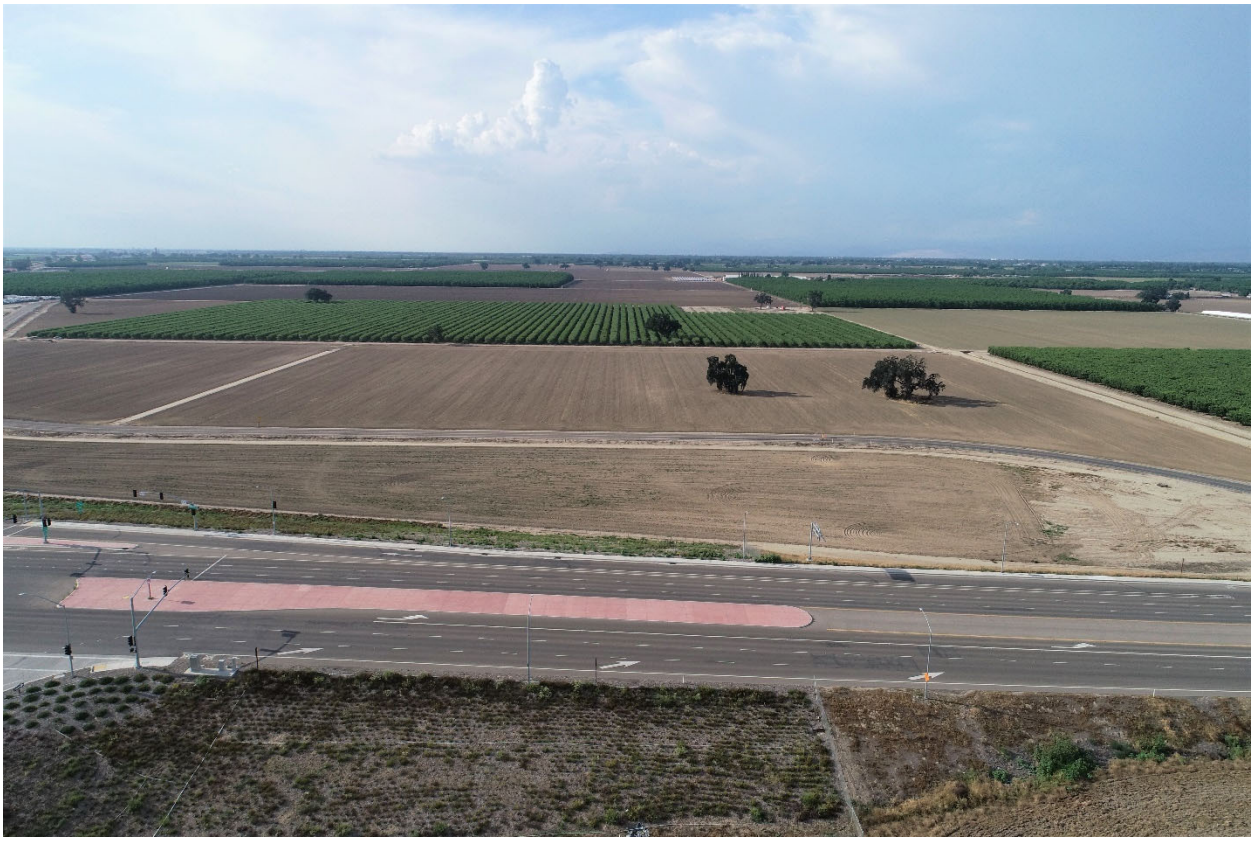
FINAL ENVIRONMENTAL IMPACT REPORT

CITY OF TULARE

CARTMILL CROSSINGS



AUGUST 2019

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All referenced attachments reproduced on a CD found on the inside cover of this FEIR

Attachment A: Highway Capacity Software (HCS) worksheets

CHAPTER 9 - RESPONSE TO COMMENTS

9.1 - Introduction

9.1.1 - PURPOSE

As defined by Section 15050 of the California Environmental Quality Act (CEQA) Guidelines, the City of Tulare is serving as "lead agency" for the preparation of the Environmental Impact Report (EIR) for Cartmill Crossings (proposed project or project). The Final EIR (FEIR) presents the environmental information and analyses that have been prepared for the proposed project, including comments received regarding the adequacy of the Draft EIR (DEIR) and responses to those comments. In addition to the responses to comments, clarifications, corrections, or minor revisions have been made to the Draft EIR. The Final EIR, which includes the responses to comments, the Draft EIR, and the Mitigation Monitoring and Reporting Program (MMRP), will be used by the City of Tulare Planning Commission and City Council in the decision-making process for the proposed project.

9.1.2 - ENVIRONMENTAL PROCESS

A Notice of Preparation /Initial Study (NOP/IS) (State Clearinghouse No. 2018111038) was circulated for a 30-day public review period beginning on November 19, 2018. A Scoping Meeting was held on December 6, 2018. No verbal comments were received at the scoping meeting. Four written comments were received regarding the NOP/IS and used in the preparation of the Draft EIR. The Draft EIR for the proposed project was circulated for a 45-day public review period beginning on June 17, 2019 and ending on August 1, 2019. A total of two written comment letters were received on the DEIR.

Section 15088 of the *CEQA Guidelines* requires that the lead agency evaluate comments on environmental issues received from persons and agencies that reviewed the Draft EIR and prepare a written response addressing each of the comments received. In addition, the City has elected to provide written responses to organizations and interested parties, which is the response to comments contained in this document— Volume 3, Chapter 9 of the Draft EIR. Volumes 1, 2, and 3, together constitute the Final EIR. A list of agencies, organizations, and interested parties who have commented on the Draft EIR is provided below. A copy of each numbered comment letter and a lettered response to each comment are provided in Section 9.3, "Response to Comments," of this chapter.

State Agencies

Letter 1 – California Department of Fish and Wildlife

Letter 2 – California Department of Transportation

9.2 - Revisions to the Draft EIR

The revisions that follow were made to the text of the Draft EIR. Amended text is identified by page number. Additions to the Draft EIR text are shown with underline and text removed from the Draft EIR is shown with ~~strikethrough~~. *Italicized text was not part of the original draft EIR but has been added to clarify why revisions were made in the Response to Comments Chapter, if necessary.*

Pages 1-16 through 1-31 – Introduction and Executive Summary

Impact #	Mitigation Measure(s)	Level of Significance after Mitigation
AGRICULTURAL AND FORESTRY RESOURCES		
Impact #3.2-a: Would the Project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use	**MM AFR-1:** Prior to issuance of a grading or building permit, whichever occurs first, the Project proponent shall provide written evidence of completion of one or more of the following measures, consistent with Tulare General Plan Policy COS-P3.12 to mitigate the loss of agricultural land at a ratio of 1:1 for net acreage before conversion. (The net acreage calculation shall exclude existing roads and areas already developed with structures, and a site plan shall be submitted to substantiate the net acreage calculation, along with written evidence of compliance.) • Funding and/or purchasing agricultural conservation easements (to be managed and maintained by an appropriate entity). • Purchasing credits from an established agricultural farmland mitigation bank. • Contributing agricultural land or equivalent funding to an organization that provides for the preservation of farmland in California. • Participating in any agricultural land mitigation program adopted by Tulare County that provides equal or more effective mitigation than the measures listed above. Mitigation land shall meet the definition of Prime Farmland and be of similar agricultural quality or higher, as established by the DOC.	**Significant and Unavoidable**

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	If mitigation land is also suitable for Swainson's hawk foraging habitat, this land shall satisfy the compensation requirements of MM BIO-1. Completion of the selected measure or, with the City of Tulare Community Development Department Director's approval, a combination of selected mitigation measures can occur on qualifying land within the southern San Joaquin Valley (Kings, Tulare, or Kern County) that is located outside of a city's UDB.	
BIOLOGICAL RESOURCES		
Would the Project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	**MM BIO-1:** A pre-construction survey for Swainson's Hawk shall be conducted no more than 10-days prior to the start of construction, if ground-disturbing activities take place during the normal bird breeding season (February 1 through September 15). Nesting surveys for the Swainson's hawks shall be conducted in accordance with the protocol outlined in the "Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley" (Swainson's Hawk Technical Advisory Committee, 2000). If potential Swainson's hawk nests or nesting substrates are located within 0.5 miles of the Project site, then those nests or substrates must be monitored for activity on a routine and repeating basis throughout the breeding season, or until Swainson's hawks or other raptor species are verified to be using them. The protocol recommends that 10 visits be made to each nest or nesting site: one during January 1-March 20 to identify potential nest sites, three during March 20-April 5, three during April 5-April 20, and three during June 10-July 30. To meet the minimum level of protection for the species, surveys shall be completed for at least the two survey periods immediately prior	**Less than Significant**

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	to Project-related ground disturbance activities. If Swainson's hawks are not found to nest within the survey area, then no further action is warranted. If Swainson's hawks are found to nest within the survey area, during the nesting period, active Swainson's hawk nests shall be avoided by 0.5 miles unless this avoidance buffer is reduced through consultation with the CDFW and/or USFWS. If a construction area falls within this nesting site, construction must be delayed until the young have fledged (left the nest). The 2,500-foot radius no construction zone may be reduced in size. A qualified biologist must conduct construction monitoring on a daily basis, inspect the nest on a daily basis, and ensure that construction activities do not disrupt breeding behaviors. In no case shall the no construction zone be reduced to less than 500 feet. If Swainson's Hawk nests are identified during surveys, compensation lands at the following ratios shall be provided: • For project development within 1-mile of an active nest tree, a minimum of one acre of habitat management (HM) land for each acre of development. • For project development within 5-miles of an active nest tree, but greater than 1-mile, a minimum of 0.75-acres of HM land for each acre of development. • For project development within 10-miles of an active nest tree, a minimum of 0.5-acres of HM land for each acre of development.	

