# APPENDIX C

ENGINEERS
2202 Plaza Drive
Rocklin, California
95765-4404
PHONE (916) 783-3838
FAX (916) 783-5003
www.mroengineers.com

November 6, 2007

Mr. Ron Mauck
Quad Knopf
One Sierragate Plaza, Suite 270C
Roseville, California 95678

Subject: Foresthill Divide Community Plan – Supplemental Traffic Analysis

Dear Mr. Mauck:

MRO Engineers, Inc., has completed the desired additional traffic analysis work with respect to the Foresthill Divide Community Plan. The analysis documented in this letter report supplements the material provided in our *Revised Draft Traffic Study – Foresthill Divide Community Plan – Placer County, California*, dated June 20, 2007. As requested by Placer County staff, this work evaluated traffic operations assuming the exclusion of two future parallel roadways (Patent Road and Powerline Road) that had been included in the previous analysis. For reference, Attachment A contains Figure 3 from the June 2007 report, illustrating the "Future Circulation Network" assumed in the earlier work (including the two parallel roadways).

This supplemental analysis evaluated traffic impacts of the proposed Foresthill Divide Community Plan under the following future land use scenarios:

1. Year 2030 "Without Forest Ranch,"
2. Year 2030 "With Forest Ranch,"
3. Buildout of the Foresthill Divide Community Plan "Without Forest Ranch," and
4. Buildout of the Foresthill Divide Community Plan "With Forest Ranch."

For each analysis scenario, the trip distribution and assignment information developed in the earlier work was modified to reflect the exclusion of Patent Road and Powerline Road. Essentially, trips that were previously assumed to travel on these two roads were rerouted to other parallel facilities, primarily Foresthill Road.

An evaluation of the roadway network and trip distribution and assignment information indicated that the four study intersections at the Interstate 80/Auburn Ravine Road/Foresthill Road interchange would not be affected by the modified study parameters. As such, this supplemental analysis focused on traffic operations on the study roadway segments.

## Year 2030 "Without Forest Ranch" Scenario

The project-generated trips were distributed to the modified roadway network and were then added to the existing traffic volumes, with the result being the "Cumulative Plus Project" traffic volumes for the Year 2030 "Without Forest Ranch" scenario. The modified roadway segment traffic volumes and corresponding levels of service are presented in Table 1. The technical calculation sheets for the two-lane highway segments are presented in Attachment B.

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**Table 1**
**Roadway Segment Level of Service Summary[1]**
**Cumulative + Project Conditions**
**Year 2030 "Without Forest Ranch" Scenario**

| Roadway Segment | Direction | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Peak Hour Volume | LOS[2] | Peak Hour Volume | LOS |
| Foresthill Rd. – Foresthill Bridge to Spring Garden Rd. | Eastbound | 253 | C | 899 | D[3] |
| | Westbound | 888 | E | 341 | D |
| Foresthill Rd. – Spring Garden Rd. to Todd Valley Rd. (West) | Eastbound | 328 | B | 573 | C |
| | Westbound | 605 | E | 383 | C |
| Foresthill Rd. – Todd Valley Rd. (West) to Owl Hill Ct. | Eastbound | 436 | C | 471 | B |
| | Westbound | 494 | D | 406 | D |
| Foresthill Rd. – Owl Hill Ct. to Yankee Jim's Rd. | Eastbound | 227 | C | 287 | C |
| | Westbound | 295 | | 193 | |
| Foresthill Rd. – Yankee Jim's Rd. to Michigan Bluff Rd. | Eastbound | 73 | B | 123 | B |
| | Westbound | 119 | | 88 | |
| Foresthill Road – East of Michigan Bluff Road | Eastbound | 66 | B | 84 | B |
| | Westbound | 83 | | 65 | |
| McKeon-Ponderosa Way | Northbound | 163 | B | 46 | C |
| | Southbound | 30 | | 174 | |
| Spring Garden Road | Northbound | 12 | B | 65 | B |
| | Southbound | 60 | | 30 | |
| Happy Pines Drive | Northbound | 172 | C | 71 | C |
| | Southbound | 62 | | 161 | |
| Todd Valley Road (West) | Northbound | 319 | D | 156 | D |
| | Southbound | 78 | | 266 | |
| Todd Valley Road (East) | Northbound | 32 | A | 34 | A |
| | Southbound | 26 | | 26 | |
| Mosquito Ridge Road | Northbound | 18 | A | 25 | A |
| | Southbound | 16 | | 27 | |
| Yankee Jim's Road | Northbound | 8 | A | 24 | A |
| | Southbound | 23 | | 13 | |
| Main Street | Eastbound | 33 | A | 60 | B |
| | Westbound | 20 | | 50 | |
| Michigan Bluff Road | Northbound | 15 | A | 11 | A |
| | Southbound | 7 | | 20 | |
| Race Track Street | Eastbound | 34 | A | 68 | B |
| | Westbound | 44 | | 35 | |

Notes:
1 Reference: Transportation Research Board, *Highway Capacity Manual*, 2000.
2 Level of service.
3 Shading denotes an unacceptable level of service.

*AM Peak Hour Level of Service*

As shown in Table 1, during the AM peak hour, four of the study roadway segments are projected to operate at unacceptable levels of service, according to the County's Level of Service (LOS) C policy. The westbound segments of Foresthill Road between the Foresthill Bridge and Todd Valley Road (West) are expected to operate at LOS E, while LOS D is projected for the westbound segment from Todd Valley Road (West) to Owl Hill Court. Additionally, Todd Valley Road (West) is projected to operate at LOS D without the additional parallel roadways.

*PM Peak Hour Level of Service*

In the PM peak hour, implementation of the proposed Foresthill Divide Community Plan is expected to significantly impact traffic operations on four roadway segments. The following four segments are projected to operate at LOS D, thereby failing to meet the County's LOS C requirement: both directions of Foresthill Road between the Foresthill Bridge and Spring Garden Road, the westbound direction of Foresthill Road between Todd Valley Road (West) and Owl Hill Court, and Todd Valley Road (West).

*Mitigation Measures*

Without construction of the parallel roadways, the proposed Foresthill Divide Community Plan is expected to cause a significant impact to traffic operations at a total of five roadway segments, as described above. To improve operations to LOS C or better in the Year 2030 "Without Forest Ranch" scenario, the following mitigation measures are recommended:

- Foresthill Road between the Foresthill Bridge and Spring Garden Road (10.8 miles long): Increase the length of passing lanes in the eastbound direction from 4.9 to 7.6 miles (including tapers). The additional passing lanes will improve conditions to LOS B in the AM peak hour and LOS C during the PM peak hour. In the westbound direction, increase the length of passing lanes from 1.3 miles to 6.5 miles. The westbound improvement results in LOS C during both peak hours.
- Foresthill Road between Spring Garden Road and Todd Valley Road (West) (1.7 miles long): Construct 0.8 miles of passing lanes (including tapers) in the westbound direction. This improvement results in LOS C in the AM peak hour and LOS B in the PM peak hour.
- Foresthill Road between Todd Valley Road (West) and Owl Hill Court (1.2 miles long): Construct 0.6 miles of passing lanes (including tapers) in the westbound direction. This mitigation measure improves levels of service in the morning and evening peak hours to LOS C and LOS B, respectively.
- Todd Valley Road (West): The mitigation measure for this "Secondary/Feeder" roadway would be to widen it to four-lanes (i.e., two lanes in each direction). Implementation of this measure would approximately double the capacity of the roadway and raise the level of service to LOS C or better. However, it is unlikely that this mitigation measure is physically feasible, due to right-of-way constraints and practical considerations regarding the nature of Todd Valley Road. Therefore, this traffic impact would remain ***significant and unavoidable***.

*Modified Roadway Segment Level of Service Criteria Results*

As described in the June 2007 report, Placer County is considering modifications to the Community Plan policy document that would allow operation at LOS D on the study area roadway segments, instead of the current LOS C requirement. If Placer County adopts LOS D as the minimum level of service standard for the study area roadway segments, then only two segments would operate unacceptably in the Year 2030 "Without Forest Ranch" scenario. The westbound segments of Foresthill Road from the Foresthill Bridge to Spring Garden Road and from Spring Garden Road to Todd Valley Road (West) are both expected to operate at LOS E in the AM peak hour and would, therefore, not meet the LOS D minimum. Under the modified (LOS D) level of service policy, all roadway segments would operate acceptably in the PM peak hour.

The mitigation measures needed to allow peak hour operation at LOS D or better are as follows:

- Foresthill Road between the Foresthill Bridge and Spring Garden Road (10.8 miles long): Increase the length of passing lanes in the westbound direction from 1.3 miles to 1.5 miles (including tapers). Implementation of this measure will improve conditions to LOS D in both peak hours.
- Foresthill Road between Spring Garden Road and Todd Valley Road (West) (1.7 miles long): Construct 0.2 miles of passing lanes (including tapers) in the westbound direction. This improvement results in LOS D in the AM peak hour and LOS C in the PM peak hour.

