CHINDEN BLVD (US-20/26) TO SH-44 CONCEPT STUDY
CONCEPT REPORT
JULY 2019

PREPARED BY:
HORROCKS ENGINEERS
Linder Road, Chinden Blvd (US 20/26) to SH-44
Concept Study

Concept Report
July 2019

BOISE, ID
ACHD PROJECT NO.: 518020

PREPARED FOR:
ADA COUNTY HIGHWAY DISTRICT

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1 INTRODUCTION AND BACKGROUND

The Linder Road Concept Study, from US 20/26 (Chinden Boulevard) to SH-44 (State Street) (ACHD Project No. 518020.00, GIS No. RD207-19) is a conceptual analysis for the future widening of this 2.2 mile segment of roadway. Currently Linder Road is mostly a two lane rural section within the project area. However, this roadway is designated as a Residential Mobility Arterial on the Ada County Master Street Map and a principal arterial on COMPASS’ Functional Class Map, which highlights the significance of this corridor as part of the regional transportation system. Linder Road has been designated as a Residential Mobility Arterial from Chinden Blvd to Homer Road, which is approximately a five mile long corridor that serves the developing cities of Eagle and Star as well as the foothills area. With a river crossing, a future I-84 overpass designation, and direct connections to Meridian and Kuna to the south as well as the foothills to the north, Linder Road is a regionally significant roadway that currently plays an important role, and will continue to play an ever increasing role, in the overall transportation system in the valley. As such, the preservation and future improvement of this roadway is critical to maintaining a quality transportation system in Ada County.

The project is located in the cities of Meridian and Eagle, Idaho west of Eagle Road. The project begins at the intersection of Linder Road and Chinden Blvd (US 20/26) and terminates approximately 2 miles north at the intersection of Linder Road and SH-44. Refer to Figure 1 below for a map of the project location.
Roadway capacity insufficiencies currently exist on Linder Road within the project area and the future traffic demands along this corridor indicate that the existing two-lane roadway will be insufficient to accommodate the projected traffic demands. The purpose of the future widening of Linder Road within the project area will be to increase capacity, improve safety for all modes of transportation and accommodate the forecasted traffic volumes. This project is currently under preliminary development for right-of-way and construction.

The Linder Road Concept Study included an evaluation of the following, each of which are summarized in the sections to follow:

- Traffic analysis to determine timeline to transition from a five lane to seven lane corridor,
- Evaluation of roadway alignment alternatives,
- Hydraulic analysis of the Boise River channels and preliminary environmental scan,
- Bridge alternate study for existing bridge structures, and
- Future project phasing evaluation and Opinion of Probable Costs.

2 TRAFFIC ANALYSIS

A traffic analysis was performed for the AM, PM and daily existing and 2040 horizon year projected volumes to determine the existing deficiencies and future operational needs for Linder Road from US 20/26 to SH-44. A 2045 horizon year projection was also analyzed as it is anticipated that there will be roadway improvement projects along this corridor that will not occur within the next five years. The capacity analysis performed assumed a staged transition from the existing two-lane section to a “5-lane interim” and ultimately a “7-lane ultimate” section throughout the project area. The findings and recommendations from the traffic analysis are summarized below:

- The existing roadway section will need to have increased capacity to meet the future traffic volumes at an appropriate LOS E or better.

- The operational benefits of creating a five-lane section with a two-way left-turn lane are substantial. Using an assumed growth rate of 4% a five-lane facility will be sufficient for ACHD’s “LOS E or Better” requirement until approximately 2036 using ACHD’s Level of Service Standards for a principal arterial with a continuous center left-turn lane.

- The implementation of future improvements at the US 20/26/Linder Road and the SH-44/Linder Road intersections will influence the operational needs of Linder Road within the study area. However, ITD and ACHD currently have no programmed projects to improve these intersections.

- It is recommended that a 5 lane interim facility be built with a long-term 7 lane facility anticipated once capacity thresholds are met. A “5-lane interim” section is recommended for the study area as this roadway section can accommodate a reasonable growth rate of 3.1% to the year 2040. However, the growth projections clearly indicate that a “7-lane ultimate” section will be needed to accommodate the future traffic volumes.
• All structures should be designed to accommodate the “7-lane ultimate” section, due to the fact the design life for these structures is significantly longer that the design life for the roadway.

The complete final Traffic Memorandum can be found in Appendix A.

