TABLE OF CONTENTS

1.0 PROJECT INFORMATION .................................................................................. 1
  1.1 Purpose and Scope .................................................................................. 1
  1.2 Proposed Construction ............................................................................. 1
  1.3 Site Conditions ......................................................................................... 1
  1.4 Site Geology ............................................................................................ 1

2.0 SITE INVESTIGATION ........................................................................................ 2
  2.1 Subsurface Investigation .......................................................................... 2
  2.2 Subsurface Conditions ............................................................................. 2
    2.2.1 Groundwater ........................................................................................ 3

3.0 SITE GRADING ................................................................................................... 3
  3.1 Construction Dewatering .......................................................................... 4

4.0 FOUNDATION RECOMMENDATIONS ............................................................... 4
  4.1 Footing Foundations ................................................................................ 5
  4.2 Lateral Earth Pressure ............................................................................. 6

5.0 SEISMIC CONSIDERATIONS ............................................................................. 7

6.0 CONCRETE ........................................................................................................ 7

7.0 PAVEMENT RECOMMENDATIONS ................................................................... 7
  7.1 Subgrade Strength Evaluation .................................................................. 8
  7.1 Design Assumptions and Inputs .................................................................. 8
  7.2 Pavement Thickness Recommendations .................................................. 9
  7.3 Hot Mix Asphalt Type ............................................................................... 9
  7.4 Pavement Subgrade Preparation ............................................................... 10
  7.5 Drainage Considerations ........................................................................... 10

8.0 LIMITATIONS .................................................................................................... 11

LIST OF TABLES

Table 1 – Structural Fill Specifications ................................................................. 4
Table 2 – Seismic Design Parameters .................................................................... 7
Table 3 – Seismic Design Parameters for Site Class E ............................................ 7
Table 4 – Design Traffic Loading ......................................................................... 8
Table 5 – Flexible Pavement Design Parameters for 34 Road .............................. 9
Table 6 – Recommended Pavement Sections for 34 Road .................................... 9

LIST OF FIGURES

Figure 1 – Approximate Site Location
Figure 2 – Approximate Test Hole Locations
Figure 3 – Test Hole Logs and Legend
Figure 4 – Grain Size Analyses
Figure 5 – Swell/Consolidation Tests
Summary of Laboratory Test Results
1.0 PROJECT INFORMATION

1.1 Purpose and Scope
This report presents the results of our geotechnical investigation and recommendations for design and construction of the 34 Road Bridge (Structure MESA-34-F.9A) project over the Government Highline Canal in Mesa County, Colorado. The scope also included pavement design for the approaches to the new structure. The project location is presented on Figure 1. The investigation was performed to provide foundation and construction recommendations for design of the bridge foundations and pavements at the referenced site. Test hole locations were selected based on discussions with the client.

The site investigation consisted of geologic reconnaissance and exploratory test hole drilling to investigate subsurface conditions. Test hole drilling was observed by a representative of RJ Engineering. Samples obtained during the field exploration were examined by the project personnel and representative samples were subjected to laboratory testing to determine the engineering characteristics of materials encountered. This report summarizes our field investigation, the results of our analyses, and our conclusions and recommendations based on the proposed construction, site reconnaissance, subsurface investigation, and results of the laboratory testing.

1.2 Proposed Construction
We anticipate the bridge will be planned as a single span structure. The bridge is to be located over the Government Highline Canal. The bridge will likely be widened and lengthened from the current configuration. We anticipate pavement will be removed and replaced at the approaches.

1.3 Site Conditions
The site is located about 400 feet south of the intersection of 34 Road and G Road (Figure 1). The site is located within rural residences consisting of farm and pasture lands. Canal access roads are located at both abutments. The existing pavement and bridge structure appear to be in poor to fair condition. Existing vegetation included brush and grasses.