**Year 2030 "With Forest Ranch" Scenario**

The modified roadway segment traffic volumes and levels of service associated with the Year 2030 "With Forest Ranch" scenario are presented in Table 2. Attachment C contains the level of service calculation worksheets for the two-lane highway segments.

*AM Peak Hour Level of Service*

In the AM peak hour, the westbound direction of Foresthill Road segments between the Foresthill Bridge and Todd Valley Road (West) are again expected to operate at LOS E, and the westbound direction between Todd Valley Road (West) and Owl Hill Court is projected to operate at LOS D. Todd Valley (West) is also projected to operate at LOS D in the morning peak hour. The remaining study roadway segments are expected to operate at acceptable levels of service during this peak hour.

*PM Peak Hour Level of Service*

In the PM peak hour, 14 of the 19 study roadway segments are projected to operate acceptably (i.e., LOS C or better). The westbound Foresthill Road segments between the Foresthill Bridge and Owl Hill Court are not expected to meet the County's level of service standard under this scenario. This is also true of Todd Valley Road (West) and the eastbound segment of Foresthill Road between the Foresthill Bridge and Spring Garden Road.

**Table 2**
**Roadway Segment Level of Service Summary[1]**
**Cumulative + Project Conditions**
**Year 2030 "With Forest Ranch" Scenario**

| Roadway Segment | Direction | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Peak Hour Volume | LOS[2] | Peak Hour Volume | LOS |
| Foresthill Road – Foresthill Bridge to Spring Garden Road | Eastbound | 347 | C | 1,009 | D |
| | Westbound | 993 | E[3] | 405 | D |
| Foresthill Road – Spring Garden Road to Todd Valley Road (West) | Eastbound | 405 | B | 676 | C |
| | Westbound | 684 | E | 455 | D |
| Foresthill Road – Todd Valley Road (West) to Owl Hill Court | Eastbound | 509 | C | 598 | B |
| | Westbound | 571 | D | 501 | D |
| Foresthill Road – Owl Hill Court to Yankee Jim's Road | Eastbound | 338 | C | 459 | C |
| | Westbound | 416 | | 330 | |
| Foresthill Road – Yankee Jim's Road to Michigan Bluff Road | Eastbound | 80 | B | 126 | B |
| | Westbound | 124 | | 92 | |
| Foresthill Rd. – East of Michigan Bluff Rd. | Eastbound | 71 | B | 87 | B |
| | Westbound | 88 | | 71 | |
| McKeon-Ponderosa Way | Northbound | 165 | B | 48 | C |
| | Southbound | 31 | | 176 | |
| Spring Garden Road | Northbound | 24 | B | 94 | B |
| | Southbound | 82 | | 44 | |
| Happy Pines Drive | Northbound | 167 | C | 64 | C |
| | Southbound | 61 | | 150 | |
| Todd Valley Road (West) | Northbound | 316 | D | 152 | D |
| | Southbound | 76 | | 261 | |
| Todd Valley Road (East) | Northbound | 33 | B | 33 | A |
| | Southbound | 28 | | 24 | |
| Mosquito Ridge Road | Northbound | 20 | A | 34 | B |
| | Southbound | 24 | | 31 | |
| Yankee Jim's Road | Northbound | 28 | B | 70 | B |
| | Southbound | 57 | | 44 | |
| Main Street | Eastbound | 37 | A | 59 | B |
| | Westbound | 21 | | 52 | |
| Michigan Bluff Road | Northbound | 15 | A | 11 | A |
| | Southbound | 7 | | 20 | |
| Race Track Street | Eastbound | 44 | B | 87 | B |
| | Westbound | 61 | | 46 | |

Notes:
1 Reference: Transportation Research Board, *Highway Capacity Manual*, 2000.
2 Level of service.
3 Shading denotes an unacceptable level of service.

*Mitigation Measures*

In the Year 2030 "With Forest Ranch" scenario, four segments of Foresthill Road between the Foresthill Bridge and Owl Hill Court as well as the Todd Valley Road (West) roadway segment are not expected to meet the County's LOS C requirement. The mitigation measures listed below are recommended to improve the levels of service on those roadway segments to conform to the County's standard.

- Foresthill Road between the Foresthill Bridge and Spring Garden Road (10.8 miles long): Increase the total length of passing lanes provided in the eastbound direction from 4.9 to 7.6 miles (including tapers). The additional length of passing lanes will improve conditions to LOS C during the both peak hours. In the westbound direction, increase the length of passing lanes from 1.3 miles to 7.6 miles (including tapers), which will also result in LOS C in both peak hours. The increase in passing lanes in the westbound direction is 1.1 miles more than what is necessary in the "Without Forest Ranch" scenario.
- Foresthill Road between Spring Garden Road and Todd Valley Road (West) (1.7 miles long): Construct 0.8 miles of passing lanes (including tapers) in the westbound direction, which results in LOS C in the AM peak hour and LOS B in the PM peak hour.
- Foresthill Road between Todd Valley Road (West) and Owl Hill Court (1.2 miles long): Construct 0.6 miles of passing lanes (including tapers) in the westbound direction. This mitigation measure improves levels of service in the morning and evening peak hours to LOS C and LOS B, respectively.
- Todd Valley Road (West): Widen the roadway to four-lanes (i.e., two lanes in each direction). Again, while this measure would approximately double the capacity of the roadway and raise the level of service to LOS C or better, it is unlikely that it is physically feasible, due to right-of-way constraints and other considerations. Therefore, this traffic impact would remain ***significant and unavoidable***.

*Forest Ranch "Fair Share" Contribution*

The following list describes the percentage of the improvement cost for which Forest Ranch is responsible, based on the proportion of new traffic generated by that proposed project:

- Foresthill Road between the Foresthill Bridge and Spring Garden Road: Forest Ranch is responsible for 29 percent of the cost of improvements in the eastbound direction, 23 percent of 5.2 miles of passing lanes needed in the westbound direction, and 100 percent of the cost of the additional 1.1 miles needed in the westbound direction (beyond what is needed in the "without" scenario).
- Foresthill Road between Spring Garden Road and Todd Valley Road (West): Forest Ranch is responsible for 24 percent of the cost of improvements in the westbound direction.
- Foresthill Road between Todd Valley Road (West) and Owl Hill Court: For improvements in the westbound direction, Forest Ranch is responsible for 35 percent of the cost of the recommended measure.
- Todd Valley Road (West): Forest Ranch is not responsible for the cost of improvements because it does not add any traffic to this roadway segment.

*Modified Roadway Segment Level of Service Criteria Results*

If Placer County adopts LOS D as the minimum acceptable level of service on Foresthill Road, two segments would operate below this standard in the Year 2030 "With Forest Ranch" scenario. The westbound segments of Foresthill Road from the Foresthill Bridge to Spring Garden Road and from Spring Garden Road to Todd Valley Road (West) are both projected to operate at LOS E in the AM peak hour. In the PM peak hour, all study roadway segments are expected to conform to the modified level of service policy.

Implementation of the following mitigation measures would allow peak hour operation at LOS D or better:

- Foresthill Road between the Foresthill Bridge and Spring Garden Road (10.8 miles long): Increase the length of passing lanes in the westbound direction from existing 1.3 miles to 1.8 miles (including tapers). This improvement would result in LOS D during both peak hours. Forest Ranch would be responsible for 23 percent of the cost of 0.2 miles of passing lanes and 100 percent of the cost of the additional 0.3 miles of passing lanes beyond what would be needed in the "without" scenario.
- Foresthill Road between Spring Garden Road and Todd Valley Road (West) (1.7 miles long): Construct 0.2 miles of passing lanes (including tapers) in the westbound direction. This improvement results in LOS D in the AM peak hour and LOS C in the PM peak hour. Forest Ranch would be responsible for 24 percent of the cost of this improvement.

**Buildout "Without Forest Ranch" Scenario**

The modified roadway segment traffic volumes and levels of service for the Buildout "Without Forest Ranch" scenario are presented in Table 3. The two-lane highway segment level of service calculation worksheets for this scenario are located in Attachment D.

*AM Peak Hour Level of Service*

As shown in Table 3, eleven of the study roadway segments are projected to operate at LOS C or better during the AM peak hour. However, Todd Valley Road (West) and both directions of Foresthill Road, from the Foresthill Bridge to Yankee Jim's Road, are expected to operate unacceptably at LOS D, E or F. Therefore, the traffic generated in the Buildout "Without Forest Ranch" scenario will significantly impact traffic operations on these portions of Foresthill Road and Todd Valley Road (West).

*PM Peak Hour Level of Service*

In the PM peak hour, the same Foresthill Road segments and Todd Valley Road (West) are expected to operate at unacceptable levels of service.