3 CONCEPTUAL ALIGNMENT ALTERNATIVES EVALUATION

Conceptual alignment alternatives were evaluated for two horizontal and four vertical alignment alternatives. Only two horizontal alignment alternatives were evaluated as variations in the horizontal alignment were restricted by the numerous water features within the project area. The alternatives evaluation assumed that a five-lane roadway section would be implemented initially within this 2.2-mile project area with preservation for an ultimate seven-lane roadway section to be built based on the operational needs of the Linder Road corridor. Horizontal and vertical alignment alternatives were evaluated for the project area assuming both a five lane and seven lane urban and rural roadway section with sidewalks, bike lanes, and/or a multi-use pathway.

The project team discussed the advantages and disadvantages with each alternative and determined that the rural roadway section in the interim 5 lane condition provides significant advantages over the urban interim section. The rural roadway section will minimize initial construction costs as well as costs to transition from a five lane facility to a seven lane facility which is anticipated to occur well before the end of the design life of the interim roadway pavement section. All alternatives recommend an urban roadway section for the ultimate seven lane corridor due to the significant impacts of a rural seven lane section from a right-of-way and drainage perspective.

An Alternatives Matrix was created in order to present a thorough comparison between the alternatives recommended at the conceptual level. Impacts were defined for right-of-way and property owners, environmental, structures, irrigation, utilities, drainage, pedestrians and bikes, construction staging, and relative construction cost for each alternative. Two alternatives were carried forward for inclusion in the Final Alternatives Matrix. The Final Alternatives Matrix is shown in Figure 2 on the following page:
ACHD requested alternative refinements in order to present similar facilities for pedestrians on both sides of the roadway for consistency and increased safety as is reflected in the alternatives presented below. Alternative A shows a rural roadway section for the interim five lane condition with separated pathways as shown in Figure 3:

**Figure 3 – Alternative A Section View**

**ALTERNATIVE A**

5 LANE RURAL - NO BIKE LANE/SEPARATED PATHWAYS (130' ROW)
Alternative B, shown in Figure 4 below, depicts a rural roadway section for the interim five lane condition with separated sidewalks:

![Figure 4 – Alternative B Section View](image)

Alternatives A and B were recommended to be carried forward to the public meeting in order to evaluate the public’s preference of separated pathways versus separated sidewalks. The complete Conceptual Alignment Alternatives Evaluation can be found in Appendix B.

## 4 Public Involvement

### 4.1 Online Survey

An online survey was performed from May 24th, 2018 to June 14th, 2018 in order to determine how the public uses Linder Road and what concerns the public has with the existing facility. There were 867 people that responded to the online survey. Some of the recurring comments are noted below:

- With the development of a Costco and a Winco in the area congestion will get worse,
- Design for future growth development in the area,
- Concerned that development will increase traffic before Linder improvements are done,
- Improve the safety along the road, current conditions unsafe,
- Keep the rural scenery by planting trees and grass for aesthetics,
- Install a traffic light at Linder Road and Temple,
- Start the process of widening Linder Road soon, and
- Slow down construction of residential development and assigning permits.

### 4.2 Public Meeting

Alternatives A and B were carried forward for public comment at the public meeting held on December 3, 2018. Refinements were made to these alternatives based on ACHD’s review of the public meeting exhibits to provide an 8’ buffer area between the proposed back of curb to the edge of sidewalk/pathway. The revised section views for both alternatives are shown Figures 5 and 6 below:
ACHD requested the incorporation of ultimate five lane only, with no expansion, roadway section alternatives for the public meeting exhibits to evaluate the public’s opinion for the preservation of a seven lane roadway section. Therefore, two additional alternatives were added to show an ultimate five lane urban roadway section with separated sidewalks as well as separated pathways. The final alternatives presented at the public meeting are shown in Figures 7 thru 10:

**ALTERNATIVE A:** Five Lanes to Seven Lanes with Shared Pathway

**ALTERNATIVE B:** Five Lanes Only with Shared Pathway
The public involvement meeting was held on December 3, 2018. There were 119 people that signed in at this open house with 70 comment sheets received during the meeting. Comments were accepted until December 17th and 136 comments were received in total. Based on the comments that were received the public preferred Alternative A with 46% of the respondents selecting this alternative and 61% of the respondents preferring the preservation of an ultimate seven lane corridor. Figure 11, shown below, displays the comment response percentages for each of the alternatives presented at the public information meeting:
The publics preferred alternative, Alternative A, was presented at the February 6 ACHD commission meeting. Staff and commission discussed the findings from the December 3 public meeting and concurrence was received to proceed to the next study and design phases with the preferred Alternative A as shown in Figure 12 below:

**ALTERNATIVE A:** Five Lanes to Seven Lanes with Shared Pathway

A complete summary of the public involvement information can be found in Appendix C.

