Memorandum

To: TK Consulting

Attn: Mr. James Tate

From: Steven Robinson P.E., T.E.

Date: February 18, 2022

Subject: Hwy 120 Lodging Project: State Route 120 / Memorial Drive Intersection Study

Wood Rodgers, Inc. (Wood Rodgers) was retained by TK Consulting to perform an intersection geometric analysis at the intersection of State Route 120 and Memorial Drive in Groveland, California. Wood Rodgers understands that Caltrans has concerns with vehicle turning movement safety at the existing intersection of State Route 120 and Memorial Drive. Specifically, this full-access intersection has poor stopping sight distance and corner sight distance due to existing horizontal and vertical curve obstructions, and Caltrans is concerned that the added traffic generated by the proposed Hwy 120 Lodging Project will increase the risk of a collision at the intersection.

This technical memorandum presents the results of Wood Rodgers’ review of the existing conditions, and discusses the existing nonstandard geometric and design features that are present at the State Route 120 and Memorial Drive intersection, along with a summary of the improvements and costs that will be necessary to bring them up to standard. Features such as sight distance, vertical and horizontal curves, and lane and shoulder width were all evaluated using the Caltrans Highway Design Manual 7th Edition.

Wood Rodgers also developed two conceptual intersection improvement options that would address some of the nonstandard features and improve safety at the intersection.

I. EXISTING INTERSECTION

The State Route 120/Memorial Drive intersection is located above 3,000 foot elevation in Tuolumne County near Groveland, California. State Route 120 (SR 120) is a two lane conventional highway with lane widths varying from 11 feet to 12.5 feet, and shoulder widths varying between less than 1 foot and 12 feet. Memorial Drive is a single lane road with a width of 13.5 feet and no shoulder. The posted speed limit on SR 120 is 40 miles per hour (mph). As is standard Caltrans practice, the design speed was set 5 mph higher to 45 mph for analyzing the highway. The two roads intersect at a skewed tee intersection with poor sight distance. There are no turning lanes provided on SR 120 for either left or right turns onto Memorial Drive. There are multiple utilities located at or adjacent to the intersection, including overhead electrical and telephone lines, and an underground telecommunications conduit.

Memorial Drive is currently a 14-foot wide one lane Tuolumne County road. It only serves the Historic Divide Cemetery. Its average daily traffic (ADT) volume is less than 50 ADT. Memorial Drive has no posted speed limit, so a design speed of 25 mph was assumed.
1.1 Nonstandard Features

Wood Rodgers used the Caltrans Highway Design Manual 7th Edition (HDM) to evaluate any existing nonstandard highway and intersection geometrics and features. Within the HDM, Caltrans has identified certain design standards as being the most critical for design. It was these standards, otherwise known as **Boldface** and **Underlined** standards, that Wood Rodgers evaluated. The analysis has found several existing nonstandard design features at and immediately adjacent to the intersection. However, only some of the features are due to or are impacted by the presence of the intersection, while the remaining features would still exist without the intersection. The results of this analysis are summarized in Table 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>HDM Section</th>
<th>Minimum Standard</th>
<th>Existing Condition</th>
<th>Due To/Impacted By the Intersection?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>201.3: Stopping Sight Distance</td>
<td>360 feet</td>
<td>Minimum Horizontal = 140 feet Minimum Vertical = 115 feet</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>202.2: Standards for Superelevation</td>
<td>e_{max}=8%</td>
<td>Minimum e=3%</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>202.5: Superelevation Transition</td>
<td>Runoff Length: 210 feet</td>
<td>Runoff Length: 50 feet</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>203.1: Horizontal Alignment – General Controls</td>
<td>Horizontal alignment shall provide at least the minimum stopping sight distance for the chosen design speed at all points on the highway</td>
<td>Does not meet standard</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>204.3: Standards for Grades</td>
<td>Maximum 7%</td>
<td>10%</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>204.4: Vertical Curves</td>
<td>Minimum 450 feet long</td>
<td>140 feet long</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>301.1: Lane Widths</td>
<td>12 feet</td>
<td>Varies 11 to 12.5 feet</td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>302.1: Shoulder Widths</td>
<td>4 feet</td>
<td>Varies 3 to 12 feet EB side Less than 1 foot on the WB side</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>304.1: Side slope Standards</td>
<td>4: 1 or flatter</td>
<td>2:1</td>
<td>No</td>
</tr>
<tr>
<td>10</td>
<td>403.3: Angle of Intersection</td>
<td>75 degrees</td>
<td>50 degrees</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>405.1: Sight Distance (Intersection Design Standards)</td>
<td>Minimum 560 feet (right turn movement) Minimum 630 feet (left turn movement)</td>
<td>340 feet (right turn movement) 200 feet (left turn movement)</td>
<td>Yes</td>
</tr>
<tr>
<td>12</td>
<td>405.1: Set Back (Decision Point)</td>
<td>Minimum 15 feet</td>
<td>14 feet</td>
<td>Yes</td>
</tr>
</tbody>
</table>
1.2 IMPROVEMENTS TO MAKE STANDARD

