

# **I-70 Mountain Corridor**

## **Level 1 Maintenance of Traffic Cost Estimate Summary**

**REV0 – February 3, 2014**

This white paper is a summary of the logic used to estimate the maintenance of traffic (MOT) costs for each alternate and option of the Level 1 study for the I-70 Mountain Corridor. Detailed MOT concepts have not been developed for any of the alternates/options at this stage of the study, therefore, MOT costs are being expressed as an assumed percentage of the total construction cost for each alternate/option. These percentages will be applied only to the total estimated construction costs, with a few exceptions as noted in the appropriate summaries.

For each alternate/option, the following items are used as the basis for the MOT cost estimate and are listed accordingly:

- Primary construction operations
- An assumed general MOT concept(s)
- Construction items that will skew the MOT costs up or down and affect the percentages

In general, for all concepts with significant off-line expensive work which have limited impacts to traffic and thus require less MOT (such as retaining walls in widened sections), the percentage of the construction cost will be much less than those concepts with significant MOT operations. Additionally, for those concepts that are improving the design speed to 65 mph, there will be many locations where the roadway must be realigned, which requires more off-line work and will also have a lower percentage of the construction cost for MOT.

For all alternates/options, assume the westbound twin tunnel has been widened, but no other westbound roadway improvements are complete prior to this project.

For reference in the following discussions, EJMT = Eisenhower Johnson Memorial Tunnels.

### **Alternate 01 – Option 01: 2 Tolloed Reversible Managed Lanes**

Construct two reversible managed lanes at 65 mph in the median of I-70 between Silverthorne and C-470. These lanes will be on a viaduct between the east end of Idaho Springs and Floyd Hill and on grade for the remainder of the corridor. General purpose lanes will be reconstructed to 55 mph for all areas except the viaduct, where they will remain at the existing design speed. No new general purpose lanes will be added. There will be two 10' shoulders in the reversible lanes, and 12' outside and minimum 4' inside shoulders in the general purpose lanes.

Project includes a 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels.

Major construction components:

- Reconstruction/overlay of existing pavement (except from east of Idaho Springs to Floyd Hill)
- All new bridges (except from east of Idaho Springs to Floyd Hill)
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Significant rock cuts
- Drainage improvements, including closed drainage and water quality facilities

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- For rock cut areas and structure/retaining wall construction adjacent to Clear Creek, assume the contractor needs more room to work and use a three stage construction approach
  - Stage 1: shift traffic to the outside and construct the median/managed lanes
  - Stage 2: shift traffic into the managed lanes away from the rock cut or structure/wall work
  - Stage 3: shift traffic onto the widened section from Stage 2 and construct the remainder
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

The 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels requires minimal traffic control. Exclude the cost of the tunnel work from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation. The new viaduct will only require traffic control in areas where piers are in the median or in close proximity to the lanes, thus this element would skew the MOT costs and will not be included in the calculation.

**Estimated MOT Percentage of Construction Cost: 3% of all items excluding the 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels, and the new managed lane viaduct**

### **Alternate 01 – Option 02: 2 Tolloed Reversible Managed Lanes**

Construct two reversible managed lanes at 65 mph in the median of I-70 between Silverthorne and C-470. General purpose lanes will also be reconstructed to 65 mph. No new general purpose lanes will be added. There will be two 10' shoulders in the reversible lanes, and 12' outside and minimum 4' inside shoulders in the general purpose lanes.

Project includes a 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels.

Major construction components:

- Reconstruction/overlay of existing pavement
- All new bridges
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Significant rock cuts
- Drainage improvements, including closed drainage and water quality facilities

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- For rock cut areas and structure/retaining wall construction adjacent to Clear Creek, assume the contractor needs more room to work and use a three stage construction approach
  - Stage 1: shift traffic to the outside and construct the median/managed lanes
  - Stage 2: shift traffic into the managed lanes away from the rock cut or structure/wall work
  - Stage 3: shift traffic onto the widened section from Stage 2 and construct the remainder
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

The 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels requires minimal traffic control. Exclude the cost of the tunnel work from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation.

The significant difference from Alternate 01 – Option 01 is the 65 mph design speed for the general purpose lanes. This will require more three stage construction work, thus a slightly higher MOT cost.

