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PLANNING PERMITTING DESIGN SCIENCES

GEOLOGY AND SOILS
U.S. 287 BYPASS AT LAMAR

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GEOLOGY AND SOILS

The geology and soils present along the proposed US 287 Bypass corridor at Lamar, Colorado are described in this section. The information presented is based on a literature review of the bypass study area (i.e., the proposed bypass corridor) including information obtained from the U.S. Geological Survey (USGS) and the Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS). The primary sources of information consisted of the Geologic Map of the Lamar Quadrangle, Colorado and Kansas (Sharps 1976) and the Soil Survey of Prowers County, Colorado (SCS 1966).

GEOLOGY

The geology of the bypass study area is illustrated in Figure 1. Starting at the north end of the bypass, the route passes through Broadway Alluvium (Qb), Holocene Alluvium (Qa), Eolian Sand (Qe), and Loess (Qlo). These geologic units consist primarily of unconsolidated sands and silts of recent deposition. The specific characteristics and extent of each geologic unit are summarized below.

Broadway Alluvium (2% of route) – Consists of unconsolidated Pleistocene gravel, sand, and silt in terraces north of the Arkansas River at an elevation of approximately 100 to 120 feet above the river.

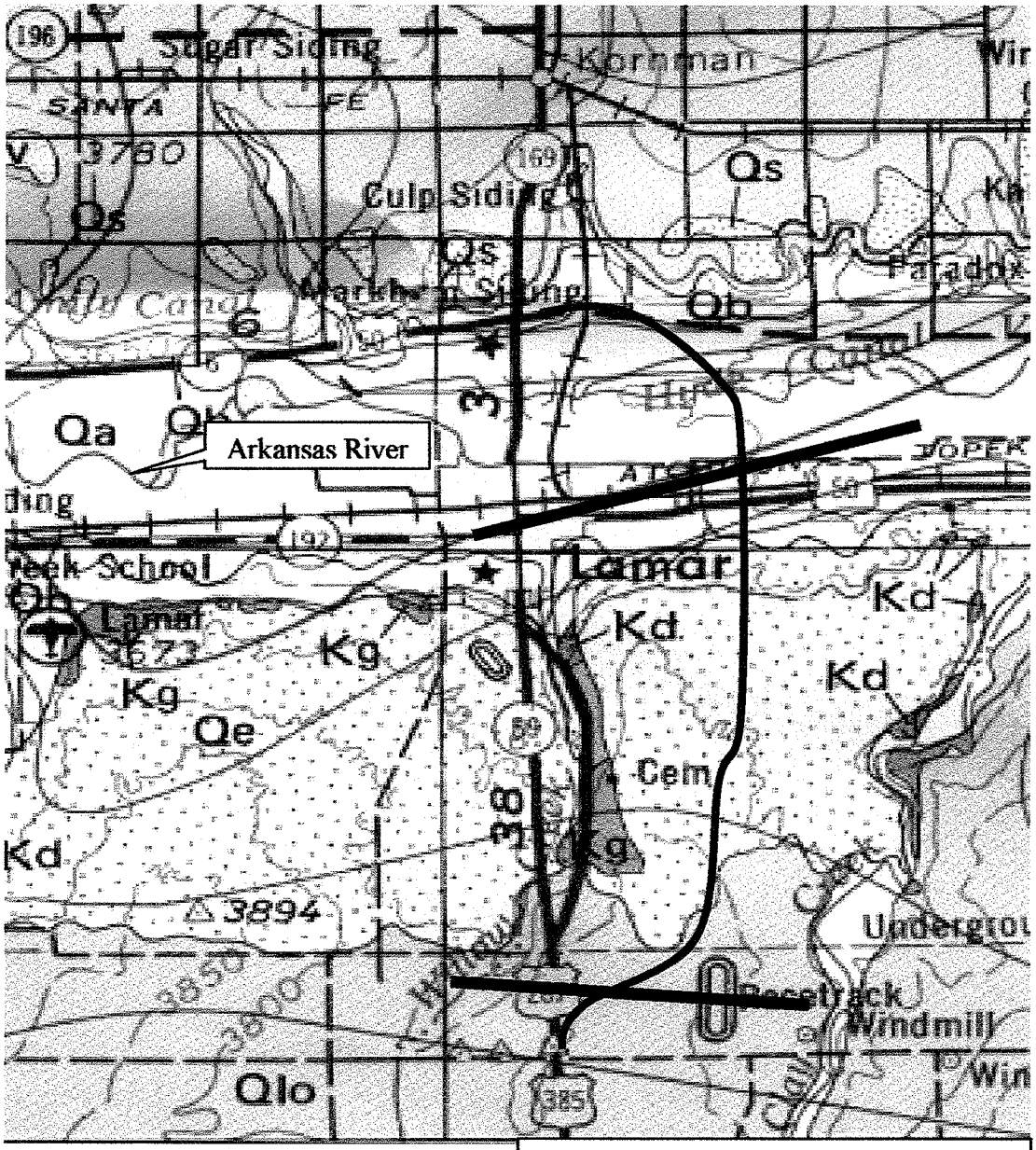
Alluvium (35% of route) – Consists of crossbedded, unconsolidated Holocene silt, sand, Holocene and gravel deposited by the Arkansas River. The material is dark-yellowish-gray to yellowish-tan in color. This geologic unit extends from the river channel to approximately 100 feet in elevation above the channel on both the north and south sides of the river.

