction of forest roads up to and including the fiscal year ending June 30, 1930, is $84,500,000, of which amount $83,055,000 have been appropriated.

After the passage of the Federal Highway Act the state highway departments of the states in which national forests are located made a study, in cooperation with the Bureau of Public Roads and the forest service, of the highway situation in the forest areas and designated a forest highway system for each state. These systems have been approved by the secretary of agriculture and consist of a total of 14,413 miles located in 28 states, Alaska and Porto Rico.

A study of the needs for roads of primary importance to individual forests was made by the forest service, and the system of forest development roads, recommended by the forester, has also been approved by the secretary. This system includes all existing or proposed roads within or adjacent to and serving the forests and which are designated as forest roads by the forester.

The forest highway system is divided into classes 1, 2 and 3; class 1 being roads on the federal-aid system or extensions thereof which are wholly within the forests; class 2, roads on the federal-aid system or extensions thereof which are partly within or adjacent to national forests; and class 3, roads which are of primary importance to counties or local communities and which are within or adjacent to the fores

Annual construction program both forest development road forest highways are prepared submitted to the secretary of culture for approval. The fore velopment road program is pre in accordance with the needs dividual forests and is submitt the secretary by the forester. forest highway program is pre as a result of conferences be the state highway department Bureau of Public Roads and th est service.

In arriving at this progra construction consideration is to projects which will improve ing roads or provide new where most urgently needed where construction of ade roads will be of greatest bene traffic.

Responsibility for the prosec of the work outlined in the highway program is vested i Bureau of Public Roads; an work incidental to making su plans and estimates, and handli details of construction is carried by this organization. The b also has supervision and contr all forest development pro where the services of an engi ing organization are required where the estimated cost of work is $5,000 per mile or more.

Maintenance of forest high is undertaken by the federal go ment for a period of two years construction in order to assur integrity of the work during th riod of most rapid deteriorationby the state or county there Frequent inspections are mad the Bureau of Public Roads t sure adequacy of maintenance.

Due to the fact that most o national forests are in mountai country and usually at high tudes the location of forest roa difficult, and the construction h In many cases, however, these are links in very important sta interstate highways and their construction is highly importan order to provide through t lanes from one section of a sta another or from one state to a joining one. In many cases f highways provide the only appr roads to the national parks an this reason their early construc to an adequate standard is hi desirable.

A Monarch tractor and Coleman truck clean snow from Hoosier Pass.

State highway rotary snow plow clearing Monarch Pass on April 4th.—Photo by Patrolman E. E. Hawkins.

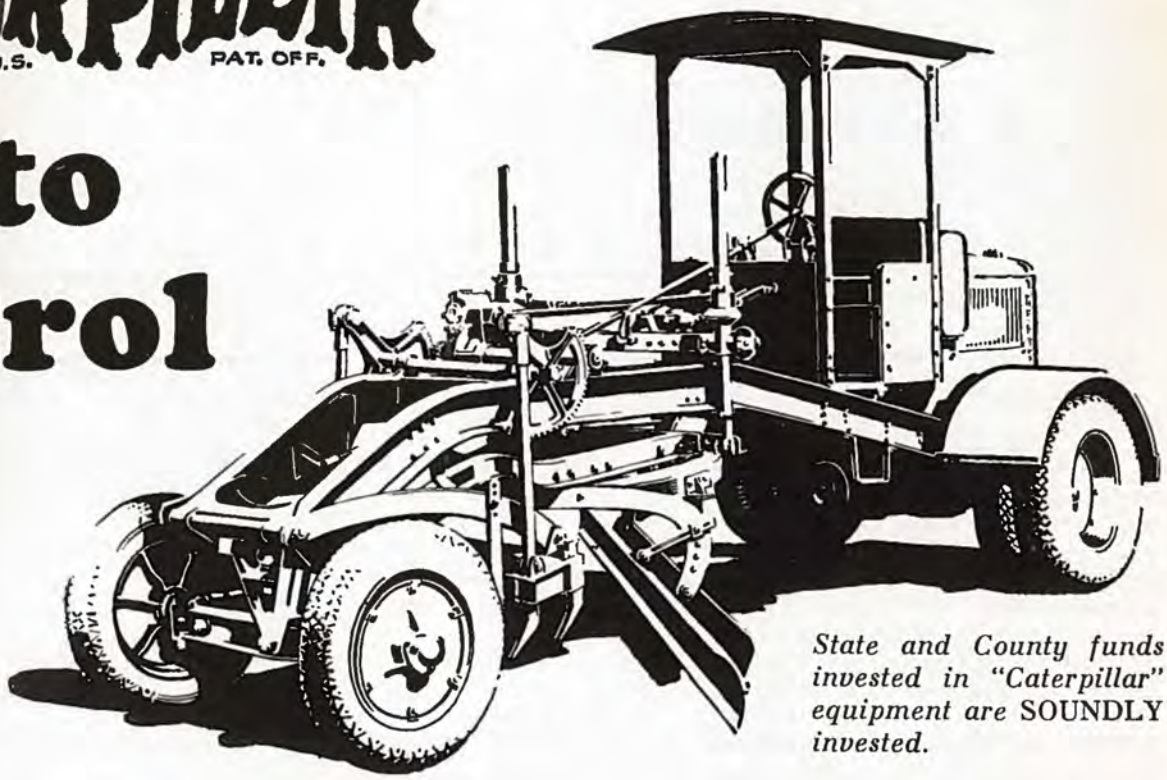
Road Construction in Natio Parks Supervised by Bureau

Since 1924 the engineering ices of the Bureau of Public R

(Continued on page 28)

CATERPILLAR
REG. U.S. PAT. OFF.

Auto Patrol



State and County funds invested in "Caterpillar" equipment are SOUNDLY *invested.*

With One Man in COMPLETE Control

Four Speeds Ahead

—And 2.3 miles per hour reverse. Ahead: 1.8, 3.7, 6.5 and 10 miles per hour! A speed suited to every working condition of road maintenance and a flexibility that makes it easy to match the speed with the job being done.

Perfect MECHANICAL Control

Every operation of the "Caterpillar" Auto Patrol is MECHANICAL and *powered.* Not a maze of cranks and wheels—just five power controlled levers which respond to the driver's touch—and all levers within easy reach.

Power—and then some

The fact that this machine is designed to take a 16-ft. blade if desired is evidence enough of ample power. Thirty-five horsepower "Caterpillar" motor—mounted *back* of the cab. Motor and transmission in *one unit.*

Weight with 12-foot blade, 14,000 lbs. Pneumatic tires, electric lights with battery, and canopy top. F.O.B. Denver, $3,275.

The "Caterpillar" Auto Patrol will be demonstrated on your own roads in your own county—or, if you prefer, we will take you to other counties where it has been purchased and is already on the job. There's nothing so convincing as seeing this remarkable machine in action.

The NEW "Caterpillar" Auto Patrol is not a rehash of any other road machine—and not a makeshift combination. It is a masterpiece of engineering design and thorough testing with one idea foremost —to build a one-man road maintainer worthy of the good name "Caterpillar" has earned over forty-odd years of doing one job better.

Can be equipped with scarifier and either 10, 12, 14 or 16-ft. blade as desired.

Clinton & Held Co., Denver, Colo.

How U. S. Bureau Plans *Road Work*

(Continued from page 26)

have been employed at the request of the national park service for the survey, construction and improvement of roads and trails in the national parks and national monuments. The work involved fits in well with the other duties of the bureau, which supervises similar activities in the national forests, many of which are adjacent to the parks. Since 1926 the cooperative relationship between the two federal agencies has been maintained under a standing agreement entered into in February of that year.

Nearly all the national parks are located in mountainous regions. The location and construction of the roads is both difficult and expensive and calls for the exercise of engineering skill of high order. Esthetic considerations are of first importance. Since the roads are built to provide access to natural beauty spots, their construction must be carried out with as little disturbance and scarring of the landscape as possible.

The roads must be blended into the landscape to a greater extent than is generally practicable. For example, bridges are made to harmonize with their surroundings by such means as the use of local stone facing and the tinting or staining of concrete. Heavy cuts give way to rolling grades and long tangents to graceful curves. The waste of side-hill cuts is not cast down hill to blemish the landscape, but is hauled away and disposed of in locations where it will be out of sight; and all necessary cuts are covered as quickly as possible with, ferns, flowers, or shrubs.

So located as to connect and approach all points of particular interest or beauty, the roads are designed to be traveled at a speed that will afford opportunity for the appreciation of the ever-changing panorama; and ample parking facilities are provided for the convenience of more leisurely study.

This district has charge of the survey and construction of major projects in Yellowstone National Park and Devil's Tower National Monument in Wyoming; Wind Cave National Park in South Dakota; Carlsbad Cavern National Park in New Mexico, and Rocky Mountain and Mesa Verde National Parks in Colorado. The average yearly program totals approximately $1,500,000. The construction of the new Fall River Highway following the high line over Trail Ridge and Fall River Pass from the Fall river on the east to the Colorado river on the west, a distance of 28 miles, is one of this district's major projects. It is financed over a three-year period for a million dollars for grading and structures to a 24-foot shoulder width.

Construction of roads in Yellowstone National Park presents one of our most serious problems in reconstructing its present system without leaving traces of the present road. That is, we incorporate the old into a heavy annual program of new, passing the intense traffic through the workings in the same short season the park is open to either travel or construction. While under way, the traveling public doesn't give us much praise for this, but this procedure is required in complying with the national park's policy to preserve them in their natural state.

SPEAKING OF "SECOND-STORY" CULVERTS

The article with illustrations which appeared on page 16 of the March issue of COLORADO HIGHWAYS is very interesting and demonstrates a unique, economical means of salvaging a concrete pavement while at the same time securing greater drainage capacity.

The photos herewith illustrate another instance where unique methods were employed, although for quite different causes.

Picture A-593 shows a concrete box culvert which was installed to serve a certain purpose. Later on a drainage ditch was constructed considerably deeper than the bottom of the concrete box and it became essary to provide additional d age area.

In this instance Armco corru culverts of the Armco ja method were employed as the simple and satisfactory means.

The original concrete stru was not disturbed in the least at a nominal cost these two cul were jacked into position as sh in picture A-638. They will care of all normal flow, but in of high water the concrete box come into use.

On June 1 the State Highwa partment will open the new way between Palisade and De in Mesa county. The new roa duces the distance between two points to fourteen miles, sa eight miles over the old through Plateau canon.

Graveling of six miles on Canon City-Colorado Springs way has been completed by Fre county commissioners. Three of the Dead Man's canon secti the same road also has been proved by the elimination of s bad curves and gravel surfacin

---

Ten miles of gravel surfacin tween Sedgwick and the Neb state line has been completed cost of $18,438. Completion o project gives a continuous stret gravel roadway from Sterling t Nebraska line. Grading and gr ing of fifteen miles of new ro cated east of Sterling is now u way. This will give a new g road to Fleming and Holyok State Route No. 14.

STATE HIGHWAY DEPARTMENT

Financial Statement Ending April 30, 1931

BALANCES		
State Treasurer	$ 885,930.15	
County Time Warrants	10,333.42	
Revolving Fund	9,500.00	
Total Balances		$ 905,763.57

RECEIPTS		
U. S. Government	$ 457,501.61	
Gas Tax	1,194,978.69	
Internal Improvement	22,700.00	
Highway Receipts	108,363.48	
Total Receipts		$1,783,543.78
Total Balances and Receipts		$2,689,307.35

DISBURSEMENTS		
Federal Aid Projects	$1,133,260.40	
State Projects	163,277.76	
Maintenance	309,074.84	
Maintenance Equipment	21,762.90	
Property and Equipment	19,471.70	
Surveys	5,444.77	
Traffic Signs and Census	2,331.98	
Administration	59,228.98	
Total Disbursements		$1,713,853.3

BALANCES 4-30-31		
State Treasurer	$ 955,620.60	
County Time Warrants	10,333.42	
Revolving Fund	9,500.00	
Total Balances		$ 975,454.0
Total Disbursements and Balances		$2,689,307.3

3% SPECIAL GAS TAX FUND	
Receipts	$ 145,523.2
Disbursements	12,048.6
Balance	$ 133,474.5

Concrete Highways Colorado

Roads That Last!

Everywhere you see new, modern highways being constructed of Cement Concrete.

Cement Concrete pavements embody those qualities essential to modern highways—moderate cost, non-skid safety, durable and long wearing, beauty, practical serviceability, low maintenance.

The photograph above illustrates an example of the Cement Concrete highway. This is the type of splendid, long-lasting highway which is being standardized throughout the West, where the very best in road service is desired.

Colorado Portland Cement Company

DENVER NATIONAL BUILDING — DENVER, COLORADO

Concrete for Permanence

Highway engineers have completed plans for four and one-half miles of concrete pavement northeast of Brush, which includes a railroad overhead crossing of the Burlington tracks. By September 1 it is expected that motorists will ride over a continuous ribbon of concrete from Denver to Sterling, via Greeley.

Five miles of the Ward-Brainard lake road will be widened and improved by the U. S. Forestry service this summer. Engineers are now working on the plans.

A law providing for the use of convict labor in the construction of the Shrine pass highway was passed by the last legislature. It was introduced by Rep. Harry Johns of Eagle county. It is claimed that the construction of the Shrine pass highway will reduce the distance between Denver and Redcliff 96 miles.

Surveyors have started location work on a new road to be constructed between Hamilton and Axial in Moffat county. This road will serve the rich oil field of northwest Colorado.

State highways engineers are now surveying a proposed new road over Whiskey Creek pass in Las Animas and Costilla counties. This pass is 13,000 feet above sea level. Snowshoes are being used by the surveyors.

PLANS BEING DRAFTED

Proj. No.	Est. Length	Type	Location
68-B	4 mi.	Gravel Surfacing	South of Saguache
134-E	6 mi.	Gravel Surfacing	West of Vona
145-C	21 mi.	Gravel Surfacing	East of Rifle
149-H	20 mi.	Gravel Surfacing	Northwest of Limon
150-C	8 mi.	Gravel Surfacing	West of Lay
181-A	2 mi.	Pavement	Idaho Springs
211-B	3 mi.	Gravel Surfacing	North of Hamilton
261-ER		Bridge	East of La Veta
259-B	13 mi.	Gravel Surfacing	East of Gunnison
265-E	3 mi.	Gravel Surfacing	West of Bayfield
263-C	5 mi.	Gravel Surfacing	East of La Veta Pass
270-E	5 mi.	Gravel Surfacing	West of Monte Vista
295-E	8 mi.	Gravel Surfacing	South of Alamosa
278-D	15 mi.	Gravel Surfacing	West of Cheyenne Wells
296-A, B & C R	6 mi.	Pavement	North of Greenhorn
298-E	4 mi.	Gravel Surfacing	South of South Fork
248-B	8 mi.	Gravel Surfacing	South of Buena Vista

PLANS FINISHED

Proj. No.	Length	Type	Location	Note
71-C	5 mi.	Gravel Surfacing	North and South of Hesperus	
298-F	4 mi.	Gravel Surfacing	West of Piedra	
149-F	10.8 mi.	Gravel Surfacing	East of Bennett	
254-AR BR & CR	2.6 mi.	Gravel Surfacing	Byers Canon	
288-AR	4.526 mi.	Pavement	Northeast of Brush	
2-R-11	3.2 mi.	Surfacing	South of Starkville	
2-R-12	4.503 mi.	Pavement	North of Aguilar	

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R10	Bet. Starkville and Trinidad	2.097 mi.	Paving	J. H. Miller & Co.	$109,577.10	19	2-R1
15-B	East of Sterling	18.553 mi.	Grading & Surfacing	Bedford & Woodman, Inc.	237,781.55	32	15-B
78-R	Near Minturn	0.709 mi.	Gravel Surfaced	J. Fred Roberts & Sons	96,342.90	95	78-R
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	46	91-A
134-AR&C	West of Burlington	11.174 mi.	Oil Processed Surf.	H. C. Lallier Const. Co.	111,217.20	30	134-A
134-D	West of Stratton	5.076 mi.	Gravel Surfacing	Mountain States Const. Co.	49,350.50	53	134-D
144-E	North of Fort Collins	1.286 mi.	Concrete Paving	F. C. Dreher Const. Co.	99,187.55	91	144-E
144-F	Northwest of Ft. Collins	10.386 mi.	Gravel Surfaced	Blanchard Bros.	144,180.80	79	144-F
144-G	Betw. Forks & Colo.-Wyo. Line	13.204 mi.	Gravel Surfacing	Morrison-Knudsen Co.	248,078.00	16	144-G
149-C	East of Aurora	7.863 mi.	Gravel Surfacing	Chas B. Owen	130,329.47	51	149-C
149-D	East of Watkins	8.370 mi.	Gravel Surfacing	A. R. MacKey	13,207.82	32	149-D
149-F	Between Strasburg and Peoria	Detour	Bridge	A. R. MacKey	13,207.82	73	149-F
149-G	Denver-Limon	9.778 mi.	Grading and Surfacing	Lawrence Const. Co.	189,623.96	0	149-G
150-B	West of Craig	4.630 mi.	Gravel Surfacing	N. M. Monaghan	73,181.65	0	150-B
151-A	Between Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	0	151-A
151-B	Bet. Fraser and Granby	3.925 mi.	Grading & Surfacing	Utah Construction Co.	63,954.80	15	151-B
189-B	Between Hayden and Craig	2.567 mi.	Gravel Surfaced	C. A. Switzer	91,497.00	50	189-B
189-C	West of Hayden to County Line	7.534 mi.	Gravel Surfacing	F. L. Hoffman	115,356.94	0	189-C
242-D	Betw. Mack & Colo.-Utah Line	9.883 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	124,552.36	19	242-D
242-E	West of Fruita	4.243 mi.	Gravel Surfacing	Wallace Const. Co.	54,907.53	0	242-E
245-C	Between Hadley & La Junta	8.442 mi.	Grading	A. S. Horner	133,383.10	11	245-C
248-B	South of Buena Vista	2.766 mi.	Gravel Surfacing	J. Finger & Son	51,979.50	86	248-B
251-D	East of Boulder	0.284 mi.	Paving	Collier-Latimer	25,598.50	28	251-D
258-I	Between Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	57	258-I
261-AR	Bet. Rifle and Grand Junction	0.053 mi.	Bridge & Grav. Surf.	Herbert S. Crocker	21,300.00	11	261-A
265-D	Wilson Gulch	1.930 mi.	Bridge & Approaches	Grant Shields	29,455.50	69	265-D
271-F	East of Florence	0.593 mi.	Viaduct	Mountain States Const. Co.	57,583.40	81	271-F
272-F	Betw. Manzanola & Rocky Ford	4.097 mi.	Concrete Pavement	Driscoll Const. Co.	122,418.50	7	272-F
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc.	116,829.21	13	278-A
279-H	Betw. Kenosha & Webster	1.691 mi.	Grading	Anderson, Sheldon & Miller	76,636.12	92	279-H
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	31	282-I
282-J	Bet. Rifle and Meeker	0.057 mi.	Bridge & Approaches	Herbert S. Crocker	20,400.00	18	282-J
286-E	Denver-Cheyenne Highway	4.052 mi.	Concrete Pavement	J. Fred Roberts & Son	126,032.85	35	286-E
287-AR&C5	Bet. Kersey and Wiggins	Detour		A. R. Mackey	11,946.05	100	287-A
287-AR5	Bet. Kersey and Wiggins	10.586 mi.	Concrete Pavement	Edw. Selander	251,717.00	5	287-A
287-CR1	Bet. Kersey and Wiggins	10.246 mi.	Concrete Pavement	J. B. Bertrand, Inc.	254,341.70	10	287-C
292-D	Between Wolcott and Avon	9.834 mi.	Graded Surface	Utah Construction Co.	159,143.40	23	292-D
297-C	Southwest of De Beque	9.953 mi.	Gravel Surface	Hinman Bros. Const. Co.	312,453.50	96	297-C
297-D	South of DeBeque	4.198 mi.	Surf. & Bridge	Hinman Bros. Const. Co.	185,230.50	87	297-D
298-C	Bet. Twin Bridges & South Fork	3.780 mi.	Gravel Surfacing	H. C. Lallier Const. & Eng. Co.	116,864.50	87	298-C
298-D	Bet. Del Norte and Durango	4.100 mi.	Gravel Surfacing	H. C. Lallier	164,814.00	15	298-D

Pure Iron Endures

That's Why **Armco Culverts** *have established A Durability Record of twenty-five years to date*

ARMCO CULVERTS installed in the early days of the corrugated culvert industry are in good condition today, ready for many more years of useful service. Those installed today will serve equally well because they are made of the same material—

ARMCO
Ingot Iron

The analysis of this rust-resisting iron has varied but slightly in all these years. The slight difference is due to the successful efforts of the manufacturers to produce a still purer iron.

No iron is 100% pure. ARMCO INGOT IRON contains only ten one-hundredths of one per cent of the six solid impurities—it is the purest commercial iron available today.

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These culverts are widely used under the nation's leading highways and railroads. They are convenient and adaptable. Under shallow covers where impacts are at their greatest, and under high fills where dead loads and shifting and settling fills often prove disastrous to other types of construction, Armco corrugated culverts go on serving long and well.

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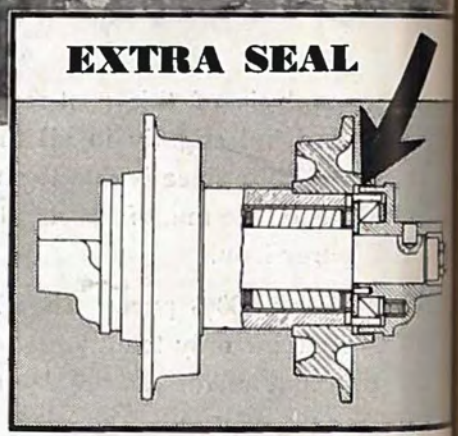

Cross section through truck wheel

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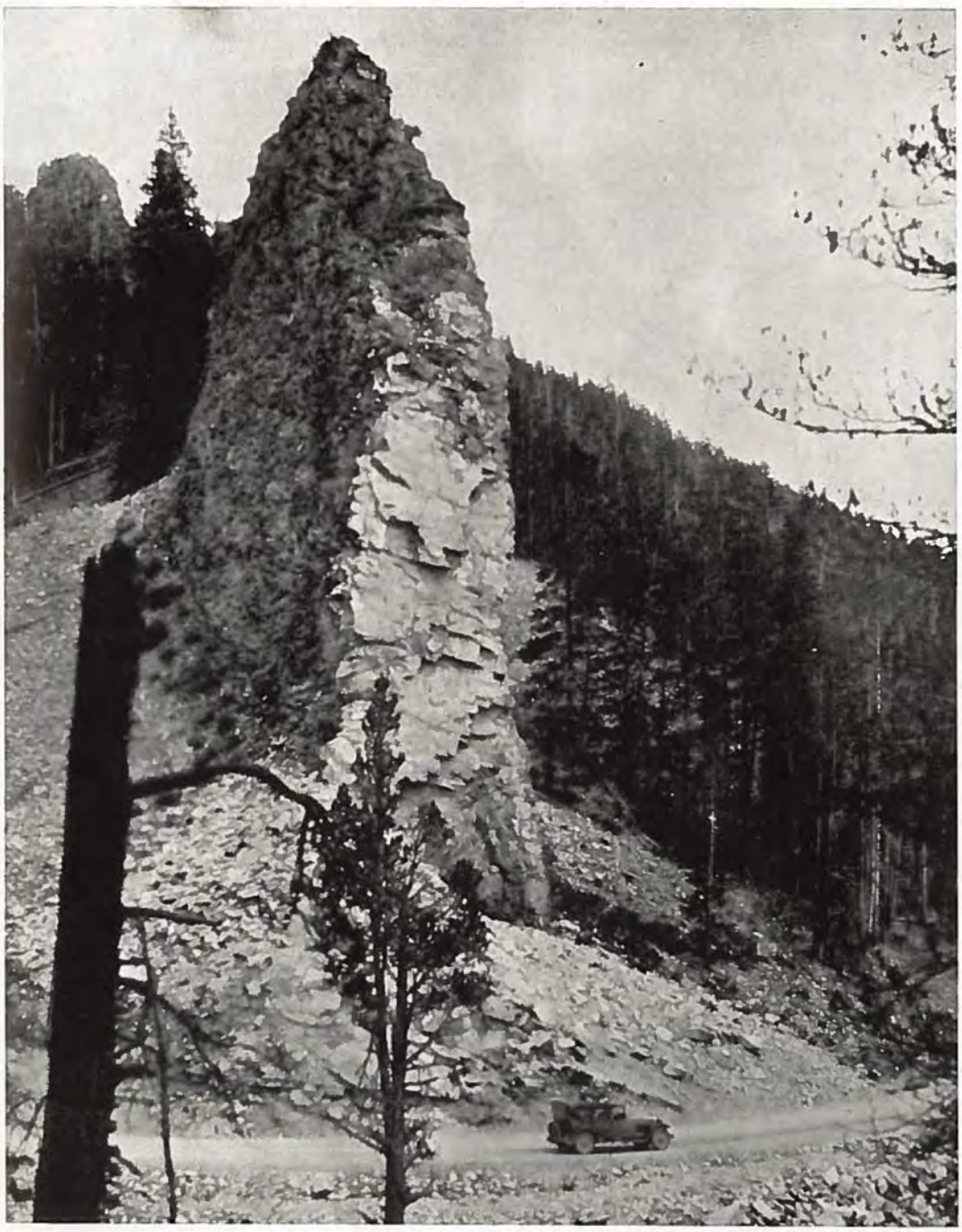

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Colorado Highways

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Articles on the subject of road building and highway development in Colorado are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible.

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Our Cover Picture

ON THE cover of this month's issue of COLORADO HIGHWAYS we show one of the many rock dykes, which add to the picturesque beauty of the Willow Creek pass highway, recently improved between Granby and Walden, located in Grand and Jackson counties. Cost of this improvement was borne by the U. S. Forest Service, the work being done under the supervision of the U. S. Bureau of Public Roads, approximately $250,000 having been expended on this route to date. Photo on cover by Clyde E. Learned, U. S. Bureau of Public Roads.

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Colorado Highways
"BETTER ROADS"
VOLUME X. JUNE, 1931 NUMBER 6

Come Up to *Cool*, Colorful *Colorado*

COLORADO invites the world to come and visit. She extends true characteristic Western hospitality in the spirit of the cordial injunction of the olden days "'Light stranger, and eat!" She adds to her invitation the inducement that no other place on the globe offers such a happy variety of entertainment and interest, in a climate giving such exhilarating health and comfort.

Colorado is the stage, set with the continent's most majestic scenery, where you see America's epic drama in thrilling living pictures. The life of 3,000 years ago contrasts the life of today. Nowhere is there a more alluring story of man's progress from the stone age to the machine age.

Come to the peaks that have looked down upon the ages-old pageant, beginning in the days when the ocean thudded at their granite ribs. Climb the glistening glaciers, remnants of the ice age. Gaze from a mountain height at the billowing prairies, once the ocean bed. See the rocky tombs from which scientists dig the fossilized remains of the strange gigantic creatures that roamed in the vast marshes, upon the subsidence of the waters. Look at the petrified forest where kingly redwoods grew a thousand feet high, beside the ocean. Visit the prehistoric towns and witness man's slow emergence from the barbarism of the caves and pit-houses to the culture of above-ground stone dwellings and open air theaters.

Go back thirty centuries and more to the important day when the secret of the corn was learned and men became farmers and builded America's first irrigation ditches, no longer having to depend upon wild game for food. Journey to the mystical San Juan, to the Mesa Verde where, in the cavernous gloomy pockets of the cliffs, stand the largest, best preserved cliff dwellings. See the Sun Temple, the first "community church;" walk through the shrines of the fire worshippers; the ancient stone age is here more vividly illustrated than by anything Europe can show!

Colorado presents in its "ghost towns" and its still active world—renowned mining camps, the living panorama of the romantic gold-rush days of 1858 and '59, and the swirling sixties. Here came the second, and the last, of the voyagings of America's Pilgrim Fathers. The Mayflower brought the freedom-seeking Anglo-Saxon to the wild and storm-bound coast of New England. In "prairie schooners," oxen-drawn, the treasure-seeking Pilgrim fathers and mothers crossed the perilous plains to Pikes Peak to found another empire and to civilize the Indian-infested wilderness of the "shining mountains."

In Colorado, the first discovery of gold in the Rocky Mountains was made by a white man 128 years ago, and it was natural that Colorado should be the first location of the migration from the east, that populated the western third of the United States. Here, before you, in the work of their hands, is the record of the heroic achievements of the pioneers.

There has been no perishing from the earth of the old, here in Colorado. True, the plains no longer echo to the thundering herds of bison, but you see in the mountain parks these "hump-backed cattle" of the Spanish conquistadores. Deer, elk, bear are in the mountains. The streams are filled with trout. The beaver ply their trade of carpentering. The eagle zooms in the turquoise bowl of the sky.

Colorado has advanced in progress, keeping step with every modern achievement, yet in no way has it lost its atmosphere of unspoiled grandeur. Where explorers, fur trappers, prospectors followed Indian trails, now boulevard highways of easy grade lead up to, and over, the roof tree of the continent. Without effort, you reach the most glorious vistas known to man. Up Mount Evans is the highest motor road in the world! Colorado has more high peaks than any other state in the Union, and from the plains to the eternal-snow heights, there is more infinitely varied flora and fauna than is observable elsewhere in North America.

High, cool, colorful Colorado offers you in its pure, dry air, its life-giving sunshine, and purest of mountain-snow water, health for body and mind. Here in nature's most beautiful garden, there is the constant unfolding of new delights to every sense. Camp and fish in the forests; motor wherever you fancy; pitch your tent by the singing stream or enjoy cottage, cabin or hotel—there are all kinds, fitted to every wish. Here is entertainment, hospitality and every aid to perfect pleasure and rest.

Come up to Colorado, where everyone and everything bids you welcome!

New Roads *Uncover Hidden* Lake

Falstaff—Prithee, no more prattling; go. I'll hold. This is the third time; I hope good luck lies in odd numbers. Away! go. They say there is divinity in odd numbers, either in nativity, chance or death. Away!

A TANNED, lean face looked over the volume of Shakespeare and Sir George Gore, marking with his finger the page in "The Merry Wives of Windsor," quizzically regarded his companion, the bearded, long-haired, buckskin-garbed trapper and guide, Jim Bridger.

"Well, Jim," he said, "What do you think of Falstaff's remark about divinity being in odd numbers?"

"Mr. Gore, I don't believe that fat Dutchman, Full-stuff, knew what he was talkin' of. No, sir; Wagh! They ain't no good luck in numbers, odd or even. They ain't no luck in any numbers, ef ye's afoul a lot o' redskins whoopin' to lift yer ha'r."

"Speaking, of course, from the standpoint of the wilderness, where one man finds the odds are against him when there's more than one antagonist," amusedly said Sir George. "Falstaff speaks as a European and you, Jim, as a Rocky Mountain man."

"He wa'nt no hunter, that Full-stuff. I'd be obleeged, Mr. Gore, if ye'd read that thar sayin' over again careful so's I kin ketch each word."

It was the nightly diversion of the millionaire Irish baronet and the celebrated mountaineer, the hour of reading after the late dinner. The scene was a large square tent, luxuriously fitted with folding furniture; the ground spread with bear and buffalo skins; brass candelabra on the table which half an hour before had been spread with fine china, sparkling glassware and gleaming silver. As usual, dinner had been served by a butler in full and correct apparel for that office. On the damask cloth was a carafe of sherry, biscuits, and a humidor—box of cigars.

The campfire burned brightly in front of Sir George's tent this cool

The waterfall where Black Creek empties into Black Lake.

summer night of 1856, seventy-five years ago. The flames were reflected in the still waters of Black Lake. The camp for several days had been pitched on the north shore of the lake. In the baronet's party were half a hundred persons. Seventy-five years ago, two years before Green Russell led his Georgians to Cherry Creek and the Platte River on their search for gold, which resulted in the carving out of the wilderness of what is now the state of Colorado. It was this visit of the Irish millionaire that gave to the mountains towering beyond Black Lake the name, Gore range.

Black Lake is a hidden lake, a considerable body of water of unknown depth, icy cold, filled with trout, and a mile long and a half mile wide. It is one of the most enchanting spots in Colorado and, because of Sir George Gore's camping there, occupies a romantic chapter in the early history of the state.

For three quarters of a century it has remained unknown, because inaccessible, but now it is another illustration of how good roads in the mountains disclose, as out of hitherto locked chest, gems jewels of unforgetable beauty.

The state highway from Geo town, over Loveland Pass, to lon will cut considerable distance the present route to Black Lake, will offer an easier, quicker proach from the east. The high project over Shrine Pass, which bring near the Mount of the H Cross to motorists, will afford easier, quicker and shorter appr to Black Lake from the west south. This is the road now un construction from Redcliff Wheeler.

Black Lake lies at the foot of Gore Range, in the Leadville tional Forest in Summit County is between Kremmling and Dil and five miles west of Blue Ri The altitude is 8,800 feet, and either way now available from D ver is 145 miles from the capital c It is reached over government state roads, main highways open year around.

One route is, from Denver Golden, through Idaho Springs, Berthoud Pass—11,309 feet ab sea level—through pastoral Mid Park to Kremmling, then up Blue River to Black Lake. other way is Denver to Fairplay South Park, over Hoosier Pass Breckenridge and Dillon and al the Blue to Black Lake.

Either way is of unusual inter both in a scenic and historic se for the highways traverse the gions where gold was first covered in the Rocky Mounta "Ghost towns," once world-fam mining camps, vie in interest w the grandeur of canon, rush rivers, high peaks and passes. It on the Platte, near where Fairp now stands in South Park, t James Purcell, a carpenter fr Kentucky, who had taken ref with the friendly Utes, from w ring plains Indians, in 1803 pic up nuggets of gold. He was the white man to discover gold in

Rocky Mountains. When taken prisoner by the Spanish while on a trip to Santa Fe, Purcell steadfastly refused to disclose the place where he had found the gold. For this he was a captive in Santa Fe for seventeen years!

Completely surrounded by national forests, Black Lake is one of the very few privately-owned properties in government territory. The property consists of 526 acres, and was homesteaded by the late H. A. Jonas, a noted pioneer, in the sixties. It was purchased from his heirs in 1925 by George W. Olinger, a prominent citizen of Denver, and the property improved by the building of two stone and massive log chalet-style modern dwellings with baths, plumbing, great stone fireplaces, and completely furnished. These chalets are of eight rooms each. There is a complete fish hatchery; a large barn; ice house; saw mill; boat house accommodating five boats; a power launch, two rowboats and two flat-bottom boats. Sufficient pasture is fenced with barbed wire to care for horses during the summer. Picturesquely blending into the ruggedly beautiful shore line are the old ranch houses, one of six rooms and two cabins of two rooms each. Everything is provided to give a perfect mountain home to the man who finds zest and a longer lease on life in his enjoyment of the out-of-doors.

Black Lake lies in a valley, sunny and aspen-groved and filled with wild flowers; beaver build in the streams, deer graze in the meadows, the rabbits are bounding comets; and in this exquisite park adjoining the lake apparently every bird known to the Rocky Mountains has its home.

Gentle, forested mountains enclose the valley to the north and east, and it is walled to the south and southeast by high peaks, Mount Powell and Mount Dora, whose summits, close to 14,000 feet above sea level, apparently support the sun-sparkling turquoise dome that is the Colorado sky. These peaks, rising from the shore of the lake, are covered to timber line, 11,000 feet, with as perfect and dense a spruce forest as can be found in the Rockies. Between the mighty pinnacles is Black Creek Canon.

Through the narrow canon flows the stream, filled with gamey native and rainbow trout, and affording—all on the property—a mile and a half of as sporting a fishing course as there is in North America. Black Creek leaps over the granite cliff into the lake, a diamonded, flashing waterfall, joyously framed by the twilight stretches of massive Englemann spruce in what is truly a "forest primeval."

Black Lake, when the deep waters are still, becomes a great mirror, reflecting forest and snow peaks.

And towering in the background is the Gore Range, majestic, aloof, far above the merry world of flower-carpeted glens and fragrant forests, laughing streams and rippling lake. Below the riven, crenellated summits of these awesome mountains are snow banks that last the year around, dazzling white against the gray and shadowed blues of the starkly sliced abysmal walls.

Black Lake remains a fisherman's and hunter's paradise. Nothing has changed since the day Sir George Gore saw it. Game abounds in the wild country surrounding: deer, elk, bear, coyotes, grouse, sage hens. Adjoining the lake is a marsh of 75 or 80 acres offering excellent duck shooting. The trout in Black Lake are of even size, 11 to 12 inches, but many 14 and 15-inch trout are caught each summer. The meat is firm and delicate in flavor, as this purest of mountain water is always cold. The average temperature in summer at Black Lake is 70 degrees. The highest ever reached was 85 degrees.

Those who have fallen under the spell of Black Lake pronounce it the most beautiful spot on earth. And who, once he has seen this great liquid emerald sparkling with the fires of the sun, hasn't felt the enchantment of the setting?

Centuries-old forests that laughed with the bluejay when Columbus sailed from Spain to find the new world, carpet with blue-green the towering peaks that glow in a world made double, when Black Lake becomes a magic mirror. So deep is

the lake and so dense the forest—many of the spruce reaching 175 feet in height—that the word Black is truly descriptive.

"It is the illusion that is real in the never-wearying living drama on this sublime stage of nature, where eternal snow on the granite roof of the continent heliographs the passage of the sun," said a writer who visited the lake with a party of distinguished Easterners last summer, "and where each cool and fragrant breeze turns the surface of Black Lake into crinkled gold on jet."

In his "Thirty Years of Army Life on the Border," published in 1866, Colonel R. B. Marcy tells of famous pioneer characters who knew Black Lake, and the circumstances leading to the christening of the Gore Range.

"Scattered here and there throughout the wilds of the Rocky Mountains are still remaining a few of those semi-civilized white men called 'mountaineers,' who wandered from their homes in the border states early in life, and enlisted in the service of the different fur companies," he wrote. "Many of these peculiar and interesting people have spent the greater portion of their lives and grown gray in the rough and adventurous life incident to their occupations as hunters and trappers, and the history of their experiences teems with thrilling incident and reckless personal adventure.

"At the time the American and Northwest Fur Companies were at the height of their prosperity, and when beaver fur was worth $10 a pound, these men were employed in Montreal, St. Louis, and other places on the frontier for a term of years, and from the time they left the settlements, until their return, they seldom tasted bread, sugar, tea, coffee or vegetables. Like the prairie Indians, almost their only subsistence from one year's end to another, consisted of fresh meat, and even this was only supplied by the precarious results of the chase. The rifle furnished their entire commissariat, and, as a necessary consequence in a locality where game did not abound, they were often subjected to great suffering from hunger.

"Notwithstanding the privations and perils to which these people were constantly exposed, and the slender pecuniary profits which they derived from their avocations, strange as it may appear, I have yet to see the first one of them who did not become fascinated with the life,

A modern shovel moving huge dirt and rock slopes from Berthoud Pass highway in order to make travel over this world-famous route more easy and pleasant for the motorist. Over $500,000 is being expended by the government this summer in widening and straightening this road, which forms an important link in the Victory highway.

and it is seldom, if ever, they can be prevailed upon to abandon it. It seems to possess for them a charm of excitement and romance which no other occupation can supply.

"I have known several of these men who returned to the settlements after years spent in the Indian country, intending to abandon their roving life; but they soon became restless and discontented, and, after a brief period, went back to the mountains and resumed the habits of the trapper.

"Among these people, one of the most interesting specimens it has been my fortune to meet with, and one who occupies an exalted position among his confreres as a successful trapper and hunter, and who has no superior as a reliable guide and bold Indian fighter is the well-known veteran mountaineer, Jim Bridger, who has passed the major portion of his solitary life in the Rocky Mountains, far removed from all intercourse with civilized society.

"When I first met him at Fort Laramie in 1857, he was a man about sixty years of age, tall, thin, wiry, and with a complexion well-bronzed by toil and exposure, with an independent, generous and open cast of countenance indicative of brave and noble impulses, which are characteristics of the hunter generally. His history, pregnant as it is with scenes of startling personal incident, interested me supremely."

Bridger was a native of the "Old Dominion," and had come to the headwaters of the Missouri about thirty-four years before, and was there engaged for many years in trapping. From thence he wandered south and ultimately establi himself upon Black's Fork of Gr River, one of the two princ tributaries of the Colorado. Her erected an establishment which called Fort Bridger, and here he for several years prosecuting a pr itable traffic, both with the Ind and with California emigrants. length, however, his prosperity cited the cupidity of the Morm and they intimated to him that presence in such close proximity their settlements was not agreea and advised him to pull up sta and leave forthwith; and upon questioning the legality or justic this arbitrary summons, they ca to his place with a force of "ave ing angels," and forced him to m his escape to the woods in order save his life. He remained secre for several days, and through the sistance of his Indian wife, was abled to elude the search of "Danites," and make his way Fort Laramie, leaving all his ca and other property in possession the Mormons.

From Laramie he, for the fi time in thirty-one years, returne the States, and laid his case bef the authorities at Washington. was on his return that Colo Marcy met him. "As may be im ined," writes the Colonel, "he did entertain the most friendly feeli for the 'Latterday Saints,' and would not probably have gone ye far out of his way to have 'sa their sculps,' as he termed the s ages' battle trophy."

Bridger had been the guide, in preter, and companion of that

(Continued on page 18.)

Willow Creek Road Completed

By M. F. EGAN

THE Willow Creek Pass Forest Highway, which is designated as Route No. 24 of the Colorado highway system, is located between Granby Junction—three and one-half miles west of Granby—in Grand county, and Rand—25 miles south of Walden—in Jackson county, a distance of 34 miles. This highway derives its name from Willow Creek Pass, a relatively low pass over the Continental Divide, elevation 9,683 feet. It is also part of Route No. 125 of the state highway system connecting U. S. Highway No. 40 at Granby Junction with State Route No. 14 at Walden, and when completed will be a part of the most direct route from Denver to North Park.

Commercially important, due to its livestock, agriculture and oil industries, North Park is also noted as being one of the areas in the state where hunting and fishing abound, and for this reason it is a favored tourist and recreational center. A circle trip of exceptional interest will also be available upon the completion of this route. Starting at Denver, this trip includes Berthoud Pass, Middle Park, Willow Creek Pass to Walden in North Park, then over Cameron Pass to Fort Collins and return to Denver.

The Willow Creek Pass Forest Highway Project, which has been surveyed by the Bureau of Public Roads, is that portion of the highway between Willow Creek Pass and Granby Junction and is 22.33 miles in length.

This report covers the construction of Section "A" of the project. This section begins at the summit of Willow Creek at station 0-00 and ends five miles southeast of the pass at station 264-00. This is the initial section of the project and is wholly within the Arapahoe National Forest; a key map for reference is in the appendix.

The survey for this project was included in the 1928 fiscal year program at a joint conference of state, forest service and bureau representatives on January 28, 1927, at which time it was recommended that an allotment of $7,500 forest highway funds be set aside for the survey of the 25 miles of road between the top of Willow Creek Pass and Granby Junction.

Showing section of the newly completed highway on the eastern slope of Willow Creek pass, forming a part of the U. S. Forest highway system in Colorado. This route leads from Middle Park into the Walden region, sometimes called the "fisherman's paradise."

On January 9 and 10, 1928, at a joint conference of state, forest service and bureau representatives for the purpose of deciding on forest highway recommendations for a program for the 1929 fiscal year, it was recommended that an allotment of $74,000 forest highway funds be made for the construction of five miles, beginning at the top of the pass and extending southerly toward Granby, this piece being designated as Section "A." This program was approved by the secretary of agriculture on May 21, 1928.

The project was surveyed between August 8, 1927, and October 14, 1927, the location being made by Mr. S. A. Wallace, chief of party, District No. 3; a report of the survey has been submitted. The survey was 22.33 miles in length. The total cost of the survey and preparation of the plans was $6,368.35.

Plans and estimates for the entire project were prepared in the district office during the winter of 1927-28, the design being made for a 12-foot, 1926 standard earth graded and drained road.

The original length of the section was 5 miles, this length being reduced to 4.834 miles by line changes after the project was let.

The location estimate was for $74,057.83, and included 10 per cent for engineering and contingencies.

The engineer's estimate, excluding any amount for engineering and contingencies, was $67,325.30. The bid of the Pioneer Construction & Engineering Corporation was for $59,781.40, and that of Hamilton & Gleason was for $69,675.30. A tabulation of these bids is appended to this report. On June 30, 1928, the district engineer recommended that the low bid be accepted. The contract was awarded on July 10, 1928, the secretary approving same July 25, 1928.

The Pioneer Construction & Engineering Corporation is considered to be a reliable and experienced firm which has had several previous contracts with the bureau.

The contractor anticipated the approval of the contract and set up a camp at station 125 on July 13, 1928. From station 0-00 to station 105-00, the surveyed line was in heavily timbered country, and from station 105-00 to station 264-00 the clearing was light. The contractor used a one-yard Osgood steam shovel to excavate with and originally planned to ship it to Granby, then move it overland to the lower end of the section and work uphill, thereby allowing the right-of-way to be cleared without its interfering in any way

with the grading operations. Investigation disclosed the fact that the road from Granby to Section "A" was in many places too narrow to permit moving the shovel over it without doing considerable work, and that the bridges over Willow Creek were so weak they would have to be strengthened and in some instances completely rebuilt. About 30 miles north of Willow Creek Pass the Laramie and North Park Railroad has a siding named La Rand; at this point the shovel was unloaded and with the help of a Coleman truck was moved to the top of the pass and started digging at station 0-00 on July 21, 1928.

The steam shovel worked steadily throughout the season, losing very little time on account of weather or breakdowns. Two 3-yard Indiana dump trucks moved the excavated material from the shovel. Coal was delivered to the work from Coalmont in North Park, a haul of approximately 34 miles. One Ford truck was used to haul coal from the stockpiles to the shovel and at times hauled water. A small gasoline pump usually delivered water to the shovel by a pipeline. A rented Gardner-Denver air compressor was used from July 9 to September 1; all the cuts in which the contractor thought rock would be encountered were drilled and shot. Four teams were worked the entire season and additional teams were employed when they could be secured. These teams were to be used in finishing the grade behind the shovel, but the contractor had to use them to skid logs during most of the season.

Between stations 37-65 and 38-50 the located road crosses a rock dyke. This dyke is from 20 to 25 feet wide and from 100 to 135 feet in height. It rises out of the ground as a sheer wall, the side slope of the road requiring a slice to be taken off of it. This piece of work was sublet to three station men, who started drilling on July 9, 1928. Holes 15 feet deep and five feet apart were drilled on the slope line and shot. This method was successful until the third set of holes were fired, then the wall broke at a seam about 20 feet back of the slope line. The excess rock was used to widen the bank on the outside of the road. One team and a stoneboat moved the material.

Corrugated metal pipe culverts, minimum diameter 24-inch, were installed to take care of surface drainage. All culverts required were delivered on the section during 1928 and were placed ahead of the grading. Where the road crosses Trail Creek, and the three tributaries to Trail Creek, log crib timber bridges, 10-foot span, were to be erected. No bridges or headwalls were built in 1928 and very little finishing was done, which later was admitted by the contractor to have been a mistake.

Looking south from the summit of Willow Creek pass, showing rock dyke which ... blasted away to make room for the road, and showing condition of road before finishi... Photos by courtesy U. S. Bureau of Public Roads.

During the season the contractor worked an average force of 20 men and four teams. He moved approximately 35,500 cubic yards of material from July 21 to October 17, working 89 shifts, averaging about 400 cubic yards per shift.

On Friday, September 7, 1928, a forest fire started at station 76. The steam shovel was working at this location at 11:30 a. m. when work was suspended for the dinner hour. After work was stopped the right-of-way was patrolled to see that no sparks had ignited any underbrush. The shovel was equipped with a spark arrester, but occasionally sparks had escaped and the regular procedure on the work had been to patrol the right-of-way after the shovel ceased working, as everyone realized the fire hazard in the heavy timber.

One hundred and one acres were burned, extending from the right-of-way eastward to the crest of the Continental Divide.

The contractor suffered no loss of, or damage to, equipment, but paid for the burned timber and the suppression of the fire, which amounted to approximately $1,200.

The contractor, after reviewing his 1928 progress, was evidently impressed by the amount of unfinished work that would have to be done during the 1929 season. He opened camp on June 12, 1929, increasing ... capacity from 25 men to 50 m... His superintendent was replaced ... an experienced and competent fo... man, and a timekeeper was ... ployed. After overhauling ... shovel it was started digging ... June 20.

During this season, because of ... longer haul, more rain and some ... lay waiting for a compressor, ... shovel moved less yardage per s... than in 1928, averaging about ... cubic yards per shift. The aver... yardage moved per shift for b... years was approximately 325 cu... yards.

A finishing crew was organi... and starting at station 0-00 on J... 20, worked downhill toward sta... 264, the end of the section. T... crew was composed of from 15 ... 20 men, three teams and one F... truck. A new Galion grader w... a scarifier was provided. Prac... cally all the side ditches on the s... tion had to be shot out and becau... there was no compressor on ... work, the drilling was done by ha... This proved to be a slow and co... method, but it was not until July ... when the shovel encountered ma... rial in the cut at station 217 wh... it could not handle, that the c... tractor saw fit to secure a compr... sor. He rented a second-hand o... hammer compressor with a secon... hand Fordson for power and af... two weeks of futile effort with ... secured a new 3-hammer Schra... compressor, the use of which e... abled the finishing crew to speed ... so that the section was finished O... tober 1.

The cost of finishing was e... tremely high. The crew took ...

days to finish the section. Two-thirds of the time was spent on the upper two and one-half miles, which portion was roughed out by the shovel in 1928.

A bridge gang consisting of a foreman, seven men and one team, started constructing bridges on July 3. These structures were standard log crib timber bridges, 10-foot span, and were located at stations 122-83, 175-13, 196-00 and 235-60. Local logs were used for the cribs and Oregon fir was secured and used for the decks. The bridges were completed September 15, 1929.

The headwalls for the minor drainage structures were cement rubble masonry. The construction of these walls was purposely delayed until the roadbed was practically finished in order to save the walls from any damage which might be occasioned by falling rocks or by dumping them with fresno or grader.

Nine thousand four hundred pounds of explosives were used, which were furnished by the government, and the contractor used about 8000 pounds which he secured from other sources.

No difficulty was experienced in obtaining and keeping good labor on this contract. A suitable camp was maintained by the contractor and he supplied good and sufficient food for the men. Slightly higher wages were paid than the prevailing scale in the vicinity, and the men were satisfied to stay on the work. Following is the scale of wages paid:

Shovel operator	$8.00	per day
Shovel fireman	5.00	per day
Truckdrivers	5.00	per day
Drillers	.62½	per hour
Powdermen	.62½	per hour
Bridgemen and finishing crew	.62½	per hour
Teamsters and other laborers	.50	per hour

Section "A" as constructed is an earth graded and drained type, 12-foot roadway, 1926 standard. The initial station is 0-00, the terminal station is 264-00; the length is 4.834 miles.

On account of snow conditions the width of the cleared right-of-way between stations 0-00 and 105-00 is 80 feet, whereas on the remainder of the section the cleared right-of-way is 60 feet wide.

The largest structures are standard log crib timber culverts, 10-foot span, of which four were built. The other structures are 24-inch or 30-inch corrugated metal pipe culverts with cement rubble masonry headwalls.

Two changes were made during 1928 affecting both the alignment and grade of the located road. The first of these, between stations 76-25 and 120-51.2, was considered a major change and was covered by Change Order No. 1. Here the location is on the north side of Trail Creek on the sidehill. The original line held high above the creek and, descending in an easterly direction on a slack grade, turned north at station 93, using a 20-degree curve, headed a drainage north of station 93, then turned southeast at station 100-50, using a 100-foot radius curve, then continuing to descend, crossed Trail Creek at station 123. The maximum grade on this line was 5 per cent, the maximum curve 100-foot radius, the length from station 76-25 to station 120-51.2 being 4,426.2 feet. The relocated line, utilizing some 6 per cent grade, descends along the sidehill, crosses the drainage on a 10-degree curve and connects with the original line at station 120-51.2. The maximum grade of the relocated line is 6 per cent, the maximum curve is 10 degrees, the length is 3,459.8 feet, a decrease of 966.4 feet. A saving of $4,728.99 was estimated to have been made by the relocation.

The other change occurred between stations 239-97 and 264-00. The original line using a 3.43 per cent adverse grade climbs over the shoulder west of the confluence of Trail and Willow Creeks, then descends, using a 6 per cent grade. A 200-foot radius curve was located on the crest of the shoulder. The relocated line is lower than the original line, using a one per cent adverse grade to get onto the shoulder, and a 16-degree curve to go around the shoulder and then descends on a 3.18 per cent grade. It is 96.2 feet longer than the original location and about $400 cheaper to construct.