**Estimated MOT Percentage of Construction Cost: 4% of all items excluding the 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels**

### **Alternate 02 – Option 01: 3 Tolled Reversible Managed Lanes**

Construct three reversible managed lanes at 65 mph in the median of I-70 between Silverthorne and C-470. These lanes will be on a viaduct between the east end of Idaho Springs and Floyd Hill and on grade for the remainder of the corridor. General purpose lanes will be reconstructed to 55 mph for all areas except the viaduct, where they will remain at the existing design speed. No new general purpose lanes will be added. There will be two 10' shoulders in the reversible lanes, and 12' outside and minimum 4' inside shoulders in the general purpose lanes.

Project includes a 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels.

Major construction components:

- Reconstruction/overlay of existing pavement (except from east of Idaho Springs to Floyd Hill)
- All new bridges (except from east of Idaho Springs to Floyd Hill)
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Significant rock cuts
- Drainage improvements, including closed drainage and water quality facilities

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- For rock cut areas and structure/retaining wall construction adjacent to Clear Creek, assume the contractor needs more room to work and use a three stage construction approach
  - Stage 1: shift traffic to the outside and construct the median/managed lanes
  - Stage 2: shift traffic into the managed lanes away from the rock cut or structure/wall work
  - Stage 3: shift traffic onto the widened section from Stage 2 and construct the remainder
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

The 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels requires minimal traffic control. Exclude the cost of the tunnel work from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation. The new viaduct will only require traffic control in areas where piers are in the median or in close proximity to the lanes, thus this element would skew the MOT costs and should not be included in the calculation.

**Estimated MOT Percentage of Construction Cost: 3% of all items excluding the 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels and the new managed lane viaduct**

### **Alternate 02 – Option 02: 3 Tolloed Reversible Managed Lanes**

Construct three reversible managed lanes at 65 mph in the median of I-70 between Silverthorne and C-470. General purpose lanes will also be reconstructed to 65 mph. No new general purpose lanes will be added. There will be two 10' shoulders in the reversible lanes, and 12' outside and minimum 4' inside shoulders in the general purpose lanes.

Project includes a 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels.

Major construction components:

- Reconstruction/overlay of existing pavement
- All new bridges
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Significant rock cuts
- Drainage improvements, including closed drainage and water quality facilities

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- For rock cut areas and structure/retaining wall construction adjacent to Clear Creek, assume the contractor needs more room to work and use a three stage construction approach
  - Stage 1: shift traffic to the outside and construct the median/managed lanes
  - Stage 2: shift traffic into the managed lanes away from the rock cut or structure/wall work
  - Stage 3: shift traffic onto the widened section from Stage 2 and construct the remainder
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

The 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels requires minimal traffic control. Exclude the cost of the tunnel work from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation.

The significant difference from Alternate 02 – Option 01 is the 65 mph design speed for the general purpose lanes. This will require more three stage construction work, thus a slightly higher MOT cost.

**Estimated MOT Percentage of Construction Cost: 4% of all items excluding the 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels**

### **Alternate 02 – Option 03: 3 Tolled Reversible Managed Lanes**

Construct three reversible managed lanes at 65 mph in the median of I-70 between Silverthorne and C-470. These lanes will be on a viaduct between the west end of Idaho Springs and Floyd Hill and on grade for the remainder of the corridor. General purpose lanes will also be reconstructed to 65 mph for all areas except the viaduct, where they will remain at the existing design speed. No new general purpose lanes will be added. There will be two 10' shoulders in the reversible lanes, and 12' outside and minimum 4' inside shoulders in the general purpose lanes.

Project includes a 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels.

Major construction components:

- Reconstruction/overlay of existing pavement (except from east of Idaho Springs to Floyd Hill)
- All new bridges (except from east of Idaho Springs to Floyd Hill)
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Significant rock cuts
- Drainage improvements, including closed drainage and water quality facilities

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- For rock cut areas and structure/retaining wall construction adjacent to Clear Creek, assume the contractor needs more room to work and use a three stage construction approach
  - Stage 1: shift traffic to the outside and construct the median/managed lanes
  - Stage 2: shift traffic into the managed lanes away from the rock cut or structure/wall work
  - Stage 3: shift traffic onto the widened section from Stage 2 and construct the remainder
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

The 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels requires minimal traffic control. Exclude the cost of the tunnel work from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation. The new viaduct will only require traffic control in areas where piers are in the median or in close proximity to the lanes, thus this element would skew the MOT costs and should not be included in the calculation.

