



Corridor Planning Process Guide

DIVISION OF TRANSPORTATION PLANNING
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Foreword

Purpose

The Caltrans Corridor Planning Process Guide (Guide) was prepared for the California Department of Transportation (Caltrans) by the Division of Transportation Planning for use on preparing corridor planning documents. This Guide establishes a comprehensive planning approach through desired protocols and procedures to identify and implement multimodal transportation needs. It is neither intended as, nor does it establish, a legal standard for these functions.

The protocols and procedures discussed herein are for the information and guidance of the officers and employees of Caltrans.

Some of the guidance given herein is subject to an amendment as conditions, needs and experience warrant. Special situations may call for innovative solutions and consultation with other Caltrans divisions may be necessary and appropriate.

It is not intended that any standard of conduct or duty toward the public shall be created or imposed by the publication of this Guide. Statements as to the duties and responsibilities of any given classification of officers or employees mentioned herein refer solely to duties or responsibilities owed by these in such classification to their superiors. However, in their official contacts, each employee should recognize the necessity for good relations with the public and stakeholders.

Scope

This Guide may involve, either directly or indirectly, engineering and operational issues. It is not a substitute for engineering knowledge, experience of judgment in terms of addressing Caltrans design standards or otherwise engineer approved designs.

No warranty is made regarding the results of use of the Guide. In no event, shall Caltrans be liable for costs of procurement of substitute goods, loss of profits, or for any indirect, special, consequential, or incidental damages, however caused, by use of the Guide. Caltrans shall not be liable for any claims in connection with the use of the Guide, including without limitation, liability arising from third-party claims, liability related to the implementation, or non-implementation of any concepts developed based on the protocols and procedures outlined in the Guide.

Caltrans Corridor Planning Process Guide

Introduction

The transportation system in California moves people and goods between home, work, school, shopping, recreation, and other destinations, and connects ports, industry, residential communities, commercial centers, educational facilities, and natural wonders. California's vast transportation system includes roads and highways, public-use airports, major ports, freight systems, and transit systems including the nation's first High-Speed Rail (HSR) system, currently under construction. Transportation has a profound and varied impact on individuals, business, and communities, with benefits such as economic growth, greater accessibility, and transport-related physical activity, as well as consequences such as pollution, traffic congestion, and sedentary behaviors. Regional variation, including the different conditions between rural and urban areas, shape the character of the transportation system, the planning documents, and potential improvements to address needs. Transportation systems and the mobility they provide are also affected by changing transportation technologies, evolving land use patterns, and system disruptions from climate change impacts.

Corridor Planning is a multimodal transportation planning approach that recognizes that transportation needs are based on the complex geographic, demographic, economic, and social characteristics of communities. These locations are tied together by a complex system of streets, roads, highways, trails, paths, rail lines, bus corridors, and other elements that affect the convenience, safety, and accessibility of transportation choices. Increasingly, technologies such as real-time, web- and mobile-enabled trip planning and ride-sourcing services are changing how people travel. Soon, automated and connected vehicles, and unmanned aerial systems (e.g., drones) are expected to be part of our transportation landscape and will transform the way that people and freight are transported.

A corridor can be defined as a linear geographic area with one or more modes of transportation that facilitates the movement of people and goods, supports the economy, and connects communities. Origins and destinations, land use, place types, and existing and future development that surround the transportation infrastructure influences how the corridor and its limits are defined.

While there may be multiple routes to get from one place to another, key predominant routes within corridors connect the origins and destinations. Most travel is focused on the shortest or fastest routes. These routes become more evident when measured in terms of total volume along the route or the number of origins and destinations served. Land use often predicts travel demand and conversely high capacity routes often determine land uses. The relationship between land use and transportation is manifested by the volume of travel demand. This demand is an indicator that people have chosen certain routes connecting the origins and destinations of greatest interest. When land use and transportation have been well coordinated, travel times are reliable and vehicle miles traveled (VMT) is low.

Corridor definitions vary and are typically context specific. A good example is the definition prepared for the U.S. Department of Transportation (USDOT), the Federal Highway Administration (FHWA), and the Federal Transit Agency (FTA). A corridor is a largely linear geographic band defined by existing and forecasted travel patterns involving both people and goods. The corridor serves a particular market or markets that are affected by similar transportation needs and mobility issues. The corridor includes various networks (e.g., limited access facility, surface arterial(s), transit, bicycle, pedestrian pathway, waterway) that provide similar or complementary transportation functions. Additionally, the corridor includes cross-network connections that [may] permit the individual networks to be readily accessible from each other. The term “network” is used to denote a specific combination of facility and mode (L. Neudorff)¹. The final determination of the corridor study area will depend on policies, location, and need and will ultimately be made by the corridor team, which should be comprised of Caltrans, regional and local planning agencies, Tribal Governments, advocates, and other stakeholders as applicable.

Objectives of comprehensive multimodal corridor planning may well include the following:

- Encourage effective communication with partners, stakeholders, Tribal Governments, advocacy groups, and the public by providing a transparent planning process with clear corridor objectives.
- Identify the corridors by considering origin and destination, along with land-use and place-types, to address multimodal transportation opportunities through a comprehensive, cooperative, and continuing planning process.
- Task a multi-disciplinary, multi-organizational corridor team to look at State and local transportation systems, while including community, local, and regional transportation systems.
- Identify opportunities to employ cooperative, multimodal, and systematic improvements by leveraging federal, state, and local funding programs such as self-help county sales tax programs.
- Underscore the importance of corridors identified in the Interregional Transportation Strategic Plan (ITSP) and other statewide plans.
- Support Caltrans' asset management program and emphasize the importance of utilizing maintenance and operational improvements to strengthen the mobility and accessibility options of the community.
- Identify and prioritize projects and strategies to meet future corridor opportunities.
- Analyze multimodal transportation issues and opportunities for optimizing system operations and support a safe and reliable system.

¹ L. Neudorff, J. Harding, and L. Englisher, Integrated Corridor Management Concept Development and Foundational Research, Task 3.2 Develop Criteria for Delineating a Corridor, United States Department of Transportation, ITS Joint Program Office, FHWA, FTA, Washington DC. https://connected-corridors.berkeley.edu/sites/default/files/fhwa_develop_criteria_for_delineating_a_corridor.pdf

- Further federal and State ambient air standards and greenhouse gas (GHG) emissions reduction standards pursuant to the California Global Warming Solutions Act of 2006 (Division 25.5, commencing with Section 38550, of the Health and Safety Code) and Senate Bill (SB) 375 (Chapter 728, Statutes of 2008).
- Preserve the character of local communities, create opportunities for neighborhood enhancement, and improve multimodal accessibility including complete streets.
- Consider climate change adaptation and resiliency of the transportation system to reduce disruptions.
- Identify opportunities that achieve a balanced set of transportation, environmental, and community access improvements.

Ideally corridor planning culminates in a clear vision for identified improvements, while recognizing both the positive and negative impacts of changes over time. Currently, California is seeing tremendous population growth and has a critical housing shortage. While the economy is doing well, the transportation system is strained in many places. The state of repair is a key priority within the entire system. Many facilities are overloaded with demand, disruptions would therefore place significant burdens on users and on the larger regional economy. Travel choices are limited in many communities. Air and noise pollution and GHG emissions are negative externalities that often disproportionately affect underserved communities. Corridor improvement concepts should strive for travel equity, economic opportunity, access to jobs and housing, and consider the environment and users of the system. By thinking in holistic terms about what success looks like, corridor planners can fully weigh all options that reflect the desires of the local community as well as the State.

Tribal, local, regional, and statewide goals must be considered and incorporated into the corridor planning process where relevant. Statewide goals draw from documents including the California Transportation Plan (CTP), the Caltrans Strategic Management Plan (SMP), California's Climate Change Scoping Plan, the California Freight Mobility Plan (CFMP), the California State Rail Plan (CSRP), Statewide Transit Strategic Plan, and from stakeholders. This planning context, where applicable, must be integrated into the corridor planning process and into the final corridor plans.

Corridor Planning within California should address quality of life, access to destinations, environmental factors including GHG, and transportation system performance. The impacts of the benefits and the burdens on different groups and communities should also be considered in the system analysis and improvement discussions. Although, Caltrans is the owner operator of the State Highway System (SHS), planning for tomorrow is not bound by the State's right of way or jurisdictional boundaries. The State's transportation system should be integrated, seamless, resilient, multimodal, and accessible. Examples of statewide policies include Executive Order N-19-19 and the Regions Rise Initiative.

- Executive Order N-19-19 – California Governor Gavin Newsom signed Executive Order N-19-19 on September 20, 2019 to require the redoubling of the state's

“efforts to reduce greenhouse gas emissions and mitigate the impacts of climate change while building a sustainable, inclusive economy.”

- Regions Rise Initiative – Regions Rise Together is a vision for inclusive and resilient economic development and sustainable land use and transportation planning across California and regions. Key Pillars:
 1. Promoting Regions Up Planning and Partnerships
 2. Changing our Mental Map of California
 3. Improving Connections Across Regions to Link California

This Guidebook provides direction to Caltrans staff regarding the transportation planning process, but it can be used by other agencies. It does not focus on a specific fund source but should consider all available funding sources. It is basically a comprehensive analysis of a transportation corridor and should address multiple needs. The Guidebook was developed in collaboration with the California Transportation Commission's (CTC) Comprehensive Multimodal Corridor Plan Guidelines approved in December of 2018. The CTC's Guidelines were developed to provide guidance to eligible program applicants regarding the statutory requirements for comprehensive corridor plans utilized by agencies to apply for funding through the Solutions to Congested Corridors Program. In other words, the CTC Guidelines provide direction for one funding program and the Caltrans Guidebook provides guidance for corridor planning irrespective of fund source.

Background and Purpose

Caltrans Commitment to Corridor Plans

Caltrans is committed to developing transportation corridor plans (or Corridor Plans) that identify and recommend transportation strategies and improvements in coordination with our planning partners, resulting in a range of pre-Project Initiation Document (PID) project candidates and non-project strategies that achieve Caltrans goals and objectives. These project candidates and strategies are advanced to implementation through regional planning, system planning and programming processes. The corridor plans and recommended projects should strive to meet local, regional, statewide goals for a safe, sustainable, integrated, and effective transportation system that positively impacts all Californians. They should also outline a corridor vision for improving and operating the system in a manner that achieves these goals.

Replacement of Transportation Concept Report (TCR) Guidelines

This Guide supersedes the Transportation Concept Report (TCR) Guidelines from September 2012. Previously, the TCR was Caltrans' main System Planning product that described SHS routes and identified transportation options along those routes. Caltrans System Planning to Programming (SP2P) Study² was released in May 2017 and endorsed

² (Kittelson & Associates, Inc., Emergent Transportation Concepts, and System Metrics Group, 2017)

by Caltrans. The Guide implements many of the SP2P recommendations, including shifting Caltrans System Planning program towards more partnership and performance-based Corridor Plans.

Purpose of Corridor Planning Process Guide

The purpose of the Guide is to clearly state Caltrans expectations on conducting the corridor planning process steps as outlined in Figure 1. The outcome will be recommended projects and strategies compiled by the district and its partners, documented in Corridor Plans, and advanced in the planning process for future funding and programming opportunities and programming process. This Guide presents a flexible methodology and approach that is intended to be helpful to districts in corridor planning. The scope and work activities related to this process can and should be tailored to the district and its partners based on available, time, resources, and expertise.