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	If Swainson's Hawk are detected and the proposed 0.5-mile no-disturbance nest buffer is not feasible, consultation with CDFW is warranted to determine if the project can avoid take. If Swainson's Hawk take cannot be avoided, acquisition of an Incidental Take Permit (ITP), pursuant to Fish and Game Code Section 2081(b) prior to vegetation- or ground-disturbing activities may be necessary to comply with CESA. **MM BIO-3:** The following measures shall be implemented to reduce potential impacts to San Joaquin kit fox, Burrowing owl, and American badger: Because there is the potential for the San Joaquin kit fox to occur on the Project site, the USFWS "Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance" (USFWS, 2011) shall be followed. In addition, because the project site is within the range of Burrowing Owl, contains suitable burrow habitat in the vicinity, and has the potential to significantly impact local Burrowing Owl populations, Burrowing Owl surveys shall be conducted following the California Burrowing Owl Consortium's (CBOC) "Burrowing Owl Survey Protocol and Mitigation Guidelines" (CBOC 1993) and California Department of Fish & Wildlife "Staff Report on Burrowing Owl Mitigation" (CDFG 2012). Surveys shall include a 500-ft buffer around the Project area. The measures that are listed below have been excerpted from those guidelines and would protect San Joaquin kit foxes, Burrowing owls, and American badgers from direct mortality and from destruction of active burrows/dens and natal or pupping dens. The Lead Agency or designee shall determine the	

<table>
<tr><th>Impact #</th><th>Mitigation Measure(s)</th><th>Level of Significance after Mitigation</th></tr>
<tr><td></td><td>applicability of the following measures depending on specific construction activities and shall implement such measures when required.

• Pre-construction surveys shall be conducted no fewer than 14 days and no more than 30 days prior to the beginning of ground disturbance and/or construction activities, or any project activity likely to impact the San Joaquin kit fox, Burrowing owl, or American badger.
• Exclusion zones shall be placed in accordance with USFWS Recommendations using the following:

<table>
<tr><td>Potential Den</td><td>50-foot radius</td></tr>
<tr><td>Known Den</td><td>100-foot radius</td></tr>
<tr><td>Natal/Pupping Den (Occupied and Unoccupied)</td><td>Contact U.S. Fish and Wildlife Service for guidance</td></tr>
<tr><td>Atypical Den</td><td>50-foot radius</td></tr>
</table>

In addition, impacts to occupied burrows shall be avoided in accordance with the following table unless a qualified biologist approved by CDFW verifies through non-invasive methods that either: 1) the birds have not begun egg laying and incubation; or 2) that juveniles from the occupied</td><td></td></tr>
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burrows are foraging independently and are capable of independent survival.

<table>
<tr><td rowspan="2">Location</td><td rowspan="2">Time of Year</td><td colspan="3">Level of Disturbance</td></tr>
<tr><td>Low</td><td>Med</td><td>High</td></tr>
<tr><td>Nesting sites</td><td>April 1-Aug 15</td><td>200 m*</td><td>500 m</td><td>500 m</td></tr>
<tr><td>Nesting sites</td><td>Aug 16-Oct 15</td><td>200 m</td><td>200 m</td><td>500 m</td></tr>
<tr><td>Nesting sites</td><td>Oct 16-Mar 31</td><td>50 m</td><td>100 m</td><td>500 m</td></tr>
</table>
*meters (m)

If any den or burrow is found within the construction area and must be removed, it must be appropriately monitored and excavated by a trained wildlife biologist. Destruction of natal dens and other “known” kit fox dens must not occur until authorized by USFWS. Replacement dens will be required if such dens are removed. Potential dens that are removed do not need to be replaced if they are determined to be inactive after monitoring.
• Project-related vehicles shall observe a daytime speed limit of 20 mph throughout the site in all project areas, except on county roads and State and federal highways; this is particularly important at night when kit foxes and American badgers are most active. Night-time construction shall be minimized to the extent possible. However, if it does occur, then the speed limit shall be reduced to 10 mph. Off-road traffic outside of designated project areas shall be prohibited.
</td><td></td></tr>
</table>

Impact #	Mitigation Measure(s)	Level of Significance after Mitigation
	• To prevent inadvertent entrapment of kit foxes or other animals during the construction phase of a project, all excavated, steep-walled holes or trenches more than two-feet deep shall be covered at the close of each working day by plywood or similar materials. If the trenches cannot be closed, one or more escape ramps constructed of earthen-fill or wooden planks shall be installed. Before such holes or trenches are filled, they shall be thoroughly inspected for trapped animals. If at any time a trapped or injured kit fox is discovered, the USFWS and the CDFW shall be contacted at the addresses provided below. • Kit foxes and American badgers are attracted to den-like structures such as pipes and may enter stored pipes and become trapped or injured. All construction pipes, culverts, or similar structures with a diameter of four inches or greater that are stored at a construction site for one or more overnight periods shall be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a kit fox is discovered inside a pipe, that section of pipe shall not be moved until the USFWS has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved only once to remove it from the path of construction activity, until the fox has escaped. • All food-related trash items such as wrappers, cans, bottles, and food scraps shall be disposed of in securely	

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	closed containers and removed at least once a week from a construction or project site. • Use of firearms on the site shall adhere to USFWS protocols. • No pets, such as dogs or cats, shall be permitted on the project site to prevent harassment, mortality of kit foxes, or destruction of dens. • Use of rodenticides and herbicides in project areas shall be restricted. This is necessary to prevent primary or secondary poisoning of kit foxes and the depletion of prey populations on which they depend. All uses of such compounds shall observe label and other restrictions mandated by the EPA, California Department of Food and Agriculture, and other State and federal legislation, as well as additional project-related restrictions deemed necessary by the USFWS. If rodent control must be conducted, zinc phosphide shall be used because of a proven lower risk to kit fox. • A representative shall be appointed by the project proponent who will be the contact source for any employee or contractor who might inadvertently kill or injure a kit fox or who finds a dead, injured or entrapped kit fox. The representative will be identified during the employee education program and their name and telephone number shall be provided to the USFWS. • An employee education program shall be conducted. The program shall consist of a brief presentation by persons knowledgeable in San Joaquin kit fox biology and	

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	legislative protection to explain endangered species concerns to contractors, their employees, and military and/or agency personnel involved in the project. The program shall include the following: A description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; an explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information shall be prepared for distribution to the previously referenced people and anyone else who may enter the project site. • Upon completion of the project, all areas subject to temporary ground disturbances, including storage and staging areas, temporary roads, pipeline corridors, etc. shall be re-contoured if necessary, and revegetated to promote restoration of the area to pre-project conditions. An area subject to "temporary" disturbance means any area that is disturbed during the project, but after project completion will not be subject to further disturbance and has the potential to be revegetated. Appropriate methods and plant species used to revegetate such areas shall be determined on a site-specific basis in consultation with the USFWS, CDFW, and revegetation experts. • In the case of trapped animals, escape ramps or structures shall be installed immediately to allow the animal(s) to escape, or the USFWS shall be contacted for guidance.	