**Table 3**
**Roadway Segment Level of Service Summary[1]**
**Cumulative + Project Conditions**
**Buildout "Without Forest Ranch" Scenario**

| Roadway Segment | Direction | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Peak Hour Volume | LOS[2] | Peak Hour Volume | LOS |
| Foresthill Road – Foresthill Bridge to Spring Garden Road | Eastbound | 1,040 | E[3] | 1,574 | E |
| | Westbound | 1,768 | F | 1,210 | F |
| Foresthill Road – Spring Garden Rd. to Todd Valley Rd. (West) | Eastbound | 1,160 | E | 1,117 | E |
| | Westbound | 1,215 | E | 1,305 | E |
| Foresthill Road – Todd Valley Road (West) to Owl Hill Court | Eastbound | 1,129 | E | 1,026 | D |
| | Westbound | 1,082 | E | 1,233 | E |
| Foresthill Road – Owl Hill Court to Yankee Jim's Road | Eastbound | 700 | D | 749 | D |
| | Westbound | 754 | | 717 | |
| Foresthill Road – Yankee Jim's Road to Michigan Bluff Road | Eastbound | 168 | C | 302 | C |
| | Westbound | 304 | | 206 | |
| Foresthill Road – East of Michigan Bluff Rd. | Eastbound | 114 | B | 138 | B |
| | Westbound | 134 | | 106 | |
| McKeon-Ponderosa Way | Northbound | 204 | C | 63 | C |
| | Southbound | 42 | | 210 | |
| Spring Garden Road | Northbound | 68 | C | 239 | C |
| | Southbound | 274 | | 117 | |
| Happy Pines Drive | Northbound | 196 | C | 80 | C |
| | Southbound | 67 | | 180 | |
| Todd Valley Road (West) | Northbound | 336 | D | 174 | D |
| | Southbound | 95 | | 285 | |
| Todd Valley Road (East) | Northbound | 103 | C | 239 | C |
| | Southbound | 233 | | 110 | |
| Mosquito Ridge Road | Northbound | 80 | B | 53 | B |
| | Southbound | 38 | | 80 | |
| Yankee Jim's Road | Northbound | 39 | B | 140 | C |
| | Southbound | 129 | | 67 | |
| Main Street | Eastbound | 69 | B | 88 | B |
| | Westbound | 33 | | 118 | |
| Michigan Bluff Road | Northbound | 68 | B | 34 | B |
| | Southbound | 21 | | 67 | |
| Race Track Street | Eastbound | 46 | B | 99 | B |
| | Westbound | 71 | | 53 | |

Notes:
1 Reference: Transportation Research Board, *Highway Capacity Manual*, 2000.
2 Level of service.
3 Shading denotes an unacceptable level of service.

*Mitigation Measures*

To mitigate the impacts projected on Foresthill Road, it is recommended that the entire length of Foresthill Road from the Foresthill Bridge to Yankee Jim's Road be upgraded from a two-lane highway to a four-lane facility in the Buildout "Without Forest Ranch" scenario. The resulting levels of service for the impacted segments of Foresthill Road are described below:

- Foresthill Road from the Foresthill Bridge to Spring Garden Road: Eastbound – LOS B during both peak hours; Westbound – LOS B during both peak hours.
- Foresthill Road from Spring Garden Road to Todd Valley Road (West): LOS B in both peak hours in both directions.
- Foresthill Road from Todd Valley Road (West) to Owl Hill Court: Eastbound – LOS B in the AM and PM peak hours; Westbound – LOS B in both peak hours.
- Foresthill Road from Owl Hill Court to Yankee Jim's Road: LOS B during both peak hours.

The recommended mitigation measure for Todd Valley Road (West) is as follows:

- Todd Valley Road (West): Widen the roadway to four-lanes (i.e., two lanes in each direction). Although this mitigation measure would result in operation at LOS C or better, it is unlikely that it is physically feasible, due to right-of-way constraints and other considerations. Therefore, this traffic impact would remain ***significant and unavoidable***.

Furthermore, to avoid a potential "bottleneck" of traffic at the Foresthill Bridge, the bridge would need to be widened to provide two lanes in each direction to accommodate all of the traffic expected in the Buildout "Without Forest Ranch" scenario. Additionally, between Lincoln Way and the Foresthill Bridge, the eastbound direction of Foresthill Road would need to be widened to two lanes (for a total of two lanes in each direction) to support the increase in traffic in that area. However, due to financial constraints, the widening of the Foresthill Bridge is not feasible. As such, the traffic generated in this scenario will result in a ***significant and unavoidable*** impact on the Foresthill Bridge.

*Modified Roadway Segment Level of Service Criteria Results*

In the Buildout "Without Forest Ranch" scenario, many of the Foresthill Road segments will fail to meet the County's level of service standard, even if the policy is modified to allow LOS D. From the Foresthill Bridge to Owl Hill Court, all of the roadway segments will operate at LOS E or LOS F in both peak hours, with the exception of the eastbound direction from Todd Valley Road (West) to Owl Hill Court, which will operate at LOS D in the PM peak hour.

The following mitigation measures would result in operation of all roadway segments at LOS D or better in both peak hours:

- Foresthill Road between the Foresthill Bridge and Owl Hill Court: This entire section (consisting of both directions of three study roadway segments) would need to be widened to two lanes in each direction to meet the LOS D policy. This mitigation measure would result in LOS B in both peak hours in both directions of the three study segments.

As noted above, the widening of Foresthill Road immediately east of the Foresthill Bridge would also require that the bridge be widened to two lanes in each direction. Between Lincoln Way and the Foresthill Bridge, the eastbound direction of Foresthill Road would also need to be widened to two lanes (for a total of two lanes in each direction). However, as mentioned previously, the widening of the bridge is not feasible and, therefore, the traffic generated in this scenario will result in a ***significant and unavoidable*** impact on the Foresthill Bridge.

**Buildout "With Forest Ranch" Scenario**

In addition to the modified traffic volumes, the roadway segment levels of service for the Buildout "With Forest Ranch" scenario are presented in Table 4. Attachment E contains the modified level of service calculation sheets for the two-lane highway study roadway segments.

*AM Peak Hour Level of Service*

During the AM peak hour, eleven of the study roadway segments are projected to operate at acceptable levels of service (i.e., LOS C or better). The traffic generated by the Forest Ranch project will exacerbate the unacceptable operations anticipated in the Buildout "Without Forest Ranch" scenario on the Foresthill Road segments between the Foresthill Bridge and Yankee Jim's Road. Therefore, these roadway segments will continue to fall short of meeting the County's LOS C requirement.

*PM Peak Hour Level of Service*

Similarly, in the PM peak hour, the levels of service on the Foresthill Road segments between the Foresthill Bridge and Yankee Jim's Road are not expected to meet the County's policy calling for LOS C or better. Additionally, Todd Valley Road (West) will continue to operate below the County standard, at LOS D. The Forest Ranch project will exacerbate unacceptable operations by adding traffic to these roadway segments.

*Mitigation Measures*

In the Buildout "With Forest Ranch" scenario, several of the Foresthill Road segments as well as Todd Valley Road (West) are expected to operate at levels of service that fail to meet the County's LOS C requirement. With regard to the Foresthill Road study roadway segments that are significantly impacted by the increase in traffic, the same mitigation measures that were proposed in the Buildout "Without Forest Ranch" scenario are recommended for the "With Forest Ranch" scenario. Specifically, it is recommended that Foresthill Road be widened from two lanes to four lanes between the Foresthill Bridge and Yankee Jim's Road. The following describes the expected levels of service on the affected Foresthill Road segments under four-lane highway conditions, as well as the proposed mitigation measure for Todd Valley Road (West):

- Foresthill Road between the Foresthill Bridge and Spring Garden Road: Eastbound – LOS B during both peak hours; Westbound – LOS C during the AM peak hour and LOS B in the PM peak hour.
- Foresthill Road between Spring Garden Road and Todd Valley Road (West): LOS B in both directions during both peak hours.

**Table 4**
**Roadway Segment Level of Service Summary[1]**
**Cumulative + Project Conditions**
**Buildout "With Forest Ranch" Scenario**

| Roadway Segment | Direction | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | | Peak Hour Volume | LOS[2] | Peak Hour Volume | LOS |
| Foresthill Road – Foresthill Bridge to Spring Garden Road | Eastbound | 1,126 | E[3] | 1,649 | E |
| | Westbound | 1,853 | F | 1,247 | F |
| Foresthill Road – Spring Garden Rd. to Todd Valley Rd. (West) | Eastbound | 1,234 | E | 1,203 | E |
| | Westbound | 1,286 | E | 1,355 | E |
| Foresthill Road – Todd Valley Road (West) to Owl Hill Court | Eastbound | 1,203 | E | 1,124 | E |
| | Westbound | 1,162 | E | 1,297 | E |
| Foresthill Road – Owl Hill Court to Yankee Jim's Road | Eastbound | 794 | E | 894 | E |
| | Westbound | 859 | | 851 | |
| Foresthill Road – Yankee Jim's Road to Michigan Bluff Road | Eastbound | 167 | C | 300 | C |
| | Westbound | 304 | | 199 | |
| Foresthill Road – East of Michigan Bluff Rd. | Eastbound | 118 | B | 140 | B |
| | Westbound | 138 | | 109 | |
| McKeon-Ponderosa Way | Northbound | 204 | C | 62 | C |
| | Southbound | 41 | | 211 | |
| Spring Garden Road | Northbound | 71 | C | 252 | C |
| | Southbound | 290 | | 121 | |
| Happy Pines Drive | Northbound | 192 | C | 76 | C |
| | Southbound | 66 | | 173 | |
| Todd Valley Road (West) | Northbound | 334 | D | 172 | D |
| | Southbound | 94 | | 282 | |
| Todd Valley Road (East) | Northbound | 105 | C | 233 | C |
| | Southbound | 240 | | 109 | |
| Mosquito Ridge Road | Northbound | 78 | B | 57 | B |
| | Southbound | 44 | | 78 | |
| Yankee Jim's Road | Northbound | 56 | C | 186 | C |
| | Southbound | 162 | | 98 | |
| Main Street | Eastbound | 73 | B | 91 | B |
| | Westbound | 34 | | 119 | |
| Michigan Bluff Road | Northbound | 66 | B | 33 | B |
| | Southbound | 20 | | 66 | |
| Race Track Street | Eastbound | 55 | B | 116 | B |
| | Westbound | 86 | | 64 | |

Notes:
1 Reference: Transportation Research Board, *Highway Capacity Manual*, 2000.
2 Level of service.
3 Shading denotes an unacceptable level of service.

