State of California
DEPARTMENT OF TRANSPORTATION

California State Transportation Agency

Memorandum

Making Conservation
a California Way of Life

To: DEPUTY DISTRICT DIRECTORS, DESIGN **Date:** December 23, 2020

From: JANICE BENTON
Chief
Division of Design

Subject: **EVACUATION ROUTE DESIGN GUIDANCE- DESIGN INFORMATION BULLETIN 93**

Large wildfire events over the last few years have exhibited a need to coordinate with communities where a state highway may be one of or the only evacuation route for that community. It is recognized that the geometrics of the state highway can affect the ability to move large volumes of people and vehicles into and out of communities threatened by a wildfire. Therefore, the need for the state highway to serve in an emergency capacity should be considered when a project is being developed.

To address the need, evacuation route design guidance has been developed and specified in the new Design Information Bulletin 93 (DIB-93) - Evacuation Route Design Guidance (see attached document).

For any questions, please contact Antonette Clark, Chief, Office of Standards and Procedures, at <antonette.clark@dot.ca.gov>.

Project specific applicability and questions should be referred to the Division of Design, Project Delivery Coordinators or the District Design Liaisons.

Attachment: Design Information Bulletin 93 - Evacuation Route Design Guidance

c:

JASVINDERJIT BHULLAR, Chief, Division of Traffic Operations
RACHEL CARPENTER, Chief, Safety Programs
MARLON FLOURNOY, Chief, Division of Transportation Planning
DAVID AMBUEHL, Acting Chief, Division of Maintenance
PHILIP J. STOLARSKI, Chief, Division of Environmental Analysis
KIMBERLY ERICKSON, Chief, Division of Right of Way and Land Surveys
TOM OSTROM, Chief, Division of Engineering Services
RAMON HOPKINS, Chief, Division of Construction
PAUL CHUNG, Deputy Chief, Division of Design
MONICA KRESS-WOOSTER, Deputy Chief, Safety Programs
GUDMUND SETBERG, Deputy Chief, Division of Engineering Services
SRIKANTH BALASUBRAMANIAN, Deputy Chief, Division of Traffic Operations
SAID ISMAIL, Deputy Chief, Division of Traffic Operations
ANTONETTE CLARK, Chief, Office of Standards and Procedures, Division of Design
ROBERT EFFINGER, Project Delivery Coordinator, Division of Design

DESIGN INFORMATION BULLETIN NUMBER 93

California Department of Transportation
Division of Design

Evacuation Route Design Guidance

APPROVED BY:

JANICE BENTON
Chief, Division of Design

December 23, 2020

TABLE OF CONTENTS

1.0 INTRODUCTION

This Design Information Bulletin (DIB) provides guidance on design procedures and recommendations for developing projects on evacuation routes. The guidance is primarily for rural communities where access to and from the community is limited and where a State highway will be used as an evacuation route. While the guidance focuses on wildfire evacuation routes, it can be applied to other events that require the evacuation of a community through a limited number of available routes. This guidance should be considered during the project initiation phase when working with local agencies in identifying potential evacuation routes or how a State highway project on an evacuation route may enhance that route's effectiveness during an emergency. During the Project Approval and Environmental Document (PA&ED) phase, the guidance assists in setting study limits, developing project details, and identifying and balancing elements that serve a dual purpose during normal and emergency operations.

This DIB is not a textbook or a substitute for engineering knowledge, experience or judgment. Much of the guidance given herein is subject to amendment as conditions and experience may warrant. Unique situations may call for variation from the policies and procedures described in this document, subject to Division of Design or delegated approval, or such other approval as may be specifically provided for in the text.

2.0 PLANNING AND ROUTE DEVELOPMENT

The county sheriff, in conjunction with city officials, having jurisdiction over the community has the discretion to designate evacuation routes for that community. This is part of the sheriff's responsibility as an emergency service provider. The California Department of Forestry and Fire Protection, commonly known as Cal Fire, provides Fire Hazard Severity Zone Maps that can be used to assess the fire potential for an area. In high and very high severity areas, consultation with the community and local agency should occur to determine if a State highway or a local street that intersects a State highway is considered an evacuation route or should be considered as such. Consultation with the California Highway Patrol, Office of Emergency Services, and Caltrans Maintenance should occur. Districts should consider discussing potential evacuation routes and developing lists or maps of such routes prior to a project being considered. These lists/maps can inform the prioritization and development of projects.

If a project is on an evacuation route, an assessment should be made on the project's potential to impact the route and what may be done to enhance the route's efficiency and effectiveness at moving significant numbers of people and vehicles. Such discussion may need to occur outside the project development process, depending on the needs of the community and the route.