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	• Any contractor, employee, or military or agency personnel who are responsible for inadvertently killing or injuring a San Joaquin kit fox shall immediately report the incident to their representative. This representative shall contact the CDFW immediately in the case of a dead, injured or entrapped kit fox. The CDFW contact for immediate assistance is State Dispatch at (916) 445-0045. They will contact the local warden or Mr. Paul Hofmann, the wildlife biologist, at (530) 934-9309. The USFWS shall be contacted at the numbers below. • The Sacramento Fish and Wildlife Office of USFWS and CDFW shall be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during project-related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information. The USFWS contact is the Chief of the Division of Endangered Species, at the addresses and telephone numbers below. The CDFW contact is Mr. Paul Hofmann at 1701 Nimbus Road, Suite A, Rancho Cordova, California 95670, (530) 934-9309. • All sightings of the San Joaquin kit fox shall be reported to the CNDDB. A copy of the reporting form and a topographic map clearly marked with the location of where the kit fox was observed shall also be provided to the service at the address below. • <u>If Burrowing owl are found to occupy the Project site and avoidance is not possible, burrow exclusion may be</u>	

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	conducted by qualified biologists only during non-breeding season, before breeding behavior is exhibited, and after the burrow is confirmed empty through non-invasive methods (surveillance). Replacement or occupied burrows shall consist of artificial burrows at a ratio of 1 burrow collapsed to 1 artificial burrow constructed (1:1). Ongoing surveillance of the Project site during construction activities shall occur at a rate sufficient to detect Burrowing owl, if they return. Any project-related information required by the USFWS or questions concerning the above conditions or their implementation may be directed in writing to the U.S. Fish and Wildlife Service at: Endangered Species Division 2800 Cottage Way, Suite W2605 Sacramento, California 95825-1846 (916) 414-6620 or (916) 414-6600 **MM BIO-5:** Any person desiring to destroy or remove a heritage tree on private or public property must first obtain a removal permit by applying in writing to the Director of Community Services for such a permit. Within seven days of receipt of the application, the Director shall inspect the premises whereon the heritage trees are located and shall issue an intended decision in writing as to whether or not the application will be approved, with or without conditions; provided, however, that failure to render an intended decision within such period shall not be deemed	

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Would the Project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	approval. The intended decision of the Director shall be based upon reasonable standards, including, but not limited to, the following: • The condition of the heritage tree with respect to its general health, status as a public nuisance, danger of falling, proximity to existing or proposed structures, interference with utility services and its status as host for plant, pest or disease endangering other species of trees or plants with infection or infestations; • The necessity of the requested action to allow construction of improvements or otherwise allow economic or other reasonable enjoyment of property; • The topography of the land and the effect of the requested action on soil retention, water retention and diversion or increased flow of surface waters; • The number, species, size and location of existing trees in the area and the effect of the requested action on shade areas, air pollution, historic values, scenic beauty and the general welfare of the city as a whole; and/or • Good forestry practices such as, but not limited to, the number of healthy trees the subject parcel of land will support. In the intended decision on an application for a permit, the Director may attach reasonable conditions to insure compliance with the stated purposes of this section, such as, but not limited to, a condition requiring up to two replacement trees from 15-gallon containers or larger, in a suitable location as substitutes for the removed tree or	

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	trees, at the sole expense of the applicant. Any such intended decision shall include a statement for the reasons for the decision. Where feasible, all existing trees shall be preserved on-site. When not feasible, any tree removed shall be replaced with an appropriate native tree species planting at a ratio of 3:1 at or near the Project area or in another area that will be protected in perpetuity.	

Page 3.2-8 – Agricultural and Forestry Resources

MM AFR-1: Prior to issuance of a grading or building permit, whichever occurs first, the Project proponent shall provide written evidence of completion of one or more of the following measures, consistent with Tulare General Plan Policy COS-P3.12 to mitigate the loss of agricultural land at a ratio of 1:1 for net acreage before conversion. (The net acreage calculation shall exclude existing roads and areas already developed with structures, and a site plan shall be submitted to substantiate the net acreage calculation, along with written evidence of compliance.)

- Funding and/or purchasing agricultural conservation easements (to be managed and maintained by an appropriate entity).
- Purchasing credits from an established agricultural farmland mitigation bank.
- Contributing agricultural land or equivalent funding to an organization that provides for the preservation of farmland in California.
- Participating in any agricultural land mitigation program adopted by Tulare County that provides equal or more effective mitigation than the measures listed above.

Mitigation land shall meet the definition of Prime Farmland and be of similar agricultural quality or higher, as established by the DOC. If mitigation land is also suitable for Swainson's hawk foraging habitat, this land shall satisfy the compensation requirements of MM BIO-1. Completion of the selected measure or, with the City of Tulare Community Development Department Director's approval, a combination of selected mitigation measures can occur on qualifying land within the southern San Joaquin Valley (Kings, Tulare, or Kern County) that is located outside of a city's UDB.

Page 3.4-15 – Biological Resources

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If Swainson's hawks are found to nest within the survey area, during the nesting period, active Swainson's hawk nests shall be avoided by 0.5 miles unless this avoidance buffer is reduced through consultation with the CDFW and/or USFWS. If a construction area falls within this nesting site, construction must be delayed until the young have fledged (left the nest). The 2,500-foot radius no construction zone may be reduced in size. A qualified biologist must conduct construction monitoring on a daily basis, inspect the nest on a daily basis, and ensure that construction activities do not disrupt breeding behaviors. In no case shall the no construction zone be reduced to less than 500 feet.

If Swainson's Hawk nests are identified during surveys, compensation lands at the following ratios shall be provided:

- For project development within 1-mile of an active nest tree, a minimum of one acre of habitat management (HM) land for each acre of development.
- For project development within 5-miles of an active nest tree, but greater than 1-mile, a minimum of 0.75-acres of HM land for each acre of development.
- For project development within 10-miles of an active nest tree, a minimum of 0.5-acres of HM land for each acre of development.

If Swainson's Hawk are detected and the proposed 0.5-mile no-disturbance nest buffer is not feasible, consultation with CDFW is warranted to determine if the project can avoid take. If Swainson's Hawk take cannot be avoided, acquisition of an Incidental Take Permit (ITP), pursuant to Fish and Game Code Section 2081(b) prior to vegetation- or ground-disturbing activities may be necessary to comply with CESA.

Pages 3.4-16 and 3.4-17 – Biological Resources

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The measures that are listed below have been excerpted from those guidelines and would protect San Joaquin kit foxes, Burrowing owls, and American badgers from direct mortality and from destruction of active burrows/dens and natal or pupping dens. The Lead Agency or designee shall determine the applicability of the following measures depending on specific construction activities and shall implement such measures when required.

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Potential Den	50-foot radius
Known Den	100-foot radius
Natal/Pupping Den (Occupied and Unoccupied)	Contact U.S. Fish and Wildlife Service for guidance
Atypical Den	50-foot radius

In addition, impacts to occupied burrows shall be avoided in accordance with the following table unless a qualified biologist approved by CDFW verifies through non-invasive methods that either: 1) the birds have not begun egg laying and incubation; or 2) that juveniles from the occupied burrows are foraging independently and are capable of independent survival.

Location	Time of Year	Level of Disturbance		
		Low	Med	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
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*meters (m)

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- To prevent inadvertent entrapment of kit foxes or other animals during the construction phase of a project, all excavated, steep-walled holes or trenches more than two-feet deep shall be covered at the close of each working day by plywood or similar materials. If the trenches cannot be closed, one or more escape ramps constructed of earthen-fill or wooden planks shall be installed. Before such holes or trenches are filled, they shall be thoroughly inspected for trapped animals. If at any

time a trapped or injured kit fox is discovered, the USFWS and the CDFW shall be contacted at the addresses provided below.

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- Use of firearms on the site shall adhere to USFWS protocols.
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- An employee education program shall be conducted. The program shall consist of a brief presentation by persons knowledgeable in San Joaquin kit fox biology and legislative protection to explain endangered species concerns to contractors, their employees, and military and/or agency personnel involved in the project. The program shall include the following: A description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; an explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information shall be prepared for distribution to the previously referenced people and anyone else who may enter the project site.
- Upon completion of the project, all areas subject to temporary ground disturbances, including storage and staging areas, temporary roads, pipeline corridors, etc. shall be re-contoured if necessary, and revegetated to promote restoration of the area to pre-project conditions. An area subject to "temporary" disturbance means any area that is disturbed during the project, but after project completion will not be subject to

further disturbance and has the potential to be revegetated. Appropriate methods and plant species used to revegetate such areas shall be determined on a site-specific basis in consultation with the USFWS, CDFW, and revegetation experts.

- In the case of trapped animals, escape ramps or structures shall be installed immediately to allow the animal(s) to escape, or the USFWS shall be contacted for guidance.
- Any contractor, employee, or military or agency personnel who are responsible for inadvertently killing or injuring a San Joaquin kit fox shall immediately report the incident to their representative. This representative shall contact the CDFW immediately in the case of a dead, injured or entrapped kit fox. The CDFW contact for immediate assistance is State Dispatch at (916) 445-0045. They will contact the local warden or Mr. Paul Hofmann, the wildlife biologist, at (530) 934-9309. The USFWS shall be contacted at the numbers below.
- The Sacramento Fish and Wildlife Office of USFWS and CDFW shall be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during project-related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information. The USFWS contact is the Chief of the Division of Endangered Species, at the addresses and telephone numbers below. The CDFW contact is Mr. Paul Hofmann at 1701 Nimbus Road, Suite A, Rancho Cordova, California 95670, (530) 934-9309.
- All sightings of the San Joaquin kit fox shall be reported to the CNDDB. A copy of the reporting form and a topographic map clearly marked with the location of where the kit fox was observed shall also be provided to the service at the address below.
- <u>If Burrowing owl are found to occupy the Project site and avoidance is not possible, burrow exclusion may be conducted by qualified biologists only during non-breeding season, before breeding behavior is exhibited, and after the burrow is confirmed empty through non-invasive methods (surveillance). Replacement or occupied burrows shall consist of artificial burrows at a ratio of 1 burrow collapsed to 1 artificial burrow constructed (1:1). Ongoing surveillance of the Project site during construction activities shall occur at a rate sufficient to detect Burrowing owl, if they return.</u>