During 1929 work on Section "A" was carried on in conjunction with Section "B," which was also let to the Pioneer Construction & Engineering Corporation, on August 8, 1929.

One of the standard log crib timber bridges constructed as a part of the project. Headwalls are of cement rubble masonry.

INQUIRIES RECEIVED BY A. A. A. CLUBS INDICATE HEAVY TRAVEL TO WEST THIS SUMMER

Inquiries received by the more than 1,000 A. A. A. travel bureaus throughout the country indicate that many thousands of car owners are planning tours to the far western states this summer, with Colorado and Wyoming especially favored as touring objectives, according to Rocky Mountain Motorists, the local A. A. A. auto club.

Pointing out that the ten states in the far west now have a $100,000,000 road program under way, the automobile association declared that the speeding up of highway construction has been an important factor in increasing the flow of travel toward the Rocky Mountains and the west.

"While only a small proportion of the motorists of the country have actually visited the west," said the local motoring body, "the building of highways and the development of adequate motoring facilities has strengthened the position of this section on the travel map of the nation.

"One of the best indications of this is the number of great national conventions being staged in this area. These national gatherings provide the incentive for car owners to take their families and combine business and pleasure in an extended motor trip. All this means definite returns and paves the way for Colorado and Wyoming to reap a greater share of the more than $3,000,000,000 now spent annually by motorists for vacation travel."

Highway *Research Data* Distribute

EVERY research agency has in its files many reports containing research data which for one reason or another are not extensively published, but which would be of great interest to other workers if they knew of their existence. The Highway Research Board of Washington, D. C., frequently receives copies of such information and it is the intention of the Research Information Service to distribute from time to time abstracts of all such reports that it has at hand, in the belief that they will be found interesting and helpful. This circular is the first of the series.

It is hoped that the laboratories and other research agencies will adopt the practice of sending to the board copies of all reports and data that can be released for this purpose. Abstracts of important research articles in publications that do not have comprehensive circulation among highway research men may also be included.

The Effect of the Gradation of Coarse Aggregate on the Density and Strength of Concrete—D. V. Terrell, Professor of Civil Engineering, University of Kentucky.

Results of two series of tests are given. The first series contained eight different gradations of gravel. The water-cement ratio was kept constant at .77. The mixes were designed to have a cement factor of 1.4 and to have enough sand to overfill the voids in the coarse aggregate by 25 per cent. The second series contained three different gradations of both gravel and crushed stone. Water-cement ratio was kept constant for the gravel at .77 and .83 for the stone. Tests made to determine slump, density and compression strength of concrete.

Insofar as these data are concerned, Professor Terrell concludes that the gradation of the coarse aggregate does not affect the density or strength, but that slump is affected. Also one size aggregate if larger than one inch is not satisfactory and that density decreases as the water content increases.

Contracts let for excavation and back-filling jobs as a means of preventing frost-heaving on routes to be paved this year—Minnesota Highway News, January 4-11, 1931.

Five contracts totaling 125,000 cubic yards of excavation at a cost of $93,347 were let by the Minnesota Highway Department as a means of preventing frost-heaving. This includes excavating the undesirable type of soil and back-filling with suitable material. The amount of excavation on these jobs varied from 9,000 cubic yards to 44,000 cubic yards. Interesting and useful information will be obtained by observing developments at the locations where these special subgrade design measures were used.

Hot Aggregates—Their Effect on Concrete—Minnesota Highway Department.

The aggregates and water in these tests were heated to give batch temperatures of 70,100 and 130 degrees Fahrenheit when discharged from the mixer. The temperature of mixing water was considered important on account of its high specific heat. To obtain the same workability, as measured by the table, it was necessary to add water to the warmer mixes. concrete specimens were tested compression and cross bend Time of set was determined by ing several flow specimens and ing them at different intervals. results showed that the warmer concrete, the more rapid the set Strength tests (3, 7, 14 and 28 d showed that strength decrease the temperature increased and less than half the difference strength was due to the additi water in the warmer concrete. additional tests made at the diffe temperatures using a constant w cement ratio, the 28-day transv tests showed that concrete place 130 degrees Fahrenheit lost app imately 20 per cent of its stren

Field Tests — Concrete Curi (Series 1925)—By T. E. Stan Materials and Research Engin California Highway Department

A section of the newly completed standard Federal Aid highway on Kenosha pass Park county, constructed by the State Highway Department, eliminating the steep grade between Denver and the western slope. The old grade over this two-mile sect was almost prohibitive in low for most cars.

Tests made at Davis, Yolo county, on California Standard 1-2-4 concrete laid in 1925. All sections were covered with burlap immediately after laying and with earth on the following morning. The table shows the results secured at 14, 21, 28 and 90 days, and at 1, 3 and 5 years on pavement cured with water from 0 days to 14 days.

Date Cured	Watering Period (Days)	Average Core Strengths Days 14	21	28	90	Years 1	3	5
7-25	14	3227	3789	4160	4255	4393	6230	6130
8-25	12	3401	4021	4328	4823	4531	7130	6460
9-25	10	3069	3616	4103	4382	4631	6620	6280
0-25	8	3307	3404	3809	4168	5089	6436	6490
1-25	7	3025	3483	4070	4812	4751	6176	6480
2-25	3	3904	4241	4045	4580	4914	6770	5820
3-25	0	3252	3349	3755	3412	3511	5203	4930

The strength of the section which received no watering remained the weakest at the 5-year test period. The relatively close agreement in strength of the sections wetted from 3 to 14 days, shows the importance of effective early curing.

The early strength data on this investigation were reported by Mr. J. L. McKesson in the Transactions of the American Society of Civil Engineers, 137-150, Vol. 91 (1927).

Tests on Transverse and Center Joints in Concrete Pavements—Reported by Searcy B. Slack, Bridge Engineer, Georgia Highways, Vol. 3, No. 2, February (1931).

Tests of the effectiveness of different type joints in transmitting loads from one slab to another were made by applying a heavy load on one side of the joint by means of a jack-type loadmeter and by measuring the deflection of both slabs at the joint or crack by Ames dials. The types of joints tested were: (a) a doweled center joint of the usual type; (b) a 2-inch open joint across the pavement without dowels the edges of the slabs being free to move; (c) an ordinary transverse crack about one-sixteenth inch wide; (d) a doweled transverse joint, formed by a one-half inch strip of bituminous felt through which were placed three-fourths inch smooth bars 4 feet long, spaced 2 feet 8 inches center to center. One end of the bars was greased and inserted in an expansion sleeve. The tests were made on Georgia Standard pavement 7 inches thick at the edge, 6 inches thick at the center and 20 feet wide.

The deflections for a load of 10,000 pounds measured to one ten-thousandth of an inch show averages as follows:

Where Made	Deflection on Side of Load	Deflection on Side Away from Load	No. of Tests	Remarks
Center Joint.....	57	50	2	Consistent results
Half-in. Exp. Joint..	132	17	5	Erratic results
2-in. Exp. Joint.....	197	24	5	Fairly consistent results
Transverse crack ...	155	60	5	Fairly consistent results

The results indicate that the "V" type center joint with dowels is very effective in transmitting deflection across the joint. The dowel bars passing through one-half inch bituminous material were not effective in transmitting deflection from one side of the joint to the other. Dowel bars make it difficult to spade the concrete adjacent to the expansion joint properly and frequently honeycomb or stone pockets occur below or adjacent to the bars. Based on these observations, a proposed method of reinforcing edges of paving slab adjacent to transverse joints is suggested. Detailed drawings of the various joints are given.

New Mexico's Experience with High Viscosity Oil—By E. B. Bail, Construction Engineer—New Mexico Highway Journal, February, 1931.

California oil of 340 viscosity (Engler) mixed in place with disc and blade gave a more stable surface than did the 65-70 oils, especially in the presence of moisture. Such material can only be economically worked in fairly hot weather, unless a plant mixing method is employed. The report gives comparative costs and describes the experimental development of the process.

Cement-Bound Roads in Ireland—County Donegal—By John Caffery, County Surveyor. From the "Surveyor and Municipal and County Engineer," April 10, 1931.

A description of the resurfacing of seven and a half miles of cement-bound road. It was constructed in half widths to convenience traffic, and placed non-continuously in alternate 50-yard lengths. A layer of 2½-inch stones was spread and rolled with an 8-ton tandem roller. One inch of 1:2½ mortar was placed over the stone base course. A coat of 2-inch stone was evenly spread on this mortar and thoroughly consolidated with the roller. When mortar appeared between the crevices of the stones, the surface was slightly "wetted" and swept with coarse brooms. Total thickness of resurfacing was 4 inches. Cost per square yard, 81 cents. The road surface presents a mosaic appearance and has cost nothing for surface dressing since it was laid four years ago.

The Resistance of Stone to Frost Action—By W. A. Kessler, Civil Engineer, U. S. Bureau of Standards. New International Association for the Testing of Materials, p. 37-44, Group B (1930).

The object of this paper is to show various relations between frost resistance and some of the more easily determined characteristics of limestone. The results were derived from an extended series of tests involving the commercial limestones of the United States. The materials are considered in two groups—one consisting of 20 limestones of considerable range in characteristics, while the other comprises 13 limestones of the same type and similar characteristics. Of the properties studied, strength and absorption appear to be of considerably more value in judging frost resistance than saturation co-efficients or wet strength reduction.

Structure of Weather-Resisting Rocks—By A. L. W. E. Van Der Veen, Civil Engineer, The Hague (Holland). New International Association for the Testing of Materials, p. 10-12, Group B (1930).

Fossilization (cementation) of a sediment is accomplished by solutions circulating in its interstices. The microscope reveals the mineralogical composition of the sediment, and the nature of its cement. The chemical analysis of a weather-resisting rock may suggest that something is wrong within, whereas the microscope reveals that the dangerous atoms are locked up in most resisting minerals. There follows a description of the relation between genesis and weather-resistance of some sandstones and marbles.

YANTIS WELLS, Mayor
GUS A. HALL, City Attorney
Councilmen-at-large
HAUGHEY D. MOUNT
HARRY E. ROACH

Councilmen
1st Ward—DR. CALVIN E. CARNEY
2nd Ward—VICTOR J. PORTER
3rd Ward—ROY C. CLAUSER
4th Ward—GEORGE W. BEALE

CITY CLERK'S OFFICE
TALMAR R. ARNOLD, Clerk

Delphi, Ind. January 2nd, 1931.

Standard Oil Co.
South Bend, Indiana.
Gentlemen:-

After paving some of the streets in our City with Cut Back Asphalt, we are very well pleased with results and the economical cost of putting down the pavement. We have nearly all Cut Back streets in Delphi.

We are resurfacing some of the streets each year to water proof them and keep the same in good condition. We extend an invitation to any interested parties to inspect our streets.

H. D. Mount
G. W. Beale
Roy C. Clauser

Committee on
Streets & Alleys.

Stanolind Cut-Back Asphalt Makes Good Low Cost Roads Possible

Stanolind Cut-Back Asphalt has made it possible to give taxpayers of this country durable low cost paved roads. Stanolind Cut-Back Asphalt likewise has made it possible for highway officials to build more miles of smooth riding, durable secondary roads at a relatively low cost. Stanolind Asphalt and Road Oil have been important factors in lifting numerous rural communities up "out of the mud."

Many highway officials have testified to the economy and satisfactory performance of roads and streets constructed with Stanolind Cut-Back Asphalt in letters similar to the one shown here. Performance such as referred to in this letter is not at all exceptional with roads and streets constructed with Stanolind Cut-Back Asphalt.

Today when economy is the watchword of the country and every roadbuilding dollar needs to be used to the best advantage, state, county and city highway officials are favoring Stanolind Cut-Back Asphalt as a means of getting most value from their road building dollars.

STANDARD ASPHALT ROAD OIL

Digest of New *Highway Laws*

SEVEN laws were enacted by the last general assembly affecting state highways and motor traffic. The principal law enacted was the Hoover motor code, which abolished the old speed limit of thirty-five miles per hour; revised the administration of the motor vehicle department under the supervision of the secretary of state; changed the method of taxation from factory price to weight; and sets a maximum weight limit for trucks.

Other new laws enacted include authorization of the use of convict labor on certain state roads; a statute relating to the excise tax on gasoline and increasing the bond for gasoline dealers; a law providing for the regulation of private carriers operating over state roads; a law relating to the method of issuance of motor vehicle license plates; and a law requiring the state auditor to make an annual audit of state road funds by the counties.

Following is a digest of the several new laws now in effect:

HOUSE BILL NO. 56

By Representatives LaFollette, Johns, Anderson, Phelps, Albright and Collier, and Senator Simonson.

Relative to motor and other vehicles, providing a penalty for the violation thereof and repealing all acts and parts of acts in conflict therewith.

Provides for the reorganization of the motor vehicle department, under the secretary of state and the employment of a motor vehicle supervisor.

Requires the filing and tabulation of accident reports; designates county clerks as agents of the department in the sale of tags; provides for the examination and licensing of chauffeurs and private drivers; empowers department to refuse license to any vehicle deemed unsafe to be operated; sets a minimum of $5 registration fee on passenger cars; a fee of $2 on motorcycles and a minimum of $10 on motor trucks, and a minimum fee of $10 on trailers.

The new law also requires every driver of a car or truck to have a driver's license; makes it unlawful for a child under fifteen years to drive a motor vehicle; gives the department authority to examine applicants before issuance of a driver's license.

The new law revokes the old thirty-five-miles-per-hour speed limit and requires every person to "drive at a careful and prudent speed not greater or less than is reasonable and proper, having due regard to the traffic, surface and width of the highway—nor at such speed as to prevent him from retaining complete control of said vehicle."

A minimum speed limit of thirty miles per hour has been fixed by the secretary of state on certain state roads, and the use of glaring and dazzling headlights is prohibited.

The new law is embraced in 150 sections and covers practically every phase of the licensing and operation of passenger cars, trucks, trailers, tractors and motorcycles upon the public highways of the state.

Enforcement of the law is placed in the hands of the motor vehicle department and local peace officers.

HOUSE BILL NO. 549

By Representatives Phelps and Johns.

Relating to the employment of state prisoners on the construction of State Highway No. 78.

Provides that the warden of the state penitentiary shall have charge of the camps and state engineers in charge of the work.

State Highway No. 78 is commonly called the Holy Cross Trail, leading from Dillon to Redcliff.

HOUSE BILL NO. 248

By Representatives Morris and Hallar, Phelps, Johns, Joe Anderson and Rogers.

Relating to an excise tax on motor fuel and to provide for the disposition of the funds derived therefrom and to repeal chapter 139 of the Sessions Laws of 1929.

Provides for a flexible bond up to $20,000 for gasoline dealers, in place of the maximum of $3,000 that was provided for in the 1929 statutes.

Exempts the state and any of the state's political subdivisions from the payment of the four-cent gas tax.

Requires an annual permit from the state oil inspector for all persons, firms or corporations claiming a refund of the state gas tax, this permit containing, among other things, a description of the machines in which motor vehicle is to be used and for which refund may be claimed.

Allows the state oil inspector not to exceed one per cent of the collections for the conduct of his office.

HOUSE BILL NO. 497

By Representatives Kelso, Burnett and Brighton, and Senators Evans and Ehrhart.

Relating to the employment of convicts on the construction of a road between Canon City and Salida.

Provides that the state highway engineer, with the consent of the state highway advisory board and the approval of the governor, may appropriate money from the state highway fund for the purpose of employing inmates of the Colorado state penitentiary, and paying the expenses of equipping the necessary camps for their accommodation, together with the expenses of maintaining such camps in and about the construction of that portion of the state highway system between Canon City and Salida.

The warden, with the approval of the board of corrections, shall, on request of the state highway engineer, furnish such number of able-bodied convicts as the highway engineer may require, and the warden shall have full control and supervision of whatever camps may be established. The engineer in charge of the construction work shall have full charge of all labor.

HOUSE BILL NO. 173

By Representatives Johnson, Rogers, Kavanaugh, Johns and Holland, and Senators Nelson, Simonson, King, Headlee and Lashley.

Providing for the regulation of the use of public highways by private carriers for hire, and prescribing the compensation to be paid for the use of such highways in carrying on such business.

Requires private carrier to obtain a permit from the state public utilities commission; fixes tax on freight or express service at five mills per ton mile and for passenger service at one mill per passenger mile for all revenue business.

Requires operators to keep a daily record of all motor vehicles used on public highways during the current month. Special tax is collected in addition to the regular license fees or taxes imposed upon motor vehicles.

Motor vehicles using solid tires in whole or in part are required to pay 25 per cent more than those using pneumatic tires.

All moneys collected by the utilities commission under the provisions of the new law are to be used for the construction and maintenance of state roads, 75 per cent going to the state highway department and 25 per cent to be apportioned among the various counties.

Every private carrier is required to file with the commission a liability insurance policy, or a surety bond in such sum as the commission may deem necessary to adequately safeguard the public interest.

(Continued on page 23.)

State Road Work *Gives Many* Jobs

OLD Man Unemployment was given a knockout punch during the month of May by the State Highway Department.

More than 3,000 men were given employment in all parts of the state through the expenditure of nearly a million dollars by the department through contractors and the regular maintenance forces. At the same time the various counties of the state were getting their local road programs well under way and hundreds of men were employed in this work.

While the state and counties were under way with their programs, the government was hitting its stride with various road projects in the different national forests of the state.

Altogether, it is estimated that something over $2,000,000 was paid out to workmen engaged on construction and maintenance projects in Colorado during the month of May, according to reports reaching State Highway Engineer Chas. D. Vail.

The disbursement of the State Highway Department for the month of May totals $910,819.25, as follows: Federal Aid projects, $703,281.01; state projects, $71,582.03; maintenance, $98,106; maintenance equipment, $12,206.20; property equipment, $7,800.21; surveys, $2,890.54; traffic signs and census, $595.03; administration, $14,358.23.

This was an increase of over $300,000 over May, 1930, when the total disbursements were $653,418.34, as follows: Federal Aid projects, $353,171.33; state projects, $54,551.06; maintenance, $119,337; maintenance equipment, $105,695.25; property equipment, $3,146.61; surveys, $1,046.79; traffic signs and census, $1,731.19; administration, $14,738.01.

The receipts of the State Highway Department for May, 1931, were $702,058.94, as follows: United States government, $323,734.85; gasoline tax, $367,200; internal improvement, $5,100; highway receipts, $6,024.09.

Receipts for May, 1930, were: U. S. government, $67,637.65; gasoline tax, $392,000; internal improvement, $5,000; highway receipts, $4,601.52; a total of $469,239.17.

The department's financial statement, ending May 31, 1931, is interesting in its showing of the great business to which the building and maintenance of highways has grown in Colorado.

The total balance at the beginning of June was $905,753.57, and receipts during the past month of $2,485,602.72, with total disbursements during the month of May of $2,624,672.58, plus disbursements of $21,061.10, from the special 3 per cent gasoline tax fund.

Contracts calling for the expenditure of nearly $5,000,000 are being executed for the State Highway Department. This is the greatest amount of work the department has had underway at this time of the year in its entire twenty-one years of existence.

Engineering costs are the lowest in the history of the department. The state law allows 10 per cent of the contract price on all projects for engineering expense. On some of the projects already completed this year the engineering expense has run as low as 3 per cent, while the administration cost has shown a steady decline, considering the great amount of work in progress.

The decrease in engineering cost has been brought about by big projects which the governor, advisory board and highway engineer budgeted this year. Bid prices by contractors on the work also have been the lowest in the history of the department. Lack of work in other fields of construction attracted a large number of railroad contractors to the local highway construction program, and they have made attractive prices on work in order to keep their equipment and employe organizations together. The size of the contracts let by the department also has enabled contractors to purchase heavier and more modern equipment and this has brought about lower bid prices.

On government road projects more than 600 men are being given employment at the present time. Virtually all the government road projects are in national forests and parks and are being handled by contractors. Laborers are hired by the contractors and not by the bureau of public roads.

The standard wage scale for laborers on road work is 50 cents per hour, or $4.00 per eight-hour day. While it is not written in their contracts, all concerns having contracts with the highway department have accepted as an unwritten rule that they must pay their men $4.00 per day on all state road work. This rule is understood between the contractor and the state highway engineer when the work is let on contract.

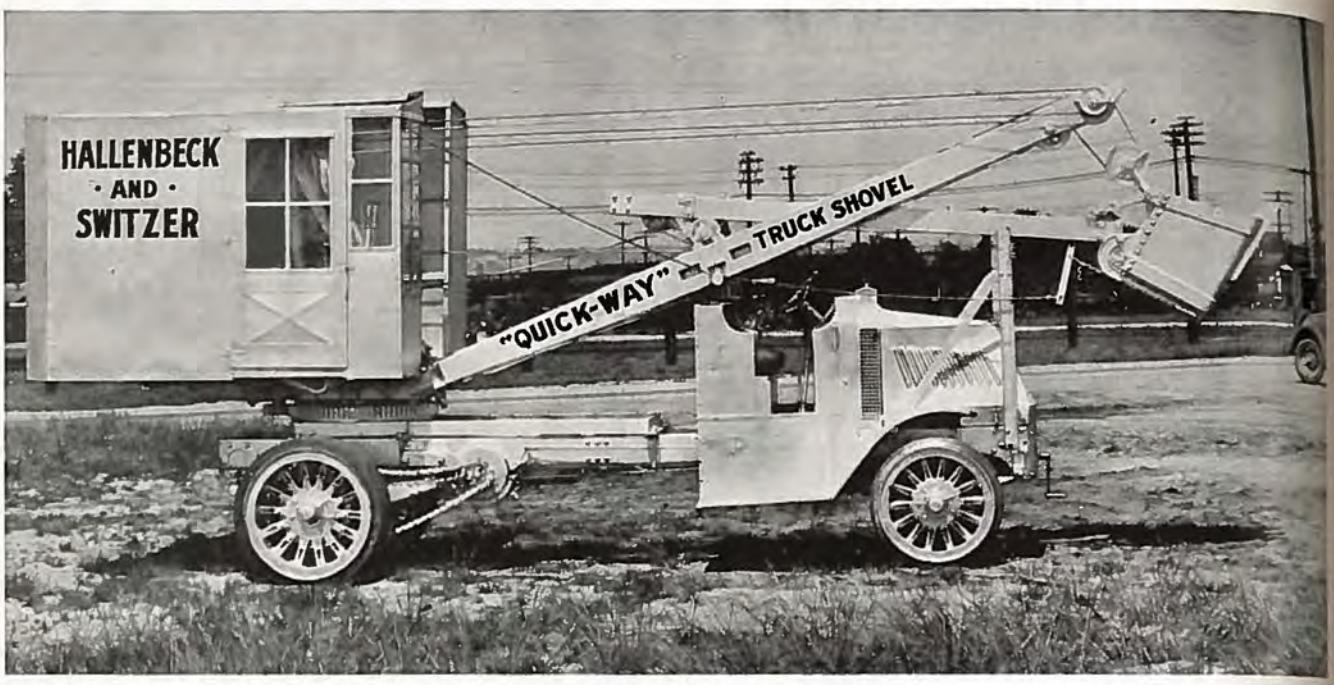
By July 1 the government through the bureau of public roads will have work under way on more than twenty projects in the parks and national forests in Colorado. Total cost of these projects will be over $3,000,000, and contracts already let call for their completion this year.

Comparative Statement

COLORADO STATE HIGHWAY DEPARTMENT

For the Month of May, 1930 and 1931

	1930	1931
RECEIPTS		
U. S. Government	$ 67,637.65	$323,734.85
Gas Tax	392,000.00	367,200.00
Internal Improvement	5,000.00	5,100.00
Highway Receipts	4,601.52	6,024.09
	$469,239.17	$702,058.94
DISBURSEMENTS		
Federal Aid Projects	$353,171.53	$703,281.01
State Projects	54,551.06	71,582.03
Maintenance	119,337.90	98,106.00
Maintenance Equipment	105,695.25	12,206.20
Property and Equipment	3,146.61	7,800.21
Surveys	1,046.79	2,890.54
Traffic Signs and Census	1,731.19	595.03
Administration	14,738.01	14,358.23
	$653,418.34	$910,819.25



A New "Quick-Way" Truck Shovel . . .

Delivered to Hallenbeck & Switzer. Their first work was dragline work near Hayden, Colorado. The next move overland to Pitkin county near Aspen, Colorado, nearly 175 miles away—and it traveled on its own power in record time.

It's the "QUICK-WAY" *to the job—*
The "QUICK-WAY" *to do the job—and*
The "QUICK-WAY" *to the next one.*
"QUICK-WAYS" *are built "right" in Colorado and we sell 'em.*

H. W. MOORE EQUIPMENT CO.

120 WEST 6TH AVENUE TABOR 1361 DENVER, COLORADO

"Colorado's Largest and Oldest"

Three "Quick-Way" Truck Shovels...

Delivered to the State Highway Department mounted on Liberty trucks June 21, 1931, just one week after receiving their order. "QUICK-WAYS" will do the many odd jobs for the department economically and satisfactorily, just as they are for Pueblo, Las Animas, Gunnison, Delta and Montrose counties. *"Watch them work when you pass one."*

H. W. Moore Equipment Co.

120 WEST 6TH AVENUE · TABOR 1361 · DENVER, COLORADO

"Colorado's Largest and Oldest"

New Roads *Uncover Hidden* Lake

(Continued from page 6.)

tinguished Irish sportsman, Sir George Gore, whose peculiar tastes led him in 1855 to abandon the luxurious life of Europe and bury himself for more than two years among the savages in the wildest and most unfrequented glens of the Rocky Mountains.

The outfit and adventures of this titled Nimrod, conducted as they were upon a most gigantic scale, probably exceeded anything of the kind ever before attempted on this continent, and the results of his exploits will compare favorably with the performances of Gordon Cumming in Africa. Colonel Marcy, who knew Sir George Gore, continues:

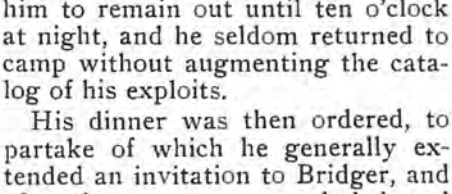
"Some conception may be formed of the magnitude of his equipment when it is stated that his party consisted of about fifty persons, comprising secretaries, stewards, cooks, fly-makers, dog tenders, hunters, servants, etc. He was provided with a train of thirty wagons, besides numerous saddle horses and dogs.

"I met Sir George at St. Louis soon after his return from the mountains, and found him affable and communicative. He related to me several of his adventures with the Indians, and showed me his guns of various descriptions and calibres, suited to the destruction of all kinds of game, and upon them I observed the names of Joe Manton, Purdy, Westley Richards, and other celebrated makers. He informed me that during his protracted hunt he had slaughtered the enormous aggregate of forty grizzly bears, twenty-five hundred buffalos, besides numerous elk, deer, antelope, and other 'small' game. He had brought back with him a host of trophies, which would be abundant vouchers for his performances on his return home.

"Some persons will probably think it a very strange infatuation that a nobleman like Sir George, possessing an income of some $200,000 per annum, should voluntarily withdraw from all society, and retire to the wilderness among savages for two long years, exposed to all the perils and privations consequent upon such a life; but I assure the denizens of cities that he required no sympathy from them, as he was one of those enthusiastic, ardent sportsmen who derived more real satisfaction and pleasure from one day's successful hunting than can possibly be imagined by those who have never participated in this exhilarating and healthful amusement. Besides, he returned home with a renovated constitution, good health and spirits, and a new lease of perhaps ten years to his life and, finally, he had seen something of life out of the ordinary beaten track of the great mass of other tourists.

"Bridger often spoke to me about Sir George Gore, and always commended him as a bold, dashing, and successful sportsman, a social companion, and an agreeable gentleman."

Colonel Marcy gives us a detailed and lively picture of the first white man to camp at Black Lake, and the hunter from across the Atlantic for whom the "back wall" of Black Lake, the towering Gore Range, is named.



Making a fill on sidehill on the Willow Creek project, which has been converted into one of the most beautiful mountain boulevards in Colorado.

Sir George's habit was to sleep until about ten or eleven o'clock in the morning, when he took his bath, ate his breakfast, and set out generally alone for the day's hunt; and Bridger said it was not unusual for him to remain out until ten o'clock at night, and he seldom returned to camp without augmenting the catalog of his exploits.

His dinner was then ordered, to partake of which he generally extended an invitation to Bridger, and after the repast was concluded, and a few glasses of wine had been drunk, he was in the habit of reading from some book and eliciting from Bridger his comments thereon. His favorite author was Shakespeare, which Bridger "reckon'd was a leetle too high-falutin for him." Moreover, he remarked that he "rayther calculated that thar big Dutchman, Mr. Full-stuff, was a leetle bit too fond of lager beer," and suggested that probably it mig have been better for the old man he had imbibed the same amount good old Bourbon whiskey.

Bridger seemed deeply interes in the adventures of Baron Mu chausen, but admitted, after reading was finished, that "he'd dogon'd if he swallered everyth that thar Barren Mountchaw said, an' he thought he was a dur liar." Yet, upon farther reflect he acknowledged that some of own experiences among the Bla feet would be equally marvelous writ down in a book."

One evening Sir George ent tained his auditor by reading to Sir Walter Scott's account of battle of Waterloo, and afterw asked him if he did not regard as the most sanguinary battle he ever heard of. To which Brid replied:

"Wall, now, Mr. Gore, that must'a bin a considdible of a scr mage, dogon my skin ef it must them Britishers must'a fit be thar than they did down to H leans, whar Old Hickory gin um forkedest sort o' chain-lightnin' t perhaps you ever did see in all born days!"

And upon Sir George's expres a little incredulity in regard to estimate Bridger placed upon battle, the latter added: "You jist go yer pile on it, Mr. Gor **you can**, as sure as yer born."

CRIPPLE CREEK IS WORLD GREATEST GOLD MINE CAMP

Cripple Creek is possibly as miliar to persons in all parts of world as Denver. It is the wor greatest gold producing area and situated in the bowl-shaped val of an extinct volcano and in heart of the Rockies.

Cripple Creek has figured in m fiction, magazine articles and mot pictures than any other town in country. Its boast is that it has m more millionaires than any ot gold-producing place on the gl The annual gold production of mines now is around $6,000,000. mines have produced more th $400,000,000 in gold.

Cripple Creek is easily reach over a marvelous automobile r from Colorado Springs and also railroad. State highways enter district from three sides, includ two branches of the Pikes P Ocean-to-Ocean and the fa Phantom Canon route, as well as road from Colorado Springs.

NEWS OF THE MONTH

Gasoline sales and gasoline taxes during the record tourist years of 1929-1930 reflect these facts: Gas consumption—1929, 155,000,000 gallons; 1930, 170,000,000 gallons. Gas tax collected—1929, $5,560,000; 1930, $6,642,000.

Treacherous Wolf Creek, once the most feared, dangerous and rugged of all Colorado passes, will soon be tamed by modern engineering prowess, according to the Monte Vista Tribune. Summer traffic is now traveling over the pass. Eight miles of new roadway is now under construction between Twin Bridges and Del Norte. Three shifts of workmen are employed on the job. Gravel surfacing has been placed on four miles of the new work.

Work of oil surfacing the road between Longmont and Lyons in Boulder county is nearing completion. This work will cost $60,000, one-half of which is contributed by Boulder county. The oil processing is being done under the supervision of the State Highway Department. This is one of the main routes to Estes Park.

Twenty-five miles of roads in Yuma county will be widened and elevated during this summer, according to William Heindel, road supervisor. Most of this work will be done on State Road No. 51, north and south of Wray, the county seat.

Four miles of concrete pavement has been completed between Manzanola and Vroman on the Santa Fe Trail. It will be opened to traffic around July 1, after the curing process. This completes the paving between Manzanola and Rocky Ford.

The new road between Palisade and DeBeque along the Colorado river was opened on June 14. Appropriate ceremonies dedicating the new road were held by the Grand Junction lodge of Elks. A monument honoring western Colorado pioneers was unveiled by the Elks. Speakers included Dr. F. C. Luke, of Palisade; Dr. P. A. Materoli; Charles J. Moynihan, of Montrose, and William Weiser, Grand Junction, member of the State Highway Advisory Board. This is one of the most important highway improvements made on the western slope. Fourteen miles of new roadway was constructed through the canon, costing $500,000.

On June 16 Edward Selander, contractor, completed the pouring of concrete on ten and one-half miles of pavement between Kersey and Fort Morgan. One week later J. B. Bertrand, Inc., contractors, completed concrete work on a connecting link ten and one-quarter miles in length. Traffic is now moving over a part of this new pavement.

Plans are being formulated for a tri-county celebration to mark the opening of this important highway improvement. When put in use this road will be paved from Denver to Sterling, with exception of two small sections.

More than 4,000 men are now employed on state, county and Federal road projects in Colorado, according to a survey just completed by the State Highway Department.

State Highway Engineer C. D. Vail made an inspection tour of western slope roads the week of June 15. He looked over plans for the new road between New Castle and Glenwood Springs, which the department expects to get under way during July.

On May 28 Frank Hoffman, contractor, was awarded a contract for three miles of gravel surfacing in Byers canon west of Hot Sulphur Springs in Grand county. The bid price was $18,191.

Nine and one-half miles of grading and gravel surfacing will be constructed by the State Highway Department between Gunnison and Parlin. Bids for this work were to be opened on June 23.

The Highway Department will receive bids on twelve miles of gravel surfacing on State Road No. 4 in El Paso county east of Colorado Springs.

Contract for the construction of two and one-half miles of heavy grading between Leadville and Climax has been let to Cole Brothers. This is a U. S. Forestry proj... The estimated cost is $60,000.

Hamilton & Gleason, contract... were low bidders on eighteen ... one-half miles of grading and gra... surfacing work between Deert... and Limon in Elbert county on J... 16. Their bid was $240,319.

Construction of ten miles of n... roadway over Rabbit Ears Pass ... been contracted by the U. S. Bur... of Public Roads. The project is ... cated between Kremmling ... Steamboat Springs, and conne... with work completed last fall by ... State Highway Department on ... east slope of the pass. Cook & R... som, Ottawa, Kan., contractors, ... doing the work. Their bid for ... contract was $149,548. Work w... continue throughout the sum... and the road will be ready for tra... early next year.

On June 12 the State Highw... Department announced the follo... ing low bidders on five road proje... located in various parts of the sta...

No. 2-R-11, 3.13 miles of gra... surfacing south of Trinidad on hi... way No. 1 in Las Animas coun... J. H. Miller & Co., of Denver, w... $80,967.

No. 211-B, 2.725 miles of gradi... and surfacing north of Hamilton, ... highway No. 13, in Moffat coun... the Utah Construction Company ... Ogden, Utah, with $93,720.40.

No. 144-F-2, 10.386 miles of s... facing north of Fort Collins, ... highways Nos. 14 and 123, in La... mer county, M. R. Deakin of F... Collins, with $21,945.

The Colorado Builders Sup... Company, with $845.10, and the M... west Steel & Iron Company, w... $2,479.40, were low on reinforci... and structural steel, respectively, f... a new bridge to be built on the c... tinuation of Broadway south of E... glewood, on the Littleton road.

Contracts have been made by t... Highway Department with Woo... Morgan & Burnett for the constru... tion of five miles of gravel-surface... highway east of Bayfield in Archu... leta county. Completion of this im... provement will eliminate one of t... worst stretches of road between D... rango and Pagosa Springs.

New Highway Equipment and Materials

Gyratory Crushers.—The Allis-Chalmers Superior McCully fine-reduction gyratory crusher is described exhaustively in Bulletin 1461-B issued by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Armco Metalcurb.—A new pamphlet on Armco Metalcurb has been issued by the American Rolling Mill Co., Middletown, Ohio, to give more complete information about this new product, which is designed to reduce road construction and maintenance costs.

Leaning Wheel Graders.—Caterpillar Tractor Co. has brought out a new book describing the Caterpillar "30" Leaning Wheel Grader.

Dirtmovers.—A new booklet featuring Ateco Hydraulic Dirtmovers has just been issued by the American Tractor Equipment Co., of Oakland, California, and Peoria, Illinois. It tells a tale graphically and pictorially of wider, safer and smoother roads, of smoother landing fields for airports, of lower costs on big and little excavation jobs, and of Ateco's accurate control, careful design and sturdy construction.

Copies of this Bulletin No. 131 may be obtained from the factory either in Oakland or Peoria and from any "Caterpillar" dealer.

Accessories, Motor Truck.—Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of folders issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Culverts—Large Diameter.—Ease and speed of installation, economy, a full-width roadway and durable, maintenance-free service are listed in the new catalog, "Armco Large Diameter Corrugated Pipe," as the advantages following the use of larger diameter culverts in meeting small bridge requirements. Catalog No. 8 will be sent free on request. Address Armco Culvert Mfrs. Association, Middletown, Ohio.

Crushers.—Pioneer Gravel Equipment Manufacturing Company, Minneapolis, Minnesota, publishes complete 80-page manual, showing blueprint sketches of set-ups in pit or quarry of the eleven different sizes of Pioneer Crushing Plants.

Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., Galion, Ohio.

J. D. Adams Co. has announced that all Adams motor graders are now of electrical welded construction throughout. The company also announces a new tandem drive, with four driving wheels for Adams motor graders.

Three advantages claimed for the Adams tandem drive are: First, equal weight is carried on all four drive wheels which pivot around the tractor axle, giving each drive wheel equal traction. Second, the front end of the tractor is supported in the grader frame, thereby utilizing a considerable portion of the tractor's weight as effective weight on the blade. And third, all drive chains, sprockets and bearings are completely enclosed in dirt-proof housings, greatly increasing the life of all these parts. Each drive wheel is driven by a separate roller chain, and the tractor and the wheel axles are mounted on ball and roller bearings.

Commissioners I. B. Rogers and Frank Patterson with one of the new Wehr graders recently purchased for maintaining roads in Las Animas county.

Tires for the Adams tandem drive are 40 in. x 8 in., 12 ply heavy duty pneumatics. They are furnished with puncture-proof tubes. These tubes are stated to eliminate the question of flat tires from punctures, because they are self-sealing. The special rubber of the tube presses tightly against the penetrating object, retains air and closes the hole when the object is removed, with no loss of air pressure. They are said to practically eliminate motor grader tire trouble.

Adams motor graders are furnished with McCormick-Deering, Allis-Chalmers, or Case tractor power units, and with solid tires, with pneumatic tires in the single or tandem drives, and with steel or rubber crawlers. The new Adams catalog No. 31 completely illustrates and describes Adams motor graders and the new tandem drive. A copy will gladly be sent on request to J. D. Adams Company, Indianapolis, Ind.

Showing a Bucyrus-Erie gas-air shovel owned by Contractor E. H. Honnen in "heavy going" on Berthoud pass, keeping a fleet of trucks busy moving excavation.

Gravel Plant.—A new broadside issued by the Pioneer Gravel Equip Mfg. Co. illustrates and describes the model Pioneer washing, screening, ing and loading plant. This is a por single unit plant for producing w crushed gravel and sand. Another b side also just issued illustrates an scribes the Pioneer Duplex scre crushing and loading plant.

"Asphalt for Every Purpose," a 44 illustrated booklet describing Stan Asphalt products, is now ready for d bution. Recently published by the S ard Oil Co. of Indiana, 910 So. Mi Ave., Chicago, Ill.

Complete directions for surface ment and bituminous surfacing wit Back Asphalt are contained in a 3 data book just issued by the Standa Co. of Indiana, 910 So. Michigan Chicago, Ill.

New Motor Patrol.—A new road tenance machine has been added to line of the Caterpillar Tractor Co., P Ill. The machine has four speeds ward: 1.8 miles, 3.7 miles, 6.5 mile 10 m.p.h.; and a 2.3 m.p.h. reverse.

The steering wheel is the only co operated manually. The other con are conveniently located in front of operator and effect the raising and low ing of the scarifier, raising and low of the blade, swinging the circle and ing the blade from side to side. power for these controls is supp through a proper take-off from the en

The 35-hp. engine is mounted in main frame, behind the operator's Power from the engine is conv through the power take-off and contro the mechanical operation of the blad scarifier, and through the change-s gearing to the rear axle and the wheels, which bear 40x8-in. dual matic tires. Brake control is simple effective. The brake pedal applies po ful braking action through a drum on lower transmission shaft.

At the annual meeting of the stockh ers of the Monighan Manufacturing poration, manufacturers of walking dr line excavators, the stockholders vote change the name of the company to B cyrus-Monighan Company. This act has been approved by the Board of Dir tors of the Bucyrus-Erie Company. Bucyrus-Monighan Company will oper as a separate organization exactly as Monighan Manufacturing Corporation in the past, except that sales will be han dled by the Bucyrus-Erie sales organ tion. The following directors were elect

Messrs. W. W. Coleman, E. K. Swig W. M. Bager and G. A. Morison of Mil kee, and Messrs. O. J. Martinson, W. Brennen and T. H. McGowen of Chica W. W. Coleman was elected chairman the Board of Directors and G. A. Mori vice chairman, in addition to which t old officers were reelected as follows: J. Martinson, president; W. T. Bren vice president and treasurer, and H. Voss, secretary.

Digest of New *Highway Laws*

(Continued from page 14.)

...w does not apply to school busses, ...the transportation of farm produce ...market or supplies to the farm by ...person chiefly engaged in farming. ...private carrier is defined as all per... ...or corporations operating their own ...or vehicles for the transportation ...their own goods, who charge or col... ...from the consignee, purchaser or re... ...ent of such property, goods or mer...ndise, compensation for transporting ...delivering the same.

HOUSE BILL NO. 125

...Representative A. E. Leach and Sen...ator Talbot.

...elating to motor vehicle license ...tes.

...rovides license plates shall carry ...tifying key numbers for the various ...nties of the state, as follows: ... Denver; 2, Pueblo; 3, Weld; 4, El ...o; 5, Las Animas; 6, Larimer; 7, ...lder; 8, Mesa; 9, Otero; 10, Arapa... ...11, Jefferson; 12, Adams; 13, Logan; ... Fremont; 15, Morgan; 16, Huerfano; ... Prowers; 18, Delta 19, Yuma; 20, La ...ta; 21, Montrose; 22, Baca; 23, Rio ...nde; 24, Garfield; 25, Conejos; 26, ... Carson; 27, Washington; 28, Routt; ... Bent; 30, Alamosa; 31, Chaffee; 32, ...ntezuma; 33, Lincoln; 34, Elbert; 35, ...guache; 36, Crowley; 37, Phillips; 38, ...tilla; 39, Sedgwick; 40, Gunnison; 41, ...ke; 42, Moffat; 43, Teller; 44, Eagle; ... Kiowa; 46, Cheyenne; 47, Douglas; 48, Archuleta; 49, Rio Blanco; 50, San Miguel; 51, Clear Creek; 52, Custer; 53, Grand; 54, Park; 55, San Juan; 56, Ouray; 57, Pitkin; 58, Dolores; 59, Jackson; 60, Gilpin; 61, Summit; 62, Mineral; 63, Hinsdale.

HOUSE BILL NO. 537

By Representatives Tarbell and Johnston.

Relating to the powers and duties of the state auditing board.

Provides that board shall have control of all appropriations made by the General Assembly for the several executive and judicial departments and state institutions, boards and bureaus.

All purchases must be made on requisitions approved by the board.

Also provides that the state auditing board shall audit county expenditures from state road funds. Reads as follows:

"It shall be the duty of the state auditing board acting by and through the state auditor to audit annually the records of the several counties in the use and expenditure of all state road funds, and the proportionate part of the necessary expenses of the state auditor's annual audit of the records of the county treasurers applicable to the audit of the road funds shall be paid from the funds of the state highway department. Any moneys unlawfully obtained by the counties or unlawfully expended by the counties from the road funds shall be returned to the state treasurer for the use of the state highway funds, and the attorney general is hereby authorized and directed to take appropriate action to recover such funds for the state highway fund."

The sum of $185,000 has been appropriated for road work in the Mesa Verde National Park this summer. Contracts for the work should be made within the next thirty days. The project calls for the gravel surfacing of the 19 miles of roadway from the park entrance to the headquarters.

Two miles of new road on Kenosha pass in Park county on State Route No. 8 has been completed at a cost of $76,000. This work eliminates the steepest grades between Denver and Fairplay.

Charles V. Hallenbeck, Rifle, Colo., contractor, has been awarded the contract for oil surfacing 26 miles of roadway in Yellowstone National Park.

"Roads," a series of five fully illustrated folders, prepared by the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows what Russell graders and "Caterpillar" tractors can do and are doing to build better roads quicker and cheaper.

The design, construction, details and complete specifications of the new Ten and Fifteen models "Caterpillar" are given in a booklet recently published by the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill.

Of interest to citizens of Routt and Moffat counties is the contract recently made by the highway department for the construction of seven and one-half miles of new road west of Hayden on the Victory Highway. Frank L. Hoffman was the successful bidder. His price for the project completed was $115,356. The principal items in the project are 145,000 cubic yards of excavation and 25,280 tons of crushed rock gravel surfacing. Hoffman bid 22 cents on the excavation and 80 cents on the gravel. The job is to be completed September 1st.

A new watchman had been employed to sit up nights by the road construction job and see that nobody made away with the red lanterns or other paraphernalia. When he was due to be relieved after his first night on the job, the foreman approached and asked him if everything was all right.

"Well, boss," said the new hand modestly, "I don't want to brag about myself, but I don't think I've done so bad for a beginner. I checked up on everything just before you came, and there's only one thing missing—the steam roller."

"I want to see Florence; do you know where I can get hold of her?"

"Couldn't tell you; the boys say she's awfully ticklish!"

PLANS BEING DRAFTED

Proj. No.	Est. Length	Type	Location
134-E	6 mi.	Gravel Surfacing	West of Vona
145-C	15 mi.	Gravel Surfacing	East of Rifle
150-C	8 mi.	Gravel Surfacing	West of Lay
181-A	2 mi.	Concrete Pavement	Idaho Springs
262-ER		Bridge	East of La Veta
263-C	3 mi.	Gravel Surfacing	East of La Veta
270-E	5 mi.	Gravel Surfacing	West of Monte Vista
296-AR&BR	4.5 mi.	Pavement	North of Greenhorn
298-E	4 mi.	Gravel Surfacing	South of South Fork
248-B	8 mi.	Gravel Surfacing	South of Buena Vista
158-B	6 mi.	Gravel Surfacing	West of Lake George
168-BCR	4.5 mi.	Pavement	West of Lamar

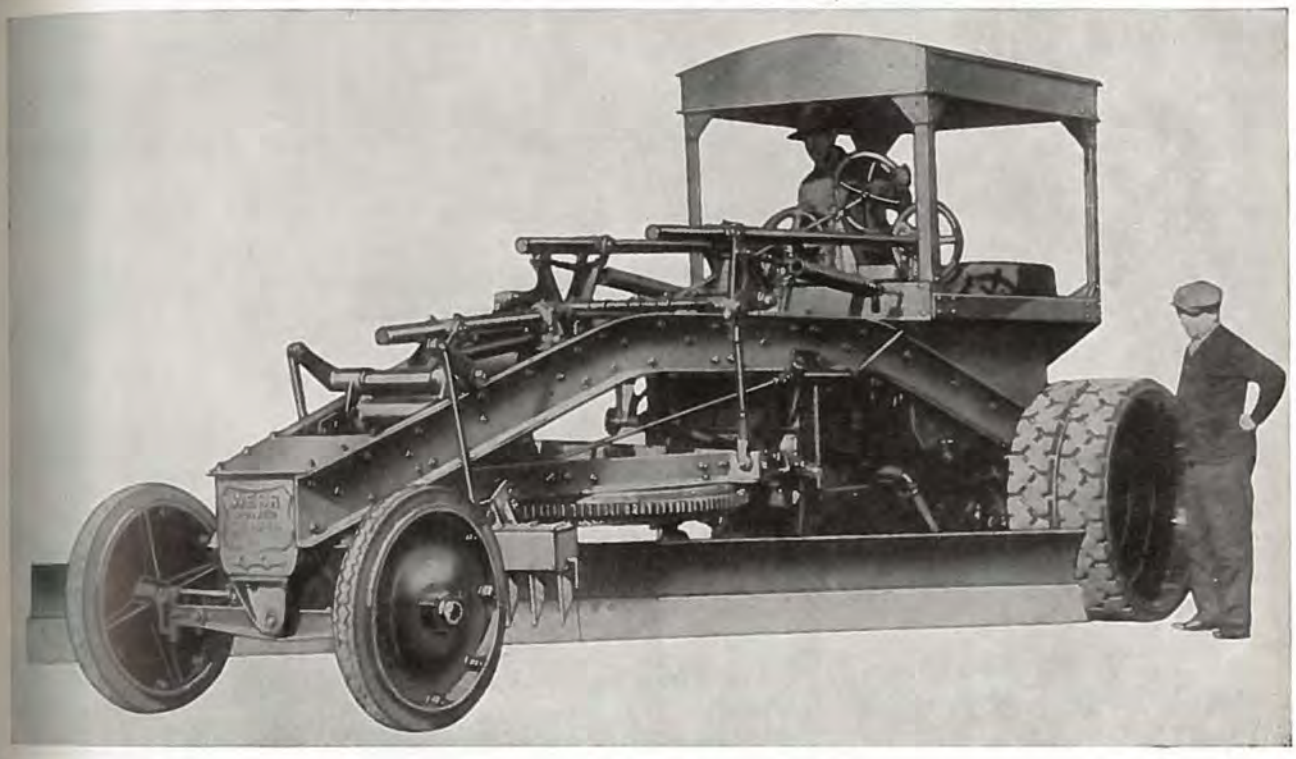
PLANS FINISHED

Proj. No.	Length	Type	Location	Note
79-B	12.248 mi.	Gravel Surfacing	East of Colorado Springs	Bids to be opened
259-B	9.587 mi.	Gravel Surfacing	East of Gunnison	Bids to be opened
265-E	2.950 mi.	Gravel Surfacing	West of Bayfield	Bids to be opened
68-B	7.527 mi.	Gravel Surfacing	South of Saguache	Bids to be opened
278-D	20.603 mi.	Gravel Surfacing	West of Cheyenne Wells	
288-AR	4.526 mi.	Pavement	Northeast of Brush	
296-CR	6.606 mi.	Pavement	North of Greenhorn	
295-E	7.627 mi.	Surfacing	South of Alamosa	

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Pr
2-R10	Bet. Starkville and Trinidad	2.097 mi.	Paving	J. H. Miller & Co.	$109,577.10	34	
2-R12	Bet. Aguilar & Walsenburg	4.503 mi.	Paving	Orman Const. Co.	192,443.50	0	
15-B	East of Sterling	18.553 mi.	Grading & Surfacing	Bedford & Woodman, Inc.	237,781.55	50	
71-C	Bet. Durango and Mancos	4.965 mi.	Gravel Surfacing	J. Finger & Son	86,146.75	0	
78-R	Near Minturn	0.709 mi.	Gravel Surfaced	J. Fred Roberts & Sons	96,342.90	95	
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	58	
134-AR&C	West of Burlington	11.174 mi.	Oil Processed Surf.	H. C. Lallier Const. Co.	111,217.20	36	
134-D	West of Stratton	5.076 mi.	Gravel Surfacing	Mountain States Const. Co.	49,350.50	83	
144-E	North of Fort Collins	1.286 mi.	Concrete Paving	F. C. Dreher Const. Co.	99,187.55	91	
144-F	Northwest of Fort Collins	10.386 mi.	Gravel Surfaced	Blanchard Bros.	144,180.80	92	
144-G	Bet. Forks & Colo.-Wyo. Line	13.204 mi.	Gravel Surfacing	Morrison-Knudsen Co.	248,078.00	45	
149-C	East of Aurora	7.863 mi.	Gravel Surfacing	Chas. B. Owen	130,329.47	58	
149-D	East of Watkins	8.370 mi.	Gravel Surfacing	A. R. MacKey	13,207.82	38	
149-F	Between Strasburg and Peoria	Detour Bridge		A. R. MacKey	13,207.82	89	
149-F	Bet. Strasburg and Peoria	10.745 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	198,660.00	0	
149-G	Denver-Limon	9.778 mi.	Grading & Surfacing	Lawrence Const. Co.	189,623.96	15	
150-B	West of Craig	4.630 mi.	Gravel Surfacing	N. M. Monaghan	73,181.65	55	
151-A	Bet. Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	15	
151-B	Bet. Fraser and Granby	3.925 mi.	Grading & Surfacing	Utah Construction Co.	63,954.80	38	
189-B	Bet. Hayden and Craig	2.567 mi.	Gravel Surfaced	C. A. Switzer	91,497.00	59	
189-C	West of Hayden to County Line	7.534 mi.	Gravel Surfacing	F. L. Hoffman	115,356.94	19	
208-AR	East of Grand Junction	Bridge and Detour		Phelps Bros.	7,305.70	0	
242-D	Bet. Mack & Colo.-Utah Line	9.883 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	124,552.36	40	
242-E	West of Fruita	4.243 mi.	Gravel Surfacing	Wallace Const. Co.	54,907.53	18	
245-C	Between Hadley & La Junta	8.442 mi.	Grading	A. S. Horner	133,383.10	34	
248-B	South of Buena Vista	2.766 mi.	Gravel Surfacing	J. Finger & Son	51,979.50	87	
251-D	East of Boulder	0.284 mi.	Paving	Collier-Latimer	25,598.50	51	
254-AB&CR	Byers Canon	2.615 mi.	Gravel	F. L. Hoffman	16,537.30	0	
258-I	Bet. Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	69	
258-J	West of Cerro Summit	5.796 mi.	Grading and Gravel	Lumsden Hall Const. Co.	107,027.30	11	
261-AR	Bet. Rifle and Grand Junction	0.053 mi.	Bridge & Grav. Surf.	Herbert S. Crocker	21,300.00	35	
265-D	Wilson Gulch	1.930 mi.	Bridge & Approaches	Grant Shields	29,455.50	95	
271-F	East of Florence	0.593 mi.	Viaduct	Mountain States Const. Co.	57,583.40	87	
272-F	Bet. Manzanola & Rocky Ford	4.097 mi.	Concrete Pavement	Driscoll Const. Co.	122,418.50	35	
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc	116,829.21	17	
279-H	Bet. Kenosha & Webster	1.691 mi.	Grading	Anderson, Sheldon & Miller	69,669.20	100	
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	41	
282-J	Bet. Rifle and Meeker	0.057 mi.	Bridge & Approaches	Herbert S. Crocker	20,400.00	55	
286-E	Denver-Cheyenne Highway	4.052 mi.	Concrete Pavement	J. Fred Roberts & Son	126,032.85	59	
287-AR5	Bet. Kersey and Wiggins	10.586 mi.	Concrete Pavement	Edw. Selander	251,717.00	39	
287-CR1	Bet. Kersey and Wiggins	10.246 mi.	Concrete Pavement	J. B. Bertrand, Inc.	254,341.70	45	
292-D	Bet. Wolcott and Avon	9.834 mi.	Graded Surface	Utah Const. Co.	159,143.40	32	
296-D	South of Pueblo	8.348 mi.	Gravel Surfacing	Cole Bros.	84,815.10	25	
297-C	Southwest of DeBeque	9.953 mi.	Gravel Surface	Hinman Bros. Const. Co.	312,453.50	96	
297-D	South of DeBeque	4.198 mi.	Surf. & Bridge	Hinman Bros. Const. Co.	185,230.50	100	
298-C	Bet. Twin Bridges & South Fork	3.780 mi.	Gravel Surfacing	H. C. Lallier Const. & Eng. Co.	116,864.50	90	
298-D	Bet. Del Norte and Durango	4.100 mi.	Gravel Surfacing	H. C. Lallier	164,814.00	25	
299-AR	Alkali Creek	Bridge		Phelps Bros.	8,690.05	0	

The New Model Wehr Z-4 One-Man Maintainer Is Here



New screw type lifting device—heavier frame—heavier circle longer blade lengths, 10 to 16 feet, *and*

Powered by the same famous McCormick-Deering Model "30" power unit (the same power unit that Weld County purchased in the ten new tractors in February, 1931).