### 5 **DESIGN CONSIDERATION**

#### 5.1 GEOTECHNICAL INVESTIGATION

Geotechnical field exploration and the associated laboratory testing was completed to determine the preliminary pavement section to be utilized for the conceptual design as well as the percolation rates for stormwater infiltration. Soil borings were taken at a depth of about 21.5’ at four boring locations and 17.5’ for three boring locations within the project area. Piezometers were installed at three boring locations for groundwater measurements. Geotechnical investigations conducted within the project area support the stormwater management solutions presented below. The complete geotechnical report can be found in Appendix D.

#### 5.2 HYDRAULIC ANALYSIS

Linder Road crosses the Boise River in three locations within the project area: the South Channel, Middle Channel, and North Channel. Each crossing is a bridge structure that was constructed in the 1990s. The roadway and bridges are located in a Federal Emergency Management Agency (FEMA) regulatory floodplain that characterizes flood hazards during the 100-year flood event. Proposed project improvements include replacing bridges on the South Channel, Middle Channel, and North Channel of the Boise River to increase hydraulic capacity and meet a concept level goal of 2 feet of clearance above the 100-year water elevations. The roadway profile will generally be raised for design reasons including meeting hydraulic clearance. The
primary hydraulic permitting requirement is to demonstrate no increase in 100-year water elevations when comparing existing conditions to proposed conditions.

The results of the hydraulic analysis performed by TO Engineers demonstrates the concept level improvements at the potential seven lane configuration meet the “no-rise” condition, albeit with limited flexibility at preliminary and final design level. The concept level bridges also meet the 2-foot clearance above the 100-year water elevation. The model results indicate there may be adverse impacts to flood hazards in localized areas due to encroachment into the Middle Channel, and raising the road profile that blocks and redirects floodwaters overtopping the existing Linder Road.

Following are recommendations for future hydraulic analysis and permitting at the design level. The complete Hydraulic Report can be found in Appendix E.

1) Update the hydraulic analysis as design progresses and submit a floodplain development permit application at an appropriate stage of design to minimize the risk of any minor refinements at final design level impacting the floodplain permit application. This recommendation is offered to reduce the potential for floodplain permitting to impact the project schedule.

2) Coordinate the hydraulic analysis and design throughout project development to test for a successful “no-rise” condition, develop hydraulic mitigation as necessary, and refine the project design and environmental permitting accordingly.

3) Develop project phasing plans to the appropriate level of certainty for a productive discussion with Ada County and the City of Eagle regarding floodplain permitting.

4) Further investigate potential adverse impacts to flood hazards and mitigation as necessary. Mitigation measures will likely require early coordination with involved landowners.

5) Develop a two-dimensional hydraulic model to gain further insight into flood behavior throughout the floodplain and at the smaller physical scale of adverse impacts identified herein. For purposes of floodplain permitting, consider advancing the concept level one-dimensional model presented herein, and conduct early coordination with Ada County and the City of Eagle as to application of a two-dimensional model.

6) Anticipate in the project schedule that a Conditional Letter of Map Revision (CLOMR) may be required in view of the reasons presented herein. A timeline of 12 months is suggested for processing a CLOMR after the time of submittal. Floodplain permits may be conditioned upon approval of a CLOMR and a post-construction LOMR.

7) Maintain communications with Ada County, City of Eagle, consultants working in the area, and other stakeholders regarding floodplain development or FEMA map modifications that may impact the floodplain analysis and associated project improvements.

8) Perform value engineering study to determine the costs and benefits of decreasing the clearance above the 100-year water elevation to 1 foot.
5.3 DRAINAGE

A conceptual drainage report was prepared to evaluate the existing drainage facilities within the project limits, and develop stormwater conveyance and storage options for the project area. The conceptual conveyance system and infiltration/storage facilities were analyzed for the ultimate seven-lane section for the preferred alternative, as shown in Figure 12. Sizing the drainage facilities for the ultimate roadway section, which provides the most impervious area, will prevent the need for costly re-work of newly constructed conveyance and storage facilities in order to accommodate the additional future roadway widening.