Any project-related information required by the USFWS or questions concerning the above conditions or their implementation may be directed in writing to the U.S. Fish and Wildlife Service at:
Endangered Species Division
2800 Cottage Way, Suite W2605
Sacramento, California 95825-1846
(916) 414-6620 or (916) 414-6600

EFFECTIVENESS OF MITIGATION

Implementation of Mitigation Measure MM BIO-3 would reduce potential impacts to the San Joaquin kit fox<u>, Burrowing owl,</u> and American badger to a level that is ***less than significant.***

Pages 3.4-21 and 3.4-22 – Biological Resources

MM BIO-5: Any person desiring to destroy or remove a heritage tree on private or public property must first obtain a removal permit by applying in writing to the Director of Community Services for such a permit. Within seven days of receipt of the application, the Director shall inspect the premises whereon the heritage trees are located and shall issue an intended decision in writing as to whether or not the application will be approved, with or without conditions; provided, however, that failure to render an intended decision within such period shall not be deemed approval. The intended decision of the Director shall be based upon reasonable standards, including, but not limited to, the following:

- The condition of the heritage tree with respect to its general health, status as a public nuisance, danger of falling, proximity to existing or proposed structures, interference with utility services and its status as host for plant, pest or disease endangering other species of trees or plants with infection or infestations;
- The necessity of the requested action to allow construction of improvements or otherwise allow economic or other reasonable enjoyment of property;
- The topography of the land and the effect of the requested action on soil retention, water retention and diversion or increased flow of surface waters;
- The number, species, size and location of existing trees in the area and the effect of the requested action on shade areas, air pollution, historic values, scenic beauty and the general welfare of the city as a whole; and/or
- Good forestry practices such as, but not limited to, the number of healthy trees the subject parcel of land will support. In the intended decision on an application for a permit, the Director may attach reasonable conditions to insure compliance with the stated purposes of this section, such as, but not limited to, a condition requiring up to two replacement trees from 15-gallon containers or larger, in a suitable location as substitutes for the removed tree or trees, at the sole expense of the applicant. Any such intended decision shall include a statement for the reasons for the decision.

Where feasible, all existing trees shall be preserved on-site. When not feasible, any tree removed shall be replaced with an appropriate native tree species planting at a ratio of 3:1 at or near the Project area or in another area that will be protected in perpetuity.

9.3 - Response to Comments

9.3.1 - INTRODUCTION

The comment letters received on the Draft EIR are addressed in their entirety in this section. Each comment contained in the letter has been assigned a reference code. The responses to the reference code comments follow each letter. Each comment letter has been given its own number.

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Central Region
1234 East Shaw Avenue
Fresno, California 93710
(559) 243-4005
www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

July 25, 2019

Mario Anaya, Principal Planner
City of Tulare
411 East Kern Street
Tulare, California 93274
manaya@tulare.ca.gov

Subject: Cartmill Crossings (Project),
DRAFT ENVIRONMENTAL IMPACT REPORT (DEIR)
SCH No.: 2018111038

Dear Mr. Anaya:

The California Department of Fish and Wildlife (CDFW) received a DEIR from the City of Tulare for the above-referenced Project pursuant to the California Environmental Quality Act (CEQA) and CEQA Guidelines.[1]

Thank you for the opportunity to provide comments and recommendations regarding those activities involved in the Project that may affect California fish and wildlife. Likewise, we appreciate the opportunity to provide comments regarding those aspects of the Project that CDFW, by law, may be required to carry out or approve through exercise of its own regulatory authority under the Fish and Game Code.

CDFW ROLE

CDFW is California's **Trustee Agency** for fish and wildlife resources and holds those resources in trust by statute for all the people of the State (Fish & G. Code, §§ 711.7, subd. (a) & 1802; Pub. Resources Code, § 21070; CEQA Guidelines § 15386, subd. (a)). CDFW, in its trustee capacity, has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (*Id.*, § 1802). Similarly, for purposes of CEQA, CDFW is charged by law to provide, as available, biological expertise during public agency environmental review efforts, focusing specifically on projects and related

1-A

[1] CEQA is codified in the California Public Resources Code in section 21000 et seq. The "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

activities that have the potential to adversely affect fish and wildlife resources. CDFW is also submitting comments as a **Responsible Agency** under CEQA (Pub. Resources Code, § 21069; CEQA Guidelines, § 15381). CDFW expects that it may need to exercise regulatory authority as provided by the Fish and Game Code. As proposed, for example, construction associated with the Project may be subject to CDFW's Lake and Streambed Alteration regulatory authority (Fish & G. Code, § 1600 *et seq.*). Likewise, to the extent implementation of the Project as proposed may result in "take" as defined by State law of any species protected under the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 *et seq.*), related authorization as provided by the Fish and Game Code will be required.

Nesting Birds: CDFW has jurisdiction over actions with potential to result in the disturbance or destruction of active nest sites or the unauthorized take of birds. Fish and Game Code sections that protect birds, their eggs and nests include, sections 3503 (regarding unlawful take, possession or needless destruction of the nest or eggs of any bird), 3503.5 (regarding the take, possession or destruction of any birds-of-prey or their nests or eggs), and 3513 (regarding unlawful take of any migratory nongame bird).

1-A
(cont.)

PROJECT DESCRIPTION SUMMARY

Proponent: West Coast Construction

Objective: The proposed Project is the construction of a multi-use commercial and residential development. Approximately 68.6-acres of commercial businesses will be developed in accordance with the permitted uses of the C-3 zone district. Examples of permitted uses include restaurants, fast food restaurants, retail stores, hotels, and fuel stations. The northeastern portion of the Project site will consist of approximately 30-acres of low-density, single-family residential homes with lots no smaller than 6,000 square feet. West of the low-density residential development will be approximately 4.4-acres of medium-density residential development, which will likely consist of fourplex residences. Southeast of the medium-density area will be approximately 7.7-acres of high-density, multi-family development, which will likely consist of an apartment complex. Northeast of the multi-family development will be a 7-acre park.

Location: The Project site is in the northeast corner of the State Route 99 and Cartmill Avenue interchange immediately north and adjacent to the City of Tulare, California. Assessor's Parcel Nos. 149-230-010, -019, -020 and -021.

Timeframe: The Project will be developed in phases with Phase 1 consisting of 15-acres of regional commercial uses in the southeastern most corner of the Project site, as well as a retention basin to the north and is scheduled to be constructed from 2019-2022. Phase 2, expected to be developed between 2022 and 2028, will include the single-family

1-A (cont.)

residential homes and a park that will be integrated into the basin site. Phase 3, the multi-family component, is anticipated for development from 2028 to 2030. The rest of the regional commercial development, Phase 4, is projected to be completed by 2040.

COMMENTS AND RECOMMENDATIONS

CDFW offers the comments and recommendations below to assist the City of Tulare (City) in adequately identifying and/or mitigating the Project's significant, or potentially significant, direct and indirect impacts on fish and wildlife (biological) resources. Editorial comments or other suggestions may also be included to improve the document.

Environmental Setting and Related Impact

Currently, the DEIR indicates that the Project's impacts would be less than significant with the implementation of the mitigation measures described in the DEIR. CDFW acknowledges these mitigation measures but is concerned regarding adequacy of the measures for the State threatened Swainson's hawk (*Buteo swainsoni*). In addition, CDFW is concerned regarding potential impacts to the State species of special concern burrowing owl (*Athene cunicularia*).

1-B

COMMENT 1: Swainson's Hawk (SWHA)

SWHA are known to nest in the vicinity of the Project site (CDFW 2019). In addition, page 3.4-15 of the DEIR states that during the reconnaissance-level survey, three stick nests were observed in the Valley Oak trees present onsite and a single SWHA individual was observed flying over the Project site near one of the stick nests. The biological report included with the DEIR indicates that although none of the nests were currently occupied during the survey, one of the nests may have been active during the 2018 breeding season.

Without appropriate avoidance and minimization measures for SWHA, potential significant impacts associated with development of the Project include loss of nest trees, nest abandonment, reduced reproductive success, and reduced health and vigor of eggs and/or young.

Nest trees are a limited resource in the San Joaquin Valley. For this reason, and because SWHA exhibit high nest-site fidelity year after year, CDFW considers removal of known SWHA nest trees, even outside of the nesting season, a potentially significant impact under CEQA (CDFW 2016). In addition, because nest trees are a limited resource, disturbance to occupied nests has the potential to significantly impact annual recruitment of SWHA if nests are disturbed or abandoned as a result of construction activities.

In addition to the SWHA nesting surveys included in Mitigation Measure BIO-1, CDFW recommends that additional pre-construction surveys for active nests be conducted by a qualified biologist no more than 10-days prior to the start of construction if ground-disturbing activities take place during the normal bird breeding season (February 1 through September 15).