1.4 Site Geology
We reviewed the Geologic Map of the Clifton Quadrangle, Mesa County, Colorado by Carrara, P.E., 2001: US Geological Survey, Miscellaneous Field Studies Map MF-2359, scale 1:24,000.
Both abutment locations are mapped as alluvium and colluvium deposits (map symbols Qac) consisting of fine sandy silt and clayey silt containing shale and sandstone pebbles. Also, containing scattered sandstone boulders up to 1 meter in diameter. The formation may also contain pebble-cobble gravel lenses, 1 to 1.5 meters thick containing rounded pebbles and cobbles of Colorado River origin.

2.0 SITE INVESTIGATION

2.1 Subsurface Investigation

Two test holes were drilled on January 19, 2017. Test hole TH-1 was drilled near the south abutment and TH-2 was drilled near the north abutment location. The approximate locations of the test holes are presented in Figure 2. All test holes were advanced with a CME 55 rubber track rig using 4-inch continuous flight auger to depth where a modified California sampler was used to record blow counts and obtain samples. Test hole logs presented on Figure 3.

To perform the modified California penetration resistance tests, a 2.0-inch inside diameter sampler was seated at the bottom of the test hole, then driven up to 12 inches with blows of a standard hammer weighing 140 pounds and falling a distance of 30 inches utilizing an “auto” hammer (ASTM D1586). The number of blows (Blow Count) required to drive the sampler 12 inches or a fraction thereof, constitutes the N-value. The N-value, when properly evaluated, is an index of the consistency or relative density of the material tested. Test hole logs and legend are presented on Figure 3.

2.2 Subsurface Conditions

Subsurface conditions encountered at both abutments generally consisted of 90 feet of silty to sandy clay. Gravels, cobbles and boulders were occasionally encountered within the clay soils. A 5 to 6-foot thick layer of silty gravel was encountered at depth of 26 and 37 feet in test holes TH-1 and TH-2, respectively. The clay was soft to medium stiff. The gravels were medium dense to dense. Drive samples below a depth of about 40 feet could not be obtained due to groundwater and “squeezing” of the clay soils.

Two clay samples had 70 and 71 percent fines (material passing the No. 200 sieve). Atterberg limit testing indicated the samples had liquid limits of 26 and 27 percent and plasticity indices of
10 percent. Two clay samples were subjected to swell/consolidation testing. The samples exhibited slight compression of 0.1 percent when wetted under an applied load of 1,000 psf. Two gravel samples had 26 and 30 percent fines. The clays classified as low plasticity clay with sand (CL) and the gravels as silty (GM) according to the Unified Soil Classification System (USCS). Results of the laboratory testing presented on Figures 4 and 5 and are summarized in the Summary of Laboratory Test Results.

2.2.1 Groundwater
During drilling groundwater was encountered at depths of 18 and 19 feet in test holes TH-1 and TH-2, respectively. Groundwater was measured at depths of 13.5 and 12 feet on January 30, 2017 in test holes TH-1 and TH-2, respectively. Based on our experience, we anticipate groundwater could be encountered at shallower depths during the spring and summer months when the canal is in operation. The magnitude of the variation will be largely dependent upon the level of canal flow and the surface and subsurface drainage characteristics of the surrounding area.

3.0 SITE GRADING
Minor cuts and fills are likely planned at abutment locations. Based on drilling and our observations, we believe that material can be excavated by conventional construction equipment. We recommend cut and fill slopes be constructed at 2H:1V or flatter. If groundwater or seeps are encountered, flatter slopes will likely be necessary for stability.

Fill below foundations and behind wing walls should consist of CDOT Structure Backfill Class 1. For aggregate base course below pavement, the material should consist of CDOT Class 6 aggregate base. The structural backfill should meet CDOT Class 6 or Structure Backfill Class 1 specifications as presented in Table 1 below.
The on-site (cut) soils can be used in general site grading fills (beyond structures and pavements) provided the material is substantially free of organic material, debris and particles are no larger than 6 inches. Areas to receive fill should be stripped of vegetation, organic soils and debris. Topsoil is not recommended for fill material. Fill should be placed in thin, loose lifts of 8 inches thick or less. We recommend fill materials be moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of maximum standard Proctor dry density (ASTM D 698). Placement and compaction of fill should be observed and tested by a geotechnical engineer.

