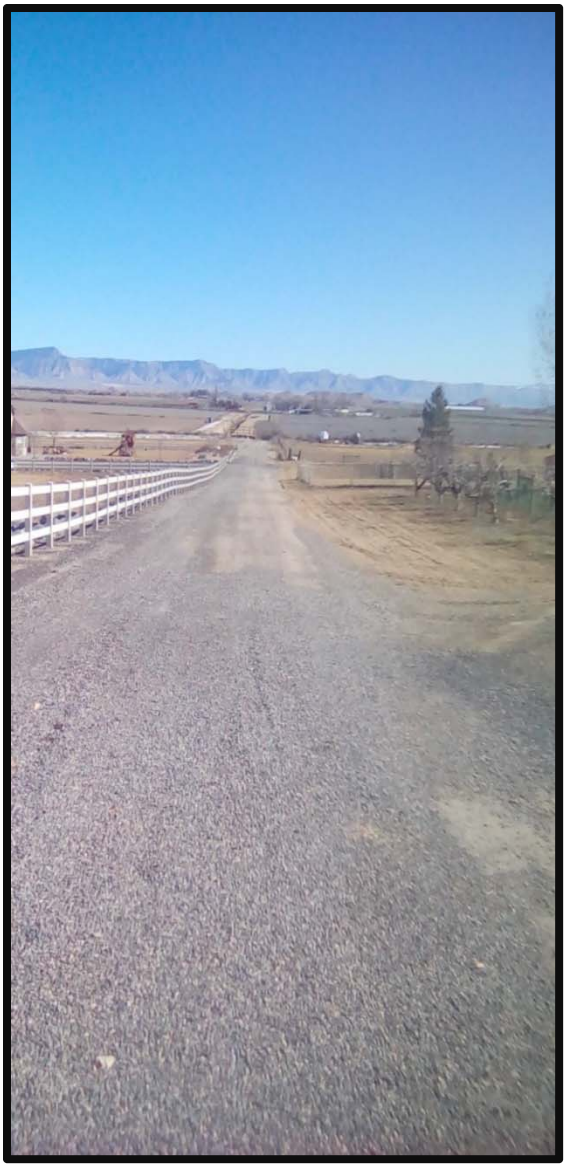
O Road Corridor Improvements Feasibility Analysis



Prepared for Mesa County

by

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Executive Summary

Background

Currently, there is not a continuous east-west corridor across the middle of the Grand Valley in Mesa County. O Road offers a good opportunity to provide this because it contains only two gaps, each a mile long. If the two gaps were connected, O Road would provide a continuous route from the community of Mack to 19 Road at the Book Cliffs, a distance of about nine miles.

In order to investigate the feasibility of this idea, Mesa County hired Amec Foster Wheeler to determine the environmental effects, permitting requirements, and cost to construct O Road between 13 Road and 14 Road and between 17 Road and 18 Road.

Report Structure

This feasibility study consists of eight major areas:

- Public Involvement
- Roadway and Bridge Design
- Cost Estimates
- Traffic Analysis
- Utilities
- Geotechnical
- Hydrology and Hydraulics
- Environmental Considerations

The major conclusions related to each topic are included in this summary report. More complete information is included in the technical reports, which are provided as appendices.

Significant Findings

Public support for the proposed project is not high. Many of the residents oppose the idea of completing O Road while some support the proposal.

The proposed improvements would cost nearly $11 million to complete. The benefit-cost ratio is estimated at 0.62, which means that the cost to construct the project is greater than the estimated social benefit at this time.

No substantial environmental design, compliance, or permitting issues were identified, although additional effort would be necessary to actually obtain the required permits and approvals.

Public Involvement

A major aspect of this feasibility study was to engage with the public to understand their perspectives, concerns, and hopes regarding improvements to O Road. This information was used by our design team to help determine the public perception, to help evaluate alternatives, and to better understand existing conditions that could affect the estimated construction costs.