Furthermore, CDFW recommends that the removal of known raptor nest trees, even outside of the nesting season, be replaced with an appropriate native tree species planting at a ratio of 3:1 at or near the Project area or in another area that will be protected in perpetuity. This mitigation would offset the temporal impacts of nesting habitat loss.

1-B (cont.)

Because SWHA nests occur on the Project site, CDFW also recommends compensation for the loss of SWHA foraging habitat as described in CDFW's Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (DFG, 1994) to reduce impacts to foraging habitat to less than significant. The Staff Report recommends that mitigation for habitat loss occur within a minimum distance of 10-miles from known nest sites. CDFW has the following recommendations based on the Staff Report:

- For projects within 1-mile of an active nest tree, a minimum of one acre of habitat management (HM) land for each acre of development is advised.
- For projects within 5-miles of an active nest but greater than 1-mile, a minimum of 0.75-acres of HM land for each acre of development is advised.
- For projects within 10-miles of an active nest tree but greater than 5-miles from an active nest tree, a minimum of 0.5-acres of HM land for each acre of development is advised.

If SWHA are detected and the proposed 0.5-mile no-disturbance nest buffer is not feasible, consultation with CDFW is warranted to determine if the Project can avoid take. If SWHA take cannot be avoided, acquisition of an Incidental Take Permit (ITP), pursuant Fish and Game Code Section 2081(b) prior to vegetation- or ground-disturbing activities may be necessary to comply with CESA.

COMMENT 2: Burrowing Owl (BUOW)

The DEIR indicates that BUOW have the potential to occur on the Project site but does not consider Project impacts to the species or include mitigation measures. Potentially significant direct impacts associated with the Project's construction include burrow collapse, inadvertent entrapment, nest abandonment, reduced reproductive

1-C

success, reduction in health and vigor of eggs and/or young, and direct mortality of individuals.

BUOW rely on burrow habitat year-round for their survival and reproduction. Habitat loss and degradation are considered the greatest threats to BUOW in California's Central Valley (Gervais et al. 2008). The Project area is within the range of BUOW and suitable burrow habitat is present on or in the vicinity of the Project area. Therefore, the Project has the potential to significantly impact local BUOW populations.

To evaluate potential Project-related impacts to BUOW, CDFW recommends conducting the following evaluation of the Project site and including the following measures in the Project's EIR.

Recommended Mitigation Measure 1: BUOW Surveys

CDFW recommends assessing presence/absence of BUOW by having a qualified biologist conduct surveys following the California Burrowing Owl Consortium's (CBOC) "*Burrowing Owl Survey Protocol and Mitigation Guidelines*" (CBOC 1993) and CDFW's *Staff Report on Burrowing Owl Mitigation*" (CDFG 2012). In addition, CDFW advises that surveys include a 500-foot buffer around the Project area.

1-C
(cont.)

Recommended Mitigation Measure 2: BUOW Avoidance

CDFW recommends no-disturbance buffers, as outlined in the "*Staff Report on Burrowing Owl Mitigation*" (CDFG 2012), be implemented prior to and during any ground-disturbing activities associated with Project implementation. Specifically, CDFW's Staff Report recommends that impacts to occupied burrows be avoided in accordance with the following table unless a qualified biologist approved by CDFW verifies through non-invasive methods that either: 1) the birds have not begun egg laying and incubation; or 2) that juveniles from the occupied burrows are foraging independently and are capable of independent survival.

Location	Time of Year	Level of Disturbance		
		Low	Med	High
Nesting sites	April 1-Aug 15	200 m*	500 m	500 m
Nesting sites	Aug 16-Oct 15	200 m	200 m	500 m
Nesting sites	Oct 16-Mar 31	50 m	100 m	500 m

* meters (m)

Recommended Mitigation Measure 3: BUOW Passive Relocation and Mitigation

If BUOW are found to occupy the Project site and avoidance is not possible, it is important to note that according to the Staff Report (CDFG 2012), exclusion is not a minimization or mitigation method and is considered a potentially significant impact under CEQA. However, if necessary, CDFW recommends that burrow exclusion be conducted by qualified biologists and only during the non-breeding season, before breeding behavior is exhibited and after the burrow is confirmed empty through non-invasive methods, such as surveillance. CDFW recommends replacement of occupied burrows with artificial burrows at a ratio of 1 burrow collapsed to 1 artificial burrow constructed (1:1) as mitigation for the potentially significant impact of evicting BUOW. BUOW may attempt to colonize or re-colonize an area that will be impacted; thus, CDFW recommends ongoing surveillance of the Project site during Project activities, at a rate that is sufficient to detect BUOW if they return.

1-C (cont.)

ENVIRONMENTAL DATA

CEQA requires that information developed in environmental impact reports and negative declarations be incorporated into a database that may be used to make subsequent or supplemental environmental determinations (Pub. Resources Code, § 21003, subd. (e)). Accordingly, please report any special status species and natural communities detected during Project surveys to the California Natural Diversity Database (CNDDB). The CNDDB field survey form can be found at the following link: https://www.wildlife.ca.gov/Data/CNDDB/Submitting-Data. The completed form can be emailed to CNDDB at the following email address: CNDDB@wildlife.ca.gov. The types of information reported to CNDDB can be found at the following link: https://www.wildlife.ca.gov/Data/CNDDB/Plants-and-Animals.

FILING FEES

1-D

The Project, as proposed, has the potential to impact fish and/or wildlife, and assessment of filing fees may be necessary. Fees are payable upon filing of the Notice of Determination by the Lead Agency and serve to help defray the cost of environmental review by CDFW. Payment of the fee is required in order for the underlying project approval to be operative, vested, and final (Cal. Code Regs, tit. 14, § 753.5; Fish & G. Code, § 711.4; Pub. Resources Code, § 21089).

CONCLUSION

CDFW appreciates the opportunity to comment on the DEIR to assist the City of Tulare in identifying and mitigating subsequent project's impacts on biological resources. Questions regarding this letter or further coordination should be directed to Jennifer

Giannetta, Environmental Scientist, at the address provided on this letterhead, by telephone at (559) 243-4014 extension 216, or by email at Jennifer.Giannetta@wildlife.ca.gov.

1-D
(cont.)

Sincerely,

Julie A. Vance
Regional Manager

REFERENCES

California Burrowing Owl Consortium (CBOC), 1993. Burrowing owl survey protocol and mitigation guidelines. Pages 171-177 *in* Lincer, J. L. and K. Steenhof (editors). 1993. The burrowing owl, its biology and management. Raptor Research Report Number 9.

California Department of Fish and Game (CDFG), 1994. Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (*Buteo Swainsoni*) in the Central Valley of California. California Department of Fish and Game.

CDFG, 2012. Staff Report on Burrowing Owl Mitigation. California Department of Fish and Game. March 7, 2012.

California Department of Fish and Wildlife (CDFW), 2016. Status Review: Swainson's hawk (*Buteo swainsoni*) in California. Reported to California Fish and Game Commission. Five year status report.

CDFW, 2019. Biogeographic Information and Observation System (BIOS). https://www.wildlife.ca.gov/Data/BIOS. Accessed July 15, 2019.

STATE AGENCIES

COMMENT LETTER 1: CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE (JULY 25, 2019)

1-A Thank you for your comment. The California Department of Fish and Wildlife's (CDFW) participation in and assistance with the public review of this document is appreciated.

The comments have been noted for the record and have been provided to the City of Tulare Planning Commission and City Council for consideration.

1-B Thank you for your comment. The description of MM BIO-1 has been modified to include a pre-construction survey for Swainson's Hawk to be conducted no more than 10 days prior to the start of construction, if ground-disturbing activities take place during the normal bird breeding season (February 1 through September 15). Additionally, language was added to MM BIO-1 that establishes ratios for the establishment of compensation lands in the event Swainson's Hawk nests are identified during biological surveys.

1-C Thank you for your comment. The description of MM BIO-3 has been modified to include a pre-construction survey for Burrowing owl to be conducted no fewer than 14 days and no more than 30 days prior to the start of ground-disturbing activities. Additionally, language was modified to MM BIO-3 that outlines the radius of exclusion zones in the event of the discovery of Burrowing Owl active burrows. Finally, MM BIO-3 was modified to include instructions in the event that burrows are identified on the Project site and avoidance is not possible.

1-D Thank you for your comment. The Project proponent shall provide a completed field survey form to the CNDDB during project surveys and also pay the filing fees to be filed with the project's Notice of Determination.

DEPARTMENT OF TRANSPORTATION
DISTRICT 6
1352 WEST OLIVE AVENUE
P.O. BOX 12616
FRESNO, CA 93778-2616
PHONE (559) 488-7396
FAX (559) 488-4088
TTY 711
www.dot.ca.gov

Making Conservation a California Way of Life.