You bet, we'll demonstrate it any place—any time

H. W. MOORE EQUIPMENT CO.

120 WEST 6TH AVENUE TABOR 1361 DENVER, COLORADO

"Colorado's Largest and Oldest"

For Finishing Shoulders

THE Insley Shoulder Finisher solves the problem of finishing shoulders accurately and mechanically. It eliminates guess work on that part of the road job that has always represented the greatest hazard and the surest chance of loss.

It is automatically guided from the edge of the slab by means of a guide bar on a concrete pavement, or by means of an indicator on a macadam job. The distance from the edge of the pavement to the edge of the shoulder is thus automatically set.

The Finisher travels on the pavement, the tractor on the shoulder—thus the grade of the finished shoulder is correct with reference to the slab—as it should be.

It can carry a full blade at all times without any side slip of the rear wheels—due to the correct balance and use of large pneumatic tires.

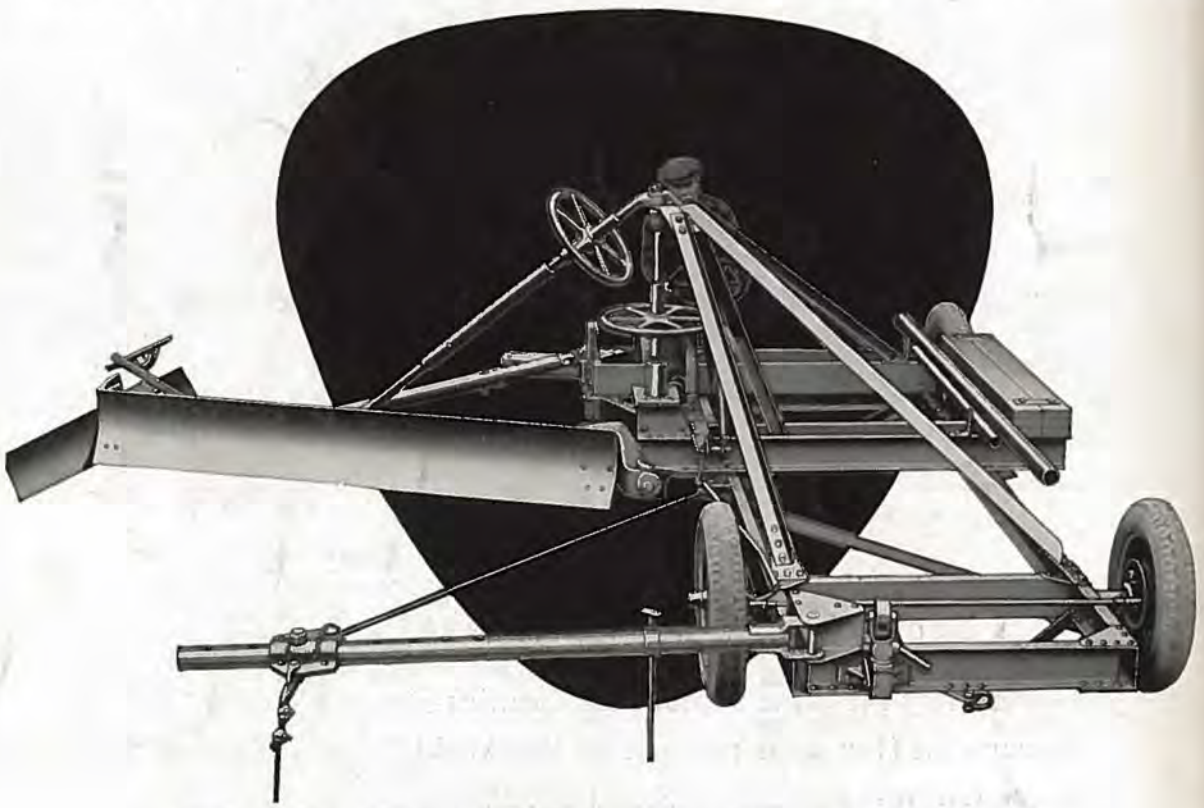
Its blade is adjustable up and down at both ends—forward or backward to take care of various widths of shoulders—or to drag material in toward or push it away from the machine.

The blade can be folded so that the machine is less than 8 feet wide for traveling.

With an 8 foot blade, it finishes 5 to 7 foot shoulders—with a 10 foot blade from 6 to 8 foot shoulders—and with a 12 foot 6 inch blade from 8 to 11 foot shoulders.

It will speed up your estimates, and clean up important but expensive work in a hurry. In fact, it will pay for itself in short order.

Investigate the Insley Shoulder Finisher today.



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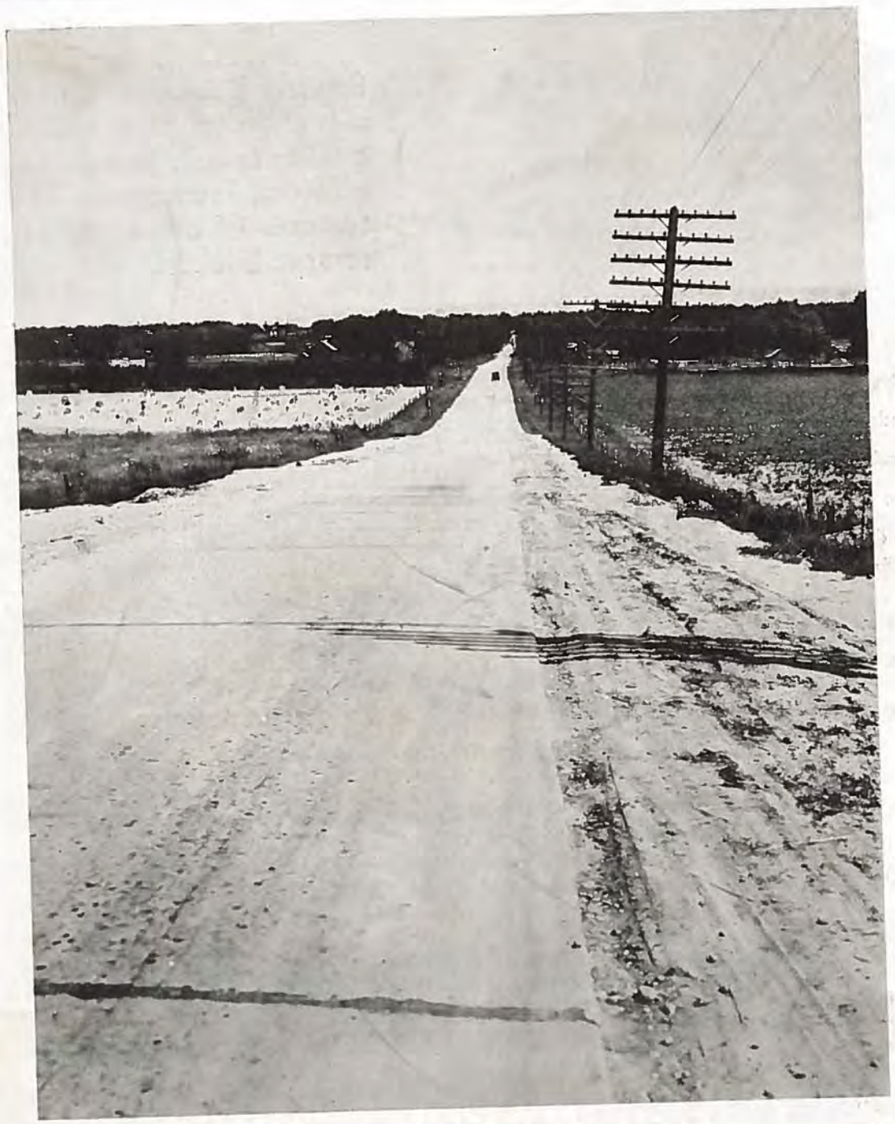

Vol. X July, 1931 No. 7

COLORADO HIGHWAYS

Vol. X July, 1931 No. 7

THE OLD OAKEN BUCKET OR A MODERN DRAG SCRAPER BUCKET?

WHICH ONE ARE YOU USING?

½ yard Bucket—less Teeth
Manganese Teeth can be furnished for all sizes

THE Cedar Rapids Drag Scraper Bucket is a new idea in a bottomless drag scraper, thoroughly tested, proven to be very efficient. It combines *all* the *good* features of other makes of drag scraper buckets.

FEATURES

- Made of cast alloy steel
- Special heat treatment
- Two cutting edges
- No delays to right this bucket
- No repairs or upkeep expense
- Absolutely cleans up the pit

A Cedar Rapids ¾ Yd. Bucket in Action

FEATURES

- No crossbar at the front
- With or without teeth
- Requires less power
- Digs straight
- Floats on the load when filled
- Full capacity

These Buckets are made in sizes from ½ yard to 3 yards inclusive, and are furnished complete with front and rear bridle chains. This bucket will last longer than those made of the ordinary boiler plate sheet steel. Complete specifications mailed upon request. "Another Cedar Rapids Product."

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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 Colorado are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible.

20 CENTS A COPY. $2.00 A YEAR.

Our Cover Picture

Our cover picture on COLORADO HIGHWAYS this month shows a stretch of concrete pavement on U. S. Highway No. 285, located in Larimer County, near Fort Collins, running through one of the richest irrigated agricultural sections in the world. It is one of the most heavily traveled highways in the state. It was constructed during the past 10 years by the State Highway Department with Federal Aid funds. Photo by courtesy Colorado Association.

"BLAZING" THE MODERN TRAIL

"Cost less in the long run always"

NEW highways where highways never ran before! Wider roads . . . smoother roads . . . faster roads! And out in front, where the going is toughest . . . bucking steep banks, cutting ditches, doing all kinds of subgrade work . . . you find ADAMS Leaning Wheel Graders equal to every job.

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LEANING WHEEL GRADERS

Colorado Highways
"BETTER ROADS"
VOLUME X. JULY, 1931 NUMBER 7

Everybody Doing *Double Duty*

Children playing in the streets.

Parents criminally negligent in permitting their children to make a playground of public streets.

Cars driven through stop signs.

Cars driven from side roads to main thoroughfares, without driver first ascertaining if there are approaching cars from either direction.

Drivers of cars who cut in.

Drivers of cars who side-swipe.

Drivers who habitually make left turns without regard to traffic coming or following.

Drivers who pass cars on hills or turns, where the vision is obscured.

Drunken drivers.

Insane drivers.

Drivers with poor vision.

Drivers with poor judgment.

Smart aleck drivers.

Drivers with deficient mentality.

Habitually careless drivers.

Sleepy drivers.

Dahmphool drivers.

And so one could ramble on, column after column, in listing the accident-causing possibilities of driving a motor car in the present day.

During 1931 two leading manufacturers of low-priced cars will turn out on the streets and highways two million new cars. This number added to the total of all other motor cars manufactured represents a stupendous output. Added to the present number rolling, the traffic problem becomes just that much more intricate.

Many who have visited the Black Hills of South Dakota have no doubt smiled at the wise-crack sign found frequently posted at sharp turns, viz.: "Go Slow—You May Meet a Fool!"

However, no more truthful warning was ever printed.

There will always be accidents, of course. It is human for judgment to be in error at times, but the problem is to reduce these accidents to the minimum, instead of permitting them to increase from year to year.

As "The Leader" sees it, the one solution is—"Everybody Doing Double Duty!"

That double duty will consist of every driver carefully guarding his own driving conduct, so that he will not cause an accident to his own car, or be responsible for grief coming to any other driver or car on the highway.

That will be one phase of the "double duty"! The other consists of so regulating the conduct of your own car that if the other driver fails in any one of the rules of the road, that there will be no resultant crash.

Crushed bodies, broken bones, paralyzed forms, huddled heaps of quivering flesh, glazing eyes are the price of speed and the breaking of the rules of the road.

Motoring is one of the greatest gifts of the age, but its payroll is appalling in the number of annual killings and maimings; in the loss of protecting care of fathers and mothers, and in the lives and laughter of innocent children taken from loving parents.

Why not a society of motor car drivers who are willing to do "Double Duty"?

—Pipestone Leader.

Tennessee Pass *Gravel* Surfaced

By JESSE E. WILLIAMS
U. S. Bureau of Public Roads

THE Tennessee Pass Project, of which these two sections are a part, extends from Leadville, Colorado, northerly over Tennessee Pass to Redcliff, Colorado, a total distance of 26 miles. It is a portion of the Tennessee Pass Forest Highway which extends from Leadville to Minturn, a point about 8 miles beyond Redcliff. The highway is designated as a Class 2 Route of 34 miles in length; as No. 36 of the Colorado Forest Highway System; as No. 40S of the National Highway System, and as No. 4 of the Colorado State Highway System. The whole of the route is on the Pikes Peak Ocean-to-Ocean Highway between Colorado Springs and Salt Lake City, Utah. It is one of the most important of the state's highways, and forms a part of Colorado's Federal Aid system. The Denver and Rio Grande Western Railroad uses Tennessee Pass for their main line and it approximately parallels the highway.

The road on the western slope of the divide follows the watershed of the Eagle River, one of the best fishing streams in Colorado, and the Mount of the Holy Cross is visible from several places. Tourists and fishermen will derive a great deal of benefit from the improvement, but by far the greater will accrue [to] commercial traffic between the ea[st]ern and western slopes of the st[ate]. The route provides a comparativ[ely] low pass over the Continental [Di]vide, on easy grades and good ali[gn]ment, and will undoubtedly be u[sed] by a large volume of traffic to [and] from the Pacific coast. It also fa[ci]litates the administration and dev[el]opment of the national forests in [the] vicinity.

The project at the Leadville e[nd] connects with the Loveland-F[re]mont Pass Forest Highway, Ro[ute] No. 33; indirectly with the In[de]pendence Pass Forest Highw[ay] Route No. 38; and also with [the] "Frying Pan" road, a state ro[ad] through the Carlton tunnel to Ba[ker] on the Independence Pass route. [At] the Redcliff end it connects w[ith] Colorado Federal Aid Project [No.] 182, the "Battle Mountain" road, a[nd] with the proposed state highw[ay] over Shrine Pass, known as the H[oly] Cross Trail. This state road, [when] built, will connect the Tennessee a[nd] Fremont Pass roads through Re[d]cliff and Wheeler, respectively. T[he]

Dumping base course of crushed gravel on roadway near Station 442.

Finished road after application of crushed rock surfacing, where several sharp curves and steep grades on old road were eliminated.

ey map in the appendix shows the
ute with its relation to other pub-
projects, and to the cities and
wns in the vicinity.

In ordinary seasons the road is
osed to travel during the period be-
ween about December 20 and May
due to heavy snows.

The Homestake section of 3.98
les on the Redcliff end, completed
1925, improved the worst section
the old road. The Mitchell sec-
n, extending northerly from the
of the pass 4.36 miles, completed
1926, improved the next needed
tion. The Pando section of 6.88
les, completed in 1927, connects
north end of the Mitchell sec-
n with the south end of the
omestake section and finishes the
ading and draining of all of the
oject that lies on the western
pe of the divide except eight-
ths of a mile between Redcliff and
northern end of the Homestake
ction. This short section, designed
include a grade separation with
D. & R. G. W. Railroad and a
er bridge in the same structure,
ill be constructed as a separate
ction.

The surfacing section, 5.84 miles
length and completed in 1927, in-
ludes all of the Mitchell section
th an additional 1.48 miles imme-
iately adjacent to it on the south,
former being surfaced only,
hile the latter 1.48 miles was
aded, drained and surfaced.

General Fremont, during his ex-
orations in Colorado in 1843, se-
ted this as a feasible route across
mountains between Colorado
Utah. It had been used by In-
ns previous to this time, and con-
ued to be for some time after.
Until 1870 it was only passable by
ck trains. In that year a toll
d was constructed and operated
til 1880. About that time gold
s discovered at Leadville and the
D. & &R. G. Railroad built a narrow
uge line over the pass, causing the
andonment of the toll road. Later
county road was built and it was
ed until 1913.

In 1891 the D. & R. G. rebuilt
eir line to a standard gauge and
andoned the greater part of their
rrow gauge grade. In 1913 the
d grade between Pando and a
int a mile and a half south of the
of the pass was worked over,
nected with the old road, and
verted into a county highway.
Between Mitchell and the top about
and three-quarters miles of new
ad was built.

The Tennessee Pass project was

Upper picture shows old road looking west before work started, and lower picture shows completed road, as seen from Station 825. All photos by courtesy U. S. Bureau of Public Roads.

initiated as a proposed forest highway improvement in 1923 at a conference between the state, the Forest Service and the Bureau. On April 22, 1923, the state requested co-operation in the improvement of the project between Leadville and Redcliff. The Secretary's program of June 21, 1923, approved the survey and on August 4, 1923, an investigation of the general route was made. The location survey was run in September of that year.

On September 17, 1924, construction of the Homestake section between Stations 1087 and 1297 started, and it was completed on October 18, 1925. On July 7, 1925, construction of the Mitchell section, Stations 500 to 730, started, and was completed on October 2, 1926. Construction of the Pando section, Stations 730 to 1087, started on September 7, 1925, and was completed on July 30, 1927. On May 23, 1927, work on the surfacing section, Stations 422 to 730, started, and it was completed on October 25, 1927.

The completion of these two sections has accomplished a much-needed improvement on the project. The Pando section connected two previously completed grading and drained sections, making a total of 15.22 miles of continuous improved road. The surfacing section extended this grading and draining 1.48 miles on the eastern slope of the divide and surfaced 5.84 miles at the top with crushed gravel.

The project is designed with snow elimination as one of the main considerations. No real attempt had ever been made to keep the pass open for travel during the winter season until the winter of 1927 and 1928, when the state provided funds, men and equipment to do this. It has been successfully done to date. It is believed that the new road is largely instrumental in causing the attempt.

Maintenance of the whole project should not be excessive. During the first season or two, slides and settle-

(Continued on page 22)

Roads *Vital to* Farming

By EDWARD FOSTER, Commissioner
Colorado State Board of Immigration

IN the settlement of new communities and the development of those in which settlement already has commenced the gasoline engine has solved old problems, but in their stead have come new problems, no less serious but vastly less difficult to solve. The automobile and the motor truck have annihilated space, but with equal force they have made poor roads no longer to be tolerated.

Until a few years ago there was a general hallucination to the effect that any kind of a road was good enough and that money spent on roads for any purpose other than making them merely passable in ordinary weather was wasted, but it is now recognized that there never has been a time or a circumstance in which poor roads were anything but poor economy. The necessities of pioneering and lack of funds for public purposes often has made poor roads an economic loss which it is difficult to estimate.

In the mind of the intelligent farmer who looks to Colorado for his new home, one of the first questions which presents itself is that of transportation. Can he get his supplies from the railroad to his farm and transport his crop from the farm to the railroad at a reasonable cost, or is he to be financially handicapped and from the standpoint of time by poor roads, over which neither wagon nor motor truck can haul heavy loads or make good time? He knows that a farm with five miles of mud road between it and the railroad is frequently as thoroughly isolated as a farm 25 miles from the railroad with a connecting highway which is passable with reasonable loads under all ordinary conditions. Consequently, when he applies for information as to his prospective home, one of his first questions is, "How are the roads in that country?"

Some years ago Secretary Houston of the United States department of agriculture made some estimates as to the relative cost of transportation by railroad and over ordinary roads by wagon, finding that the cost of the latter was from 35 to 45 times greater per ton-mile than the cost of shipping by railroad. The cost for railroad freight at that time was approximately four mills per ton-mile, making the cost of the transportation by wagon road at that time, at his lowest estimate, 14 cents per ton-mile. Assuming that the average farm haul in Colorado to the nearest point is five miles, which probably is not as great as the actual average, the cost per ton by wagon over average roads was 70 cents, while the charge for transporting the same load an equal distance by railroad was two cents—an excess of 68 cents per ton for the five-mile haul by wagon.

At the same time the interstate commerce commission estimated the total annual tonnage of farm products and livestock moved over the railroads of the country at 200,000,000. On that basis the cost of a five-mile haul of the entire total by wagon road was $136,000,000 more than the cost of hauling the same total an equal distance by rail. Other figures prepared in other quarters at about the same time increased the total tonnage hauled to the railroads considerably, but the commission's estimates are used here because of their conservative character.

It is probably true that the cost of hauling by motor truck over public roads can never be brought to as low a level as the cost of hauling over rails, but it certainly is true that the tremendous difference between the two cents at the present time can be lowered appreciably. The intelligent farmer of today knows that his problem is twofold, including the question of producing a good crop and the equally important question of getting it to the nearest market with the least possible expense, and that is why he is concerned with the problem of good roads and is using every effort to induce the improvement of the highways and the construction of new ones along the line which he must take to reach the market from which he buys and to which he sells.

The present rate of increase in lands being put under cultivation is probably greater than the rate in any other state in the Union. This alone furnishes proof that Colorado is feeling the effect of the westward tide of immigration more than any other state and is in itself the strongest argument for extensive road construction and improvement. Immigration and settlement halt abruptly at the edge of any district which is not fairly well supplied with adequate highway facilities, for poor roads are more discouraging to the prospective settler than is remoteness from railroads. At present

View of section of the newly completed Federal Aid highway between the summit of La Veta Pass and Fort Garland, a distance of twenty miles. Picture taken near Russell, in Costilla County, leading to the rich agricultural section of the San Luis Valley.

Hauling sugar beets to Brighton factory over Denver-Greeley concrete paved road. Farmers using this road have saved its cost several times over since its completion in reduced haulage costs.

olorado cannot anticipate any con-iderable extension of its railroad fa-ilities, so the problem admits but ne answer — the construction of ighways which shall make the pres-nt railroads accessible from every art of the state. That and the roven economy of transporting ver good roads, compared with ransporting over poor roads, con-titute irrefutable arguments for the ssertion that the work of road im-rovement must be considered only n its infancy.

As good roads tap the rich lands hich are remote from railroads and s yet unnocupied, they will become hickly settled and intensively armed. In this age of motor trans-portation they will be made as easily ccessible from railroad points as are the now thickly settled commun-ties more conveniently located. The modern farmer judges his distance rom town not in miles but by the ime it requires to make the trip and y the loads he can haul. Improved oads eliminate distance and poor oads magnify it.

There are few considerations as ital to the future of the develop-ment of the agricultural communi-ies as is the question of highways. The present program of the state in his direction will determine largely he immediate future of the immi-gration question. A constructive olicy will promote settlement ightily and an ultra-conservative olicy will retard it for years to ome.

The Lord is with us democrats, but not often.—Will Rogers.

It isn't the shortness of the skirt that counts—it's the up-creep.

FUTURE OF MOTOR TRANSPORT DEPENDS ON ROAD BUILDING

THE growth of motor transport depends on the type of road, the length of haul and the speed of travel all affecting the amount of goods hauled, according to L. A. Graham, vice president, Relay Motor Company, in an address before the American Road Builders' Association.

"Highway engineers have much to do with determining the amount of load that can be hauled on highways," declared Mr. Graham, "the kind of highways to be built, and the speed with which goods can be transported.

"If the average speed of haul and the average amount of goods can be doubled, there is a saving in transportation costs and higher operating efficiency. Savings as high as seven cents a mile are possible based on a twenty-five cents per mile trucking cost due to increasing the average speed or the average load. These increases can only be made through adequate highway capacity."

There are three major factors that must be considered as well as the matter of loads and speed. Road facilities must be provided that will make automobile use profitable and pleasurable, vehicles must be operated with safety, and taxation must be on an equitable basis.

Motor vehicle safety seems to be falling behind instead of improving, according to latest figures. An insurance company reports that 50,900 people were killed in automobile accidents in the past eighteen months which is 400 more than were killed in action and died of wounds in the A. E. F. during the same length of time in the World War. A multitude of unrelated agencies are studying traffic accidents, the work of which must be correlated. It is difficult to find out just what causes accidents, due to differences in methods of compilation.

Radical revision and extension of highway programs have been advocated in some quarters to provide facilities for both automobile and motor truck operation that will permit higher speeds with safety and increase the comfort of automobile driving. The other alternative is the limitation of speeds and the ruling off the roads of some classes of vehicles.

THE FORMULA OF HIGHWAY SAFETY

Highway safety consists of three elements, like a three-legged stool, on each of which rests a part of the burden and without one of them the whole topples over. Any program will fail that does not consider all three of the elements.

The formula for highway safety is:

Safe drivers + Safe vehicles + Safe roads = Safety

Carelessness at high speeds is undoubtedly one of the underlying causes of accidents, but a safe roadway is the foundation on which to build a concerted effort to reduce carelessness. Carelessness can be overcome by "courtesy and caution."

Week-Ends, *Cars and Road* Widths

By E. E. DUFFY

THE American week-end isn't what it used to be, no more than today's washing machine and refrigerator are like the antiquated affairs of only a handful of years ago. In years gone by the front porch, or if glorified, the veranda, was a necessary part of every week-end. Nowadays, however, the front porch is largely used as a taking-off place for a motor trip.

The success of the American week-end is intimately bound up with a rather unromantic thing, and that is road width. It so happens that in road building there are three things of prime importance. Perhaps, first of all, come road lengths. People want to get to distant points and they must have roads to do it. Then comes the matter of road thickness. It doesn't do much good to build a road unless the road is substantial enough to carry traffic smoothly, comfortably and inexpensively. The third item, road width, is also very important, but in many, many cases it has been given very little attention.

The question "How wide should a road be?" of course can be answered only after consideration has been given to the volume of traffic carried by the highway. To build a road wide enough to take care of Tuesday's or Wednesday's traffic is obviously an error. It has long been recognized that roads should be built wide enough to take care of the peak automobile traffic flow, and that means week-end and holiday traffic. A highway may serve very well during the week, but when a sunny Saturday and Sunday come along the road may be hopelessly inadequate.

A two-way grade separation in Wayne County, Michigan, near Detroit.

It may be said with safety that the average passenger car owner gets little use out of his car except over the week-end. He may pay his gasoline taxes the year 'round and if he lives in a city he only really gets to see what his money has purchased on the week-end when he ventures out into the country. It is disappointing to the motorist to find that on the two days of the week when he has the time to use his car that everybody else has the same idea and the same roads in mind. Although the number of passenger cars did not increase last year, motoring did increase appreciably, and it appears that this year the average motorist will cover many more miles of travel than he did in 1930.

The continuous increase in motor car usage has been more rapid than the increase in wide pavements. Let us look for a moment at traffic conditions found in various parts of the country over last Independence Day week-end. Jacob L. Bauer, state highway engineer of New Jersey, reports: "At this first motoring holiday of the year our highways, especially on the main routes, were completely filled with traffic. New Jer-

One of the newly designed traffic circles recently completed in Wayne County, Michigan.

-ey is trying to meet the demand by the construction of many miles of additional state highway routes throughout the state, but as soon as the new roads are completed they are filled with traffic. However, the public seems to desire more and more highways, and if they are well built the public is satisfied to pay the bill. We are proceeding with that attitude in New Jersey."

Another insight into conditions in the New York City area is given in the following statement made by High W. Robertson of the Westchester County Newspapers, Inc., who states: "Statistics gathered show that Westchester roads and parkways were heavily strained July Fourth, especially during the homeward rush Sunday evening. The Albany Post Road was jammed all Sunday afternoon, also the Boston Post Road was congested throughout its entire length in Westchester County. A traffic check kept at two corners in Yonkers showed that 36,862 and 40,552 cars, respectively, passed in a 14-hour period on Sunday, a total of 280 solid miles of cars. Police in Yonkers are worrying about the impending Labor Day traffic."

It is almost axiomatic that shortly after a new road or street is constructed it immediately attracts traffic in a greater volume. So far traffic demands in metropolitan areas, almost without exception, are ahead of traffic facilities. Enough progress, however, has been made in building highway facilities to indicate that the problem of providing ample space can be successfully solved.

Wellshire Boulevard in Los Angeles, one of the heaviest traveled streets in the world, showing six lanes for traffic with eight-foot parking strips on each side.

It must be remembered that a two-lane road can only carry with safety a limited number of cars. Observing the principles of safety, with sufficient space between cars, a two-lane country road can carry approximately 1,000 cars per hour and a two-lane highway in a suburban area from 800 to 1,000 cars per hour. Naturally a high proportion of trucks, buses or slow drivers will decrease these capacities.

The traffic capacity of a four-lane pavement may carry more than double the volume of traffic that the two-lane pavement will carry, according to authorities of Wayne county, Michigan. T. H. Dennis, maintenance engineer for the California Highway Department, estimates that a three-lane pavement will carry around 2,000 vehicles per hour, while a four-lane pavement will carry about 3,200 cars.

Business has its ups and downs, but motoring goes on regardless. Early gasoline tax returns from various states show the likelihood that the average motorist's travel of last year of 8,340 miles will easily be exceeded this year. Of the 26,500,000 motor vehicles in the United States more than 20,000,000 are city-owned. Considering this along with increased motoring, it is apparent that more attention should be given streets and outlets to the country. Granting that the first consideration in highway building is that of length, it now appears high time attention, similar to that devoted to rural roads, be given metropolitan thoroughfares.

Present traffic conditions in most metropolitan areas are responsible for huge economic wastes. In the regions around New York, Detroit, Chicago, Los Angeles and a few other cities there is enough evidence to show that traffic congestion on outlets to the country can be eliminated through the construction of wide highways and elevated highway intersections and widening existing highways. Such facilities, of course, cost money, but the lack of these facilities also costs money. So the money is spent one way or another and most communities can find a more satisfactory way to spend it. The Great American weekend needs attention.

Pedestrian subway, crossing Center Street, Chicago. Two sets of railroad tracks are crossed by the subway.

Oil Road *Process* *Tested* Near Manitou

By B. F. CLARK,
Manitou, Colorado

COLORADO, as well as most of the other Rocky Mountain states, has an abundance of road building materials, in the way of gravel, sand and stone. The state also has many miles of surfaced roads that would be considered good if they were located in some state where the rainfall is greater.

Graveled roads, of course, must be dragged and scraped often if they are to be kept in good condition. Such work must be done after a rain, or at least when the surface of the road is moist so the gravel and clay will pack in the holes into which it is scraped.

On account of the lack of moisture in the semi-arid states it is impossible to keep the gravel-surfaced roads in good condition. For, no matter how often they are scraped and dragged, the material does not pack when rolled into the holes. It lies there loose, and is soon knocked out again by the traffic, leaving the surface of the road as rough as it was before it was worked.

Regardless of these undesirable features of the gravel-surfaced roads, many county, state and government roads in Colorado, which have been so cheaply constructed on account of the abundance of the material often found lying right beside the highways, will make substantial foundations for surfacing materials later to be applied.

The most prominent question in county and state highway matters in Colorado now is the one concerning the possibility of finding a cheaper substance for treating the gravel highways.

Seek Cheap Surfacing Material

In an interview published some time ago in the "Colorado Springs Telegraph," Robert Higgins, superintendent of maintenance of the state highways, said:

"We have been looking for a material with which we can build and repair roads at a much cheaper figure than we now pay. When we find that material we can construct far more miles of roads, and we can keep them in shape far better than we have in the past. The present program is all right, but it is expensive, and with limited means, only a small proportion can be accomplished each year.

"We are investigating a product from Utah that we think will reduce the cost of road building. They are going to build a few sample miles on the heavily-used streets of Pueblo, and we will see what happens after it has been used a few years. We are also investigating a product from Missouri for repairing roads. It is called bitucrete. The people in Missouri and nearby states say that it is a perfect product for the repairing of roads and for construction. They are also sending a sample lot to Pueblo to be tried out, and if satisfactory we will use it in the repairing work. The Utah product can be secured for about 70 per cent of what it is costing us to build roads now, and the Missouri repairing product can be secured for about 60 per cent of what we are paying now."

One of the cheapest combinations of substances recently used in Colorado in the surfacing of roads and one that is proving to be a successful one, is emulsified asphalt.

Two Successful Experiments

In Weld county, near Nunn, the State Highway Department constructed 24 miles of emulsified asphalt pavement. The town of Greeley has also paved several blocks with this kind of pavement. So far, these two projects have given satisfaction, and the cost of the work has been surprisingly low, the cost of the paving of the road mentioned above in Weld county being only about $2,200 a mile.

The county commissioners of El Paso county also finished a mile stretch of this kind of road in the Cheyenne Canon district, near Broadmoor, a suburb of Colorado Springs. The county paid about 50 per cent of the cost of this road and the beneficiary property owners along the road, who were as much interested in the experiment as the county officials, paid the rest.

This highway, which leads from the city to some of the most popular scenic districts in the state, during the summer months is one of the most heavily-used roads in the locality. Consequently, if this road holds up, as the officials believe it will, there will be many more miles of such pavements constructed in the county.

The emulsified paving product is very simple, the combination being merely asphalt and oil, one and two-thirds gallons of oil being used to one yard of pavement three inches thick.

The application of this material to the surface of the road is also as simple as the combination of materials. The surface is merely scarified, by running a heavy disc over it. The asphalt is then heated, spread over the road with rakes, and the oil, or petroleum, poured on and mixed in with the hot asphalt.

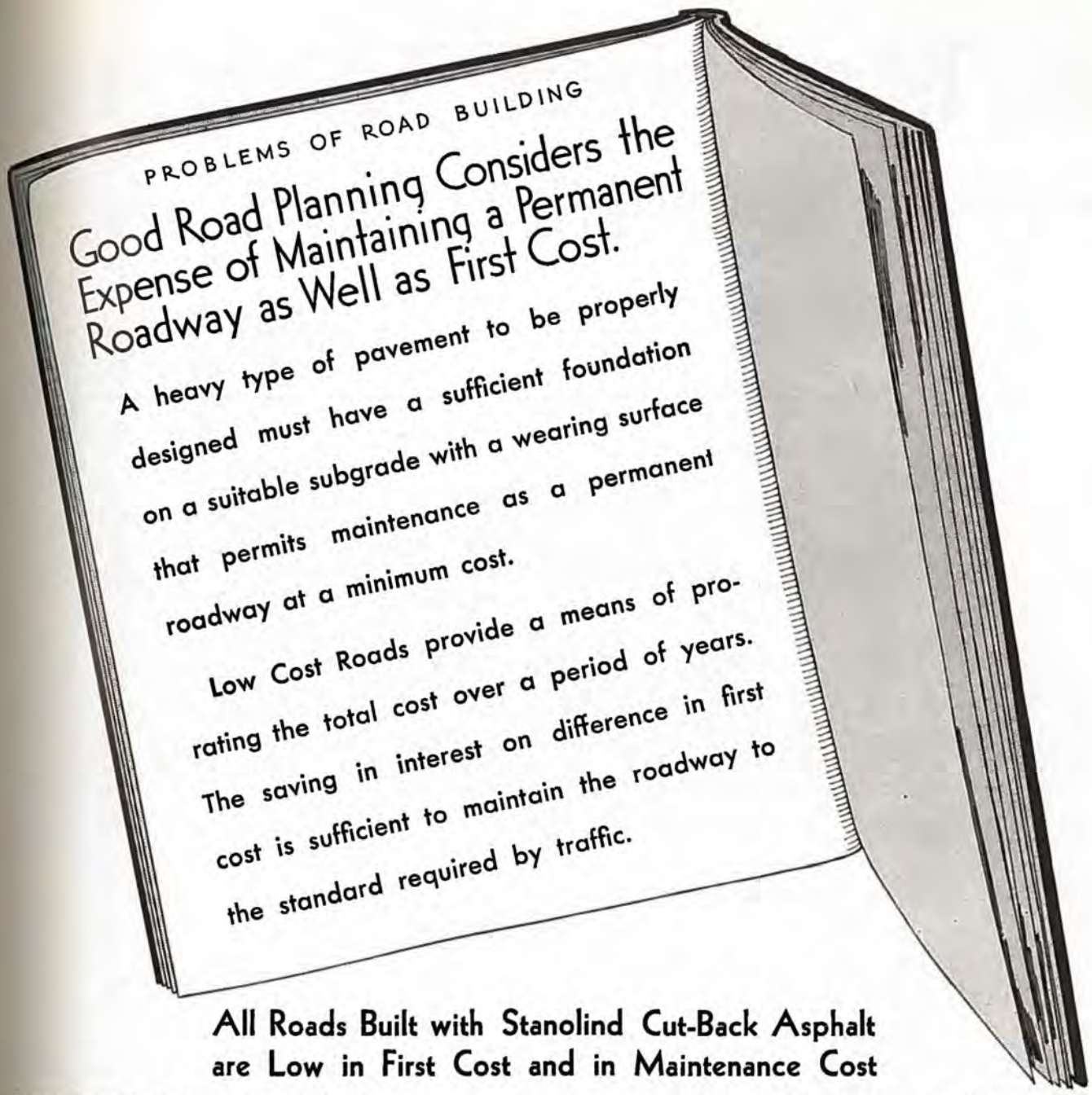
No rollers whatever are used. Traffic packs the material, vehicles being permitted to run over it a short time after it is spread.

Hardened by Weather and Traffic

For a few days after this pavement has been finished, vehicles make deep tracks in it as if it were so much stiff mud. But heat and cold gradually harden it, until the deep ruts made by wheels give way to slight corrugations, which should be a good feature in freezing weather, when ice on ordinary pavements becomes as "slick as glass."

A few weeks after this kind of pavement is finished it becomes as firm as concrete. For example: a 17-ton gas shovel was recently run over the road in Weld county, mentioned above, without denting it.

The mile of pavement in the Cheyenne Canon district which has been constructed for experimental purposes, as well as others, comprises sections on two different roads which intersect. The paved strip on one section is twenty feet wide and on the other it is twenty-four feet wide.



All Roads Built with Stanolind Cut-Back Asphalt are Low in First Cost and in Maintenance Cost

Stanolind Cut-Back Asphalt makes it possible for highway officials to build more miles of good roads per dollar invested. It enables them to give taxpayers a greater return on their money.

The advantages of Stanolind Cut-Back Asphalt roads are obvious . . . low first cost . . . saving in interest . . . durability . . . smooth riding . . . low maintenance . . . high earning power. Of all low cost types of roads being constructed, Stanolind Cut-Back Asphalt roads provide to the highest degree, all of the desirable qualities a good road should have.

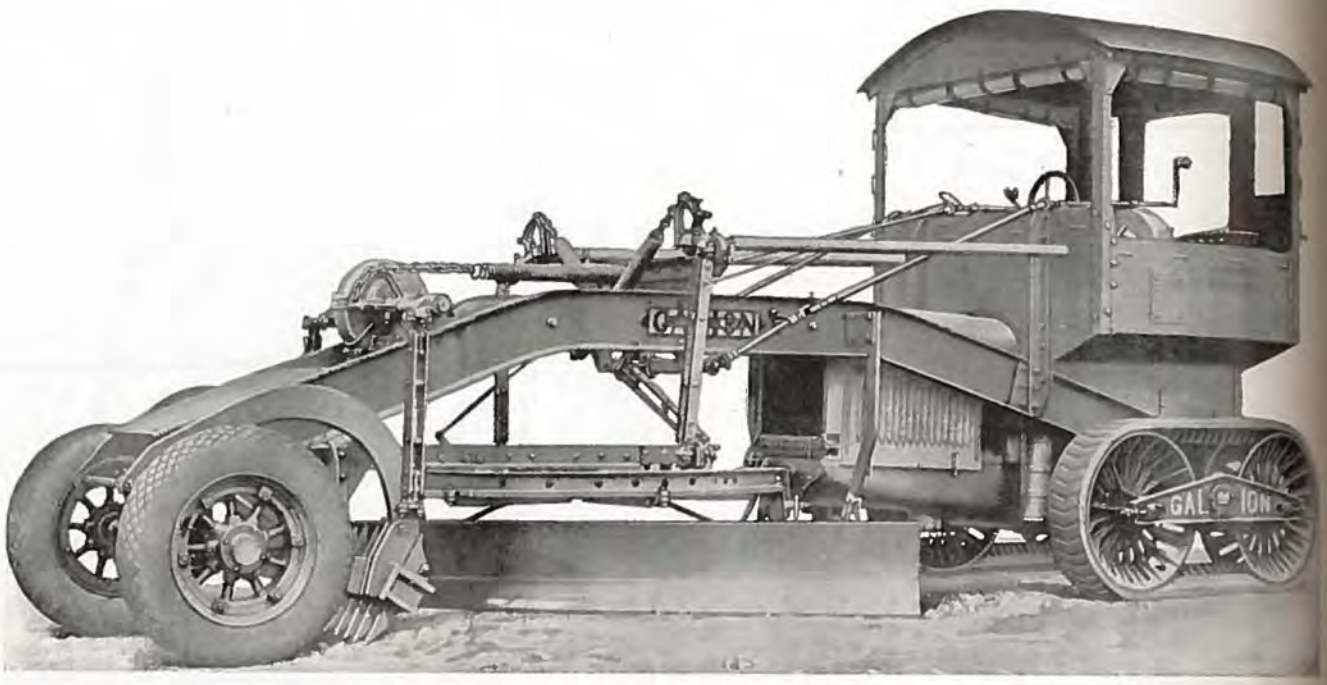
If you would like further information on Low Cost Roads, write for our Cut-Back Asphalt Booklet. It is a valuable handbook on low cost road building with Asphalt.

STANDARD OIL COMPANY
(INDIANA) 107
910 South Michigan Avenue Chicago, Illinois

STANOLIND ASPHALTS FOR ROAD BUILDING

A Modern Mainte
Condition

WE WILL DEM



THE NEW TRIED AND PROVEN (in Colorado) GALION Sur-Trac One Man Maintainer powered by McCormick-Deering Model 20 Industrial Tractor. Pneumatic or solid front tire equipment. Sur-Trac Crawlers for traction. Blade lengths, ten or twelve feet. When Galion builds it—it's built right.

THE NEW GALION No. 8 Multiple Blade Maintainer. Exclusive Galion lifting device. Rubber tired roller bearing wheels. Can be used with either truck, crawler type or round wheel Model "30" McCormick-Deering Industrial Type Tractor with either solid or pneumatic tired wheel equipment.

This is also "one man" maintenance equipment.

We guarantee to meet your mainte
for your particular work. Write, ca

H. W. Moore Equipm

Colorad

Reaper *Harvests* Good Roads

By JOSEPH EMERSON SMITH

JULY, 1931, sees the Centennial of the Reaper. Closely allied to this indispensable machine which revolutionized grain production methods, are the nation's improved highways. Good roads from farm to market became a necessity when agriculture demanded systems of safe transportation for a greatly increased production. In a sense, the centennial should be celebrated for both—the reaper and the road.

How the reaper helped develop the West to agriculture is of special interest this year when its centennial is being commemorated throughout the world.

During the early days when the log forge shop on the farm in Virginia was the only reaper factory, Cyrus Hall McCormick, the inventor, himself was the only salesman. In 1844 an unexpected order for eight reapers coming in from the West caused McCormick to investigate this vast new market. He traveled through New York, Ohio, Wisconsin, Illinois, and Missouri, his pockets filled with order blanks explaining to farmers the value of his reaper.

His eyes were opened, his imagination challenged. He wrote to his family that while reapers were luxuries in Virginia, they were absolute necessities in Ohio, Illinois, and on the great plains of the West. It was after this western trip that he began preparations to move to Chicago to build a big factory located centrally in the grain-producing regions.

The story of McCormick, the inventor, the manufacturer, the salesman and the advertiser, is one of the great true romances of opportunity in America.

CYRUS HALL McCORMICK,
the Inventor.

The year 1931 marks the centennial of the McCormick reaper. In July, 1831, Cyrus Hall McCormick, a young Virginia farmer, displayed at public trial the world's first successful grain-cutting machine. The accompanying illustration below of the 1831 reaper, a McCormick-Deering tractor binder, and a modern McCormick-Deering combined harvester-thresher shows clearly the advancement made in grain harvesting methods since the introduction of McCormick's reaper a century ago. The 1831 reaper, cutting ten to twelve acres a day, did as much work as four or five cradlers or twelve to sixteen men using reaping hooks. The McCormick-Deering combined harvester-thresher is the ultimate in modern grain harvesting methods. With the combine it is possible to perform the entire harvesting job in a single operation, cutting and threshing twenty-five to sixty acres a day, depending upon the size of machine used.

When Cyrus Hall McCormick was fifteen, the scarcity of harvest hands demanded that he help in the harvest on the farm where he was born and reared, Walnut Grove Farm, near Steele's Tavern, Virginia. The heavy cradle was too much for his young muscles, so he made a special light cradle for his own use.

His father, Robert McCormick, for years had been working on the problem of cutting grain by a machine drawn by horse power. In May, 1831, the elder McCormick came to the conclusion that the reaper problem could not be solved. Young Cyrus, however, had his own idea and within six weeks after the last failure of his father's machine made a model and then built a reaper for public trial.

The first public test was held in a small field of late oats in July, 1831. The new reaper worked well. It is interesting to note that it combined in their true balance and proportion seven basic principles which have to this day been considered essential in virtually every grain cutting machine built: straight cutting knife with reciprocal motion, fingers or guards extending in front of the knife, the reel, the platform, the main wheel, the divider, and forward draft from one side. True these principles have been improved upon from time to time, but none have been added—none dropped.

In 1833 the new machine attracted the attention of the editor of the Lexington, Virginia, "Union," and the September 14, issue carried a

(Continued on page 18)

NOW.. International Quality At *Low Price*—a *New* 1½-ton International with 4 Speeds

Only $675

136-inch wheelbase chassis, standard equipment, f. o. b. factory

INTERNATIONAL

MODEL A-2 FEATURES

4 forward speeds.
22 ball and roller bearings.
Powerful engine, L-head type; 3⅜ in. bore, 4½ in. stroke; ample power with unusual fuel economy.
Cam-and-lever steering gear.
Vibration-dampened clutch.
2 wheelbases: 136 and 160 in.

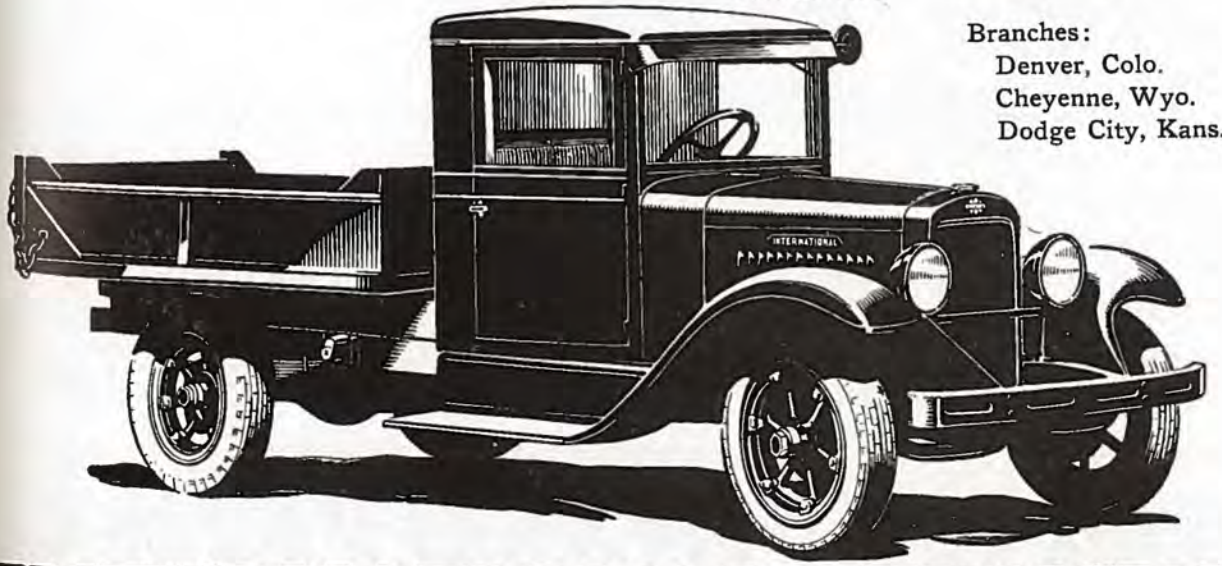
International Harvester announces a new 1½-ton, 4-speed, 136-inch wheelbase truck—the Model A-2. A better truck with more power than International has ever been able to offer at the low price of $675 f. o. b. factory. It is a true International from front bumper to tail-light—of the same high quality and backed by the same Company-owned service that has made Internationals famous for low-cost hauling.

Here are power, speed, stamina, attractive lines, and all-around dependability. Here also is absolute assurance of low upkeep expense and unusual operating economy for many years.

Ask for a demonstration of this new truck. Drive it. In no other way can you appreciate the quality that has been built into the Model A-2. It is another International achievement that will add to the ever-increasing popularity of the International line. Internationals are built in ¾-ton to 5-ton capacities. Sizes for all needs. There are 183 International Company-owned branches. Call on the nearest branch.

INTERNATIONAL HARVESTER COMPANY
OF AMERICA
(Incorporated)
606 So. Michigan Ave. Chicago, Illinois

Branches:
Denver, Colo.
Cheyenne, Wyo.
Dodge City, Kans.



INTERNATIONAL TRUCKS

Three and a half-ton F. W. D. CU-6 model coming down an 18% grade. Second gear held the load back without using brakes. James N. Warner, Salida, Colo., owner. FWDs are at work on the highways of the world 12 months per year

How're Your Profits?

HERE'S A TIP on cutting your overhead and realizing the most profit on your truck investment. Depreciation and interest on the investment are the two largest factors in truck operating expenses. These charges being fixed on a yearly basis, the only way they can be reduced is to work more days per year and thus distribute the cost for a greater amount of work.

Put FWDs to work and the maintenance year becomes twelve months instead of six as is figured on for the ordinary trucks. It's the extra performance built into the FWD (four-wheel drive) trucks that makes possible the twelve month per year operation as well as more days per week in the average construction work. The four-wheel traction plus plenty of power enables the FWD to work on poor roads with a full load where other trucks would have difficulty in traveling empty.