3.1 Construction Dewatering
Depending on planned foundation elevations, groundwater may be encountered during construction. For excavations greater than 10 feet deep, groundwater flowing into excavations should be anticipated. If construction is planned at the same time the canal is in operation, groundwater will likely be encountered at shallower depths. Multiple large volume pumps may be likely be required to dewater deep excavations.

4.0 FOUNDATION RECOMMENDATIONS
The overburden soils encountered at the abutment locations consisted of soft compressible clay soils. We do not believe deep foundations are appropriate because of the depth of soft soils encountered. We believe a shallow footing foundation with subgrade improvement could be utilized at this site. Subgrade improvement could consist of removal and replacement of the
soils or by installation of rammed aggregate piers. The foundation recommendations contained herein, generally comply with AASHTO for either ASD\(^1\) (Allowable Stress Design) or LRFD\(^2\) (Load Resistance Factor Design).

### 4.1 Footing Foundations

Soft clay was encountered below proposed abutment locations. These soils are compressible when subjected to loading. We recommend removal and replacement of foundation soils or installation of rammed aggregate piers as presented in the following section. The foundation subgrade improvement should mitigate future settlement of the foundation soils. For removal and replacement, we recommend the upper 6 feet of the clay soils below foundations be removed and replaced with CDOT Class 1 Structural backfill or other approved granular fill. The extents of removal and replacement should extend at least 5 feet from the outer edge of footings. A geotextile separator (Class A) should be placed above the on-site soils prior to placement of the Class 1 Structural backfill. Removal and replacement is not necessary for foundations underlain by rammed aggregate piers. The structural fill should be placed in accordance with the recommendations in Section 3.0 above. The following details should be observed for design and construction of abutment and wing wall foundations.

1. Foundations should be constructed on structural backfill or rammed aggregate piers as recommended above.

2. For Allowable Stress Design (ASD) criteria, we recommend foundation subgrade improvement be performed. If the upper 6 feet of the clay soils below foundations is removed and replaced with CDOT Class 1 Structural backfill. Footings can then be designed for a maximum allowable soil pressure of 2,000 psf. For rammed aggregate piers, footings can typically be designed for a maximum allowable soil pressure of 3,000 to 3,500 psf depending on the aggregate pier design.

3. Using Load Resistance Factor Design criteria (LRFD), a nominal bearing capacity can be determined for shallow spread footing foundations placed on recommended subgrade improvement using the following equations based on a minimum footing width of 6 feet:

---


Remove and replace: \[ q_n = 6.33 + 0.22*(B-2*e) \]
Rammed aggregate piers: \[ q_n = 8.69 + 0.36*(B-2*e) \]

where: \( q_n \) – nominal bearing capacity in ksf
\( B \) – footing width in feet
\( e \) – eccentricity in feet

4. A coefficient of friction of 0.30 may be used for the calculation of sliding resistance when performing an external stability check.

5. Passive pressure against the sides of the abutments and wing walls can be used for sliding resistance and can be calculated using an equivalent fluid unit weight of 350 pcf if granular backfill is used.

6. Shallow spread footing foundations for the abutments and wing walls should be protected from frost action. Footings should be placed a minimum of 3 feet below finished grade to provide adequate frost protection. Scour protect may require additional depth.

7. All foundation and retaining structures should be designed for appropriate hydrostatic and surcharge pressures resulting from adjacent roadways, traffic construction materials, and equipment.

4.2 Lateral Earth Pressure
Bridge abutments and wing walls should be designed to resist lateral earth pressure. We recommend all retaining/wing walls are backfilled with CDOT Class 1 Structure Backfill. Walls can be designed using an equivalent fluid density of 40 pcf for active or 60 pcf for at rest conditions for Class 1 Structure Backfill. This equivalent fluid density assumes a horizontal slope above the wall. This value also assumes that the backfill materials are not saturated. Wall designs should consider the influence of surcharge loading such as traffic, construction equipment and/or sloping backfill.