July 29, 2019

06-TUL-99-32.36
DEIR - CARTMILL CROSSINGS
SCH # 2018111038

Mr. Mario Anaya, Principal Planner
City of Tulare - Community & Economic Development Dept.
411 E. Tulare Street
Tulare, CA 93274

Dear Mr. Anaya:

Thank you for the opportunity to review the Draft Environmental Impact Report (DEIR) for the Cartmill Crossings multi-use development (Project). The proposed 120-acre project site is located in the northeast quadrant of the State Route (SR) 99/Cartmill Avenue interchange.

The Project includes an Annexation, a General Plan Amendment, and a Pre-Zoning to allow a commercial shopping center with multi-family and single-family residential developments. Examples of uses include restaurants, fast food restaurants, retail stores, hotels, and fuel stations. The northeastern portion of the Project site will consist of approximately 30 acres for a low density single-family residential development, approximately 4.4 acres for a medium density residential development, approximately 7.7 acres for a high-density multi-family development and will include a 7-acre park.

The Project will be developed in phases. Phase 1 will include 176,000 square feet of regional commercial uses with an estimated construction timeline from 2019 to 2020. Phase 2 will include 132 single-family residential homes with an estimated construction between 2022 and 2025 which also includes a multi-family component that is anticipated for construction in 2028. Phase 3 will include the remainder of the Regional Commercial development (approximately 630,400 square feet) and is projected to be completed by 2039.

The mission of Caltrans is to provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability. Caltrans provides the *following comments* consistent with the State's smart mobility goals that support a vibrant economy and sustainable communities:

1. The DEIR included a Traffic Impact Study (TIS) that analyzed traffic impacts associated with the Project. Caltrans *cannot* complete review of the TIS because the Highway Capacity Software (HCS) worksheets for the freeway ramp analysis were not included. Please *provide* the HCS worksheets for Caltrans review.

If you have any other questions, please call me at (559) 488-7396.

2-A

Sincerely,

DAVID DEEL
Associate Transportation Planner
Transportation Planning - North

COMMENT LETTER 2: CALIFORNIA DEPARTMENT OF TRANSPORTATION, DISTRICT 6 (JULY 29, 2019)

2-A Thank you for your comments. The participation of the California Department of Transportation (Caltrans) in the public review of this document is appreciated. Attachment A of this Chapter includes the HCS worksheets. The Traffic Impact Study, as included in the Draft EIR (Appendix G), analyzed freeway ramps in accordance with Caltrans standards.

ATTACHMENT A

Highway Capacity Software (HCS) worksheets

Freeway Segment Analysis

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Cartmill Ave/Ave 264
Jurisdiction: Tulare County
Analysis Year: 2018
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	5151	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1400	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1414	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1414	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	69.5	mi/h
Number of lanes, N	4	
Density, D	20.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Cartmill Ave/Ave 264
Jurisdiction: Tulare County
Analysis Year: 2020
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	5415	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1471	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1486	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1486	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	69.1	mi/h
Number of lanes, N	4	
Density, D	21.5	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Cartmill Ave/Ave 264
Jurisdiction: Tulare County
Analysis Year: 2020+Project
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	5443	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1479	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1494	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1494	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	69.0	mi/h
Number of lanes, N	4	
Density, D	21.7	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Cartmill Ave/Ave 264
Jurisdiction: Tulare County
Analysis Year: 2029
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	6780	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1842	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1241	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	6	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1241	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	17.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Cartmill Ave/Ave 264
Jurisdiction: Tulare County
Analysis Year: 2029+Project
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	6865	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1865	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1256	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	6	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1256	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	18.0-	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Cartmill Ave/Ave 264
Jurisdiction: Tulare County
Analysis Year: 2039
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	8705	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	2365	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1593	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	6	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1593	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	68.2	mi/h
Number of lanes, N	6	
Density, D	23.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Cartmill Ave/Ave 264
Jurisdiction: Tulare County
Analysis Year: 2039+Project
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	8790	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	2389	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1608	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	6	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1608	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	68.1	mi/h
Number of lanes, N	6	
Density, D	23.6	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Prosperity Ave/Cartmill Ave
Jurisdiction: Tulare County
Analysis Year: 2018
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	5099	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1386	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1399	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1399	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	69.5	mi/h
Number of lanes, N	4	
Density, D	20.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Prosperity Ave/Cartmill Ave
Jurisdiction: Tulare County
Analysis Year: 2020]
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	5360	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1457	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1471	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1471	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	69.1	mi/h
Number of lanes, N	4	
Density, D	21.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Prosperity Ave/Cartmill Ave
Jurisdiction: Tulare County
Analysis Year:
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	5471	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1487	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1502	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1502	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	68.9	mi/h
Number of lanes, N	4	
Density, D	21.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Prosperity Ave/Cartmill Ave
Jurisdiction: Tulare County
Analysis Year: 2029
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	6712	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	1824	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1228	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	6	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1228	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	17.5	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Prosperity Ave/Cartmill Ave
Jurisdiction: Tulare County
Analysis Year:
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	8617	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	2342	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1577	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	6	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1577	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	68.4	mi/h
Number of lanes, N	6	
Density, D	23.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Basic Freeway Segments Release 6.65

Phone: Fax:
E-mail:

Operational Analysis

Analyst: Shalisha Hodson
Agency or Company: R&S Civil
Date Performed: 10/26/2018
Analysis Time Period: Peak Hour
Freeway/Direction: SR 99
From/To: Prosperity Ave/Cartmill Ave
Jurisdiction: Tulare County
Analysis Year:
Description: Cartmill Ave

Flow Inputs and Adjustments

Volume, V	8961	veh/h
Peak-hour factor, PHF	0.92	
Peak 15-min volume, v15	2435	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Level	
Grade	-	%
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.990	
Driver population factor, fp	1.00	
Flow rate, vp	1640	pc/h/ln

Speed Inputs and Adjustments

Lane width	-	ft
Right-side lateral clearance	-	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	6	

Free-flow speed:	Measured	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	70.0	mi/h

LOS and Performance Measures

Flow rate, vp	1640	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	67.8	mi/h
Number of lanes, N	6	
Density, D	24.2	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year:
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2556	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	230	vph
Length of first accel/decel lane	580	ft
Length of second accel/decel lane	580	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2556	230		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	695	62		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	2778	250		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2778 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2778	4800	No
$v_{FO} = v_F - v_R$	2528	4800	No
v_R	250	4000	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12} = 2778 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2778	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 12.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.451

Space mean speed in ramp influence area, S_R = 57.4 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 57.4 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period: 2018
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave
Jurisdiction: Tulare County
Analysis Year:
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2556	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	158	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2556	158		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	695	43		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3112	192		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{12}(P_{FM}) =$ 3112 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3304	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3112 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3304 4600 No
R12

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A = 13.6$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $M_S = 0.231$

Space mean speed in ramp influence area, $S_R = 63.5$ mph

Space mean speed in outer lanes, $S_0 = N/A$ mph

Space mean speed for all vehicles, $S = 63.5$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year:
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2549	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	97	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	1450	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2549	97		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	693	26		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Grade	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	2771	105		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2771 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2771	4800	No
$v_{FO} = v_F - v_R$	2666	4800	No
v_R	105	4000	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_3 = 2771 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2771	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D = -11.1$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $D_S = 0.437$

Space mean speed in ramp influence area, $S_R = 57.8$ mph

Space mean speed in outer lanes, $S_0 = N/A$ mph

Space mean speed for all vehicles, $S = 57.8$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period: 2018
Freeway/Dir of Travel: SR 99
Junction: NB Cartmill Ave On Ramp
Jurisdiction: Tulare County
Analysis Year:
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2556	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	79	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2556	79		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	695	21		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3112	96		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{12A}(P_{FM})$ = 3112 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3208	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3112 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3208 4600 No
R12

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 21.7 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.319
S

Space mean speed in ramp influence area, S = 61.1 mph
R

Space mean speed in outer lanes, S = N/A mph
0

Space mean speed for all vehicles, S = 61.1 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period: 2018
Freeway/Dir of Travel: SR 99
Junction: W Cartmill Ave NB On Ramp
Jurisdiction: Tulare County
Analysis Year:
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2556	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	131	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2556	131		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	695	36		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3112	159		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{12A}(P_{FM}) =$ 3112 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3271	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3112 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3271 4600 No
R12

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 26.8 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.378
S

Space mean speed in ramp influence area, S = 59.4 mph
R

Space mean speed in outer lanes, S = N/A mph
0

Space mean speed for all vehicles, S = 59.4 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/25/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Oakdale Ave
Jurisdiction: Tulare County
Analysis Year: 2018
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2576	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	7	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2576	7		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	700	2		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3136	9		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{12}(P_{FM})$ = 3136 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3145	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3136 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3145 4600 No
R12

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 26.6 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.373
S