Eolian Sand (39% of route) – Consists of Holocene and Pleistocene quartz sands deposited by wind. The sand is yellowish brown and ranges from very fine to medium grained with the finer silt fractions typically found at the surface. This geologic unit extends from an elevation of approximately 3,600 feet (i.e., 100 feet above the river) to between 3,700 and 3,750 feet on the south side of the Arkansas River.

Loess (24% of route) – Consists of unindurated Holocene and Pleistocene silt, sandy silt, and very fine sand. The surface expression of this geologic unit starts at an elevation of 3,700 to 3,750 feet and extends beyond the southern limit of the bypass study area. The suitability of those unconsolidated geolgic deposits for use as road base or construction fill material is described in the geotechnical engineers report.

Two faults are mapped in the project area. One is mapped in the area of Qa; it follows U.S. 50 (approximately) through project area with the downthrown side to the north (Voegeli and Hersey 1965). The other is aligned east to west, just north (1.0 mi) of the southern junction of the by-pass and U.S. 287. The downthrown side is to the north.

Figure 1
Geology of the Proposed US 287 Lamar Bypass



PROPOSED US 287 LAMAR BYPASS

FAULT LINE

Scale: 1" = 1.5 miles

Source map:
Geologic Map of the Lamar Quadrangle, Colorado and Kansas (Sharps 1976)

Qa	**ALLUVIUM (HOLOCENE)** – Silt, sand, and gravel of modern flood plains and streams, dark-yellowish-gray to yellowish-tan, crossbedded, unconsolidated. Equivalent to Piney Creek Alluvium and post-Piney Creek alluvium
Qb	**BROADWAY ALLUVIUM (PLEISTOCENE)** – Gravel, sand, and silt; in terraces which are 20-50 feet (6-15 m) above the Arkansas River in western part of quadrangle and 15-40 feet (4-12 m) above in eastern part. Pebbles have a very thin caliche coating. Unconsolidated
Qe	**EOLIAN SAND (HOLOCENE AND PLEISTOCENE)** – Yellowish-brown very fine to medium silty quartz sand; generally more silty towards top
Qlo	**LOESS (HOLOCENE AND PLEISTOCENE)** – Brown silt, sandy silt, and very fine sand. Mostly equivalent to Peoria Loess (Pleistocene) of Kansas and Nebraska but includes some Holocene windblown silt; may in places include equivalents of Bignell Loess (Holocene and Pleistocene) and Loveland Loess (Pleistocene) of Kansas and Nebraska

HYDROGEOLOGY

The hydrogeology in the project area is related to climate, geology and land use conditions in and near the project area. The mean annual precipitation in the project area is about 14 inches.

There are four principal aquifers in Powers County; only the Arkansas River aquifer occurs in the project area. The alluvium of the Arkansas River and its tributaries are the primary source of ground water in the project area. The alluvium of the Arkansas River is also the chief source of water for large-capacity irrigation wells and for many stock and a few domestic wells (Voegeli and Hersey 1965). The ground water reservoirs in Powers County are recharged by precipitation; by seepage from intermittent streams, canals and the Arkansas River; by spreading of irrigation water; and by underflow from adjacent areas. The Arkansas River aquifer discharges into adjacent areas; by evaporation and transpiration in areas of a shallow ground water table; by seepage into streams and canals; and by wells.

The coefficients of permeability in the Arkansas River alluvium and terrace deposits in the project area range from 3,000 to 10,000 gpd per ft. This wide range is attributed to the differences in size, shape and interconnections of the interstices.