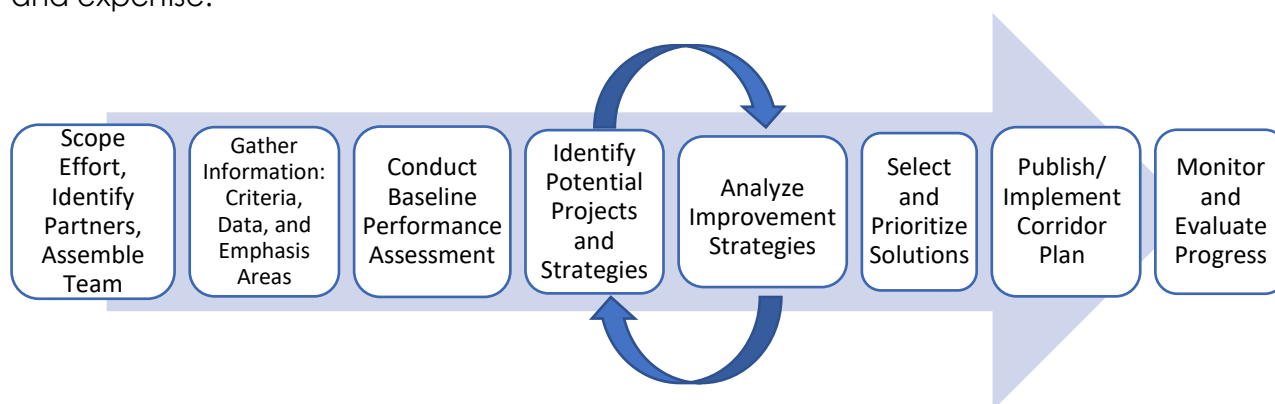


Figure 1. Steps of the Corridor Planning Process

Who is Involved and What is Covered

The Guide is intended for Caltrans' System Planning staff assigned to lead or participate in corridor planning efforts and is also intended to inform and encourage broader Caltrans staff participation in corridor planning efforts led by partner agencies. The Guide covers System Planning activities for any transportation corridor as delineated by a corridor team with Caltrans involvement, typically (but not necessarily) focused on one or more segments of the SHS. [Appendix A](#) provides a more comprehensive listing of relevant federal laws and regulations, State laws and policies, and Caltrans Directives and Policies related to corridor planning.

Purpose of System Planning and Corridor Planning at Caltrans

The purpose of System Planning at Caltrans is to identify and recommend projects and strategies that achieve Caltrans goals and objectives in a collaborative manner.³ In response to federal law, System Planning supports and adheres to a continuing, cooperative and comprehensive statewide transportation planning process.⁴ Furthermore, federal law states that a congestion management process shall be

³ California Government Code Section 65086

⁴ Title 23 United States Code Section 135.

developed, established and implemented as part of the planning process.⁵ The Congestion Management Process (CMP) is a systematic approach, collaboratively developed and implemented throughout a region, providing for the safe and effective management and operation of new and existing transportation facilities through the use of demand reduction and operational management strategies. Caltrans' System Planning process is necessary for the CMP approach to be successful, which includes development of performance measures, assessment/evaluation of potential projects and improvement strategies, and performance monitoring. Corridor planning is one of the ways in which Caltrans System Planning achieves its purpose (in cooperation with other Caltrans functions) and complies with federal law and State policy.

A corridor planning approach relies on collaboration between Caltrans districts and their regional partners to identify their key transportation corridors, and develop individual corridor plans to identify and address a corridor's opportunities. The identification of high priority travel corridors in a district occurs through discussions with partners, which helps to inform development of the District System Management Plan (DSMP). In this context, corridor prioritization refers to the relative level of urgency to devoting staff time and resources to planning activities on specific travel corridors. Guidance related to corridor prioritization will be incorporated into separate Caltrans DSMP Guidelines.

Role of Corridor Plans in Statewide and District System Planning Process

A corridor plan defines how a corridor is performing (and estimates for the future), why it is performing that way, and recommends projects and strategies that achieve corridor goals and objectives. The recommended strategies, opportunities, or projects may become candidates for funding programs. Corridor Planning is one way in which district transportation candidate projects get identified and compiled for inclusion into a district's project list and Headquarters' Multimodal Operations non-State Highway Operations and Protection Program (SHOPP) Transportation Equity Report (MONSTER) project list. Other ways include asset management planning, safety program planning, district-wide modal plans, and other collaborative methods. One such collaborative method are district-led project nomination teams related to specific transportation investment programs. The process begins when the team analyzes multiple needs and selects anchor or satellite projects. An "anchor" is the main purpose of the project and the "satellite" is a secondary goal. Anchor and satellite projects may be grouped together as one, also known as bundling, then selected for PID development and potentially recommended for programming. Figure 2 below, illustrates the District System Planning process within Caltrans and its key products.

⁵ Title 23 CFR Part 450.322 (d)

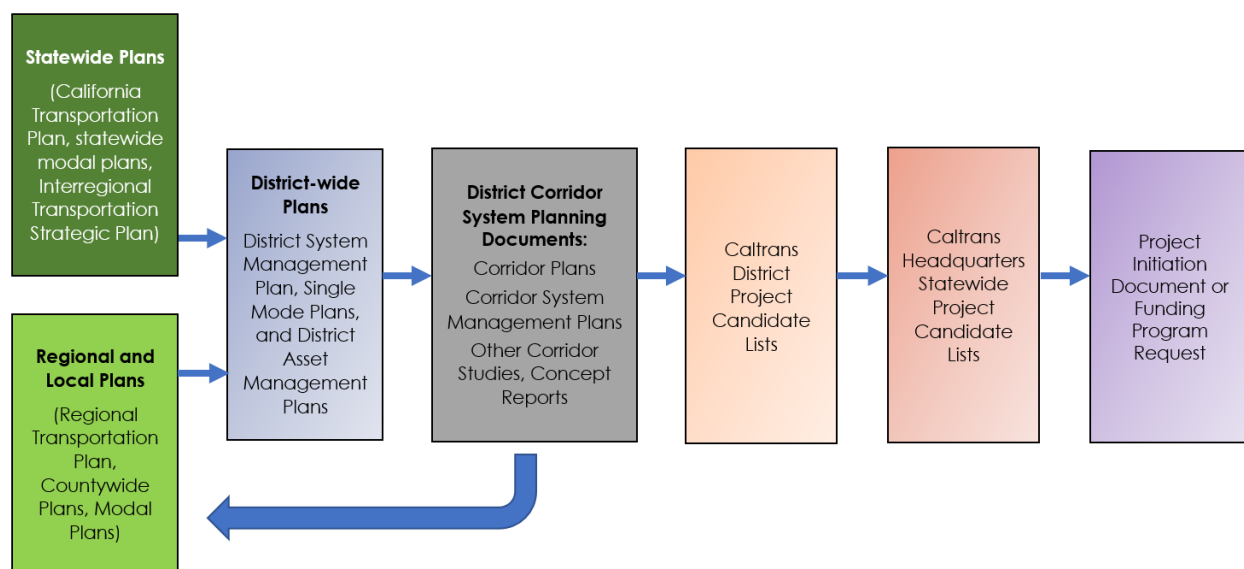


Figure 2. Caltrans District System Planning Process

District System Planning and Corridor Plan Development Approaches

Development of a Corridor Plan can be approached in three distinct ways: Creating a new Corridor Plan, update of an existing Corridor Plan, or a hybrid approach combining existing studies that result in a single more comprehensive Corridor Plan. The process outlined in this Guide applies to these approaches.

Governance

Corridor Planning is conducted through partnerships with a variety of agencies and groups leading to the development of a comprehensive corridor plan that includes roles, responsibilities, and implementation steps. The roles and responsibilities of each agency should be outlined during the initiation and development of the corridor plan and can vary depending on level of interest and legal responsibility.

For example, Caltrans as the owner and operator of the SHS has specific responsibilities related to the highway system, along with varying levels of responsibility for statewide rail services, while local and regional agencies have responsibilities for other systems including local street networks, transit services, local trails, and regional rail lines. Responsibilities also extend to funding sources with Caltrans controlling certain fund sources, such as the SHOPP and the Interregional Transportation Improvement Program (ITIP), and local and regional agencies controlling their own funding, such as Regional Transportation Improvement Programs (RTIPs).

During the project scoping, it is important to identify roles, responsibilities, and establish a process/strategy to develop and accept the final corridor plan. The process could include the input of a combination of technical experts, policy leads, and ultimately the approving management group. For example, the following teams or committees could be formed to develop a corridor plan: a Technical Advisory Committee (TAC) of knowledgeable staff of the representative agencies to conduct the technical work; a

Policy Advisory Committee (PAC) to provide higher level planning direction; and a steering committee to ultimately recommend the final plan for approval.

One of the key elements of the planning process, beyond the final plan, is an implementation strategy. This strategy should outline who is responsible for what elements of the corridor plan and how they are expected to implement those identified activities. Governance responsibilities should be included in this strategy. Agencies that are the owner and operator of transportation infrastructure and systems, along with control over identified funding sources, should have greater responsibility over their specific assets and activities. Partner agencies that do not control the major resources but are willing and able to provide support should have identified and committed activities outlined in the implementation plan.

Implementation Plan

As previously identified in the scoping step of this process, an implementation plan is necessary to outline roles and responsibilities of the key elements, strategies, and projects in the final corridor plan. The roles and responsibilities should be shaped by an agency's ability to control the appropriate resources (transportation infrastructure, staff, and funding) and willingness to partner. During the corridor planning process, the implementation plan should be developed and agreed upon by the TAC, PAC, and management team. The implementation plan should outline a series of activities and projects that once completed should achieve the overall vision and benefits targeted by the corridor planning team and identified in the final plan. A key element is the monitoring of the plan to ensure implementation is successful which should be conducted by representatives of the partner agencies. Another important element is the continuous reassessment of performance measures and assumptions to determine if an update of the plan is needed due to unforeseen changing conditions regarding the infrastructure, funding availability, and policies. Roles and responsibilities for implementation can be identified in an agreement between the agencies such as a Memo of Understanding (MOU).

Key Elements of a Corridor Plan

When participating as either the lead or as a partner agency, Caltrans expects Corridor Plans contain to contain certain important elements as part of its approach.

Caltrans expects the following key elements to be considered within a Corridor Plan, no matter the lead or sponsoring agency. Elements of a plan should include, but are not limited to, the following:

- Clear demonstration of State, regional, and local collaboration
- Short, medium, and long-term planning horizon
- Specific corridor objectives
- Multimodal considerations for and approaches to address transportation system issues
- Identification and evaluation of performance measures for recommended projects and strategies

- Consideration and application of a range of performance metrics (such as those outlined in Chapter 7 of the 2017 Regional Transportation Plans (RTP) Guidelines,⁶ project specific performance measures as outlined in the Statewide Transportation Improvement (STIP) Guidelines,⁷ and other plans such as the Rail Plan or Asset Management plan, etc.) for the set of recommended project and strategies.
- Recommendations and prioritization of multimodal improvements that feed into transportation funding programs and regional transportation planning
- Consistent with the principles of the federal Congestion Management Process⁸ and incorporation of the State Congestion Management Program goals for designated Congestion Management Agencies
- Consistency with the principles of the CTP⁹ and including the ITSP, the Caltrans' Smart Mobility Framework¹⁰, California's Climate Change Scoping Plan, and climate adaption plans
- Consistency with the goals and objectives of the regional transportation plan including the forecasted development pattern identified in the Sustainable Communities Strategy (SCS) and, when applicable, areas identified as high-priority for growth
- Consistency with other applicable regional or local planning frameworks such as local jurisdiction land use plans including transit supportive land use plans, freight and goods movement plans, local climate action plans, and policies

Demonstrating and documenting that these key Corridor Plan elements were addressed along with the outcomes of the corridor planning process will exhibit the use of best corridor planning practice in identifying projects and strategies to achieve corridor goals and objectives.