The needs of the community and route will vary but the information needed for assessment includes, but is not limited to:

- the population of the community
- percentage of that population expected to use the route during an evacuation

- percentages and descriptions of citizens who may require buses or special transportation needs
- types and numbers of vehicles expected to use the route during an evacuation
- commute patterns
- locations of schools and hospitals – either as a facility that requires evacuation or as a destination refuge area
- the need for emergency services to use the route to access to the community while the route is also being used for evacuations (note that the emergency services can include large pieces of equipment transported on large trucks)
- location of recreational or tourist areas
- the need of residents, visitors, and tourists to remove pets and livestock

A Project Initiation Document (PID) should address the needs of the route as it functions under emergency conditions as well as under normal conditions. The scope of the project should identify resource and information needs as well as a general idea on how the evacuation route can be maintained and enhanced as much as possible. Potential conflicts between project goals, such as Complete Streets needs versus vehicular needs during an evacuation, need to be identified and addressed.

3.0 PROJECT DEVELOPMENT

At a minimum, the project's design should not degrade the ability of the roadway to serve as an evacuation route. Opportunities to enhance the roadway's ability to facilitate evacuations should be included when possible. The following guidance can be used to assist in this effort.

3.1 Geometric Considerations

This DIB supplements the Highway Design Manual (HDM) for design guidance. Any deviation from the HDM standards will require documentation per HDM Index 82.2. This DIB may be used as a source that supplements engineering judgement and to help justify the use of a nonstandard feature.

3.2 Travel Lanes

Per the HDM Index 301.1, the standard lane width is 12 feet, although in rural town centers with low speeds and truck volumes (Average Annual Daily Truck Traffic - AADTT) 11 feet is acceptable. Some routes in rural areas may have narrow lanes if they have not been upgraded significantly since original construction. The goal of evacuation routes, though, is to move large volumes of people out of a community. In addition to increased volumes of vehicles, the expected types of vehicles on evacuations routes will likely include recreational vehicles (RVs) and vehicles pulling trailers. As such, standard lane widths should be used for routes designated for evacuations. Balancing the different goals is necessary.

If standard lane widths cannot be provided or are not preferred, then consider alternatives that can provide additional travel width during evacuations, but which can serve other purposes during normal use. Parking lanes may be cleared of vehicles during an emergency and used for vehicular movement. Additionally, a Class II bicycle lane, especially with a buffer, may provide additional width to serve emergency purposes and still satisfy Complete Streets goals. Wider shoulders may also be used to compensate for narrow lanes.

The number of lanes should also be considered. A two-lane road with minimal or no shoulders presents different opportunities for evacuation than a four-lane road with medians and shoulders. Minimal access to a community subject to evacuation may justify a four-lane highway connecting the community to safe areas. Such highways would enable evacuation as well as allow emergency vehicles access in the opposite direction. Multiple lanes can also allow for contra flow operations - the use of lanes opposite to their normal traffic flow - during an evacuation. Adding lanes can be considered depending on the size of the community and potential evacuation needs, but this should be done in consideration of other impacts. The presence of raised medians and wide unpaved medians may impede contra flow opportunities that can be addressed through painted medians and median openings. Contra flow requires examining the roadside for unprotected objects such as bridge piers and guardrail and barrier ends that would not normally be present for traffic.

Routes connecting the community to temporary shelter areas need to also be examined to determine if there are any narrow sections, such as at structures and overcrossings, that would impede the flow of traffic. An additional emphasis should be given to addressing these areas.

3.3 Shoulders

As noted above, wider shoulders allow more room for drivers, often distracted by the emergency and other needs, to recover and avoid other vehicles or objects. The needs of the evacuation route may warrant an additional lane that is not needed otherwise. The use of a wide shoulder (e.g. 10 feet or greater) can serve as an additional evacuation lane or as a separate access lane to get emergency equipment or residents needing to recover family members, pets, or livestock into the community. The wide shoulder should be evaluated for use as a Class II bicycle lane or parking area for non-emergency needs.

If not used as an extra evacuation lane, shoulder widths should be such that vehicles that break down can pull out of the travel way. It may be necessary, where a continuous width cannot be provided, to construct wide pullout areas at key locations to serve breakdown or other emergency related purposes.

Restricted right-of-way, environmental, scenic highway designation, or other issues may prevent the construction of wide paved shoulders. Providing grassy, dirt or gravel areas adjacent to the roadway may serve breakdown needs and, depending on the width and surface, additional vehicle access for emergency needs.

Verify that shoulder structural sections are adequate to handle anticipated loads. Loading will depend on the anticipated frequency of use for emergency purposes and the number of vehicles as well as the type of vehicles. Reconstructing shoulders, if needed for emergency purposes, should be considered only as part of a project with independent justification. Using the same structural section as the roadway can provide the necessary support and make construction more efficient.