Public involvement for the feasibility study consisted of two major components: one-on-one meetings with residents and utility operators in the corridor and a public meeting. In the one-on-one interviews, people expressed views ranging from general support for the project to substantial opposition. During the public meeting, the design team presented the results of the initial study and received further feedback from the public. Additional public comments, both oral and written, were collected at the meeting and more comments were provided via e-mail to Mesa County.

In general, residents are content with the way that O Road currently functions and do not see significant benefits to themselves through connecting O Road. There are a few landowners who would be directly impacted by the project, and these individuals expressed concerns about what the changes would mean to their properties, investments, and livelihoods. While there were residents both supporting and opposing the idea of developing O Road as a continuous facility, the majority of comments were in opposition.

Roadway and Bridge Design

Design Criteria

National, state, and county design guidelines were considered in the development of the project criteria. These requirements provide the basis for determining overall roadway width, curvature, sight distances at intersections, and other safety and operational expectations. The proposed roadway includes one 12-foot-wide travel lane in each direction with 6-foot shoulders, accommodates a posted speed of 55 mph, and meets the requirements of a rural arterial roadway.

Alternatives Analysis

Two different options for the improvements for O Road were considered: one follows the section line and the other incorporates a shift to the north at 14 Road to provide a clear zone buffer between the roadway and an existing house. This shifted alignment was chosen as the preferred option and became the basis for developing the cost estimates.

Roadway Design Concerns

Residents raised concerns with sight lines at intersections. This study confirmed that the row of trees along the west side of State Highway 139 does in fact block the intersection sight line for eastbound traffic on O Road. However, because State Highway 139 is a CDOT facility, Mesa County does not have the authority to remove the trees. In addition, all the intersections lie to the south of a hill. Our study shows that the sight lines over this hill are acceptable, given the posted speeds of the crossing roads.

Bridge Design

In order to meet the hydraulic requirements at Big Salt Wash, a 400 to 500-foot long bridge is required at Big Salt Wash. For the purposes of this study, we assumed a 440-foot long structure consisting of 4 or 5 short spans. The cost of this type of bridge is typically about 150 dollars per square foot.

Cost Estimate

Estimating construction costs is critical to a feasibility study. At a preliminary design level such as this study entails, standard practice is to measure the quantities and assign costs to the major elements of the project based upon the design. To this, a percentage of contingency is added. The cost for minor items is estimated as a percentage of the major items plus the contingency. The costs and percentages are based on historic CDOT data and past similar projects.

The table below summarizes the cost estimate for the preliminary design of this feasibility study:

Segment	**Cost**
13 Road to 14 Road	$3.4 million
17 Road to 18 Road	$7.4 million
Total	**$10.8 million**

Traffic Analysis

Operational Analysis

This feasibility study included an analysis of the traffic and operations. Operational analyses are rated by Level of Service (LOS) ranging from A to F, where LOS A represents free-flow conditions and LOS F represents heavy congestion. LOS is a shorthand means of documenting how a roadway is functioning.

Mesa County counted traffic on O ½ Road, N 3/10 Road, and the intersections that people must currently use to travel east-west across the Grand Valley. Amec used these traffic counts to estimate the number of vehicles that would potentially use the new O Road. Current operations were compared to the anticipated operations with a continuous O Road. No substantial difference was identified in the LOS for any intersection or in the delays that people would experience. In both scenarios, the LOS was evaluated as a LOS of A, or free-flow conditions, at all intersections.

The operational analysis also looked at the vehicle miles traveled, travel time, changes in emissions for the network in the area, and fuel consumed during peak travel periods each day between O Road at 13 Road and O Road at 18 Road. Based on our evaluation, vehicle miles travelled would be reduced by two miles, and travel time between the points would be reduced from nearly 12 minutes to around five minutes. Emissions for hydrocarbons, carbon monoxide, and nitrogen oxides would all decrease. Fuel consumption would remain basically the same.