Wood Rodgers developed potential solutions for each nonstandard feature along SR 120 and Memorial Drive as listed in the table above. Using the HDM as a guidance, each nonstandard highway and intersection geometric feature was evaluated, and the most conservative solutions are presented below. Wood Rodgers understands there are various factors playing a role when deciding which proposed solution to select, such as cost, feasibility, right of way impact, and scheduling which were all considered when recommending the solutions described in the paragraphs below. The improvement and cost for each nonstandard feature is presented such that it only addresses that specific feature, without directly addressing any of the others (although some of the features and improvements do overlap and/or complement one another).

No. 1: Stopping Sight Distance

Approximately 100 feet east of the intersection, the existing horizontal stopping sight distance on SR 120 is 140 feet in the eastbound direction and 255 feet in the westbound direction. A steep 1:1 cut hillside obstructs the vision of the drivers around the curve. The existing crest vertical curve on SR 120 located at the intersection only provides a stopping sight distance of 115 feet for both directions. Per Table 201.1 in the HDM, the required minimum stopping sight distance at any point along the roadway is 360 feet.

To meet horizontal stopping sight distance standard, the 1:1 hillside will need to be graded back approximately 50 feet with a 2:1 side slope, or approximately 30 feet with a 10-foot tall retaining wall if used to minimize the grading. The estimated construction cost to implement these improvements is $500,000. This cost includes grading and relocation of overhead telecommunication facilities. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

In order to meet vertical stopping sight distance standard, per Figure 201.4 in the HDM, a crest vertical curve length of 1,685 feet is necessary. The existing vertical curve length is only 170 feet. Improving this vertical curve to meet standard will require significant reconstruction of the roadway to either raise the roadway approaches to the curve to flatten the grades in and out of the curve, or lower the profile of the roadway at the curve. Lowering the posted speed limit at this location could significantly improve the stopping sight distance, but even with a posted speed limit of 25 mph, neither the horizontal or vertical curves would meet the standard stopping sight distance of 150 feet for 25 mph.

The estimated construction cost to implement these improvements is $2.5 million. This cost includes grading to adjust the roadway profile and relocation of overhead and underground telecommunication facilities. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