The significant difference from Alternate 02 – Option 01 is the 65 mph design speed for the general purpose lanes. This will require more three stage construction work, thus a slightly higher MOT cost.

**Estimated MOT Percentage of Construction Cost: 4% of all items excluding the 3<sup>rd</sup> bore of the EJMT and the Twin Tunnels and the new managed lane viaduct**

**Alternate 03 – Option 01:** Minimum Program per PEIS

Widen I-70 in select locations to add auxiliary lanes. Cross section will accommodate a new 12' auxiliary lane and 12' inside and outside shoulders. The design speed will be 55 mph, so only limited locations will need to be re-aligned. The following locations will be improved:

- EB at Silverthorne
- EB and WB between the EJMT and Bakerville
- EB and WB between the twin tunnels and Floyd Hill
- WB between Chief Hosa and Morrison

Assume all significant widening is to the outside. Project includes the 3<sup>rd</sup> bore of the EJMT. Tolling is limited to the 3<sup>rd</sup> bore of the EJMT and the twin tunnels.

Major construction components:

- Widening/reconstruction of inside shoulders in limited locations, where necessary
- Widening of outside shoulders
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Rock cuts
- Drainage improvements, including closed drainage in retaining wall areas and water quality facilities
- Mill and overlay full width of existing pavement (only in locations of new auxiliary lanes)

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

The 3<sup>rd</sup> bore of the EJMT requires minimal traffic control. Exclude the cost of the tunnel work from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation.

**Estimated MOT Percentage of Construction Cost: 7% of all items excluding the 3<sup>rd</sup> bore of the EJMT**

### **Alternate 03 – Option 02:** Minimum Program per PEIS

Widen I-70 in select locations to add auxiliary lanes. Cross section will accommodate a new 12' auxiliary lane and 12' inside and outside shoulders. The design speed will be 65 mph, so a number of locations will need to be re-aligned. The following locations will be improved:

- EB at Silverthorne
- EB and WB between the EJMT and Bakerville
- EB and WB between the twin tunnels and Floyd Hill
- WB between Chief Hosa and Morrison

Assume all significant widening is to the outside. Project includes the 3<sup>rd</sup> bore of the EJMT, new EB and WB bored tunnels at Hidden Valley, and a new WB cut & cover tunnel near US 6. Tolling is limited to the 3<sup>rd</sup> bore of the EJMT, the new Hidden Valley Tunnels, and the twin tunnels.

Major construction components:

- Widening/reconstruction of inside shoulders in limited locations, where necessary
- Widening of outside shoulders
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Drainage improvements, including closed drainage in retaining wall areas and water quality facilities
- Rock cuts
- Mill and overlay full width of existing pavement (only in locations of new auxiliary lanes)

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

All bored tunnel work requires minimal traffic control. Exclude the cost of the tunnel work for all three new bored tunnels from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation and the cut & cover tunnel.

The significant difference from Alternate 03 – Option 01 is the 65 mph design speed for the general purpose lanes. This will require more three stage construction work, thus a slightly higher MOT cost.

**Estimated MOT Percentage of Construction Cost: 8% of all items excluding the 3<sup>rd</sup> bore of the EJMT and the two tunnels at Hidden Valley**

**Alternate 03 – Option 03:** Minimum Program per PEIS

Widen I-70 in select locations to add auxiliary lanes. Cross section will accommodate a new 12' auxiliary lane and 12' inside and outside shoulders. The design speed will be 55 mph, so only limited locations will need to be re-aligned. The following locations will be improved:

- EB at Silverthorne
- EB and WB between the EJMT and Bakerville
- EB and WB between the twin tunnels and Floyd Hill
- WB between Chief Hosa and Morrison

Assume all significant widening is to the outside. Tolling is limited to the twin tunnels.

Major construction components:

- Widening/reconstruction of inside shoulders in limited locations, where necessary
- Widening of outside shoulders
- Retaining walls
- Drainage improvements, including closed drainage in retaining wall areas and water quality facilities
- Rock cuts
- Mill and overlay full width of existing pavement (only in locations of new auxiliary lanes)

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- Assume rock cuts are done at night with full freeway closures for blasting.
- Final mill and overlay done at night with lane closures.