Auxiliary Lane Analysis

In order to understand potential CDOT access permit requirements, an auxiliary lane analysis was conducted for the new intersection of SH 139 and O Road. Auxiliary lanes include right- or left-turn lanes as well as acceleration and deceleration lanes. The estimated traffic volumes do not warrant auxiliary lanes.

Cost-Benefit Analysis

A cost-benefit evaluation was conducted comparing the cost to construct the improvement versus costs or benefits to local businesses, money saved in terms of personal time spent travelling, vehicle operating costs (based on average vehicle costs per mile travelled and the number of miles not travelled by the more direct route created), pollution effects, accident rates, noise, and property values. The goal of this

comparison is to determine if the cost of the proposed improvements is met or exceeded by the benefits that the project will provide.

A project is considered effective if there is approximately a 1:1 ratio of cost to benefit. This O Road project has a predicted cost of $10.8 million. The social benefits are estimated at about $6.6 million. This is a 1.6:1 cost-to-benefit ratio, meaning that the proposed project would provide a social value equal to about 60 percent of the cost to construct the project. To achieve parity, the average daily traffic would need to increase from the current 163 vehicles per day to more than 300 vehicles per day. At an annual population growth rate of 3.5 percent, it would take 20 years to reach 300 vehicles per day.

Traffic Summary

The proposed project has very little impact on traffic operations in the Grand Valley.

Auxiliary lanes are not currently warranted at SR 139 and O Road. However, this could change if the project were constructed and the route became more desirable and traffic patterns evolved.

At current traffic levels, the project cost outweighs the social benefits. However, an increase of approximately 140 vehicles per day along this corridor would move it into an acceptable range.

Utilities

The table below lists the utilities in the project area and summarizes the services they provide:

Utility Company	Services Provided
CenturyLink	Telecommunications
Grand Valley Drainage District (GVDD)	Irrigation return flow
Grand Valley Irrigation Company (GVIC)	Irrigation water (13 Road to 14 Road)
Grand Valley Water Users Association (GVWUA)	Irrigation water (17 Road to 18 Road)
Ute Water Conservancy District (Ute Water)	Potable water
Xcel Energy	Gas (17 Road to Big Salt Wash)

A good understanding of the existing utilities is important to this feasibility study because they affect the design; in addition, the relocation of utilities adds significant costs.

Some facilities of every utility company listed above would have to be relocated or adjusted if the project were to move forward. The relocation of water lines represent the greatest risk and the most significant cost and are specifically estimated and accounted for in the cost estimate. We have accounted for the relocation of the other utilities in the cost estimate by adding a small percentage to the total of the bid items (see Appendix C of this report for the cost estimate).

If the project moves forward, further investigation of the existing utilities and additional coordination with the utility companies will be needed, with the goal of more clearly defining which utilities could remain in place, which ones would need to be relocated, and the costs associated with the relocations.

Geotechnical Investigation and Analysis

The purpose of geotechnical investigation and analysis is to evaluate how soils and geologic conditions affect the design. For this study, geotechnical analysis was done for two major elements of the design:

the bridge foundation and the pavement. Several other less significant issues were also evaluated, such as the depth to groundwater and the corrosivity of the soils.

In order to understand the subsurface conditions well enough to make engineering recommendations, geotechnical borings are necessary. As part of this study, our geotechnical engineer, Yeh and Associates, drilled in seven distinct locations, one at each of the three washes to develop structure foundation recommendations, and at four other locations to develop pavement recommendations. Soil samples obtained from these drill holes were analyzed in Yeh's laboratory to determine the engineering characteristics of the on-site materials.

Geotechnical Analysis Results

The details of the geotechnical analysis and recommendations are included in Appendix F of this report; a brief summary is provided here.

Bridge foundations: Use deep foundations for the bridge, either driven H-piles or drilled shafts founded in bedrock, which was measured at 24 feet deep at the west edge of Big Salt Wash.

Pavement: The pavement design is either 3.5 inches (between 13 and 14 Roads) or 4 inches (between 17 and 18 Roads) of hot mix asphalt on 4 inches of Class 6 aggregate base course on 12 inches of Class 1 aggregate base course. Although the geotechnical report recommends differing depths of hot mix asphalt, the roadway design and cost estimate assumes 4 inches throughout for purposes of simplicity.