- Foresthill Road between Todd Valley Road (West) and Owl Hill Court: Eastbound – LOS C during the AM peak hour and LOS B in the PM peak hour; Westbound – LOS B during both peak hours.
- Foresthill Road between Owl Hill Court and Yankee Jim's Road: LOS B in both peak hours.
- Todd Valley Road (West): Widen the roadway to four-lanes (i.e., two lanes in each direction). Although this mitigation measure would result in satisfactory traffic operations, it is not likely to be physically feasible, due to right-of-way constraints and other considerations. Therefore, this traffic impact would remain ***significant and unavoidable***.

Again, to avoid a bottleneck of traffic at the Foresthill Bridge, it is recommended that the bridge be widened to provide two lanes in each direction. Also, between Lincoln Way and the Foresthill Bridge, the eastbound direction of Foresthill Road would need to be widened to two lanes to carry the increase in traffic between the Auburn Ravine Road/Foresthill Road/Lincoln Way intersection and the bridge. However, widening the Foresthill Bridge is not feasible due to financial constraints and, therefore, a ***significant and unavoidable*** impact is projected on the bridge.

*Forest Ranch "Fair Share" Contribution*

Because the Forest Ranch project would add traffic to roadway segments that are already expected to operate at unacceptable levels of service without the project, the Forest Ranch project is responsible for a share of the cost to improve those roadways. The following list describes the project's modified "fair share" responsibility, based on the proportion of new traffic that is directly associated with Forest Ranch:

- Foresthill Road between the Foresthill Bridge and Spring Garden Road: Forest Ranch should contribute 8 percent of the cost of the eastbound improvement and 5 percent of the westbound improvement.
- Foresthill Road between Spring Garden Road and Todd Valley Road (West): Forest Ranch is responsible for 8 percent of the cost of improvements in the eastbound direction and 6 percent of the cost of improvements in the westbound direction.
- Foresthill Road between Todd Valley Road (West) and Owl Hill Court: With respect to improvements in the eastbound direction, Forest Ranch is responsible for a 14 percent "fair share" contribution. Also, Forest Ranch is responsible for 14 percent of the westbound improvements.
- Foresthill Road between Owl Hill Court and Yankee Jim's Road: Forest Ranch generates 17 percent of the new eastbound traffic and 16 percent of the westbound traffic and is, therefore, accountable for those percentages of the cost of the improvements.
- Todd Valley Road (West): Forest Ranch is not responsible for the cost of improvements because it does not add any traffic to this roadway segment.
- Foresthill Road between Lincoln Way and the Foresthill Bridge: Forest Ranch is responsible for 8 percent of the cost to widen the eastbound direction of this roadway segment to two lanes.
- Foresthill Bridge improvements: Forest Ranch is responsible for 8 percent of the cost to widen the eastbound direction of the bridge and 5 percent of the widening of the westbound direction.

*Modified Roadway Segment Level of Service Criteria Results*

If the County adopts LOS D as the minimum level of service standard on the study roadway segments, then Todd Valley Road (West) would operate acceptably in the Buildout "With Forest Ranch" scenario. However, all of the roadway segments on Foresthill Road from the Foresthill Bridge to Yankee Jim's Road are projected to operate at LOS E or F in both peak hours, and would continue to operate unacceptably. Consequently, the following mitigation measures would be needed to improve operations to LOS D or better:

- Foresthill Road between the Foresthill Bridge and Yankee Jim's Road: This portion of Foresthill Road would need to be widened to two lanes in each direction to meet the LOS D policy. The mitigated level of service results would be unchanged from the results presented above. The Forest Ranch "fair share" portion of the cost of improvements is described below:
    - Foresthill Road between the Foresthill Bridge and Spring Garden Road: Forest Ranch should contribute 8 percent of the cost of the eastbound improvement and 5 percent of the westbound improvement.
    - Foresthill Road between Spring Garden Road and Todd Valley Road: Forest Ranch would be responsible for 8 percent of the cost of improvements in the eastbound direction and 6 percent of the cost of the westbound improvements.
    - Foresthill Road between Todd Valley Road and Owl Hill Court: With respect to improvements in the eastbound direction, Forest Ranch would be responsible for a 14 percent "fair share" contribution. In the westbound direction, Forest Ranch would also be responsible for 14 percent.
    - Foresthill Road between Owl Hill Court and Yankee Jim's Road: Forest Ranch would be accountable for 100 percent of the cost of the improvements because no mitigation measures were needed in the "without" scenario.

As mentioned above, the Foresthill Bridge would need to be widened to two lanes each way to avoid creating a bottleneck at the bridge, and the eastbound direction of Foresthill Road between Lincoln Way and the bridge should be widened to two lanes in each direction. However, as previously discussed, the bridge widening mitigation measure is not feasible. As such, the traffic generated in this scenario will result in a ***significant and unavoidable*** impact on the Foresthill Bridge.

**Conclusion**

The analysis presented in this letter report represents a supplement to the MRO Engineers traffic analysis documented in the *Revised Draft Traffic Study – Foresthill Divide Community Plan – Placer County, California*, dated June 20, 2007. The purpose of this analysis was to evaluate the operational impacts associated with the potential exclusion of two future parallel roadways (Patent Road and Powerline Road) that were included in the earlier work. Revised level of service results for the study area roadway segments are presented here, as well as needed mitigation measures associated with the modified study parameters. Because elimination of the two parallel roadways will have no impact on traffic operations at the four study intersections at the Interstate 80/Auburn Ravine Road/Foresthill Road interchange, this analysis focused on the study area roadway segments.

We appreciate having this opportunity to work with you. Please call if you have questions or need further information.

Sincerely,

**MRO ENGINEERS, INC.**

Neal K. Liddicoat, P.E.
Traffic Engineering Manager

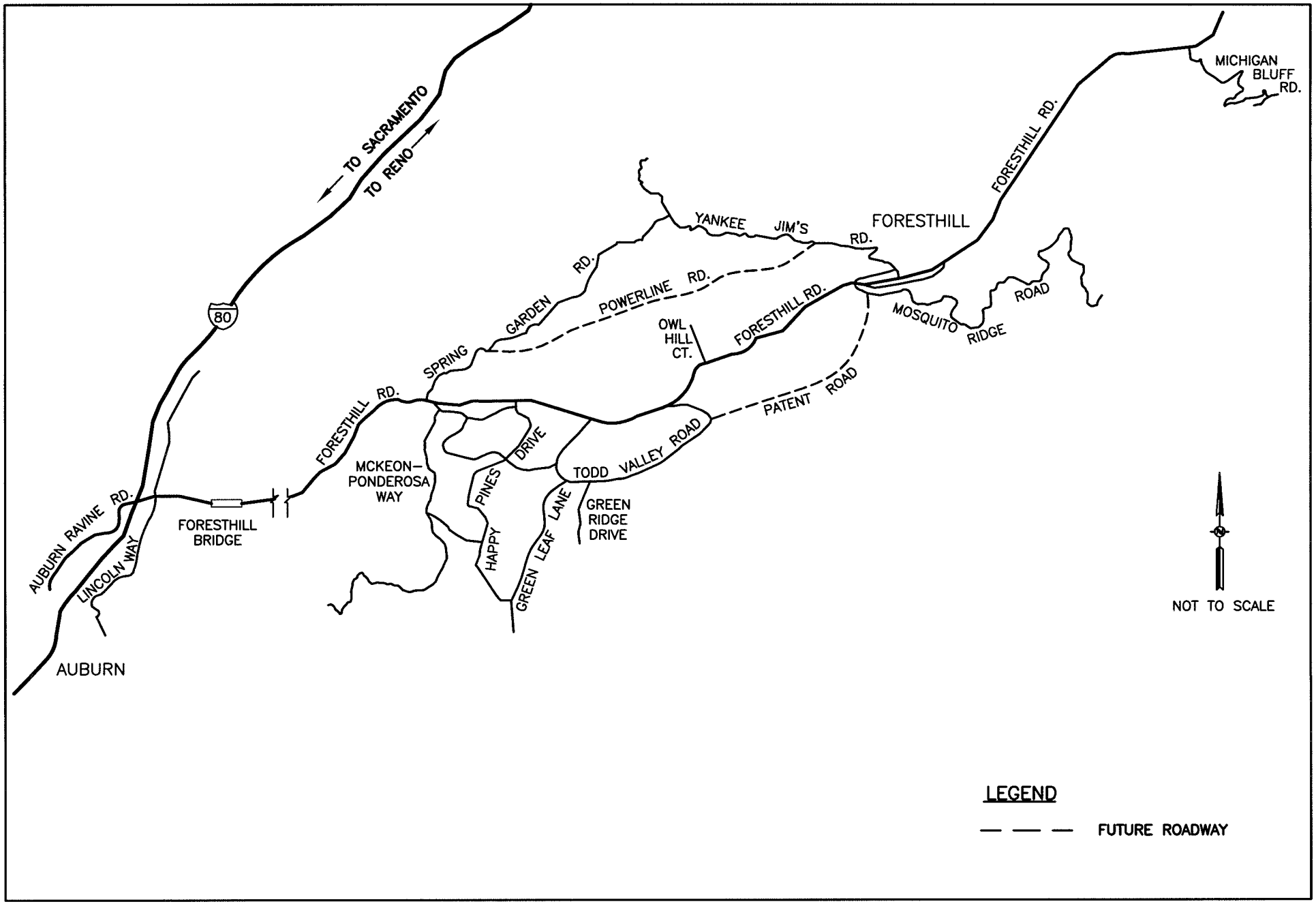
Melissa K. Pierce, E.I.T.
Assistant Engineer