Space mean speed in ramp influence area, S = 59.6 mph
R

Space mean speed in outer lanes, S = N/A mph
0

Space mean speed for all vehicles, S = 59.6 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2020
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2667	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	240	vph
Length of first accel/decel lane	580	ft
Length of second accel/decel lane	580	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2667	240		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	725	65		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	2899	261		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2899 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2899	4800	No
$v_{FO} = v_F - v_R$	2638	4800	No
v_R	261	4000	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_3 = 2899 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2899	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 13.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.451

Space mean speed in ramp influence area, S_R = 57.4 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 57.4 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave
Jurisdiction: Tulare County
Analysis Year: 2020
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2680	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	166	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2680	166		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	728	45		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3263	202		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{12}(P_{FM}) = 3263$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3465	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3263 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3465 4600 No
R12

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 14.9 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M = 0.250
S

Space mean speed in ramp influence area, S = 63.0 mph
R

Space mean speed in outer lanes, S = N/A mph
0

Space mean speed for all vehicles, S = 63.0 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2020
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2680	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	102	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	1450	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2680	102		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	728	28		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Grade	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	2913	111		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2913 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	2913	4800	No
$v_{FO} = v_F - v_R$	2802	4800	No
v_R	111	4000	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_3 = 2913 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2913	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D = -9.8$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $D_S = 0.438$

Space mean speed in ramp influence area, $S_R = 57.7$ mph

Space mean speed in outer lanes, $S_0 = N/A$ mph

Space mean speed for all vehicles, $S = 57.7$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: NB Cartmill Ave On Ramp
Jurisdiction: Tulare County
Analysis Year: 2020
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2667	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	82	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2667	82		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	725	22		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3247	100		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{F} (P_{FM}) =$ 3247 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3347	4800	No

v_{3} or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_{3} or v_{av34} > 2700 pc/h? No

Is v_{3} or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3247 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3347 4600 No
R12

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 22.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.334

Space mean speed in ramp influence area, S_R = 60.7 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 60.7 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: W Cartmill Ave NB On Ramp
Jurisdiction: Tulare County
Analysis Year: 2020
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2667	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	137	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2667	137		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	725	37		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3247	167		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 3247 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3414	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3247 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3414 4600 No
R12

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 28.0- pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.394

Space mean speed in ramp influence area, S_R = 59.0 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 59.0 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/25/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Oakdale Ave
Jurisdiction: Tulare County
Analysis Year: 2020
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2708	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	7	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2708	7		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	736	2		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3297	9		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{12}(P_{FM}) =$ 3297 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3306	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3297 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3306 4600 No
R12

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 27.8 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.389
S

Space mean speed in ramp influence area, S = 59.1 mph
R

Space mean speed in outer lanes, S = N/A mph
0

Space mean speed for all vehicles, S = 59.1 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2020+Project
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2818	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	391	vph
Length of first accel/decel lane	580	ft
Length of second accel/decel lane	580	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2818	391		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	766	106		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3063	425		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3063 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3063	4800	No
$v_{FO} = v_F - v_R$	2638	4800	No
v_R	425	4000	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_3 = 3063 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3063	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 14.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.466

Space mean speed in ramp influence area, S_R = 56.9 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 56.9 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave
Jurisdiction: Tulare County
Analysis Year: 2020+Project
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2791	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	277	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2791	277		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	758	75		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3398	337		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{12}(P_{FM}) = 3398$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3735	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3398 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3735 4600 No
R12

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A = 16.9$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $M_S = 0.288$

Space mean speed in ramp influence area, $S_R = 61.9$ mph

Space mean speed in outer lanes, $S_0 = N/A$ mph

Space mean speed for all vehicles, $S = 61.9$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2020+Project
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2787	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	209	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	1450	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2787	209		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	757	57		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Grade	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3029	227		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 Using Equation 0

$v_{12} = v_R + (v - v_F) P_{FD}$ = 3029 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3029	4800	No
$v_{FO} = v - v_R$	2802	4800	No
v_R	227	4000	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_3 = 3029 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v 12	3029	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D = -8.8$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $D_S = 0.448$

Space mean speed in ramp influence area, $S_R = 57.4$ mph

Space mean speed in outer lanes, $S_0 = N/A$ mph

Space mean speed for all vehicles, $S = 57.4$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: NB Cartmill Ave On Ramp
Jurisdiction: Tulare County
Analysis Year: 2020+Project
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2807	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	222	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2807	222		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	763	60		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3417	270		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{F}(P_{FM})$ = 3417 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3687	4800	No

v_{3} or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_{3} or v_{av34} > 2700 pc/h? No

Is v_{3} or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3417 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3687 4600 No
R12

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 25.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.379

Space mean speed in ramp influence area, S_R = 59.4 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 59.4 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: W Cartmill Ave NB On Ramp
Jurisdiction: Tulare County
Analysis Year: 2020+Project
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2667	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	137	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2667	137		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	725	37		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3247	167		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_F (P_{FM})$ = 3247 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3414	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3247 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3414 4600 No
R12

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 28.0- pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.394

Space mean speed in ramp influence area, S_R = 59.0 mph

Space mean speed in outer lanes, S_0 = N/A mph

Space mean speed for all vehicles, S = 59.0 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/25/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Oakdale Ave
Jurisdiction: Tulare County
Analysis Year: 2020+Project
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	2	
Free-flow speed on freeway	70.0	mph
Volume on freeway	2736	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	35	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2736	35		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	743	10		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3331	43		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 1.000 Using Equation 0

$v_{12} = v_{F} (P_{FM})$ = 3331 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3374	4800	No

v_3 or v_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 3331 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3374 4600 No
R12

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 28.3 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, M = 0.396
S

Space mean speed in ramp influence area, S = 58.9 mph
R

Space mean speed in outer lanes, S = N/A mph
0

Space mean speed for all vehicles, S = 58.9 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2029
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3226	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	290	vph
Length of first accel/decel lane	580	ft
Length of second accel/decel lane	580	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3226	290		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	877	79		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3507	315		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1751 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3507	7200	No
$v_{FO} = v_F - v_R$	3192	7200	No
v_R	315	4000	No

v_3 or v_{av34} 1756 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_3 = 2004 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2004	4400	No

12A

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 5.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.456

Space mean speed in ramp influence area, S_R = 57.2 mph

Space mean speed in outer lanes, S_0 = 74.8 mph

Space mean speed for all vehicles, S = 63.6 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave
Jurisdiction: Tulare County
Analysis Year: 2029
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3355	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	208	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3355	208		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	912	57		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4084	253		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 Using Equation 0

$v_{12} = v_{12}(P_{FM}) =$ 2267 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4337	7200	No

v_3 or v_{av34} 1817 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2333 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 2586 4600 No
12A

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{R12} - 0.00627 L_A = 8.0$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $M_S = 0.177$

Space mean speed in ramp influence area, $S_R = 65.1$ mph

Space mean speed in outer lanes, $S_0 = 65.5$ mph

Space mean speed for all vehicles, $S = 65.2$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2029
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3355	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	128	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	1450	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3355	128		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	912	35		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Grade	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3647	139		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1718 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3647	7200	No
$v_{FO} = v_F - v_R$	3508	7200	No
v_R	139	4000	No

v_3 or v_{av34} 1929 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_3 = 2084 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2084	4400	No

12A

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D = -17.0$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $D_S = 0.441$

Space mean speed in ramp influence area, $S_R = 57.7$ mph

Space mean speed in outer lanes, $S_0 = 74.6$ mph

Space mean speed for all vehicles, $S = 63.9$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: NB Cartmill Ave On Ramp
Jurisdiction: Tulare County
Analysis Year: 2029
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3226	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	100	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3226	100		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	877	27		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3927	122		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.617 Using Equation 3

$v_{12} = v_{12}(P_{FM}) =$ 2422 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4049	7200	No

v_3 or v_{av34} 1505 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2422 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 2544 4600 No
12A

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 16.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.273

Space mean speed in ramp influence area, S_R = 62.4 mph

Space mean speed in outer lanes, S_0 = 66.4 mph

Space mean speed for all vehicles, S = 63.8 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: W Cartmill Ave NB On Ramp
Jurisdiction: Tulare County
Analysis Year: 2029
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3226	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	165	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3226	165		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	877	45		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3927	201		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.596 Using Equation 3

$v_{12} = v_{12}(P_{FM})$ = 2339 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4128	7200	No

v_3 or v_{av34} 1588 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2339 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 2540 4600 No
12A

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 21.1 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.325

Space mean speed in ramp influence area, S_R = 60.9 mph

Space mean speed in outer lanes, S_0 = 66.1 mph

Space mean speed for all vehicles, S = 62.8 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/25/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Oakdale Ave
Jurisdiction: Tulare County
Analysis Year: 2029
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3391	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	9	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3391	9		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	921	26		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4128	11		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.593 Using Equation 3

$v_{12} = v_{12}(P_{FM}) =$ 2447 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4139	7200	No

v_3 or v_{av34} 1681 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2447 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 2458 4600 No
12A

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 21.2 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.328
S