Groundwater: Groundwater was measured as close as 3.4 feet from the surface. Due to the flood irrigation systems is use adjacent to the proposed roadway, the groundwater table may fluctuate seasonally. The presence of groundwater means that dewatering will be required during construction of drilled shaft foundations.

Soil Corrosivity: Because the soils on-site were found to be highly corrosive, a cement type designed to resist corrosion should be used for material placed directly on native soils.

Future Geotechnical Investigation

AASHTO requires a boring at or near each pier for final design. Due to limited permission to enter, all the borings needed to comply with these requirements for bridge foundation design could not be obtained. Therefore, additional borings will be required in Big Salt Wash if the project moves into final design.

At the time the geotechnical borings were done, our project team assumed bridges would be required at Reed Wash and Peck and Beede Wash. However, the final hydraulics report, which was done after the geotechnical report, recommends box culverts at these locations. The geotechnical borings required for box culverts are directly in the channel, whereas the borings actually obtained were on the edge of the channel. Additional borings within the washes might be necessary for final design of the bedding for these concrete box culverts if the information in the completed borings is insufficient.

Hydrology, Hydraulics, and Drainage Design

Hydrology

A quick definition of flood-frequency will help with the following discussion. Hydrology is discussed using terms like the 50-year or 100-year rainfall event, which describe the frequency of a storm event. As an example, the 50-year storm statistically happens once every 50 years. In other words, it has a 2 percent

chance of happening any year. A very simple way to think of it is that a 100-year event is much more rare than a 10-year event.

Hydrologic engineers use historic rainfall data and topographic and soil characteristics of the contributing basin to estimate how much water will arrive at each crossing for various storm events. The design frequency event, or recurrence interval, used depends on the facility's cost and the potential flood hazard to property. For two-lane road in rural areas, the CDOT Drainage Manual specifies to use either the 25- or 50-year event depending on how much water is anticipated in the 50-year event. The table below summarizes the hydrologic parameters that were used in our analysis.

Stream	Basin Area (Square Miles)	Design Recurrence Interval	Peak Discharge (cfs)
Reed Wash	6.7	25-year	287
Peck and Beede Wash	8.6	25-year	269
Big Salt Wash	120	50-year	4350

Hydraulics

The hydraulics were analyzed using HEC-RAS, a software developed by the U.S Army Corps of Engineers. HEC-RAS takes the peak discharge, upstream and downstream channel conditions, and the proposed structure dimensions as inputs and calculates the water surface elevations along the stream. Using this software, Amec's hydraulic engineers determined that the peak discharge at Reed Wash and Peck and Beede Wash could be carried by 8-foot-wide by 6-foot-tall concrete box culverts. Big Salt Wash needs a bridge. Based on topography, the length of the bridge is proposed at 440 feet.

At the box culverts, the 25-year water surface elevation will be at the top of the box. During the 100-year event, the water surface will rise above the top of the box, but will not overtop the roadway. This meets all applicable CDOT criteria.

According to the *CDOT Drainage Manual*, the bridge must meet two criteria:

1. Have at least 2.04 feet of freeboard during the 50-year event
2. Cause less than a 1-foot rise in the upstream water surface elevation

The HEC-RAS analysis of the bridge shows that the minimum freeboard is 8.53 feet and the rise in upstream water surface elevation is about 6 inches, immediately upstream of the bridge. Therefore, the proposed bridge meets all applicable CDOT drainage criteria.

In addition to these three major washes, the local roadside drainage was conceptually considered as part of this study. Roadside ditches and culverts are shown in the roadway plans that generally maintain existing drainage patterns (see Appendix B of this report for roadway plans). Hydraulic analysis of these ditches, driveway culverts, and minor cross-culverts was not done as part of this study.

