US 6 BRIDGES DESIGN BUILD DESIGN EXCEPTION/DESIGN DECISION MEMORANDUM

After completing the preliminary design for the US 6 Bridges design-build project it was determined that in several instances it was impractical to meet the prescribed design criteria. This memorandum identifies the locations where a design criteria could not be met and why it was impractical to meet the design criteria.

Design Exception numbers 1 & 2 are not used. These design exceptions were changed to design decisions.

Design Decision 1 – *US 6 at tie in with existing near Knox Ct.*

The US 6 Design Build project ties into the existing US 6 roadway at this location. The horizontal curve of the existing US 6 alignment prohibits achieving a design speed of 65 MPH at the Knox Ct. tie-in. At this location the existing US 6 alignment has a curve with a radius of approximately 5300 feet and a superelevation of 2.6%, resulting in a design speed of 48 MPH. Without the replacement of the Knox Ct. structure, which spans US 6, this curve cannot be altered. Replacement of the Knox Ct. structure is not within the scope of this project. A design decision was made at this location to allow a reduced horizontal design speed of 40 MPH. This work is considered the approach to the project and future projects can upgrade this design.

Design Decision 2 – *Entrance Ramp from Federal Blvd to WB US 6.*

Due to the widening of US 6 the horizontal curvature of the on-ramp from Federal Blvd to US 6 was reduced from its original condition. The new ramp alignment results in a horizontal design speed of 45 MPH. The project technical criteria state that interchange ramps should reach a design speed of 50 MPH at the highway gore. Although it is physically possible to increase the radius of this ramp to improve the design speed it is impractical to do so without creating further impacts to Barnum Park North. As a result a design decision was made use a horizontal design speed for this ramp of 45 MPH.

Design Exception 3 – *Federal Boulevard to EB US 6 (Braided Ramp Structure)*

This structure is located at the beginning of the ramp from Federal Blvd to EB US 6. The horizontal design speed of this ramp at the EB US 6 CD Road structure is 25 MPH. The lower design speed reduces the skew and length of the structure spanning the CD Road and therefore

reduces the overall cost of the structure. A sharper skew would not be structurally feasible. If the ramp design speed were to be increased to 30 MPH, as the design standards dictate, the length of the structure would increase and become excessively costly and challenging to construct. As a result a design exception has been requested for this area.

Design Exception 4 – *Bryant Street to Federal Boulevard Ramp*

The ramp which connects Bryant Street to Federal Boulevard has a vertical design speed of 35 MPH. The project design criteria for ramps is 45 MPH which satisfies the requirement that the ramp design speed be 10 MPH less than the adjoining road design speed. A 45 mph design speed was not met on this ramp due to the restrictive distance between Federal Blvd and Bryant St, and the proposed profile of US 6. Because this ramp adjoins the WB US 6 CD Road off ramp at Federal Blvd it must match grades with the US 6 mainline profile between the gores of the Bryant St to Federal Blvd ramp and the WB US 6 CD Road to Federal Blvd ramp. This requirement in association with the vertical difference between Bryant St and Federal Blvd require that either the vertical curves of this ramp be designed at speeds lower than 45 MPH or the grades be increased to greater than 6%. Due to the large trucks which will be utilizing this ramp it was decided to decrease the design speed of the vertical curves and maintain grades below 5%. As a result a design exception has been requested for the vertical curves on this ramp.

Design Exception numbers 5 & 6 are not used. These design exceptions were changed to design decisions.

Design Decision 5 *– EB US 6 CD Road tie into existing I-25 Flyovers*

At the termination of the new EB US 6 CD road, the tie-in to the existing structure does not meet the project horizontal design speed, vertical design speed and stopping sight distance criteria. This condition cannot be corrected without replacing or reconstructing the US 6 to I-25 flyover ramps. Replacement or reconstruction of these ramps is not within the project scope. A design decision was made to maintain the horizontal design speed of 30 MPH, the vertical design speed of 30 MPH, and the stopping sight distance of 230'. At this location the US 6 Design Build project ties into an existing condition and as a result this deficiency is considered a design decision and not a design exception.

Design Decision 6 *– WB US 6 CD Road (South of Robinson Dairy)*

The outside shoulder of the WB US 6 CD road was reduced from 12 feet to 8 feet south of the Robinson Dairy. This reduction in shoulder width reduced impacts to the operations of the Robinson Dairy loading docks which border the South Platte River. The reduction of this

shoulder from 12 feet to 8 feet eliminates the need to acquire R.O.W at this location. For these reasons a design decision was made to reduce the shoulder width at this location. Since this is an isolated reduction it was determined to be a design decision.