For this study, it was determined that the stormwater will be collected by roadside swales in the interim five lane section, and by curb and gutter and roadside swales between the back of curb and pathway in the ultimate seven lane section, conveyed to inlets and then piped to the proposed stormwater management facilities. Given the existing site constraints and historical drainage systems, four stormwater management systems were considered: conventional seepage beds (BMP 20), vertical sand filters (BMP 21), detention basin with forebay (BMP 11) or wet retention/detention basin (BMP 13), and constructed wetland basins (BMP 14). Constructed wetland basins were determined to be a viable stormwater management option, however these facilities were not analyzed or sized as part of this conceptual design.

Four drainage basin areas were evaluated for the project area. Given that the proposed roadway follows the general pattern of the existing roadway, the proposed drainage basin areas are very similar to the existing basin areas. In the existing condition, the majority of stormwater along Linder Road sheet flows from the roadway to roadside ditches and follows the existing terrain to adjacent properties or bordering bodies of water. With the proposed improvements, the roadway runoff will be captured and conveyed within roadside swales and curb and gutter and discharged to conventional seepage beds, detention basins, or constructed wetland basins. Although vertical sand filters are acceptable per ACHD policy, vertical sand filters were eliminated from consideration due to the maintenance issues associated with these types of facilities.

Within the southernmost drainage basin, five existing seepage beds will continue to be utilized with the proposed conceptual drainage design. Two additional conventional seepage beds will be required to handle the additional stormwater incurring from the roadway widening. Along the middle and northern segments of Linder Road, from the Boise River Middle Channel to Old Valley Road, the ground water has been documented as very shallow, prohibiting the use of conventional seepage beds along the majority of this area. In these areas of high groundwater, ACHD BMP #13 Wet Retention/Detention Basin, or BMP #14 Constructed Wetland Basin are recommended to store, treat, and infiltrate stormwater. In areas where the required separation from groundwater is not achievable, detention basins would need to be lined, or designed as wet facilities or constructed wetlands. The drainage analysis performed with this concept study reflects footprints for a traditional retention/detention basin to detain a 25 year event and discharge in perpetuity to irrigation facilities or other surface waters under license agreements obtained by ACHD. The facility requirements associated with the Constructed Wetland Basins will need to be determined in later phases of design if this stormwater management option is utilized. The Final Drainage Report can be found in Appendix F.
5.4 IRRIGATION
Numerous irrigation facilities will be affected by the planned widening of Linder Road. All existing crossings will need to be modified by either an extension or replacement. Below is a summary of the irrigation crossings within the project area from south to north:

- Phyllis Canal Structure – two span concrete structure
- Eureka Canal Structure – stiff leg culvert
- Zinger Lateral Crossing (12" PVC)
- Zinger Lateral Crossing (48" RCP)
- North Slough Crossing (48" RCP)
- Seven Suckers Ditch Crossing (18" CMP)
- Harton Davis South Crossing (30" RCP)
- Harton Davis North Crossing (18" RCP)
- Old Middleton Mill Canal Crossing (12" PVC)

At a minimum, the hydraulic capacity of the crossings will need to be maintained to perpetuate the existing irrigation capacity and delivery. Initial contact was made with the irrigation entities noted below with jurisdiction over facilities located within the project area. Summaries of these discussions, contact names, and the limits of each jurisdiction can be found in Appendix G. The following lists the irrigation entities in a south to north direction along Linder Road: Settler’s Irrigation District, North Slough Lateral Association, Zinger Lateral, Pioneer Irrigation District, Eureka Water Company, Seven Suckers Ditch Company, Hart Davis Ditch Company, and the Middleton Mill Ditch Company.

Replacement of the existing Eureka Canal culvert should be accomplished with a culvert having the same or similar dimensions as the existing 15’x7’x100’ precast three-sided culvert along with inlet improvements. A 15’ wide x 7’ high x 200’ long precast four-sided box culvert is recommended for this crossing. The existing and proposed Phyllis Canal structures do not encroach into the canal and therefore will not affect hydraulic capacity. A single 105-foot span structural steel girder bridge with composite concrete deck is recommended for this structure.