⁶ <https://dot.ca.gov/programs/transportation-planning/regional-planning>

⁷ <https://catc.ca.gov/programs/state-transportation-improvement-program>

⁸ https://ops.fhwa.dot.gov/plan4ops/focus_areas/cmp.htm; 23 CFR 450.320(a) and (b).

⁹ <https://dot.ca.gov/programs/transportation-planning/state-planning/california-transportation-plan>

¹⁰ <https://dot.ca.gov/programs/transportation-planning/office-of-smart-mobility-climate-change/smart-mobility-active-transportation/smart-mobility-framework>

Eight-Step Corridor Planning Process

There are eight main steps of the corridor planning process, illustrated in Figure 1. This process should include:

- Internal and External Partners
- Stakeholders
- Tribal Governments
- Advocacy Groups

The eight steps are briefly described below then followed by a more complete description of each.

1. SCOPE EFFORT

The Corridor Plan's scope frames the overall corridor planning effort, defines the corridor partnership, and helps to determine appropriate analysis tools. This step will result in a defined corridor team, agreement on the issues and potential opportunities that will be considered, and a comprehensive set of goals, objectives, and performance measures for the corridor.

2. GATHER INFORMATION

Corridor information is collected and organized to inform an understanding of the corridor context, identification of different operational conditions in the corridor, current and future conditions, and the defining factors that would drive alternative investment scenarios. This information outlines the corridor description, basic system characteristics of the corridor and its unique elements within a larger national, State, and regional context. The assessment of current conditions may require new data collection to fill identified data gaps and may require a data collection.

3. CONDUCT BASELINE PERFORMANCE ASSESSMENT

A performance assessment is conducted to clearly outline system performance and trends. The results are then interpreted to highlight the relationship between identified issues and their causes. For the assessment of existing conditions and for the most frequent/impactful operational conditions corridor performance issues are identified then their causes are diagnosed. At a minimum, corridor profiles are developed for mobility, safety, travel time reliability and sustainability. This task also includes performance assessment for the future baseline (do nothing or no build). A reassessment/adjustment of the performance measures from the scoping effort step may be necessary based on the study of the current conditions and future potential scenarios.

4. IDENTIFY POTENTIAL PROJECTS AND STRATEGIES

Potential projects and strategies are identified at sufficient levels of detail for analysis and evaluation based on existing plans and studies, as well as the performance assessment, gaps identification, and diagnosing the causes of congestion, safety, and reliability issues.

5. ANALYZE IMPROVEMENT STRATEGIES

Possible improvement projects and strategies may be grouped into scenarios to be evaluated. An Analysis Plan may also be developed to scope the analysis effort and to identify resources required for the analysis. The Analysis Plan should be consistent with planning horizons, analysis tools, and performance measures previously identified. A corridor analysis is then conducted to evaluate the effect of potential investments on corridor performance. During the analysis, assumptions made in the scoping step may be reassessed and modified if necessary.

6. SELECT AND PRIORITIZE SOLUTIONS

Decisions are made on which corridor projects and strategies are promising for addressing the identified goals, objectives, and performance measures for the corridor. then the recommended are given an expected implementation timeframe of either short-, medium-, or long-term horizons. The outcome is a recommended set of multimodal solutions for the corridor that addresses the identified issues and opportunities, along with and may include estimated implementation timeframes. The combination of promising projects and strategies are summarized in a statement or document outlining how the corridor is expected to operate, including any recommended technical, organizational, and institutional arrangements necessary for the corridor improvements to realize their expected benefits. In some instances, it may be difficult for all agencies involved to agree on a prioritized list of projects recommended for the corridor. In addition, determining short-, medium-, or long-term timeframes will be speculative and also greatly depend on the outcome of competitive discretionary programs, availability of funds, and year of programming.

7. PUBLISH / IMPLEMENT CORRIDOR PLAN

The corridor planning process is documented with the publication of the Corridor Plan. The adopted corridor plan documents how a corridor is performing today (and estimates for the future), why it is performing that way, and recommends projects and strategies that support the corridor goals and objectives agreed upon by its partners. The Corridor Plan may include an implementation schedule, as well as the identification of responsibilities of the various partner agencies; however, prioritizing projects may be difficult to achieve without knowing when funding will be approved. In addition, specific project selection criteria will dictate the type of projects funding programs will consider. In parallel, formal technical, institutional, and organizational arrangements may be initiated among the corridor partners, including use cases about how the corridor is expected to operate under different conditions. Therefore, project Recommendations are ready to can be advanced toward implementation by the corridor partnership upon approved funding.

The Corridor Plan is not expected to require its own coverage under the California Environmental Quality Act (CEQA) but will typically serve as project and program input to the next update of the pertinent Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), which will undergo its own programmatic environmental compliance under CEQA. Adoption of Corridor Plans do not supersede the adoption of the RTP/SCS by the respective Metropolitan Planning Organizations. The adoption of Corridor Plans represent a consensus on candidate projects for future

programming and funding opportunities and may become the basis for input to the RTP/SCS.

8. MONITOR AND EVALUATE PROGRESS

Ongoing reporting on corridor performance is conducted for Corridor Plans should be updated to evaluate the effectiveness of recommended projects and strategies on corridor performance over time. Corridor objectives may also be re-assessed and refined by the corridor team. The Corridor Plan may also identify triggers or events that may necessitate an update of the Plan. Corridor Plans should be updated every five years or at the discretion of the lead and/or partner agencies.

Scope Effort

Outcomes: A clearly defined scope and team to guide the corridor planning process. Agreement on the issues and potential opportunities that will be considered during the corridor planning process. A comprehensive set of goals, objectives and performance measures for the corridor that will guide the selection of solutions that address the corridor's issues and opportunities.

The Corridor Plan's scope frames the overall corridor planning effort, defines the corridor partnership, identifies corridor planning horizons (short-, medium-, and long-term), and helps determine appropriate analysis tools. This step will result in a defined corridor team (including Caltrans, partner agencies and stakeholders with interests in the corridor), agreement on the issues and potential opportunities that will be considered, and a comprehensive set of goals, objectives, and performance measures for the corridor. The assessment of current conditions may require new data collection to fill identified data gaps. Coordination with the Metropolitan Planning Organizations or Regional Transportation Planning Agencies are vital to a successful corridor plan.

Assemble corridor planning team

Assembling the corridor team marks the beginning of stakeholder outreach, which should remain an on-going effort during the study. The main objective for this step is for the lead agency to determine who should be involved with a potential study, who will be involved as partners and stakeholders, and discussing the resources and expertise that team members could devote to a corridor planning effort. Depending on the anticipated size of the effort, development of a Project Management Plan (PMP) should be considered to document and monitor the plan scope, schedule, cost, communications, and risk.

The team should do its corridor planning work within a collaborative organizational structure. This can be outlined and described with a charter, mandate, or Memorandum of Agreement. Alternatively, the team could build on an existing collaborative group and formalize the corridor planning effort in the form of a resolution. Either approach should be the basis for securing support from agency leadership, which provides critically important high-level commitment to the Corridor Plan and its process.

Define corridor area

Once the corridor team is assembled, the corridor area to be addressed by the Plan should be defined in general terms. Agreement on the corridor area and its limits should be documented in the team's charter or agreement. This Guide defines a corridor as a geographic area defined by existing and forecasted travel patterns for people and goods. Travel in the corridor may be multimodal, is context specific, relative in scale to the region wherein it exists, with its limits defined by travel or modal decision points.

Draft issue statements and opportunities

An important early step for the corridor team is to develop a common understanding of issues and opportunities within the corridor at a high level, including the blend of transportation, community, economic, advanced mitigation, and environmental issues. This will form the basis for identifying goals and objectives later in the process and provide early indication of the focus areas for the corridor's performance assessment. The result should be an issue and opportunity statement that can be later aligned to corridor objectives.

Determine timeframe and available resources

In the scoping process, it is important to consider the time-period within which the Corridor Plan is expected to be completed. This is also helpful when determining the analysis approach for the Corridor Plan, and when choosing the appropriate analysis method. For instance, decision makers may need quick answers regarding a specific issue or alternately may be seeking comprehensive solutions to input into a long-range plan.

Getting a clear picture of the resources available is a particularly important part of determining the scope of the Corridor Plan. Awareness of available data for such a corridor planning effort is critical. This not only includes knowing the data inventory, collection, and processing capabilities of the lead agency, but as well as of partner agencies. The level and type of public and stakeholder outreach to be conducted is another important factor. The team should consider developing an outreach plan or strategy at this stage of the Corridor Plan scoping. Figure 3 shows the key components that helps to define the level of available resources for a corridor planning effort.

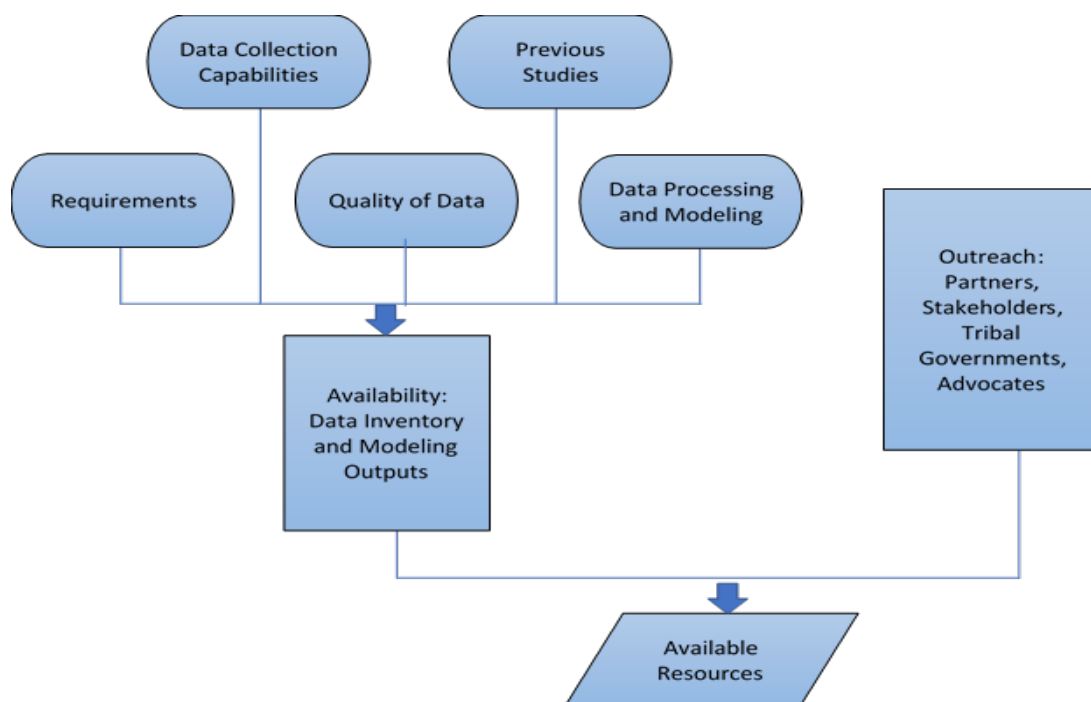


Figure 3. Key Components Determining Level of Available Resources to Construct Corridor Plan

Existing Plans, Policies, and Architectures

The existing planning and policy settings in which the Corridor Plan is taking place should be considered from the beginning of the scoping process. Applicable planning goals and objectives, relevant policies, and intelligent transportation systems (ITS) architectures should all be explored. A review of existing studies, reports, and plans provides information about the broader planning context, and offers insight into how current partners have recently defined elements of a big-picture vision for the corridor and/or the surrounding study area. There are many planning documents which will be useful in identifying applicable goals and policies, as well as potential stakeholders.