No. 2: Standards for Superelevation

The existing maximum superelevation of the horizontal curve along SR 120 west of the intersection is 3%. Index 202.2 in the HDM states that the maximum superelevation for a curve of this radius where snow and ice conditions prevail (elevation above 3,000 feet) is 8%. Therefore, the existing superelevation of SR 120 does not meet standard. In order to correct this, SR 120 needs to be reconstructed to have the road raised so a cross slope of 8% can be achieved. The estimated construction cost to implement these improvements is $750,000. This cost includes reconstructing the roadway to correct superelevation rates. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.
**No. 3: Superelevation Transition**
The existing superelevation runoff length on the horizontal curve on SR 120 east of the intersection is 50 feet. Per Figure 202.5A in the HDM, the superelevation runoff length for a 2-lane highway should be 210 feet minimum for a standard 8% superelevation rate. The roadway will have to be reconstructed to lengthen the runoff. The estimated construction cost to implement these improvements is $750,000. This cost includes reconstructing the roadway to correct superelevation runoff. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**No. 4: Horizontal Alignment – General Controls**
Multiple horizontal curves are located along SR 120 at or immediately adjacent to the Memorial Drive intersection. Some of them meet sight distance requirements while others do not due to the mountainous terrain. Index 203.1 of the HDM discusses alignment consistency and how it shall provide at least the minimum stopping sight distance for the chosen design speed at all points on the highway. As discussed in No. 1, the stopping sight distance criteria is not met, thus making the existing alignment nonstandard. Refer to No. 1 for improvements to make standard. The estimated construction cost to implement these improvements is $1.5 million. This cost includes grading and relocation of overhead telecommunication facilities. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**No. 5: Standards for Grades**
The existing profile of SR 120 has a maximum grade of 10% located just east of the SR 120 and Memorial Drive intersection. Table 204.3 in the HDM indicates a maximum grade of 7% is allowed for a road in mountainous terrain. To address this nonstandard feature, the vertical profile of the road at the crest curve needs to be lowered by approximately 3.5 feet to flatten the profile to meet the 7% maximum grade requirement. This will require significant reconstruction of the roadway. The estimated construction cost to implement these improvements is $1.5 million. This cost includes grading to adjust the roadway profile and relocation of overhead and underground telecommunication facilities. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**No. 6: Vertical Curve**
The vertical curve located east of SR 120 and Memorial Drive intersection has a length of 140 feet. Index 204.3 in the HDM states if the algebraic grade difference is greater than or equal to 2% and the design speed is 40 mph or more, then the minimum length of the vertical curve must be 10x the design speed. With the design speed being 45 mph along SR 120, the minimum length allowed for the curve located at the intersection is 450 feet. Improving this vertical curve to meet standard will require significant reconstruction of the roadway to either raise the roadway approaches to the curve, or lower the profile of the roadway at the curve. The estimated construction cost to implement these improvements is $1.5 million. This cost includes grading to adjust the roadway profile and relocation of overhead and underground telecommunication facilities. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**No. 7: Lane Widths**
The existing lane widths vary from 11 feet to 12.5 feet along SR 120. The standard lane width for a conventional state highway is 12 feet as stated in Index 301.1 of the HDM. The lanes will have to be widened in some areas in order to meet the 12-foot lane width standard. Widening will require grading into hillsides and/or requiring fill in certain areas along the road. The estimated construction cost to
implement these improvements is $750,000. This cost includes pavement and grading to widen the roadway and relocation of overhead telecommunication facilities. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**No. 8: Shoulder Widths**

The shoulder widths along SR 120 vary from less than 1 foot to 12 feet on both sides of the road. Table 307.2 in the HDM requires a minimum right shoulder width of 8 feet for a conventional 2-lane highway with a two-way average daily traffic volume over 400. Widening of the shoulders is necessary to meet standard shoulder widths. However, this will require grading into hillsides and placing embankment in areas along the road. Utility poles and signs will need to be removed/relocated as well. The estimated construction cost to implement these improvements is $1 million. This cost includes pavement and grading to widen the roadway and relocation of overhead telecommunication facilities. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**No. 9: Side Slope Standards**

The embankment slope adjacent to SR 120 intersection is 2:1. Index 304.1 of the HDM requires an embankment (fill) slope be 4:1 or flatter. To meet the standard, the existing embankment slope on the north side of SR 120 must be flattened out, meaning more fill material will be needed, in order to catch the existing ground. The estimated construction cost to implement these improvements is $200,000. This cost includes grading. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**No. 10: Angle of Intersection**

Memorial Drive and SR 120 intersect at a skewed 50-degree angle tee intersection. The HDM prefers intersection to intersect at a 90-degree angle but states a minimum angle of 75-degrees must be kept to classify as a standard intersection. Memorial Drive would need to be realigned in order to intersect SR 120 at a 75 to 90-degree intersection. A preliminary design of this realignment is shown in Exhibit 2 of the attachments, and is further described in Section 2 of this technical memorandum. The estimated construction cost to implement these improvements is $1 million. This cost includes grading, new pavement, and relocation of overhead telecommunication facilities, and is limited to the costs directly related to realigning the driveway itself. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features, including sight distance, grade, etc.