Environmental Considerations

Transportation projects must comply with a variety of different environmental laws and regulations at local, state, and federal levels. These laws and regulations cover a variety of different social, economic, and natural resources including historic and cultural resources, endangered species, migratory birds, noise, air and water quality, and many others. As a part of the feasibility study, the team looked at

several different environmental considerations as a means of evaluating the potential environmental impact and compliance requirements for developing a continuous O Road across Mesa County. Specifically, historic resources, hazardous materials, wetlands and rivers, and wildlife and plants were evaluated. These studies were not conducted to the level required for identifying specific impacts and obtaining the permits or other clearances necessary for a project to be constructed. Rather, they will help determine the level of effort that would likely be required should this project be pursued.

Historic Resources

Historic resources include both historic and prehistoric artifacts. These can include things like homes or farmsteads as well as archaeological resources. Safeguarding historic resources is part of preserving and maintaining our cultural heritage. Because historic resources are protected under the National Historic Preservation Act of 1966 (NHPA), projects that involve federal funding are required to comply with the NHPA. This includes identifying potential historic resources in a project area, the potential impacts to those resources, and options to avoid and minimize impacts. To qualify for protection under the NHPA, a resource must have:

- Significance. Significance means that the resource is associated with events, activities, people, or developments that were important in the past. Significance can also relate to architectural or engineering achievements or may relate to sites that have the potential to yield valuable information through archaeological investigation.
- Age. For a property to be eligible for protection under the NHPA, it must be at least 50 years old. In many cases, resources that are approaching the 50-year mark are considered to avoid having to do so later, if the project takes a few years to complete.
- Integrity. Integrity refers to whether the resource maintains the aspects it had when it was created. Integrity can refer to the structural aspects of a resource as well as its setting.

A survey of known historic resources was conducted for the O Road project area and a field survey conducted within the road right-of-way. Segments and/or features of the historic Grand Valley Irrigation System Kiefer Extension Canal have been identified in prior studies of the surrounding area, but no prior studies in the O Road project area have been documented. One ditch and segments of a historic two-track road were identified as potential historic resources needing further investigation. Private properties outside of the right-of-way were not surveyed.

If the project moves forward and federal funding is likely to be involved, further evaluation of the identified resources and adjacent private properties would be needed.

Hazardous Materials

An Initial Site Assessment (ISA) was performed to identify known recognized hazardous materials, conditions, or concerns along O Road. A hazardous materials condition or concern is identified by the presence or likely presence of any hazardous substances or petroleum products in, on, or at a site: (1) due to any release to the environment, (2) under conditions indicative of a release to the environment, or (3) under conditions that pose a material threat of a future release to the environment. To complete the ISA, the following tasks were performed:

- Review of reasonably ascertainable records and search of regulatory agency databases to identify federal- and state-listed properties of known potential environmental concern located within the minimum search distances from the roadway;
- Review of existing published information related to geology, hydrology, and topography;
- Review of historical land use of the project site dating back to the first developed use or 1940, whichever is earlier;
- A physical site reconnaissance to identify likely hazardous materials;
- Visual observation of adjoining properties or facilities to assess conditions that may indicate hazardous materials on the project site or on an adjoining property; and
- Interviews with representatives of the state, county, or local regulatory agencies with knowledge of the area.

Our site reconnaissance and evaluation of compiled information and documentation has revealed no evidence of hazardous materials concerns with the project site.

Wetlands and Other Waters of the United States (WOUS)

Wetlands and other Waters of the United States (WOUS) are protected by various laws and regulations. The most prominent of these is the Clean Water Act (CWA), which requires permitting for impacts to wetlands and WOUS. Wetlands are identified by the presence of three features:

1. Hydrophytic Vegetation. Prevalent vegetation consists of macrophytes, which are adapted to soils that are inundated or saturated by surface or ground water. Hydrophytic species, due to morphological, physiological, and/or reproductive adaptation(s), can grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions.
2. Hydric Soils. Soils are classified as hydric if they possess characteristics that are associated with reducing soil conditions. A hydric soil is one that, in its undrained condition, is sufficiently wet in the upper part to develop anaerobic conditions during the growing season.
3. Wetland Hydrology. Wetland hydrology indicators provide evidence that the site has a wetland hydrologic regime and that hydric soils and hydrophytic vegetation are not relicts of past conditions. Wetland hydrology encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some point during the growing season.