They should include but are not limited to the following:

- The California Transportation Plan is California's long-range transportation plan providing a 20-year vision for the State's transportation system and a set of supporting goals, policies, and recommendations.
- Caltrans Strategic Management Plan is a roadmap of how Caltrans will meet its mission, vision, and goals and identifies specific performance measures tied to each of five goals.
- Caltrans modal plans including: Interregional Transportation Strategic Plan, California State Rail Plan, California Freight Mobility Plan, California State Transit Plan, Toward an Active California: State Bicycle and Pedestrian Plan, California Aviation System Plan.
- A Regional Transportation Plan (RTP) – (sometimes called a Metropolitan Transportation Plan) is required by federal and State regulations and Federal law to set a region's long-term transportation goals and objectives.
- Regional, county, and local level transportation plans are often produced to feed into the RTP. County plans often include multimodal goals, objectives, and strategies.
- Transit agencies prepare short-range transit plans to identify desired transit projects and services within their service areas.
- Regional ITS Architectures can play an important role in decision making for regional-level ITS planning activities, and like RTPs are required by federal regulation.^{11 12}
- Regional ITS Architectures are sometimes supported by regional ITS strategic plans.

Goals and objectives identified in these documents should be highlighted by the corridor team to help inform corridor-specific goals and objectives, used later to align with performance measures to gauge corridor performance, and inform selection of short, medium, and long-term strategies to address objectives.

¹¹ FHWA Final Rule. Part 940 – Intelligent Transportation Systems Architecture and Standards. 23 CFR 940. https://ops.fhwa.dot.gov/its_arch_imp/policy_1.htm

¹² California Department of Transportation. 2018. White Paper: Federal Policy, Rule Making and Guidelines Related to ITS Architecture Activities. <http://www.dot.ca.gov/trafficops/switsa/assessment.html>

Develop Corridor Goals, Objectives, and Performance Measures

A goal is a broad statement that reflects a desired end state. Corridor goals are developed by the corridor team and should be adopted by consensus. Objectives should align with the adopted goals and reflect how the goals are meant to be achieved. While objectives can start out as broad statements, the corridor team should strive to make them as Specific, Measurable, Agreed-upon, Realistic, and Time-bound (SMART) as possible.

Building on existing planning efforts and discussions within the corridor team on current issues and opportunities, the corridor team needs to define a clear and relevant set of corridor goals and objectives. These goals and objectives will later be linked to performance measures. The development of these goals should be a collaborative effort with the various partners in the corridor planning process.

There are a wide range of performance measures (PMs) that can be considered for use in a Corridor Plan within any category of goal or objective. PMs may be quantitative, qualitative, or a combination of both. Caltrans' Smart Mobility Framework¹³ points toward transportation goals, objectives and performance metrics beyond the traditional auto-centric delay measures. This is particularly important in the context of sustainability goals and policies unique to California such as SB 375 which sets regional targets called Sustainable Communities Strategies for reducing GHG reductions from cars and light trucks integrating planning processes for transportation, land use, and housing; and SB 743 which changed the transportation impact analysis for CEQA from level of serves to VMT. Also, funding sources will have their own performance measures and those should be considered for inclusion as appropriate.

A range of federal and State transportation planning performance goals aligned to performance metrics are outlined in Chapter 7 of the 2017 RTP Guidelines¹⁴. While they are meant to inform regional analysis, many could be applied to Corridor Plans. The Solutions for Congested Corridors Program project evaluation criteria from the Road Repair and Recovery Act of 2017 (SB 1) can also help inform the development of corridor goals, objectives, and performance measures.

The feasibility of any given measure will depend on data availability and level of analysis to be conducted. Chosen performance measures should also support any related regional performance measures, while being able to be tailored to identify corridor-level issue areas. Table 1 and Table 2 provide examples of corridor goals linked to objectives and performance measures for consideration by corridor planning teams.

¹³ <https://dot.ca.gov/programs/transportation-planning/office-of-smart-mobility-climate-change/smart-mobility-active-transportation>

¹⁴ <https://dot.ca.gov/programs/transportation-planning/regional-planning/federal-state-planning-program>

GOAL	OBJECTIVE	PERFORMANCE MEASURE
Improve Travel Safety	Reduce accident rate for collisions, injuries, and fatalities	• Number of fatal and injury crashes compared to facility type average • Rate of fatal and injury crashes – Fatal and injury crashes per 100 million VMT • Number of bicycle and pedestrian collisions • Rate of bicycle and pedestrian collisions per number of bicycle and pedestrian trips
Improve Mobility - System Efficiency	Reduce Recurrent Congestion/hours of peak hour excessive delay	• Hours of peak hour excessive delay • Person throughput – Corridor total (multimodal) person throughput • Person hours of delay – number of person hours of delay in the corridor • Travel Time Reliability –Level of Travel Time Reliability (LOTTR) or Travel Time Buffer Index
Improve Mobility - System Reliability	Reduce Non-Recurrent Congestion/Improve LOTTR/ Reduce non-recurrent person hours delay	• LOTTR • on-recurrent person hours delay
Reduce GHG and pollutant emissions in support of State goals and standards	Reduce peak hours excessive delay/Improve travel time reliability/Reduce VMT per capita.	• GHG and pollutant emissions, peak hour delay, travel time reliability, VMT per capita

Table 1. Example Set of Corridor Goals and Objectives (continues next page)

GOAL	OBJECTIVE	PERFORMANCE MEASURE
Improve Multimodal Access	Reduce Single Occupancy Vehicle travel demand in peak period / Increase alternative mode share	• Mode share • Availability or existence of High-Occupancy Vehicle (HOV) infrastructure connecting major residence and employment centers
	Improved access to multimodal choices system connectivity, or gap closure	• Availability of connections between modes, convenience of multiple transportation choices • Number of households within 45-minute transit ride of major employment center or college
	Improved Transit Service Frequency /Decrease average wait time for transit service	• Transit service wait time/frequency
	Increased bicycle and pedestrian accessibility/Increase number of Complete Streets features on primary bike/pedestrian network in corridor	• Number of complete street features on primary bike/pedestrian network
Support Economic Opportunity	Improve Freight Travel Time Reliability/Increase access to jobs	• Truck Travel Time Reliability • Access to jobs – Change in cumulative jobs accessibility within 30 minutes (45 minutes for transit) • Access to jobs for disadvantaged populations – Change in cumulative jobs accessibility for disadvantaged populations within 30 minutes (45 minutes for transit)

Table 2. Example Set of Corridor Goals and Objectives (continued)

Analysis Methods

There are a range of factors to be considered by the corridor team when determining the level and type of analysis desired in a corridor planning effort. Table 3, on the next page, identifies factors that should be considered in the selection of an appropriate

Analysis Context											
<u>Study Type</u> ▪ Planning ▪ Design ▪ Transportation Management Plan ▪ Operations ▪ Evaluation		<u>Analysis Horizon</u> • Short Term (1-4 years) • Medium Term (5-10 years) • Long Term (Up to 25 years) • Extended Period (25-100 years)		<u>Analysis Timeframe</u> • Daily • Peak Hour • Peak Period							
Analysis Characteristics											
<u>Geographic Area</u> ▪ Urban/ Suburban ▪ Rural ▪ Isolated Location ▪ Segment ▪ Corridor ▪ Small Region ▪ Large Region		<u>Facility Type</u> ▪ Isolated Intersection ▪ Roundabout ▪ Arterial ▪ Highway ▪ Freeway ▪ High-Occupancy Vehicle Lane ▪ Ramp ▪ Auxiliary Lane ▪ Reversible Lane ▪ Truck Lane ▪ Toll Plaza ▪ Rail ▪ Bus Lane ▪ Express Lanes ▪ Managed Lanes ▪ Bicycle ▪ Pedestrian ▪ Park and Ride Lots		<u>Travel Mode</u> ▪ Single Occupancy Vehicle ▪ High Occupancy Vehicle (2, 3, 3+) ▪ Bus ▪ Rail ▪ Truck ▪ Motorcycle ▪ Bicycle ▪ Pedestrian ▪ Shared Rides ▪ Low/No Emissions Vehicle ▪ Connected/ Autonomous Vehicle ▪ Maritime ▪ Airports		<u>Improvement Strategies</u> ▪ Roadway Infrastructure ▪ Roadway Mgmt. ▪ Integrated Corridor Mgmt. ▪ Active Traffic Mgmt. ▪ Connected Vehicles ▪ Autonomous Vehicle ▪ Truck Bypass ▪ Incident Mgmt. ▪ Weather Mgmt. ▪ Work Zone ▪ Travel Information ▪ Electronic Payment ▪ Transit Services ▪ Transit Infrastructure ▪ Active Transportation ▪ Complete Streets ▪ Shared Mobility ▪ Climate Adaptation ▪ Evacuation Routes		<u>Traveler Responses</u> ▪ Pre-Trip Route Diversion ▪ En-Route Diversion ▪ Mode Shift ▪ Departure Time Choice ▪ Destination Change ▪ Induced Demand ▪ Foregone Demand ▪ Response Timeframe ▪ Real-Time Response ▪ Longer-Term Response		<u>Performance Measures</u> ▪ Delay ▪ Bottleneck Locations & Extents ▪ Travel Time Speed ▪ Travel Time Reliability ▪ Throughput/Volume ▪ LOS ▪ Transit Ridership ▪ Service Frequency ▪ Injury and Fatality crashes ▪ Bicycle and Pedestrian Collisions ▪ Crash Rates ▪ Reduced Safety Conflicts ▪ Access or System Connectivity ▪ Truck Hours of Delay ▪ Truck Travel Time Reliability ▪ Job Access ▪ Disadvantaged Population Served ▪ GHG ▪ Air Pollutants ▪ VMT ▪ Fuel Consumption ▪ Noise ▪ Mode Share ▪ Jobs/Housing Ratio ▪ Benefit/Cost	
Resource Considerations											
<u>Time</u> ▪ Time Available for Study		<u>Data</u> ▪ Accuracy/Quality ▪ Availability ▪ Dynamics ▪ Resources Available for Additional Data		<u>People</u> ▪ Knowledge ▪ Skills ▪ Ability ▪ Availability		<u>Tools</u> ▪ Availability ▪ Cost ▪ Visualization Capabilities ▪ Processing/Run-Time		▪ Ease of Use ▪ User Support ▪ Precision/Accuracy Requirements ▪ Well - Trusted			

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Table 3. Factors to Consider When Selecting an Analysis Method(s)/Tool(s)

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travel analysis tool. The first step is to identify the analysis context for the Corridor Plan (including study type, analysis horizon, and analysis timeframe).