**No. 11: Intersection Design Standards – Sight Distance**

The corner sight distance, a clear line of sight that needs to be maintained between the driver stopped on a minor road and the driver on a major road with no stop, is dependent on the design speed and the time gap it takes the driver on the minor road to enter safely onto the major road. Because this is a public intersection, per Figure 405.1 in the HDM, a single unit truck was used to calculate the required corner sight distance time gap for the intersection. Based on this, the corner sight distance needs to be 560 feet for a vehicle turning right, and 630 feet for a vehicle turning left out of Memorial Drive. However, the existing corner sight distance is only measured to be 340 feet for a right turning vehicle and 200 feet for a left turning vehicle. A diagram showing the existing versus standard intersection corner sight distance is shown in Exhibit 1 of the attachments.

To meet sight distance standard for a left turning vehicle, the hillside will need to be graded back approximately 60 feet with a 2:1 side slope, or approximately 40 feet with a 10-foot tall retaining wall. To meet sight distance standard for a right turning vehicle, clearing and grubbing approximately 40 feet
maximum from the edge of pavement will be needed. At certain locations along the road, approximately 20 feet of grading with an 8-foot tall 2:1 slope into the hillsides will also be necessary for a driver to see around the curve on SR 120. This grading area is fairly small and could be accomplished with minor grading. The estimated construction cost to implement these improvements is $1 million. This cost includes grading and relocation of overhead telecommunication facilities. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**No. 12: Set Back / Decision Point**

The HDM illustrates the set back (or decision point) of the driver should be 10 feet from the edge of travel way plus the shoulder width, but not less than 15 feet. The existing set back is located approximately at 14 feet -- 10 feet from the edge of travel way plus 4 feet from the existing shoulder -- based on the current stop bar location. The stop bar can be moved back approximately 1 foot from its current location to satisfy the set back, but as discussed above, there are still other nonstandard features that would exist. The estimated construction cost to implement this improvement is $1,000. This cost includes restriping. This cost does not include any additional right of way acquisition costs, or costs to address any of the other nonstandard features.

**2. REALIGN MEMORIAL DRIVE INTERSECTION**

The Memorial Drive and SR 120 intersection connects at a skewed angle, making turning movements in and out of Memorial Drive more difficult than with a standard 90-degree intersection. Wood Rodgers has developed a preliminary design for realigning Memorial Drive to the west to fix the skewed intersection. This preliminary design is shown in Exhibit 2 in the attachments. The Memorial Drive realignment is based on Figure 405.7 in the HDM for a public road intersection using a bus for the design vehicle.

Memorial Drive currently goes uphill at an approximate 7% grade. The vertical profile would have to be altered because the realignment would shorten Memorial Drive. A 30 foot sag curve is proposed at the tie in at SR 120, and a maximum allowed grade of 16% will be necessary to tie into the existing Memorial Drive in as short a distance as possible to minimize the amount of road to reconstruct. With the new layout of the intersection, an overhead telephone pole will have to be relocated and an underground conduit may be impacted.

The preliminary improvements shown in Exhibit 2 do not address most of the nonstandard design features discussed in Section 1 of this technical memorandum. Assuming improvements are confined to the immediate intersection area, the following features could be addressed with these improvements:

- No. 10: Angle of Intersection
- No. 11: Intersection Design Standards – Sight Distance (Eastbound Traffic Only)
- No. 12: Set Back / Decision Point

The estimated construction cost to reconstruct the intersection to tee into SR 120 at a 90 degree tee is $1 million. This cost includes grading, new pavement, and relocation of overhead telecommunication facilities. It is assumed that these improvements would be constructed entirely within existing State, County, and Client owned right of way, so no additional right of way acquisition is required.