Continued coordination with the irrigation entities having jurisdiction over these crossings will be important to understanding operations, capacity, potential impacts, license agreement requirements, and the development of proposed modifications. Design and public involvement activities should include coordination with end users to accommodate water delivery and any modifications of private irrigation structures.
5.5 UTILITIES

Utility relocations will be necessary within the project limits. Utilities were not field located, with the exception of those located within proximity of the geotechnical boring locations, however utility maps were acquired and utilized throughout the conceptual design. Existing utilities within the project limits include the following:

- **Suez** – 12” water line just west of east curb and gutter from Chinden to south of the Phyllis Canal with no services shown north of Phyllis to State Street.
- **City of Meridian Sewer** – Reclaimed Main Water Line from Chinden to Duck Alley.
- **Intermountain Gas** – 4” high pressure line on west side of road from SH-44 to Artesian where it crosses to the east side to Temple Drive. On east and west side from Temple Drive to Chinden with a 6” line from Brandt Lane to Chinden.
- **AT&T** – Long line fiber optic along entire length of Linder Road.
- **City of Eagle Sewer** – Sewer service from SH-44 to Old Valley.
- **Zayo** – Facilities located on the north side of the Chinden/Linder intersection only.
- **Syringa** – On west side of Linder north of River Ranch Lane and east side of Linder from River Ranch Lane to the Phyllis Canal, west of Linder Road from Phyllis to Almaden and east side of Linder from Almaden to Chinden.
- **ACHD Fiber** – Fiber on east and west side of Linder to north of Fred Meyer property. West side of Linder Road from Fred Meyer property to Temple Drive. West side of Linder Road from north of the North Channel to SH-44.
- **Idaho Power** – Overhead Phase 3 and Phase 1 east side of Linder Road from SH-44 to Phyllis Canal, and Overhead Phase 3 and Phase 1 east side of Linder Road from Temple Drive to Chinden.

The improvement of Linder Road will provide opportunities to incorporate any potential City water/sewer and ACHD fiber extensions or upgrades along Linder Road.

5.6 ENVIRONMENTAL SCAN

The Linder Road Concept Study completed an environmental scan which collected and documented environmental resources, and assessed the high level environmental impacts resulting from the implementation of the preferred ultimate seven lane section shown in Figure 12. Environmental resource information and impacts have assisted in making concept-level planning decisions. Future design phases, and project construction permitting, will use avoidance and minimization of impacts when considering future facility expansion.

The environmental scan report summarizes potential effects on the physical, hydrological, biological, and human environment resulting from the proposed roadway improvements. Concept-level design features were evaluated along with the expected temporary and permanent impacts associated with the preferred design alternative. A high-level analysis of potential effects was conducted for nearly twenty environmental resource categories. Several resources categories are protected by local, state, and/or federal laws and policy. Impacts to some resources are unavoidable.
Project specific impacts will be further refined in future design phases and impact mitigation will guide a formal impact assessment as required by the National Environmental Policy Act (NEPA) when the proposed project(s) is permitted under the Clean Water Act. The result of the environmental scan showed that “No significant un-mitigatable impacts” exist. However, aquatic, cultural and historic resources as well as species protected under the Endangered Species Act will be the focus of future environmental efforts and permitting going forward. A complete copy of the Environmental Scan can be found in Appendix H.

5.6.1 ENVIRONMENTAL PERMITTING

The Linder Road project has two potential paths to obtaining environmental permitting approval with the staged construction spanning multiple years. Option 1 is to permit the entire corridor as a single complete project. Permitting a single complete project would allow for a single permitting and compensatory mitigation effort executed commensurate with the initial project phase. The key advantage of permitting a single and complete project is economy of scale of the permitting effort and implementation of the mitigation approach for corridor wide impacts. A key disadvantage is the design for the entire corridor (not just an initial project phase) will need to be advanced to a point that permitting can occur. Permitting the project as a single and complete project would follow the following steps:

- Permitting the project as a single and complete project would require that ACHD advance the design for the corridor to near final design with the quantification of impacts in a Joint Application for Permit submitted to the US Army Corps of Engineers (USACE). The permitting action would be supported with agency concurrences for the Endangered Species Act and Section 106 of the State Historic Preservation Act. It is possible that future field survey work may be needed to determine presence or absence of species protected under the Endangered Species Act based on recent conversations with USACE as the yellowbill cuckoo may become a concern. Endangered Species Act survey work, if required, and Section 106 concurrence would need to be completed regardless of the project permitting approach.

- It is assumed that the project corridor impacts would be in excess of 0.5 acres and as such would precipitate the processing of the permit as a Clean Water Act Individual Permit. The typical time frame for processing an individual permit is 180 days once the permit is determined to be complete by the USACE. It is assumed that compensatory mitigation would be required for the anticipated project impacts. This compensatory mitigation would be defined in the permit application and implemented concurrently with the construction of the initial project phase.

- If compensatory wetlands construction are to be implemented to address stormwater runoff then permittee responsible mitigation in the project corridor will require right-of-way acquisition in order to allow for the construction of wetlands habitat at the amounts determined by the USACE.