Additional analysis characteristics help identify the analysis tool(s) that are most appropriate for a corridor planning effort. Depending on the analysis goals, objectives, and context, the relevance of each analysis characteristic may differ. Generally, the more characteristics that need to be considered increases the complexity of the analysis tools necessary for detailed results or reduces the level of detail of results using simpler analysis methods. Analysis characteristics to consider include:

- **Geographic Scope**—Is the corridor located in an urban/suburban or rural area and is the tool capable of analyzing the identified study area whether it is an isolated location, segment, corridor, or region?
- **Facility Type**—Is the tool able to analyze the various facility types for the Corridor Plan, such as freeways, express lanes, ramps, arterials, truck lanes, bus lanes, bike and pedestrian facilities, transit and rail, etc.?
- **Travel Mode**—Can the tool analyze necessary travel modes such as single-occupancy vehicles (SOV), high-occupancy vehicles (HOV), no and low emission vehicles, bus, train, truck, bicycle, pedestrians, etc.?
- **Improvement Strategy**—Is the tool able to analyze the potential projects and strategies identified for the Corridor Plan?
- **Traveler Response and Response Timeframe**—Does the analysis tool have the capability of estimating traveler responses to the potential projects and strategies including route diversion, departure time choice, mode shift, destination choice, and induced demand and the response timeframe whether it's a real-time response or longer term?
- **Performance Measure**—Can the tool output the desired performance measures for the Corridor Plan?

The appropriate analysis tool(s) should be identified based on the analysis context and analysis characteristics. Several resource considerations must also be considered to select the analysis method and tool(s) to be used by the corridor team. These resource considerations include the time available to conduct the analysis, data availability, staff availability and skills, and analysis tool features. One specific analysis tool may not address all the Corridor Plan's analysis considerations; multiple tools may be necessary to conduct the analysis.

The corridor team should consider developing an Analysis Plan for corridors of moderate or high complexity. The analysis plan clarifies the analytical approach and methodology, as well as project objectives, the study area conditions, performance measures, strategies being implemented, and the tools and data to be used in the analysis. The Analysis Plan needs to be sufficiently detailed to provide practical guidance on the actual conduct of analysis, yet it should also retain some flexibility to adapt to project contingencies as they are encountered. Iterative updates to the

assumptions, scope, and agreements should take place as the analysis moves forward. The Analysis Plan can also help maintain clear and mutual understanding among stakeholders of the analysis' expectations and assumptions, as well as help identify potential flaws or technical issues in the evaluation of corridor improvements. The FHWA guide on Scoping and Conducting Data-Driven 21st Century Transportation System Analyses (2017) is an excellent resource for developing and implementing transportation analyses.¹⁵

Approaches and appropriate tools for different analysis methods are further discussed in the Corridor Analysis and Outputs area of the Analyze Improvements section.

¹⁵ <https://ops.fhwa.dot.gov/publications/fhwahop16072/fhwahop16072.pdf>

Gather Information

Outcome: Corridor information is collected and organized to inform an understanding of the corridor context, as well as current and future conditions.

Corridor information is collected and organized to inform an understanding of the corridor context, identification of different operational conditions in the corridor (incident days, high-demand days, etc.), current and future conditions, and identification of the likely disruptions that would drive alternative scenarios (such as economic changes, technological innovation, etc.) This information outlines the corridor description, basic system characteristics of the corridor and its unique elements within a larger national, state, and regional context. In addition to gathering information on travel times, volumes, delays, and bottlenecks and their extents, market analysis should be conducted which determines travel patterns (origins-destinations, time of day, day of the week, different transportation modes and mode choice in the corridor, trip purposes, socioeconomic characteristics, industry concentrations, employment, etc.) The assessment of current conditions may require new data collection to fill identified data gaps. Table 4 outlines important topics to include when describing the corridor, but others can be considered for inclusion.

- | |
|---|
| <ul style="list-style-type: none"> • Corridor Context <ul style="list-style-type: none"> ○ Current context (population, employment, travel demand) ○ Future context (population, employment, travel demand) ○ Location, purpose, and users ○ Network and Corridor Designations ○ Issues of Regional Significance ○ Existing planning efforts and studies (State, regional, local) ○ Operational conditions in the corridor (bottlenecks, travel times, demand and delay trends, etc.) ○ Travel patterns (origins-destinations, time-of-day, day of the week, different transportation modes and mode choice in the corridor, trip purposes, socioeconomic characteristics, industry concentrations, employment, etc.) • Community Characteristics • Land Use and Place Types (current and future) • System Characteristics (freeway/highway, arterial, transit, freight, complete streets) • Demand Management Programs and Partnerships • Transportation System Management & Operations Assets, Agreements, Partnerships • Environmental Scan • Climate change vulnerabilities |
|---|

Table 4. Elements of Corridor Description section within Corridor Plan.

Depending on the level of effort, development of a data collection plan will ensure that gaps and any costs for acquiring data (e.g., turning movement counts, cell phone, commercial vehicle Global Positioning Service tracking traffic counts, real estate transactions, business characteristics, etc.) are identified and the time needed for collection is incorporated into the study schedule. Basic data on the corridor description to be collected and documented includes geographic location, population, employment, and travel demand figures. Many other elements of the

corridor description section of a Corridor Plan are qualitative in nature, providing important planning and operational context for the Plan. This includes describing the primary purposes and network designations of the corridor, along with describing the corridor's main users. Issues of regional significance related to the corridor also provide important context, as well as major trip generators and attractors. Existing planning efforts and studies should also be identified.

Expected future changes to population, employment and travel demand are included here to illustrate regional or statewide trends based on current forecasts. The California Department of Finance is an important source of population and employment forecasts. Regional travel demand models and the Statewide Travel Demand Model can provide high-level forecasts of expected travel demand based on the population and employment forecasts.

Community Characteristics

Community characteristics, demographics, economic base, and land use plans are likely to influence the future transportation options for the corridor in terms of trip generation and accessibility and are an important part of the corridor's context. This should include identifying sensitive populations (e.g. children, elderly, tribes, etc.) and communities of concern related to Title VI/Environmental Justice. The Corridor Plan should develop a brief community profile, summarizing the social and economic characteristics of the area served by the corridor.

Land Use, Demographics, and Place Types

Existing and expected land use and demographics should be summarized at the corridor level. This includes a brief description of the Place Types within the corridor area, as well as a general description of local and regional land use, demographic characteristics, broadband, environmental, and development plans. A range of Place Types appropriate for description in Corridor Plans are listed within Caltrans Smart Mobility Framework.¹⁶

System Characteristics

The major elements of a corridor's transportation network are described in this section. They include the highway and arterial network, transit network, active transportation/complete streets network, and freight network. The complexity of the information gathered can vary depending on the nature of the corridor; however, a broad scope and level of detail is generally acceptable.

Demand Management Programs and Partnerships

This section describes major programs and partnerships within the corridor area that serve to reduce travel demand by promoting a range of trip reduction strategies that reduce trips or shift trips to different times, locations, routes, or modes. Such programs are often regional in nature or tied to major employers but can have important influence on travel demand within a corridor. Examples include regional ridesharing or

¹⁶ <https://dot.ca.gov/programs/transportation-planning/office-of-smart-mobility-climate-change/smart-mobility-active-transportation>

shared mobility services, traveler information systems, congestion pricing, or telecommuting.

Transportation System Management & Operations Assets, Agreements, and Partnerships

Gathered information should also include existing operational assets, partnerships, relationships, and programs that affect system management and operations and collectively referred to as Transportation System Management and Operations (TSMO). Examples include ITS components, ramp metering, traveler information systems, incident management programs, and Transit Signal Priority, among others.

Environmental Scan

An environmental scan should be conducted to identify important environmental issues, advanced mitigation, and other factors. For instance, wetlands and other sensitive habitats aren't a factor to be modeled for travel demand but can influence corridor development in terms of the location and type of improvement scenarios that might be considered feasible. As a result, sensitive habitats and landforms need to be identified. Other factors that should be identified include hazardous materials sites, and other sensitive land uses related to air quality and noise. High-level outreach and consultation to resource agencies and organizations may be helpful in conducting this activity. In addition, in areas that are likely susceptible to future changes in environmental conditions due to climate change (e.g., sea level rise, storm surges, coastal erosion, landslides and wildfires) along with identifying the portions of the corridor that potentially face future climate change-related threats.

Data Sources

Important data sources for the corridor planning effort include existing studies, reports, plans and forecasts, including:

- Regional Transportation Plans and General Plans
- Bike Master Plans, Local Transit Agency Plans
- Congestion Management Plans
- Prior corridor studies and planned and programmed projects from existing plans, studies, and reports
- Proposed project CEQA/National Environmental Protection Act (NEPA) environmental documents
- For current and forecasted population and employment, the US Census Bureau¹⁷, California Department of Finance forecasts¹⁸, and local sources (such as chambers of commerce)

¹⁷ <https://www.census.gov/>

¹⁸ <http://www.dof.ca.gov/>

- Caltrans system information, sources include the Division of Research, Innovation, and System Information¹⁹, Division of Operations²⁰ and Division of Transportation Planning²¹, and Caltrans Performance Measurement System (PeMS)²² data
- Caltrans Geographical Information System (GIS) Data Library²³ and local sources such as MPOs and RTPAs

Members of the stakeholder team are typically an excellent resource in identifying and providing the most relevant and current information sources.

Identify Data Needs and Sources for Corridor Performance Indicators

Core data necessary to assess corridor performance includes traffic volumes (average daily traffic and peak hour volumes), mode split and travel patterns. Additional data on actual travel speeds and delay in a corridor can be critical to understanding existing conditions. Level of service (LOS), which is a function of traffic volumes, traffic composition, roadway geometry, and the traffic control at intersections, remains a widely used performance indicator in traffic studies and reports. However, it does not capture the source or extent of congestion, nor does it account for non-recurring congestion (due to traffic incidents, work zones, bad weather, special events, etc.) or factors beyond automobile travel. Therefore, LOS should never be used as a sole indicator of corridor performance; if used it should be in combination with other performance indicators.

Archived operations data form the basis for understanding a wide variety of performance metrics. Sources such as PeMS can be used to assess operational conditions for many freeway corridors and make findings on the effects of recurrent traffic congestion on overall system reliability, transit, and freight performance for such corridors.

The necessary data collection activities for a Corridor Plan could be data intensive or relatively simple depending on the method of performance assessment and evaluation chosen. For example, for complex, congested urban corridors, a large amount of data could be needed by the corridor team, especially if micro-simulation is chosen as the operations analysis method. Stakeholders may also contribute significant data such as signal timing details. Systems that are currently in place to provide transportation system data can significantly reduce the corridor team's efforts for data collection and reduce data collection costs. The corridor team should consider developing a Data Collection Plan to organize and coordinate necessary data collection activities.

There are a wide range of performance measures to consider for use in a Corridor Plan for any category of goal or objective. The feasibility of any given measure will depend on data availability and level of analysis to be conducted. Chosen performance

¹⁹ <http://www.dot.ca.gov/drisi/>

²⁰ <http://www.dot.ca.gov/trafficops/>

²¹ <http://www.dot.ca.gov/transplanning/index.html>

²² <http://pems.dot.ca.gov/>

²³ <https://dot.ca.gov/programs/geospatial-data>

measures should also support any related regional performance measures and be able to be tailored to identify corridor-level issue areas.

Corridor performance measures must be discussed and agreed upon by the corridor team and should link back to the overall corridor goals and objectives. Tables 5 through 8 outline examples of corridor performance measures for Freeway/Highway/Arterial, Transit, Freight, and Complete Streets/Active Transportation performance assessments. These are examples of performance measures, others should be considered and included as appropriate.