This improvement would not address the most significant safety concerns of stopping sight distance or corner sight distance at the intersection, and would reduce safety for left turning vehicles due to shifting the intersection away from the crest of the vertical curve. Considering the minimal safety and geometric benefits this improvement would provide when compared to the construction cost, this improvement is not recommended.
3. **RIGHT-IN RIGHT-OUT INTERSECTION IMPROVEMENTS**

Due to the poor intersection corner sight distance at the SR 120/Memorial Drive intersection, Wood Rodgers has prepared a preliminary design for improvements that would restrict the intersection to right-in right-out only turning movements. Exhibit 3 in the attachments illustrates the implementation of a raised median to restrict the turning movements. The median was sized to prevent a vehicle from attempting to make a left turn in or out of the intersection. However, because of the skewed nature of the intersection, Memorial Drive will need to be widened by approximately 17 feet to the west in order to provide sufficient pavement for a typical passenger vehicle to make a right turn onto Memorial Drive. However, if Memorial Drive needs to accommodate a larger vehicle, such as a bus, then additional widening will be needed.

Alternatively, the raised median could be replaced with a striped median with surface mounted delineators to prevent left turn movements as shown in Exhibit 4 in the attachments. The current Caltrans Transportation Concept Report for SR 120 classifies this segment of SR 120 as a Two Lane Expressway. Raised curbs are discouraged from being used on expressways per the HDM.

The preliminary improvements shown in Exhibits 3 and 4 do not address most of the nonstandard design features discussed in Section 1 of this technical memorandum. Assuming improvements are confined to the immediate intersection area, the following features could be addressed with these improvements:

- **No. 11: Intersection Design Standards – Sight Distance (Westbound Traffic Only)**
- **No. 12: Set Back / Decision Point**

By implementing these improvements, the following features could be partially mitigated:

- **No. 1: Stopping Sight Distance – Horizontal (Eastbound Traffic Only)**
- **No. 11: Intersection Design Standards – Sight Distance (Eastbound Traffic)**

Although not directly improved by the improvements shown in Exhibits 3 and 4, the intersection sight distance for eastbound traffic could be improved to standard with some minor additional grading west of the intersection as described in Section 1.2, No. 11: Intersection Design Standards – Sight Distance. Intersection sight distance under the improvements proposed as part of Exhibit 4 with some minor additional grading west of the intersection is shown in Exhibit 4A.

The estimated construction cost to modify the intersection to only allow right-in right-out turning movements with a raised median is $100,000. This cost includes raised median and minor pavement widening. The estimated construction cost to modify the intersection to only allow right-in right-out turning movements with striping and surface mounted delineators is $65,000. This cost includes striping, delineators, and minor pavement widening. It should be noted that although the striping and delineator option construction cost is lower, it is common for delineators to eventually require replacement, increasing the long term maintenance costs compared to raised islands. It is assumed that these improvements under both options would be constructed entirely within existing State, County, and Client owned right of way, so no additional right of way acquisition is required.

This improvement would partially address the most significant safety concerns of stopping sight distance and corner sight distance at the intersection by eliminating left turn movements. Although stopping sight distance on westbound SR 120 would still apply due to the other geometrics of the roadway, corner sight distance in this direction would not, since the left turning movement would be eliminated. Additionally, this would eliminate seven (7) of the nine (9) conflict points at the intersection, significantly improving overall safety. Tuolumne County supports this proposed improvement, and the improvement will have
considerable safety benefits when compared to the construction cost. It should also be noted that the SR 120/Memorial Drive intersection will be a secondary access point for the Project, with the proposed main full-access entrance and exit located approximately 900 feet to the west. Internal circulation roads will connect between the main entrance and Memorial Drive, so the main entrance can be used for the left-turn movements eliminated by the improvement. This is shown on Exhibit 7 in the attachments.