Wetlands were identified in both proposed project areas along O Road. Permitting under the CWA would be necessary for any construction project. Depending on the degree of impacts, mitigation might be required. This is dependent on design and construction activities and would be evaluated once those details are developed.

In most cases, waters designated as WOUS are hydrologically connected to navigable waterways. For this area, the various drainages are connected to the Colorado River and as such would likely be considered WOUS. The WOUS generally overlap with the identified wetlands, although the WOUS cover a larger area. As with wetlands, impacts to the WOUS would require permitting prior to construction and may require mitigation depending on the extent of the impacts.

The potential impacts to both wetlands and other WOUS is low. Permitting would likely be required for the types of projects proposed to connect O Road. Depending on the size of the impacts, mitigation might be needed, but neither wetlands nor WOUS issues appear to rise to the level where impacts would represent a substantial issue.

Wildlife and Vegetation

There are several laws and regulations that apply to impacts to wildlife, vegetation, and general habitat. The most prominent of these are the Migratory Bird Treaty Act (MBTA) and the Endangered Species Act (ESA). Potential issues were evaluated to determine if state or federally protected species were present and to establish the potential degree of wildlife and vegetation evaluation that would be needed prior to construction.

The MBTA governs the take of migratory bird species. More than 22 different MBTA-covered species were identified as potentially occurring in the area. Compliance with the MBTA is generally accomplished by avoiding impacts through best practices that focus construction activities to times of year when the species are not present or by discouraging nesting in the project area. However, determining impacts and permitting needs under the MBTA is done only after a project's design has progressed enough to determine impacts; therefore, it was not conducted for this study.

The area of the potential O Road improvements was evaluated to determine the types of habitat present as a measure of the potential for special species of concern, including birds, fish, mammals, and plants. The types of habitat present could potentially serve more than 30 different plant and animal species; however, we determined that only four state sensitive species are likely to occur:

Wildlife

- Long-nosed leopard lizard *(Gambelia wislizenii*)
- Great Basin pocket mouse (*Perognathus parvus)*

Plants

- Westwater buckwheat (*Eriogonum scabrellum)*
- Cliff dweller's candlestick catseye (*Oreocarya elata)*

The habitat is also significantly degraded by the presence of noxious weed. Noxious weeds are invasive species that do not naturally occur in a habitat. Their presence reduces the viability of habitat for native species and can potentially impact crop production. Projects like this are generally required to take steps to eliminate noxious weeds and reduce their potential to grow, both during and after construction.

The presence of significant levels of noxious weeds in the proposed project areas reduces but does not eliminate the potential for state sensitive species to occur. Targeted evaluation of impacts and minimization or mitigation measures would need to be conducted as part of specific project development.

The table below summarizes the permits that would be required if the project were to continue into final design and construction.

Permit/Process Requirements	Non-federalized	Federalized
Water Quality		
MS4	•	•
Wetlands and WOUS		
Section 404 Permit	•	•
Historic		
NHPA Section 106		•
Section 4(f)		•
National Environmental Policy Act (NEPA)		
Environmental Review		•
Resources with little or no additional review needed		
Hazardous Waste		
Endangered Species		

Conclusion

This feasibility study was conducted to determine if the development of a continuous facility along O Road could be constructed considering several factors, including the cost/benefit of developing such a facility, public acceptance and support, and potential environmental impacts.

Public support for the proposed project was not high, as many residents opposed the idea of completing O Road. While it is feasible to construct the necessary improvements to connect O Road, those improvements will cost nearly $11 million to complete, and the social benefit over a period of 20 years is $6.6 million. No substantial environmental compliance or permitting issues were identified, although additional environmental study would be necessary to obtain any required permits and approvals.