Option 2 is to permit the Linder Road Corridor in discrete construction packages/phases or projects. The key advantage of permitting the project in phases is that ACHD will not need to advance the design of the project, for the entire corridor, to the same level to permit the initial phase. The key disadvantage of permitting the project in phases is implementing the compensatory mitigation in phases. Permitting the project in discrete packages/phases would follow the following steps:
• Permitting the project by phase will require that both Endangered Species Act and Section 106 of the State Historic Preservation Act be completed for the initial phase as well as subsequent phases.

• Permitting the project in phases would require that ACHD advance the design for a specific project phase to near final design with the quantification of impacts in a Joint Application for Permit to the US Army Corps of Engineers (USACE). The permitting action would be supported with agency concurrences for the Endangered Species Act and Section 106 of the State Historic Preservation Act. It is possible that future field survey work may be needed to determine presence or absence of species protected under the Endangered Species Act.

• It is assumed that the project impacts for discrete phases could be in excess of 0.5 acres and as such would precipitate the processing of multiple Clean Water Act Individual Permits. The typical time frame for processing an individual permit is 180 days once the permit is determined to be complete by the USACE. It is assumed that compensatory mitigation would be required for each project phase and its associated impacts. This compensatory mitigation would be defined in the permit application and implemented concurrently with the construction of each individual project.

• If compensatory wetlands construction are to be implemented to address stormwater runoff then permittee responsible mitigation in the project corridor will require right-of-way acquisition in order to allow for the construction of wetlands habitat at the amounts determined by the USACE. The difference in this option is that the compensatory mitigation amounts would be acquired and constructed per phase rather than in total for the entire corridor. However, the ultimate overall compensatory mitigation requirements will be the same for both options.

It is recommended that once project timelines are better understood ACHD should consult again with the USACE to determine what permitting option is best suited for implementing the corridor improvements. A meeting was held with ACHD and USACE on June 3 to discuss the potential permitting requirements for Linder Road. The final USACE comments associated with the delineation of the wetlands facility had not yet been received at the time this report was prepared. Following are the action items that were defined from the outcome of this meeting: USACE to submit comments regarding Environmental Scan and Wetland Delineation, ACHD to update the Environmental Scan and Wetland Delineation based on the USACE comments, ACHD to request approved jurisdictional determination from USACE, ACHD to provide alignment options to USACE with updated wetland delineation identified on design plans in future design phases, and ACHD to determine construction phasing to assist in permitting.

Finalizing the delineation of aquatic habitats will be a key next step to document compliance with Clean Water Act 401 (b)(1) guidelines during future design phases. Determination of where constructed wetland basins will be built for stormwater and permittee responsible compensatory mitigation is also recommended. Identifying the size of the constructed wetland basin facility will be a key considerations for the right-of-way acquisition process. Lastly, the constructed wetland basin facilities and their discharge locations may need license agreements from 3rd parties. It is recommended that coordination continue to ensure proof of concept. The recommendations noted assumes that only local funds are used for the design and construction for all projects.
5.7 BRIDGE ALTERNATE STUDY

The Linder Road Concept Study area encompass five irrigation and river crossings requiring bridge structural design. These crossings are Phyllis Canal, Eureka Canal, Boise River – South Channel, Boise River – Middle Channel, and Boise River – North Channel. The existing roadway vertical alignment had to be raised at all crossing locations in order to achieve sufficient hydraulic clearance. As a result, all five structures need to be replaced to accommodate the future widening of Linder Road.

The preferred corridor concept is to construct a roadway accommodating five lanes in the interim and widen to seven lanes in the future as dictated by traffic volumes. It was investigated whether the bridges should also be constructed for the five lane interim condition and widened in the future. However, in order to accommodate future widening all pathway approaches, vehicular railing, and pedestrian/bicycle railing would have to be completely reconstructed on each bridge at a significant cost. Additionally, the design life of these structures is significantly longer than the design life of the roadway and it is more cost-effective to construct to seven lanes initially than build five lanes and add on later. Therefore, it is recommended to construct the bridges for seven lanes during the original construction. The conceptual typical bridge cross section, shown in Figure 13 below, was derived from the preferred roadway typical section as shown in Figure 12.

Figure 13 – Conceptual Bridge Cross Section

Several key factors were investigated to determine the recommended structure location, type and size. The recommended structure alternatives were selected based upon roadway geometry, pedestrian pathways, hydraulic impact, environmental impact, constructability, and cost effectiveness. In addition to six lanes, a 12-foot median lane is continued across all proposed structures to provide adequate room to prevent vehicle stacking due to approach roads and driveways near crossings. However, potential cost savings were investigated for six lane structures at the Boise River Middle Channel and the Boise River North Channel structures as the median turn lane may not be needed on these bridges. Additional traffic analyses should be performed with future design phases to verify the need for the additional median lane on these structures.