cc: Richard Moorehead, Placer County Department of Public Works
Loren Clark, Placer County Planning Department

MRO ENGINEERS

**ATTACHMENT A**

**FIGURE 3**
**FUTURE CIRCULATION NETWORK**
**(Reference: MRO Engineers, Inc., *Revised Draft Traffic Study – Foresthill Divide Community Plan – Placer County, California*, June 20, 2007.)**




MRO ENGINEERS
2202 Plaza Drive
Rocklin, CA 95765
Phone (916) 783-3838
Fax (916) 783-5003
www.mroengineers.com

FUTURE CIRCULATION NETWORK

FIGURE 3

N:\2005\20516 Quad Knopf - Foresthill Comm. Plan\Working\CADD\Traffic\FORESTHILL DIVIDE.dwg Nov 05, 2007-03:34 pm

MRO ENGINEERS

# ATTACHMENT B

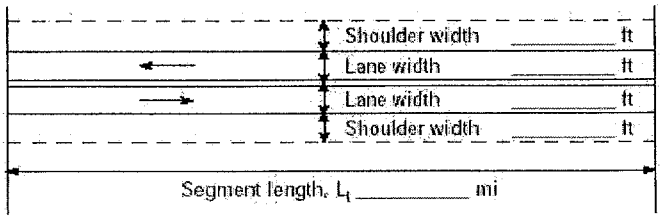
## TWO-LANE HIGHWAY
## LEVEL OF SERVICE CALCULATION WORKSHEETS
## YEAR 2030 "WITHOUT FOREST RANCH" SCENARIO

# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | *MKL* | Highway / Direction of Travel | *Foresthill Road - Eastbound* |
| Agency or Company | *MRO Engineers, Inc.* | From/To | *Bridge to Spring Garden Road* |
| Date Performed | *2/27/07* | Jurisdiction | *Placer County* |
| Analysis Time Period | *AM Peak Hour* | Analysis Year | *Year 2030 Without Forest Ranch* |

Project Description: *Foresthill Divide Community Plan*

## Input Data



☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☒ Rolling

Grade Length *4.00* mi Up/down *3.0*

Peak-hour factor, PHF *0.88*

No-passing zone *55%*

% Trucks and Buses , $P_T$ *6 %*

% Recreational vehicles, $P_R$ *2%*

Access points/ *mi* *2*

Analysis direction vol., $V_d$ *253*veh/h

Opposing direction vol., $V_o$ *888*veh/h

## Average Travel Speed

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9 or 20-15) | *7.5* | *1.1* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9 or 20-17) | *1.0* | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | *0.719* | *0.994* |
| Grade adjustment factor [1], $f_G$ (Exhibit 20-7 or 20-13) | *0.94* | *1.00* |
| Directional flow rate[2], $v_i$(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$ | *425* | *1015* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field measured speed[3], $S_{FM}$ | *mi/h* | Base free-flow speed[3], $BFFS_{FM}$ | *60.0 mi/h* |
| Observed volume[3], $V_f$ | veh/h | Adj. for lane width and shoulder width,[3] $f_{LS}$(Exh 20-5) | *0.0 mi/h* |
| Free-flow speed, $FFS_d$ $FFS=S_{FM}+0.00776(V_f/f_{HV})$ | *mi/h* | Adj. for access points[3], $f_A$ (Exhibit 20-5) | *0.5 mi/h* |
| Adjustment for no-passing zones, $f_{np}$ (Exhibit 20-19) | *0.8 mi/h* | Free-flow speed, $FFS_d$ $(FSS=BFFS-f_{LS}-f_A)$ | *59.5 mi/h* |
| | | Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$ | *47.5 mi/h* |

## Percent Time-Spent-Following

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$(Exhibit 20-10 or 20-16) | *1.5* | *1.0* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10 or 20-16) | *1.0* | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | *0.971* | *1.000* |
| Grade adjustment factor[1], $f_G$ (Exhibit 20-8 or 20-14) | *1.00* | *1.00* |
| Directional flow rate[2], $v_i$(pc/h)$=V_i/(PHF*f_{HV}*f_G)$ | *296* | *1009* |
| Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$ | *42.3* | |
| Adj. for no-passing zone, $f_{np}$ (Exhibit. 20-20) | *26.6* | |
| Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$ | *48.3* | |

## Level of Service and Other Performance Measures

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 or 20-4) | *C* |
| Volume to capacity ratio, $v/c=V_p/1{,}700$ | *0.25* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)$=0.25L_t(V/PHF)$ | *776* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)$=V*L_t$ | *2732* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)$=VMT_{15}/ATS$ | *16.3* |

## Notes

1. If the highway is extended segment (level) or rolling terrain, fG=1.0 .
2. If $v_i$($v_d$ or $v_o$) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

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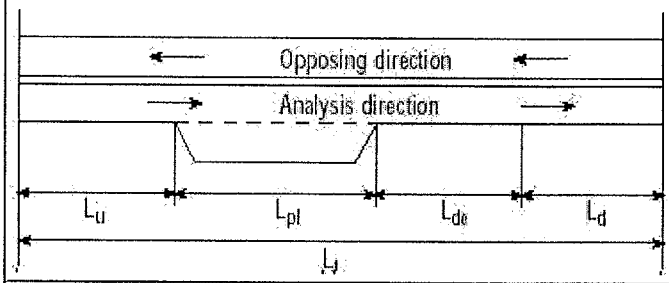
# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | *MKL* | Highway of Travel | *Foresthill Road - Eastbound* |
| Agency or Company | *MRO Engineers, Inc.* | From/To | *Bridge to Spring Garden Road* |
| Date Performed | *2/27/07* | Jurisdiction | *Placer County* |
| Analysis Time Period | *AM Peak Hour* | Analysis Year | *Year 2030 Without Forest Ranch* |

Project Description: *Foresthill Divide Community Plan*

**Input Data**

☑ Class I highway ☐ Class II highway



| | |
|---|---|
| Total length of analysis segment, $L_t$ ( *mi*) | *10.8* |
| Length of two-lane highway upstream of the passing lane, $L_u$ ( *mi*) | *3.0* |
| Length of passing lane including tapers , $L_{pl}$ ( *mi*) | *4.9* |
| Average travel speed, $ATS_d$ (from Directional Two-Lane Highway Segment Worksheet) | *47.5* |
| Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet) | *48.3* |
| Level of service[1], $LOS_d$ (from Directional Two-Lane Highway Segment Worksheet) | *C* |
| **Average Travel Speed** | |
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, $L_{de}$ ( *mi*) (Exhibit 20-23) | *1.70* |
| Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, $L_d$ ( *mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$ | *1.20* |
| Adj. factor for the effect of passing lane on average speed, $f_{pl}$ (Exhibit 20-24) | *1.10* |
| Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+(2L_{de}/(1+f_{pl}))$ ) | *49.9* |
| **Percent Time-Spent-Following** | |
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, $L_{de}$ ( *mi*)(Exhibit 20-23) | *10.65* |
| Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, $L_d$ ( *mi*)$=L_t-(L_u+L_{pl}+L_{de})$ | *-7.75* |
| Adj. factor for the effect of passing lane on percent time-spent-following, $f_{pl}$ (Exhibit 20-24) | *0.58* |
| Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$ | *34.4* |
| **Level of Service and Other Performance Measures[4]** | |
| Level of service including passing lane $LOS_{pl}$ (Exhibit 20-3 or 20-4) | *C* |
| Peak 15-min total travel time, $TT_{15}$(veh-h) $TT_{15}= VMT_{15}/ATS_{pl}$ | *15.5* |

**Notes**

1. If $LOS_d$=F, passing lane analysis cannot be performed.
2. If $L_d$ <0, use alternative Equation 20-22.
3. If $L_d$<0, use alternative Equation 20-20.
4. v/c, $VMT_{15}$ and $VMT_{60}$ are calculated on Directional Two-Lane Highway Segment Worksheet.