Measurements	Data Needs	Sources
Bottleneck Location, Delay, Speed, Productivity	Volume, Speeds	PeMS, big data sources, Caltrans field collection
Peak Hour Excessive Delay	Volume, Speeds	PeMS, big data sources
Travel Time Reliability	Travel time, speeds	PeMS, big data sources
Safety	Incident/Accident reports	Traffic Accident Surveillance and Analysis System, CA Highway Patrol, PeMS
Pavement Condition	Pavement condition	Highway Performance Management System, National Bridge Inventory Database, Caltrans State of Pavement Report, and/or Pavement Condition Index

Table 5. Example Performance Measures for Freeway-Highway Corridor Assessment

Measurements	Data Needs	Sources
Transit ridership	Ridership by route, line, or service	Transit Operator data
Service on-time percentage	On-time percentage by route, line, or service	Transit Operator data
Service hours and frequency	Route, line, or service schedules	Transit Operator data
Number and type of transit-supportive infrastructure in corridor	Infrastructure inventory and description	Transit Operator data, Caltrans, local govt.

Table 6. Example Performance Measures for Transit Corridor Assessment

Measurements	Data Needs	Sources
Productivity	Equivalent Lost Lane Miles; Volume/ Capacity	PeMS
Truck VMT	Truck Volume	Caltrans, HPMS, field collection, big data sources
Truck Travel Time Reliability	Truck Travel Time	Caltrans, big data sources
Container Transfers (Truck)	Number of containers transferred	Port / Intermodal facility operator
Container Transfers (Rail)	Number of containers transferred	Port / Intermodal facility operator

Table 7. Example Performance Measures for Corridor-Based Freight Assessment

Measurements	Data Needs	Sources
Active Transportation Asset Inventory: • Number and type of complete streets features within corridor • -Gap analysis	• Pedestrian crossings • Sidewalk continuity and gaps • Bicycle facility continuity and gaps • Sidewalk and shoulder widths	• Field Review • Google Maps/Streetview • Postmile Query Tool • Geospatial data inventory
Active Transportation Travel Demand	• Trip data- collected via counter or collected via GPS-tracking big data platforms. • Travel demand for active transportation- walking trips, bicycling trips, or short-distance automobile. • Trip generators- schools, parks, residential, etc.	• Collected trip data • Travel demand model • Big Data Platforms • Land use maps
Active Transportation Level of Traffic Stress	• Roadway geometrics such as number of lanes, presence of crossings, etc. • Traffic Data & Databases • Traffic Volumes from Traffic Census • Traffic Speeds	• Refer to Pedestrian and Bicycle Info for more information.
Active Transportation Safety	• Collision Data • Systemic Safety Analysis	• SWITRS/TASAS
First-mile and Last-mile access to transit	• Transit Routes • Transit trips- boardings and alightings • Transit stop access shed analysis	• Transit Operator data • Geo-spatial walkable/bikeable catchment analysis.
Multimodal Network Connectivity		• Refer to FHWA's Guidebook for Measuring Multimodal Network Connectivity for analytical methods.²⁴

Table 8. Example Performance Measures for Complete Streets Corridor Assessment.

Refer to [Toward an Active California: State Bicycle and Pedestrian Plan's](#) Measuring Success section [Page 81] for further information.

²⁴https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/multimodal_connectivity/

Field Visit

Finally, conduct field visits to observe facilities and conditions previously identified as having issues to validate the current conditions findings and to help identify expected and unexpected causes of the issues.

Conduct Performance Assessment

Outcome: Identified performance issues and trends.

A corridor performance assessment is necessary to identify and quantify performance issues, which assists the corridor team in identifying potential solutions for analysis and evaluation. First the type and sources of quantitative data related to corridor performance must be identified and organized, after which the performance assessment can be conducted. Following the assessment and preliminary analysis the corridor team identifies a range of projects and strategies to test.

A performance assessment is conducted to clearly outline system performance and trends, and the results interpreted to highlight the relationship between identified issues and their causes. For the assessment of existing conditions, the most frequent/impactful operational conditions corridor performance issues are identified, and their causes are diagnosed. At a minimum, corridor profiles should be developed for mobility, safety, travel time reliability and sustainability. This task also includes performance assessment for the future baseline (do nothing or no build). A reassessment/adjustment of the performance measures from the scoping effort step may be necessary based on the study of the current conditions and future potential scenarios.

Corridor Performance Assessment

With corridor performance indicators agreed upon and data sources identified, the corridor performance assessment can take place. The results of the performance assessment should clearly outline current system performance, and the results interpreted to highlight the relationship between identified issues and their causes. Agreed upon corridor performance indicators and measures should be grouped by the related goal or key corridor objectives to ensure a clear linkage between objectives and measurable performance. Different types of performance assessments are necessary depending on the range of multimodal and intermodal issues present in the corridor. Four common types of multimodal performance assessments are noted below.

Freeway, Highway, and Arterial Network Performance Assessment

The performance assessment for a freeway, highway and arterial network involves collecting and documenting a range of corridor-wide performance measures that illustrate existing conditions. Identification of traffic bottlenecks and measures related to mobility, travel time reliability, safety and pavement conditions are important indicators of network performance. These indicators serve to illustrate and quantify the magnitude of corridor issues noted in the team's initial scoping.

Transit and Rail Network Performance Assessment

Using data on transit ridership, service frequency and measures such as on-time percentage, the corridor team assesses type and frequency of transit services within the corridor and makes connections between the mobility options of corridor users and the availability and accessibility of transit modes to accommodate that movement. The

corridor team should also assess the existence of supporting infrastructure for transit centers and major transit routes as well.

Freight Assessment

Using data on truck VMT, truck travel time reliability, commodity flows, trip schedules and trip frequency the corridor team assesses the main types and frequency of freight and goods movement services within the corridor and makes connections between the mobility options of freight services and the availability and accessibility of necessary infrastructure or intermodal connections to accommodate that movement. Barriers and gaps to freight services are identified. The FHWA Freight Analysis Framework²⁵ is an excellent resource in conducting a freight assessment.

Complete Streets/Active Transportation Assessment

The performance assessment for complete streets and active transportation needs can leverage many forms of data and analysis. These can include:

- **Conduct Existing Conditions and Asset Inventory:** Using the inventory of existing active transportation/complete street elements as a basis, the corridor team can analyze the necessary connections between important origins and destinations within the corridor and the existence of complete streets features to facilitate movement between those areas. Gaps in system continuity should be identified, with strategies to connect these gaps proposed within the Corridor Plan. The corridor teams should also take note of locations where pedestrian and bicycle access is prohibited or allowed on the State Highway system, to determine whether parallel facilities are needed. The adequacy of existing features in meeting demand and relevant corridor objectives should also be assessed if data on the type and volume of active transportation trips can be ascertained by the corridor team. Further, the condition of assets can provide meaningful information for needs to maintain current systems. This analysis can leverage geo-spatial or tabular inventories for complete streets and active transportation assets. It is encouraged that corridor planning teams conduct field review of these assets and select strategic locations to conduct walk and bicycle audits. These audits can provide qualitative data and recommendations to improve the condition of active transportation assets and connect disparate facilities.
- **Local input and Local or regional planning documents:** Robust complete streets and active transportation planning occurs at the local and/or regional level. Corridor teams should refer to locally- and regionally-adopted complete streets and active transportation plans and include existing and proposed facilities from those plans. Coordination with local and regional agencies can provide valuable input into the selection and prioritization of proposed facilities in these plans. Finally, conducting public

²⁵ https://ops.fhwa.dot.gov/freight/freight_analysis/faf/

outreach and engagement activities is best practice for complete streets planning.

- **Pedestrian and bicycle volume data (collected or inferred using big data platforms):** Many local and regional agencies, as well as local community groups, collect permanent, short-term, or manual counts of pedestrian and bicycle activity. Others are leveraging proprietary 'big data' platforms that use GPS-enabled smart phone apps to estimate walking and bicycling demand and activity. These data can be used to determine locations of highest priority to increase walking and bicycling, or improve the conditions of locations with high levels of pedestrian and bicycle activity. In the absence of data, consideration of travel demand modeling concepts that would suggest locations of high walking and bicycle activity can occur, such as trip generators, connecting nearby communities, schools and employment areas, areas of high population density, and areas with short car trips (0-3 miles) can suggest areas of high demand for walking and bicycling.
- **Pedestrian and bicycle safety data:** Many local agencies that operate and maintain pedestrian and bicycle facilities utilize safety-related data to inform needs assessments, including consideration of pedestrian and bicycle exposure. Several agencies within the state of California have developed "Vision Zero Plans" that identify and prioritize corridors for improvement.
- **Level of Traffic Stress:** There is an emphasis within the active transportation field to consider the level of traffic stress of roadway facilities to propose improvements for people walking and bicycling. This concept is connected to the "Four Types of Cyclists" analytical framework, that shows that a large proportion of survey respondents are often "Interested, Yet Concerned" to bicycle in their community on facilities that place them in close proximity to high vehicle volumes and/or speeds. The Mineta Transportation Institute²⁶ developed a Level of Traffic Stress framework for bicyclists that takes into account automobile daily travel (ADT), Vehicle speeds, and other roadway characteristics to determine the level of stress these factors cause for people bicycling. It also recommends methods to improve the roadway to reduce the traffic stress on that roadway.

For further information, refer to Caltrans' Complete Streets Program webpage²⁷, which provides additional resources in conducting Complete Streets/Active Transportation Assessment and field review within a corridor.

²⁶ <https://transweb.sjsu.edu/research/low-stress-bicycling-and-network-connectivity>

²⁷ <https://dot.ca.gov/programs/transportation-planning/office-of-smart-mobility-climate-change/smart-mobility-active-transportation/complete-streets>

Forecasted Future Performance

While the corridor performance assessment is meant to identify existing issues, it is also important to identify the scale and scope of performance issues in the future if no action is taken or if only already approved investments move forward. This is called the future no build and is one of the bases upon which the benefits of alternative investment scenarios are tested against in the evaluation step of the Corridor Plan.

Only certain performance measures can be forecasted at a corridor level using available tools and expertise, however, meaning only certain performance measures can be used to define a future no build. While most performance measures should be the same as used in the existing performance assessment, travel demand model limitations may not support some existing measures, such as truck delay, truck reliability, mode split, access to jobs, jobs/housing split, VMT, etc.

The Travel Demand Model is one of the primary tools to forecast future performance of a transportation network. Other tools and approaches include Highway Capacity Manual analysis tools and a range of simulation models. Table 9 illustrates some examples of performance measures able to be forecast for purposes of developing a future no build, along with some of the tools used to develop those forecasts.

Measurements	Data Needs	Sources/Tools
Bottleneck Location, Delay, Speed	Forecasted Volumes, Speeds	Highway Capacity Manual analysis tools, simulation models.
Peak Hour Excessive Delay		
Travel Time Reliability		
Truck Trips	Forecasted truck volumes	Travel Demand Model
Transit Trips	Transit Ridership	Travel Demand Model
Active Transportation Trips	Active Transportation trip volumes	Travel Demand Model; sketch planning models; collected pedestrian and bicycle trips; travel analysis platforms utilizing big data to determine pedestrian and bicycle travel.
% trips by Travel Mode (Mode Split)	Trips by travel mode	Travel Demand Model

Table 9. Example Performance Measures and Methodologies for Forecasting Future Performance

System Profiles

Visualizing the results of the performance assessments conducted is important and can be done by developing system profiles for the different types of corridor performance assessed. The purpose of building system profiles is to characterize corridor performance and to help the team identify issues to address. This section describes examples of system profiles for mobility, reliability, safety, and sustainability. The corridor team can choose to develop additional or different system profiles that align with unique corridor issues and objectives.