Retaining/wing walls should be constructed with a drainage system to drain away any excess water immediately behind the wall. Drainage systems such as free-draining gravel, pipes, drain board and/or weep holes are commonly used for the wall drainage.
5.0 SEISMIC CONSIDERATIONS
The project is located at approximate latitude 39.105° and longitude -108.422°. The site classified as Site Class E in accordance with Table 3.10.3.1-1 of the AASHTO LRFD Bridge Design Specifications. The Peak Ground Acceleration (PGA), and the short- and long-period spectral acceleration coefficients (S_S and S_1, respectively) for the bridge site were obtained using the USGS 2002 Seismic Parameters for an event with a 7% Probability of Exceedance (PE) in 75 years and a Site Class B (reference site). An event with the above probability of exceedance has a return period of about 1,000 years. The values were adjusted using Site Factors for Site Class E in accordance with Section 3.10.3.2 of the AASHTO LRFD Bridge Design Specifications. The seismic parameters for this site are shown on the tables below.

<table>
<thead>
<tr>
<th>PGA (0.0 sec)</th>
<th>S_S (0.2 sec)</th>
<th>S_1 (1.0 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.085</td>
<td>0.172</td>
<td>0.041</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AS (0.0 sec)</th>
<th>S_DS (0.2 sec)</th>
<th>S_D1 (1.0 sec)</th>
<th>Seismic Design Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.212g</td>
<td>0.429g</td>
<td>0.142g</td>
<td>A</td>
</tr>
</tbody>
</table>

6.0 CONCRETE
Two clay samples from a depth of 9 feet were subjected to water-soluble sulfate testing. The samples had measurable concentrations of 0.02 and 0.03 percent. These concentrations of water-soluble sulfate are considered negligible/low (Class 0 exposure) degree of sulfate attack for concrete exposed to these materials. The degree of attack is based on a range of 0.00 to less than 0.10 percent water-soluble sulfates as presented in the American Concrete Institute Guide to Durable Concrete. Due to the negligible/low degree, no special requirements for concrete are necessary for this site.

7.0 PAVEMENT RECOMMENDATIONS
Traffic information for the design for 34 Road was provided by the client. Twenty-year flexible pavement Equivalent Single Axle Loads (ESALs) were calculated and used for thickness
designs. Table 4 presents a summary of the ESAL values used as pavement design inputs. Traffic calculations and information used in the designs is presented in Appendix A.

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>20-Year Flexible ESALs</th>
</tr>
</thead>
<tbody>
<tr>
<td>34 Road</td>
<td>23,911</td>
</tr>
</tbody>
</table>

### 7.1 Subgrade Strength Evaluation

Based on the results of our field exploration and laboratory testing, the subgrade materials below pavements as classified by the American Association of State Highway and Transportation Officials (AASHTO) consisted of A-7-6. A design R-value of 5 was selected based on our experience.

We recommend new fill material placed within the proposed roadway alignment below the aggregate base course (ABC) meet a minimum R-value of 15. Aggregate base course (ABC) should meet CDOT Class 6 specifications and have a minimum R-value of 78. The subbase should meet CDOT Class 2 or 3 specifications and have a minimum R-value of 59.

### 7.1 Design Assumptions and Inputs

For the hot mix asphalt (HMA) pavement thickness designs, resilient modulus of 3,025 psi was calculated from the R-value of 5, using equations 2.1 and 2.2 from the CDOT 2013 Pavement Design Manual. Table 5 presents the input design parameters used for the designs of flexible pavement sections for 34 Road.
### Table 5 – Flexible Pavement Design Parameters for 34 Road

<table>
<thead>
<tr>
<th>HMA Design Inputs</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Serviceability</td>
<td>4.5</td>
<td>Reliability Level, %</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Terminal Serviceability</td>
<td>2.5</td>
<td>Subgrade Resilient Modulus, $M_r$, psi</td>
<td>3,025</td>
<td></td>
</tr>
<tr>
<td>Design Subgrade R-value</td>
<td>5</td>
<td>HMA Str. Layer Coefficient</td>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>20 Year Design ESAL</td>
<td>23,911</td>
<td>ABC Str. Layer Coefficient</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Subbase Str. Layer Coefficient</td>
<td>0.10</td>
<td></td>
</tr>
</tbody>
</table>

### 7.2 Pavement Thickness Recommendations

A pavement section is a layered structure designed to disperse dynamic traffic loads to the subgrade. The performance of the pavement structure depends on the traffic loadings and physical properties of the subgrade materials. Recommended pavement design thickness sections are summarized below.