The winter season should be even more profitable for the contractor than the summer, as competition is less severe. Work for snow removal, log hauling and similar difficult jobs are open only to the capable, and the FWD is recognized as the leader in handling these tough jobs.

Complete information and timely suggestions on FWDs for year 'round service can be secured from

Liberty Trucks & Parts Co.

West Sixth Ave. and Bannock St., Denver, Colorado

For Finishing Shoulders

THE Insley Shoulder Finisher solves the problem of finishing shoulders accurately and mechanically. It eliminates guess work on that part of the road job that has always represented the greatest hazard and the surest chance of loss.

It is automatically guided from the edge of the slab by means of a guide bar on a concrete pavement, or by means of an indicator on a macadam job. The distance from the edge of the pavement to the edge of the shoulder is thus automatically set.

The Finisher travels on the pavement, the tractor on the shoulder—thus the grade of the finished shoulder is correct with reference to the slab—as it should be.

It can carry a full blade at all times without any side slip of the rear wheels—due to the correct balance and use of large pneumatic tires.

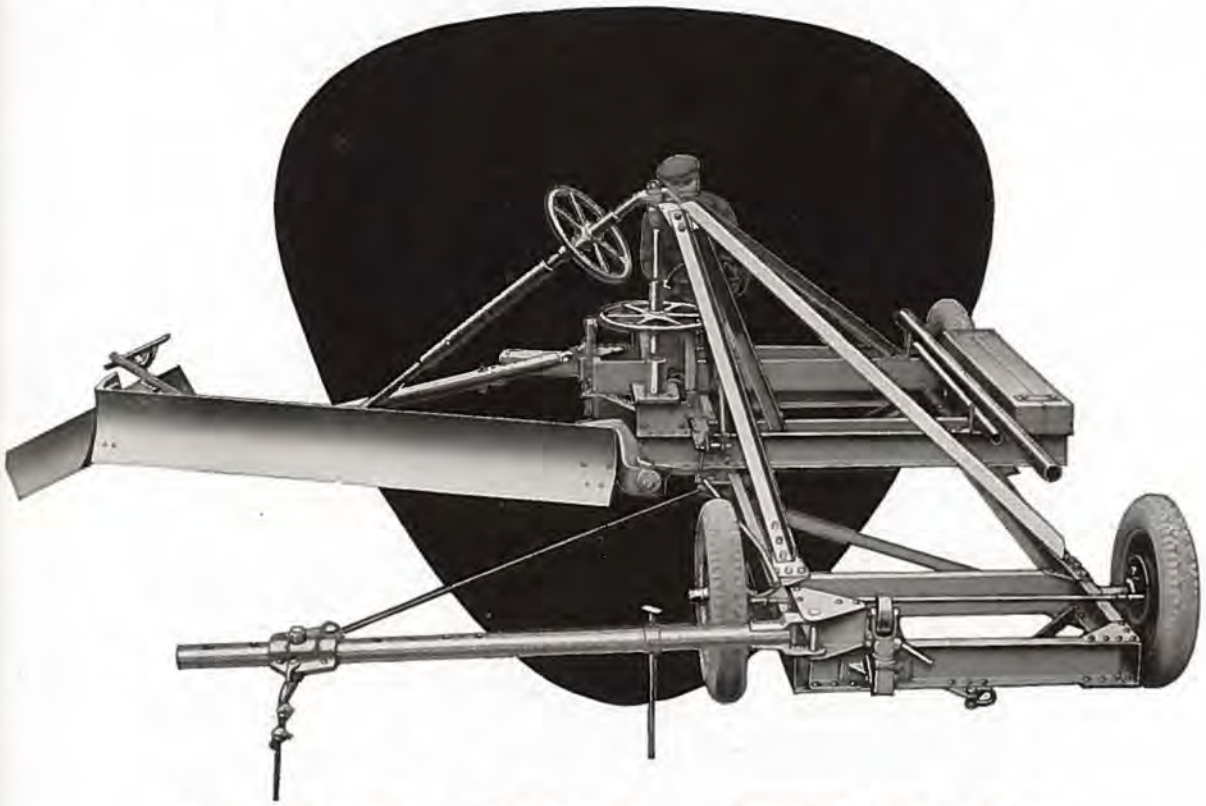
Its blade is adjustable up and down at both ends—forward or backward to take care of various widths of shoulders—or to drag material in toward or push it away from the machine.

The blade can be folded so that the machine is less than 8 feet wide for traveling.

With an 8 foot blade, it finishes 5 to 7 foot shoulders—with a 10 foot blade from 6 to 8 foot shoulders—and with a 12 foot 6 inch blade from 8 to 11 foot shoulders.

It will speed up your estimates, and clean up important but expensive work in a hurry. In fact, it will pay for itself in short order.

Investigate the Insley Shoulder Finisher today.



INSLEY

814

From whom you buy equipment is equally as important as what equipment you buy! National Equipment Corporation lines are handled only through representatives of financial responsibility, equipped and willing to maintain localized service to N. E. C. standards.

WILSON MACHINERY COMPANY

1936 Market Street **Telephones: TAbor 0135-0136** **Denver, Colorado**

Reaper *Harvests* Good Roads

(Continued from page 14)

complete description, along with certificates of leading citizens of Rockbridge County. This was the first word of the machine, which was to take the country by storm, ever to appear in print.

New York and other papers reprinted the article. McCormick had cuts made of the reaper to give farmers, who had not the opportunity of viewing the actual machine, an idea of its appearance. A firm believer in advertising, he used column after column of space filled with long advertisements in which he loudly proclaimed his Patent Virginia Reaper the first in the field, therefore the model after which all others were copied.

Advertising was far from being an art a hundred years ago. McCormick's task was to educate a nation of farmers who were accustomed to look upon new things with skepticism, to the use of a mechanical grain cutter. His advertisements usually consisted of a wood-cut illustration showing a reaper being pulled at a trot by a pair of high-stepping horses and a man dressed in Sunday clothes raking the platform; this being followed with a long mechanical description of the machine and numerous testimonials of prominent men who might or might not be farmers. Small type was used in order to pack more words into each column, and to the farmer these advertisements—which we of today would never stop to read because of their length—were sources of much information. The parts of the machine were numbered to make it easier to follow the mechanical description.

Competitive field trials were a source of amusement and helped popularize the reaper. Direct-mail advertising was used. The need for information on operating the reaper made it necessary to print complete instructions to go with each machine. Local agents with territories too large to permit visiting farmers individually, mailed personal letters and enclosed printed descriptions. McCormick also prepared large handbills which were posted throughout the towns and countryside and used by village merchants for wrapping the purchases of their farmer customers. McCormick's challenges to competitors and statements as to the merits of his machines were set forth in the pompous language characteristic of the day and carried a tone of sincerity bound to be convincing. Old world prestige was added when his American machines carried off highest honors in every World's Fair at which he exhibited from 1851 to 1878; these including those in London, 1851; Paris, 1855; Hamburg, 1863, and Vienna, 1873.

With no former systems of advertising campaigns to follow, the young manufacturer worked out methods of publicity so resultful that they are in use today without essential change except for the advancements which time has brought.

The little log forge shop in which the first reaper was built served as the only factory until 1843. A local blacksmith, John McCown, made the steel cutting knives. Robert and Leander McCormick with their farm helpers, formed the factory personnel. The two sold in 1840 were the first reaper sales. Seven reapers were sold for the harvest of 1842. Sales jumpeed to 29 in 1843 and to 50 in 1844. Cyrus contracted with firms, first in Brockport, New York, and Cincinnati, Ohio, and later in other cities, to manufacture reapers for their respective communities. Cyrus traveled over the country spreading the reaper gospel and selling machines.

Unexpected orders coming in from the new western plains, combined with trouble with his licensed manufacturers—some of whom were using inferior materials poorly put together—led to the establishment, in Chicago, in 1847, of his own factory on the north bank of the Chicago River just east of the present Michigan Boulevard bridge. McCormick's Reaper Factory was a three-story brick building, 100 by 30 feet in ground size. A steam engine operated saws, lathes, planing machines, and grinding stones. There were six forges in the first factory and 33 men were employed. Within eight years the factory had a daily capacity of 40 machines. In 1855 four thousand reapers were actually built. The younger brothers, William S. and Leander J. McCormick, came to Chicago and joined Cyrus as partners.

The great Chicago fire in 1871 completely destroyed the plant. Cyrus acquired a new factory site on the prairies southwest of the city. On this site was built McCormick Works, which soon became and ever since has been the greatest farm implement factory in the world.

During the fifty years following the invention of the reaper in 1831, McCormick saw his original machine grow into the steel-frame twine binder. It had progressed slowly but surely, through the self-rake reaper, the Marsh harvester, the wire binder, and the wood-frame twine binder. The inventor had watched his reaper evolve from a machine replacing four or five cradlers in the harvest field to one which enabled one man to cut and bind twenty or more acres a day.

The sales methods of McCormick are a part of salesmanship history.

By 1855 most of the states in the Union, as well as Canada, were covered by a network of McCormick agencies. Pressing work at the factory made it necessary for Cyrus and his brothers to spend less and less time traveling in the field. Cyrus spent much time in developing and testing improvements to make his reaper increasingly valuable to the farmer, while his brothers supervised production of the machine. During the harvest season, however, they traveled over the grain country helping agents to defeat competitors in field contests, studying their machines in operation, and talking to farmers to get their views on possible improvements.

These trips also gave McCormick an opportunity to see what advancement his competitors were making and to detect possible infringements upon his patents.

It was not until 1848 or 1849 that written contracts began to be made with appointed agents. The salary or commission depended upon the territory, the strength of the competition in particular regions, and the ability of the man to sell reapers and make collections. It was required that agents have sufficient mechanical skill to assemble harvesting machines and start them out for the farmer. Agents also carried stocks of repair parts and had to be able to repair machines in the field in case of breakdown.

The first reapers were sold by cash, but a liberal credit system was soon adopted. The farmer was required to pay the freight and one-third of the purchase price upon delivery of his machine, the balance to be paid December 1, with interest from July 1. Although each agency contract clearly stated that suit should be started immediately upon a farmer's failure to pay his reaper notes, it is a fact that for many years never a case was brought into court. The good will of the farmers in general meant too much to McCormick to run the risk of lessening it by legal procedure. (Con. on p. 25)

The new Colorado highway bridge over Clay Creek, located east of Lamar, is of reinforced concrete pile trestle type construction. Ideal Cement was used exclusively. It was designed under the supervision of Paul M. Bailey, Bridge Engineer, State Highway Department. The Division Engineer was James D. Bell of Pueblo and the contractor, W. A. Colt & Son, Las Animas, Colorado. The Resident Engineer was L. A. Rose of Pueblo.

NEWS OF THE MONTH

Shower baths, bed sheets spotless white and changed like a hotel—a kitchen that one could eat off the floor—that's the kind of a road camp one finds on a state highway project located in northwestern Colorado.

On this project three shifts of men are employed, working night and day, using the biggest and most powerful dirt-moving machinery ever seen in this state. A battery of huge arc lights are used by the men at night.

"We find that a clean camp, including beds with clean sheets, good food and plenty of it from a clean kitchen, pay big dividends," said the contractor. "Our men are pleased with their living conditions and they give us an honest day's work, and we in turn give them an honest day's pay."

And, as a result, a thirteen-mile job which the engineers estimated would take all summer to complete will have traffic moving over about the first of August.

Hamilton & Gleason, well known railroad contracting outfit, were successful bidders on eighteen miles of grading and gravel surfacing on the Denver-Limon road, west of River Bend in Elbert county. Their bid was $240,000 for the completed job, $17,000 under the engineer's estimate. There were twelve bidders on this project, including five other railroad contractors from Colorado, Missouri, Nebraska and Idaho.

With the construction season only three months old, the Colorado Highway Department has let contracts involving the expenditure of $4,500,000. It is expected that contracts for road work will total over $5,000,000 by the middle of July. Payments by the department for road work are now running about $1,000,000 per month. It is expected that payments will reach this total each month until November 1st.

Another project of six miles, involving grading and widening, on the Willow Creek Pass road, extending north from the Granby Junction, was contracted by the U. S. Bureau of Public Roads on July 6th. The estimated cost of this work is $72,000.

A total of 675 men were given employment in the national forests of Colorado during the month of June, according to Col. Allen S. Peck, regional forester. So far this year 1,668 men have been given employment through forestry projects of various kinds, Col. Peck reports.

Boulder is to have an "Inspiration Point" if plans now being formulated are carried out, through efforts of the Boulder chamber of commerce, Rocky Mountain Climbers Club and the city of Boulder. It is planned to construct a side road from the pavement to the summit of Goodview Hill, located four miles east of Boulder. On the crest of Goodview visitors will be able to stop and take in the unexcelled vista of Boulder valley, the city, foothills and back range.

A guard rail is being placed on three miles of the Byers Canon road west of Hot Sulphur Springs. Thirteen hundred 7-foot cedar posts and approximately 30,000 feet of heavy wire cable is being used in construction of the safety fence. Motorists who have travelled this route will readily appreciate this improvement.

Another contract for three miles of grading and gravel surfacing on the Meeker-Craig highway has been let to the Utah Construction Co. Completion of this project, which is promised for winter travel, will give a standard U. S. gravel road south from Craig to Hamilton, a distance of fourteen miles. Hamilton is in the heart of the Moffat county oil fields.

On Sunday, June 21, a group of 400 church members from all parts of Colorado and Wyoming dedicated the recently completed road from Red Cliff to Shrine Pass, known as State Road No. 78. Eight miles of this scenic highway has been constructed. As funds become available it will be extended across the pass to Wheeler, where it will connect with the fine motor highway to Dillon and Loveland Pass.

In his story of the ceremony, Al G. Birch, of the Denver Post, wrote in part as follows: "While Sunday's dedication figuratively marked the opening of a new motor road and a beautiful religious shrine, in reality it was a tribute to the work and vision, through many years, of one man—O. W. Daggett, postmaster and newspaper editor of Redcliff."

Now that the work of constructing this beautiful Holy Cross Trail has been started by private enterprise, it is expected that the construction work will be continued by state and Federal forces.

Speakers at the dedicatory exercises included Editor Daggett, Col. A. S. Peck, regional forester, Judge Francis E. Bouck of Leadville, Hume White of Eagle, and Rev. Lee Smith of Leadville. W. W. (Micky) Walsh of Redcliff was master of ceremonies.

Edward Selander, Fort Morgan contractor, has been awarded a contract for the construction of 1.127 miles of concrete pavement in the town of Fort Morgan, on State Road No. 2. Payment for the work will be made from Morgan county's 1931 3% gasoline fund. Selander's bid for the completed project was $27,488.12, being $7.37 higher than a bid made by J. Fred Roberts & Sons on the work. Because of the fact that Selander has one of the largest paving outfits in the state idle at Fort Morgan, he was given the work under an agreement that it is to be finished in forty working days.

On June 30th the State Highway Department opened bids on $265,000 worth of construction work. The work was included in two projects—three miles of gravel surfacing east and west of Bayfield in La Plata county, and 12½ miles of gravel surfacing on State Road No. 4, east of Colorado Springs in El Paso county. J. H. Miller & Co. of Denver were low bidders on the Bayfield project with $107,622.97, and Charles B. Owen of Denver was low bidder on the El Paso county project with $157,707.05. Work on the two projects will start immediately. There were six bidders on the Bayfield project and fourteen bidders on the El Paso county job. In both instances the successful bids were lower than the engineer's estimate—on the Colorado Springs project by $41,000.

CRUSHING POWER!

when brought under control, can be made to serve. With it for instance, you can produce required capacities of specification gravel from roadside pits. Pioneer Gravel Plants are splendid examples of crushing power under control, harnessed to screening and loading mechanism, in perfect team work, to obtain maximum gravel capacities at lowest costs.

There are 11 different sizes of Pioneer Crushing and Screening Plants, also Washing Plants, Loading Plants, Drag Lines, Storage Bins, Conveyors, Shakers, Revolving Screens, etc. . . . . Write for catalog.

PIONEER

PORTABLE GRAVEL PLANTS

No. 12B Pioneer Screening, Crushing and Loading Plant owned by Threet Bros., Lovell, Wyoming, operating in Teton mountains in Wyoming and producing large daily capacities

Pioneer Gravel Equipment Manufacturing Co.

Minneapolis 1515 Central Ave. Minnesota

ELTON T. FAIR COMPANY

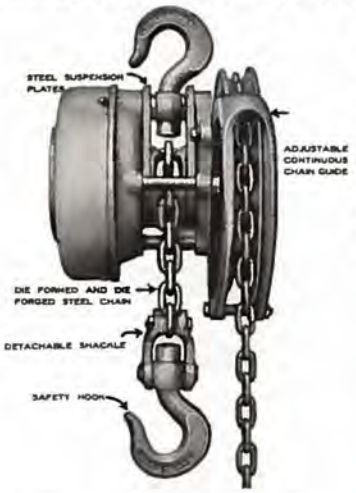
Distributors

1611 Wazee Street Denver, Colorado

Road Builders Supplies

SUPPLYING road contractors with all necessary lifting equipment is one of the services which we are prepared to render. This equipment may consist of Leschen Wire Rope, Columbian Manila Rope, Hoists, Rope Rollers and Pulleys and the two items pictured below.

YALE SPUR-GEARED BLOCKS embody safety and ease of operation—85 per cent of the power exerted by a man pulling on the hand chain is transformed into lifting energy.



One man can lift a load of one ton with one hand—only 77 pounds pull on the chain. Write for a booklet.

SIMPLEX JACKS are flexible and versatile and in the road builder's outfit they will pay for themselves many times over. They have long been regarded as standard in road construction, repairing and maintenance work. We carry a complete stock for immediate delivery. Write for a booklet showing the entire line.

WRITE OR TELEPHONE

The MINE and SMELTER SUPPLY COMPANY

Seventeenth and Blake Streets

DENVER

Tennessee Pass *Gravel* Surfaced

(Continued from page 5)

ment may cause the expense to run higher than an average, but this is to be expected on a newly completed work. Care should be exercised in working the surfaced portion, as experience has shown that inexperienced crews (especially county forces) are apt to blade the loose gravel off the roadway and over the shoulders, thereby losing expensive road material and losing the benefit of the loose gravel.

The highway on which this project is located is one of the major transcontinental routes. In Colorado it connects the valleys of the Eagle and Colorado rivers with the eastern watersheds of the Arkansas and South Platte rivers. It serves a number of the larger towns of Colorado and is used a great deal by interstate travel, both tourist and commercial. The pass is comparatively low, on good grades and alignment. A beautiful view of two of the highest mountains in the United States (Mount Massive and Mount Elbert)

View of the gravel crushing outfit used in furnishing material for surfacing one of the early Tennessee Pass projects.

is to be seen from the road. Several view of the well advertised Mount of the Holy Cross may be enjoyed from the road between Tennessee Pass and Redcliff. Battle Mountain, between Redcliff and Minturn, and Glenwood Canon, farther west, are other scenic attractions on the highway. The Eagle River is recognized as one of the best fishing streams in Colorado, and many lakes in the vicinity are stocked with trout. These features all attract travel of both tourist and commercial classes, and it is expected that a marked increase will be evident each year, especially as the route becomes better known.

Reaper *Harvests* Good Roads

(Continued from page 18)

As sales methods for the field force became more and more systematized so also did the central directing force at the office in Chicago.

The position at the head of the long list of harvesting machine manufacturers which was gained and held by Cyrus Hall McCormick cannot be attributed to the fact alone that he invented the world's first successful reaper. His complete success was due to his exceptional ability to follow a job through. He alone was able to visualize the value of his invention to all mankind. While others considered it just a passing fancy, he set about to originate a means of putting a reaper on every farm. And in doing so, he revolutionized farming methods over the world!

STATE HIGHWAY DEPARTMENT

Financial Statement, June 30, 1931

BALANCES		
State Treasurer	$ 885,930.15	
County Time Warrants	10,333.42	
Revolving Fund	9,500.00	
Total Balances		$ 905,763.57

RECEIPTS		
U. S. Government	$1,575,843.94	
Gas Tax	1,925,278.69	
Internal Improvement	30,900.00	
Highway Receipts	118,289.65	
Bus Licenses	19,188.96	
Total Receipts		$3,669,501.24
Total Balances and Receipts		$4,575,264.81

DISBURSEMENTS		
Federal Aid Projects	$2,701,127.86	
State Projects	344,040.12	
Maintenance	516,344.05	
Maintenance Equipment	57,841.58	
Property and Equipment	31,283.65	
Surveys	11,284.46	
Traffic Signs and Census	4,323.75	
Administration	91,518.69	
Total Disbursements		$3,757,764.16

BALANCES 6-30-31		
State Treasurer	$ 798,167.23	
County Time Warrants	9,833.42	
Revolving Fund	9,500.00	
Total Balances		$ 817,500.65
Total Disbursements & Balances		$4,575,264.81

3% SPECIAL GAS TAX FUND

Receipts	$ 176,723.21
Disbursements	40,822.16
Balance	$ 135,901.05

CLAUSE IN HIGHWAY DEED KEEPS BILLBOARDS AWAY

Here is a new way to keep billboards from obscuring scenery along the highways, or creating a traffic hazard by obstructing the view. The Oklahoma state highway department has inserted this clause in its standard conveyance form used in buying right-of-way:

"In consideration of the construction of State Highway.....the grantor herein agrees to prohibit the construction of any signs, billboards, or other advertising devices within 150 feet of the center line of said highway. And further agrees that the State Highway Commission, its officers, agents, and employes, may enter upon and remove therefrom any sign, billboards or other advertising devices which now exist or which may hereafter be placed upon said premises, within said 150 feet of the center line of said highway."

The plan has been called to the attention of other state highway departments by the U. S. Bureau of Public Roads.

FOREST FIRES REAL MENACE

What forest fires destroy means loss to you personally. Seventy-five per cent of the forest fires in Colorado are due to human agency. Help stop this waste. Be careful with cigarets, matches and campfires. Make it your business to put out any fire you discover, or, if this is impossible, to report it at once.

PLANS BEING DRAFTED

Proj. No.	Est. Length	Type	Location
134-E	6 mi.	Gravel Surfacing	West of Vona
150-C	8 mi.	Gravel Surfacing	West of Lay
181-A	2 mi.	Pavement	Idaho Springs
262-ER		Bridge	East of La Veta
263-C	3 mi.	Gravel Surfacing	West of La Veta
298-E	4 mi.	Gravel Surfacing	South of South Fork
248-C	8 mi.	Gravel Surfacing	South of Buena Vista
168-BCR	4.5 mi.	Pavement	West of Lamar
245-AR	4.5 mi.	Pavement	West of Las Animas
F. L. H. P. No. 1	5 mi.	Gravel Surfacing	West of Elk Springs.

PLANS FINISHED

Proj. No.	Length	Type	Location	Note
145-C	14.901 mi.	Gravel Surfacing	East of Rifle	Bids on July 16, 19
278-D	20.587 mi.	Gravel Surfacing	West of Cheyenne Wells	Bids on July 16, 19
295-E	7.627 mi.	Gravel Surfacing	South of Alamosa	Bids on July 23, 19
158-B	10.319 mi.	Gravel Surfacing	Wilkerson Pass	Bids on July 28, 19
270-E	8.664 mi.	Gravel Surfacing	West of Monte Vista	Bids on July 28, 19

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj No.
2-R10	Bet. Starkville and Trinidad	2.097 mi.	Paving	J. H. Miller & Co.	$109,577.10	76	2-R
2-R11	South of Trinidad	3.130 mi.	Paving	J. H. Miller & Co.	89,063.70	3	2-R
2-R12	Bet. Aguilar & Walsenburg	4.503 mi.	Paving	Orman Const. Co.	192,443.50	10	2-R
15-B	East of Sterling	18.553 mi.	Grading & Surfacing	Bedford & Woodman, Inc.	237,781.55	68	15-B
71-C	Bet. Durango and Mancos	4.965 mi.	Gravel Surfacing	J. Finger & Son	86,146.75	10	71-C
78-R	Near Minturn	0.709 mi.	Gravel Surfaced	J. Fred Roberts & Sons	96,342.90	97	78-R
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	64	91-AR
134-AR&C	West of Burlington	11.174 mi.	Oil Processed Surf.	H. C. Lallier Const. Co.	111,217.20	39	134-AR
134-D	West of Stratton	5.076 mi.	Gravel Surfacing	Mountain States Const. Co.	49,350.50	87	134-D
144-E	North of Fort Collins	1.286 mi.	Concrete Paving	F. C. Dreher Const. Co.	99,187.55	91	144-E
144-F	Northwest of Fort Collins	10.386 mi.	Gravel Surfaced	Blanchard Bros.	144,180.80	92	144-F
144-F2	North of Fort Collins	10.386 mi.	Gravel Surfacing	M. R. Deakin	19,950.00	9	144-F
144-G	Bet. Forks & Colo.-Wyo. Line	13.204 mi.	Gravel Surfacing	Morrison-Knudsen Co.	248,078.00	69	144-G
149-C	East of Aurora	7.863 mi.	Gravel Surfacing	Chas. B. Owen	130,329.47	60	149-C
149-D	East of Watkins	8.370 mi.	Gravel Surfacing	A. R. MacKey	13,207.82	50	149-D
149-F	Between Strasburg and Peoria	Detour	Bridge	A. R. MacKey	13,207.82	100	149-F
149-F	Bet. Strasburg and Peoria	10.745 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	198,660.00	29	149-F
149-G	Denver-Limon	9.778 mi.	Grading & Surfacing	Lawrence Const. Co.	189,623.96	41	149-G
150-B	West of Craig	4.630 mi.	Gravel Surfacing	N. M. Monaghan	73,181.65	93	150-B
151-A	Bet. Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	27	151-A
151-B	Bet. Fraser and Granby	3.925 mi.	Grading & Surfacing	Utah Construction Co.	63,954.80	57	151-B
189-B	Bet. Hayden and Craig	2.567 mi.	Gravel Surfaced	C. A. Switzer	91,497.00	72	189-B
189-C	West of Hayden to County Line	7.534 mi.	Gravel Surfacing	F. L. Hoffman	115,356.94	36	189-C
208-AR	East of Grand Junction	Bridge and Detour		Phelps Bros.	7,305.70	44	208-AR
242-D	Bet. Mack & Colo.-Utah Line	9.883 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	124,552.36	58	242-D
242-E	West of Fruita	4.243 mi.	Gravel Surfacing	Wallace Const. Co.	54,907.53	58	242-E
245-C	Between Hadley & La Junta	8.442 mi.	Grading	A. S. Horner	133,383.10	60	245-C
248-B	South of Buena Vista	2.766 mi.	Gravel Surfacing	J. Finger & Son	51,979.50	100	248-B
251-D	East of Boulder	0.284 mi.	Paving	Collier-Latimer	25,598.50	75	251-D
254-AB&CR	Byers Canon	2.615 mi.	Gravel	F. L. Hoffman	16,537.30	.06	254-AB
258-I	Bet. Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	79	258-I
258-J	West of Cerro Summit	5.796 mi.	Grading and Gravel	Lumsden Hall Const. Co.	107,027.30	33	258-J
261-AR	Bet. Rifle and Grand Junction	0.053 mi.	Bridge & Grav. Surf.	Herbert S. Crocker	21,300.00	58	261-AR
265-D	Wilson Gulch	1.930 mi.	Bridge & Approaches	Grant Shields	29,455.50	99	265-D
271-F	East of Florence	0.593 mi.	Viaduct	Mountain States Const. Co.	57,583.40	87	271-F
272-F	Bet. Manzanola & Rocky Ford	4.097 mi.	Concrete Pavement	Driscoll Const. Co.	122,418.50	89	272-F
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc.	116,829.21	28	278-AR
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	53	282-I
282-J	Bet. Rifle and Meeker	0.057 mi.	Bridge & Approaches	Herbert S. Crocker	20,400.00	82	282-J
286-E	Denver-Cheyenne Highway	4.052 mi.	Concrete Pavement	J. Fred Roberts & Son	126,032.85	89	286-E
287-AR5	Bet. Kersey and Wiggins	10.586 mi.	Concrete Pavement	Edw. Selander	251,717.00	77	287-AR
287-CR1	Bet. Kersey and Wiggins	10.246 mi.	Concrete Pavement	J. B. Bertrand, Inc.	254,341.70	87	287-CR
292-D	Bet. Wolcott and Avon	9.834 mi.	Graded Surface	Utah Const. Co.	159,143.40	37	292-D
296-D	South of Pueblo	8.348 mi.	Gravel Surfacing	Cole Bros.	84,815.10	49	296-D
297-C	Southwest of DeBeque	9.953 mi.	Gravel Surface	Hinman Bros. Const. Co.	312,453.50	96	297-C
298-C	Bet. Twin Bridges & South Fork	3.780 mi.	Gravel Surfacing	H. C. Lallier Const. & Eng. Co.	116,864.50	91	298-C
298-D	Bet. Del Norte and Durango	4.100 mi.	Gravel Surfacing	H. C. Lallier	164,814.00	36	298-D
298-F	East of Bayfield	5 mi.	Gravel Surfacing	Wood, Morgan & Burnett C. Co	66,920.85	13	298-F
299-AR	Alkali Creek	Bridge		Phelps Bros.	8,690.05	46	299-AR

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COLORADO HIGHWAYS

Vol. X September, 1931 No. 9

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M. W. BENNETT, Editor

Articles on the subject of road building and highway development in Colorado are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible.

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Our Cover Picture

ON THE front cover of this month's COLORADO HIGHWAYS we print a view of the new gravel surfaced highway located between Byers and Deertrail, on the Denver-Limon highway. This is a link in the 90-mile stretch of new road which the State Highway Department is constructing this year with Federal aid funds. The surfacing is being laid in such a manner that it can be treated with oil some time in the future.

Colorado Highways
"BETTER ROADS"
VOLUME X. SEPTEMBER, 1931 NUMBER 9

Towns Want *Trunk Routes* Off Main Streets

COLORADO is not the only state where there are differences of opinion as to the routing of trunk highways through cities and villages. Illinois towns have been going through experiences similar to those of many towns in this state. A recent issue of Tennessee Highways contains this interesting account of what is happening:

"Ten days ago a delegation of small town civic officials appealed to the state highway department of Illinois to undo an error which the delegations themselves admitted was their own. They asked the Illinois highway commission to change the routing on numerous state highways so that the trunk line roads would go around their towns instead of through them.

"These delegates told the highway commission that through-highway traffic had so congested their streets that their own citizens could no longer get into the stores to shop, that through-highway trucks and busses had battered their street paving to pieces, that through-highway traffic had compelled them to create traffic police jobs which were severely taxing the property owners of the city to maintain, that through-highway traffic had increased the accident toll among their own citizens because downtown streets were not wide enough or properly enough engineered to carry the burden of both through and local traffic. For every reason that was advanced ten years ago as to why trunk line highways should be routed through the heart of the city, these same cities now had ten reasons why they should be taken away from the heart of the city.

"All interstate and most intercity automobilists will throw up their hats and cheer the day when they can pursue their way across country without being dragged through small town business districts. Acting on the assumption that automobile tourists spend money, and that the more tourists you can get through the city and past the spending points, the more that will be spent, small towns have clamored for midcity routing of direct highways. Now they are beginning to understand that the automobile tourist is like any other tourist. He spends money for what he wants and what he must have, and for that only. If there is anything in a small town that a tourist wants or has to have, he is perfectly willing to drive into the city, get it and drive out again.

"The dawning recognition by these small town Illinois delegations may be made of very practical service if called to the attention of highway departments everywhere, that there is about to be a new style set in locating trunk line highways around small cities."

GOOD ROADS SAVINGS

Paste this up. Toledo Blade: Good highway construction has reduced the average automobile operation cost from 10 cents a mile in 1924 to 6.43 cents in 1929. This is neither guessing nor gossip. Thomas P. Henry says so and Mr. Henry ought to know, for he is the president of the American Automobile Association. In this information there is proof of the assertion which has been made repeatedly by this newspaper, that it is cheaper for motorists to pay for good roads than it is to try to skimp along without them. One gallon of gasoline will produce power sufficient to drive the average automobile fifteen miles. Using Mr. Henry's figures as a basis for the calculation, it costs about 54 cents less to drive over 15 miles of good roads than an equal distance on poor roads. Fuel and time saving and the less wear and tear on tires and cars are all taken into the accounting. Paste this on your windshield for reference when you drive to the filling station.

SNOW PLOWING IS PRACTICAL AND ECONOMICAL

It was just a few years ago that no attempt was made to keep our highways open. First the state highway department purchased equipment and announced its intention to keep the highways open. Then the various counties followed, and today driving a car is more or less of a safe proposition the year around. It makes the investment in the car more sound and it tends to economy in road maintenance, as the spring thaw finds the grade practically bare of snow. In years gone by some of the high snow banks over the grade practically ruined the roads, making extensive re-graveling a necessity. A trial has shown winter maintenance to be a practical thing. We could hardly go back to the old custom now.

Greeley-Ft. Morgan *Paving* Completed

APPROXIMATELY 1,000 people were present at the gala opening of the new Greeley-Fort Morgan concrete paving on Tuesday, July 28th. The celebration was held at Deerfield, about midway between Greeley and Fort Morgan. Following an hour of short talks by dignitaries present, Lieut. Governor Ed. C. Johnson officially opened the road by driving his car through the blue ribbon stretched across the cement. This marked the opening of a stretch of pavement extending from Sterling to Pueblo, the longest in this section of the country. The Deerfield celebration marked the opening of twenty-one miles of pavement constructed by the State Highway Department with Federal Aid funds in two projects—the west half being laid by J. B. Bertrand and the east half by Edward Selander.

R. B. Spencer of Fort Morgan, in charge of the program, called upon a number of prominent citizens and officials of Colorado to speak. The following took part in the program: Edward C. Johnson, Lieut. Governor; Charles D. Vail, State Highway Engineer; George D. Begole, Mayor of Denver; Carl S. Milliken, Manager of Safety, Denver; Dudley R. Grimes, Secretary, Colorado Association; James S. Ogilvie, Chairman of the Weld County Board of Commissioners; O. B. Schooley, Chairman, Morgan County Board of Commissioners, and J. B. Bertrand, contractor.

Lieut. Gov. Ed. C. Johnson, who drove first auto over new Ft. Morgan-Greeley pavement.

The road was declared officially opened when the ribbon was cut by Charles D. Vail, State Highway Engineer, and Lieut. Governor Johnson drove his car through. Music was furnished for the occasion by the State Teachers' College band. R. E. Smith, Sterling band leader, led the community singing. Present at the celebration were official visitors from Greeley, Fort Morgan, Brush, Sterling, Fort Collins, Denver, and other cities and towns along the route.

EARLY this spring there was awarded by the State Highway Department of Colorado two paving projects approximately 12 miles each, one to Edward Selander of Greeley, and the other section to J. B. Bertrand, Inc., of Denver. Both of these contractors have had a wide experience in paving work and have a wonderful organization and modern equipment to make the best job possible in the least possible time. They started approximately at the same time on putting their outfits on the ground and doing the necessary preliminary work in connection with these projects. It was not only the efficiency of the most modern equipment used, but the organization that each had, the skilled men that were employed and the coordination of the contractors in making every move count.

Of course on a job of this kind, material for the paving, the State Highway's inspection is of paramount importance. After making an exhaustive test, the State Highway Department passed the rock as furnished from the Cripple Creek section of Colorado and the Lyons, Colorado, section. This rock was crushed the proper size, screened and loaded at the quarries. The railroad hauled this crushed rock to points on each project, where it was unloaded with gasoline cranes, using clamshell buckets and into storage piles. These storage piles were arranged close to the central propor-

Part of crowd that attended celebration at opening of pavement at Deerfield.

Lieut. Gov. Johnson drives first car through ribbon to mark opening of pavement.

Tourists who passed over pavement following official opening of concrete road at Deerfield.

Highway Engineer C. D. Vail addresses crowd at Deerfield celebration marking the opening of new road.

toning plants for ready access to loading the bins, and with a surplus supply of sufficient quantity on hand for emergencies. The sand was taken from a wet pit on the Bertrand job near Hardin, and the Selander job from the river bed near Masters. The material was taken out by the use of hoists and dragline scrapers of the Cableway type, brought in over conveyors and deposited over screens, taking out the oversize material, and then into a bin for direct loading into trucks.

For the storage of sand as well as the crushed rock, in each case the contractors used steel Blaw-Knox bins with accurate measuring devices set by pounds of weight to required proportions, and the material, both the sand and crushed rock in proper proportions, was deposited in trucks ready for each batch for the big Koehring 27-E pavers. There were a number of trucks used of various sizes on the work; these trucks obtaining an accurate batch of measured rock and sand, and on their way to the paver they stopped at a loading point to obtain the proper proportion of cement. This cement was obtained in box cars in bulk, and was loaded out in special carts which were filled by hand in the cars, and each cartload of cement weighed on a special platform scale. Then this cement was dumped on top of the load of aggregate and the complete batch was immediately ready to journey to the paver.

In preparation of the subgrade for this pavement, heavy tractors and scrapers were used to break up the hard surface of the road and the surplus material bladed off. After this subgrade was made to grade, the steel forms for accurately measuring the depth of the pavement were set to line, and approximately a 4-inch sand cushion was placed between these forms and accurately struck off, before the concrete was laid. The pavers on this job were of the most modern and fastest, the Koehring 27-E, mixing one yard mixed concrete per batch, and were semi-automatic in operation. The trucks with their load of aggregate came down to the paver and just before reaching the skip, were run up over a turntable and turned around, so that they could expedite their time in coming in between the forms in ahead motion, and going back the same way, eliminating backing and its consequent loss of time. On this paver is located an accurate water measuring device which measures to the ounce all water required per batch, and with the cement, crushed rock and sand weighed to accurate proportions per batch, and the water accurately measured, it kept each batch consistent.

The time element in mixing is another important factor, and this was controlled by a batchmeter which is mechanically operated by the mechanism of the paver, so that for whatever required time, sixty seconds or more, that the inspector determines, each batch was mixed for that required time.

The mixed concrete then was discharged and placed between the steel forms and a mechanical finishing machine, compacting this concrete, finished it true to form, and all that was left to do was a little hand finishing by two men. The finished concrete was then covered with dirt and wet down daily with water to prolong its curing time. After the concrete had been placed for twenty-four hours, forms were removed and set ahead in continuous operation.

Another important factor in any paving operation is the water supply. This water is furnished the paver for mixing operation and for curing purposes through a 2½-inch line of pipe from a C. H. & E. triplex portable pumping unit, which

John Bertrand, one of the contractors who laid pavement that completed concrete road between Sterling and Pueblo.

took its supply of water from an irrigation ditch or other handy water supply, sometimes five miles from its point of discharge. These pumps were of the No. 11 size, supplying 80 gallons of water per minute at a pressure of 500 lbs. per square inch. All through the job these pumps never stopped, but consistently supplied the necessary water in volume and sufficient pressure.

The structures on this job were done by a special crew, the excavations made, the forms set and the concrete poured ahead of the paving operation, so that this work was completed and properly set before the concrete was poured over them.

After the concrete pavement was laid and completed, all that was left to do was to build up the shoulders on each side, grade them and their birms.

On a job of this sort there are three things that make for good con-

(Continued on page 20)

Westward *Path* *of* Empire

THE official opening of the last important link in the paved highway from Sterling through Brush and Fort Morgan to Greeley and thence to Denver brings to virtual completion man's improvement of a natural traffic route that has been in steady use long before the dawn of recorded history.

The valley of the South Platte River from the prairies of Nebraska and eastern Colorado to the foothills of the majestic Rockies, has always been a path of travel. Up and down its shores ranged herds of buffalo that grazed on its rich grasses and drank of its waters. Parties of Indian hunters stalked the herds and took heavy toll of them.

Along its banks raced Indian war parties invading the country of enemy tribes or returning from conquest laden with scalps and booty.

Up this valley, ever westward, rolled the emigrant trains bound for the western lands of promise. Gold-mad mobs rolled toward the mountains up this valley when news of the Colorado Golconda reached the east.

Troops of blue-clad cavalry, Uncle Sam's defenders, jogged up and down the valley, lending the protection of their carbines to those who trod this "path of empire."

If the hills that border this valley through which today's modern highway unrolls its smooth concrete ribbon could speak, the tales they might tell would make a chapter of history more valuable than any that has ever been recorded.

The first authentic account of any people of the white race looking upon the South Platte valley is that of the Mallet brothers, French traders, who in 1739, with six companions from a French settlement in Illinois, went as far west as Julesburg, Colo., and followed the South Platte valley westward from there for some distance before turning directly south to the Arkansas and on to Santa Fe. This company, though nothing of importance resulted, may have been the first white men to cross what is now Logan and Morgan counties.

It is possible that Coronado, who came into this country from Mexico in 1539, seeking the "Seven Cities of Cibola," may have reached northeastern Colorado. It is known that he went as far north as northeastern Kansas before he gave up the search for the "cities, he was told, had been paved with yellow gold." Historians say that he entered the valley of the South Platte in western Nebraska and he may have returned southward by traveling down the valley of the Platte through Morgan County.

The next expedition to this part of the West was sent out by the U. S. Government in 1819, when Stephen Harriman Long headed a group of explorers who started from St. Louis. Their orders were "to see whether or not the western country was worthy of settlement" and with others to make straight for the Rocky Mountains. They followed the Missouri and the Platte rivers, crossing the latter at Grand Island, and then to the south fork of the Platte, reaching that point on June 22, 1820. On June 30, 1820, they caught sight of a peak which was later named Long's Peak in honor of its discoverer. The party was camped at the time at the junction of Bijou Creek with the Platte River a short distance west of Fort Morgan.

A view of the new road over Willow Creek Pass—a Federal Aid project.

Long's report of this expedition was discouraging and retarded immigration westward for some time to come. The region was described as an "arid waste of sand and stone." Dr. James, botanist, geologist and surgeon of the party, wrote: "This barren and ungenial district appeared to be filled with greater numbers of animals than its meager productions are sufficient to support. Animals in great numbers are seen in this territory, including bison, deer, badgers, wolves, hares, eagles, buzzards, ravens and owls. In regard to this extensive section of the country, we do not hesitate in giving the opinion that it is almost wholly unfit for cultivation and, of course, uninhabited by a people depending upon agriculture for subsistence."

John C. Fremont, called "The Pathfinder," made five expeditions. The first was in 1842 and the last in 1853. Two of these followed the South Platte through what is now Logan, Morgan and Weld counties.

The South Platte River valley, through which today's modern highway is laid, marked the battleground between the clash of white man's westward march and the red man's determination to halt the pale-face tide.

The plains Indians made many depredations in the South Platte valley, but on August 20, 1864, the Indians attacked simultaneously all the Overland stages between Kansas City and Denver and all the white settlements for 200 miles up and down the front range along the Platte and Arkansas rivers. Troops were sent out to fight the Indians and the ten years from 1860 to 1870 was a time of terror on the Colorado plains.

Many stories might be written of battles fought and lives lost. In 1865 the federal officer in charge of the troops reported: "The Indians are bold in the extreme. They have burned every ranch between Julesburg and Valley Station and nearly all the property at the latter place and have driven off all the stock, both public and private. The stage route from Denver to Julesburg has been devastated every mile of the way."

On January 14, 1865, the Godfrey ranch, west of Merino, was attacked by a large force of Cheyennes. It was defended by the owner, Hollen Godfrey, and three other men and four women, who helped in every way they could during the attack, which lasted all day. After nightfall one of the defenders, named Perkins, escaped from the ranch and rode to an encampment of soldiers near Fort Morgan for help. A corporal and four enlisted men accompanied him back to the ranch and succeeded in stealing into the house unmolested. With this reinforcement Godfrey repelled the Indians. The next day another fight took place at the Wisconsin ranch, south of the river near Atwood.

Recorded history shows that several people were killed by Indians near what is now Fort Morgan.

Discovery of gold in 1858 in the vicinity of Denver brought a big stampede to the mountains and much of this travel came down the South Platte valley, the natural road from the plains country. The roads were lined with covered wagons drawn by ox or mule teams. Some had packs on their backs as they trudged along on foot. Some clubbed together and bought a hand cart and became their own beasts of burden. Some had a single yoke of oxen, an Indian pony, or a mule or ox-drawn wagon laden with supplies, provisions and mining equipment.

Naturally many were disappointed at not finding gold as they had expected, sold their baggage or left it on the ground and started back East declaring that the whole thing was a humbug. So across the plains stretched a double line, some going and others returning, sour and sullen.

For twenty-six years Weld County occupied the entire northeastern part of the state and embraced an area of 10,494 square miles. It has since been divided and subdivided until at present seven counties occupy the territory originally assigned to Weld. They are, in order of their organization: Weld, Washington, Logan, Morgan, Yuma, Phillips and Sedgwick.

The first railroad entered Weld County at Julesburg and the first railroad built into the heart of the state had for a time its terminus at Evans in Weld County.

Along the South Platte highway some of the oldest and best known stage stations, forts and Indian trading posts were situated, among them Fort Lupton, built in 1835; Fort St. Vrain, in 1835; Fort Wicked, in 1860, Fort Morgan, Fort Sedgwick and others.

Today's modern concrete highway down the South Platte valley where trucks, busses and passenger cars replace the emigrant wagon, the stagecoach and the horseman, is but an improvement upon a roadway that has a history of blood and tears, terror and fear, hopes and misery, happiness and the final glory of the conquest of empire.—Ft. Morgan Times.

Here we have an 85-foot slope on the new Berthoud Pass highway which is nearing completion—constructed with U. S. Forest funds.

HIGHWAY TRAFFIC DEVICES MUST BE STANDARDIZED

There is practically no uniformity in the design, construction or use of traffic devices, states a report of the American Road Builders' Association.

One manufacturer reports as to standard STOP signs that production for stock is impossible because each order he receives has variations. He is called upon to furnish 27 different secondary copies, 3 sizes of one secondary copy, 3 sizes of signs, 4 different gauges of metal, 3 different color combinations, 5 variations in finish and fabrication, 6 requirements as to the number of reflector buttons, 3 different colors of buttons.

Many of these variations tend to confuse the mind of the motorist; all of them add materially to the cost of production and maintenance. Much study is needed to bring about proper standardization.

More than sixty Allis-Chalmers tractors of various sizes and types have been sold in the Denver territory during the spring and summer of 1931, according to Wilson Machinery Co. These units have been sold for state, federal, county and city work, together with contractors on various types of dirt moving. Altogether it has been a very successful season, says Ray Corson, sales manager.

A late model Hughes-Keenan Iron Mule is being used on the construction of the Grand Lake section of the new highway being constructed over Fall River Pass. This equipment was furnished by H. W. Moore Equipment Co.

The Schramm Company announces a number of important changes in their newest model 540-foot compressor. H. W. Moore Equipment Co. will send literature.

Sale of two heavy-duty FWD trucks and a dozen Woods hoists and bodies was reported by the Liberty Trucks & Parts Co. during the month of August.

Charles Sweitzer, a Denver contractor, on August 1st completed two and one-half miles of gravel surfacing west of Hayden.

States Adopt *Uniform* Rules

By WM. E. METZGER

SEVEN states have been added to the number which had previously adopted the Uniform Vehicle Code, or substantial portions of it, through the enactment of one or more Acts of the Code by their 1931 legislatures. In addition, several states have made changes in their motor vehicle laws, bringing them in closer harmony with the Uniform Code. This brings to 34 the total number of states whose motor vehicle laws are in harmony with the Code or have been amended toward conformity with it.

The Uniform Vehicle Code, providing the national standard for assisting the states in securing uniformity in traffic regulations, was developed by the National Conference on Street and Highway Safety in 1926, and revised to date in 1930 in the light of the most recent experience with traffic laws throughout the country. The Code in its present form has received the formal endorsement of the American Bar Association and the National Conference of Commissioners on Uniform State Laws.

The states which have adopted one or more acts of the Code in 1931 are: Colorado, Iowa, Kansas, Michigan, Nebraska, Oregon and Utah. Among the states which made amendments to their existing motor vehicle laws are: Pennsylvania, Nevada and New Jersey. It should be added that the legislatures of several states are still in session, among them Alabama and Georgia, where the Code has been introduced. In Alabama local groups have centered their attention on promoting adoption of the Operators' and Chauffeurs' Act, and a Uniform Act Regulating Traffic on Highways—Acts III and IV, respectively, of the Uniform Vehicle Code; while in Georgia efforts are being made to impress upon the legislature the desirability of enacting into law all four Acts of the Code.

Colorado Takes Lead

Colorado heads the states acting favorably on the Uniform Vehicle Code this year in that she adopted three of the four Acts of the Code, namely: "A Uniform Registration Act," "A Uniform Operators' and Chauffeurs' License Act," and "A Uniform Act Regulating Traffic on Highways." The state already had an Anti-Theft or Certificate of Title Law in close harmony with the corresponding Act of the Code, thus completing adoption of the national standard code.

Oregon adopted the Uniform Operators' and Chauffeurs' License Act, Act III of the Uniform Vehicle Code, as well as the Uniform Act Regulating Traffic on Highways, Act IV of the Uniform Code, thus also coming closely in line with the national standards.

The Uniform Operators' and Chauffeurs' License Act (Act III of the Code) was adopted this year by Iowa, Kansas and Michigan, in addition to Colorado and Oregon already mentioned. The addition of these five states brings up to nineteen the total of those having the standard Operators' License Law with mandatory examination. Under this law all operators and chauffeurs must be licensed and new drivers only after examination to determine whether they have sufficient knowledge of the motor vehicle laws and regulations and are competent to operate a motor vehicle with safety to themselves and other users of the highway.

The following now comprise the group of standard drivers' licensing states: New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, Pennsylvania, New York, New Jersey, Delaware, Maryland, West Virginia, District of Columbia, Iowa, Michigan, Kansas, Arizona, Colorado, California and Oregon. Seven additional states require motor vehicle operators and chauffeurs to be licensed but do not make mandatory the examination of new drivers. These states are: Arkansas, Indiana, Nebraska, Nevada, South Carolina, Tennessee and Wisconsin. Organizations interested in better traffic conditions in some of these states have initiated efforts to secure strengthening of their licensing laws by the legislatures in harmony with the national standards.

Uniform Traffic Regulations

The enactment of the Uniform Act Regulating Traffic on Highways, Act IV of the Uniform Vehi

A scene taken along the new gravel-surfaced highway between Fort Collins and Laramie, Wyoming, recently opened to traffic.

cle Code, in four additional states this year brings up to 18 the number of states having adopted that Act: Colorado, Nebraska, Oregon and Utah being the states having taken this action this year. The following states are included in the group whose motor vehicle laws contain the major part of this Act: Pennsylvania, Delaware, Virginia, North Carolina, Louisiana, Michigan, Wisconsin, Minnesota, North Dakota, South Dakota, Nebraska, Colorado, New Mexico, Arizona, Idaho, Utah, Oregon and California. The foregoing statement requires some qualification in that thirteen of the eighteen states listed above adopted Act IV of the Code in the form in which it appeared prior to its revision in 1930 by the Third National Conference on Street and Highway Safety. The states whose motor vehicle laws contain the provisions conforming substantially with those contained in Act IV in final form, as revised to date are: California, Colorado, Nebraska, Oregon and Utah.

The principal changes embodied in the Act as revised in 1930 are: Incorporation into the Act for adoption by states of many important provisions relating to traffic regulation in cities and towns, found formerly only in the Model Municipal Traffic Ordinance; rearrangement of the sections of the Act in more convenient order; and changes in the speed restrictions providing greater flexibility but at the same time imposing more drastic penalties for speeds unsafe for conditions. In addition there are changes in the rules of the road with respect to overtaking and passing, laning of streets and highways, stopping of certain vehicles at railway crossings, and certain modifications of the equipment requirements, all recognized by the National Conference as desirable to meet present-day traffic conditions.

Municipal Regulations

The significance of incorporating in Act IV of the Uniform Code many of the provisions found formerly only in the Model Municipal Traffic Ordinance becomes apparent when it is recognized that this affords a means of establishing uniformity in a larger part of the traffic rules and regulations in all cities and towns within the borders of a state through state law enactment.

Thus municipalities in the states adopting the 1930 Uniform Vehicle Code, as well as those in New Jersey and Wisconsin, which had previously adopted similar provisions, are assured of uniformity in regard to a large number of traffic regulations. Such municipalities, therefore, need to cover but relatively few additional matters by municipal traffic ordinance. The Model Municipal Traffic Ordinance provides a national standard for such use and offers the benefits from a modern and effective measure for cities and towns. Besides the features of strictly municipal application the Model Municipal Traffic Ordinance, for educational purposes and for use where state laws are inadequate, repeats many provisions of the standard code (Act IV) of special importance under urban conditions.

A steam shovel moving thousands of yards of dirt from the Berthoud Pass highway which is being widened and straightened by the U. S. Government.