Mobility Profile

For highway corridors, a common mobility profile would contain delay and congestion measures for travel time, vehicle delay, bottleneck throughput, queue length and other attributes including induced demand depending on the nature of the issue and the system features. For example, to create a freeway corridor congestion profile, travel time and bottleneck throughput may be selected as performance measures; to analyze an intersection performance, queue length and vehicle delay may be used throughout the study. Mobility profiles may also be generated for managed lanes or alternative mode choices.

Reliability Profile

Non-recurrent congestion, or the extent of unexpected delay can be profiled by measuring and displaying travel time reliability, typically for highway corridors. A within-day time-variant travel time chart is an effective way to convey travel-time reliability for a travel corridor. The FHWA Travel Time Reliability Measures Guidance²⁸ suggests a set of performance measures to quantify travel time reliability: 90th or 95th percentile travel time, buffer index, planning time index, and frequency that congestion exceeds some expected threshold. As with traditional mobility profiles, reliability profiles may also be generated for managed lanes or alternative mode choices. It is difficult to forecast system resilience (which affects travel time reliability) given the uncertainty with the timing, magnitude, and duration of disruptions. However, for climate change, Caltrans has developed district vulnerability assessments including exposure maps to different types of future threats that can be used as part of the reliability profile.

Safety Profile

Common measures for a safety profile include accident rates and number of collisions, injuries, and fatalities, which can be collected directly from Caltrans or local agency databases. Safety data is useful for identifying potential issues within the corridor that may be addressed by operations strategies. It is important for corridor planners to understand that while reporting safety data at a corridor level is important as part of an overall awareness of corridor issues, it does not take the place of safety investigations and analyses performed by Traffic Operations staff. While reporting of corridor-level safety data in a Corridor Plan is appropriate, planners should not make their own conclusions about safety project options or issues within that corridor. Making such conclusions is the responsibility of traffic safety staff within Caltrans' Traffic Operations function. A district's Office of Traffic Safety should always be consulted when reporting and documenting safety data within a safety profile.

Sustainability Profile

A sustainability profile should focus on reporting corridor performance related to policies that practice environmental stewardship and the fostering of livable, healthy, and equitable communities. Examples of such measures include criteria pollutant and GHG emission estimates, VMT per capita in areas served by the corridor, and measures of multimodal accessibility and connectivity for households and employers. Caltrans

²⁸ Travel Time Reliability Measures Guidance,
http://ops.fhwa.dot.gov/publications/tt_reliability/

Smart Mobility Framework lists Smart Mobility Principles linked to examples performance measures that could help inform development of a sustainability profile; these measures should link to sustainability-related corridor objectives previously identified by the corridor team.

Operational Conditions

Assessment of operational conditions should go beyond describing a single “normal” operational condition derived from the average of different attributes. An important part of the corridor's performance assessment is to outline the range of operational conditions present within the corridor, the level and type of operational factors, and their variability. For example, weather, special events and incidents are key factors that affect system management and operations and should be identified and described in the context of how it affects system management. Identifying a set of operational conditions and its effect on the corridor provides helpful context for any analysis aimed at improving system performance. The availability of data improves the ability to characterize system performance in this way.

Identifying the range of operational impacts for multiple distinct operational conditions will better characterize the transportation system dynamics of the corridor. If adequate data is available, the corridor team should describe and identify operational conditions within the corridor in the following situations:

- Extreme Weather (identify type of weather, frequency, and range of operational impact)
- Special Events (identify type of event, frequency, and range of operational impact)
- Major Incidents (identify most frequent incident type(s) and range of operational impact)

Identify Potential Projects and Strategies

Outcome: Potential projects and strategies identified for analysis and evaluation.

Identify Projects and Strategies for Corridor Analysis

The corridor team will discuss and utilize the results of the current and future performance assessment, as well as the list of previously planned and programmed projects, to identify project and strategy ideas to be carried forward into the corridor analysis. The corridor team will approach how to identify those projects and strategies depending on the causes of the identified issue and their potential to address multimodal corridor objectives. The team will discuss a range of multimodal projects or strategies, consider their ability to address specific corridor objectives, and to make a determination whether to include that project or strategy as part of the corridor analysis.

The number of projects and strategies to be considered for analysis and level of project detail necessary to conduct that analysis will be decided by the corridor team and will depend greatly on the analysis method chosen in the scoping step of the Corridor Plan. Projects and strategies identified for evaluation should clearly identify the corridor objectives they are meant to address.

Freeway/Highway/Arterial Projects and Strategies:

If the corridor team identifies freeway, highway or arterial improvement opportunities as having potential to address corridor objectives, those opportunities need to be refined into project ideas for the corridor analysis and evaluation. The team will discuss the extent to which specific project ideas address identified issues compared to other corridor objectives and will advance project ideas to be evaluated on that basis. A range of qualitative and quantitative analysis tools can assess the project-level impacts of individual highway projects and strategies if desired. Sketch planning tools that can assess high-level project impacts for highway projects and strategies can often be appropriate here; see the Role of Analysis Tools area in the Analyze Improvement Strategies section for more information.

Transit Projects and Strategies:

The corridor team may wish to consider new or improved transit services in a corridor to address certain corridor objectives. Revisiting corridor goals and objectives and comparing them to identified gaps and issues can help identify a range of transit services that could address those issues. For exploring transit service options, the Transportation Research Board's Transit Capacity and Quality of Service Manual is a comprehensive resource.²⁹ Issues and opportunities may also be identified in local and regional transit plans.

New or improved transit services along with associated infrastructure such as park and ride lots may also be promoted as mitigations for current and future highway congestion, to increase person trips through the corridor, to provide additional mobility

²⁹ TCRP Report 165. Transportation Research Board, 2013.
<http://www.trb.org/Main/Blurbs/169437.aspx>

options beyond driving and carpooling, to reduce VMT, and to augment highway system investments (such as operating highway-based bus rapid transit on new Express Lanes).

Transit improvement opportunities identified by the corridor team need to be refined into project ideas for the corridor analysis and evaluation. The team will discuss the extent to which specific project ideas address identified issues compared to other corridor objectives and will advance transit projects to be evaluated on that basis. One or more transit improvement opportunities are then packaged to define projects for evaluation.

Complete Streets Projects and Strategies:

The corridor team may wish to consider Complete Streets projects to address certain corridor objectives related to increasing walking and bicycling trips; improving connectivity, accessibility, or comfort; or reducing risks for people walking and bicycling. If so, the team will review the applicable performance assessment results along with a review of gaps in walking and bicycling networks to identify Complete Streets opportunities. Caltrans' Complete Streets Elements Toolbox³⁰ and Complete Streets Project Planning Guide are excellent resources in providing Complete Streets elements to consider in projects and provide selection guidance appropriate to specific facility types and Place Types noted in Caltrans Smart Mobility Framework³¹.

Complete Streets improvement opportunities identified by the corridor team need to be refined into project ideas for the corridor analysis and evaluation. The team should discuss the extent to which specific project ideas address identified issues compared to other corridor objectives and should choose Complete Streets projects to be evaluated on that basis.

Freight Projects and Strategies:

The corridor team may wish to consider freight projects and strategies to address certain corridor objectives. With the basic freight inventory and assessment as background, an analysis of freight system issues can be conducted, beginning with a review of gaps and other issues to identify improvement opportunities. Any freight projects or strategies should address issues identified in the freight assessment, as well as linking back to corridor goals and objectives. Once the corridor team identifies freight improvement opportunities and other options, they are refined into project ideas for the corridor analysis and evaluation. The team will discuss the extent to which specific project ideas address identified issues compared to other corridor objectives, and advance freight projects to be evaluated on that basis.

³⁰ <https://dot.ca.gov/programs/transportation-planning/office-of-smart-mobility-climate-change/smart-mobility-active-transportation/complete-streets>

³¹ <https://dot.ca.gov/programs/transportation-planning/office-of-smart-mobility-climate-change/smart-mobility-active-transportation>

Climate Change Adaptation and Resiliency Projects and Strategies:

The corridor team should consider climate change in all its projects and strategies. Climate change treatments can be identified and implemented in stand-alone projects or as an element of projects in which it is a complimentary feature. Simply put, climate change and its impacts must be carefully considered in all projects to ensure appropriate treatments are integrated into the overall system. The importance of these considerations is emphasized in Executive Order N-19-19, signed by California Governor Gavin Newsom on September 20, 2019 requiring the redoubling of the state's "efforts to reduce greenhouse gas emissions and mitigate the impacts of climate change while building a sustainable, inclusive economy."

Define Improvement Projects

Individual improvement opportunities and options must be translated into defined projects for the corridor team to carry forward into the corridor analysis and evaluation. This requires that the team refine improvement opportunities and options into defined projects. This refinement is done by ensuring there is sufficient description and information to define the projects to be evaluated.

For the purposes of identifying transportation projects for evaluation, a project is defined as follows: having sufficient scope details to describe specific physical or operational changes to effect desired results, where costs can be estimated, timeline projected, and major limitations anticipated. This would typically be far less detail than would be necessary for a Caltrans PID. If the potential project does not meet this definition, then there may not be sufficient information to perform a qualitative or quantitative analysis. A rough scope and cost estimate needs to be a part of defining the project for evaluation. Table 10 outlines the minimum information required of a potential project candidate or strategy for evaluation.

• Project Name • Project Location • Project Type	• Short Project Description/Scope • Short Purpose and Need • Estimated Total Cost (Capital + Support)
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Table 10. Minimum Project Candidate Information Required for Evaluation

Consider Corridor Integration Options

Once a set of projects and strategies are identified to be evaluated, it is important to consider how certain projects and strategies might need to be integrated or otherwise work together for the benefits of those projects and strategies to be realized. This encourages the corridor team to consider "system" solutions rather than a collection of stand-alone activities. Examples of integration opportunities include:

- Technical integration among different Intelligent Transportation System deployments to support data sharing, multimodal connectivity, or transportation management systems
- Institutional partnership among agencies to support services such as integrated corridor operations, extreme weather response, emergency services, or maintenance

- Interagency transit service agreements
- Regional travel demand management initiatives or programs
- Public/Private partnerships for intermodal freight connectivity

Analyze Improvement Strategies

Outcome: Evaluation of a broad set of solutions for the corridor that can address the identified issues and opportunities.

In this step, possible improvement projects and strategies are grouped into scenarios to be evaluated. A corridor analysis is then conducted to evaluate the impact of potential investments on corridor performance. As the analysis is being conducted, assumptions made in earlier steps can be reassessed and modified if necessary. The analysis can be high-level for broader corridor areas or detailed for more focused corridor study areas.

The analysis of possible improvement strategies begins with defining a set of investment/improvement scenarios to be analyzed, then populating those scenarios with potential projects. The corridor analysis is then conducted to evaluate the impact of those scenarios on corridor performance.

Scenario Development - Baseline, Future Baseline, and Additional Scenarios

A base analysis year and future base year(s) are set by the corridor team. The team then defines and develops a set of "options packages," or investment/improvement scenarios that build on each other. Corridor team input and acceptance of the scenarios being tested is important to make sure that all desired scenarios have been discussed and consensus achieved on a finite set. Table 11 provides an example set of Corridor Plan scenarios.