HMA pavement design calculations were performed using the guidelines from the 2013 CDOT Pavement Design Manual. Calculations for all pavement designs are presented in Appendix A. HMA pavement thicknesses presented are rounded up to the nearest half-inch. HMA pavement thicknesses are based on 20-Year ESAL loadings and are presented in Table 6.

### Table 6 – Recommended Pavement Sections for 34 Road

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Pavement Type</th>
<th>Design Life (years)</th>
<th>Thickness (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34 Road</td>
<td>HMA</td>
<td>20</td>
<td>7” HMA</td>
</tr>
<tr>
<td></td>
<td>HMA + ABC</td>
<td>20</td>
<td>5” HMA + 6” ABC</td>
</tr>
<tr>
<td></td>
<td>HMA + ABC + Subbase</td>
<td>20</td>
<td>4” HMA + 4” ABC + 4” Subbase</td>
</tr>
</tbody>
</table>

### 7.3 Hot Mix Asphalt Type

We recommend that the asphalt mix for this project meet the specifications for Grading SX (75) in accordance with the specifications. The number of SuperPave Gyratory revolutions (Ndes) for the asphalt mixes should be at 75 gyrations is recommended if the design ESALs are below 3 million. We recommend that unmodified performance grade asphalt binder meeting the
CDOT requirements for performance grade PG 58-28 be used in both the lower and top lifts for 34 Road. PG 58-28 is a 98% reliability binder for both binder rutting resistance and thermal cracking for the Debeque area based on data from the FHWA Binder Selection Program, LTPP Bind. The lower lift should meet the requirements for SX (75) and be placed at thicknesses of three inches. The top 2-inch lift should conform to SX (75) with PG 58-28 binder.

Aggregates for hot plant mix bituminous pavement should be of uniform quality, composed of clean, hard, durable particles of crushed stone, gravel, or slag. Excess of fine material should be wasted before crushing. The specified gradations for the above mixes are published in Tables 703-4 and 703-5 of the 2012 CDOT Standard Specifications.

7.4 Pavement Subgrade Preparation
We recommend that the top 6 inches of the subgrade for the entire roadway width be scarified and recompacted in compliance with CDOT Standard Specifications. We recommend that a separator geotextile Class 1 conforming to the requirements listed in Section 712.08 of the 2011 CDOT Standard Specifications be placed between the subgrade and the ABC Class 6 in conformance with Section 420.07 where subgrade soils consist of silt or clay. The subgrade and ABC should be compacted in accordance with the requirements shown in Section 203.07 of the 2011 CDOT Standard Specifications.

The pavement subgrade should be proof rolled with a heavily loaded pneumatic-tire vehicle. Areas that deform more than ½-inch under heavy wheel loads should be removed, replaced if necessary and reworked to achieve a stable subgrade prior to paving. We recommend that proof rolling and compaction tests be observed and documented by a representative of a registered Professional Engineer.

7.5 Drainage Considerations
The collection and diversion of surface drainage away from paved areas is critical to the satisfactory performance of the pavement. Proper drainage design should include prevention of ponding of water on or immediately adjacent to pavement areas. Concentrated runoff should be avoided in areas susceptible to erosion. Slopes and other stripped areas should be protected against erosion by re-vegetation or other methods.
8.0 LIMITATIONS
This study was conducted in accordance with generally accepted geotechnical engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from exploratory test holes, field reconnaissance and anticipated construction. The nature and extent of subsurface variations across the site may not become evident until excavation is performed. If during construction, conditions appear to be different from those described herein; this office should be advised at once so reevaluation of the recommendations may be made. We recommend on-site observation of excavations by a representative of the geotechnical engineer.