CONNECTING STATE ROUTES THROUGH CITIES

Many of the state roads stop at the city limits of municipalities of more than 2,500 population and the traveler finds that he has more difficulty in getting over the roads in the municipalities than in the country. Congestion on the roads is usually found in the cities or near them.

To meet this condition some of the states have undertaken to improve the connecting links on state routes through municipalities, feeling that such work is essential to a complete highway system that will permit one to travel at will to any part of the state on good roads.

In some cases grants of money have been made to the municipalities for the purpose of improving connecting links and for their maintenance. This practice has done much to improve the general condition of the state systems and has met with the approval of the municipalities where a large part of the motor vehicles are registered. The advantage of this procedure to the farmers is that the municipalities are the best markets for much of the produce of the farms and the prosperity of the cities is necessary to provide good markets for farm produce. To the cities there is an advantage because the most usual method of improving city streets is by the assessment of private property, and these assessments make taxes high and to that extent reduce the purchasing power of city folk.

Since taxation of motor vehicles through the license and gasoline taxes has become so widespread almost a billion dollars annually is raised for road purposes, a large part of which is paid by city-owned motor vehicles. These city-owned motor vehicles are used both in the country and in town, for the major part of the country traffic is city-owned vehicles. However, there is a large use of motor vehicles that are seldom out of the various municipalities. It has been found that 57% of the automobiles are in towns of under 10,000 population, while only about 20% of the motor vehicles are on farms. It is only in the larger cities that the motor vehicles do not go out of the municipality on the country roads.

Road Building *Finances* Self

One of the State Highway Department's new Quick-Way shovels widening the road in DeBeque Canon.

TAXES paid by motor vehicle owners amount to half the cost of the road and street construction and maintenance in the United States, according to W. R. Smith, president of the American Road Builders' Association.

"Close studies of heavy traffic roads show that in specific cases the user taxes or tolls in the form of gasoline and license taxes paid by motor vehicles more than pay the road costs, including a sinking fund for replacement. On light traffic roads the cost of the improvement is not entirely met by the user taxes and the property owners pay part of the cost," continued Mr. Smith.

"If half the traffic is on the 700,000 miles of surfaced roads out of the 3,000,000 miles in the United States, a simple computation shows the saving due to road surfacing. It is accurately estimated that the money saving to a motor vehicle driver is from two to four cents per mile traveled when the road is surfaced as compared with a dirt road. If an automobile makes only 12 miles on a gallon of gasoline, the 15,000,000,000 gallons of gasoline used by motor vehicles in 1930 resulted in 180,000,000,000 miles traveled. A saving of two cents a mile on the 700,000 miles surfaced on which half the miles are traveled amounts to $1,800,000,000 annually. This is several times the cost of maintaining these roads. The annual saving in money due to the surfaced roads about equals the total expenditures each year on all roads and streets, two-thirds of which is a capital investment in new surfaced highways.

"These definite money savings due to good roads are but a small part of the profits. Other intangible benefits are even more important. The joy and comfort of good roads, not to mention the faster tempo of life that permits us to do more things in a shorter time, are inestimable. Like light and air, the public has come to accept good roads as one of the necessities of life.

"Poor roads mean danger and discomfort in travel in wet weather, isolation in country sections, no movies or schools except in good weather, high hauling costs, and a multitude of small inconveniences in daily life that are irritating and make life less worth living," he concluded.

HIGHWAY BONDS NOW DESIRABLE

Bonding for state highway construction has been a paying investment in every instance, according to a report of the American Road Builders' Association. Tangible savings from lowered cost of operation are in excess of construction and maintenance costs in all cases.

The savings in operating costs to motorists of Illinois are estimated to be $333,000,000 since the improved highway program was started, which is considerably more than the first cost, interest and amortization charges on the $160,000,000 highway bond issue.

Bonding is generally recommended, the report states, for both states and counties where credit is sound, where there is an urgent need for highways, and where there is a fixed annual income. The issuing of bonds should be preceded by economic studies of credit conditions of the political subdivision, industrial growth, agricultural needs, population trends, transportation demands and the availability of road building materials.

AMERICA'S HOME ON AUTO WHEELS

Part of America's home is on auto wheels if one considers the 150 billion miles traveled by private automobiles, declared W. R. Smith, president of the American Road Builders' Association, in discussing the need for good roads. Buses travel enough miles so that every man, woman and child in the country could take a good trip five times a year.

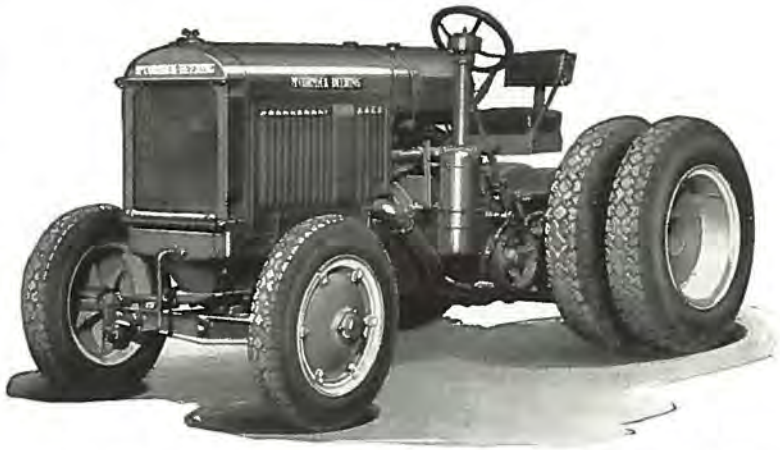
"Everyone demands safety, comfort and convenience in home life and the same demand is made for the home on automobile wheels," continued Mr. Smith. "But there are other benefits. The money profits from good roads are apparent in the increased prosperity of those states and counties that have good roads. Co-operative marketing associations flourish, increasing farm profits and giving city dwellers fresher produce at lower prices. Isolated sections are moved closer to schools, churches, markets and movies through good roads. The trading area of cities is extended. Profitable tourist travel is encouraged. In North Carolina following a state road bond issue and general highway improvement, property values increased eight times, while values in the whole United States increased four times.

McCormick-Deering Tractors provide reliable power for any snow-removal program, and for other road work the year around.

Breaking a drifted road with a McCormick-Deering-powered snow plow.

Streets are cleaned fast with this McCormick-Deering-powered snow loader and an International Speed Truck.

Above: Excavating shovel mounted on a McCormick-Deering Tractor and used for removing snow. *Below:* A snow plow mounted on an International Heavy-Duty dump truck.



McCormick-Deering Model 30 Industrial Tractor, 40 h. p. engine. Model 20 is similiar in design and has a 25 h. p. engine.

Remove the Fear of Being Snow-Bound

WINTER loses its grip when plans for snow-removal are laid well in advance, and crews and equipment are ready for action. *Transportation* has to move freely the year around in these times to get the full benefit of the tremendous investment in roads and automobiles. *Mail* has to get through, *business* has to be kept going, and *life* and *property* must be protected. All of these depend on the open road.

Your snow-removal program hinges on power that can stand the gaff in this heavy work. McCormick-Deering Power has made a record as a top-notch snow-fighter and today it is the accepted standard throughout the snowbelt. In the form of Industrial Tractors and as the power heart for a variety of snow-removal equipment, it provides plenty of driving force to break through drifts and keep roads and streets wide open.

Convenient service backs up McCormick-Deering Power wherever it is at work. There are 117 Company-owned branches in the United States and Canada, more than 50 McCormick-Deering distributors, and thousands of dealers ready to give factory-standard service at all times. They will be glad to demonstrate for you. Write us for information.

INTERNATIONAL HARVESTER COMPANY
OF AMERICA
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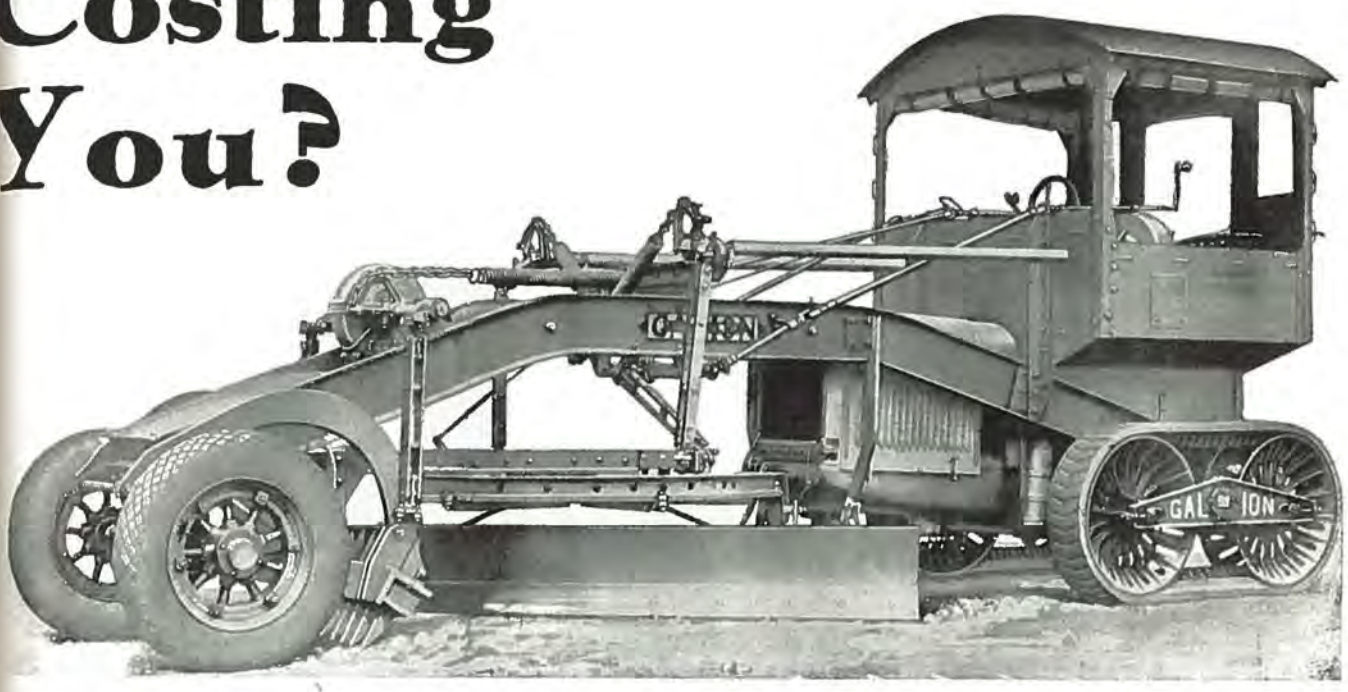
606 So. Michigan Ave. Chicago, Illinois

McCORMICK-DEERING INDUSTRIAL POWER

COMPANY-OWNED BRANCHES:

Denver, Colorado; Cheyenne, Wyoming;
Dodge City, Kansas

How Much Is Your Maintenance Costing You?



Galion McCormick-Deering E-Z Lift Motor Patrol Grader with Sure-Trac Rubber Crawlers and Pneumatic Front Wheels. Can also be furnished with pneumatic tires in rear or with Steel Crawlers in rear and steel wheels in front, or solid rubber tired wheels front and rear, and with or without cab.

Figures prove not only in Colorado but other states as well that Galion plus McCormick-Deering power have made possible the lowest cost per mile in the history of road maintenance with power—and it's the type of maintenance that gets results. Either type, with Round Wheel or the new Sure-Trac Rubber Crawler, will be demonstrated any time, any place, upon request.

IN STOCK FOR IMMEDIATE DELIVERY

H. W. Moore Equipment Co.

"Colorado's Largest and Oldest"

120 WEST 6TH AVENUE TABOR 1361 DENVER, COLORADO

NEWS OF THE MONTH

Meet my friend "Mac"—E. E. McKelvey, to be more formal. McKelvey has changed places of employment. He is now identified with the H. W. Moore Equipment Co. "Mac" has a wide circle of friends among contractors and county and state highway employes. For a number of years he was connected with the Wilson Machinery Co., with headquarters in Pueblo. On his new job he will represent the Moore Company in northeastern Colorado. For the present he will make his headquarters in Denver, according to George Meffley, general sales manager.

Word comes from Chicago of the election of Edward J. Mehren, editorial director of the McGraw-Hill Publishing Co., as president of the Portland Cement Association. This is the first time that a president from outside the industry has been elected.

Ransome Concrete Machinery Co. of Dunellen, N. J., has acquired a controlling interest in Transit Mixers, Inc. This type of mixer will be added to the Ransome line and will be built in the Ransome plant in the future.

A new maintainer designed to plane off chatter bumps is being marketed by the J. D. Adams Company. This unit is equipped with seven zig-zag blades. It can be hitched to any tractor and is handled by one man. It is equipped with lift springs front and rear. Elton T. Fair Company, Denver, will furnish full details.

What is probably the largest single tractor order ever placed at one time by any state has just been received by the manufacturers of Cletrac Crawler tractors. A total of 153 crawler type tractors are called for in Pennsylvania's present program and the entire contract was awarded to Cletrac in competition with other makes, according to word just received from the factory by Liberty Trucks & Parts Co., Denver Cletrac distributors.

E. E. McKELVEY

As a result of this order, approximately 500 men have been returned to work by the Cletrac Company, not to mention the many jobs that will be created in other companies which supply materials and special equipment to Cletrac.

More than one hundred million dollars has been appropriated in Pennsylvania for the building of 20,000 miles of new roads and for the improvement of 11,000 miles of present highways.

One of the State Highway Department's new maintenance outfits working near Whitewater.

A large circle of Colorado friends were saddened to learn of the sudden death of W. Guy Frazee, vice-president and chief engineer of the Iowa Manufacturing Co., Cedar Rapids, on July 20th. Mr. Frazee was killed in an automobile accident near Moose Lake, Minn.

Mr. Frazee had been with the Iowa Manufacturing Co. since its organization. He was the chief designer of the Cedar Rapids "One-Piece" portable rock crushing plant. He was born in Princeton, Ill., Nov. 2, 1891, and went to Cedar Rapids in 1908 and was educated in Cedar Rapids schools.

In addition to his widow and two children, W. Guy Frazee, Jr., 17 years old, and Nancy, 3 years old, he is survived by his mother, one brother and five sisters.

As chief designer of the Cedar Rapids firm, he made frequent visits to Colorado and enjoyed a host of warm friends in this territory, who mourn his loss.

Six Companies, Inc., contractors on the Boulder Dam, have placed an order for fifty large heavy-duty International trucks. The Los Angeles branch of International Harvester Co. got the order. With this order the Six Companies standardized on Internationals for all heavy-duty hauling work.

Contracts for over 200 miles of Blotter Type oil and sand surfacing have been let by the Kansas highway department. This surfacing is expected to materially reduce maintenance costs. It is estimated that 140 yards per mile per year of surfacing material will be saved, besides eliminating dust and chuck-holes. The Standard Oil Co. of Indiana have a corps of experts in various parts of their territory working out formulas for this type of surfacing in co-operation with state, county and city officials.

Doings Along the Highways

A new transcontinental highway has been recently approved by the executive committee of the American Association of Highway Officials at a meeting held in Chicago. The new highway will be routed through Brush, Sterling, Fort Morgan and Greeley to Denver. It will be known as Roosevelt Highway No. 6. It has its starting point at Provincetown, Mass., and terminates in Denver.

One thousand motorists attended the opening of the new Forest road that now extends from Newcastle to Buford at the junction of the north and south forks of the White River. Congressman Edward T. Taylor, Mayor Earl Clift of Newcastle, Mayor Harry Flynn of Silt and Joseph Davis of Newcastle addressed the gathering. This road was constructed by the U. S. Forest Service

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Colorado's emergency road construction program, totaling more than $3,000,000 in new projects, was completed on August 30th. The highway budget for 1931 totals 60 Federal Aid projects. Two-thirds of this work has been completed, and all will be under contract before the end of the year. The emergency program totaled $3,015,664. This work was paid for 100 per cent by the U. S. Government.

J. Fred Roberts Construction Company, Denver, submitted the low bid of $119,234 for the construction of 7 miles of gravel surface highway between Lay and Maybell. This is a link of the Victory Highway, extending west from Craig.

The U. S. Bureau of Public Roads has contracted with the Gordon Construction Co. of Denver to build the last 6 miles of the Willow Creek road in Grand County, which will connect the completed portion from the top of the pass to a junction with the Victory Highway three miles west of Granby.

The Driscoll Construction Co. of Pueblo has started work on paving 4½ miles of highway between Las Animas and Hadley, in Bent County. Two shovels and a like number of compressors with a crew of 20 men are now engaged in repairing 1,500 feet of the Mount Evans highway. This road has been closed above Summit Lake because of a rock slide. A highway crew will build a new road around the slide before snow flies.

The highway engineer made a recent visit to Manitou to inspect the Ute Pass highway. The 1931 highway budget contains $350,000 for the improvement of this road. Work is expected to be started this fall.

Construction of five miles of concrete pavement west of Lamar has been started by the Pueblo Bridge and Construction Co. Plans are being considered for the oiling of the present road between Granada and Holly, which will provide a surface for the next two years or so until the paving can be laid on the more direct route between these two towns.

Construction of 55 miles of new road between Denver and Limon is rapidly nearing completion and it is expected the highway will be open for the entire distance by October 1st. The total cost of this improvement is approximately $902,000. The work is divided into five large projects. When they are completed, all but approximately nine miles of the ninety miles of road between Denver and Limon will be improved.

With exception of the 18.565 miles of new road being built northwest of Limon, starting at River Bend, the projects will be completed and ready for traffic the first week of September. Although this project, being done by the Hamilton & Gleason Company at a cost of $240,319, did not call for completion until Dec. 1, the contractors are expected to finish by Oct. 1. This is Federal Aid Project No. 149-H.

One Project Begins Near Aurora

The other four projects completed or nearing completion, and the contractors are:

F. A. P. No. 149-C, Charles B. Owens, 7.863 miles, starting at the end of the present oiled road east of Aurora, costing $130,329.

F. A. P. No. 149-D, A. R. Mackey, 8.37 miles east of Watkins, costing $143,933.

F. A. P. No. 149-F, H. C. Lallier Construction & Engineering Company, 10.745 miles, costing $198,660.

F. A. P. No. 149-G, Lawrence Construction Company, 9.778 miles, southeast of Peoria, costing $189,624.

Contract has been let to the Mountain States Construction Co. of Pueblo for the construction of nine miles of highway between Del Norte and Monte Vista. Contract price is $102,199. Local labor will be used on the project.

A new road between Fleming and Sterling has been completed and opened to traffic. Work on this project started in February. The new road cuts seven miles off the distance between these two cities.

New Mexico Construction Co., Denver, on a bid of $154,000, has been given contract for the construction of four and one-half miles of paving between Greenhorn and Pueblo on Highway No. 1 in Pueblo County.

Bedford-Woodman submitted a low bid for six miles of gravel surfacing between Siebert and Vona in Kit Carson County, State Highway No. 4. The price was $31,426.40 for the completed job. Work has been started on the project.

A. R. Mackey Construction Co. have started work on fifteen miles of new road between Rifle and Newcastle. Their contract price is $271,567.

J. H. Miller Construction Co. of Denver are engaged in grading and gravel-surfacing a new highway over Wilkerson Pass. The improvement of the pass is made necessary by the loss of the Eleven Mile Canon road through Denver's dam construction work there. An effort is being made by the Miller concern to complete this work this fall.

A fine new road from Mack to the Utah state line, Mesa County, is expected to be completed by September 24th. Plans are on the way for an elaborate program to celebrate the opening of this and other projects between Grand Junction and Salt Lake City on September 24th and 25th.

Greeley-Ft. Morgan *Paving* Completed

(Continued from page 5)

struction; one, that all materials be accurately proportioned and the mixing time the same, batch to batch, and that the concrete be laid to grade between accurately set forms and finished mechanically as well as being compressed with a mechanical finishing machine.

These two jobs used the most modern equipment, the pavers on both jobs being the late Koehring 27-E semi-automatic pavers, the finishing machines furnished by the Blaw-Knox Company, of the double screed type, each machine furnished with a mechanical grooving attachment for making the center joint groove; crawler type gasoline draglines, made by the Koehring Company, using Blaw-Knox clamshell buckets; and the rest of the miscellaneous equipment, although minor in detail, important in the final result and as high class as the major units above.

SNOW REMOVAL EQUIPMENT

Now is the time to think about snow removal equipment—so we are told by the equipment dealers. All Denver distributors were active calling on prospects for this type of equipment during August. A number of early sales were reported.

The four-mile stretch of concrete pavement between Manzanola and Rocky Ford is complete, and motorists now have a continuous stretch of surfaced road from La Junta to Pueblo without any detours.

PLANS BEING DRAFTED

Proj. No.	Location	Type	Length
138-D	So. of Steamboat Springs	Gravel Surfacing	6 mi.
149-E	West of Strasburg	Gravel Surf. & Underpass	4 mi.
150-D, F. L. H. P. No. 1	South of Elk Springs	Gravel Surfacing	4 mi.
158-A	Northwest of Colorado Springs	Gravel Surfacing	4 mi.
216-B	West of Holly	Gravel Surfacing	10 mi.
263-C	East of La Veta Pass	Gravel Surfacing	5 mi.
298-E	East of Wolf Creek Pass	Gravel Surfacing	3 mi.

PLANS FINISHED

Proj. No.	Location	Type	Length
68-B	South of Saguache		
181-A	Idaho Springs	Pavement	2 mi.
248-AR&BR	North of Salida	Gravel Surfacing	14 mi.
248-C	South of Buena Vista	Gravel Surfacing	4 mi.
288-AR	Northeast of Brush	Paving & Overhead R.R. Crossing	3 mi.

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R10	Bet. Starkville and Trinidad	2.097 mi.	Paving	J. H. Miller & Co.	$109,577.10	88	2-R10
2-R11	South of Trinidad	3.130 mi.	Paving	J. H. Miller & Co.	89,063.70	72	2-R11
2-R12	Bet. Aguilar & Walsenburg	4.503 mi.	Paving	Orman Const. Co.	192,443.50	89	2-R12
15-B	East of Sterling	18.553 mi.	Grading & Surfacing	Bedford & Woodman, Inc.	237,781.55	100	15-B
57-R4 & 168-BCR	West of Lamar	4.801 mi.	Paving	Pueblo Bridge & Const. Co.	130,690.50	0	57-R4 & 168-BCR
71-C	Bet. Durango and Mancos	4.965 mi.	Gravel Surfacing	J. Finger & Son	86,146.75	66	71-C
78-R	Near Minturn	0.709 mi.	Gravel Surfaced	J. Fred Roberts & Sons	96,342.90	100	78-R
79-B	East of Colorado Springs	12.248 mi.	Gravel Surfacing	Chas. B. Owen	143,370.05	44	79-B
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	87	91-AR
134-AR&C	West of Burlington	11.174 mi.	Oil Processed Surf.	H. C. Lallier Const. Co.	111,217.20	39	134-AR&C
134-D	West of Stratton	5.076 mi.	Gravel Surfacing	Mountain States Const. Co.	49,350.50	100	134-D
134-E	East of Limon	5.052 mi.	Gravel Surfacing	Bedford & Woodman, Inc.	31,426.40	0	134-E
144-E	North of Fort Collins	1.286 mi.	Concrete Paving	F. C. Dreher Const. Co.	99,187.55	100	144-E
144-F	Northwest of Fort Collins	10.386 mi.	Gravel Surfaced	Blanchard Bros.	144,180.80	94	144-F
144-F2	North of Fort Collins	10.386 mi.	Gravel Surfacing	M. R. Deakin	19,950.00	100	144-F2
144-G	Bet. Forks & Colo.-Wyo. Line	13.204 mi.	Gravel Surfacing	Morrison-Knudsen Co.	248,078.00	94	144-G
145-C	East of Rifle	14.901 mi.	Grading & Grav.	A. R. MacKey	271,703.80	10	145-C
149-C	East of Aurora	7.863 mi.	Gravel Surfacing	Chas. B. Owen	130,329.47	85	149-C
149-D	East of Watkins	8.370 mi.	Gravel Surfacing	A. R. MacKey	13,207.82	88	149-D
149-F	Bet. Strasburg and Peoria	10.745 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	198,660.00	73	149-F
149-G	Denver-Limon	9.778 mi.	Grading & Surfacing	Lawrence Const. Co.	189,623.96	90	149-G
149-H	East of Deertrail	18.565 mi.	Gravel Surfacing	Hamilton & Gleason	240,319.15	53	149-H
150-B	West of Craig	4.630 mi.	Gravel Surfacing	N. M. Monaghan	73,181.65	100	150-B
150-C	West of Craig	6.893 mi.	Gravel Surfacing	J. Fred Roberts & Sons	120,139.05	0	150-C
151-A	Bet. Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	62	151-A
151-B	Bet. Fraser and Granby	3.925 mi.	Grading & Surfacing	Utah Construction Co.	63,954.80	88	151-B
158-B	Bet. Hartsel & Florissant	10.319 mi.	Gravel Surfacing	J. H. Miller & Co.	133,380.70	12	158-B
189-B	Bet. Hayden and Craig	2.567 mi.	Gravel Surfaced	C. A. Switzer	91,497.00	86	189-B
189-C	West of Hayden to County Line	7.534 mi.	Gravel Surfacing	F. L. Hoffman	115,356.94	83	189-C
208-AR	East of Grand Junction	Bridge and Detour		Phelps Bros.	7,305.70	93	208-AR
211-B	South of Craig	2.725 mi.	Gravel Surfacing	Utah Const. Co.	93,720.40	31	211-B
242-D	Bet. Mack & Colo.-Utah Line	9.883 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	124,552.36	94	242-D
242-E	West of Fruita	4.243 mi.	Gravel Surfacing	Wallace Const. Co.	54,907.53	99	242-E
245-AR	West of Las Animas	4.544 mi.	Grading & Oiling	Driscoll Const. Co.	94,398.85	0	245-AR
245-C	Between Hadley & La Junta	8.442 mi.	Grading	A. S. Horner	133,383.10	89	245-C
251-D	East of Boulder	0.284 mi.	Paving	Collier-Latimer	25,598.50	99	251-D
254-AB&CR	Byers Canon	2.615 mi.	Gravel	F. L. Hoffman	16,537.30	100	254-AB
258-I	Bet. Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	79	258-I
258-I2	East of Montrose	Concrete Box Culvert		Hinman Bros. Const. Co.	8,455.50	0	258-I2
258-J	West of Cerro Summit	5.796 mi.	Grading and Gravel	Lumsden Hall Const. Co.	107,027.30	81	258-J
259-B	Bet. Gunnison and Parlin	9.587 mi.	Gravel Surfacing	Cole Bros.	184,503.00	28	259-B
261-AR	Bet. Rifle and Grand Junction	0.053 mi.	Bridge & Grav. Surf.	Herbert S. Crocker	21,300.00	100	261-AR
265-D	Wilson Gulch	1.930 mi.	Bridge & Approaches	Grant Shields	29,455.50	99	265-D
265-E	West Bayfield	2.950 mi.	Gravel Surfacing	J. H. Miller & Co.	97,839.06	28	265-E
270-E	Bet. Del Norte & Monte Vista	8.663 mi.	Gravel Surfacing	Mountain States Const. Co.	102,199.10	16	270-E
271-F	East of Florence	0.593 mi.	Viaduct	Mountain States Const. Co.	57,583.40	100	271-F
272-F	Bet. Manzanola & Rocky Ford	4.097 mi.	Concrete Pavement	Driscoll Const. Co.	122,418.50	100	272-F
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc.	116,829.21	37	278-AR&C
278-D	West of Cheyenne Wells	21.913 mi.	Gravel Surfacing	A. R. MacKey	93,563.30	10	278-D
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	75	282-I
282-J	Bet. Rifle and Meeker	0.057 mi.	Bridge & Approaches	Herbert S. Crocker	20,400.00	100	282-J
286-E	Denver-Cheyenne Highway	4.052 mi.	Concrete Pavement	J. Fred Roberts & Sons	126,032.85	100	286-E
287-AR5	Bet. Kersey and Wiggins	10.586 mi.	Concrete Pavement	Edw. Selander	251,717.00	100	287-AR5
287-CR1	Bet. Kersey and Wiggins	10.246 mi.	Concrete Pavement	J. B. Bertrand, Inc.	254,341.70	100	287-CR1
292-D	Bet. Wolcott and Avon	9.834 mi.	Graded Surface	Utah Const. Co.	159,143.40	49	292-D
295-E	South of Alamosa	7.627 mi.	Gravel Surfacing	Mountain States Const. Co.	71,049.56	8	295-E
296-AR&BR	South of Pueblo	4.372 mi.	Paving	New Mexico Const. Co.	154,509.00	0	296-AR&BR
296-D	South of Pueblo	8.348 mi.	Gravel Surfacing	Cole Bros.	84,815.10	97	296-D
297-C	Southwest of DeBeque	9.953 mi.	Gravel Surface	Hinman Bros. Const. Co.	312,453.50	100	297-C
298-C	Bet. Twin Bridges & South Fork	3.780 mi.	Gravel Surfacing	H. C. Lallier Const. & Eng. Co.	116,864.50	91	298-C
298-D	Bet. Del Norte and Durango	4.100 mi.	Gravel Surfacing	H. C. Lallier	164,814.00	75	298-D
298-F	East of Bayfield	5 mi.	Gravel Surfacing	Wood, Morgan & Burnett C. Co	66,920.85	67	298-F
299-AR	Alkali Creek	Bridge		Phelps Bros.	8,690.05	94	299-AR

PENNSYLVANIA

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DEPARTMENT

on August 15, 1931

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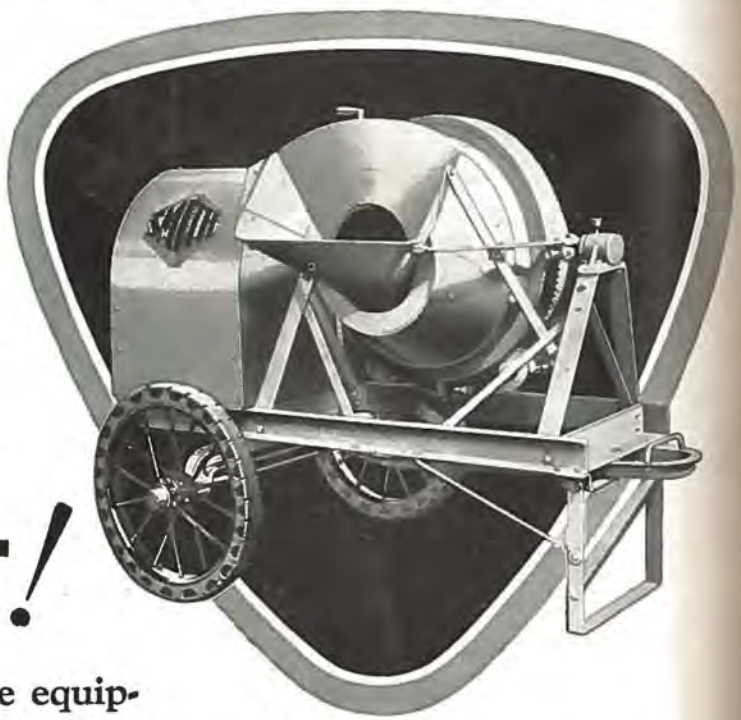

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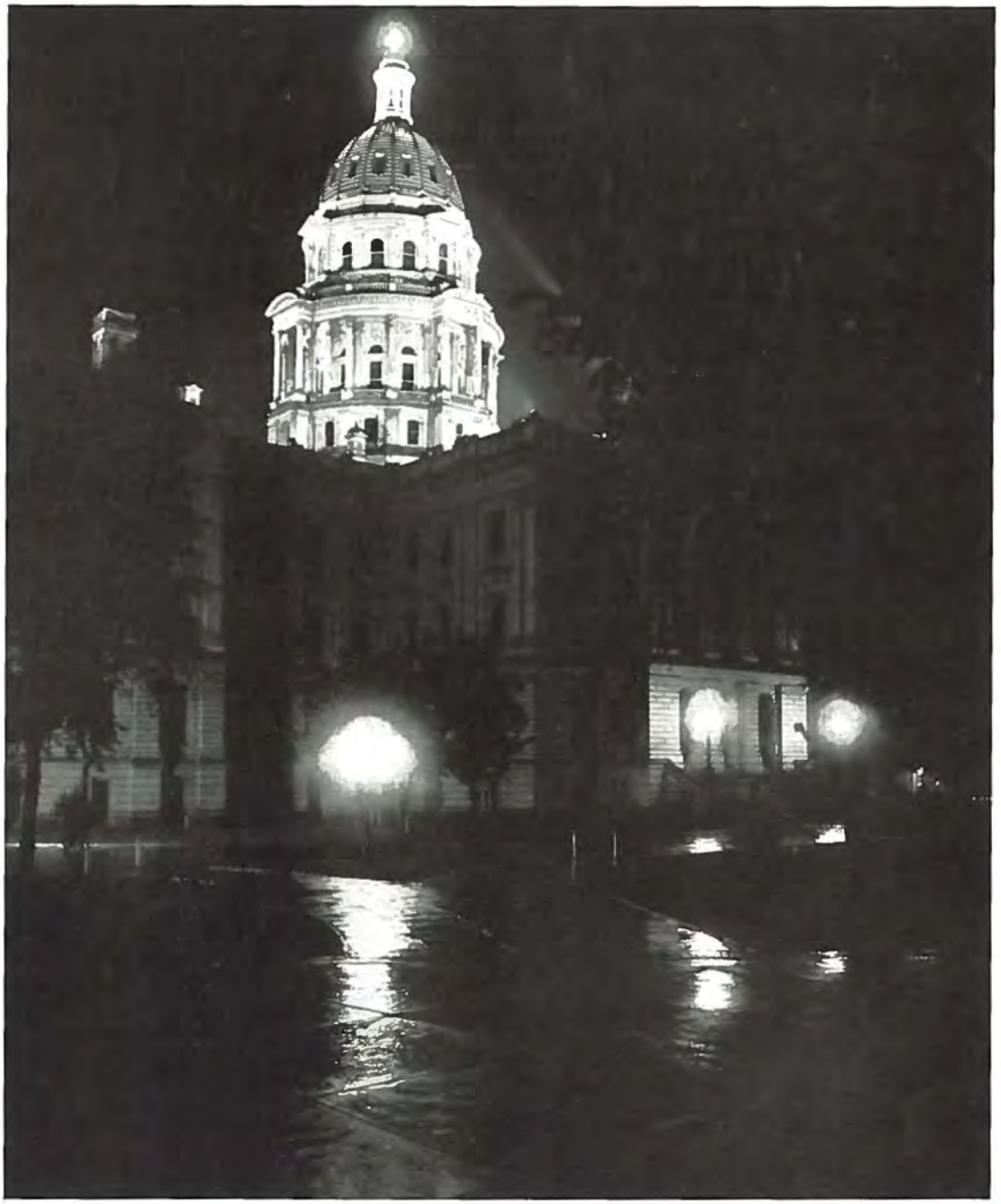

Vol. X October, 1931 No. 10

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Colorado Highways

"BETTER ROADS"

Official Publication of the
COLORADO STATE HIGHWAY DEPARTMENT
Denver, Colorado

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Articles on the subject of road building and highway development in Colorado are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible.

20 CENTS A COPY. $2.00 A YEAR.

Our Cover Picture

One of the most striking pictures ever made of the State Capitol building in Denver is printed on the cover of this month's issue of COLORADO HIGHWAYS. It shows what the state building looks like on a dark, rainy night. A poet or novelist might paint a marvelous word picture from the scene, but we'll leave it to you. The photo was furnished us by James Merrick, superintendent of the State Capitol building.

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Colorado Highways
"BETTER ROADS"
VOLUME X. OCTOBER, 1931 NUMBER 10

Work *for* All

(Reprinted from Engineering News-Record)

SHALL next winter's unemployment emergency be relieved by work or by charity. This question which we asked two weeks ago in urging public works for relief, is now the outstanding question of the day. The emergency has been brought into sensational prominence by the President's step in organizing nationwide charity relief measures. As yet nothing has been done toward mobilizing increased public works.

The President's extragovernmental organization is a reminder of wartime methods. And in a very real sense we are again at war—fighting to overcome the menacing effects of economic breakdown and win back for all the people the opportunity for self-support. If so, let wartime methods be applied purposefully, by overcoming idleness rather than by compromising with it. The outcome is sure if the fight is pressed intelligently and unitedly. At a time when our national resources have been developed to unparalleled richness it is unthinkable that we should yield to distress, or allow large numbers of the people to be demoralized by charity.

Public works can employ the idle and can make available to them, not by gift but by right of labor, the stores of food, clothing and shelter of which the country has abundance. Private business has proved powerless to maintain the workers at their jobs. The great resource of public work remains.

Is this resource sufficient? There are those who say that the great volume of public works required to meet the emergency does not exist, and that therefore we must resign ourselves to the charity plan. They disregard the facts.

Construction needs exist in prodigious volume. The country's annual budget of public-works construction approaches three and a half billion dollars. An addition of little more than twice this amount will give work to five million men at an expenditure of $1,500 per man for labor and materials. Less will do, in fact. Large numbers are engaged behind the lines: the supply, housing and service workers whose employment results from that of the direct producers; construction payrolls need not provide for these. It is quite likely that mere doubling of the volume of public-works construction for a year would provide a job for every seeker.

Let us make the picture specific. Road work alone would take care of the entire unemployment emergency were no other source of work at hand. More than two million miles of road in the United States still want improvement from the dirt-road stage. Reasonable modernization of but half or a third of that mileage within a year would enlist the service of every unemployed worker. Tools might prove short at the start, but they could be provided.

Cities can make available a vast total of urgent work—street widening and paving, modernization of public buildings, sewer and water improvement and the bettering of medieval conditions in dozens of directions. If nothing more were done than to safeguard, reconstruct and render decently habitable the notoriously unfit institutional buildings throughout the land, it would absorb a large contingent of the idle.

In brief, the volume of needed public works is ample to provide the employment by which the emergency can be met in full. Every state, county and city has its quota. There is federal construction also, but this is only a tenth of the country's annual public-works budget. The great bulk of emergency construction will come from the states and local communities.

We are not forced to depend on charity, then. We can work our way out.

And the means are available. We lack neither money nor the ability to organize and plan quickly. The difficulties are great, but they can be overcome.

Financing is probably the greatest. Heavy tax burdens and local bond obligations throttle the public work of local communities. Cities are poor; tax collections are far behind and bonding margins are small or absent. But financing is easily accomplished through the superior ability of the federal government to market bonds. Loans of far greater proportions were sold to the people during the war. A reconstruction bond issue can quickly provide all the money needed, whether it taps the huge accumulation of idle investment funds through the banks or is distributed countrywide to the people.

Nor do the problems of organizing and planning surpass the nation's powers. No one who recalls what was done in 1917 and 1918 in carrying out in a few months a vast building and equipment program and putting the country to work for national purpose we will have any doubt of our present powers. Engineers are more numerous and competent, constructors have doubled their achievements. Organizational and administrative skill is ready.

Seven Million *Spent on* New Highways

OVER seven million dollars has been expended on highway construction and maintenance in Colorado up to September 1.

As a result more than 6,000 men have been given employment on the roads of this state since early in May. The work of the department has been carried on in all parts of the state, and the expenditure of this vast sum of money has resulted in almost what has amounted to prosperity in a large number of communities.

An effort will be made by the officials of the highway department to keep as much work as possible going through the forthcoming winter.

Sixty federal aid projects have been put under contract. These contracts involved 275 miles of gravel surfacing; 52 miles of concrete pavement; and nine miles of grading.

All projects let under the Emergency Unemployment Fund agreement with the government were completed prior to September 1st, and the state was reimbursed for every cent of the money expended on this account, totaling $3,000,000. Over one-half million dollars of the latter fund was expended on the construction of twenty-one miles of pavement located between Wiggins and Greeley in Weld county. Other amounts were expended in various parts of the state.

One of the outstanding improvements made by the department was in the construction of sixty miles of gravel surfaced highway located betwen Denver and Limon. Work on this project, which was started with surveys in April, has resulted in the employment of hundreds of men. Good weather conditions has made it possible to keep the work going almost every day since the first of June. It is hoped to have the entire road open to traffic on November 1st.

The longest paving project was the Wiggins-Greeley job, totaling twenty-one miles, which was let in two contracts, total cost of which was $566,664.57.

Highway Engineer C. D. Vail reports that wherever possible contractors will be urged to carry their work as far into the winter as weather will permit, in order that the maximum number of men will be given employment.

Engineering costs have been the lowest in the history of the department. This is accounted for principally in the fact that the individual projects have been larger, and the work has been expedited by the contractors. Department officials have found that large projects can be handled with little more expense than small jobs which in previous years somtimes were permitted to drag along by small contractors.

During the present season with large projects attracting large and efficient contracting organizations the construction work of the department has moved with record-breaking speed. Contract prices obtained by the department also have been the lowest in the history of the department.

The largest gravel surfacing project let this year was for the construction of fifteen miles in Garfield county, located east of DeBeque. The contract price for this project is $298,874.18, awarded to the A. R. Mackey Const. Co.

Prices on gravel surfacing this year have ranged from 18 cents to $1.50 per ton, and the price on unclassified excavation ranged from 14 cents to 83 cents per cubic yard.

On paving the prices have ranged from $1.48 to $2.19 per cubic yard, and the unclassified prices on this class of work ranged from 15 cents to 40 cents per cubic yard.

The department also has purchased 360,000 gallons of asphaltic road oil for a total of $17,938. There has been one bituminous paving project, and one bitumulus paving contract. For bridges and approaches the department has expended $52,000.

A list of the projects contracted by the department to the first of September follows:

***F. A. Project No. 149-C, Divisions 1 and 2. 7.863 miles gravel surfacing and bridge east of Aurora, S. H. No. 8, Adams-Arapahoe Counties, cost $143,362.42. Chas. B. Owen, Contractor.**

***F. A. Project No. 15-B, Division 1. 1.553 miles gravel surfacing between Sterling and Fleming, S. H. No. 14, Logan County, cost $261,559.70. Bedford and Woodman, Contractors.**

***F. A. Project No. 251-D. 0.284 miles concrete paving and railroad underpass east of Boulder near Goodview, S. H. No. 7, Boulder County, cost $28,158.35. Collier-Latimer, Contractors.**

***F. A. Project No. 287-AR5 contract 1 and 287-C. Detour road for S. H. No. 1 between Kersey and Wiggins, Weld and Morgan Counties, cost $13,140.65. A. R. Mackey, Contractor.**

One of Colorado's modern oil-surfaced highways, leading east from Denver. By the end of 1932 it is expected this oil surfacing will be extended a distance of 90 miles east of the Capital city.

*F. A. Project No. 2-R-10. 2.097 miles concrete paving between Starkville and Trinidad, S. H. No. 1, Las Animas County, cost $120,534.81. J. H. Miller and Co., Contractors.

*F. A. Project No. 286-E. 4.052 miles concrete paving between Eaton and Ault, S. H. No. 3, Weld County, cost $138,636.14. Fred Roberts & Sons, Contractors.

*F. A. Project No. 151-B. 3.925 miles gravel surfacing between Granby and Tabernash, S. H. No. 2, Grand County, cost $70,350.28. Utah Construction Co., Contractor.

F. A. Project No. 298-B. 4.1 miles gravel surfacing south of South Fork, S. H. No. 10, Mineral and Rio Grande Counties, cost $181,295.40. H. C. Lallier Construction & Engineering Co., Contractors.

*F. A. Project No. 282-J. 0.057 mile bridge and approaches at Rifle, S. H. No. 4, Garfield County, cost $22,440. Herbert S. Crocker, Contractor.

*F. A. Project No. 261-AR, No. 1. 0.053 mile bridge and approaches at Rifle, S. H. No. 4, Garfield County, cost $23,430. Herbert S. Crocker, Contractor.

*F. A. Project No. 287-C, Reo. Division 10.246 miles concrete paving between Kersey and Wiggins, S. H. No. 2, Weld County, cost $279,775.87. J. B. Bertrand, Inc., Contractor.

*F. A. Project No. 287-A, Reo. Division Contract No. 2 and F. A. Project No. 287-C, Reo Division No. 2, Combined. 10.586 miles concrete paving between Kersey and Wiggins, S. H. No. 2, Weld and Morgan Counties, cost $276,888.70. Edward Selander, Contractor.

*F. A. Project No. 242-D. 9.883 miles gravel surfacing between Mack and Colorado-Utah line, S. H. No. 4, Mesa County, cost $137,007.60. Hinman Brothers, Contractors.

*F. A. Project No. 134-D, Division No. 5.076 miles gravel surfacing west of Stratton, S. H. No. 4, Kit Carson County, cost $54,285.55. Mountain States Construction Company, Contractors.

*F. A. Project No. 144-G. 13.204 miles gravel surfacing between Forks and Colorado-Wyoming line, S. H. No. 123, Larimer County, cost $272,885.80. Morrison-Knudson Co., Contractors.

F. A. Project No. 149-D, Division No. 8.370 miles gravel surfacing east of Watkins, S. H. No. 8, Adams and Arapahoe Counties, cost $143,796.95. A. R. Mackey, Contractor.

F. A. Project No. 245-C. 8.442 miles grading between Hadley and La Junta, S. H. No. 6, Otero County, cost $146,721.41. S. Horner, Contractor.

F. A. Project No. 149-F. Detour bridge miles east of Strasburg, Adams and Arapahoe Counties, cost $14,528.60. A. R. Mackey, Contractor.

*F. A. Project No. 272-F. 4.097 miles concrete paving between Manzanola and Rocky Ford, S. H. No. 6, Otero County, cost $134,660.35. Driscoll Construction Co., Contractors.

*F. A. Project No. 189-C. 7.534 miles gravel surfacing west of Hayden, S. H. No. 2, Routt and Moffat Counties, cost $126,892.63. F. L. Hoffman, Contractor.

*F. A. Project No. 149-G. 9.780 miles gravel surfacing east of Peoria, S. H. No. Arapahoe County, cost $208,586.35. Lawrence Construction Co., Contractors.

*F. A. Project No. 242-E. 4.243 miles gravel surfacing west of Fruita, S. H. No. Mesa County, cost $60,398.28. Wallace Construction Co.. Contractors.

F. A. Project No. 258-J. 5.796 miles gravel surfacing between Cimarron and Montrose, S. H. No. 6, Montrose County, cost $117,730.03. Lumsden-Hall Construction Co., Contractors.

*F. A. Project No. 299-A, Reo., Division No. 1, 83-foot timber bridge and detour 10 miles northwest of Delta, S. H. No. 6, Delta County, cost $9,559.06. Phelps Brothers, Contractors.

*State Project No. 584-F. 0.786 mile bituminous pavement between Colorado Springs and Manitou, S. H. No. 4, El Paso County, cost $16,484.38. New Mexico Construction Co., Contractors.

*F. A. Project No. 208-A, Reo., Division No. 3. 82-foot bridge and detour east of Grand Junction, S. H. No. 4, Mesa County, cost $8,936.27. Phelps Brothers, Contractors.

*State Project No. 548-B. 220,000 gallons asphaltic oil, f. o. b. Hygiene, Boulder County, cost $10,098. Texas Company, Contractors.

*F. A. Project No. 296-D. 8.348 miles gravel surfacing south from Pueblo, S. H. No. 1, Pueblo County, cost $93,296.61. Cole Brothers, Contractors.

*F. A. Project No. 2-R-12. 4.503 miles concrete paving north of Aguilar, S. H. No. 1, Las Animas County, cost $211,687.85. Orman Construction Co., Contractors.

F. A. Project No. 149-F. 10.745 miles gravel surfacing between Strasburg and Peoria. S. H. No. 8, Arapahoe County, cost $218,526. H. C. Lallier Construction and Engineering Co., Contractors.

*1931 Pueblo County, 3% Gax Tax Fund Project. 0.430 mile concrete paving on Court and 25th Street in Pueblo, Pueblo County, cost $16,141.40. Driscoll Construction Co., Contractors.

*1931 La Plata County, 3% Gas Tax Fund Project. 0.2 mile bitumulus paving on Main Avenue in Durango, cost $5,254.92. Wood, Morgan and Burnett, Contractors.

*State Project No. 656 wire cable guard fence on Battle Mountain, near Gilman, S. H. No. 4, Eagle County, cost $5,166.48. Hinman Brothers, Contractors.

*F. A. Project No. 295-AR, 140,000 gallons asphaltic road oil, f. o. b. La Jara, cost $7,840. White Eagle Oil Co., Contractors.

F. A. Project No. 298-F. 5 miles gravel surfacing east of Bayfield, S. H. No. 10, Archuleta County, cost $73,612.93. Wood, Morgan and Burnett, Contractors.

*F. A. Projects Nos. 254-AR, No. 1, 254-BR, No. 1 and 254-CR, No. 1, Combined. 2.615 miles of gravel surfacing in Byers Canon, west of Hot Sulphur Springs, S. H. No. 2, Grand County, cost $18,191.03. F. L. Hoffman, Contractor.

F. A. Project No. 71-C. 4.965 miles gravel surfacing between Durango and Mancos, S. H. No. 10, La Plata County, cost $94,761.42. J. Finger & Son, Contractor.

*State Project No. 711-B (1931). Construction of reinforcing and structural steel bridge, near Brookridge Farm on South Broadway. Colorado Builders' Supply Co., awarded reinforcing steel at $845.10. Midwest Steel & Iron Works Co., awarded structural steel at $2,479.40.

*F. A. Project No. 144-F, Division No. 2. 10.386 miles gravel sufacing north of Fort Collins, S. H. Nos. 14 and 123, cost $21,945. M. R. Deakin, Contractor.

F. A. Project No. 2-R-11. 3.130 miles gravel surfacing south of Trinidad, S. H. No. 1, Las Animas County, cost $89,063.70. J. H. Miller & Co., Contractors.

F. A. Project No. 211-B. 2.725 miles gravel surfacing north of Hamilton, S. H. No. 13, Moffat County, cost $103,092. Utah Construction Co., Contractors.

F. A. Project No. 149-H. 18.565 miles gravel surfacing east of Deertrail, S. H. No. 8, Elbert County, cost $264,351.07. Hamilton & Gleason Co., Contractors.

F. A. Project No. 259-B. 9.587 miles gravel surfacing east of Gunnison, S. H. No. 6, Gunnison County, cost $202,953.30. Cole Brothers, Contractors.

*1931 Morgan County 3% Gas Tax Fund Project. 1.127 miles concrete paving at Fort Morgan, S. H. No. 2, Morgan County, cost $27,480.75. Edward Selander, Contractor.

F. A. Project No. 79-B. 12.248 miles gravel surfacing east of Colorado Springs, S. H. No. 4, El Paso County, cost $157,707.05. Chas. B. Owen, Contractor.

F. A. Project No. 265-E. 2.950 miles gravel surfacing west and east of Bayfield, S. H. No. 10, La Plata County, cost $107,622.97. J. H. Miller & Co., Contractors.

F. A. Project No. 278-D. 20.587 miles gravel surfacing west from Cheyenne Wells, S. H. No. 8, Cheyenne County, cost $102.919.63. A. R. Mackey, Contractor.

F. A. Project No. 145-C. 14.901 miles gravel surfacing east of Rifle, S. H. No. 4, Garfield County, cost $298,874.18. A. R. Mackey, Contractor.

F. A. Project No. 295-E. 7.627 miles gravel surfacing between Alamosa and Conejos-Alamosa county line, S. H. No. 17, cost $78,154.52. Mountain States Construction Co., Contractors.

F. A. Project No. 270-E. 8.664 miles gravel surfacing between Monte Vista and Del Norte, S. H. No. 10, Rio Grande County, cost $112,419.01. Mountain States Construction Co., Contractors.

F. A. Project No. 158-B. 10.319 miles gravel surfacing between Hartsel and Florissant. S. H. No. 4, Park County, cost $146,718.77. J. H. Miller & Co., Contractors.

F. A. Project No. 258-I, Division No. 2. Concrete box culvert and approaches at Stumpy creek, west of Montrose-Gunnison county line, S. H. No. 6, Montrose County, cost $9,301.05. Hinman Brothers, Contractors.

Combined F. A. Project Nos. 296-AR, Division No. 1, and 296-BR, Division No. 1. 4.618 miles concrete paving between Pueblo and Greenhorn, S. H. No. 1, Pueblo County, cost $169,959.90. New Mexico Construction Co., Contractors.

F. A. Project No. 150-C. 6.893 miles gravel surfacing between Lay and Maybell, S. H. No. 2, Moffat County, cost $132,152.96. J. Fred Roberts and Sons, Contractors.

Combined F. A. Project No. 57, Reo Division No. 4, and F. A. Project No. 168-BC, Reo Division No. 1. 4.801 miles concrete paving west of Lamar, S. H. No. 6, Prowers County, cost $143,759:55. Pueblo Bridge & Construction Co., Contractors.