This alternate will have less MOT required due to the elimination of the 3<sup>rd</sup> bore of the EJMT and the associated cut & cover tunnels on the approaches. However, the cost of construction of the approaches to the EJMT is a significant portion of the overall costs for Options 01 and 02 of Alternate 03, which drives down the cost of the MOT as a percentage of the project costs. Therefore, the costs for MOT of Alternate 03 – Option 03 will be higher as a percentage of the construction costs.

**Estimated MOT Percentage of Construction Cost: 10% of all items**

### **Alternate 03 – Option 04:** Minimum Program per PEIS

Widen I-70 in select locations to add auxiliary lanes. Cross section will accommodate a new 12' auxiliary lane and 12' inside and outside shoulders. The design speed will be 65 mph, so a number of locations will need to be re-aligned. The following locations will be improved:

- EB at Silverthorne
- EB and WB between the EJMT and Bakerville
- EB and WB between the twin tunnels and Floyd Hill
- WB between Chief Hosa and Morrison

Assume all significant widening is to the outside. Project includes new EB and WB bored tunnels at Hidden Valley. Tolling is limited to the new Hidden Valley tunnels and the twin tunnels.

Major construction components:

- Widening/reconstruction of inside shoulders in limited locations, where necessary
- Widening of outside shoulders
- Retaining walls
- Drainage improvements, including closed drainage in retaining wall areas and water quality facilities
- Rock cuts
- Mill and overlay full width of existing pavement (only in locations of new auxiliary lanes)

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- Assume rock cuts are done at night with full freeway closures for blasting.
- Final mill and overlay done at night with lane closures.

The new bored tunnel work requires minimal traffic control. Exclude the cost of the tunnel work for both new bored tunnels from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation.

Similar to alternate 03 – Option 03, the deletion of the 3<sup>rd</sup> bore of the EJMT and its cut & cover approach tunnels affects the cost of the MOT as a percentage of total construction costs for this alternate. The significant difference from Alternate 03 – Option 03 is the 65 mph design speed for the general purpose lanes. This will require more three stage construction work, thus a slightly higher MOT cost.

**Estimated MOT Percentage of Construction Cost: 12% of all items excluding the two tunnels at Hidden Valley**

**Alternate 04 – Option 01:** Maximum Program per PEIS

Widen both directions of I-70 between the EJMT and Floyd Hill to accommodate a new 12' toll lane, 2' buffer zone, 14' inside shoulder/enforcement area and 12' outside shoulder. Maintain the existing 12' general purpose lanes and assume all significant widening is to the outside. Also includes adding an auxiliary lane in the WB direction between Chief Hosa and Morrison. The design speed will be 55 mph, so only limited locations will need to be re-aligned.

Assume that the toll signing, detection equipment, and lane use signals will be mounted on cantilever structures in the median.

Project includes the 3<sup>rd</sup> bore of the EJMT.

Major construction components:

- Widening/reconstruction of inside shoulders in limited locations, where necessary
- Widening of outside shoulders
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Drainage improvements, including closed drainage in retaining wall areas and water quality facilities
- Rock cuts
- Mill and overlay full width of existing pavement
- Toll equipment and associated ITS

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

The 3<sup>rd</sup> bore of the EJMT requires minimal traffic control. Exclude the cost of the tunnel work from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation.

**Estimated MOT Percentage of Construction Cost: 7% of all items excluding the 3<sup>rd</sup> bore of the EJMT**

**Alternate 04 – Option 02:** Maximum Program per PEIS

Widen both directions of I-70 between the EJMT and Floyd Hill to accommodate a new 12' toll lane, 2' buffer zone, 14' inside shoulders/enforcement area and 12' outside shoulders. Maintain the existing 12' general purpose lanes and assume all significant widening is to the outside. Also includes adding an auxiliary lane in the WB direction between Chief Hosa and Morrison. The design speed will be 65 mph, so a number of locations will need to be re-aligned.

Assume that the toll signing, detection equipment, and lane use signals will be mounted on cantilever structures in the median.