The scope of services for this project did not include, specifically or by implication, any environmental or biological (e.g., mold, fungi, and bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions or biological conditions. If the owner is concerned about the potential for such contamination, conditions or pollution, other studies should be undertaken.

The report was prepared in substantial accordance with the generally accepted standards of practice for geotechnical engineering as exist in the site area at the time of our investigation. No warranties, express or implied, are intended or made.

Respectfully Submitted:
RJ Engineering & Consulting, Inc.

Richard D. Johnson, P.E.
Project Manager
**Sample Types**

Modified California Sampler. The symbol 4/12 indicates that 4 blows from a 140 pound hammer falling 30 inches was used to drive a 2-inch I.D. sampler 12 inches.

**Groundwater**

\[\text{\ding{127}}\] Indicates groundwater depth measured at time of drilling.


**Soil Lithology**

- CLAY, silty to sandy with occasional cobbles and boulders, very moist to wet, soft to medium stiff, dark gray, black (CL)
- GRAVEL, silty to sandy with occasional cobbles and boulders, medium dense to dense, wet, brown, dark brown (GM)

**NOTES:**

1. Test holes were drilled on January 19, 2017 with 4-inch continuous flight auger.
2. Test hole descriptions are subject to explanations contained in this report.
Applied Normal Pressure, ksf

Upper 9
Lower 4

Graph Test Hole Depth (ft) Dry Density (pcf) Moisture Content (%) Consolidation(-)/Swell(+) (%) Soil Description
Upper TH-1 9 102 23.1 -0.1 CLAY, sandy (CL)
Lower TH-2 4 114 12.2 -0.1 CLAY, sandy (CL)
## Summary of Laboratory Test Results

### Project No: 17-002G-G1  
#### Project Name: 34 Road Bridge, Mesa County

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Moisture Content (%)</th>
<th>Dry Density (pcf)</th>
<th>Grain Size Analysis</th>
<th>Atterberg Limits</th>
<th>Water Soluble Sulfate (%)</th>
<th>Swell (+) / Consolidation (-) at 1,000 psf (%)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TH-1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>CA</td>
<td>23.1</td>
<td>102</td>
<td></td>
<td></td>
<td>0.020</td>
<td>CLAY, sandy (CL)</td>
</tr>
<tr>
<td>19</td>
<td>CA</td>
<td>23.9</td>
<td>101</td>
<td>70</td>
<td>27</td>
<td>17</td>
<td>CLAY, sandy (CL)</td>
</tr>
<tr>
<td>29</td>
<td>CA</td>
<td>15.0</td>
<td>118</td>
<td>38</td>
<td>36</td>
<td>26</td>
<td>GRAVEL, silty, sandy (GM)</td>
</tr>
<tr>
<td><strong>TH-2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>CA</td>
<td>22.6</td>
<td>101</td>
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<td></td>
<td>0.030</td>
<td>CLAY, sandy (CL)</td>
</tr>
<tr>
<td>19</td>
<td>CA</td>
<td>23.7</td>
<td>104</td>
<td>71</td>
<td>26</td>
<td>16</td>
<td>CLAY, sandy (CL)</td>
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<tr>
<td>39</td>
<td>CA</td>
<td>15.8</td>
<td>115</td>
<td>49</td>
<td>21</td>
<td>30</td>
<td>GRAVEL, silty, sandy (GM)</td>
</tr>
</tbody>
</table>

CA-Indicates modified California sampler
APPENDIX A

Pavement Design Calculations
### TRAFFIC LOADING using Volume

#### Mesa County Road 34

**Project No. 17-002G**

<table>
<thead>
<tr>
<th>Current ADT: 126 vehicles per day</th>
<th>Design Life: 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected ADT: 223 vehicles per day</td>
<td>Growth Rate: 2.9% per year</td>
</tr>
<tr>
<td>Average ADT: 175 vehicles per day</td>
<td>Projected ADT: 223 vehicles per day</td>
</tr>
</tbody>
</table>