***Design Exception 7** – SB I-25 to WB US 6 CD Road Ramp*

Right-of-way restrictions adjacent to the widening of the SB I-25 to WB US6 CD Road ramp limits the design. A ramp that meets a 50 MPH design speed at this location would require the construction of a separate ramp structure, acquisition of additional right of way , and create additional (4f) impacts at Frog Hollow Park. These actions were determined to be impractical and as a result a design exception is being sought to reduce this ramps design speed to 35 MPH.

***Design Exception 8** – Intentionally left blank*

Originally a design exception was going to be sought for the SB I-25 to EB US 6 loop ramp. After review of the project design criteria it was determined that this design meets loop ramp design criteria. No design exception or decision is being sought for this location.

Design Exception numbers 9 & 10 are not used. These design exceptions were changed to design decisions.

***Design Decision 9** - US 6 over I-25*

Due to the existing flyovers US 6 cannot be widened near its crossing over I-25. The existing flyover piers and pier caps limit the roadway width for US 6 at this location. To accommodate the proposed section without widening the roadway a design decision was made to reduce the inside shoulders to 8 feet and the outside shoulders to 4 feet. These widths are a direct result of conflicts with the aforementioned flyover piers. This reduction in shoulder width applies to this location only.

***Design Decision 10** – I-25 underpass of US 6*

In order to tie into the existing I-25 configuration the inside shoulders at the US 6 underpass have been reduced from the required 12 feet to approximately 7 feet. This design decision allows a curve to be fit into the existing I-25 alignment without increasing the reconstruction required along I-25. The US 6 structure over I-25 has been designed with a wide enough opening to allow for full 12 foot shoulders should I-25 be widened to match the layout as described in the Valley Highway EIS (future project).

Design Exception 11 – *US 6 East of I-25*

Vertical clearance between the existing fly-over structures and US 6 east of I-25 limits the ability to obtain a 55 MPH horizontal design speed. Achieving a 55 MPH design speed requires the superelevation of US 6. Superelevating US 6 east of I-25 reduces the vertical clearance between US 6 and the I-25 flyovers to less than 16.5 feet. To remedy this vertical clearance conflict, lowering the profile of US 6 was investigated and several drawbacks were discovered. When the US 6 profile is lowered, I-25 must also be lowered to maintain the vertical clearance. Additional lowering of I-25 exacerbates drainage issues and increases the reconstruction limits along I-25. If US 6 is left as a normal crown section with a design speed of 50 MPH, reduced vertical clearance can be avoided. The negative impacts associated with superelevating US 6 were determined to outweigh the benefits of achieving a 55 MPH design speed. As a result a design exception is being sought to reduce the horizontal design speed from 55 MPH to 50 MPH on US 6 east of I-25.

Design Exception 12 *- Northbound I-25 to EB US 6 (Entrance to US 6)*

The entrance ramp to US 6 from NB I-25 has sub-standard design speeds due to existing horizontal and vertical constraints. The existing ramp is constrained by I-25 to the west, US 6 to the north, the UPRR to the east and a railroad spur bridge to the south. As a result of these constraints there is not adequate space to improve the radius or design speed of the exit ramp without making major modifications to one or all of the conflicting elements. For these reasons, a design exception is being requested in this area to reduce the design speed of this ramp to 30 MPH.

Design Exception number 13 is not used. This design exception was changed to a design decision.

Design Decision 13 – *SB I-25 south of US 6*

The existing vertical clearance of SB I-25 and US 6 does not currently meet the required standard of 16.5 feet. In order to comply with this standard, SB I-25 must be lowered from its current elevation. When this lowering occurs the grade along SB I-25 will be slightly in excess of 4%. At this location a design decision has been made to allow a grade of up to 4.5%. This is beneficial for several reasons. It ensures that the reconstruction along SB I-25 does not impact the railroad spur bridge south of the project area, and it reduces the amount of reconstruction needed along I-25.

Design Exception 14 – *Northbound I-25 to EB US 6 (Exit from I-25)*

The exit ramp from I-25 to EB US 6 has sub-standard design speeds due to existing horizontal and vertical constraints. The existing exit ramp is constrained by I-25 to the west, US 6 to the

north, the UPRR to the east and a railroad spur bridge to the south. These constraints restrict improving the exit radius or design speed without making major changes to one or all of the constraining elements including the existing US 6 to I-25 flyovers. As a result a design exception is requested for both the vertical and horizontal design speeds of the exit from I-25. A future project will be able to improve this design (part of the Valley Highway EIS).

Design Exception 15 – *Northbound I-25 to WB US 6 Loop Ramp*

The NB I-25 to WB US loop ramp must be aligned to avoid several of the US 6 to I-25 flyover piers. These piers presented both horizontal and vertical challenges in creating the alignment for the NB I-25 to WB US 6 loop ramp. . The result is a ramp which has a 20 MPH horizontal design speed and a 43 MPH vertical design speed at the tie-in to US 6. Due to the existing flyover constraints it was determined that a design exception for both the vertical and horizontal design speeds at this location is necessary.