Project includes the 3<sup>rd</sup> bore of the EJMT, new EB and WB bored tunnels at Hidden Valley, and a new WB cut & cover tunnel near US 6.

Major construction components:

- Widening/reconstruction of inside shoulders in limited locations, where necessary
- Widening of outside shoulders
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Drainage improvements, including closed drainage in retaining wall areas and water quality facilities
- Rock cuts
- Mill and overlay full width of existing pavement
- Toll equipment and associated ITS

MOT concept:

- For sections that are not being re-aligned, generally use a two stage roadway construction approach
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work
- For re-aligned sections, generally use a three stage roadway construction approach
  - Stage 1: construction off-line portion
  - Stage 2: shift one direction onto new widening and construct the median work
  - Stage 3: shift the other direction into the median and complete the remainder of the work
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay done at night with lane closures.

All tunnel work requires minimal traffic control. Exclude the cost of the tunnel work for all three new bored tunnels from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation and the cut & cover tunnel.

The significant difference from Alternate 04 – Option 01 is the 65 mph design speed. This will require more three stage construction work, thus a slightly higher MOT cost.

**Estimated MOT Percentage of Construction Cost: 8% of all items excluding the 3<sup>rd</sup> bore of the EJMT and the two tunnels at Hidden Valley**

**Alternate 05 – Option 01:** Permanent Peak Period Shoulder Lane

Widen both directions of I-70 between the EJMT and Floyd Hill to accommodate 14' inside shoulders and 12' outside shoulders. The inside shoulder will operate as a toll lane during peak periods. Assume all significant widening is to the outside.

Assume that the toll signing, detection equipment, and lane use signals will be mounted on cantilever structures in the median.

Project includes the 3<sup>rd</sup> bore of the EJMT.

Major construction components:

- Widening/reconstruction of inside shoulders in limited locations, where necessary
- Widening of outside shoulders
- Cut & cover tunnels at the WB approaches to the EJMT
- Retaining walls
- Drainage improvements, including closed drainage in retaining wall areas and water quality facilities
- Rock cuts (assume limited locations)
- Barrier/guardrail improvements
- Mill and overlay full width of existing pavement
- Toll equipment and associated ITS
- Signing and striping

MOT concept:

- Generally two stage roadway construction
  - Stage 1: shift traffic to the inside and complete all outside widening
  - Stage 2: shift traffic to the outside and complete median work including toll equipment, signing, and new barriers
- Assume rock cuts are done at night with full freeway closures for blasting.
- The cut and cover tunnel for the WB approaches to the 3<sup>rd</sup> bore of the EJMT will require at least three stages and likely temporary pavement.
- Final mill and overlay of WB barrel done at night with lane closures.

The 3<sup>rd</sup> bore of the EJMT requires minimal traffic control. Exclude the cost of the tunnel work from the calculation for MOT costs, but include all work for the tunnel approaches in the calculation.

**Estimated MOT Percentage of Construction Cost: 12% of all items excluding the 3<sup>rd</sup> bore of the EJMT**

**Alternate 06 – Option 01:** Temporary Peak Period Shoulder Lane

Perform minor widening and improvements to WB I-70 from Empire Junction to Floyd Hill to accommodate peak period inside shoulder running. Eastbound work between the twin tunnels and Floyd Hill is already complete. Assume that the toll signing, detection equipment, and lane use signals will be mounted on cantilever structures in the median from the previous project and can be modified to fit this alternate.

Major construction components:

- Widening of inside and outside shoulder where necessary
- Barrier/guardrail improvements
- Mill and overlay full width of existing pavement
- Toll equipment and associated ITS
- Signing and striping

MOT concept:

- All roadway work is done from the WB barrel without affecting EB traffic. One phase of temp configuration required for all outside shoulder and barrier improvements.
- Tolling/ITS equipment median construction requires a WB shift to the outside and an EB shoulder/toll lane closure for construction. If loss of toll revenue is a concern, and alternate to the long term closure may be taken, such as using only off-peak closures.
- Lane closures at night in one or both directions will be required for access and construction in the median.
- Final mill and overlay of WB barrel done at night with lane closures.

Construction does not include any high cost items, such as structures and walls, so the MOT costs will be a greater percentage of the overall construction costs.

**Estimated MOT Percentage of Construction Cost: 20% of all items**