Geotechnical analysis and borings specific to the structures was not performed with the concept study and will be developed for each bridge location during future design. For the purposes of this study, and based on the precedence set by the existing structures, all bridges are assumed to be founded on piling unless otherwise noted. In addition, it is recommended all structures have an approach slab if possible to provide smooth bridge transitions and mitigate potential settlement of roadway approach fill. Bridge elements and members such as girders, vehicular barriers, and pedestrian railing are based on ITD Standard Drawings and Bridge Design Manual to ensure elements can be sourced locally, and contractors will be familiar with proposed bridge construction. See Table 1 for a summary of concept bridge alternative information and the recommended bridge type.
The complete Bridge Alternate Study can be found in Appendix I.

### 5.8 Pedestrians and Bicycles

Linder Road, within the project area, currently has limited pedestrian and bicycle facilities within the rural roadway section north of the Phyllis Canal structure. The existing irrigation crossings for the Eureka and Phyllis canals, as well as the three Boise River crossings, all have raised sidewalks on the east side of these existing structures. These facilities then tie to the existing narrow shoulders which are present on the east and west side of the roadway along the majority of the corridor.

With plans for the Boise River Greenbelt extension to the west and a future green belt crossing at the North Channel River crossing, pedestrian and bicycle facilities will be critical along this corridor. The proposed project improvements will provide separated 10’ multi-use pathways on both sides of Linder Road north of the Phyllis Canal structure to SH-44, which will tie to separated sidewalks and 6’ bike lanes south of the Phyllis Canal to Chinden Blvd. The Linder Road pedestrian and bicycle facilities would then tie to the existing facilities located on Chinden Boulevard and SH-44 as well as the future Boise River Greenbelt crossing at the Boise River North Channel. Future at grade signalized pedestrian crossings should also be evaluated within the project area as part of future design phases.

Linder Road within the project area is considered a Level 3 facility in ACHD’s 2018 Roadway to Bikeways Plan. The consideration of buffered bike lanes is recommended for Level 3 facilities if separate multi-use pathway facilities are not provided. Therefore, future design considerations should evaluate the inclusion of this buffer area in the transition from the multi-use pathway to the Chinden Blvd./Linder Road intersection.

<table>
<thead>
<tr>
<th>Crossing</th>
<th>Out to Out Width</th>
<th>Out to Out Length</th>
<th>Spans</th>
<th>Span Length</th>
<th>Bridge Type</th>
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</thead>
<tbody>
<tr>
<td>Boise River, N. Channel</td>
<td>114.5 ft</td>
<td>433.08 ft</td>
<td>4</td>
<td>95ft, 125ft</td>
<td>Pre-stressed Concrete</td>
</tr>
<tr>
<td>Boise River, Middle Channel</td>
<td>116.0 ft*</td>
<td>76.25 ft</td>
<td>1</td>
<td>75.00 ft</td>
<td>Voided Slab</td>
</tr>
<tr>
<td>Boise River, S. Channel</td>
<td>114.5 ft</td>
<td>107.00 ft</td>
<td>1</td>
<td>105.00 ft</td>
<td>Pre-stressed Concrete</td>
</tr>
<tr>
<td>Phyllis Canal</td>
<td>114.5 ft</td>
<td>107.25 ft</td>
<td>1</td>
<td>105.00 ft</td>
<td>Steel</td>
</tr>
<tr>
<td>Eureka Canal</td>
<td>17.0 ft</td>
<td>200.00 ft</td>
<td>1</td>
<td>15.00 ft</td>
<td>Pre-cast Box Culvert</td>
</tr>
</tbody>
</table>

*Standard void slab girder sizes dictate a slight increase in width.
5.9 CONSTRUCTION STAGING (OPINION OF PROBABLE CONSTRUCTION COSTS)

Three construction stages are recommended for the phasing of the construction of Linder Road from US 20/26 (Chinden Boulevard) to SH-44 (State Street):

CONSTRUCTION STAGE 1 encompasses the roadway and bridge construction for the southern portion of the project area from south of Almaden Dr. to north of Artesian Road. The major construction tasks for Stage 1 are noted below:

- Roadway widening for urban five lane section with 5’ setback sidewalks for 2200’
- Roadway widening from two lanes to five lanes with 10’ separated pathways for 1350’
- Phyllis Canal Structure – single span steel girder bridge with composite concrete deck (105’)
- Eureka Canal Structure – box culvert (15’ x 7’)
- South Channel Structure – single span concrete girders with cast in place deck (105’)
- Re-alignment of Duck Alley
- Construction of Pond 1

CONSTRUCTION STAGE 2 includes the roadway and bridge construction for the middle portion of the project area from north of Artesian Road to south of Hatchery Road. The major construction tasks for Stage 2 are noted below:

- Roadway widening from two lanes to five lanes with 10’ separated pathways for 2550’
- Middle Channel Structure – single span voided slab with composite cast in place deck (75’ span)
- Construction of Pond 2

CONSTRUCTION STAGE 3 includes the roadway and bridge construction from south of Hatchery Road to south of SH-44 which includes the North Boise River Channel structure. The major construction tasks for Stage 3 are noted below:

- Roadway widening from two lanes to five lanes with 10’ separated pathways for 3500’
- North Channel Structure – pre-stressed four span concrete girders with cast in place deck (443’)
- Construction of Pond 3

Three independent construction stages were defined for the project area in order to allow for projects that can be constructed within ACHD’s fiscal year budget constraints. The three construction stages defined can be programmed as standalone projects in ACHD’s Five Year Work Program based on funding availability. Table 2 shown below summarizes the construction costs for each stage of construction, which includes costs for temporary pavement to match back to existing facilities prior to the completion of the final stage. Construction Stage 3 was evaluated for separating the construction of the structure and roadway into two separate packages due to the significant cost of this construction stage. However, it is recommended that the structure and the roadway are constructed together as the construction duration increases and the
individual project cost for the structure alone is only slightly lower than the combined structure and roadway project cost.

<table>
<thead>
<tr>
<th>Stage</th>
<th>2019 Estimated Construction Cost*</th>
<th>Estimated R/W Required (acres)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAGE 1 (STA. 113+00 TO STA. 148+50)</td>
<td>$13.3M to $15.3M</td>
<td>3.5</td>
</tr>
<tr>
<td>STAGE 2 (STA. 148+50 TO STA. 174+00)</td>
<td>$7.1M to $9.1M</td>
<td>3.52</td>
</tr>
<tr>
<td>STAGE 3 (STA. 174+00 TO STA. 209+00)</td>
<td>$16.1M to $18.1M</td>
<td>4.18</td>
</tr>
<tr>
<td>Total</td>
<td>$36.5M to $42.5M</td>
<td>11.2</td>
</tr>
</tbody>
</table>

*Design fees are not included in the estimated construction costs. Design fees are estimated to be 10% of the construction cost.

Estimated construction costs include traditional drainage ponds for stormwater. Right-of-way take areas and costs for construction may increase for final drainage solution.

Table 2: Opinion of Probable Costs

The sequencing of these construction projects does not need to occur in chronological order as the staging numbers indicate. There is benefit to performing the construction of Stage 1 first, followed by Stage 3, with Stage 2 being the final stage. Constructing in this sequencing would provide improvements at the southern and northern limits of the project first where most of the recent development is occurring. The complete Construction Staging Memorandum can be found in Appendix J.

6 CONCLUSION

The objective of the Linder Road Concept Study was to identify the long-range needs for this regionally significant roadway. The preferred “interim” five-lane alternative, as presented in this report, serves as the recommendation for the long-range planning of Linder Road from Chinden Boulevard (US 20/26) to SH-44 with the implementation of the “ultimate” seven-lane roadway section based on the operational needs of the corridor. This recommendation is based on the analysis, engineering and public involvement coordination as summarized in this report. Due to the sensitive environmental considerations within this corridor efforts should be made throughout future design phases for avoidance and minimization of impacts to environmentally sensitive areas.

Upon completion of the Concept Study, it is anticipated that ACHD will proceed with the design and construction as funding allows. This project is currently under preliminary development for right-of-way and construction and programming years have not yet been defined.
Appendicies (included in individual files)

Appendix A – Final Traffic Memorandum
Appendix B – Final Conceptual Alignment Alternatives Evaluation Memorandum
Appendix C – Public Involvement Information
Appendix D – Final Geotechnical Investigation
Appendix E – Final Hydraulic Analysis Report
Appendix F – Final Drainage Report
Appendix G – Final Irrigation Facilities Report
Appendix H – Final Environmental Scan
Appendix I – Final Bridge Alternate Study
Appendix J – Final Construction Staging Memorandum