The depth to groundwater in most of the Qa in the project area is less than 10 ft, however, in some of the Qa near Lamar depths range from 10-20 ft. The thickness of the aquifer is usually 20-40 ft. In the Qe and Qlo the water table is discontinuous, usually less than 20 ft thick, and usually at depths greater than 100ft (Voegeli and Hersey 1965).

SOILS

The soil survey maps of the area (SCS 1966), which characterizes soils to a depth of 5 feet, divide the study area into three soil associations that generally correspond with the alluvium, eolian sand, and loess units previously described in the geology section. The alluvium of the flood plains and lower terraces is referred to as the Las-Glendive Association. The wind-blown, sand deposits located south of the Arkansas River are described as the Tivoli-Vona Association, and the loess in the southern portion of the study area is described as the Wiley-Colby Association. The soil survey report (SCS 1966) provides the following information regarding these three soil associations:

- Las-Glendive Association – This association occupies the bottomlands and terraces in the Arkansas River Valley. The soils in this association consist of alluvial materials that vary extensively in texture, depth, and drainage characteristics. The Las Series forms the majority of the alluvium found in the bypass study area and is characterized by a high water table and high salinity. The Las soils have a clay loam surface layer and a clay loam to clay subsoil. Sandy loams are also present in the bypass corridor, especially within or next to the main river channel. The SCS (1966) rates these soils as a good source of roadfill, with

the exception of Las-Saline, which rates as poor because of the high amount of salt in the soil.

- Tivoli-Vona Association – This association, commonly referred to as the sandhills, consists of deep sandy soils deposited by the wind. The association occurs south of the Arkansas River in a wide belt that extends across the county. Most of the soils are sand and loamy sand, but some sandy loam occurs. The soils in this association are susceptible to wind erosion, especially in the dune areas, and are difficult to revegetate after being disturbed. The SCS (1966) rates these soils as a fair to good source of roadfill.

- Wiley-Colby Association – This association consists mostly of deep soils that developed in loess on the uplands. They are light-colored, medium-textured, and gently sloping soils. Both Wiley and Colby Series soils are present in the bypass corridor. The Wiley soils have a light-colored silt loam surface layer and a silty clay loam subsoil. The Colby soils have a light-colored silt loam surface layer and subsoil. The SCS (1966) rates these soils as a fair source of roadfill

POTENTIAL IMPACTS

The Arkansas River channel and the eolian sands located south of the river are the primary geologic features that will be impacted by the proposed bypass. Both short and long-term impacts are expected to occur in these areas.

Bridge construction is expected to cause a short-term increase in erosion in the vicinity of the Arkansas River. Short-term impacts may be mitigated by the implementation of erosion control practices such as installing silt fences, straw bales, diversion ditches, and sedimentation basins. Long-term erosion impacts may be reduced through the installation of erosion control blankets and revegetation of the disturbed areas. Some areas of high surface water flow may require rock armoring or similar protection to minimize erosion.

The configuration of the proposed bypass avoids the larger sand dunes present in the eolian sand geologic unit thereby reducing the magnitude of potential impacts associated with stabilizing and reclaiming the wind-blown sands. Short-term impacts from construction activities are expected to include wind and water erosion of disturbed areas. Erosion impacts can be reduced by limiting the total area disturbed at any one time, implementing standard erosion control measures such as temporary watering (wetting) of the surface during windy periods, and by planting a temporary vegetative cover consisting of fast-growing grasses as soon as the construction is completed.
Long-term impacts may include an elevated level of wind-blown sand in disturbed areas and in those areas located downwind of the larger sand dunes. Blowing sand is a safety concern for motor vehicles as visibility can be reduced substantially under high-wind conditions. Seeding of disturbed areas with aggressive, drought tolerant plant species such as sandreed (*Calamovilfa longifolia*), sand bluestem (*Andropogon hallii*), big bluestem (*Andropogon gerardii*) and little bluestem (*Schizachyrium scoparium*) can

reduce the level of wind erosion experienced over time. Problematic areas may require reseeding or temporary irrigation to establish adequate vegetative cover

REFERENCES

SCS. 1966. Soil Survey of Prowers County, Colorado. United States Department of Agriculture, SCS, in cooperation with the Colorado Agricultural Experiment Station. U.S. Government Printing Office. Washington, D.C. 20250.

Sharps, Joseph A. 1976. Geologic Map of the Lamar Quadrangle, Colorado and Kansas. USGS Miscellaneous Investigations Series Map I-944.

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