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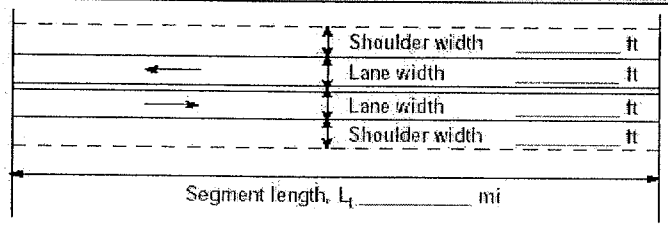
# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | MKL | Highway / Direction of Travel | Foresthill Road - Westbound |
| Agency or Company | MRO Engineers, Inc. | From/To | Bridge to Spring Garden Road |
| Date Performed | 2/27/07 | Jurisdiction | Placer County |
| Analysis Time Period | AM Peak Hour | Analysis Year | Year 2030 Without Forest Ranch |

Project Description: *Foresthill Divide Community Plan*

## Input Data



☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length 4.00 mi Up/down -3.0

Peak-hour factor, PHF 0.88

No-passing zone 88%

% Trucks and Buses, $P_T$ 2 %

% Recreational vehicles, $P_R$ 2%

Access points/ *mi* 2

Analysis direction vol., $V_d$ 888veh/h

Opposing direction vol., $V_o$ 253veh/h

## Average Travel Speed

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9 or 20-15) | 1.1 | 7.5 |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9 or 20-17) | 1.0 | 1.0 |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | 0.998 | 0.885 |
| Grade adjustment factor [1], $f_G$ (Exhibit 20-7 or 20-13) | 1.00 | 0.94 |
| Directional flow rate[2], $v_i$(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$ | 1011 | 346 |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field measured speed[3], $S_{FM}$ | mi/h | Base free-flow speed[3], $BFFS_{FM}$ | 60.0 mi/h |
| Observed volume[3], $V_f$ | veh/h | Adj. for lane width and shoulder width,[3] $f_{LS}$(Exh 20-5) | 0.0 mi/h |
| Free-flow speed, $FFS_d$ $FFS=S_{FM}+0.00776(V_f/f_{HV})$ | mi/h | Adj. for access points[3], $f_A$ (Exhibit 20-5) | 0.5 mi/h |
| Adjustment for no-passing zones, $f_{np}$ (Exhibit 20-19) | 3.1 mi/h | Free-flow speed, $FFS_d$ $(FSS=BFFS-f_{LS}-f_A)$ | 59.5 mi/h |
| | | Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$ | 45.8 mi/h |

## Percent Time-Spent-Following

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$(Exhibit 20-10 or 20-16) | 1.0 | 1.5 |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10 or 20-16) | 1.0 | 1.0 |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | 1.000 | 0.990 |
| Grade adjustment factor[1], $f_G$ (Exhibit 20-8 or 20-14) | 1.00 | 1.00 |
| Directional flow rate[2], $v_i$(pc/h)$=V_i/(PHF*f_{HV}*f_G)$ | 1009 | 290 |
| Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$ | 71.7 | |
| Adj. for no-passing zone, $f_{np}$ (Exhibit. 20-20) | 24.1 | |
| Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$ | 90.4 | |

## Level of Service and Other Performance Measures

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 or 20-4) | E |
| Volume to capacity ratio, $v/c=V_p/1{,}700$ | 0.59 |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)$=0.25L_t(V/PHF)$ | 2725 |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)$=V*L_t$ | 9590 |
| Peak 15-min total travel time, $TT_{15}$(veh-h)$=VMT_{15}/ATS$ | 59.4 |

## Notes

1. If the highway is extended segment (level) or rolling terrain, fG=1.0 .
2. If $v_i$($v_d$ or $v_o$) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

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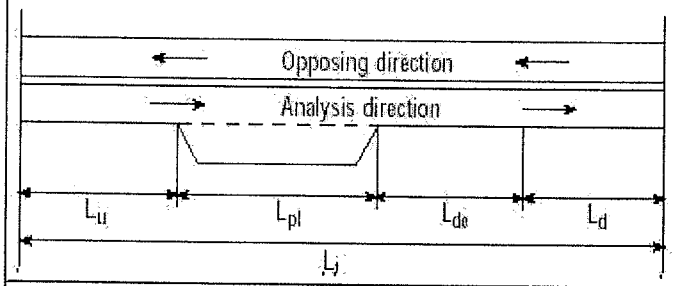
# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | *MKL* | Highway of Travel | *Foresthill Road - Westbound* |
| Agency or Company | *MRO Engineers, Inc.* | From/To | *Bridge to Spring Garden Road* |
| Date Performed | *2/27/07* | Jurisdiction | *Placer County* |
| Analysis Time Period | *AM Peak Hour* | Analysis Year | *Year 2030 Without Forest Ranch* |

Project Description: *Foresthill Divide Community Plan*

**Input Data**

☑ Class I highway ☐ Class II highway



| | |
|---|---|
| Total length of analysis segment, $L_t$ ( *mi*) | *10.8* |
| Length of two-lane highway upstream of the passing lane, $L_u$ ( *mi*) | *4.8* |
| Length of passing lane including tapers , $L_{pl}$ ( *mi*) | *1.3* |
| Average travel speed, $ATS_d$ (from Directional Two-Lane Highway Segment Worksheet) | *45.8* |
| Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet) | *90.4* |
| Level of service[1], $LOS_d$ (from Directional Two-Lane Highway Segment Worksheet) | *E* |
| **Average Travel Speed** | |
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, $L_{de}$ ( *mi*) (Exhibit 20-23) | *1.70* |
| Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, $L_d$ ( *mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$ | *3.00* |
| Adj. factor for the effect of passing lane on average speed, $f_{pl}$ (Exhibit 20-24) | *1.11* |
| Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+(2L_{de}/(1+f_{pl}))$ ) | *46.8* |
| **Percent Time-Spent-Following** | |
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, $L_{de}$ ( *mi*)(Exhibit 20-23) | *3.60* |
| Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, $L_d$ ( *mi*)$=L_t-(L_u+L_{pl}+L_{de})$ | *1.10* |
| Adj. factor for the effect of passing lane on percent time-spent-following, $f_{pl}$ (Exhibit 20-24) | *0.62* |
| Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$ | *80.5* |
| **Level of Service and Other Performance Measures[4]** | |
| Level of service including passing lane $LOS_{pl}$ (Exhibit 20-3 or 20-4) | *E* |
| Peak 15-min total travel time, $TT_{15}$(veh-h) $TT_{15}= VMT_{15}/ATS_{pl}$ | *58.2* |

**Notes**

1. If $LOS_d$=F, passing lane analysis cannot be performed.
2. If $L_d$ <0, use alternative Equation 20-22.
3. If $L_d$<0, use alternative Equation 20-20.
4. v/c, $VMT_{15}$ and $VMT_{60}$ are calculated on Directional Two-Lane Highway Segment Worksheet.