State Project No. M-22 (1931). Bridge across Oak Creek, between Canon City and Salida, S. H. No. 6, Fremont County, cost $2,848.56. Pueblo Bridge & Construction Co., Contractors.

F. A. Project No. 245-AR No. 1. 4.544 miles concrete paving between Las Animas and Hadley, S. H. No. 6, Bent County, cost $103,833.74. Driscoll Construction Co., Contractors.

F. A. Project No. 134-E. 5.052 miles base coarse gravel surfacing between Seibert and Vona, S. H. No. 4, Kit Carson County, cost $34,569.04. Bedford & Woodman, Inc., Contractors.

*Denotes completed.

Congress Urged *to Increase* Road Funds

OFFICIALS of forty-four state highway departments gathered in Salt Lake City on September 29, to attend the seventeenth annual convention of the American Association of State Highway Officials. The Colorado department was represented by Highway Engineer C. D. Vail and John P. Donovan, maintenance engineer.

F. E. Everett, state highway commissioner of New Hampshire, was elected president of the association, succeeding Henry H. Blood, chairman of the Utah highway commission. W. W. Mack of Delaware was re-elected treasurer. O. S. Warden of Great Falls, member of the Montana highway department, was elected vice-president representing the western district.

A telegram from President Hoover complimented the Federal and State Highway Organizations on the splendid manner in which they had handled the emergency road work, made possible by the $80,000,000 U. S. emergency appropriation for the relief of unemployment throughout the nation. Colorado's share of this fund was $3,000,000, and Highway Engineer Vail reported that same had been expended prior to September 1, as provided in the law.

Resolutions asking congress to continue Federal Aid appropriations for road purposes at the present rate of $125,000,000 annually during 1934 and 1935. The highway officials also expressed a willingness to handle such unemployment relief work as congress might request.

In another resolution congress was requested to eliminate the limit per mile for Federal Aid participation in road construction, and permit 50 per cent participation regardless of cost per mile. The present $16,000 limit per mile of Federal participation works a particular hardship on mountain construction in western states as well as on the superhighways of the east.

Congress also was asked to increase the present $3,000,000 appropriation for roads through public lands, to such an amount that the purpose of the appropriation may be speedily accomplished. A fifth resolution requests congress to continue the present annual $12,500,000 appropriation for construction of roads through the National Forests.

The road delegates, numbering more than two hundred and fifty, from all parts of the country, were welcomed to Salt Lake City by Governor George H. Dern and Mayor John F. Bowman. This was followed by a reading of the annual report of President Blood. Some of the recommendations made by him were later adopted in the resolutions.

Statistics on the progress of road work throughout the country were given in the annual report of W. C. Markham, executive secretary. The report revealed that this was the most active year in the history of road construction and maintenance in the United States.

One of the most interesting papers read before the conference was that of Dr. D. B. Steinman of New York, who outlined the history of bridge building during the past half century. He started with the Brooklyn bridge and followed through to the recent completion of the St. John's bridge in Multnomah County, Oregon, concluding with a recital of some of the dreams of future bridges.

Why the state of Pennsylvania has added some 20,000 miles to its state highway system, and what that state is doing about it, was outlined by Samuel Echels.

C. H. Ross, attorney for the North Carolina highway commission, related how the highway department of his state had taken over the supervision on construction and maintenance of all roads outside of city and town limits in his state. The last legislature of North Carolina added one cent to the gasoline sales tax and gave the highway commission custody of all her 4,000 prisoners outside of the state penitentiary. This action of the law-making body was taken after a two-year survey of the road situation in the state.

Opposition to the state department's taking over roads that obviously will be tremendous burden on the state, was expressed by Thomas H. MacDonald, chief of the Bureau of Public Roads. He expressed the belief that the states should wait until their main highway systems have been completed before adding more mileage to the state programs.

(Continued on Page 14)

COMPARATIVE STATEMENT
For the Month of September, 1930 and 1931

RECEIPTS	1930	1931
United States Government	$327,192.66	$ 710,051.89
Gas Tax	433,100.00	429,300.00
Internal Improvement	1,400.00	4,700.00
Highway Receipts	35,094.40	23,630.40
	$796,787.06	$1,167,682.29
DISBURSEMENTS		
Federal Aid Projects	$485,943.12	$1,263,377.94
State Projects	66,129.25	113,470.71
Maintenance	169,226.21	147,646.84
Maintenance Equipment	5,888.79	438.10
Property and Equipment	425.32	1,640.37
Surveys	7,032.94	3,524.96
Traffic Signs and Census	1,738.00	3,352.93
Administration	15,094.02	18,230.20
Compensation Insurance	24,771.28	27,165.56
	$776,248.93	$1,578,847.61

Highway Research

These brief technical highway notes have been prepared from reports and current investigations of the committees and staff of the American Road Builders' Association.—Editor.

A FINANCING PLAN FOR COUNTY HIGHWAYS

The equitable distribution of highway funds between states, counties and cities is limited somewhat in the establishment of uniformity in the 48 states, 3,000 counties and many cities by the variation in extent of improvements, population, wealth and laws. A plan of financing prepared for a Middle-Western state by H. C. McCurdy, county highway superintendent of St. Clair County, Illinois, presented in a report of the American Road Builders' Association, has many interesting features.

With the number of miles of road in the county and the density of population as a guide, it is suggested that the counties be permitted to designate county mileage which when combined with the state mileage in the county shall not exceed:

20 per cent where population is less than 50 per square mile.

25 per cent where population is between 50 and 100 per square mile.

30 per cent where population is over 100 per square mile.

The proceeds of one cent of the gasoline tax shall be prorated by the states to the various counties on the basis of mileage where a county levies the maximum highway tax; otherwise, the amount prorated shall be in proportion to the county tax levy.

All county funds for highways are to be combined and budgeted annually, an accounting made to the state highway department, and plans for all new highways and maintenance in excess of $1,000 a mile per year be subject to the approval of the state highway department.

County boards will set aside 25 per cent of the total road fund for the improvement, upon petition, of city streets connecting and completing state and county routes through cities, or major streets in cities having a city plan.

The maintenance of all county roads is to be by the counties.

COUNTY PATROL MAINTENANCE ORGANIZATION

The organization for patrol maintenance in Woodbury county, Iowa, was described by J. C. McLean, county engineer, in a report to the American Road Builders' Association as follows:

Patrol Areas Established — In working out the maintenance organization, a map was made dividing the county into 22 patrol areas. Each area was given a number, and all of the surface maintenance within the individual area is handled by either power or team patrol.

Types of Equipment—Approximately 65 per cent of the total mileage of roads of the county are under continuous or heavy maintenance with power patrols. The machines vary in size, weight, and horsepower, according to the topographical conditions, amount of traffic, and the types of soil encountered. Surface maintenance on the balance of the system is of the intermittent type, where light, horse-drawn maintainers are used.

Power Patrols—Power patrols are assigned from 60 to 75 miles of road, based on a daily coverage of 25 to 30 miles on earth surfaces, and from 30 to 40 miles on gravel. A patrol route map is furnished each operator on which his route is designated as "first day's run," "second day's run," etc., so that he will follow in the order indicated the various routes. These runs cover, in relative order of importance, all of the roads in the area, with a definite mileage assignment on each. The trunk roads are all under power maintenance and all mileage of this type is included in the "first day's run" in any area.

Team Patrols—Team patrols have been assigned to the mileage of roads where the conditions of the road, finances, traffic, and other considerations would not permit the employment of continuous heavy maintenance. Each of these areas is subdivided into patrol routes given alphabetical designation and vary in length from 6 to 10 miles. These are maintained intermittently.

Structures and Culverts — To maintain structures and culverts the 22 patrol areas are grouped into 4 districts, consisting of from 5 to 6 patrol areas per district. A bridge crew is assigned to each district. Its duties consist of the repair and upkeep of all structures, the placing of culvert pipe, and work of a similar character.

Heavy Blade Grading and Widening—Heavy blade work is continuous during the season, using large tractors of the crawler type and blade graders, with one outfit assigned to each district. This equipment covers a definite mileage schedule laid out from the condition maps of the district. By this means it is the plan to gradually raise the "condition ratings" of roads from "poor" to "fair," and from "fair" to "good."

Light Blade Grading and Reshaping—Following the power and team patrols are lighter tractors of the crawler type with smaller graders, one outfit operating in each patrol district. This equipment is on a schedule which provides for a com-

Here we have a view of the beautiful highway constructed on easy grade and wide curves over La Veta Pass, constructed with Federal Aid funds—just another example of improvements being made on Colorado's road system.

plete clean-out of ditches and reshaping of shoulders on all of the mileage of the secondary system once every 2½ to 3 years.

Snow Removal—In so far as possible all roads of the trunk system and local roads of major importance are completely protected with snow fence. Light snow removal operations are carried on by the individual patrolman, while severe conditions are handled with truck and tractor plows, stationed in and operating over the entire maintenance district.

Miscellaneous Work—The erection and storing of snow fence, clearing and grubbing, building of guard rail, changing of channels, raising of grades, and work of a similar character, which is too extensive to be handled by the patrolman, is performed by special crews operating under the district or gang maintenance plan.

Purchase of Supplies—The season's requirements of all items used in quantities for maintenance work, such as lumber, piling, nails, tools, oils, gasoline, grease, paint, etc., are anticipated in advance. Purchases are made under competitive conditions and allotments made to the maintenance districts early each season.

Contract Maintenance—The excavation, loading, or hauling of surfacing materials, major bridge repairs, and work of a similar character requiring a special or large equipment outlay is contracted to the lowest responsible bidder.

Observation suggests the following conclusions:

Inadequate funds make necessary careful planning of the whole maintenance procedure.

Lack of definite orders and responsibility, and failure to lay out and provide sufficient work for the full employment of time, are primary causes affecting the efficiency of maintenance crews.

The use of power equipment for surface maintenance will increase, tending more and more to displace horse-drawn vehicles.

The possibilities of a further extension of contract maintenance, covering both labor and materials, should be investigated and comparisons of cost made upon which to base conclusions.

UNPAVED STREETS

Planning the gradual improvement of unpaved streets by stage construction is recommended by a committee of the City Officials' Division of the American Road Builders' Association, W. A. Heimbuecher, city engineer, University City, Missouri, chairman. Other recommendations are as follows:

Chemical dust layers give good results on earth roads, but some complaints are offered that in wet weather the undersides of automobiles are rusted and even brake linings frozen to brake drums.

No unpaved street can exist under present day motor traffic without constant maintenance unless surface treated.

Weed exterminators are little used on unpaved streets.

Tar or oil blankets will usually remove the necessity for weed killers.

Excessive crowning of unpaved streets in these days of high speed motor traffic is a dangerous procedure.

Paved gutters or shoulders are necessary on steep grades.

Scarifying is recommended as a preliminary to some macadam repairs.

Any properly constructed gravel road is a potential base for all types of roadway, up to and including rigid type pavements.

Low maintenance costs follow the use of high grade local materials.

Planning the gradual improvement of unpaved street surfaces to develop a firm subgrade for pavements is recommended. This procedure necessitates the establishment of unpaved street grades at or slightly below future pavement subgrade elevations.

A monument to a state highway engineer—tree upon which bronze tablet in memory of P. J. Becker is placed. Mr. Becker was the engineer in charge of the work on a beautiful stretch of new roadway along the Eagle River. Photo by H. L. Jenness, Division Engineer.

The immediate responsibility for meeting the present unemployment needs by increasing public works construction is primarily local, stated W. A. Hardenbergh, vice-president, Public Works Journal, New York City, in an address before the American Road Builders' Association.

This means that the funds for this work to be done in the immediate future must come from local sources, and cannot be procured from outside agencies. The problem of raising these funds is one that must be faced and solved by local officials if they are to do their share to meet the needs of today.

The major sources of income for public work construction are taxes, bond issues and assessments. Of these the most important source available for early construction work is tax money. Much of this has already been duly authorized in the 1931 budgets, and no further action is necessary to start the work except to make the money immediately available.

If tax money is not yet in hand, as is often the case, money can generally be borrowed from local banks at a fair rate of interest in anticipation of the receipt of taxes. Local banks have a close interest in the welfare of the community in which they do business and with rare exceptions will cooperate fully.

Temporary loans may sometimes be arranged between different departments of the city. For instance, the water department may at this time have funds banked that can temporarily be made available for paving work, provided adequate provisions are made for timely repayment.

To raise money by bond issues or assessments requires generally a considerable period of time—two or three months at the very least. Unless initial steps have already been taken, the result will be that work financed by these means cannot be undertaken before spring.

If each of our four or five thousand communities can begin now the work they have planned for in budgets—or a sufficient amount of it to meet the local unemployment situation—the great need will be met.

Oil *Treatment of Earth* Roads

AN INVESTIGATION has been made of oil-treated earth roads in Missouri, and the Bureau of Public Roads publishes a report on same by F. V. Reagel, engineer of materials, Missouri State Highway Department, Henry Aaron, assistant highway engineer, U. S. Bureau of Public Roads, and W. I. Watkins, assistant soil surveyor, U. S. Bureau of Chemistry and Soils.

This report describes in great detail the conditions of 224 miles of roads oiled during May to November, 1928; inspections having been made 2½ months after the oil was applied, again 1½ months later, in the summer of 1929, and finally in the spring of 1931. In brief, "The investigation has disclosed that oils may be used satisfactorily for the treatment of earth surfaces to provide temporary all-weather roads if certain fundamental factors are recognized. The most important factors so far discovered are: (1) Physical characteristics of the soil; (2) drainage, both surface and subsurface; (3) condition of surface immediately prior to application of oil; (4) rate of penetration of oil; (5) type of traffic; and (6) methods of maintenance."

The manner of conducting the investigation and what was learned thereby are described in great detail in the report, and the conclusions drawn therefrom finally are summarized as follows:

1. Road oil of the types included in this study is an efficient material for use in the treatment of earth surfaces to provide all-weather roads provided applications are made to suitable surfaces, adequately drained, and repeated as needed.

2. The type of oil, as regards basic crude source, is not a major factor, all types yielding fairly satisfactory results with all types of soils, other conditions being favorable.

3. Adequate drainage, both subsurface and surface, is essential to the satisfactory service of oiled earth surfaces. Adequate drainage, on flat topography, requires greater crown than ordinarily constructed on graded earth sections.

4. General profile is not a factor affecting the service of oiled earth surfaces except as it may influence the efficiency of drainage and the character of the subgrade material.

5. To reduce the effects of erosion on noncohesive types of soils, oil should be applied on the full width of roadway.

6. All types of soil included in this study can be efficiently treated with road oil.

7. The soil type is an effective factor because of the physical characteristics of the various soil layers exposed to the application of oil. The physical characteristics of the subgrade soils affect the final results according to whether the soils require only the water-proofing qualities of the oil or in addition require an increase in their cohesive properties. The condition of the surface with respect to dust, hardness of crust, and moisture content at the time of application of the oil is directly reflected in the physical characteristics of the soils. The uniformity of penetration is controlled by the uniformity, texture and density of the several layers of a soil type.

8. Soils lacking cohesion and inclined to absorb water very readily in quantities sufficient to cause rapid loss of stability (represented in this study by A-4 subgrades), may be more effectively treated with oils having ductile and cohesive bases. Soils which possess cohesion in a high degree and which, when in a stiff or plastic state, do not absorb additional water unless manipulated (represented in this study by A-6 soils), do not require treatment with oils having cohesive bases, as waterproofing without binding will insure fairly satisfactory results. Soils which possess properties from each of the groups mentioned above but can not be placed definitely in either one may give better results if the quantity of oil applied is increased.

9. The character of the surface immediately prior to application of the oil is of major importance. Surfaces to which oil is to be applied should be fairly free from dust and should have pore spaces open to receive the oil. Final preparation of surface for treating should consist of blading to eliminate all dust, crust, and depressions of the road surface, rather than the movement of loosened material to obtain uniform cross-section. A uniformly smooth surface to insure uniform distribution of traffic over the entire roadway is essential for proper development of the surface.

10. The presence of sufficient moisture in the surface is essential in order that the pore spaces be kept open and free to receive the oil. Surfaces free from moisture tend to become dusty and hardened, causing nonuniform and selective penetration.

11. Weather conditions are a factor to the extent that they may influence the moisture content of the surface, the rate of penetration, and the quantity of oil, if loss occurs due to rainfall immediately following application.

12. Within the ranges observed in this study there did not seem to be any significant effect of air temperatures except that they might have served to speed or retard changes in the moisture content of the soil.

13. There was no apparent benefit obtained by raising the temperature of the oil for application above that required for uniform distribution. Increasing the temperature of the oil increased the tendency to flow along or from the surface by decreasing the viscosity of the oil and was detrimental rather than benefcial.

14. A retarded rate of penetration tends to improve the uniformity of distribution of the oil thereby promoting the intimate mixture of oil and soil particles which is desired. Nonuniform penetration, which usually accompanied a rapid rate of penetration, failed to produce the results desired.

15. The presence of untreated earth surfaces adjacent to oiled earth surfaces reduces to a varying extent the effectiveness of oiled surfaces particularly if the untreated surfaces are manipulated, as the untreated earth tends to deaden the treated surfaces.

16. Nonmutilative traffic is highly beneficial to oiled earth surfaces as such traffic tends to knead the oil into intimate contact with the soil particles. This intimate association is a primary requisite for successful treatment of earth with oil.

17. Mutilative traffic seriously impairs the service rendered. Such traffic should be prevented or minimized to the extent possible.

18. Dragging or blading of a good oiled earth surface is harmful. When reshaping is necessary a re-treatment must be given to restore the oiled surface.

"We have spent twice as much money for construction as in any previous year," Highway Engineer Vail states pridefully, "and we will have a smaller 'carry over' of unexpended funds than ever before. Not only that, but we have handled the double program without any additional clerical or engineering help."

Since January 1, the state highway department has let sixty-seven road building contracts, totaling for expenditure of close to $7,000,000, according to Chas. D. Vail, state highway engineer. The work has supplied employment for several thousand Colorado citizens. Contractors have been instructed to use local employes as far as possible in carrying on the work.

Operating *Costs of* Automobiles

By N. D. DOUGLAS
Assistant Engineer Surveys and Plans, State Division of Highways, Sacramento, California
(Reprinted from Engineering-News Record)

A STUDY to determine a definite evaluation of route distance, which is a factor of major importance in highway location, was published in Engineering News-Record, August 2, 1928, p. 168. This was a result of an individual preliminary study. It was pointed out in that article that the cost of owning and operating a passenger automobile can be itemized under time and mileage elements. The latter group alone is affected by the distance traveled by the vehicle. The tentative conclusion reached was that approximately 3 cents per mile of the total cost of operating the average American passenger automobile at 30 to 40 miles per hour on paved roads of normal characteristics is due to distance and is nearly directly proportional thereto at any given speed.

The article excited some comment, as it had been customary for highway engineers to evaluate route distance at from 6 cents to 12 cents per vehicle mile and to base location and design analysis on these assumed valuations. The bulk of the comment was definitely adverse, indicating that most interested engineers were not willing to give up the general accepted assumptions without further proof to substantiate the correctness of the new proposed value. The dissenting opinion was not supported in any detail by actual experiment.

Summary of Actual Cost Records

During the past two years the writer has gathered a considerable volume of additional practicable data on this subject, which is given in the accompanying table.

Column I tabulates an estimate made in 1928 of the average nationwide passenger automobile operating costs on hard-surfaced high-gear roads with normal grades and curvature.

Column II is a summary of the operating record of a car owned by the writer. The record started when the car was three years old and extended over a period of 24 months. The mileage was run approximately 5 per cent in city traffic and 95 per cent on the open road; approximately 50 per cent on hard-surfaced roads in fair condition and 50 per cent on ordinary gravel or earth roads, most of which were dry but often steep, rough or sandy, requiring considerable use of low gear. The average high-gear speed was about 25 miles per hour. All mechanical work except chassis lubrication was done commercially at standard garage prices and included a complete overhauling of the transmission system. At the end of the observation period the car was in excellent condition in all respects. On the basis of 22-cent gasoline and 35-cent oil the total cost would be 2.53 cents per mile.

Column III is a summary of the operating record of the writer's own car. The record started when the car was brand new and has extended over a period of 30 months. The mileage was run approximately 15 per cent in city traffic and 85 per cent on the open road; approximately 70 per cent on surfaced roads (in an average condition equal to a fifteen-year-old asphalt or concrete pavement) and 30 per cent on unimproved mountain and desert roads, in all stages of repair, involving many miles at low and second-gear operation; at speeds averaging as close as practicable to 40 miles per hour on good roads. The unimproved roads were practically all dry but often very rough or sandy. The best grade of eastern oil was used in the crank case and changed completely every 1,000 miles. All mechanical work and most of the greasing (except the chassis lubrication) was done commercially and paid for at standard garage prices. The car was equipped with five four-ply tires when new and now has six eight-ply tires in excellent condition. The grease item is almost entirely a labor cost. The maintenance item includes 0.13 cents per mile for replacement of parts injured by accident. This had no relation to mileage. Shortly prior to the end of the recorded period the valve had been ground, motor tuned, brakes and wheel alignment checked, etc., the costs being included in the figures shown in the table. The car was in excellent condition in all respects.

Attention is called to the fact that the cost of both gasoline and oil shown in column III is higher than the average. Using 22-cent gasoline and deducting the 0.13 cents due to accident, the total operating cost reduces to 2.52 cents per mile.

Column IV is a summary of the average operating record of 318 cars of various models produced by sixteen different manufacturers, owned and operated by the California state department of public works, practically none of which had run less than 20,000 miles. The tabulated

The operating costs of automobiles is a subject of much interest to individual car owners and of perhaps more importance to highway engineers. The operating cost of automobiles enters into every discussion of the value of a highway, and it is one of the vital factors in the study of the valuation of the route distance, which comes up in problems of highway location.

Individual car owners often like to argue for hours on this subject, and point with pride to the low cost of operating their automobiles or sometimes to bemoan the high cost. Many scientific studies have been made to arrive at operating costs, and for several years highway engineers have taken more or less accepted figures. Recently, however, there appeared in the Engineering News-Record an article by N. D. Douglas, Assistant Engineer Surveys and Plans, California Highway Department, in which he shows that cars have been operated over a period of years at three cents per mile and not more than four cents. Following the appearance of this article, letters on the same subject were received by the Engineering News-Record and published in subsequent issues, which show further data on individual cars. The entire subject is of interest to engineers, and incidentally, to road builders, and for the sake of information and comparison contained therein the following articles and letters are reprinted.—Editor.

data are derived from the accounts of the department. These cars were operated under all conceivable conditions over all types of roads, a large part of the average mileage being in city traffic, over difficult unimproved mountain and desert roads, going to construction jobs, and not infrequently in cross-country travel without roads in connection with preliminary surveys in the desert regions. The average speed probably was as close as practicable to 45 miles per hour on good roads. The gasoline, oil and grease cost items are rather low, largely on account of the lower prices of these supplies when bought in large quantities. The maintenance item is very high, as would be expected, considering the exacting service required of these cars. The average operating costs of the four-cylinder and of the six-eight cylinder cars, grouped separately, were nearly equal, and closely approaches the average. This probably is due largely to the fact that the lighter cars were used generally in the more severe service as line cars on construction projects, etc., while the heavier cars made longer trips and traveled a greater proportion of their mileage on good roads. On the basis of 22-cent gasoline and 35-cent oil the total average operating cost would be 3.94 cents per mile.

Without theorizing or assuming in the slightest degree, columns II and III show the actual cost of operating two representative cars under normal general conditions by a driver of average ability. Normally, where the condition of the road would permit, the legal speed limit was crowded and often exceeded, 45 to 50 miles per hour being not uncommon in connection with column III. Column IV shows the actual average cost of operating representative cars under unusually severe business conditions by drivers of average ability. In this last case the drivers were not the owners and therefore must have lacked the personal interest that an owner would have.

Conclusions from Cost Records

Now if all the mileage of the cars considered below had been traveled on hard-surfaced rural roads such as the states are building today, it is obvious that the operating cost would be reduced greatly, especially in the maintenance item. It is equally obvious that in deriving a factor value for route distance the highway engineer must derive an operating value for traffic on the type of road he proposes to build, and he cannot use an average value obtained from operation on all types of surface.

It must be remembered also that a certain indeterminate portion of the tire and maintenance cost is independent of mileage and due to time and weathering. This includes rusting, deterioration of paint, top, upholstery, etc.; a portion of the deterioration of springs, snubbers, tires; most of the radiator expense; much of the electrical expense, etc. Much of the wear of these details is due to standing in sun, rain, and dust, and failure to keep the car properly clean. The writer has access to no reliable data regarding operation solely on hard-surfaced rural roads, but he does believe that the authentic records of general operation tabulated above indicate strongly that the cost of passenger-automobile operation on a normal hard-surfaced high-gear road is well under 3 cents per vehicle mile. The figure does not apply to trucks, which are not considered here.

The much-disputed items of time and depreciation are largely intangible. Time saved has an economic value only when it is used to increase production. Is the quarter minute, saved by reducing rural route distance about 900 feet, used productively? If not, then we cannot claim that its value helps to offset the cost of the distance reduction. Depreciation is almost hopelessly involved with obsolescence, time, luxury, pride, fluctuating market, trade values, etc. A certain part of depreciation, but only a small, rather indeterminate part can be charged to mileage—but how much?

The writer repeats his original conclusion made in 1928 that, in general, expenditures for the purpose of route-distance reduction on modern hard-surfaced rural highways are premature and economically wasteful if based on a capitalization of passenger-car operating costs assumed to exceed 3 cents per mile. It is emphasized strongly that this is a distance value which must not be confused with grade, curvature or other values, although it is believed that these latter, within the normal limits of good practice, will have relatively little effect on passenger-car operating costs.

The 3-cent limit naturally is an approximation subject to some variation. For example, an increase in the average prevailing road speeds, unusually heavy grades or curavature and various unusual conditions of traffic might tend to increase the operating cost or bring the time element into prominence. But it might be remembered also, for instance, that the light economical car presents great future possibilities for operating economies (witness the little Austin car); that road speeds usually decrease as population and traffic grow; that additional roads often relieve traffic congestion and save time more efficiently than reduced route distance alone, especially in suburbs.

A competent business firm would not make additional capital investment for the sole purpose of earning a return thereon unless the return were definitely in sight. Highway building is a business. When a highway organization considers the cost

PASSENGER-AUTOMOBILE OPERATING COSTS

	Original Estimate, Eng. News-Record Aug. 2, 1928	One Ford Model T Touring Car	One Dodge Victory Six Sedan	Average of 318 Cars of 16 Makes and Various Models
	I	II	III	IV
Total mileage run	.....	13,225	24,653	38,894
Period of observation	.....	Apr. 1926-Apr. 1928	Apr. 1928-Oct. 1930	1924-1929
Miles per gallon of gas	17.19	23.2	17.52	15.49
Miles per quart of oil	100	98	147	108
Gasoline cost (cents per gallon)	22.00	20.3	23.92	.....
Oil cost (cents per quart)	22.50	31.8	35.00	.....
Gasoline, cents per mile	1.28	0.87	1.37	†1.31
Oil, cents per mile	0.21	0.32	0.24	
Grease, cents per mile	.....	0.02	0.12	*1.80
Maintenance, cents per mile	*1.24	0.92	0.52	
Tires, cents per mile	0.50	0.28	0.51	0.40
Total	3.23	2.41	2.76	3.51
Total operating cost per mile based on 22c gas and 35c oil	3.37	2.53	2.52	3.94

*Grease and maintenance. †Gas and oil.

of rural distance reduction alone on a hard-surfaced road, 3 cents (or less) per vehicle mile of reduced distance is definitely in sight as a return on the additional investment. An investment based on a greater return should not be made unless those in charge can prove without assumptions that the greater return is in sight and will continue through a sufficient period to pay a suitable interest and return the entire additional principal to the generation which invested it.

CORRESPONDENCE ON SUBJECT TO ENGINEERING NEWS-RECORD

Estimates of Savings in Automobile Costs on Highways Usually Too High

(August 20 issue)

Sir—The article by N. D. Douglas (ENR, August 6, 1931, p. 214) on operating automobiles at three cents a mile is one of the first (to the writer's knowledge) that has appeared suggesting a reasonable basis for capitalizing distance reduction on highways. For several years the writer has held that the 6 cents to 10 cents generally used to estimate the cost per vehicle over an additional mile of road was entirely too optimistic for those desiring to spend money for eliminating distance on our state highways. (Yet the writer would be one of the last to be quoted as favoring a reduction of this work.) Operating costs of automobiles over additional distance should include only the additional gasoline, oil, tires and maintenance. Depreciation might be included, but it is better to justify the cost of the reduced distance on these four items only. License fees, insurance, garage rent and depreciation are fixed charges whether the car operates 5,000 or 50,000 miles per year, and they will be paid whether the car is used for business or pleasure.

People estimate the time required to drive to a given destination rather than the number of miles. Ten or fifteen minutes more or less consumed in the trip is usually immaterial. While it is no doubt true that some vehicles and some drivers might suffer a loss of $3 per hour due to delay on the highway (as reported and used by the Cook County survey of highway transport a few years ago), yet it is inconceivable that this figure should be applied to anything like the number of vehicles using the road. The Ohio transport survey found, I believe, that only about half of the passenger-car mileage was for business. It might be well, therefore, to figure a small charge against time lost in additional distance or delays, although it must be remembered that time consumed on additional distance is not the same as time lost on unavoidable delays. Perhaps the highway economist ought to follow the example of the railways in refunding for lateness on extra-fare trains; that is, the train must be more than a published amount late before anything is paid, and no refunds are made for a few minutes' lateness in arriving at the destination.

In conclusion, I would like to cite the operating cost for the past three years on one of my own cars, complete records for which have been kept. During this time the car (a four-cylinder Whippet) averaged only 6,000 miles per year, being used as a "second" car. It was operated almost exclusively on hard-surfaced streets and roads. The tabulation follows the plan on p. 215 of the August 6 issue.

Miles per gallon of gas	20.0
Miles per quart of oil	129.0
Gas cost, cents per gallon	18.8
Oil cost, cents per gallon	25.6
Gasoline, cents per mile	.93
Oil, cents per mile	.20
Maintenance, cents per mile (including grease)	.46
Tires	.24
Total	1.83

It might be of interest to note that 0.18 of the 1.83 cents per mile operating cost went to the gasoline tax.

Since it is difficult to get operating costs on privately owned automobiles, I trust this will serve to substantiate Mr. Douglas' statement that 3 cents per mile is not too small for capitalizing distance.

S. B. FOLK,
Asst. Professor of Mechanics,
Ohio State University.

Columbus, Ohio,
August 11, 1931.

Showing a section of the new road being constructed by the Forest Service over Willow Creek Pass, leading into the North Park country from the Colorado River, near Granby.

Operating Cost of Automobiles

(September 3 issue)

Sir—Adding to the current discussion of the proper amount to assign to distance saving in highway studies, the following records of the cost of operating my car may be of value. I have kept the operating cost figures accurately. The car has been used on unpaved mountainous and desert roads in Arizona and also on the paved highways of California, so the results are representative of travel in the southwestern part of the United States. The car is a four-cylinder 1923 Dodge touring model, and the costs were kept from December 1, 1924, to May 1, 1930.

Total mileage	36,600
Total gallons gas used	2,250
Total depreciation cost per mile, cents	1.57
Total quarts of oil used	326
Total operating cost	$1,300
Total depreciation	575
Total operating time, months	65
Miles average per gallon gas	16.27
Miles average per quart of oil	112
Miles averaged per month	563
Operating cost per month	$20
Total operating cost per mile, cents	3.55
Total (operation plus depreciation per mile, cents)	5.12

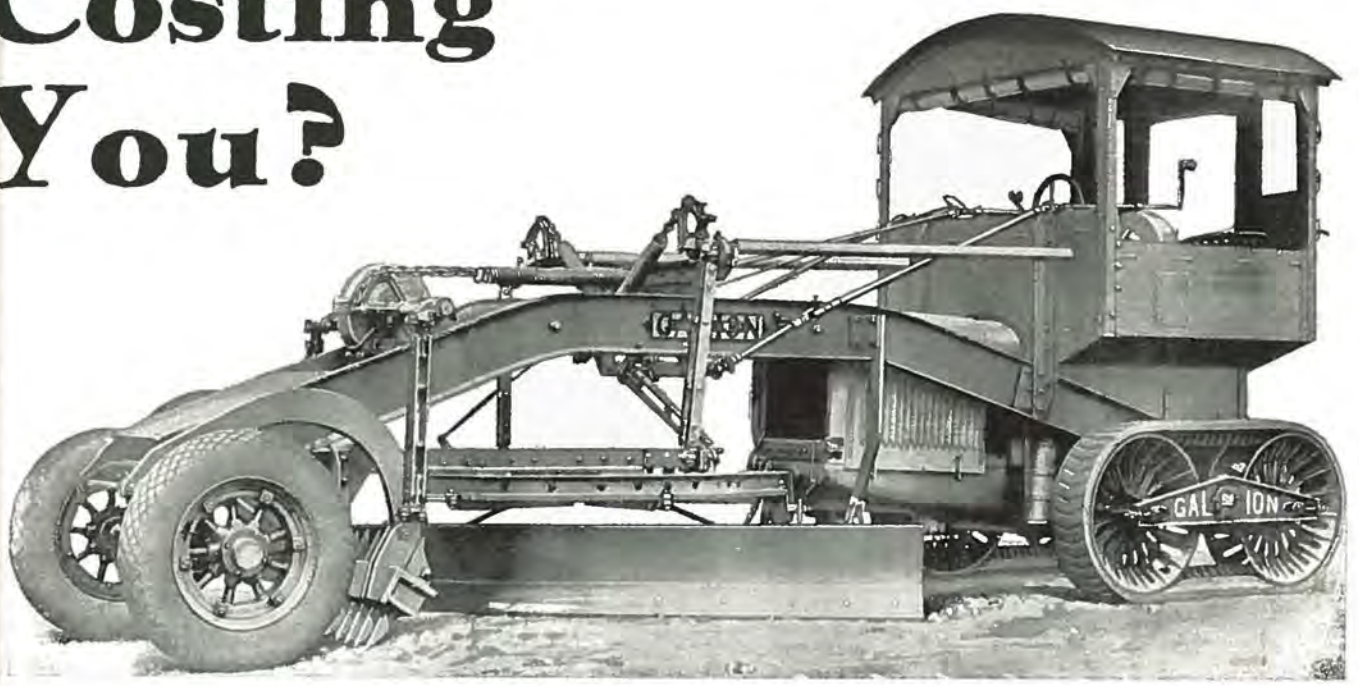
The operating cost includes gas, oil, repairs, tires, licenses, insurance, storage, batteries, etc.

H. L. COOPER,
San Luis Obispo, Calif.

Five miles of concrete pavement south of Trinidad is now open to traffic. J. H. Miller & Co. were the contractors.

All over the state contractors have put on night shifts to complete heavy grading before frost. Steam shovels, brilliant with electric lights, give an eerie greeting to motorists who travel late.

How Much Is Your Maintenance Costing You?



Galion McCormick-Deering E-Z Lift Motor Patrol Grader with Sure-Trac Rubber Crawlers and Pneumatic Front Wheels. Can also be furnished with pneumatic tires in rear or with Steel Crawlers in rear and steel wheels in front, or solid rubber tired wheels front and rear, and with or without cab.

Figures prove not only in Colorado but other states as well that Galion plus McCormick-Deering power have made possible the lowest cost per mile in the history of road maintenance with power—and it's the type of maintenance that gets results. Either type, with Round Wheel or the new Sure-Trac Rubber Crawler, will be demonstrated any time, any place, upon request.

IN STOCK FOR IMMEDIATE DELIVERY

H. W. Moore Equipment Co.

"Colorado's Largest and Oldest"

20 WEST 6TH AVENUE TABOR 1361 DENVER, COLORADO

Congress Urged *to Increase* Road Funds

(Continued from Page 6)

Mr. MacDonald declared he did not see how all of the nation's huge road system, could be constructed and maintained to a proper standard without additional revenue from a property tax. He also gave warning that in the future the United States Bureau of Roads must approve plans and specifications for highways on which Federal Aid will be requested, before the work is advertised.

Attention was called to the fact that some of the states advertise their projects and then ask for Federal Aid approval. That kind of a partnership will not be tolerated in the future, declared Mr. MacDonald.

Promise of support for increased road appropriations was made by Senator Tasker L. Oddie of Nevada in a telegram read before the gathering. Representative Don B. Colton of Utah was present in person, and gave the same assurance.

The importance of adequate road marking was stressed in an address by E. W. James, chief of the division of highway transport of the Bureau of Public Roads. Later the association passed a resolution embodying the substance of his address in relation to trail associations. This resolution reiterated the stand of the highway officials in opposition to the trail association and its activities, the main purpose of which appears to be to get somebody's name on the payroll.

Senators Reed Smoot and William H. King, both of Utah, were speakers at the Wednesday night dinner. Senator Smoot warned the road men that diversion by states of funds that properly belong to the highways, such as gasoline taxes, will have an ill effect upon the members of congress. He said he was firmly convinced that such practice would result in congress decreasing Federal appropriations for roads, giving as a reason the lack of good faith on the part of the states engaging in such procedure.

Senator Smoot also expressed opposition to the practice of charging fees at the National parks. He was opposed to charging taxpayers to see their own parks.

It was announced by Chief MacDonald of the U. S. Road bureau that the 1933 appropriations would be allocated as of October 15th. From this allocation Colorado will receive $2,290,520, which will be matched on a fifty-fifty basis, giving this state a Federal Aid program of $4,581,040 in 1933.

Transportation Engineering Taught by University of Michigan

The University of Michigan is offering a four-year course in transportation engineering, including railway, marine, automobile, aeronautical and highway. Basing their studies upon the fundamental courses in engineering, students enrolling in this new division will be expected to give at least one-fourth of their time to subjects of distinctly cultural content.

After a year of study by a committee of the faculty, the university inaugurated a curriculum in transportation in October, 1930. Among the special facilities offered are laboratories in marine, automotive, aeronautical and highway engineering, a 300-foot marine experimental tank, wind tunnel for research in aeronautics, a general library of 800,000 volumes, and a transportation library of 70,000 items, the largest collection on this subject in the world. Information can be obtained from John S. Worley, Professor of Transportation Engineering, Ann Arbor, Michigan.

Marion Steam Shovel Co. announces a new ½-yard shovel for small general excavating and material handling work.

STATE HIGHWAY DEPARTMENT

Financial Statement—September 30, 1931

BALANCES

State Treasurer	$ 885,930.15	
County Time Warrants	10,333.42	
Revolving Fund	9,500.00	
Total Balances		$ 905,763.57

RECEIPTS

United States Government	$4,144,571.30	
Gas Tax	3,262,278.69	
Internal Improvement	39,300.00	
Highway Receipts	148,792.32	
Bus Licenses	19,188.96	
Total Receipts		7,614,131.27
Total Balances and Receipts		$8,519,894.84

DISBURSEMENTS

Federal Aid Projects	$5,326,545.38	
State Projects	697,852.30	
Maintenance	916,225.24	
Maintenance Equipment	254,552.29	
Property and Equipment	38,749.86	
Surveys	19,238.87	
Traffic Signs and Census	15,392.45	
Administration	141,358.71	
Legislative Relief	2,067.35	
Compensation Insurance	27,165.56	
		$7,439,148.01

BALANCES 9-30-31

State Treasurer	$1,062,413.41	
County Time Warrants	8,833.42	
Revolving Fund	9,500.00	
Total Balances		1,080,746.83
Total Disbursements and Balances		$8,519,894.84

3% SPECIAL GAS TAX FUND

Receipts	$ 234,023.21
Disbursements	108,279.20
Balance	$ 125,744.01

PENNSYLVANIA

STATE HIGHWAY DEPARTMENT

on August 15, 1931

ORDERED FIFTY-FIVE "80-60" CLETRACS and SEVENTY CLETRAC MOTOR PATROLS

No other make tractor bought.

Largest Single Order for Tractors ever given by any State.

CLETRACS for Power

CLETRACS for Speed

CLETRACS for Daily Performance

The Pennsylvania Officials made an exhaustive examination and severe demonstration before buying.

Why not let us give you information and trial for your next tractor.

Liberty Trucks & Parts Co.

West Sixth Ave. and Bannock St., Denver, Colorado

NEWS OF THE MONTH

Nineteen contractors entered bids for the construction of four miles of gravel surfaced roadway located between Buena Vista and Salida on Oct. 8th. Pantle brothers of Pueblo were the successful bidders. Their price was $48,820 for the completed job, which includes 77,000 cu. yds. of unclassified excavation and 12,650 tons of crushed rock surfacing. The high bid was $77,518. This was the largest number of bids ever received on a single project by the highway department. Pantle Bros. bid 20 cents on the excavation and 55 cents on the gravel.

Construction work is in progress on more than 16,000 miles of roads in the United States on which Federal Aid funds are being expended. Total expenditures on these roads will reach 378 million dollars.

The 1932 program for the improvement of the Santa Fe Trail through the Arkansas Valley was discussed at the annual meeting of the Highway 50 association held in La Junta on Oct. 19th and 20th. Highway Engineer C. D. Vail was one of the speakers. Floyd M. Wilson, president, presided over the conference.

Contractor A. S. Horner has completed 8½ miles of grading located between Hadley and La Junta at a cost of $133,383. This link of the Santa Fe Trail was constructed with a view to paving as funds become available later.

Final payment for the construction of two miles of pavement located between Starkville and Trinidad in Las Animas county was made to J. H. Miller & Co., contractors, the first of October.

Eight miles of new roadway located between Del Norte and Twin Bridges on Wolf Creek pass, has practically been completed by the H. C. Lallier Const. Co. The entire stretch is gravel surfaced. This work was done in two projects, the total cost being $280,000.

Eleven miles of oil surfacing northwest of Fort Collins has been completed by the State Highway department. Completion of this work gives a continuous stretch of oil surfaced highway a distance of twenty-five miles toward the Wyoming state line.

Twenty-six miles of gravel surfacing on the Denver-Limon road east of Watkins was opened to traffic on Oct. 15th.

Over half of the construction work on 12½ miles of new road located east of Colorado Springs on U. S. South 40, has been completed. Chas. B. Owen, contractor, plans to continue the work as long as weather conditions will permit.

Plans have been completed for fourteen miles of gravel surfaced highway to be constructed north of Salida in Chaffee county.

The New Mexico Const. Co. have started work on 4½ miles of concrete pavement located between Pueblo and Greenhorn.

Four and one-half miles of concrete pavement has been completed north of Aguilar. Orman Const. Co. were the contractors.

Plans are being rushed by the Highway department for the construction of a new road through Ute Pass from Manitou to Cascade. An effort will be made to complete the project by March 15th. The road will be widened to 30 feet and the maximum grade will be 7.2 per cent.

Highway Engineer Chas. D. Vail has issued orders for the preparation of plans and specifications for several large projects which will be included in the 1932 highway budget. Work on these projects will be started as early next spring as possible in order to give employment to as many men as possible.

Surveyors of the state highway department have been working on a line for a new road east of Akron to the state line.

The state highway department has a Quick-way shovel and a crew of men with trucks working on resurfacing the main road between Bergen Park and Empire. The surfacing material is being taken from Floyd Hill.

Reports indicate that the new road under construction between Craig and Hamilton will be open for travel before winter sets in. This is a Federal Aid project being constructed by the state highway department.

Cole Brothers have completed 8½ miles of gravel surfaced highway south of Pueblo. As funds become available this stretch of road will be paved.

Rapid progress is being made by the Mt. States Const. Co. in the San Luis valley—eight and one-half miles of gravel surfacing located west of Monte Vista, and eight miles of gravel surfacing on the La Jara road south of Alamosa.

During 1930 Colorado added 270 miles of surfaced roads to its system of Federal Aid roads.

A new gravel surfaced highway between Hayden and Craig, a link in the Victory highway, was completed by the highway department this summer. The new road parallels the river and the Moffat railroad tracks from Hayden to the Moffat county line seven miles east of Craig. It includes a new steel and cement bridge across the Yampa river one mile west of Hayden. The road was constructed in two projects at a total cost of approximately $300,000.

"Detours are always disagreeable and just now Highway 50 through this section is well supplied with them, but when all road work through Prowers, Bent and Otero counties is completed we will have a real highway for the first time in history. Let the good work go on."—Bent County Democrat.

"Winter Maintenance" is the title of a recent booklet issued by the Four Wheel Drive Auto Co., which is being distributed by the Liberty Trucks & Parts Co., Denver. The booklet illustrates many types of snow plows and methods of handling snow removal problems.

About the first of November the Caterpillar Tractor Co. will start deliveries on their new "Fifty" model, according to Clinton-Held Co., Denver agents.

Doings Among Equipment Dealers

Three new items of road building and maintenance equipment have been placed on the Colorado market by the Galion Iron Works & Mfg. Co. through their Denver agents, the H. W. Moore Equipment Co. They include a "double drive motor grader," equipped with center drive; a bank cutting type of leaning wheel grader and a stone spreader for road widening. Complete details on any or all of these Galion developments will be sent by the Moore company upon request.

Standard Oil Co. of Indiana has announced plans to carry out in the remaining months of 1931 the biggest advertising and sales campaign the company has ever undertaken. The main ammunition will be the introduction of a new gasoline which the company has been making at refineries for some time. The first large announcements were made in 1,462 newspapers in the thirteen north central states in which the company operates. These newspapers have a circulation of 12,571,677 in a territory of 32,000,000 population where 8,371,750 cars and trucks are operating with a gasoline consumption of nearly five billion gallons a year.

W. A. Roberts has been placed in charge of sales in the tractor division of Allis-Chalmers Mfg. Co. H. J. Yoakum is industrial sales manager, according to advices received by Wilson Machinery Co., Colorado agents.

Killefer Company has developed a road disc for cutting off corduroy bumps on oiled macadam roads. Use of the disc does not tie up traffic.

G. M. Walker has been appointed advertising manager of the Caterpillar Tractor Company, succeeding Walter H. Gardner, who becomes manager of the Specialty Sales Division.

Tractors powered and armored for heavy work of winter service have been developed by the Cleveland Tractor Co. These Crawlers are drilled and fitted for ready attachment of all standard makes of snow plows. Enclosed cabs and special ice cleats are optional equipment. Complete literature discussing Cletrac equipment for snow removal may be had by writing the Liberty Trucks & Parts Co., Denver.

"A chip off the old block"—Little I. B. Rogers, Jr., on the job at Whiskey Creek, standing on some Gohi culverts. He is the son of Commissioner Rogers of Las Animas County, who has been supervising the construction of a new road over Whiskey Pass.

Three Koehring Dumptors have been delivered to the A. R. Mackey Const. Co. for work on a state highway job near Silt, Colo., according to Harry P. Wilson, president of the Wilson Machinery Co.

Sales of Adams graders, both power and pull-type, showed a sharp increase during the month of September, according to Elton T. Fair, Denver agent. An increased demand for Adams maintainers also was noted, with several sales to counties, that plan an intensive winter maintenance program to aid unemployment. Snow removal equipment also began to move into the counties.

Resiliflex Road Guard—View taken at night from illumination of automobile headlight.

A half dozen Bates 80 tractors equipped with snow plows were delivered during the month by the H. W. Moore Equipment Co., according to John C. Moore, president. He reported prospects bright for increased snow-removal equipment this fall. Business for the year is far ahead of 1930, he reported. Reports from the operation of sixteen Quick-way truck shovels sold early last spring, indicate these machines have proved a success in this territory.

And now we have metal cribbing adaptable to use for railroad and highway retaining walls, bridge wing walls and river bank protection work. This is a development of the American Rolling Mill Co. The Hardesty Mfg. Co. of Denver will be glad to send a descriptive booklet on request.

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23 PER CENT OF ALL ROADS IMPROVED.

No more than twenty years ago the United States had practically no hard-surfaced roads outside of the larger cities, such as are now considered indispensable for vehicular traffic. Yet, in 1910, of the 2,199,000 miles of road, only 190,000 miles were surfaced.

By the end of 1930, the length of this country's roads had grown to 3,024,233 miles, representing 38 per cent of the world highway total of 7,959,192 miles.

The investment in American highways is currently estimated at $25,000,000,000, or slightly in excess of the total investment in our railway system. In 1921, 388,000 miles, or 13 per cent of all United States roads, were surfaced, whereas, at the end of 1930, some 700,000 miles, or 23 per cent of the total, had been improved.

Twenty years ago there were few State highway systems or highway commissions, and State expenditures for road construction or improvement were relatively negligible. Today, however, every State maintains a highway organization, while in 1929 State governments spent $799,876,000 for highway construction and improvement, and in 1930, a total of $937,500,000.—New Ulm Review.

EFFICIENCY OF HIGHWAY WORK BY CONTRACT.

Highway contracting involves considerable hazard and is subject to the keenest competition. Prices are of equal interest to the contractor and the engineer. No business can long continue unless it is conducted at a profit, stated A. R. Losh, former state highway engineer of Oklahoma, in an address before the American Road Builders' Association.

When the price curve for highway work is compared with those for wages, building materials, and general commodities, for the years 1922 and 1930, inclusive, taking the prices of 1922 as the base, or 100 per cent, we find that wages, construction materials, wholesale commodities and the retail prices of food have in general increased. On this same basis highway construction costs have decreased and in a substantial amount. Skilled labor in the building trades received a uniform raise in wages from 1922 to 1927, the increase amounting to 67 per cent, or about 12½ per cent per year. The next two years the increase was slight, but by the end of 1929 wages were 169 per cent of the 1922 level. On highway construction work in Oklahoma wages increased 25 per cent from 1922 to 1926, 54 per cent by the end of 1927, and 70 per cent by the end of 1929. The high point for building materials was in 1925, reaching 107 per cent, but dropping to 94 per cent in 1930.

On the other hand, highway contract prices have taken a decidedly different trend. Based on low bid contract prices of the Oklahoma State Highway Department, we find from 1922 to 1925 there was a drop of 5 per cent. There was a slight rise for the year 1927, but since that time a gradual decline reaching 78 per cent of the 1922 level for the year 1930. Thus in nine years highway prices have fallen 22 per cent; but wages have advanced 70 per cent and food 7 per cent. Labor has become more efficient and with mechanical means has doubled its output. Contractors have speeded up their work, increased their volume of business, thus permitting a smaller overhead and profit per unit of work.

Materials, with only a small decrease in price, are further cheapened by the development of more sources of supply, giving better distribution and less transportation costs, an actual reduction in hauling costs, and finally competition which has in many instances proven ruinous to the contractor. In the highway industry there has already been a decline in wages and a marked decline in contract prices in recent lettings. Hand labor cannot replace mechanical means to any great extent. As a relief measure for unemployment the highway industry can absorb surplus labor by doing grade and drainage work on a large scale by special projects in localities where there is a pressing need for work, by minor improvements under maintenance operations, and by materially increasing the construction program.

Strange as it may seem, crushing plants are still in demand, according to Elton T. Fair. Several orders for late fall and early spring delivery have been placed for Pioneer plants with him in the past few weeks.

PLANS BEING DRAFTED

Proj. No.	Location	Type	Length
138-D	So. of Steamboat Springs	Gravel Surfacing	6 mi.
149-E	West of Strasburg	Gravel Surf. & Underpass	4 mi.
150-D F. L. H. P. No. 1	South of Elk Springs	Gravel Surfacing	4 mi.
216-B	West of Holly	Gravel Surfacing	10 mi.

PLANS FINISHED

Proj. No.	Location	Type	Length
158-A	Northwest of Colorado Springs	Gravel Surfacing	4 mi.
248-AR&BR	North of Salida	Gravel Surfacing	14 mi.
263-C	East of La Veta Pass	Gravel Surfacing	5 mi.
298-E	East of Wolf Creek Pass	Gravel Surfacing	3 mi.
288-AR	Northeast of Brush	Paving & Overhead R.R. Crossing	3 mi.