3.4 Turn lanes

Turn lanes (left or right turn movements) can serve vehicular movement needs as well as special purposes during an emergency. For vehicular movement, turn lanes should be wide enough to handle the vehicle sizes expected to use them. If all or most evacuating traffic must turn, turn lanes should provide the additional space for longer vehicles to make the turning movement without impeding traffic flow. If a turn lane cannot be provided, it may be necessary to prohibit the turn during an emergency by installing a sign on a turnable base that can display the sign when needed.

Consider including turn lanes at intersections that currently do not have them. In addition to clearing the through lane of vehicles that are slowing or stopping to turn, turn lanes can provide staging areas for enforcement or maintenance vehicles.

Continuous two-way left-turn lanes can address operational and safety needs during normal operations and can be used for an extra travel lane during emergencies. Locate termini of the lane to allow safe merging into through traffic or turning as required by the evacuation route.

Raised or pork chop islands at intersections create potential traffic handling issues. Raised islands should be removed where possible and replaced with painted islands to improve roadway usage.

3.5 Clear Recovery Zones and Horizontal Clearances

A clear recovery zone is an unobstructed, relatively flat area beyond the edge of the traveled way which provides drivers of errant vehicles the opportunity to regain control. Ensuring a clear recovery zone is a challenge in areas where access off the roadway may be limited. A clear recovery zone reduces the probabilities of collisions that may impact traffic flow and allows for disabled vehicles to clear the roadway safely. Fixed objects in the clear recovery zone can potentially become pinch points and introduce other safety concerns. A clear recovery zone may also provide access and staging areas for emergency vehicles. Additionally, removing fixed objects from the clear recovery zone may also provide a defensible space that reduces fire hazards and prevent fire damaged objects from entering the roadway.

In general, the minimum horizontal clearance in the HDM is related to the shoulder width standard, but not less than 4 feet. However, this standard is not satisfied where there are curbs or dikes within the specified distance. If curbs and dikes are not needed, i.e., not complying with Topic 303 of the HDM, they may pose an impediment to traffic during an emergency and removal should be considered.

Provide a standard width clear recovery zone where possible and remove or relocate fixed obstacles (e.g. utility poles, controller cabinet) as far away as possible. Drivers during evacuations are often under a great deal of stress and visibility may be greatly limited due to smoke or darkness, increasing the need for a recovery area. Additionally, fallen wooden poles and electric/utility lines from utilities located close to the roadway can block evacuation routes; placing utility lines further away can reduce this possibility. Balancing with other needs is required though. Environmentally sensitive areas and scenic routes may limit the opportunities to provide a clear recovery zone. In such cases, the local agency should be informed so that the evacuation plan accommodates the limitations.

The provision of a clear roadside also provides opportunities for use by larger or longer vehicles, such as horse trailers, motorhomes, campers, etc., which requires minimizing above ground obstructions to the maximum extent feasible.

The stockpiling of cones, temporary traffic control signs, and other equipment necessary to manage an evacuation route near the community is a proactive action but storage should not be in the clear recovery zone.

3.6 Intersections

Intersections present operational and geometric challenges to evacuation routes. The need to move a large volume of traffic in one direction may not necessarily align with non-emergency use. Depending on the risk severity, intersections should be sized to accommodate the primary direction of evacuating traffic. Avoid narrowing lanes to accommodate turn pockets or bike lanes.

If the evacuation route includes a turn to access refuge areas, provide a sufficient turning radius to accommodate large trucks. See HDM Topic 404. While large trucks may not be the usual design vehicle for the community or the route, emergency needs may require these trucks to bring in specialized equipment. This may require designing intersections to standard intersection angles to avoid sharp turns and enable continuous flow of traffic.

Roundabouts provide opportunities to maintain a uniform traffic flow in the evacuation route, but consideration must be given to volumes and vehicle size such that the roundabout does not become a bottleneck. Consideration should be given to using larger circulating roadways, mountable curbs, and truck aprons.

Verify that any gateway monuments, transportation art and community identity signs are located away from the roadway to not present an obstacle to evacuating traffic needs.

Provide space adjacent to the intersection for law enforcement or maintenance vehicles to stage is available as necessary (e.g. traffic/intersection control).

Railroad crossings present unique intersection challenges. Crossing signals and other infrastructure should be placed far enough from the travel lane and shoulder to facilitate the use of the shoulder as an evacuation lane and avoid creating a choke point. Verify that

the crossing profile allows emergency equipment being brought into the emergency area on large lowboy trailers to traverse the vertical curve.