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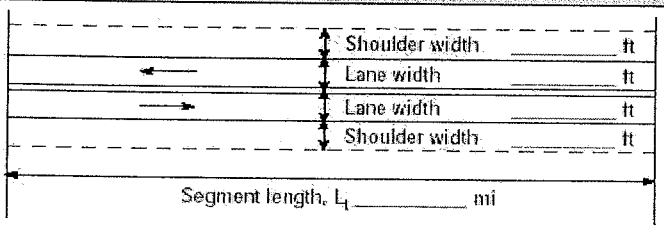
# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | MKL | Highway / Direction of Travel | Foresthill Road - Eastbound |
| Agency or Company | MRO Engineers, Inc. | From/To | Spring Garden to Todd Valley W |
| Date Performed | 2/27/07 | Jurisdiction | Placer County |
| Analysis Time Period | AM Peak Hour | Analysis Year | Year 2030 Without Forest Ranch |

Project Description: *Foresthill Divide Community Plan*

## Input Data



☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.70* mi Up/down *3.4*

Peak-hour factor, PHF *0.75*

No-passing zone *29%*

% Trucks and Buses , $P_T$ *3 %*

% Recreational vehicles, $P_R$ *2%*

Access points/ *mi* *4*

Analysis direction vol., $V_d$ *328*veh/h

Opposing direction vol., $V_o$ *605*veh/h

## Average Travel Speed

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9 or 20-15) | *5.7* | *1.1* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9 or 20-17) | *1.0* | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | *0.877* | *0.997* |
| Grade adjustment factor [1], $f_G$ (Exhibit 20-7 or 20-13) | *0.98* | *1.00* |
| Directional flow rate[2], $v_i$(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$ | *508* | *809* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field measured speed[3], $S_{FM}$ | *mi/h* | Base free-flow speed[3], $BFFS_{FM}$ | *60.0 mi/h* |
| Observed volume[3], $V_f$ | veh/h | Adj. for lane width and shoulder width,[3] $f_{LS}$(Exh 20-5) | *0.0 mi/h* |
| Free-flow speed, $FFS_d$ $FFS=S_{FM}+0.00776(V_f/f_{HV})$ | *mi/h* | Adj. for access points[3], $f_A$ (Exhibit 20-5) | *1.0 mi/h* |
| Adjustment for no-passing zones, $f_{np}$ (Exhibit 20-19) | *0.7 mi/h* | Free-flow speed, $FFS_d$ $(FSS=BFFS-f_{LS}-f_A)$ | *59.0 mi/h* |
| | | Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$ | *48.1 mi/h* |

## Percent Time-Spent-Following

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$(Exhibit 20-10 or 20-16) | *1.0* | *1.0* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10 or 20-16) | *1.0* | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | *1.000* | *1.000* |
| Grade adjustment factor[1], $f_G$ (Exhibit 20-8 or 20-14) | *0.94* | *1.00* |
| Directional flow rate[2], $v_i$(pc/h)$=V_i/(PHF*f_{HV}*f_G)$ | *463* | *807* |
| Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$ | *52.7* | |
| Adj. for no-passing zone, $f_{np}$ (Exhibit. 20-20) | *22.5* | |
| Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$ | *60.9* | |

## Level of Service and Other Performance Measures

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 or 20-4) | *C* |
| Volume to capacity ratio, $v/c=V_p/1{,}700$ | *0.30* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)$=0.25L_t(V/PHF)$ | *186* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)$=V*L_t$ | *558* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)$=VMT_{15}/ATS$ | *3.9* |

## Notes

1. If the highway is extended segment (level) or rolling terrain, fG=1.0 .
2. If $v_i$($v_d$ or $v_o$) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

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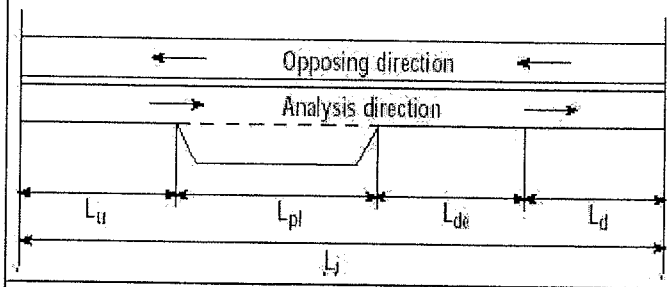
# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | MKL | Highway of Travel | Foresthill Road - Eastbound |
| Agency or Company | MRO Engineers, Inc. | From/To | Spring Garden to Todd Valley W |
| Date Performed | 2/27/07 | Jurisdiction | Placer County |
| Analysis Time Period | AM Peak Hour | Analysis Year | Year 2030 Without Forest Ranch |

Project Description: *Foresthill Divide Community Plan*

**Input Data**

☑ Class I highway ☐ Class II highway



| | |
|---|---|
| Total length of analysis segment, $L_t$ ( *mi*) | *1.7* |
| Length of two-lane highway upstream of the passing lane, $L_u$ ( *mi*) | *0.3* |
| Length of passing lane including tapers , $L_{pl}$ ( *mi*) | *1.2* |
| Average travel speed, $ATS_d$ (from Directional Two-Lane Highway Segment Worksheet) | *48.1* |
| Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet) | *60.9* |
| Level of service[1], $LOS_d$ (from Directional Two-Lane Highway Segment Worksheet) | *C* |
| **Average Travel Speed** | |
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, $L_{de}$ ( *mi*) (Exhibit 20-23) | *1.70* |
| Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, $L_d$ ( *mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$ | *-1.50* |
| Adj. factor for the effect of passing lane on average speed, $f_{pl}$ (Exhibit 20-24) | *1.10* |
| Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+(2L_{de}/(1+f_{pl}))$ ) | *51.9* |
| **Percent Time-Spent-Following** | |
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, $L_{de}$ ( *mi*)(Exhibit 20-23) | *7.60* |
| Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, $L_d$ ( *mi*)$=L_t-(L_u+L_{pl}+L_{de})$ | *-7.40* |
| Adj. factor for the effect of passing lane on percent time-spent-following, $f_{pl}$ (Exhibit 20-24) | *0.61* |
| Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$ | *41.4* |
| **Level of Service and Other Performance Measures[4]** | |
| Level of service including passing lane $LOS_{pl}$ (Exhibit 20-3 or 20-4) | *B* |
| Peak 15-min total travel time, $TT_{15}$(veh-h) $TT_{15}= VMT_{15}/ATS_{pl}$ | *3.6* |

**Notes**

1. If $LOS_d$=F, passing lane analysis cannot be performed.
2. If $L_d$ <0, use alternative Equation 20-22.
3. If $L_d$<0, use alternative Equation 20-20.
4. v/c, $VMT_{15}$ and $VMT_{60}$ are calculated on Directional Two-Lane Highway Segment Worksheet.

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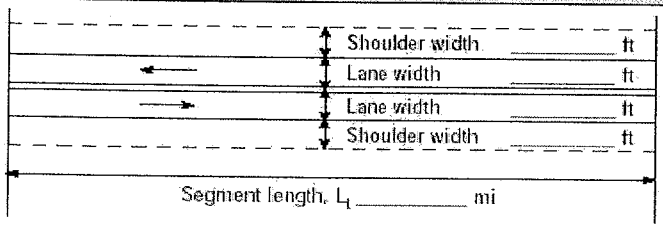
# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | MKL | Highway / Direction of Travel | Foresthill Road - Westbound |
| Agency or Company | MRO Engineers, Inc. | From/To | Spring Garden to Todd Valley W |
| Date Performed | 2/27/07 | Jurisdiction | Placer County |
| Analysis Time Period | AM Peak Hour | Analysis Year | Year 2030 Without Forest Ranch |

Project Description: *Foresthill Divide Community Plan*

## Input Data



☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

| | | | |
|---|---|---|---|
| Grade Length | 1.70 mi | Up/down | -3.4 |
| Peak-hour factor, PHF | 0.88 | | |
| No-passing zone | 100% | | |
| % Trucks and Buses , $P_T$ | 2 % | | |
| % Recreational vehicles, $P_R$ | 2% | | |
| Access points/ *mi* | 5 | | |

Analysis direction vol., $V_d$ 605veh/h

Opposing direction vol., $V_o$ 328veh/h

## Average Travel Speed

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9 or 20-15) | 1.1 | 5.7 |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9 or 20-17) | 1.0 | 1.0 |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | 0.998 | 0.915 |
| Grade adjustment factor [1], $f_G$ (Exhibit 20-7 or 20-13) | 1.00 | 0.98 |
| Directional flow rate[2], $v_i$(pc/h) $v_i=V_i/(PHF*f_{HV}*f_G)$ | 689 | 415 |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field measured speed[3], $S_{FM}$ | mi/h | Base free-flow speed[3], $BFFS_{FM}$ | 60.0 mi/h |
| Observed volume[3], $V_f$ | veh/h | Adj. for lane width and shoulder width,[3] $f_{LS}$(Exh 20-5) | 0.0 mi/h |
| Free-flow speed, $FFS_d$ $FFS=S_{FM}+0.00776(V_f/f_{HV})$ | mi/h | Adj. for access points[3], $f_A$ (Exhibit 20-5) | 1.3 mi/h |
| Adjustment for no-passing zones, $f_{np}$ (Exhibit 20-19) | 2.8 mi/h | Free-flow speed, $FFS_d$ $(FSS=BFFS-f_{LS}-f_A)$ | 58.8 mi/h |
| | | Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$ | 47.4 mi/h |

## Percent Time-Spent-Following

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$(Exhibit 20-10 or 20-16) | 1.0 | 1.0 |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10 or 20-16) | 1.0 | 1.0 |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | 1.000 | 1.000 |
| Grade adjustment factor[1], $f_G$ (Exhibit 20-8 or 20-14) | 1.00 | 0.94 |
| Directional flow rate[2], $v_i$(pc/h)$=V_i/(PHF*f_{HV}*f_G)$ | 688 | 395 |
| Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$ | 59.9 | |
| Adj. for no-passing zone, $f_{np}$ (Exhibit. 20-20) | 33.1 | |
| Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$ | 80.9 | |