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R10	Bet. Starkville and Trinidad	2.097 mi.	Paving	J. H. Miller & Co.	$109,577.10	100	2-R10
2-R11	South of Trinidad	3.130 mi.	Paving	J. H. Miller & Co.	89,063.70	89	2-R11
2-R12	Bet. Aguilar & Walsenburg	4.503 mi.	Paving	Orman Const. Co.	192,443.50	91	2-R12
57-R4 & 168-BCR	West of Lamar	4.801 mi.	Paving	Pueblo Bridge & Const. Co.	130,690.50	13	57-R4 & 168-BCR
68-B	South of Saguache	3.290 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	74,428.75	0	68-B
71-C	Bet. Durango and Mancos	4.965 mi.	Gravel Surfacing	J. Finger & Son	86,146.75	83	71-C
79-B	East of Colorado Springs	12.248 mi.	Gravel Surfacing	Chas. B. Owen	143,370.05	64	79-B
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	87	91-AR
134-AR&C	West of Burlington	11.174 mi.	Oil Processed Surf.	H. C. Lallier Const. Co.	111,217.20	39	134-AR&C
134-E	East of Limon	5.052 mi.	Gravel Surfacing	Bedford & Woodman, Inc.	31,426.40	22	134-E
144-F	Northwest of Fort Collins	10.386 mi.	Gravel Surfaced	Blanchard Bros.	144,180.80	100	144-F
144-G	Bet. Forks & Colo.-Wyo. Line	13.204 mi.	Gravel Surfacing	Morrison-Knudsen Co.	248,078.00	96	144-G
145-C	East of Rifle	14.901 mi.	Grading & Grav.	A. R. Mackey	271,703.80	21	145-C
149-C	East of Aurora	7.863 mi.	Gravel Surfacing	Chas. B. Owen	130,329.47	100	149-C
149-D	East of Watkins	8.370 mi.	Gravel Surfacing	A. R. Mackey	13,207.82	100	149-D
149-F	Bet. Strasburg and Peoria	10.745 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	198,660.00	82	149-F
149-G	Denver-Limon	9.778 mi.	Grading & Surfacing	Lawrence Const. Co.	189,623.96	100	149-G
149-H	East of Deertrail	18.565 mi.	Gravel Surfacing	Hamilton & Gleason	240,319.15	66	149-H
150-C	West of Craig	6.893 mi.	Gravel Surfacing	J. Fred Roberts & Sons	120,139.05	19	150-C
151-A	Bet. Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	83	151-A
151-B	Bet. Fraser and Granby	3.925 mi.	Grading & Surfacing	Utah Construction Co.	63,954.80	88	151-B
158-B	Bet. Hartsel & Florissant	10.319 mi.	Gravel Surfacing	J. H. Miller & Co.	133,380.70	31	158-B
181-A	In Idaho Springs	1.876 mi.	Paving	J. Fred Roberts & Sons	93,749.55	0	181-A
189-B	Bet. Hayden and Craig	2.567 mi.	Gravel Surfaced	C. A. Switzer	91,497.00	100	189-B
189-C	West of Hayden to County Line	7.534 mi.	Gravel Surfacing	F. L. Hoffman	115,356.94	93	189-C
208-AR	East of Grand Junction	Bridge and Detour		Phelps Bros.	7,305.70	100	208-AR
211-B	South of Craig	2.725 mi.	Gravel Surfacing	Utah Const. Co.	93,720.40	55	211-B
242-D	Bet. Mack & Colo.-Utah Line	9.883 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	124,552.36	94	242-D
242-E	West of Fruita	4.243 mi.	Gravel Surfacing	Wallace Const. Co.	54,907.53	99	242-E
245-AR	West of Las Animas	4.544 mi.	Grading & Oiling	Driscoll Const. Co.	94,398.85	19	245-AR
245-C	Between Hadley & La Junta	8.442 mi.	Grading	A. S. Horner	133,383.10	100	245-C
248-C	Between Buena Vista and Salida	3.944 mi.	Gravel Surfacing	Pantle Bros.	48,820.50	0	248-C
251-D	East of Boulder	0.284 mi.	Paving	Collier-Latimer	25,598.50	99	251-D
258-I	Bet. Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	79	258-I
258-I2	East of Montrose	Concrete Box Culvert		Hinman Bros. Const. Co.	8,455.50	4	258-I2
258-J	West of Cerro Summit	5.796 mi.	Grading and Gravel	Lumsden Hall Const. Co.	107,027.30	81	258-J
259-B	Bet. Gunnison and Parlin	9.587 mi.	Gravel Surfacing	Cole Bros.	184,503.00	40	259-B
265-D	Wilson Gulch	1.930 mi.	Bridge & Approaches	Grant Shields	29,455.50	100	265-D
265-E	West Bayfield	2.950 mi.	Gravel Surfacing	J. H. Miller & Co.	97,839.06	58	265-E
270-E	Bet. Del Norte & Monte Vista	8.663 mi.	Gravel Surfacing	Mountain States Const. Co.	102,199.10	35	270-E
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc.	116,829.21	48	278-AR&C
278-D	West of Cheyenne Wells	21.913 mi.	Gravel Surfacing	A. R. Mackey	93,563.30	23	278-D
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	78	282-I
292-D	Bet. Wolcott and Avon	9.834 mi.	Graded Surface	Utah Const. Co.	159,143.40	63	292-D
295-E	South of Alamosa	7.627 mi.	Gravel Surfacing	Mountain States Const. Co.	71,049.56	39	295-E
296-AR&BR	South of Pueblo	4.372 mi.	Paving	New Mexico Const. Co.	154,509.00	9	296-AR-BR
296-D	South of Pueblo	8.348 mi.	Gravel Surfacing	Cole Bros.	84,815.10	97	296-D
298-C	Bet. Twin Bridges & South Fork	3.780 mi.	Gravel Surfacing	H. C. Lallier Const. & Eng. Co.	116,864.50	100	298-C
298-D	Bet. Del Norte and Durango	4.100 mi.	Gravel Surfacing	H. C. Lallier	164,814.00	79	298-D
298-F	East of Bayfield	5 mi.	Gravel Surfacing	Wood, Morgan & Burnett C. Co	66,920.85	90	298-F
299-AR	Alkali Creek	Bridge		Phelps Bros.	8,690.05	100	299-AR

Embankment and curve protected by Resiliflex Road Guard

Resiliflex Road Guard

The Ideal Highway Guard Rail — A smooth steel plate with heavy spring connections—deflects vehicles without damage—prevents injury to motorists. Resiliflex meets all requirements of an effective guard—strength, resilience, durability—absorbs impact—no projecting parts—a perfect guide for night driving.

Further information and prices upon request

Hardesty Manufacturing Co.
Denver, Colorado

Branches: Salt Lake City, Utah; Pueblo, Colo.; Boise, Idaho; Missoula, Mont.; Sidney, Mont.

Cuts Out the Nibbling

KOEHRING Independent Crowd and Hoist lets operator distribute the power so as to obtain best results and even, when necessary, to put full power behind *either* crowd or hoist.

Dipper does not jump away from hard spots—

It cuts out "nibbling" on the tough jobs, one of the biggest time wasters of shovel operation!

Koehring capacities are rated on line-of-plate *"struck"* measure—The "heap" is yours as extra capacity "pay-dirt"!

FingerTip ease of control—secured without mechanical complications or loss of the "feel" of the load so essential to confident, accurate, high-speed operation. Ask for Shovel catalog!

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That's the Koehring Dumptor! A broad, capacious load-carrying steel body on oversize multiplanes that take the load over tough "going"—

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COLORADO HIGHWAYS

Vol. X November, 1931 No. 11

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Colorado Highways

"BETTER ROADS"

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Articles on the subject of road building and highway development in Colorado are solicited. Manuscripts should be addressed to the Editor, with return postage. Photographs should accompany articles whenever possible.

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Our Cover Picture

A SCENE along the Santa Fe Trail near Avondale in Pueblo County is shown on the cover of this month's COLORADO HIGHWAYS. This concrete pavement is part of a fifteen-mile stretch east of the steel city. Further improvement of the Santa Fe Trail route is planned for the coming year. Pavement laid with Federal Aid co-operation.

BUILDERS of HOOVER DAM Select INTERNATIONAL TRUCKS

"Six Companies Inc.," Builders of Greatest Engineering Project Since the Panama Canal, Place Large Order Exclusively with International Harvester

The Hoover Dam region on the Nevada-Arizona line.

HOOVER DAM is under way. The great Boulder Canyon project of the United States Government which has long made news for a nation now advances into construction stages.

And as action begins on the mighty Colorado, comes a news item of vital interest to the construction industry and to the automotive world. Six Companies Inc., of San Francisco, a combination of six leading western contractors which is to build Hoover Dam under a bid of $48,890,999, has standardized on International Trucks as qualified above all others to bear the heavy hauling responsibilities in their contract.

The full meaning of this decision—the extent of the honor paid to International performance and service—can be appreciated only when measured against the immensity of the project itself.

One of the International heavy-duty trucks working at Hoover Dam. The open hood is expressive of the intense heat in the canyon, rising as high as 128 degrees. The boulder-proof armored cab is further evidence of conditions encountered. Note, at right of shovel, the entrance to an auxiliary tunnel used in construction of the great diversion tunnels that will extend three miles through solid rock.

The Job—

Space does not permit going into the details of the Hoover Dam project. They have long been matters of public record. Suffice it here to say that the plan encompasses flood control and general river regulation, irrigation, silt control, power development and domestic water supply affecting a large part of the Southwest. The entire enterprise involves an appropriation of $165,000,000 and includes many auxiliary developments of great magnitude in addition to the dam itself.

The dam will fill the gigantic chasm of the Colorado River to a height of about 730 feet above the foundations. It will be one-eighth of a mile thick at the base, will contain about 3,400,000 cubic yards of concrete, and will impound 30,500,000 acre-feet of water in an area vastly greater than Gatun Lake at the Panama Canal. Millions of yards of rock and earth must be removed; millions of tons of building material must be hauled. Employment will be given to thousands of men, the work extending over a period of six to seven years.

Today the canyon hums with intense activity. "Boulder City" is springing into being like a magic town of gold or oil. Railways and highways are being built. Modern engineering genius is mobilizing to conquer problems that stagger the imagination. Already work has begun on four great diversion tunnels each 50 feet in diameter and nearly a mile long, to be driven through the solid rock of the canyon walls. These channels alone involve the hauling of *nearly a million truck loads.*

Hoover Dam as it will look on completion, towering 730 feet above foundation rock, with power houses on both banks of the river. The dam will be nearly 1200 feet long, 45 feet thick at the top, and 650 feet thick at the base. This barrier will form a reservoir 115 miles in length with a shore line of 550 miles and an area of 227 square miles, the largest artificial lake in the world.

—and the Trucks

In such a setting, with mountains to be moved under such conditions, trucks will have their work cut out for them. Six Companies Inc., guided by years of experience in heavy-duty hauling, is banking on Internationals. The fine performance of Internationals in the service of the first sub-contractors on work in the canyon only made the choice the easier. Scores of International Trucks are now in process of delivery at the site. The first fleets have long been on the job, rugged, capable, and economical—admired alike by the engineers, the drivers and the shovelmen who know full well how good each truck must be to stand the gaff.

International Harvester is proud to have Internationals selected for work on Hoover Dam. The news from Boulder Canyon is of great practical value to buyers of trucks everywhere. It provides another chapter of evidence contributing to the high reputation of International Trucks.

Front of dam will rise just beyond foot bridge shown here. Hoover Dam will be higher than any dam now existing and the construction will require 5,500,000 barrels of cement and nearly 60,000 tons of steel and other metals.

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Colorado Highways
"BETTER ROADS"
VOLUME X. NOVEMBER, 1931 NUMBER 11

EDITORIAL

THE saving in human energy, brought about by good roads, is greater than the saving in car operating costs, according to an article by James R. Griffith, engineering professor at the Oregon State Agricultural College.

Using the figures in Bulletin No. 91 of the Iowa State College of Agriculture and Mechanic Arts, which show that the cost of operating the average automobile is 5.44 cents per mile on high type (paved) roads, 6.43 cents on intermediate (gravel, macadam or bituminous treated), and 7.50 cents on low type (earth, sand-clay or light gravel). Prof. Griffith says: "I note that by operating my automobile 11,000 miles a year I will save $108.90 by staying on high type roads in preference to intermediates. Likewise, each year's operating cost will be $226.60 less on high type roads in preference to low type. This differential, multiplied by the total number of cars operating at that mileage, would provide quite an appreciable amount which would go a long way in paying for improved roads.

"To me, as a car owner, these figures are interesting. However, I am more concerned about reading between the lines.

"Cannot the medical profession give us a measure of the energy expended per mile by the front and back seat drivers over the three types of roads? What would such a chart show? I have made some short runs over low type roads requiring more physical exertion than a hard day's work. In fact, I would estimate that 50 miles of low type road required an expenditure of energy equivalent to about 300 miles of high type road. In this connection I well remember a short run on one poor road made during the summer of 1929 which completely exhausted my physical and mental reserve."

The cost per mile at present prices of gasoline, tires, etc., is probably lower than the cost shown in the Iowa bulletin, says a Minnesota highway bulletin, but the relative cost on high, intermediate and low type roads has not changed. And the amount of human energy expended in a ride on poor roads is as great as ever.

COLORADO MOTORISTS USE MORE GASOLINE

Motorists in Colorado used 76,360,389 gallons of gasoline during the first six months of 1931, an increase of 3.4 per cent as compared to the same period last year, while Wyoming had an increase of 12.5 per cent, with a total of 15,696,651 gallons, according to Rocky Mountain Motorists, the local A. A. A. club.

The automobile association pointed out that there was a total of 7,117,874,233 gallons of gasoline used by motorists in the United States during the first six months of this year. This was an increase of 4.5 per cent as compared to last year.

"Car owners," says the statement, "paid gas taxes on this fuel in the amount of $244,746,853, and with July, August and September, the peak months for gasoline consumption, there is every indication that gas tax receipts for the year will soar to a new high figure of nearly $600,000,000.

"This increase may be largely attributed to higher gas taxes, the average for the country being 3.44 cents. Only three states, namely, Connecticut, Missouri, New York and District of Columbia, retain a rate of two cents per gallon. The highest tax, seven cents, is now in effect in Florida, while four states, Arkansas, Georgia, North Carolina and South Carolina have a six-cent tax."

The A. A. A. club pointed out that diversion of gasoline taxes to other than road-building purposes amounted to $8,645,428 during the first six months of the year, with $7,406,416 of this amount going to schools.

CHARITY OR ROAD IMPROVEMENT?

Much work on the roads for unemployed men can and should be provided by public officials during the coming three or four months. The families of jobless men must be supported and it is desirable, from the standpoint of both the idle workers and the community, that the support be extended through wages paid for service rendered. Necessary road improvements which require mostly hand labor, and which can be made in the fall and winter months, exist in abundance. Culverts are in need of cleaning, waterways should be opened up to drain properly, steel bridges require painting. Brush and other obstructions at intersections and curves in the road should be cleared away. Concrete roads can be made safer for travel by graveling the shoulders, eliminating dangerous ruts at the edges of the slab. Dangerous intersections of unpaved local roads with state highways can be improved. Gravel pits can be operated and the gravel stockpiled for spring use. There are various autumn tasks, the performance of which will decrease the snow hazard. Pending national action to initiate greatly increased relief highway programs, work of this character will offer income to and will be eagerly accepted by thousands of unemployed men. To fail to undertake it—where there are not insurmountable obstacles in the way—is to confess failure in the organization and administration of community life.

Denver-Limon *Road Project* Completed

By ROY RANDALL
Office Engineer, Colorado Highway Department

WITH the exception of the Strasburg underpass section, the work on the first construction division on the Limon road has been completed. This consisted of grading, drainage structures and base course gravel surfacing of 55.321 miles on the Denver-Limon highway. This highway is a section of United States Highway 40 North and is rapidly becoming a very important link in a major transcontinental highway. The traffic using the road includes passenger automobiles and bus lines, also a surprisingly large amount of freight trucks.

The emergency funds made available by Congress in December, 1930, provided the wherewithal for doing the work, but at that time surveys had been made only on part of the first section covering a project about 8 miles in length. The surveys on the balance of the line had not been started.

Engineer crews were immediately organized and sent into the field and when the new year arrived the surveys were under way. Snow left by heavy storms in November still covered the ground and lay deeply drifted in many places. January was a cold month, with raw winds over the prairies, and the men were almost constantly subjected to a temperature "three shirts cold." The weather in February was much better, but March was accompanied by several blizzards, each of which stopped all traffic on the highway. These conditions made the work rigorous for the men, but at the same time gave the engineers a most excellent opportunity to study snow conditions and to so design the projects as to eliminate as far as possible the snow hazards during the coming years.

A great amount of detail work always incident to making the surveys and preparing plans for Federal Aid projects had to be done quickly and included location, grade laying and cross-sectioning of the work, land ties and preparation of rights-of-way descriptions, location of prospective gravel pits and other possible materials of construction, selection of detour routes and many other details too numerous to mention here.

The following resident engineers were assigned to the work and have had charge from the first preliminary surveys to the completion of construction: Clarence Green having the Watkins and Bennett projects, M. F. Egan at Byers, Fred W. Miller at Deertrail and R. E. Clancy at Limon. All these except Clancy were working under Mr. E. E. Montgomery, Division Engineer of Division No. 1.

The design of the road called for a highway 34 feet in width and the grade was laid so as to be above the elevation of the adjacent fields a sufficient height to allow the snow to blow off the roadway during the winter storms. Right-of-way is 100 feet in width and material for elevating the grade is taken from pits between the roadway and the right-of-way lines. In a great many places sufficient material could not be had from the right-of-way and extra lands had to be purchased for borrow pits or the material purchased on a yardage basis. The grading quantities averaged over 30,000 cu. yds. excavation per mile.

It was necessary to improve and surface approximately 57 miles of county road for use as detour before construction could start. This work was done by the State Highway Department maintenance forces and in-

Two views showing construction operations on two sections of the Denver-Limon Federal Aid project recently opened to traffic. Photo by Roy Randall.

volved the strengthening or reconstruction of several bridges and placing direction and caution signs.

Construction work was started on the first section on February 6, 1931. This project, F. A. P. 149-C, was contracted to Charles B. Owen and extends from the end of the oil processed project east of Aurora, F. A. P. 149-B, to a point between Watkins and Bennett and is 7.863 miles in length. The old road through the town of Watkins was located on the railroad right-of-way of the Union Pacific and the county had no title to this right-of-way. A relocation was made which straightened the highway and ran it back of the town. Since the completion of this contract, the natives of the town have been busily engaged in turning the town around so as to face the new road. The bridge over Box Elder Creek was widened from a twenty-foot roadway to a thirty-foot roadway by driving a line of batter piles along the upstream side of the bridge.

The next section to get under way was F. A. P. 149-D, 8.370 miles long, and extended from the end of F. A. P. 149-C beyond Bennett to the underpass section west of Strasburg. This contract was awarded to A. R. Mackey and construction was started April 10, 1931. This section involved a relocation past Bennett and over Kiowa Creek which straightened and shortened the line. Several buildings, including lumber yards, filling stations, etc., had to be moved in order to clear the right-of-way through Bennett.

The Lawrence Construction Co. was awarded the contract for F. A. P. 149-G and started construction April 27, 1931. This section started at Peoria and extended to the Arapahoe-Elbert county line, a distance of 9.778 miles. A relocation east of Peoria, including the Middle Bijou Creek crossing, straightened a portion of this section and improved flow conditions.

The following month a contract was awarded to the H. C. Lallier Construction and Engineering Corp. for F. A. P. 149-F, a project extending from a point east of Strasburg to Peoria, 10.745 miles long. Work was started May 29, 1931.

The last and longest of the sections, F. A. P. 149-H, was awarded to Hamilton and Gleason, and was started June 26, 1931. This project extends from the end of the oil processed project F. A. P. 149-A to River bend, a distance of 18.565 miles.

Dates for early completions were

An elevating grader outfit working near Byers. One of the many wooden pile bridges constructed along the 56 miles of new roadway. Photos by Roy Randall.

set in all contracts and special attention of all contractors was drawn to the fact that no overrun in time limit would be permitted. As a consequence the men and machinery were moved on the various jobs and the "dirt began to fly" at a rate seldom equalled on any highway work previously done in Colorado.

Twenty-three treated timber pile bridges having a total length of 4,008 feet, and with 30 feet wide roadways are on the projects. Piling range in length from 30 to 50 feet, and the longer lengths were driven with steam hammers. Two types of decks were used, these being reinforced concrete and asphalt plank wearing surface on laminated timber sub-floor. The more important of these bridges are the ones crossing Box Elder Creek, Kiowa Creek, West Bijou, Middle Bijou, East Bijou and Rattlesnake Creek.

During the summer the weather was very hot and many of the younger members of the engineer parties would strip off to the waist like disciples of Gandhi. They achieved a sun tan closely resembling the color of an old saddle. With the thermometer registering over 90 degrees in the shade, and no shade, the creosoted timber stringers in the bridges get "very hot," and after walking on them for a short time, it is quite certain that a person's feet are up to about 450° F. Some of the workmen on forms had to wrap their knees with many thicknesses of burlap.

There were 98 concrete box culverts built, ranging in size from 2′ x 2′ to double 6′ x 6′ and having a total length of 4,849 feet.

Gravel surfacing was placed at the rate of 61 tons per 100 feet. This was hauled in trucks from pits located at various points within hauling distance from the projects. The material from some of these pits was too fine to comply with the specifications and in such cases the contractors were required to furnish sufficient coarser material from other sources and mix with the local supply so that the surfacing would be satisfactory. The gravel was placed at a rapid rate and in one case a contractor had 63 trucks in the line, delivering 451 loads over the scales in one eight hour shift, the average net load weighing over 8,000 lbs.

On account of the extreme dry weather conditions which prevailed all through the season, the surfacing has not compacted. However, this condition will be corrected when storms bring sufficient moisture to lock the material down.

Some idea of the progress of construction may be had from the quantities of some of the important items done during the summer months as

(Continued on page 12)

Advisory Board *Plans* *1932 Highway* Program

COMMISSIONERS from the sixty-three counties of the state were heard by the members of the State Highway Advisory Board during the week of November 16th in regard to road improvements in their respective communities to be carried out in 1932.

Following these conferences the board adjourned until early in December, when the members will meet again for the purpose of conferring with the State Highway Engineer and will make a final draft of the 1932 budget to be submitted to the governor.

Upon opening of the meeting, the board reelected Peter Seerie as chairman, and William Weiser of Grand Junction as vice chairman. One new member of the board, I. F. Beauchamp of Trinidad, participated in the conferences.

Mr. Beauchamp was named by Governor Adams to succeed B. B. Allen of Silverton. Edward G. Middlecamp of Pueblo, Frank H. Blair of Sterling and Mr. Weiser were recently reappointed to the board.

The budget for 1932 will amount to approximately six million dollars. This is about one million dollars less than was expended on construction and maintenance this year.

No announcement of what the budget will contain was made by the board. This will be made public by the governor after he has affixed his signature.

However, it is generally conceded that a large share of the money to become available for road construction will be used on state projects. An effort will be made to relieve unemployment in every county in the state by the use of local labor.

Highway Engineer Chas. D. Vail will continue his policy that wherever possible needy laborers will be recruited in the vicinity of the jobs. These men, of course, must be able to do the work. Men with families dependent upon them are to be given preference over single men.

Complying with a suggestion from the governor and in line with its efforts to give employment to as many people as possible, the highway department during the past few months has given temporary employment to more than 1,000 men in various kinds of construction and maintenance work.

Every possible effort will be made to keep as many men employed during the winter as possible, Mr. Vail states, although it will be out of the question to keep winter work at any where near the the summer figure.

A number of grading and bridge projects are being let now for completion next spring and summer, and on several of these work will continue through the winter, except in extreme weather.

Requests have been received by the Advisory Board for more than ten million dollars' worth of work next year. Obviously it will be impossible for the board to grant all requests for state aid. As in the past the board will advise that money be expended upon what are considered the most needy construction projects at this time.

It is estimated that approximately $3,000,000 worth of work will be carried over from the 1931 budget. With the carry-over projects and the new jobs which will be authorized in the 1932 budget and the maintenance forces, it is estimated that somewhere between three and four thousand men will be given employment on the state road system during the construction season next year.

An extensive oil surfacing program will be carried out by the department next year, according to present plans. For the oiled road the department is planning to put an oil-treated gravel surface three inches thick on the roads, instead of merely mixing a small quantity of oil with the present surface. An oil treated surface costs from $3,500 to $4,000 per mile.

Several hundred miles of roads have been graded and gravel surfaced during recent years. It has been found that the gravel on these roads, due to the dry climate, requires a binder to hold it on the roadbed, and from recent experiments the highway engineers have found that oil treatment is the cheapest and more satisfactory remedy.

Plans of the department also call for a substantial sum to be allotted to placing markers on the highways. Employes of the state are raising a fund to be used for the employment of men to erect these markers. It is estimated that $40,000 will be raised by the civil service employes for this fund.

This picture shows the construction of wooden pile bridge over the Middle Bijou Creek on Denver-Limon highway. Photo by Roy Randall.

Work Started *on* *Historic* Ute Trail

By FRANK FARLEY

A THOUSAND ghosts of the past, of Indians, frontiersmen, scouts, hunters, miners, pioneer farmers, will stand on the red rimrocks of the Ute canon this month watching huge bursts of dynamite and fire blazing in the boilers of modern steam shovels as work starts on the new highway over Ute Pass.

The Ute Pass trail is one of the state's most famous highways, with a history stretching back to the days when buffalo roamed the plains and high pastures of the Rockies undisturbed even by the red men.

By next spring it will become a modern boulevard highway, thirty-six feet wide, with its steepest grade only 7 per cent.

The line of the modern highway will follow very closely the trail marked out by the wild game and Indians.

Starting at the famous Big Ute spring, it will follow up through the Ute canon, past the beautiful Rainbow falls until it reaches the high plateaus of South Park.

The first big migration of white men over the pass came in the summer of 1859, when gold was discovered in South Park. The diggings at Tarryall, Fairplay and Buckskin Joe attracted hundreds of fortune hunters and for the first time attempts were made to go over Ute Pass in wagons. The big, heavy prairie schooners of the day, drawn by teams of huge oxen, bumped and lumbered over the trails that therefore had known only the hoofs of horses and wild animals.

The following year the great California gulch placer mines, which were the beginning of Leadville, were uncovered and the travel over the pass grew in proportion.

Albert B. Sanford, assistant curator of history of the State Historical Society, passed over the Ute trail as a boy in that year and remembers it crowded with wagons and mounts of all descriptions.

Schuyler Colfax, speaker of the house of representatives and a candidate for vice president, visited Colorado in 1868 and was taken on a trip through the mountains. Shortly after he left with a party over Kenosha Pass for Fairplay, the telegraph operator at Colorado City notified Denver a war party of Cheyenne and Arapahoe braves was on its way to the South Park country over Ute Pass.

Gov. A. C. Hunt, who was with Colfax, was notified by runners and he in turn notified the various Ute camps in the region, who sent scouts to Ute Pass. The plains Indians, finding their expedition was not a surprise, turned around and went back to the plains. It was the last time a war party rode the trail, historians say.

Then in 1878 came the discovery of the carbonate deposits in Leadville. Again Ute Pass was crowded with fortune hunters.

The next development was the building in 1886 of the Colorado Midland Railroad, now mostly abandoned.

The famous automobile highway up Pikes Peak branches off the Ute Pass road near Rainbow Falls and in season this is extensively traveled.

The new Ute Pass road will serve Cascade, Florissant and connect with the Denver-Fairplay road to Buena Vista and Leadville and Salida.

Another project on the same road is being built around the reservoir which will be created by the Eleven-Mile dam being erected by the Denver city water board.

The Ute Pass project will cost $265,000 and will employ about 200 men, highway engineers said.

With gigantic machinery constructed especially for the purpose, this work is expected to carry on through the winter with little if any delay, and a large number of men will be afforded employment. There will be a tremendous amount of blasting and excavating, with hundreds of thousands of cubic yards of material to be removed. According to estimates of the highway department, 82,600 pounds of reinforced steel will be necessary along with much masonry and concrete work.

The initial stages of the work will be confined to that stretch just west of the town of Manitou where the right-of-way for the new route on State Highway No. 4 starts and on up to Rainbow Falls. A bridge in that stretch will form a separate contract. It is estimated that workmen will be engaged in this first project until about the first of the year, when the actual labor of hewing into the granite walls and cliffs of old Ute Pass will start in earnest.

At such times as blasting and blockading of the route becomes necessary the contractors will close the road to traffic and arrangements will be made for transporting school children and others from the upper towns and communities via the Midland Terminal Railroad. An extra train will be operated morning and night, according to present plans, in addition to the regular daily train between Colorado Springs and Cripple Creek.

On January 1, 1931, Colorado had completed 396 miles of pavement of all types; Kansas, 1,218 miles; Nebraska, 313 miles; New Mexico, 87 miles; Wyoming, 43 miles, and Utah, 286 miles. Pennsylvania has 9,476 miles; New York, 9,151; Illinois, 9,284; Texas, 7,758, and California, 2,209 miles.

Of the 300,000-mile system of state highways, a total of approximately 200,000 miles are now surfaced. Of the remaining 2,700,000 miles of rural roads, little over 15 per cent is out of the earth-surface class.

NEWS OF THE MONTH

Two and one-half miles of new pavement located west of Lamar have been completed by J. B. Bertrand, Inc., under a subcontract with the Pueblo Bridge & Const. Co. A. B. Bertrand was foreman in charge of the work. The contractor expects to have the entire project, consisting of five miles of pavement and a new bridge, open to traffic by December 1st.

Work has been started on four miles of grading and gravel surfacing south of Buena Vista in Chaffee county. John C. Pantle, contractor in charge, expects to complete the project in two months.

For the first ten months of 1931 a total of $157,456 was expended by Boulder county on its road system. Of this sum $14,390 was expended in September.

The route of the new road to be constructed through Ute Pass, from Manitou to Cascade in El Paso county, has been changed to avoid passing directly by the Big Ute spring in Manitou, one of the largest medicinal springs in the state. Hamilton & Gleason, contractors, were the low bidders on this 4½-mile project, and work will start immediately. The new work will be completed before the next tourist season starts.

Robert H. Higgins, superintendent of maintenance, who has been on the sick list for several months, is now back at his desk in the Denver office.

W. A. Murnan has been relieving John Stamm as assistant superintendent of maintenance in the first division for a month. Stamm is now back at his desk in division headquarters at Denver.

Since the first of the year John P. Donovan, maintenance engineer, has traveled over 30,000 miles. His work as field supervisor of maintenance takes him to every "corner" of the state.

During the month of October the highway department purchased twenty plows of various types to be used in snow removal during the coming winter. Work of attaching them to various truck and tractor units is now in progress.

Highway Engineer Chas. D. Vail has ordered all maintenance equipment to be painted a standard orange color.

Approximately 300 employes of the department have become members of the State Employes Retirement Fund. Three and one-half per cent of their salaries is deducted each month for this fund. It provides for retirement at the age of 65 years on one-half of their average pay for the last five years of their employment with the state. In September these deductions totaled $2,205 from highway employes alone.

Colorado's allotment from the Federal government for highway construction for 1932 totals $2,290,520. This will be matched by an equal amount by the state. It is estimated that Colorado's state road budget for the coming year will reach $8,240,000.

If plans now being considered by highway officials materialize the 145 miles of U. S. highway between Pueblo and the Kansas state line through the Arkansas Valley will be paved or oil surfaced by the end of 1932.

The highest through-travel highway in the world through the Rocky Mountain national park will be opened to motor traffic in 1932. Construction of this magnificent drive over the Continental Divide is now under way. It will cost the government nearly $2,000,000.

Eight miles of new roadway on Rabbit Ears Pass were constructed by the U. S. Forest Service during the past season. This improvement eliminates nearly 100 curves from the old road. The road has been widened to 24 feet and the grades reduced to an average of 5 per cent.

Highway Engineer Chas. D. Vail was one of the principal speakers at the annual convention of the Highway 50 Association held in La Junta on October 22.

After spending five months as supervising engineer in charge of constructing fifty-six miles of new roadway between Watkins and Limon, Roy Randall is now back on his old job as Office Engineer in the Denver headquarters.

Patrick Higgins has been placed in charge of the concrete pavement core drilling outfit which is now working in the Arkansas Valley.

An average of 708 men were employed on state road projects in northeast Colorado 100 days during the past summer, according to a report made by A. B. Collins, division engineer. A majority of these men were employed as day laborers. A considerable number were farmers who used their teams.

A total of 384,000 men were employed on state and Federal Aid highway programs in the 48 states, according to Thos. H. MacDonald, chief of the U. S. Bureau of Public Roads. Of this number, 2,400 were employed on road construction in Colorado. MacDonald pointed out that these figures did not represent the sum total of labor stimulation growing out of the emergency road work. The road dollar, he said, spreads back through stone quarries, sand and gravel pits, cement factories, petroleum fields and refineries, mines, engages rail and water transportation facilities and keeps the wheels of equipment and accessory factories turning.

During 1930 a total of 35,883 miles of county and township roads were surfaced, according to the U. S. Bureau of Public Roads. The total of county and local roads surfaced the first of the year was 467,338 miles.

It is estimated that the total U. S. road expenditures for 1931 will reach $2,500,000,000.

A new road from Montrose to Ouray is to be constructed by the State Highway Department. Engineers under H. T. Reno are now surveying the new route.

ALONG NATIONAL HIGHWAYS

An ordinance imposing a 1-cent gasoline tax by the city of Santa Fe, N. Mex., has been declared valid by District Judge Otero in a suit brought by the Continental Oil Co. The ordinance becomes effective on January 1.

Investigation of alleged gasoline tax evasions has been ordered by Governor Olson of Minnesota. The investigation will be made under the supervision of the State Public Examiner.

Gov. Olson ordered the investigation following complaint made by the Minnesota Gasoline Tax Evasion committee, composed of representatives of the large oil companies doing business in the state.

The recent law enacted by the Texas legislature regulating private contract motor carriers has been declared valid by the United States Supreme Court. The authority of the Texas railroad commission to refuse to issue permits in cases where territory is adequately served by common carriers was sustained by the Federal court.

In rendering its decision, the court states in part as follows:

"Standing out in decisions, text books and law articles is the universally accepted doctrine that the use of public roads for the conduct of business thereon, whether by common or by private carriers, is an extraordinary use and such is enjoyed not as a right, but as a privilege. That the state may altogether exclude hauling by carrier, common or contract, intrastate from its roads is generally taken for granted.

"The difficulties of the states have arisen where, choosing a middle course between exclusion altogether and permitting unabridged use, they have sought to impose conditions upon private carriers the same as or analogous to those imposed upon common carriers, and here its difficulty has arisen not out of efforts to regulate the manner of the use of the highways but by controlling rates and practices, to regulate the business done thereon."

A study is now being made by the Colorado Public Utilities Commission to determine what effect, if any, the decision of the U. S. Supreme Court will have on the enforcement of the recently enacted Colorado bus and truck laws.

A new U. S. highway has recently been designated in New Mexico to be known as "U. S. Highway 64." This route is extended from Raton to Santa Fe, absorbing present U. S. 485, described as follows: Raton, Cimarron, Taos, Espanola, Santa Fe.

A total of 3,626 men were employed on highway projects in Colorado on July 1, 1931. Of this total 1,090 were employed by the state and 2,536 by contractors. This compares with 2,034 by Wyoming, 4,000 by New Mexico, 6,461 by Kansas, 5,200 by Nebraska, and 3,058 by Utah.

Road and bridge contracts let by Colorado during the first six months of 1931 showed an increase of $1,920,000 over 1930. During the first six months of 1930 Colorado contracted $2,780,000 as compared with $4,700,000 in work during the same period in 1931.

Expenditures for maintenance in Colorado during 1930 totaled $1,632,000; Kansas $2,988,000; Nebraska, $3,383,000; Wyoming, $1,064,000; New Mexico, $1,750,000; and Utah, $1,289,000.

Colorado state road expenditures in 1930 totaled $7,364,231 for all purposes. During the same year Nebraska spent $11,014,000; Kansas, $13,224,735; New Mexico, $8,576,556; Wyoming, $3,470,000, and Utah, $4,705,000.

Figures gathered by the U. S. Bureau of Public Roads show that on August 1 a total of 318,936 people were employed on road work in 46 of the 48 states. Of this number 130,429 were employed directly by the state highway departments and 188,507 by contractors.

During the calendar year of 1930 the state highway departments paid out $979,997,847. To meet this expenditure motor fees, gas tax and Federal appropriations furnished $793,374,020, an average of 80 per cent. But the per cent that these three items are to the total expenditures vary greatly, however, and range from 39 per cent to 164 per cent, according to statistics gathered by the U. S. Bureau of Public Roads.

A Federal bond issue for as much as $5,000,000,000 would be favored by Senator Wheeler (Dem.) of Montana, who would use the proceeds for irrigation works construction, for waterway development, and for other projects such as the building of a broad highway from New York or Washington to the western states, Senator Wheeler stated orally November 12.

He agreed with the proposal of Senator Norris (Rep.) of Nebraska, in favoring a Federal bond issue for extensive highway construction on the basis of the present Federal Aid cooperation with states, although Senator Wheeler said he would go even further than the Norris program.

The construction of a great, broad highway from east to west would be of permanent economic value to the United States and would be a more practicable way of helping unemployed people than would be the direct relief of them in a money way.

"These millions of people unemployed must be taken care of, one way or another," he said. "They prefer work to charity. It is better to spend these large sums for work that will be of permanent value than for the temporary expedient of giving them money to get food and support their families.

"But there is another thing that I would insist upon in any emergency program of great permanent highway construction, and that is that the construction work should not be left to contracts for use of machinery. It might cost a little more, perhaps, but it would be worth while, in the light of present unemployment conditions, to have all such work on highways—or other public works for that matter—done by men with their teams instead of by machine methods. The unemployed should be put at work on such projects to the very largest possible extent and in this way it would be a very feasible plan for coping with the unemployment problem."

Doings Among Equipment Dealers

Calcium chloride has been added to the line of asphaltic highway products marketed by the Texas Company. It is a product of the new plant of the Texas Company at Tulsa, Okla.

Now the hand shovel companies have gone into a merger. Five companies have been combined under the name of Ames-Baldwin-Wyoming Shovel Company. This is a combination of the Ames Shovel & Tool Co., Baldwin Tool Works, Hubbard & Co., Pittsburgh Shovel Co. and the Wyoming Shovel Works.

Littleford Bros., manufacturers of tar heaters, have opened a new district office at Chicago.

Ralph Leavenworth has been appointed advertising manager of the Westinghouse Electric Co., with offices at Mansfield, Ohio.

An attachment for spreading sand, ashes or other materials on ice surfacing has been produced by the Hvass Company. It can be attached to a dump truck.

Galion is out with an E-Z Lift motor grader equipped with a snow plow. The plow is combined with and operated by the scarifier attachment. The H. W. Moore Equipment Co., Denver, can furnish full information on this new unit.

Just now all Denver road equipment dealers are featuring snow removal equipment. Reports indicate a greater demand for this class of machinery from counties than ever before. More than thirty new snow removal units have been installed by the State Highway Department in preparation for the winter season.

Many new improvements have been made by the J. D. Adams Co. in the snow plow which they manufacture for use with their motor graders. The plow is of the V-type and is controlled from the operating cab of the motor grader. Elton T. Fair of Denver can send anyone interested complete details of this new unit.

A combination portable washing, screening and crushing plant is the latest addition to the line of the Iowa Mfg. Co., Cedar Rapids, Iowa. The screen is 42 in. diameter by 12 ft. long, bevel gear and pinion drive.

The Austin Badger, an 11-ft. capacity shovel, is a new product of the Austin-Western Company. It is powered with a McCormick-Deering Model 20 Industrial unit.

The 26th annual convention of the National Paving Brick Association will be held in Chicago February 10-12, 1932. The program now under preparation will be presented by prominent engineers, contractors and paving authorities.

A fleet of International heavy-duty trucks have been purchased by the Six Companies, Inc., for handling excavation materials on Boulder Dam project.

Adams elevating graders have been hanging up new records on Mississippi River levee work, according to Elton T. Fair, Denver distributor. These graders are being employed in the heavy gumbo soil, a severe test for the best of equipment.

Cletrac "30" model is one of the new products of the Cleveland Tractor Co., being displayed by the Liberty Trucks & Parts Co., Denver. Tony Monell can tell you more about it.

A portable road oil mixing plant was exhibited in Denver by the H. W. Moore Equipment Co. during the meeting of the State Highway Advisory Board. It was seen by commissioners from all parts of the state, and created considerable interest among those looking toward the solution of the low cost pavement problem. The machine is a product of the Iowa Mfg. Co. of Cedar Rapids.

Reports from the Denver equipment dealers indicate that actual sales to counties exceed those of 1930. Commissioners indicated that every effort will be made to employ as many men on the roads throughout the coming winter months and next spring as possible. Snow removal equipment also occupied a large place in the road maintenance programs planned.

Water from the Western Slope is now flowing over the Continental Divide into the Arkansas River. This water is made available through a ditch constructed this past summer over Tennessee Pass. Two General Excavators and a Schramm Compressor were used in the work of excavating the ditch.

"Quick-Way" shovels are now a part of the equipment being operated by Charles Switzer, W. A. Colt & Sons, and Hamilton & Gleason, contractors. The Switzer shovel has been operating on Independence Pass, while the Colt shovel was used on Milner Pass. Hamilton & Gleason have used their shovel on a job west of Limon.

The line of road equipment consisting of dump wagons, bulldozers, wheeled scrapers, rotary scrapers and track wheels manufactured by the Euclid Road Machinery Co. is now handled in Denver by the H. W. Moore Equipment Co.

The new models "35" and "45" Bates tractors are now equipped with six-cylinder Waukesha engines and sure-footed track equalizers.

On August 15, 1931, the state of Pennsylvania took over 20,000 miles of rural roads, to build them and maintain them at state expense. A feature of the 20,000-mile rural-road program which will benefit the farmer and relieve unemployment in every county of the commonwealth is the use of local labor. The secretary of highways has been directed that wherever possible needy laborers recruited in the vicinity of the jobs must be employed without reference to party affiliations. Another plan instituted to give employment to the greatest number creates two shifts per week, giving each man a half-week's work. During September approximately 15,000 were employed.

There was a time when opponents of gas tax increases declared that raising the tax rate would cut down motoring, but this argument has long ago been refuted. Only in two states was gasoline consumption less in 1930 than in the year before, and this falling off in motoring was not due to high tax rates, but rather to poor road conditions brought about by inability to properly utilize motor tax income.

Denver-Limon *Road Project* Completed

(Continued from page 5)

shown by the following figures: During the month of February 25,000 cu. yds. of excavation were moved, followed by 35,000 cu. yds. moved in March, 71,800 cu. yds. in April, 122,430 cu. yds. in May, 254,230 cu. yds. in June, 341,241 cu. yds. in July and 391,639 cu. yds. in August.

There were 28,592 tons of gravel surfacing placed during the month of July and 74,107 tons in August.

There were 545 cu. yds. of concrete placed during the month of June, 1,365 cu. yds. in July and 2,931 cu. yds. in August.

Timber piling was driven at the following rates: 1,950 lin. ft. during the month of May, 7,964 lin. ft. in June, 26,410 lin. ft. in July and 9,633 lin. ft. in August.

There were 101,000 bd. ft. of timber placed during June, 648,000 bd. ft. in July and 248,000 bd. ft. in August.

Some idea of the number of men employed on the projects is given in the following data: Starting on February 6 with 10 men, the number steadily increased until the peak was reached about August 8, with 566 men on the work. The records show that over 100 men were continuously on the work from April 15 to October 25; over 200 men were on the work from May 25 to September 5; over 300 men were on the work from June 20 to September 1; over 400 men were on the work from July 7 to Aug. 24, and over 500 men were on the work from July 14 to Aug. 17.

However, this does not show all of the picture, for in all of the towns along the line, such as Byers, Bennett, Deertrail, Agate, Buick and at Limon, the rooming houses and eating places were doing rush business; the merchants, garages, repair shops and town blacksmiths were all busy and many of the farmers along the line had a sale for feed and material. Further than that, every material of construction used on these projects employed labor in its manufacture and transportation before it could be used in the work.

This is the story of the 1931 work on the Limon road. The underpass section, F. A. P. 149-E, will soon be under construction and within another year the whole line should be oiled, giving a fine riding surface from Denver to River Bend.

Colorado added 278 miles of new roads to its highway system in 1930, according to Chas. D. Vail, highway engineer.

Hamilton & Gleason's bid on the Ute Pass project was $169,181. Fifteen concerns submitted bids. The McClure & Dennison Co. of Tucumcari, N. Mex., was second low bidder with a bid of $173,981., and M. E. Carlson, Denver, followed with a bid of $175,035.

Resident Engineer W. J. Walsh reports the newly improved gravel surfaced road between Alamosa and LaJara opened to traffic. It is planned to oil surface this road at a later date.

The state of Pennsylvania led all other states in highway expenditures during 1930 with $85,140,000, and New York was second with $67,082,000, and Iowa was third with $48,369,000. California's road bill totaled $35,965,000.

PLANS FINISHED

Proj. No.	Location	Type	Length
138-D	So. of Steamboat Springs	Gravel Surfacing	6 mi.
149-E	West of Strasburg	Gravel Surf. & Underpass	4 mi.
150-D F. L. H. P. No. 1	South of Elk Springs	Gravel Surfacing	4 mi.
216-B	West of Holly	Gravel Surfacing	10 mi.
248-AR&BR	North of Salida	Gravel Surfacing	14 mi.
288-AR	Northeast of Brush	Paving & Overhead R.R. Crossing	3 mi.

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R11	South of Trinidad	3.130 mi.	Paving	J. H. Miller & Co.	$ 89,063.70	89	2-R11
2-R12	Bet. Aguilar & Walsenburg	4.503 mi.	Paving	Orman Const. Co.	192,443.50	100	2-R12
57-R4 & 168-BCR	West of Lamar	4.801 mi.	Paving	Pueblo Bridge & Const. Co.	130,690.50	71	57-R4 & 168-BCR
68-B	South of Saguache	3.290 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	74,428.75	30	68-B
71-C	Bet. Durango and Mancos	4.965 mi.	Gravel Surfacing	J. Finger & Son	86,146.75	88	71-C
79-B	East of Colorado Springs	12.248 mi.	Gravel Surfacing	Chas. B. Owen	143,370.05	81	79-B
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	96	91-AR
134-AR&C	West of Burlington	11.174 mi.	Oil Processed Surf.	H. C. Lallier Const. Co.	111,217.20	100	134-AR&C
134-E	East of Limon	5.052 mi.	Gravel Surfacing	Bedford & Woodman, Inc.	31,426.40	44	134-E
144-G	Bet. Forks & Colo.-Wyo. Line	13.204 mi.	Gravel Surfacing	Morrison-Knudsen Co.	248,078.00	97	144-G
145-C	East of Rifle	14.901 mi.	Grading & Grav.	A. R. Mackey	271,703.80	32	145-C
149-F	Bet. Strasburg and Peoria	10.745 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	198,660.00	88	149-F
149-H	East of Deertrail	18.565 mi.	Gravel Surfacing	Hamilton & Gleason	240,319.15	80	149-H
150-C	West of Craig	6.893 mi.	Gravel Surfacing	J. Fred Roberts & Sons	120,139.05	42	150-C
151-A	Bet. Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	90	151-A
151-B	Bet. Fraser and Granby	3.925 mi.	Grading & Surfacing	Utah Construction Co.	63,954.80	88	151-B
158-B	Bet. Hartsel & Florissant	10.319 mi.	Gravel Surfacing	J. H. Miller & Co.	133,380.70	60	158-B
181-A	In Idaho Springs	1.876 mi.	Paving	J. Fred Roberts & Sons	93,749.55	0	181-A
189-C	West of Hayden to County Line	7.534 mi.	Gravel Surfacing	F. L. Hoffman	115,356.94	93	189-C
211-B	South of Craig	2.725 mi.	Gravel Surfacing	Utah Const. Co.	93,720.40	65	211-B
242-D	Bet. Mack & Colo.-Utah Line	9.883 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	124,552.36	94	242-D
242-E	West of Fruita	4.243 mi.	Gravel Surfacing	Wallace Const. Co.	54,907.53	100	242-E
245-AR	West of Las Animas	4.544 mi.	Grading & Oiling	Driscoll Const. Co.	94,398.85	87	245-AR
248-C	Between Buena Vista and Salida	3.944 mi.	Gravel Surfacing	Pantle Bros.	48,820.50	0	248-C
251-D	East of Boulder	0.284 mi.	Paving	Collier-Latimer	25,598.50	100	251-D
258-I	Bet. Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	79	258-I
258-I2	East of Montrose	Concrete Box Culvert		Hinman Bros. Const. Co.	8,455.50	88	258-I2
258-J	West of Cerro Summit	5.796 mi.	Grading and Gravel	Lumsden Hall Const. Co.	107,027.30	84	258-J
259-B	Bet. Gunnison and Parlin	9.587 mi.	Gravel Surfacing	Cole Bros.	184,503.00	54	259-B
263-C	East La Veta Pass	5 mi.	Gravel Surfacing	State Forces		0	263-C
265-E	West Bayfield	2.950 mi.	Gravel Surfacing	J. H. Miller & Co.	97,839.06	76	265-E
270-E	Bet. Del Norte & Monte Vista	8.663 mi.	Gravel Surfacing	Mountain States Const. Co.	102,199.10	62	270-E
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc.	116,829.21	100	278-AR&C
278-D	West of Cheyenne Wells	21.913 mi.	Gravel Surfacing	A. R. Mackey	93,563.30	44	278-D
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	87	282-I
292-D	Bet. Wolcott and Avon	9.834 mi.	Graded Surface	Utah Const. Co.	159,143.40	74	292-D
295-E	South of Alamosa	7.627 mi.	Gravel Surfacing	Mountain States Const. Co.	71,049.56	84	295-E
296-AR&BR	South of Pueblo	4.372 mi.	Paving	New Mexico Const. Co.	154,509.00	23	296-AR-BR
296-D	South of Pueblo	8.348 mi.	Gravel Surfacing	Cole Bros.	84,815.10	99	296-D
298-D	Bet. Del Norte and Durango	4.100 mi.	Gravel Surfacing	H. C. Lallier	164,814.00	80	298-D
298-F	East of Bayfield	5 mi.	Gravel Surfacing	Wood, Morgan & Burnett C. Co	66,920.85	95	298-F

Minnesota State Highway No. 3—Wabasha to Lake City

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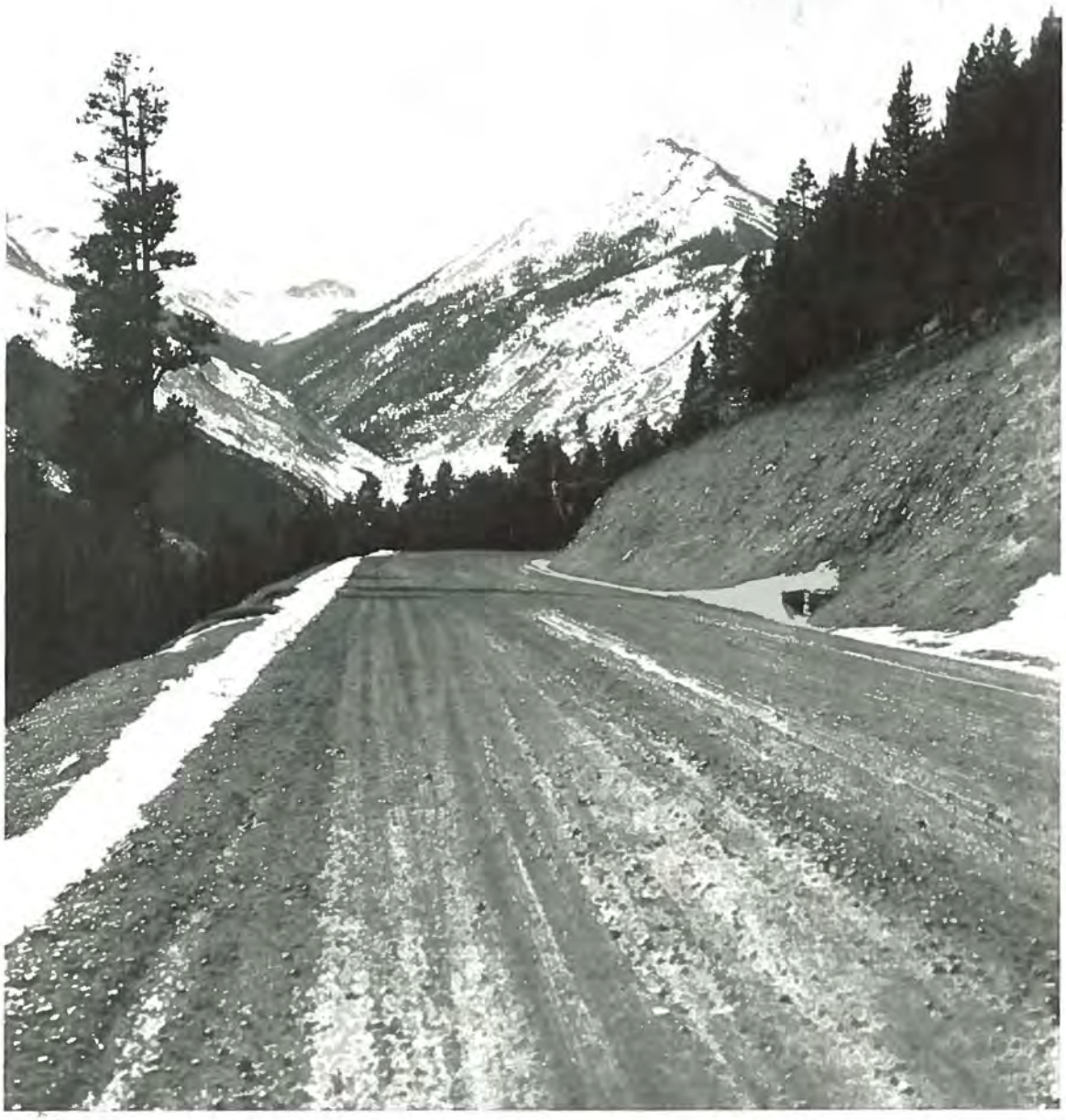

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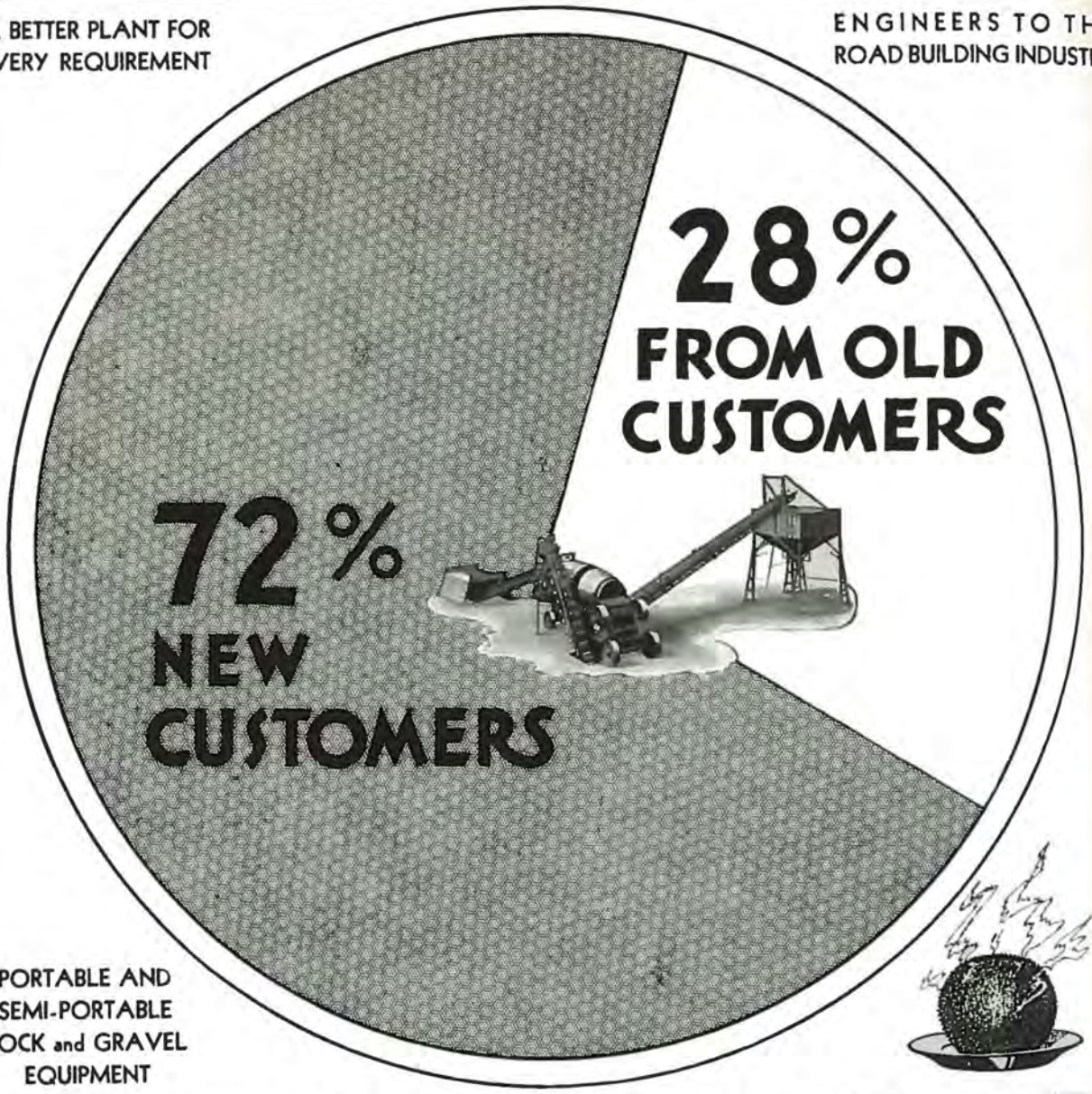
ENGINEERS TO THE
ROAD BUILDING INDUSTRY



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Our Cover Picture

AND this month we have a beautiful view of the magnificent new highway being constructed by the U. S. Bureau of Public Roads over Berthoud Pass. More than a half million dollars is being expended by the government on this improvement. Berthoud Pass is a link in the famous U. S. 40 Highway and crosses the Continental Divide a short distance from where this view was taken, at an elevation of over 10,000 feet. The new road will be completed early next spring.