3.7 Complete Streets Features

Complete Streets features provide improvements to the community but have the potential to create challenges in an evacuation. Consider the use of Class II bike lanes on evacuation routes instead of Class IV as a way of providing an unobstructed pavement width. Place all fixed objects (light posts, street furniture, parklettes, etc.) setback as far from the edge of traveled way as feasible.

3.8 Traffic Signals

Provide for minimum standard vertical clearances. A 16-foot clearance would allow emergency vehicles access to the area and avoid hitting mast arms. Sufficient setbacks minimize the possibility of turning large trucks impacting the signal poles or controller cabinets.

Note that power may not be available to operate the signal so signage or supplemental power sources should be made available. See Traffic Signal Operations During Public Safety Power Shutoff in High Priority Areas (memo dated October 31, 2019) for details. Consider back-up power installation for critical intersections when power is unavailable. Discuss this with District Maintenance to ascertain current procedures for actions during emergencies and when power failures occur.

Figure 1 Signal with Retroreflective Border (photo courtesy of Brian Simon

A FHWA-approved safety countermeasure are signal backplates with retroreflective borders. During power outages, low visibility, and at night, while the signal may not be functioning, the retroreflective border will alert drivers that they are approaching a signal.

3.9 Signs

Evacuation routes are used infrequently and usually during times when drivers may be distracted by the emergency. Clearly indicating the route that drivers should be following is essential in maintaining an efficient flow of traffic. Projects should provide appropriate and easily viewable route evacuation guide signage. The signage should align with

emergency guidance provided generally to the public. Refer to Chapter 2N of the California Manual on Uniform Traffic Control Devices for more information on emergency management signing, including signing to be used to identify evacuation routes. Consult with the District Traffic office for sign recommendations.

The use of Changeable Message Signs to provide direction and information to the evacuating traffic can be very effective, but this takes time to deploy and may be unavailable during the emergency. The installation of signs on turnable posts that can be turned to display their message during the emergency may be a more effective solution. Sign locations should be visible but not impede traffic operations. Use highly retroreflective sheeting for sign panels as power may not be available during the evacuation. Metal posts are preferred due to their inflammable nature.

The use of high retroreflective delineation and directional pavement markings (e.g. route shields) aids in traffic management should signage become unavailable.

3.10 Barriers and Guardrails

Concrete barriers and metal beam guardrails are important highway safety devices, but their placement may impede the efficient flow of an evacuation route. While often used to protect objects in the clear recovery zone, they also present another object to be hit although with less severe consequences. Removing the obstacle from the clear recovery zone reduces or eliminates the need for the barrier. Barriers should be easily identifiable during low visibility situations. Drivers may be evacuating an area in dark and smoky conditions so easy identification is necessary.

A bridge replacement or bridge rail replacement project should consider widening the structure to provide as much horizontal clearance as possible to facilitate evacuations and not become a choke point.

On multilane highways, the presence of left side barriers prevents the option of allowing traffic to cross and use the opposing lanes during an evacuation – a contra flow operation. Placing the barrier to create gaps at key locations, subject to ensuring safety during non-emergency situations, would facilitate this. Alternatively, constructing removable sections and contouring the median would enable this action although additional maintenance would be required and coordination between the local emergency services and Caltrans Maintenance would be required to facilitate operations during an evacuation.

Normally unprotected ends of barriers and rail may need crash cushions or attenuator devices installed to accommodate traffic heading in the opposite direction.

Line posts for guardrail should be metal due to their inflammable nature thereby improving sustainability.

3.11 Bridges, Tunnels and Structures

The width of bridges and tunnels should match the approach roadway width if not wider. This facilitates the movement of passenger vehicles, buses, trucks, and any special

equipment being brought through the emergency area. Narrower structures can impede the flow of traffic, both in and out of the area.

Require retaining walls to be constructed with standard horizontal clearance to allow free movement of vehicles and large loads.

Consider alternatives to placing new or maintaining existing high priority utilities on an evacuation route bridge as that utility may prompt closure of the structure.

Evaluate the placement of high priority utilities through or on bridges for compatibility with the bridge's role as an evacuation route.

3.12 Miscellaneous

Transportation management system elements such as closed-circuit television cameras and changeable message signs along the route can allow traffic conditions to be closely monitored and help improve incident management and response. Highway Advisory Radios (HARs) can be used to provide real-time information to vehicles such as traffic conditions or available alternate routes during an evacuation. Such systems, though, may not be available during power outages.

Traffic management plans for construction may need special language or details to address potential use of the roadway for evacuation purposes. Time of year and the potential for an emergency requiring the use as an evacuation route, bridge construction methods, and providing full width should be considered.