## Level of Service and Other Performance Measures

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 or 20-4) | E |
| Volume to capacity ratio, $v/c=V_p/1{,}700$ | 0.41 |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)$=0.25L_t(V/PHF)$ | 292 |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)$=V*L_t$ | 1029 |
| Peak 15-min total travel time, $TT_{15}$(veh-h)$=VMT_{15}/ATS$ | 6.2 |

## Notes

1. If the highway is extended segment (level) or rolling terrain, fG=1.0 .
2. If $v_i$($v_d$ or $v_o$) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

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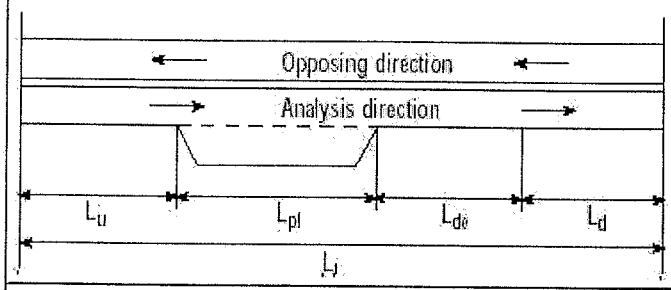
# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET WITH PASSING LANE WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | *MKL* | Highway of Travel | *Foresthill Road - Westbound* |
| Agency or Company | *MRO Engineers, Inc.* | From/To | *Spring Garden to Todd Valley W* |
| Date Performed | *2/27/07* | Jurisdiction | *Placer County* |
| Analysis Time Period | *AM Peak Hour* | Analysis Year | *Year 2030 Without Forest Ranch* |

Project Description: *Foresthill Divide Community Plan*

**Input Data**

☑ Class I highway ☐ Class II highway



| | |
|---|---|
| Total length of analysis segment, $L_t$ ( *mi*) | *1.7* |
| Length of two-lane highway upstream of the passing lane, $L_u$ ( *mi*) | *1.7* |
| Length of passing lane including tapers , $L_{pl}$ ( *mi*) | *0.0* |
| Average travel speed, $ATS_d$ (from Directional Two-Lane Highway Segment Worksheet) | *47.4* |
| Percent time-spent-following, $PTSF_d$ (from Directional Two-Lane Highway Segment Worksheet) | *80.9* |
| Level of service[1], $LOS_d$ (from Directional Two-Lane Highway Segment Worksheet) | *E* |
| **Average Travel Speed** | |
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, $L_{de}$ ( *mi*) (Exhibit 20-23) | *1.70* |
| Length of two-lane highway downstream of effective length of the passing lane for avg travel speed, $L_d$ ( *mi*) $L_d=L_t-(L_u+L_{pl}+L_{de})$ | *-1.70* |
| Adj. factor for the effect of passing lane on average speed, $f_{pl}$ (Exhibit 20-24) | *1.11* |
| Average travel speed including passing lane[2], $ATS_{pl} = (ATS_d * L_t) / (L_u+L_d+(L_{pl}/f_{pl})+(2L_{de}/(1+f_{pl}))$ ) | |
| **Percent Time-Spent-Following** | |
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, $L_{de}$ ( *mi*)(Exhibit 20-23) | *5.80* |
| Length of two-lane highway downstream of effective length of the passing lane for percent-time-following, $L_d$ ( *mi*)$=L_t-(L_u+L_{pl}+L_{de})$ | *-5.80* |
| Adj. factor for the effect of passing lane on percent time-spent-following, $f_{pl}$ (Exhibit 20-24) | *0.62* |
| Percent time-spent-following including passing lane[3], $PTSF_{pl}$(%) $PTSF_{pl}= PTSF_d[L_u+L_d+f_{pl}L_{pl}+((1+f_{pl})/2)L_{de}]/L_t$ | *80.9* |
| **Level of Service and Other Performance Measures[4]** | |
| Level of service including passing lane $LOS_{pl}$ (Exhibit 20-3 or 20-4) | |
| Peak 15-min total travel time, $TT_{15}$(veh-h) $TT_{15}= VMT_{15}/ATS_{pl}$ | |

**Notes**

1. If $LOS_d$=F, passing lane analysis cannot be performed.
2. If $L_d$ <0, use alternative Equation 20-22.
3. If $L_d$<0, use alternative Equation 20-20.
4. v/c, $VMT_{15}$ and $VMT_{60}$ are calculated on Directional Two-Lane Highway Segment Worksheet.

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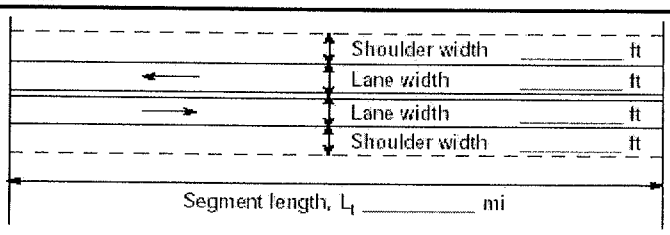
# DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | MKP | Highway / Direction of Travel | Foresthill Road - Eastbound |
| Agency or Company | MRO Engineers, Inc. | From/To | Todd Valley W to Owl Hill Ct |
| Date Performed | 10/22/07 | Jurisdiction | Placer County |
| Analysis Time Period | AM Peak Hour | Analysis Year | Year 2030 Without Forest Ranch |

Project Description: *Foresthill Divide Community Plan*

**Input Data**



☑ Class I highway ☐ Class II highway

Terrain ☐ Level ☐ Rolling

Grade Length *1.20* mi Up/down *3.0*

Peak-hour factor, PHF *0.59*

No-passing zone *17%*

% Trucks and Buses , $P_T$ *2 %*

% Recreational vehicles, $P_R$ *2%*

Access points/ *mi* *3*

Analysis direction vol., $V_d$ *436*veh/h

Opposing direction vol., $V_o$ *494*veh/h

**Average Travel Speed**

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$ (Exhibit 20-9 or 20-15) | *5.0* | *1.1* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-9 or 20-17) | *1.0* | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | *0.926* | *0.998* |
| Grade adjustment factor [1], $f_G$ (Exhibit 20-7 or 20-13) | *1.00* | *1.00* |
| Directional flow rate[2], $v_i$(pc/h) $v_i=V_f/(PHF*f_{HV}*f_G)$ | *798* | *839* |

| Free-Flow Speed from Field Measurement | | Estimated Free-Flow Speed | |
|---|---|---|---|
| Field measured speed[3], $S_{FM}$ | *mi/h* | Base free-flow speed[3], $BFFS_{FM}$ | *60.0 mi/h* |
| Observed volume[3], $V_f$ | veh/h | Adj. for lane width and shoulder width,[3] $f_{LS}$(Exh 20-5) | *0.0 mi/h* |
| Free-flow speed, $FFS_d$ $FFS=S_{FM}+0.00776(V_f/f_{HV})$ | *mi/h* | Adj. for access points[3], $f_A$ (Exhibit 20-5) | *0.8 mi/h* |
| Adjustment for no-passing zones, $f_{np}$ (Exhibit 20-19) | *0.6 mi/h* | Free-flow speed, $FFS_d$ $(FSS=BFFS-f_{LS}-f_A)$ | *59.3 mi/h* |
| | | Average travel speed, $ATS=FFS-0.00776v_p-f_{np}$ | *46.0 mi/h* |

**Percent Time-Spent-Following**

| | Analysis Direction (d) | Opposing Direction (o) |
|---|---|---|
| Passenger-car equivalents for trucks, $E_T$(Exhibit 20-10 or 20-16) | *1.0* | *1.0* |
| Passenger-car equivalents for RVs, $E_R$ (Exhibit 20-10 or 20-16) | *1.0* | *1.0* |
| Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$ | *1.000* | *1.000* |
| Grade adjustment factor[1], $f_G$ (Exhibit 20-8 or 20-14) | *0.93* | *1.00* |
| Directional flow rate[2], $v_i$(pc/h)$=V_f/(PHF*f_{HV}*f_G)$ | *791* | *837* |
| Base percent time-spent-following[4], $BPTSF(\%)=100(1-e^{av_d^b})$ | *69.3* | |
| Adj. for no-passing zone, $f_{np}$ (Exhibit. 20-20) | *15.9* | |
| Percent time-spent-following, $PTSF(\%)=BPTSF+f_{np}$ | *77.1* | |

**Level of Service and Other Performance Measures**

| | |
|---|---|
| Level of service, LOS (Exhibit 20-3 or 20-4) | *D* |
| Volume to capacity ratio, $v/c=V_p/1{,}700$ | *0.47* |
| Peak 15-min veh-miles of travel, $VMT_{15}$ (veh- *mi*)$=0.25L_t(V/PHF)$ | *222* |
| Peak-hour vehicle-miles of travel, $VMT_{60}$(veh- *mi*)$=V*L_t$ | *523* |
| Peak 15-min total travel time, $TT_{15}$(veh-h)$=VMT_{15}/ATS$ | *4.8* |

**Notes**

1. If the highway is extended segment (level) or rolling terrain, fG=1.0 .
2. If $v_i$($v_d$ or $v_o$) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

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