Colorado Highways
"BETTER ROADS"
VOLUME X. DECEMBER, 1931 NUMBER 12

Is *Your Business* Really Slow?

BY KENNETH LINDSAY

HOW many times a day do your hear this? When this subject is broached do you sit back in your chair, light a fresh cigar, and say: "Yes, sir, John, you're right—what in ——— are we going to do?" Are you permitting yourself and your sanity to be carried away by this avalanche of pessimistic, disheartening, depressive talk that is being put out promiscuously by individuals that have never stopped to analyze their position—let alone making a survey of what is being done generally. There are too many "calamity howlers," and many of these, as we know, have not been seriously affected by this so-called "depression." They are weak minded enough to lose their mental equilibrium at the first sight of blood and start singing the "Swan Song."

True, we have an unemployment condition, but it is an ill wind that doesn't blow someone some good. A universal acceptance by all sections of the country has been given the movement of relieving the unemployment situation by making available funds for the increasing of road building projects. We are exceptionally fortunate to be sitting in this picture. Let me list a few happenings of this month to prove the market is actually here.

HERE'S $100,000,000 WORTH OF BUSINESS

"* * * Road construction programs of 20,000 miles and maintenance schedules of 33,000 miles are uncommon, to say the least, but that is what Pennsylvania is going to do—improve the greatest mileage of roadways in the history of any commonwealth. And, best of all, the contemplated work is already under way. Between $5,000,000 and $10,000,000 has already been spent, obligated or budgeted for equipment and materials. In a typical week, the Pennsylvania highway department had 17,000 men on its maintenance payroll. It looks as if the unemployment problem in Pennsylvania is being settled."

HERE IS COLORADO

"A program of 100 unemployment relief projects, estimated to cost $1,000,000, is being considered by Governor W. H. Adams and state highway officials of Colorado. These projects will be included in the 1932 road budget which is now under consideration."

$1,500,000 ALLOTTED FOR EXTRA WORK THIS WINTER IN CALIFORNIA

"* * * The larger part of the work will fall under the immediate direction of the maintenance service of the Division of Highways. Something like $1,500,000 has been appropriated for payrolls.

"It is the intention of the Department of Public Works to distribute the improvement work over the state. As far as possible, each locality will profit some from the wage returns; and each section will have its share of the improvement benefits.

"This expenditure of $1,500,000 will not be in the nature of a gift by the state to the unemployed. The men will earn their money. The state will get dollar for dollar in the betterment of roads and highways."

ILLINOIS FOLLOWS SUIT

"* * * Governor L. L. Emmerson's arbitration board early this month fixed the minimum rate for wages to be paid on highway construction in Illinois. The decision makes it possible for the state to award $11,000,000 worth of road contracts this month, projects which have been delayed most of the construction season by protests brought under the "prevailing wage act" passed by the general assembly early this summer."

ADDITIONAL MEN PUT TO WORK ON MICHIGAN COUNTY AND TOWNSHIP ROADS

"* * * Conferences in four cities of the state, including county road commissioners, engineers, county supervisors and county poor commissioners, under the auspices of the Michigan Association of Road Commissioners and Engineers, developed a splendid spirit of co-operation with Governor Brucker's State Unemployment Commission, and indicated an increase of more than 100 per cent of men employed at the present time, specifically upon county and township roads."

To build needed roads is neither an extravagance nor a waste. It is an economy of the highest order, and to protect the investment already made in roads by expending money for their upkeep is nothing short of exercising sound business judgment.

The greatest minds in our country are uniting in an effort to awaken Prosperity from her slumbers and speed up the wheels of industry. Success is sure to come from this united effort.

Prosperity greater than ever before is in the offing—a natural, uninflated, sane prosperity that will be felt in every corner of our country and reflected throughout the world.

Emergency winter programs of public construction are under way and the road construction field promises to be busier this winter than ever before in its history at that season of the year.

Gigantic *Road Plan Proposed* to Board

AT the recent meeting of the State Advisory Board, road experts presented a highway financing plan for Colorado which, if carried into effect, will result in a gigantic five-year road building program in this state costing approximately fifty million dollars.

Under this plan the construction program of the highway department planned for the next fifteen years would be concentrated to five years, and would give a system of paved roads in this state totaling nearly 1,000 miles.

At the same time the plan would enable the highway department to give employment to thousands of men for the next five years.

During the past year the government advanced to the state of Colorado $1,500,000 for emergency unemployment Federal Aid road work. Under the plan proposed the government would advance to the state $25,000,000 under a similar agreement, the amount to be repaid from future Federal Aid allotments to the state, the latter paying a small rate of interest to the government for the use of the money.

The members of the advisory board took the proposal under consideration. There is a possibility that the plan will be recommended to the present Congress through Colorado representatives.

Under the present system Colorado receives $2,300,000 yearly from the federal government in Federal Aid, and has an average available fund of about 5 million dollars to spend.

Under the plan submitted to the board, the federal government would issue 3 per cent treasury certificates to the amount of 475 million dollars yearly. Colorado would receive 5 million dollars yearly and would contract to pay its share of the interest on the bonds. This would give this state an annual budget of 9 to 10 million dollars, and in five years would amount to 49¼ million dollars over the funds needed for payment of the interest.

At the end of the five-year period the Federal Aid funds, which are now being appropriated yearly, would be applied on the principal sum, paying it out in fifteen years.

Colorado's share of the interest on the bonds over fifteen years would be $5,955,000.

Proponents of the plan suggest that the bonds be issued in small denominations to bring out hoarded money which is slowing up the return to prosperous times.

The proposal also would eliminate the present plan of government emergency loans to the states without interest, such as Congress made last year to meet the unemployment emergency.

The amounts which would be available from all sources for Colorado during the next five years are as follows: first year, $9,300,000; second year, $9,800,000; third year, $10,050,000; fourth year, $10,050,000; fifth year, $10,050,000.

Seventy-one Federal Aid road projects were included on the 1931 construction program. These projects totaled 433 miles of various types of construction. The projects included 53 miles of concrete pavement, 350 miles of gravel surfacing, 14 miles of grading and structures and 16 miles of oil processed surfacing.

This was the largest program in the history of the Colorado Highway Department, and the work has moved forward more rapidly than ever before. Tabulation of the engineering costs have shown the lowest in the history of the department. Under the highway law, a cost of 10 per cent of the amount of the contract price is allowed for engineering. In several instances this cost was reduced to as low as 3 per cent on projects completed this year.

Wherever possible, construction work of the department will be carried throughout the winter months. Several projects have been put under way for the express purpose of giving employment to as many men as possible. Such a project is now under way on the east side of La Veta Pass, where five miles of new roadway is being constructed with "hand labor."

On November 17th the department opened bids on two miles of new work in the canon above Twin Bridges on Wolf Creek Pass. This project involves about 109,000 cubic yards of rock excavation. A wider roadbed, safer grades and curvature and improved drainage will result from this improvement.

View of bridge and new road in Idaho Springs, connecting with the famous Chicago Creek-Mt. Evans highway, constructed by U. S. Bureau of Public Roads.

Current *Phases of Highway* Building

BY THOS. H. MAC DONALD, Chief, Bureau of Public Roads

FOR two years public attention has been attracted to the possibilities of public and semi-public works to provide increased employment. Much of this attention has focused upon the building of public roads as one of the major activities. There has been much fantastic expectation and too many extreme remedies proposed for employment through this medium. A great exaggerated program of public works of sound and enduring value cannot be turned on and off suddenly like water at a spigot, and extreme attempts can only end in failure and waste, producing consequences worse than the situation sought to be cured.

The immediate situation of serious unemployment confronting the nation deserves the honest analysis and valuation of road building as a relief measure by the state and federal highway officials in the light of the experience of the past two years.

In brief review, the first call of President Hoover to public officials and private agencies to undertake construction enterprises to the extent of their ability came in the fall of 1929. The response from the state highway departments generally was immediate. This newly faced responsibility fortunately happened to be timed with the availability of larger than normal funds in a number of states.

The federal government in April, 1930, increased the funds for road aid by $50,000,000, and on the first of September the Secretary of Agriculture apportioned to the states $125,000,000 authorized for the succeeding year. Work proceeded at an accelerated pace. The year 1930 will be remembered as the most favorable construction season within recollection. Day after day peak production was possible because of continuously fair weather.

From the standpoint of employment it is evident now that the rate of completion of projects was too rapid. By the end of the year many of the states had utilized the funds available and faced the new year 1931 with a depleted treasury. Since the state road funds come largely from the motor vehicle license fees and the month-to-month income from the gas tax, it was evident at the Pittsburgh November, 1930, meeting of the association that many of the states would be unable to use Federal Aid funds available through the winter and early spring months because of lack of state funds to meet the legal requirements. This association placed these facts before the Emergency Committee for Employment and finally before President Hoover, who met the situation by recommending an emergency advance of $80,000,000 to be used in the place of state funds to meet the regular Federal Aid funds already available. Congress acted promptly, and on December 20, 1930, the emergency legislation was approved. Work started almost immediately in the southern states, and due to the favorable winter and spring conditions, even in the northern states it was possible to carry on construction on a much larger scale than is ordinarily the case.

In five months the $80,000,000 advance fund, together with $160,000,000 regular Federal Aid and state funds, totaling $240,000,000, had been put under way on wholly new work to provide employment in all the states. The states also continued construction and maintenance programs from wholly state funds, and there were numerous uncompleted Federal Aid projects carried over from the preceding year.

On the first of July the total going Federal Aid program, including emergency and state funds, amounted to a total of about $447,500,000, of which the total federal share was $275,250,000. Advice from the chief executives of the state highway departments agrees that the emergency fund for 1931 materially advanced the actual placing under way of work in the winter and spring months; provided for increased employment; enabled a number of states which were almost wholly without state funds to use the regular Federal Aid funds available; and made it possible to hold the combined state programs, including Federal Aid, at practically the same total of expenditure as for the preceding year. Had it not been for the $80,000,000 emergency federal appropriation for 1931 the total of the year's construction program would have fallen off by very much more than the amount of this fund, for two reasons; first, a number of the states, because of the accelerated program of the preceding year and for other causes, were not able to meet the regular Federal Aid in full; and second, the proceeds of bond issues in a number of states, which had helped to swell the construction program for 1930, were exhausted.

In 1929, when the highway construction program was not being forced, it required the full 12-month period to obligate $75,000,000 of Federal Aid funds. In 1930, following the first demand to increase the rate of expenditure, this amount was obligated by July 10, six months earlier, but in 1931, $75,000,000 of the combined regular Federal Aid and emergency funds were obligated by March 1, and by May 30 approved projects to the amount of $172,000,000 Federal Aid and emergency funds were under way. This is the record only of new work. It does not include Federal Aid projects previously placed under way but uncompleted, and does not include the state construction and maintenance program without federal funds. Such a record of work placed under way, all on the basis of standard plans and specifications prepared by the state highway departments and approved by the Bureau of Public Roads, was only possible because of prepared and competent organizations already functioning.

Our current reports indicate that work was accomplished on the

emergency projects by September 1 to absorb, with an inconsequential balance, the full amount of the emergency road appropriation.

Through the helful co-operation of the states the number directly employed is definitely known. Starting with a total of 148,600 employed on the state and federal highway programs in January, 1931, there was a rapid increase as weather conditions permitted. In May the total passed 300,000, for July was 386,659, and the August preliminary figure is 384,000. Of the July total, 164,691 were employed on federal and Federal Aid projects, 112,681 on state and state aid construction, and 109,287 on maintenance.*

Certain characteristics of the highway work for the past two years are worthy of note. Increased employment has been provided when most needed. Expansion of road building is sound, since adequate highways have not been overproduced and are needed to a much greater extent. Increased construction has been accomplished without increased but rather with decreased unit prices. These lower unit prices, however, have not been at the expense of unskilled labor, generally speaking. There has been some advantage taken of the necessity for employment, but the average of prices reported for the unskilled labor rate of wage is holding close to the average paid in the states in previous years.

The best available figures for the years 1922 to 1931, inclusive, for the unskilled labor wage scale on concrete road projects show a maximum variation of 8 cents per hour between the high and the low annual figures, with the figure for the current year, 37 cents, an exact average of the high and low figures. During the same years there has been a marked decrease in the unit price per square yard for the pavement. That is, the cost of the product has been materially lowered w i t h o u t adversely affecting the wage scale for unskilled labor.

There is much misconception of road work as a medium for the direct relief of unemployment. Construction crews and maintenance forces are distributed generally over the state road systems during the normal working season and the popular mental picture seems to be that whole armies of additional men might be armed with pick and shovel and thus take up employment slack directly. Such is far from the case. There is, on the other hand, a lack of appreciation of the large number who indirectly participate in the distribution of road funds. Direct labor costs on the simplest grading work may run above 80 per cent of the total expended, but for the types of road which are being built to meet the actual needs of traffic the average payment to labor directly on the work would be between 20 and 30 per cent. This does not, however, represent the value of the road dollar to labor.

Showing newly constructed Forest highway at Decker Springs, with bridge over South Platte River, forming a part of the network of roads in the Pike National Forest. Photo by U. S. Bureau of Public Roads.

While it is exceedingly difficult to analyze, because of the wide variations in types of work and all other conditions, there is a very general agreement among highway executives that upwards of 85 per cent of the road dollar goes eventually for labor and personnel equipment. The road dollar spreads back through stone quarries, sand and gravel plants, cement factories, petroleum fields and refineries, mines, engages rail and water transport facilities, and keeps the wheels of equipment and accessory factories turning. Labor and personnel employment in all of these receives a part of the road dollar.

There are no intrinsically valuable raw materials which go into road work. The labor, manufacturing processes and transportation which determine the price of road materials, are largely made up of employment costs. This is particularly true at this time because road materials are selling at extremely low prices. There are highly competitive conditions, surplus supplies, and sacrifice of profits, to keep production going at reduced rates. On the basis of 80 to 85 per cent of the road dollar going eventually to labor, with 20 to 30 per cent expended as a general average for labor directly on the work, for each individual so employed, the total expenditure provides additional indirect employment equivalent to two other persons. This does not mean only two men actually employed indirectly, since production of materials and equipment and transportation may involve part time of many persons, but rather employment equivalent to full time for two other persons.

The July employment on the state and the Federal Aid road programs, of 386,000 men directly, means a total of employment equivalent to around 1,158,000 people. May, June, July and August held reasonably near this amount of employment. For the remaining months there will necessarily be a considerable drop.

With the funds now in prospect it will not be possible to maintain the accelerated rate of the state highway work for the coming year which has prevailed for the past two years. But with a spirit to meet the situation, there is assurance now of a large, if not a maximum, employment program for the coming year.

It is time to make plans for the coming year in the light of the experience particularly of the two years behind us. Many kinds of proposals are being submitted to the Bureau by the states to write restrictive conditions relating to employment into the contracts for Federal Aid projects. In the effort to offer maximum employment, but at the same time to protect labor

*None of this discussion includes any local road employment or expenditure by counties, townships or municipalities.

rom exploitation, some fundamenal restrictions appear necessary, nd the Bureau will accept certain olicies which are sincerely proosed to increase and to protect abor.

Under the immediately existing onditions, expediting the compleion of projects is not so much the bjective as providing the maximum pportunity possible to absorb laor.

Private industry, as a means for creasing the number given partial mployment, is restricting hours per ay and days per week. By staggering employment more individuals receive at least a living wage.

Road work does not offer quite e same possibilities, particularly the vicinity of the larger cities, here unemployment is the most ute, but some such plan can be orked out, and it would be enely feasible to let more projects d restrict the hours per day and e days per week, such as an eighthur day and a five-day week. This ould carry the work over a longer riod for the same total expenditre.

The Bureau will therefore approve stipulations along the following lines:

First, the fixing of a fair minimum ge scale for unskilled labor only; t this should be written into the ders and contracts of the conactors. There must be a recognion on the part of the states of the r differentials existing between states and between sections of same state, and no attempt made increase a fair rate for this type labor under normal conditions. e rates of pay during former ars have been reported so that we ow from existing records actual ts as to wage scales wherever deral Aid projects have been ilt.

Second, an acceptable restriction give preference to local unskilled or and to residents of the state, ailability and other conditions be equal. This does not apply to skilled mechanics and equipnt operators who form the nuus of the contractor's organizan.

Third, if legal in the state, the reau will participate with the te on a day labor or force account is on small projects only where ch projects can be used as the ans to provide quick local emyment with reasonable economy, d which do not require the estabment of camps or too long transportation to the work. This does not mean in any way a breakdown of the contract system or apply to more than a very limited percentage of the federal road funds available. It is to be strictly construed as a possible emergency method of relieving acute local unemployment conditions in the winter and spring months. On such projects Federal Aid allowances will not be made for rentals of machinery or state-owned equipment.

Fourth, a restriction as to hours per day and days per week that unskilled labor may be continuously employed on any project, that is a provision or policy of intermittent employment.

Fifth, the Bureau will approve the reopening of projects completed if Federal Aid balance is available within the maximum mileage allowance to place large sized drain pipe in roadside ditches which are eroding, the trenches to be back-filled with porous materials and the ditches obliterated to the greatest extent possible, and other betterments which are advisable construction and improve the safety of the road.

Sixth, a restriction which the Bureau will not accept is any disbarment of a contractor from the award of a contract because he is a nonresident of the state, provided he is the lowest responsible bidder. The Federal Government consistently maintains the principle of the award of contracts to the lowest responsible bidder, and this is the only defensible public policy. The Bureau is an exponent of the prequalification of bidders, and attaches major importance to the term "responsible."

Seventh, the Bureau will not accept restriction or limitation to materials, etc., produced only within the state.

As a further move on the part of the Federal Government, I am authorized to state that the allocation of the 1933 funds to the states will be made as of October 15.

While the employment situation must now be given first consideration in the road improvement program, there are important phases which must be given concurrent attention. The construction programs are in general being accomplished with constantly higher standards both of design and construction. Researches extending to sub-soils, the proportioning of materials, efficiency and rates of production, are the methods by which resultant higher quality and lowered costs have been made possible.

During the period since its inception in 1916, Federal Aid funds have been directed to the extension of highway facilities. Road mileage added by types is as follows:

Federal Aid Roads Improved by Types as of June 30, 1931

Type	Mileage
Graded and drained	11,248
Sand-clay (treated and untreated)	7,274
Gravel (treated and untreated)	29,256
Macadam (treated and untreated)	2,345
Low-cost bituminous mix	1,574
Bituminous macadam	4,196
Bituminous concrete	3,427
Portland cement concrete	28,010
Block	993
Bridges and approaches	390
Total	88,713

More than 51,000 out of 88,000 miles have been of the pioneer type, carrying surfacings of lower type than bituminous macadam.

The rapid extension of surfaced highways available throughout the year, and the increased motor vehicles in operation, have produced a constantly growing income by way of gasoline and motor vehicle license taxes from the use of the roads themselves.

Registration Motor Vehicles

Type	1921	1925	1930
Passenger cars and taxis*	9,473,391	17,457,638	22,950,340
Busses†	10,000	53,000	92,500
Trucks	979,904	2,441,709	3,480,939
	10,463,295	19,952,347	26,523,779

The growth of the income is shown by the following:

	1921	1925	1930
Gas Tax	$ 5,302,260	$146,028,940	$493,865,117
Auto License	122,478,654	161,574,729	275,406,545
Chauffeur License		6,994,219	17,680,898
	$127,780,914	$314,597,888	$786,952,560

*Bureau figures for passenger cars, taxis and busses with number of busses, as reported by Bus Facts, deducted.
†As reported by Bus Facts.

There are six states which have completed to a satisfactory point the original 7 per cent Federal Aid system, and others will soon qualify. The states, in addition to work on a constantly enlarging state system, are in many instances contributing to the building of state aid or local roads, either through funds controlled by the state highway depart-

ment, or by funds allocated directly to the county from the road user income. Only in the policy of completion of the roads in the order of their traffic importance lies the certainty of help in building the local or farm roads.

From recent studies of the road income in Wisconsin, which has important manufacturing as well as large agricultural interests, it is evident that a major contribution is being made to the building of rural roads by the residents of cities and towns through the use of gas taxes. This condition will without doubt be found to exist in all of the states, and it will soon mean a division of road user income to streets within municipalities where this has not already taken place. This division is not to be taken as an unfair or an unwise diversion if provision is made for the control of the fund under direction or supervision of the state highway department on the streets of general traffic use or which provide additional facilities for the relief of traffic congestion within the municipal or metropolitan areas.

For nearly 10 years road building has been a major public improvement activity, made necessary but also made possible largely by the increase in the utilization of motor vehicles. During this period the number of motor vehicles has not only increased from ten and one-half to twenty-six and one-half millions, but the use of the individual vehicle has materially increased. In the past five years the apparent consumption of gasoline per year per vehicle has increased from 444 gallons to 556 gallons. No attempt is made to evaluate this in terms of increased mileage, since probably the consumption of gasoline by the individual vehicles has tended to increase because of design, while at the same time the consumption has tended to decrease because of the improved road conditions.

Such a tremendous increase in the number of all types of motor vehicles which have proved themselves so adaptable to an extremely wide range of utilization could not but produce tremendous impacts on our social and economic life. Within the past five years the ratio of trucks and busses to total cars in operation has changed but little, and there is no evidence of an abnormal growth of either of these types. The volume of truck traffic in the East, where transport surveys are available, ranges around 10 per cent, while in the western states' survey it increased to 16 per cent. This is to be expected because of various apparent conditions.

Almost the whole of our knowledge of the effect of motor vehicles upon improved roads as structures has come within the 10-year period, and perhaps the most important development so far as the movement of heavier vehicles is concerned is the sudden change to the use of high-pressure pneumatic and balloon tires by a large percentage of the heavier vehicles. The effect of this change upon the rate of depreciation and maintenance costs of our highways in the future will be very large. The development of these pneumatic tires capable of giving reliable service under heavy loads is a development of which the tire manufacturers of the country well may be proud. This development is changing the designs of the heavier vehicles so that we come now to the point where we can well agree upon legally permissible wheel loads which will be of universal application. The same uniformity can be applied to other regulations of vehicle operation, thus stabilizing and perfecting our use of motor transportation facilities.

Within the year researches ought to be concluded or brought to a point where they supply the still missing information sufficient to place the regulation of the heavier vehicles on a sound basis with relation to road design, construction and maintenance.

Contrary to the popular impression, the concentrated loadings of motor vehicles which may legally be used on our highways, are not increased over the loads which were provided for prior to the advent of a single motor truck or bus. The specifications for the early macadam roads of this country generally provided that a 10 or 15-ton road roller, with two-thirds of the weight on the rear axle, should be used.

The report of the Massachusetts highway commission for 1893 carries wheel loads per inch width of tire as high as 1,800 pounds on wagons in actual use.

The narrow tired farm wagons of the agricultural districts and the wider tired but heavier vehicles in common use in the cities provided a maximum destructive effect on road surfaces. The problem of the engineer until the advent of the pneumatic tire had been to find a surface that would stand up under the constant grinding of steel-tired, heavily loaded vehicles. The rounded granite cobbles of many city streets still bear mute testimony to the tremendously destructive effect of this traffic. We have nothing even approaching the destructive effect of such traffic today on road surfaces.

Traction tests in Iowa in 1905 required as high as 400 to 500 pounds pull per ton to move a narrow-tired farm wagon on earth roads in the spring. This means that the tire was literally being pulled through, rather than on, the surface of the road.

Even the use of the solid rubber tire should be discontinued except for special conditions where the pneumatic will not serve.

But this is the engineering side of the problem. The obtaining of uniform regulations as to use may be more difficult since there are two important classes of interests to satisfy; first, the public, which is concerned with its own use of the passenger automobile, and which comprises 90 per cent of the traffic, and second, the utility organizations which supply other forms of transportation, particularly the railroads.

From a few of the railroads there have been vigorous claims of unfair competition of the commercial motor vehicle. By and large, the regulation of the use of the larger motor vehicles on the highway is going to be determined by the attitude of the passenger automobile using public although such regulation may be to an extent promoted and in some details determined by the other interests. We must secure a harmony of operation between the private automobile and the public and private bus or truck. The controversy over common carrier and particularly interstate common carrier movements, whether of passengers or commodities, is a small and incidental part of the whole highway transport utilization, and while regulation may restrict the type of movement, this does not and probably will not remove the traffic itself from the highways. The thought should be given first consideration, in any move to suppress, severely restrict or make unnecessarily expensive the operation of the common carrier, bus or truck, that it is the small shipper and the man or family financially unable to operate individual cars or trucks that must suffer the loss in highway transportation. Thus appears again the necessity for the coordination of transportation facilities, about which much has alrea

(Continued on page 12)

CURING CONCRETE PAVEMENTS

By R. W. CRUM

Director, Highway Research Board

In these days the construction of concrete pavement moves ahead so rapidly, and so much more is put down in a day or a week than was the case just a short time ago, that the problem of securing adequate curing of the concrete has taken on new aspects. Although most highway engineers still think that the most favorable curing condition exists when the slab is kept damp during the curing period by means of a wet covering of earth, sand, hay, straw, etc., sometimes practical difficulties arise that make other methods appear attractive. Difficulty in providing an adequate water supply for keeping some two miles of cover properly wet; difficulty in securing thorough compliance with the specifications so far behind the crew; and lack of opportunity to inspect the finished work, are some of the factors that have opened the way to the use of other methods.

For two years a special committee of the Highway Research Board has been studying "Curing" and gathering facts concerning the more extensively used methods. A review of the available data is presented in the progress report of this committee in the Tenth Annual Proceedings of the board.

Although research studies have not yet progressed to a point where definite standards of comparison for different curing methods can be set up, considerable information is available on strength, surfact condition and volume change, all of which give some indication of curing qualities.

Surface applications of calcium chloride in regions where the air temperature and humidity are such that the salt will readily dissolve have been found to produce concrete 90 per cent or more as strong as concrete cured with a wet cover, with no greater changes in volume. This method has not been found to be a primary cause of surface scaling in appreciable amounts. Extensive surveys show that the percentage of total area scaled under either wet earth or calcium chloride surface curing is very small. If conditions conducive to scaling are present the scale is likely to occur under either method but will probably be somewhat more extensive on the calcium chloride cured work.

Concrete cured with bituminous coatings, in general, showed strength 90 per cent or more of that of wet cured concrete. Volume changes as evidenced by temperature ranges, direct measurement and crack surveys are greater, indicating that more frequent shrinkage cracks are to be expected unless prevented by proper joint spacing. Bituminous cured pavements in regions where fine sand and subgrades are a distinctive feature have been examined which showed uncracked slab lengths as great or greater than those on pavements cured with wet earth. Coating the bituminous covered surface as soon as possible with some light colored material such as whitewash appears to decrease the volume changes.

Conflicting evidence regarding the strength of concrete cured with calcium chloride admixture, or surface application of sodium silicate makes the acquisition of further information concerning the factors that influence the efficiency of these methods as respects strength necessary before definite recommendations can be made.

The volume changes occurring with the use of sodium silicate as a curing agent were not great enough to make this factor a matter of importance in deciding upon its use.

SAFETY ON THE ROAD

It is gratifying that the automobile associations and clubs are devoting much attention to an investigation of the basic principles of safety and responsibility in the operation of motor cars. The automobile is still in comparative infancy, from the standpoint of traffic safety, and as in the case of the railroad and other mechanical inventions, is at times destructive of life and property in this preliminary stage. In the case of the automobile, as with the railroad and factory machinery, progress will be made not by prohibiting the inventions, but by minimizing as far as possible their injurious consequences.

After years of improvement, railroad accidents were brought down to small percentages. It will be the same with motor vehicles.

Prevention of accidents and the solution of the traffic problems have many strictly engineering features. But the human and regulatory aspects are just as important. Gradually the law must close down not only upon the reckless, but upon the financially irresponsible driver.

One fact emerges crystal-clear: the impelling necessity for substantially uniform regulations in these matters. No longer is automobile traffic intrastate; it moves across state boundaries at will. Yet traffic laws treat the problem as strictly intrastate.

CARBON MONOXIDE TIME

With the cool weather comes the danger of fatalities with the deadly exhaust from the automobile motor as the cause.

It is so easy to start up the old motor and tune it up while in the garage with the doors closed, especially on a cold day. But this should not be done. For carbon monoxide fumes work quickly, silently and come unheralded. After a certain amount is inhaled one becomes drowsy and before open air can be reached death in most instances occurs.

Don't start the motor and let it run long in a closed garage. And be careful when driving with the windows closed, as cases have been known where passengers in a tightly closed car have been overcome with gases from the motor while on the road. If the atmosphere is right, enough gas fumes may seep in and do their deadly work before anyone is aware of the danger.

WISCONSIN TO ELIMINATE 90 GRADE CROSSINGS

The Wisconsin highway department since the first of the year has let contracts or called for bids on the construction of 43 railroad overhead crossings. The program of grade crossing elimination has been speeded up so that before the end of the year it is expected that contracts will be let for 90 overhead crossings, originally slated for construction over a three-year period. Part of the cost is being paid by the railroads and part from a portion of the gas tax set aside for this purpose. The Wisconsin gas tax was increased from 2 to 4 cents this spring.

In addition to the determination to remove grade crossings because of the serious accident hazard involved, the employment furnished to hundreds of men was an argument for speeding up the program.

And there are some folks over in the Durango country who are mighty proud of the new road constructed over Yellow Jacket Hill. This was another "sink hole" eliminated from the state's road system this past summer with Federal Aid co-operation.

NEWS OF THE MONTH

Traffic is now moving over the new grade from Denver to Limon on U. S. Highway 40. Seventy miles of this road east of Denver is now graded and graveled to standard Federal Aid specifications.

H. C. Lallier Const. Co., Denver contractors, were low bidders on five and one-half miles of gravel surfacing located south of Steamboat Springs on U. S. Highway No. 40 in Routt County. The bids were opened on November 19th. Lallier's bid was $99,364.60. Eight other contractors bid on the job.

On November 17th the State Highway Department opened bids on two miles of gravel surfacing located south of South Fork in Mineral County. Grant Shields, Denver contractor, was low bidder with $92,279. The largest item in the project was 109,000 cu. yards of unclassified excavation. Eight other contractors made bids.

Engineers of the highway department have practically completed surveys for a new road through Clear Creek canon from Golden to Idaho Springs. This is a Federal Aid project planned for some future date. It will eliminate Lookout Mountain and Floyd Hill.

Plans are being considered for the oil surfacing of the Pueblo-Beulah highway in Pueblo County. If plans are approved the work will be done at state-county expense.

A preliminary draft of the 1932 highway budget has been submitted to Gov. W. H. Adams. Final action on the budget will be delayed until Congress acts upon a bill calling for $60,000,000 emergency funds to be allotted to the states for road work.

Two miles of highway was blasted through virgin road of a mountainside along Whiskey Creek in Las Animas County the past summer. Commissioner I. B. Rogers was in charge of the work. When finally completed it is said this road will enjoy the distinction of being one of the finest scenic routes in the state. Ultimately it will connect Trinidad with the San Luis Valley.

Colorado has 2,000 miles of roadway on its Federal Aid system uncompleted. At the end of this season 1,400 miles have been paved, graveled and graded.

State highway maintenance forces will endeavor to keep Tennessee, Berthoud and Gore passes open this winter. Heavy equipment has been provided for this purpose.

Resident Engineer H. T. Reno has been engaged for several weeks on plans and surveys for a new road between Montrose and Ouray. One of the improvements planned is the elimination of the Kelley's Trail. Ask any motorist who has traveled this route in wet weather about Kelley's Trail.

Also, attention might be called to the marvelous piece of highway construction which has been completed on Wolf Creek Pass, above South Fork. Yes, the thrills of the old road have been eliminated by the construction of a wide, smooth roadway on easy grade and alignment.

State highway maintenance forces had their first taste of winter snow the week of November 23, when several of the main routes of the state were closed to traffic for one or two days in some places. John P. Donovan, maintenance engineer, was i charge of the field forces engage in clearing snow from the roads i the storm area. The heaviest snov encountered was between Salida an Canon City.

The district meeting of the Fift District Commissioners Highwa Assn. was held in Castle Rock o November 14th. Highway Enginee C. D. Vail and Robt. H. Higgins maintenance head of the highwa department, addressed the meetin

Hamilton & Gleason, contractors have a crew of fifty men working o the grading project through Ut Pass, in El Paso County. Tw steam shovels are in use on the jo

Governor W. H. Adams ha named twelve delegates to represen Colorado at the annual conventio of the American Road Builders As sociation in Detroit, January 11 t 15. Those named are: Charles D Vail, state highway engineer; Wi liam Whalen of Gunnison; Fre Pierce, Durango; I. F. Haines Rocky Ford; Sam Chapman, Ca han; William A. Carlson, Greeley Lynn Kennedy, Rifle; Andrew Lind strom, Dillon; W. I. Gifford, Hes perus; John R. Browne, Edgewater Fred O. Pearce, Brighton, and He man Empirius of Alamosa.

A link of the Decker Springs-Buffalo highway recently completed by the U. S. Bureau of Public Roads in the Pike National Forest. This road is heavily traveled by tourists and sportsmen during the summer months.

Craig Bradford Dies Suddenly

BY EDITH SAMPSON

CRAIG BRADFORD has crossed the range, he has ridden over the Great Divide. Probably no man in Colorado was more truly a lover of the outdoors and more a part of the mountain and.

For many years city superintendent of Denver's mountain parks, and, for the past few months, a member of the staff of the State Highway Department, Mr. Bradford traveled more than fifty thousand miles a year over the highways and byways of the state.

Fair days saw him skimming over the road towards the rising sun, storms found him at midnight fighting snow blockades shoulder to shoulder with his men, and forest fires brought him to the front of the fight.

Always cheerful and with a twinkle in his eye, his popularity with the mountain folk was legend. "Hello, Craig!" men would cry, as he waved a hand in passing or drew up beside the road, while someone poured a tale of trouble into his sympathetic ear. His was a listening soul, for, unimpressed by his own importance, he always had time for the other fellow.

Like all lovers of the out-of-doors, he was a simple man, but simple like a mountain, with the grandeur of one who has more to give than to take. He had, too, the pure clarity of the mountain pools, washed clean of deceit and duplicity.

Riding beside him on one of those daily mountain trips, you were sure to hear him say: "I never get tired of this trip. I love it. And the strange thing is, though I go over this trip day after day, it's never twice the same!"

At the end of a long day in the open he came back home, over in Rifle, sighed and said: "It's been a great day. I love it here—think perhaps I'll spend the rest of my life right here in this part of the state."

And there he watched the setting sun, and not long after it had disappeared behind the wall of mountains Craig Bradford followed it—West.

Mr. Bradford passed away on November 11th, while engaged in a construction project at Rifle. His son, Edward T. Bradford, 22 years old, lost a race with death to his father's side. After receiving a message from his mother that the elder Bradford was ill, he started for Rifle from Denver at 1 A. M., less than an hour before the death.

Starting his engineering service with the city of Denver as a chain boy on a surveying gang, Mr . Bradford became a veteran employe of that city. He worked his way up to a position in the city engineer's office, which he held until he was transferred to the park department.

He had been in charge of the mountain parks nine years and was responsible for many of the improvements which brought this system into national prominence.

Mr. Bradford was born in New York. The family moved to Leadville when he was a boy, and in 1893 came to Denver. He received most of his education in the Denver public schools. His father, Edward T. Bradford, died many years ago.

His mother was elected several times as head of the state school department and is active in educational circles. She lives at 5069 Newton Street.

Current *Phases of Highway* Building

(Continued from page 8)

appeared, and in which certain movements are taking place, but which needs to be stimulated by official and legal action.

There has already developed friction over the matter of highway vehicle movements between states. At present in 9 states full reciprocity is granted for all vehicles, in 20 for all except those operated for hire, in 17 except those operated for hire and privately operated commercial vehicles, and in 3 except those carrying passengers for hire. The tendency against full reciprocity for the movement of vehicles operating interstate is wrong in principle. Given uniformity of regulation as to the sizes, weights, financial responsibility, and all other details which would go to make up a specification for a desirable public operation, there ought to be full reciprocity granted between states. No objection could be raised to the division of the fees imposed in payment for doing business on the public highways between states affected. This would be fair. But more serious burdens or restrictions ought not be imposed on either privately or publicly owned vehicles because the freedom of interstate commerce and the proper regulation is of supreme economic importance.

One of the principal objectives of the Federal Highway Act is to develop continuity of communication over the roads between the states, and any unnecessarily restrictive or retaliatory measures would tend to break down the very interest which is sought to be served by the federal contribution.

Colorado's delegation in Congress has been asked to strive for an increased federal road building appropriation. The need for an emergency federal appropriation has been placed before the President's unemployment committee by Governor Adams.

The U. S. Bureau of Public Roads experienced its greatest year of activity in this region, according to A. E. Palen, district engineer. Expenditures of the bureau reached four million dollars and more than 2,000 persons were given employment. The largest projects were the construction of the Trail Ridge road in Rocky Mountain National Park and the rebuilding of the eastern entrance road to Yellowstone National Park. Thirty-three construction jobs were completed.

Five miles of Federal Aid constructed pavement west of Las Animas, on U. S. Highway No. 50, was opened to travel on November 18th

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Driscoll Const. Co. of Pueblo completed four paving projects this past season. These included one west of Rocky Ford, another west of Las Animas and two within the city limits of Pueblo.

The road between Gypsum and Cattle Creek has been designated as a state highway. At times this road has been used as a detour when the main highway through Glenwood canon has been blocked from snow and rock slides.

A plan whereby $50,000,000 worth of road construction can be carried out in Colorado during the next five years was recently submitted to the State Highway Advisory Board. The money would be borrowed from the U. S. Government and repaid from future federal aid allotments.

PLANS FINISHED

Proj. No.	Location	Type	Length
149-E	West of Strasburg	Gravel Surf. & Underpass	4 mi.
150-D, F. L. H. P. No. 1	South of Elk Springs	Gravel Surfacing	4 mi.
216-B	West of Holly	Gravel Surfacing	10 mi.
248-AR&BR	North of Salida	Gravel Surfacing	14 mi.
288-AR	Northeast of Brush	Paving & Overhead R.R. Crossing	3 mi.

STATUS OF FEDERAL AID PROJECTS UNDER CONTRACT

Proj. No.	Location	Length	Type	Contractor	Approx. Cost	Per Cent Complete	Proj. No.
2-R11	South of Trinidad	3.130 mi.	Paving	J. H. Miller & Co.	$ 89,063.70	89	2-R11
2-R12	Bet. Aguilar & Walsenburg	4.503 mi.	Paving	Orman Const. Co.	192,443.50	100	2-R12
57-R4 & 168-BCR	West of Lamar	4.801 mi.	Paving	Pueblo Bridge & Const. Co.	130,690.50	71	57-R4 & 168-BCR
68-B	South of Saguache	3.290 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	74,428.75	30	68-B
71-C	Bet. Durango and Mancos	4.965 mi.	Gravel Surfacing	J. Finger & Son	86,146.75	88	71-C
79-B	East of Colorado Springs	12.248 mi.	Gravel Surfacing	Chas. B. Owen	143,370.05	81	79-B
91-AR	East of Trinidad	5.613 mi.	Oil Processed	Pople Bros. Const. Co.	77,655.05	96	91-AR
134-AR&C	West of Burlington	11.174 mi.	Oil Processed Surf.	H. C. Lallier Const. Co.	111,217.20	100	134-AR&
134-E	East of Limon	5.052 mi.	Gravel Surfacing	Bedford & Woodman, Inc.	31,426.40	44	134-E
144-G	Bet. Forks & Colo.-Wyo. Line	13.204 mi.	Gravel Surfacing	Morrison-Knudsen Co.	248,078.00	97	144-G
145-C	East of Rifle	14.901 mi.	Grading & Grav.	A. R. Mackey	271,703.80	32	145-C
149-F	Bet. Strasburg and Peoria	10.745 mi.	Gravel Surfacing	H. C. Lallier C. & E. Co.	198,660.00	88	149-F
149-H	East of Deertrail	18.565 mi.	Gravel Surfacing	Hamilton & Gleason	240,319.15	80	149-H
150-C	West of Craig	6.893 mi.	Gravel Surfacing	J. Fred Roberts & Sons	120,139.05	42	150-C
151-A	Bet. Granby and Tabernash	6.663 mi.	Gravel Surfaced	J. H. Miller & Co.	76,909.90	90	151-A
151-B	Bet. Fraser and Granby	3.925 mi.	Grading & Surfacing	Utah Construction Co.	63,954.80	88	151-B
158-B	Bet. Hartsel & Florissant	10.319 mi.	Gravel Surfacing	J. H. Miller & Co.	133,380.70	60	158-B
181-A	In Idaho Springs	1.876 mi.	Paving	J. Fred Roberts & Sons	93,749.55	20	181-A
189-C	West of Hayden to County Line	7.534 mi.	Gravel Surfacing	F. L. Hoffman	115,356.94	93	189-C
211-B	South of Craig	2.725 mi.	Gravel Surfacing	Utah Const. Co.	93,720.40	65	211-B
242-D	Bet. Mack & Colo.-Utah Line	9.883 mi.	Gravel Surfacing	Hinman Bros. Const. Co.	124,552.36	94	242-D
242-E	West of Fruita	4.243 mi.	Gravel Surfacing	Wallace Const. Co.	54,907.53	100	242-E
245-AR	West of Las Animas	4.544 mi.	Grading & Oiling	Driscoll Const. Co.	94,398.85	87	245-AR
248-C	Between Buena Vista and Salida	3.944 mi.	Gravel Surfacing	Pantle Bros.	48,820.50	21	248 C
251-D	East of Boulder	0.284 mi.	Paving	Colliler-Latimer	25,598.50	100	251-D
258-I	Bet. Montrose & Gunnison	2.481 mi.	Gravel Surfaced	J. H. Miller	50,272.60	79	258-I
258-I2	East of Montrose	Concrete Box Culvert		Hinman Bros. Const. Co.	8,455.50	88	258-I2
258-J	West of Cerro Summit	5.796 mi.	Grading and Gravel	Lumsden Hall Const. Co.	107,027.30	84	258-J
259-B	Bet. Gunnison and Parlin	9.587 mi.	Gravel Surfacing	Cole Bros.	184,503.00	54	259-B
263-C	East La Veta Pass	5 mi.	Gravel Surfacing	State Forces		10	263-C
265-E	West Bayfield	2.950 mi.	Gravel Surfacing	J. H. Miller & Co.	97,839.06	76	265-E
270-E	Bet. Del Norte & Monte Vista	8.663 mi.	Gravel Surfacing	Mountain States Const. Co.	102,199.10	62	270-E
278-AR&C	East of Cheyenne Wells	8.409 mi.	Oil Gravel Surfacing	W. F. Pigg & Son, Inc.	116,829.21	100	278-AR&
278-D	West of Cheyenne Wells	21.913 mi.	Gravel Surfacing	A. R. Mackey	93,563.30	44	278-D
282-I	South of Craig	1.981 mi.	Gravel Surfaced	Utah Construction Co.	70,225.16	87	282-I
292-D	Bet. Wolcott and Avon	9.834 mi.	Graded Surface	Utah Const. Co.	159,143.40	74	292-D
295-E	South of Alamosa	7.627 mi.	Gravel Surfacing	Mountain States Const. Co.	71,049.56	84	295-E
296-AR&BR	South of Pueblo	4.372 mi.	Paving	New Mexico Const. Co.	154,509.00	23	296-AR-
296-D	South of Pueblo	8.348 mi.	Gravel Surfacing	Cole Bros.	84,815.10	99	296-D
298-D	Bet. Del Norte and Durango	4.100 mi.	Gravel Surfacing	H. C. Lallier	164,814.00	80	298-D
298-F	East of Bayfield	5 mi.	Gravel Surfacing	Wood, Morgan & Burnett C. Co	66,920.85	95	298-F

STATE HIGHWAY DEPARTMENT

Financial Statement November 30, 1931

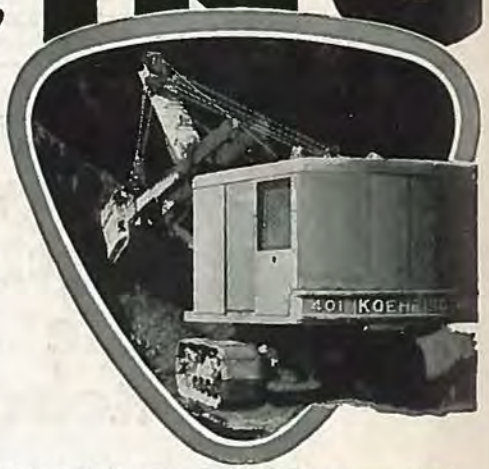
BALANCES		
State Treasurer	$ 885,930.15	
County Time Warrants	10,333.42	
Revolving Fund	9,500.00	
Total Balances		$ 905,763.57

RECEIPTS		
U. S. Government	$4,599,281.30	
Gas Tax	3,958,878.69	
Internal Improvement	43,800.00	
Highway Receipts	158,459.21	
Bus Licenses	19,188.96	
Total Receipts		8,779,608.16
Total Balances and Receipts		$9,685,371.73

DISBURSEMENTS		
Federal Aid Projects	$6,445,109.56	
State Projects	844,886.22	
Maintenance	1,197,834.06	
Maintenance Equipment	280,490.66	
Property and Equipment	41,098.05	
Surveys	32,179.37	
Traffic Signs and Census	19,285.31	
Administration	174,647.66	
Compensation Insurance	27,165.56	
Legislative Relief	2,067.35	
Total Disbursements		$9,064,763.80
BALANCES 11-30-31		
State Treasurer	$ 602,274.51	
County Time Warrants	8,833.42	
Revolving Fund	9,500.00	
Total Balances		620,607.93
Total Disbursements and Balances		$9,685,371.73
3% SPECIAL GAS TAX FUND		
Receipts		$ 263,823.21
Disbursements		125,424.19
Balance		$ 138,399.02

KOEHRING

Heavy Duty Performance!



DO you ever find yourself up against a fine grading job? Koehring Independent Crowd and Hoist enabled the 501 on the job shown above easily and quickly to shave the subgrade with an accurate four-inch slice.

All other kinds of tough jobs are Koehring jobs too. Deep excavations requiring a high lift with dipper beyond and above the end of boom, rock handling and quarry work, and regular highway grading—on all kinds of shovel work you meet the conclusive fact that the Koehring is, outstandingly, the *Heavy Duty* shovel!

—built for heavy duty operation and long, dependable service life.

Shovel Capacities—*Line-of-Plate struck measure. Shock absorber on boom. Quickly convertible to crane, dragline or pull shovel. Other dipper sizes on proportionate stick lengths.*

No. 301—¾ yd. dipper on 16 ft. stick, or 1 yd. (light) on 14 ft. stick. Wisconsin 75 H.P., 4 cylinder gasoline engine, 5¼" x 6½", 1060 R.P.M. (Mfr's. rating).

No. 401—1 yd. dipper on 16 ft. stick. Wisconsin 100 H.P., 6 cylinder gasoline engine, 5¼" x 6½", 1075 R.P.M. (Mfr's. rating). M.A.N. 94 H.P., 4 cylinder Diesel engine, 6" x 8" (Mfr's. rating).

No. 501—1¼ yd. dipper on 16 ft. stick. Wisconsin 100 H.P., 4 cylinder gasoline engine, 6"x7", 1075 R.P.M. (Mfr's. rating). M.A.N. 105 H.P., 4 cylinder Diesel engine, 6½" x 8¾" (Mfr's. rating).

No. 601—1½ yd. dipper on 16 ft. stick. Wisconsin 128 H.P., 6 cylinder gasoline engine, 6" x 7", 925 R.P.M. (Mfr's. rating). M.A.N. 115 H.P., 4 cylinder Diesel engine, 6½" x 8¾" (Mfr's. rating).

FROM whom you buy equipment is equally as important as what equipment you buy! National Equipment Corporation lines are handled only through representatives of financial responsibility, equipped and willing to maintain localized service to N. E. C. standards.

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