4. HWY 120 DECELERATION LANE ONTO MEMORIAL DRIVE

Caltrans District 10 has requested that an option be considered that would construct a turn pocket and deceleration lane for the eastbound approaching right turn movement onto Memorial Drive. It should be noted that the HDM does not require turn/deceleration lanes at intersections, and their installation is usually guided by high turning traffic volumes and/or high accident rates at an intersection.

Exhibit 5 in the attachments illustrates the addition of a deceleration lane that would allow drivers to slow down outside of the through lane as they approach the intersection and turn onto Memorial Drive. To accommodate for the new deceleration lane, SR 120 will be widened by 20 feet. This accounts for a 12-foot lane and an 8-foot shoulder. Interpolating for a design speed of 45 mph in HDM Table 405.2B results in a required deceleration lane length of 375 feet. Because there are no conflicting movements or intersection stop control that would require a vehicle to stop in the lane, no additional storage length has been assumed. Additionally, a raised median would be placed at Memorial Drive to prevent left turn movements at the intersection (see Section 3).

The widening required for the deceleration lane will also require reconstructing a portion of Memorial Drive. Because widening SR 120 requires widening into the adjacent cut slope, Memorial Drive will need to be lowered by approximately 8 feet, and its grade will have to be increased from approximately 7% to 16% as shown in Exhibit 5.

The preliminary improvements shown in Exhibit 5 do not address most of the non-standard design features discussed in Section 1 of this technical memorandum, with its only improvement over the Right-In Right-Out option described in Section 3 being an improvement to the Intersection Design Standards – Sight Distance deficiency. Assuming improvements are confined to the immediate intersection area, the following features could be addressed with these improvements in addition to those already addressed by the Right-In Right-Out option:

- No. 11: Intersection Design Standards – Sight Distance (Eastbound Traffic)

The estimated construction cost to construct a deceleration lane and modify the intersection to only allow right-in right-out turning movements with a median is $1.5 million. It is assumed that these improvements would be constructed entirely within existing State, County, and Client owned right of way, so no additional right of way acquisition is required.

The Project’s Traffic Impact Study predicts only three (3) eastbound vehicles would be turning onto Memorial Drive during peak hour. Additionally, the collision data provided by Caltrans shows zero (0) accidents at this location over the latest three year period data was available. This improvement would be significantly more expensive to construct than the Right-In Right-Out option described in Section 3, with its only improvement over that option being an improvement to the Intersection Design Standards – Sight Distance (Eastbound Traffic) deficiency. The eastbound traffic sight distance could also be addressed though the minor additional grading west of the intersection as described in Section 1.2, No. 11: Intersection Design Standards – Sight Distance for an estimated cost of $50,000. Wood Rodgers does not believe that the small improvement to the intersection sight distance supports constructing a deceleration
lane that is 1,500% more expensive than the Right-In Right-Out option, for three (3) cars an hour at a location with no history of accidents.

5. HWY 120 TAPERED SHOULDER AT MEMORIAL DRIVE

A potential alternative proposed by Caltrans District 10 to the deceleration lane described in Section 4 would be to construct a long shoulder taper on SR 120 at the eastbound approach to Memorial Drive. This would allow a right turning vehicle to pull out of the travel lane in advance of the intersection, and would have a smaller construction footprint. However, this concept is perceived by Caltrans as less safe than a full deceleration lane because a vehicle would be required to partially decelerate within the through lane. The tapered lane will extend along SR 120 west of Memorial Drive for a length of 150 feet, and will taper in width from 12 feet at Memorial Drive down to match the existing SR 120 shoulder width. The widening will require a cut into the south hillside of SR 120. Additionally, a raised median would be placed at Memorial Drive to prevent left turn movements at the intersection (see Section 3).

The widening required for the taper will also require reconstructing a portion of Memorial Drive. Because the shoulder widening on SR 120 requires widening into the adjacent cut slope, Memorial Drive will need to be lowered by approximately 8 feet, and its grade will have to be increased from approximately 7% to 16% as shown in Exhibit 6.