- **Flexible Pavement**
- **Rigid Pavement**

#### Equivalent ADT Factor

<table>
<thead>
<tr>
<th>Anticipated Traffic</th>
<th>Separate ADT</th>
<th>Equivalency Factor</th>
<th>Equivalent ADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination Trucks:</td>
<td>1%</td>
<td>2</td>
<td>1.087</td>
</tr>
<tr>
<td>Single Unit Trucks:</td>
<td>2%</td>
<td>3</td>
<td>0.249</td>
</tr>
<tr>
<td>Cars &amp; Light Trucks:</td>
<td>97%</td>
<td>169</td>
<td>0.003</td>
</tr>
<tr>
<td>100%</td>
<td>175</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

**Total ESAL:** 23,911

**Lanes per direction:** 1 lane(s)

**Lane Factor:** 0.6

**Design ESAL:** 14,346
R-value = 5
$S_1 = 3.000$
$M_r = 3,025 \text{ psi}$
$W_{18} = 14,346$
$\log(W_{18}) = 4.157$
Reliability = 95%
$Z_R = -1.645$
Deviation, $S_o = 0.49$
$p_o = 4.5$
$p_t = 2.5$
$\Delta_psi = 2.0$
$\log(W_{18}) = 4.16$
Difference = 0.00
Design SN = 2.62

### Full Depth Hot Mix Asphalt (HMA)

<table>
<thead>
<tr>
<th>Layer Material</th>
<th>Structural Coefficient</th>
<th>Drainage Coefficient</th>
<th>Thickness (inches)</th>
<th>Width (feet)</th>
<th>Calculated SN (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA</td>
<td>0.40</td>
<td>1</td>
<td>7.0</td>
<td>12</td>
<td>2.80</td>
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<tr>
<td>Totals</td>
<td>-</td>
<td>-</td>
<td>7.0</td>
<td>-</td>
<td>2.80</td>
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### Hot Mix Asphalt (HMA) over Aggregate Base Course (ABC)

<table>
<thead>
<tr>
<th>Layer Material</th>
<th>Structural Coefficient</th>
<th>Drainage Coefficient</th>
<th>Thickness (inches)</th>
<th>Width (feet)</th>
<th>Calculated SN (inches)</th>
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</thead>
<tbody>
<tr>
<td>HMA</td>
<td>0.40</td>
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<td>5.0</td>
<td>12</td>
<td>2.00</td>
</tr>
<tr>
<td>ABC</td>
<td>0.12</td>
<td>1</td>
<td>6.0</td>
<td>12</td>
<td>0.72</td>
</tr>
<tr>
<td>Totals</td>
<td>-</td>
<td>-</td>
<td>11.0</td>
<td>-</td>
<td>2.72</td>
</tr>
</tbody>
</table>

### Hot Mix Asphalt (HMA) over Aggregate Base Course (ABC) over Subbase

<table>
<thead>
<tr>
<th>Layer Material</th>
<th>Structural Coefficient</th>
<th>Drainage Coefficient</th>
<th>Thickness (inches)</th>
<th>Width (feet)</th>
<th>Calculated SN (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA</td>
<td>0.40</td>
<td>1</td>
<td>5.0</td>
<td>12</td>
<td>2.00</td>
</tr>
<tr>
<td>ABC</td>
<td>0.12</td>
<td>1</td>
<td>4.0</td>
<td>12</td>
<td>0.48</td>
</tr>
<tr>
<td>Subbase</td>
<td>0.10</td>
<td>1</td>
<td>4.0</td>
<td>12</td>
<td>0.40</td>
</tr>
<tr>
<td>Totals</td>
<td>-</td>
<td>-</td>
<td>13.0</td>
<td>-</td>
<td>2.88</td>
</tr>
</tbody>
</table>

ABC - Aggregate Base Course consisting of CDOT Class 6 (R-value ≥ 78)
Subbase - Subbase consisting of CDOT Class 1 or 2 (R-value ≥ 69)