Space mean speed in ramp influence area, S = 60.8 mph
R

Space mean speed in outer lanes, S = 65.7 mph
0

Space mean speed for all vehicles, S = 62.7 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2029+Project
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3726	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	790	vph
Length of first accel/decel lane	580	ft
Length of second accel/decel lane	580	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3726	790		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1012	215		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4050	859		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 Using Equation 0

$v_{12} = v_R + (v - v_F) P_{FD}$ = 2295 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4050	7200	No
$v_{FO} = v - v_R$	3191	7200	No
v_R	859	4000	No

v_{3} or v_{av34} 1755 pc/h (Equation 13-14 or 13-17)

Is v_{3} or v_{av34} > 2700 pc/h? No

Is v_{3} or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{3} = 2314 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2314	4400	No

12A

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 8.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.505

Space mean speed in ramp influence area, S_R = 55.9 mph

Space mean speed in outer lanes, S_0 = 73.9 mph

Space mean speed for all vehicles, S = 62.4 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave
Jurisdiction: Tulare County
Analysis Year: 2029+Project
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3699	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	552	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3699	552		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1005	150		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4503	672		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 Using Equation 0

$v_{12} = v_{12}(P_{FM}) =$ 2499 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5175	7200	No

v_3 or v_{av34} 2004 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2573 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3245 4600 No
12A

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 12.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.225

Space mean speed in ramp influence area, S_R = 63.7 mph

Space mean speed in outer lanes, S_0 = 64.9 mph

Space mean speed for all vehicles, S = 64.1 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2029+Project
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3706	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	479	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	1450	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3706	479		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1007	130		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Grade	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4028	521		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2099 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4028	7200	No
$v_{FO} = v_F - v_R$	3507	7200	No
v_R	521	4000	No

v_3 or v_{av34} 1929 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_3 = 2301 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2301	4400	No

12A

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D = -15.1$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $D_S = 0.475$

Space mean speed in ramp influence area, $S_R = 56.7$ mph

Space mean speed in outer lanes, $S_0 = 74.0$ mph

Space mean speed for all vehicles, $S = 63.0$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: NB Cartmill Ave On Ramp
Jurisdiction: Tulare County
Analysis Year: 2029+Project
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3657	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	531	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3657	531		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	994	144		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4452	646		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.617 Using Equation 3

$v_{12} = v_{12}(P_{FM}) = 2746$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5098	7200	No

v_3 or v_{av34} 1706 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2746 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3392 4600 No
12A

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{R12} - 0.00627 L_A$ = 22.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.339

Space mean speed in ramp influence area, S_R = 60.5 mph

Space mean speed in outer lanes, S_0 = 65.7 mph

Space mean speed for all vehicles, S = 62.1 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: W Cartmill Ave NB On Ramp
Jurisdiction: Tulare County
Analysis Year: 2029+Project
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3226	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	165	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3226	165		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	877	45		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	3927	201		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.596 Using Equation 3

$v_{12} = v_{12}(P_{FM})$ = 2339 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4128	7200	No

v_3 or v_{av34} 1588 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2339 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 2540 4600 No
12A

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 21.1 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.325

Space mean speed in ramp influence area, S_R = 60.9 mph

Space mean speed in outer lanes, S_0 = 66.1 mph

Space mean speed for all vehicles, S = 62.8 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/25/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Oakdale Ave
Jurisdiction: Tulare County
Analysis Year: 2029+Project
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3476	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	94	vph
Length of first accel/decel lane	550	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3476	94		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	945	26		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4232	114		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.593 Using Equation 3

$v_{12} = v_{12}(P_{FM}) =$ 2509 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4346	7200	No

v_3 or v_{av34} 1723 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2509 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 2623 4600 No
12A

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 22.4 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.336
S

Space mean speed in ramp influence area, S = 60.6 mph
R

Space mean speed in outer lanes, S = 65.6 mph
0

Space mean speed for all vehicles, S = 62.5 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2039
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3987	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	359	vph
Length of first accel/decel lane	580	ft
Length of second accel/decel lane	580	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3987	359		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1083	98		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4334	390		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2165 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4334	7200	No
$v_{FO} = v_F - v_R$	3944	7200	No
v_R	390	4000	No

v_3 or v_{av34} 2169 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_3 = 2476 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2476	4400	No

12A

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 9.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.463

Space mean speed in ramp influence area, S_R = 57.0 mph

Space mean speed in outer lanes, S_0 = 73.4 mph

Space mean speed for all vehicles, S = 63.1 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period: 2018
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave
Jurisdiction: Tulare County
Analysis Year: 2039
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4308	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-flow speed on ramp	35.0	mph
Volume on ramp	267	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4308	267		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1171	73		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	5245	325		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 Using Equation 0

$v_{12} = v_{12}(P_{FM}) =$ 2911 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5570	7200	No

v_3 or v_{av34} 2334 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2997 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3322 4600 No
12A

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 13.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.233

Space mean speed in ramp influence area, S_R = 63.5 mph

Space mean speed in outer lanes, S_0 = 63.7 mph

Space mean speed for all vehicles, S = 63.6 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period:
Freeway/Dir of Travel: SR 99
Junction: Cartmill Ave SB Off Ramp
Jurisdiction: Tulare County
Analysis Year: 2039
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4308	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	164	vph
Length of first accel/decel lane	1450	ft
Length of second accel/decel lane	1450	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		

Distance to adjacent ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4308	164		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1171	45		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Grade	Level		
Grade	0.00 %	0.00 %		%
Length	0.00 mi	0.00 mi		mi
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	1.000	1.000		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4683	178		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.450 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2205 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4683	7200	No
$v_{FO} = v_F - v_R$	4505	7200	No
v_R	178	4000	No

v_3 or v_{av34} 2478 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_3 = 2676 (Equation 13-15, 13-16, 13-18, or 13-19)

12A

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2676	4400	No

12A

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D = -11.9$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, $D_S = 0.444$

Space mean speed in ramp influence area, $S_R = 57.6$ mph

Space mean speed in outer lanes, $S_0 = 72.9$ mph

Space mean speed for all vehicles, $S = 63.3$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period: 2018
Freeway/Dir of Travel: SR 99
Junction: NB Cartmill Ave On Ramp
Jurisdiction: Tulare County
Analysis Year: 2039
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3987	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	123	vph
Length of first accel/decel lane	1400	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3987	123		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1083	33		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4854	150		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.617 Using Equation 3

$v_{12} = v_{F} (P_{FM}) =$ 2993 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5004	7200	No

v_3 or v_{av34} 1861 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2993 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3143 4600 No
12A

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{R12} - 0.00627 L_A$ = 21.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.313

Space mean speed in ramp influence area, S_R = 61.2 mph

Space mean speed in outer lanes, S_0 = 65.1 mph

Space mean speed for all vehicles, S = 62.6 mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/16/2018
Analysis time period: 2018
Freeway/Dir of Travel: SR 99
Junction: W Cartmill Ave NB On Ramp
Jurisdiction: Tulare County
Analysis Year: 2039
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	3987	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	204	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3987	204		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1083	55		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	4854	248		pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.596 Using Equation 3

$v_{12} = v_{12}(P_{FM}) =$ 2892 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5102	7200	No

v_3 or v_{av34} 1962 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 2892 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3140 4600 No
12A

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{R12} - 0.00627 L_A = 25.8$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $M_S = 0.366$

Space mean speed in ramp influence area, $S_R = 59.8$ mph

Space mean speed in outer lanes, $S_0 = 64.7$ mph

Space mean speed for all vehicles, $S = 61.6$ mph

HCS 2010: Freeway Merge and Diverge Segments Release 6.65

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Shalisha Hodson
Agency/Co.: R&S Civil
Date performed: 10/25/2018
Analysis time period: 2018
Freeway/Dir of Travel: SR 99
Junction: Oakdale Ave
Jurisdiction: Tulare County
Analysis Year: 2039
Description: Cartmill Commercial & Residential

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	3	
Free-flow speed on freeway	70.0	mph
Volume on freeway	4353	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	12	vph
Length of first accel/decel lane	455	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		

Distance to adjacent Ramp ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4353	12		vph
Peak-hour factor, PHF	0.92	0.92		
Peak 15-min volume, v15	1183	3		v
Trucks and buses	24	24		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		
Heavy vehicle adjustment, fHV	0.893	0.893		
Driver population factor, fP	1.00	1.00		
Flow rate, vp	5299	15		pcph

Estimation of V12 Merge Areas

L = (Equation 13-6 or 13-7)
EQ

P = 0.590 Using Equation 3
FM

$v_{12} = v_{12}(P_{FM}) = 3128$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5314	7200	No

v_3 or v_{av34} 2171 pc/h (Equation 13-14 or 13-17)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 3128 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

Actual	Max Desirable	Violation?

v 3143 4600 No
12A

Level of Service Determination (if not F)

Density, D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 27.1 pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M = 0.380
S

Space mean speed in ramp influence area, S = 59.4 mph
R

Space mean speed in outer lanes, S = 64.0 mph
0

Space mean speed for all vehicles, S = 61.2 mph