The preliminary improvements shown in Exhibit 6 do not address most of the non-standard design features discussed in Section 1 of this technical memorandum, with its only improvement over the Right-In Right-Out option described in Section 3 being an improvement to the Intersection Design Standards – Sight Distance deficiency. Assuming improvements are confined to the immediate intersection area, the following features could be addressed with these improvements in addition to those already addressed by the Right-In Right-Out option:

- No. 11: Intersection Design Standards – Sight Distance (Eastbound Traffic)

The estimated construction cost to construct a shoulder taper and modify the intersection to only allow right-in right-out turning movements with a raised median is $1.1 million. It is assumed that these improvements would be constructed entirely within existing State, County, and Client owned right of way, so no additional right of way acquisition is required.

As discussed in Section 4, there is no history of accidents at this location, and the projected turning movement volumes are very low. This improvement would be significantly more expensive to construct than the Right-In Right-Out option described in Section 3, with its only improvement over that option being an improvement to the Intersection Design Standards – Sight Distance (Eastbound Traffic) deficiency. The eastbound traffic sight distance could also be addressed though the minor additional grading west of the intersection as described in Section 1.2, No. 11: Intersection Design Standards – Sight Distance for an estimated cost of $50,000. Although less expensive than the Deceleration Lane option described in Section 4, Wood Rodgers does not believe that the small improvement to the intersection sight distance supports constructing a deceleration lane that is 1,100% more expensive than the Right-In Right-Out option, for three (3) cars an hour at a location with no history of accidents.

6. ACCELERATION LANE FROM MEMORIAL DRIVE

None of the options discussed in the previous sections included an acceleration lane for eastbound vehicles turning right onto SR 120 from Memorial Drive. Per Index 405.1, acceleration lanes should be considered for turning movements onto State Highways at rural intersections. An acceleration lane would need to be
500 feet minimum in length, which would require a significant cut into the hillside east of Memorial Drive (see Section 1.2, No. 1: Stopping Sight Distance for details). After discussing the impacts with Caltrans District 10 staff, they have agreed that an acceleration lane will not be required at this location.

**ATTACHMENTS**

Exhibit 1: Sight Distance Analysis
Exhibit 2: Memorial Drive Re-alignment
Exhibit 3: Memorial Drive Right-In Right-Out (Raised Island)
Exhibit 4: Memorial Drive Right-In Right-Out (Striped Island)
Exhibit 4A: Sight Distance Analysis for Right-In Right-Out Only
Exhibit 5: Hwy 120 Deceleration Lane onto Memorial Drive
Exhibit 6: Hwy 120 Tapered Shoulder at Memorial Drive
Exhibit 7: Hwy 120 Lodging Overall Site Plan
EXHIBIT 1: SIGHT DISTANCE ANALYSIS

YONDER YOSEMITE STATE ROUTE 120 / MEMORIAL DRIVE
INTERSECTION STUDY

GROVELAND, CALIFORNIA
JUNE 2021

DESIGN SPEED = 45 MPH

LEGEND:
- SIGHT DISTANCE REQUIRED TO MEET STANDARD
- EXISTING SIGHT DISTANCE
- APPROXIMATE GRADING AREA TO MEET STANDARD
BUILDING RELATIONSHIPS ONE PROJECT AT A TIME

3301 C St, Bldg. 100-B
Tel 916.341.7760
Fax 916.341.7767
Sacramento, CA 95816
GENERAL NOTES

1. The contractor shall be responsible for dust abatement during construction and development operations. Water truck or other watering device shall be on the project on all working days when natural precipitation does not provide adequate moisture for complete dust control. Said water device shall be used to spray water on the site at the end of day and at other intervals, as needed dictates, to control dust.

2. Buildings shall be accessible to fire apparatus by way of roadways with a standard on-site building access standard. Paving to comply with TCOC 11.16.020 on-site building access standards.

3. Paving to comply with 17.60.070. Design and construction standards. All off-street parking facilities shall comply with the following standards:

   1. Buildings shall be accessible to fire apparatus by way of roadways with a standard on-site building access standard. Paving to comply with TCOC 11.16.020 on-site building access standards.
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