Base Year: from travel demand model and existing conditions data with no
Future Horizon Year: from travel demand model with no programmed/planned
S1: Most near-term (≤ 5 years), fully funded, programmed mobility-related projects on
S2: Tests ramp metering and other Operational projects to isolate their impacts.
S3: Other programmed or fully committed projects to be delivered ≥ 5 years.
S4: Other project/strategy ideas not presented in previous scenarios.
S5: Trip-making or other demand factors reduced due to other changes in travel
S6+: Combinations of the above

Table 11. Example Set of Corridor Plan Scenarios

The corridor team has the option of developing and examining different scenarios as an iterative process, changing the composition of project groups within scenarios and evaluating them again to change or to improve overall performance. The results of the scenario testing should be consistent with performance metrics employed for initial corridor performance assessment to compare the impacts on the corridor.

Corridor Analysis and Output

The analysis and evaluation of performance effects for proposed projects within different investment scenarios can be conducted using a range of approaches requiring different levels of analysis and expertise. Depending on the analysis method chosen for the corridor by the corridor team, coordination of highway performance with assessment of arterial or transit performance increases the complexity of the study as the desired level of network detail and complexity increases. The level of analysis for the corridor planning effort must relate to the relative level of transportation system complexity for the corridor and the investment scenarios and to the level of resources and expertise available to conduct the work. The level of analysis that the corridor team determined back in the scoping step is applied here in the analysis step. Analysis should consider non-automobile methodology including Level of Traffic Stress, transit connectivity, and pedestrian travel time.

A level and type of system analysis for corridors is described here for three levels of relative effort (low, medium, and high). Regardless of method, the approach needs to be able to compare solutions that address the corridor's issues and approved goals/objectives. The type of analysis conducted (see the Analysis Context section within the Scope Effort section) will determine whether low, medium, or high-detail analysis is required.

Low: Qualitative analysis of performance impact in a matrix format, supplemented by travel demand model screening and/or sketch-planning tools (such as Cal B/C). Outputs are typically order-of-magnitude impact estimates of performance indicators based on highly aggregated data or averages generated from research, case studies and/or professional judgement. A travel demand model can produce rough outputs for mobility, travel time reliability and emissions that can be compared among groups of projects. Cal B/C provides rough estimates of travel time savings, vehicle cost savings, accident cost savings and emissions reductions. This level of relatively simple assessment and analysis can be conducted for a wide range of modal strategies or performance objectives where detail is not possible or warranted. Technical expertise required is relatively low.

Medium: Deterministic or Macrosimulation operational analysis tool (such as the HCM tool FREEVAL, FREQ or OPT), supplemented with sketch-planning tools (such as Cal B/C). For highway corridors, outputs are typically metrics related to delay and other operational characteristics (bottleneck locations, queue length, duration, and variation). From these metrics, travel time reliability and other impacts can be surmised for a limited range of facility types, modes, management strategies and performance measures. The output isn't as

detailed as more advanced simulation tools, and a moderate level of technical expertise is necessary to operate the tools.

High: Meso- or Micro-simulation operational analysis tool (such as AIMSUN or VISSIM), supplemented with sketch-planning tools (such as Cal B/C). For highway corridors, outputs are more detailed metrics related to delay and other operational characteristics (bottleneck locations, queue length, duration, and variation). From these metrics, travel time reliability and a wider range of performance impacts can be surmised. A wider variety of facility types, management strategies and traveler responses can be analyzed as well. The technical expertise needed to run these tools is high.

ROLE OF ANALYSIS TOOLS

To better inform the decision-making process, transportation analysis tools are meant to assist planners and other professionals in evaluating projects and strategies by providing estimates of benefits or impacts. The following are examples of analysis tools often used in corridor-based transportation planning.

Sketch-Planning

Analysis tools in this category provide general order-of-magnitude estimates of performance impacts for individual projects or groups of projects. They are relatively simple and limited in their scope and analytic capability. An example is the California Life-Cycle Benefit-Cost Model (Cal B/C) tool.

Travel Demand Models

These analytical tools model and forecast both current and future travel demand (among other travel characteristics) based on current conditions and future projections of population, employment, and travel behavior. They are typically used to gauge regional impacts of major transportation investments. State DOTs, MPOs, RTPAs, and County-level transportation planning agencies typically operate Travel Demand Models.

Deterministic/Macroscopic Simulation

These traffic operations analysis tools predict basic traffic factors such as capacity, density, speed, delay, and queueing on roadway networks for a range of different projects and operational strategies. They often implement traffic analysis procedures outlined in the HCM. They have fewer data and processing demands than more complex simulation models, but less detailed output. Examples include FREEVAL and FREQ12.

Meso- and Microsimulation

Microsimulation analysis tools simulate the movement of individual vehicles on a roadway network to provide detailed operational analyses. The data and processing requirements are quite large, as well as the level of expertise required to operate and interpret detailed results. The size of microsimulation networks is typically limited as a result. Meso-simulation tools combine features of microsimulation with some of the simpler, aggregated approaches of macrosimulation. Where expertise is available, this can result in more detailed results in larger networks than simpler analysis methods. Examples of microsimulation are AIMSUN, CORSIM, PARAMICS and VISSIM; examples of meso-simulation are AIMSUN, Dynameq and DYNASMART.

Optimization

These tools are meant to optimize the efficiency of transportation management systems, typically networks of traffic signals and/or ramp metering. The most common tool of this type is Synchro.

Other Tools

Many other tools are available to inform the analysis and evaluation of transportation improvements within a Corridor Plan beyond impacts to traffic operations. Tools that evaluate projects and strategies on sustainability metrics include the INVEST (FHWA) and Mosaic (Oregon DOT) tools.

As with all analysis tools, limitations in their use include data availability, inconsistency of data quality, limited expertise, resources, or training to operate the tool, and limits in the understanding of available tools and their capabilities. For example, Highway Capacity Manual results are not reliable for conditions where the volume-to-capacity (v/c) ratio exceeds 1.0; in those cases, other methods will be necessary. It is important to understand the data analysis capabilities present within the agencies represented in the corridor team and if necessary, have a plan to develop or acquire those capacities.

Corridor Evaluation Results

The output of analysis and evaluation tools are displayed to compare their results. The main output of the corridor analysis should be a matrix that outlines the evaluation results of the projects and strategies tested, grouped by scenario or project type. If the method of corridor analysis allows for it, include the expected corridor performance results for each grouped scenario.

The potential improvements are evaluated using factors that tie back to the corridor goals and objectives. The corridor analysis provides a range of information to the corridor team, helping them evaluate the relative costs and benefits of different projects and strategies. No matter the level of detail the performance and evaluation tools provide, the project team should summarize those results qualitatively (by scenario, investment package or project group) into relative levels of benefit (high, medium, low or none), along with any basic quantitative information (such as CAL B/C). The following tables provide a sample corridor scenario evaluation matrix, as well as a sample corridor project evaluation matrix.

SAMPLE CORRIDOR SCENARIO EVALUATION MATRIX

Scenario #	Scenario Name	Scenario Projects	SAFETY (Non-Recurrent PHD)	MOBILITY (PHD, TTI)	ACCESSIBILITY (Transit Ridership)	ECON DEVELOPMENT (Eq. Truck Travel Time Reliability)	IMPROVE AQ / REDUCE GHG (Ave. Tons)	SAMPLE CAL B/C RATING
Base Year	Base Year Model	No programmed/ Planned scenario projects	#	#	#	#	#	N/A
Future Base Year	Future Base Year Model	No programmed/ Planned scenario projects	#	#	#	#	#	N/A
S1	Fully Funded, Programmed Projects (≤ 5 years)	- Project A - Project B - Project C	# LOW	# MEDIUM	# MEDIUM	# MEDIUM	# LOW	5.5
S2	TSMO Projects	- Project D - Project E - Project F	# HIGH	# MEDIUM	# LOW	# HIGH	# MEDIUM	10.0
S3	Other programmed or fully committed projects to be delivered ≥5 years.	- Project G - Project H - Project I	# LOW	# MEDIUM	# LOW	# LOW	# LOW	1.5
S4	Other project/strategy ideas	- Project X - Project Y - Project Z	# LOW	# LOW	# HIGH	# LOW	# HIGH	4.5
S5	Trip-making or other demand factors reduced due to other changes in travel demand	- Strategy J - Strategy K - Strategy L	# MEDIUM	# MEDIUM	# LOW	# MEDIUM	# MEDIUM	7.0

PERFORMANCE
INDICATORS:

Level of Benefit: High - Medium - Low



SAMPLE CORRIDOR PROJECT EVALUATION MATRIX

Proj. #	Project Name	SAFETY	MOBILITY	ACCESSIBILITY	ECON DEVELOPMENT	IMPROVE AQ / REDUCE GHG	EST. COST	SAMPLE CAL B/C RATING	Existing Fund Source(s)	Project Readiness
1	Project A	HIGH	HIGH	MEDIUM	LOW	MEDIUM		4.5	CMAQ	HIGH
2	Project B	MEDIUM	LOW	LOW	LOW	LOW		1.2		MEDIUM
3	Project C	LOW	MEDIUM	NONE	MEDIUM	NONE		5.5	RM1	LOW
4	Project D	HIGH	LOW	MEDIUM	LOW	MEDIUM		2.5		HIGH
5	Project E	MEDIUM	HIGH	LOW	HIGH	LOW		6	Toll	MEDIUM
6	Project F	LOW	MEDIUM	HIGH	MEDIUM	HIGH		0.5		LOW
7	Project G	NONE	LOW	MEDIUM	LOW	NONE		1.5	STIP	LOW
8	Project H	MEDIUM	HIGH	LOW	HIGH	LOW		3.7		MEDIUM
9	Project I	LOW	MEDIUM	HIGH	MEDIUM	HIGH		22	Dev. Fee	LOW
10	Project J	HIGH	NONE	LOW	LOW	NONE		4.6		LOW
11	Project K	MEDIUM	HIGH	LOW	HIGH	LOW		10.1	SHOPP	MEDIUM

SAFETY:

Impact on Safety: High - Medium - Low

High

Medium

Low

MOBILITY:

Impact on Reducing Person-Hours of Delay: High - Medium - Low

Impact on Accessibility to transportation network: High - Medium - Low

ACCESSIBILITY:

ECONOMIC DEVELOPMENT:

Impact on Freight Mobility and Access to Jobs: High - Medium - Low

IMPROVE AQ / REDUCE GHG:

Impact on AQ improvement/GHG reduction: High - Medium - Low

CRITERIA RATING:

Total of criteria ratings. High - 5 pts. Medium - 3 pts. Low - 1 pt. None/Negative - 0 pts.

CAL B/C:

CAL B/C tool rating

Existing Fund

Source:

Name/Amount of Existing Funds (federal, state, regional, local, or private)

High - Active construction within one year. Medium - Construction within 1-3 years. Low - Construction within 3+ years.

Project Readiness:

Select and Prioritize Solutions

Outcome: A recommended set of solutions for the corridor that can address the identified issues and opportunities.

Decisions are made on which corridor projects and strategies are promising for addressing the identified issues; those recommended are given an expected implementation timeframe in the short-, medium, and long-term horizons. The outcome is a recommended set of multimodal solutions for the corridor that address the identified issues and opportunities, along with estimated implementation timeframes. The combination of promising projects and strategies should be summarized in a statement or document outlining how the corridor is expected to operate, including the recommended technical, organizational, and institutional arrangements necessary for the corridor improvements to realize their expected benefits.

The corridor team meets to make decisions on which corridor projects and strategies to recommend and prioritizes those recommended by assigning an expected implementation timeframe goal: Short (1-4 years), Medium (5-10 years) or Long Term (11+ Years). If the project team recommends any scenario package, project, or strategy, will be the outcome of a selection process that starts with reviewing the results of the project evaluation from the previous step.

The corridor project selection and prioritization process are conducted using the following steps, illustrated as Figure 4.

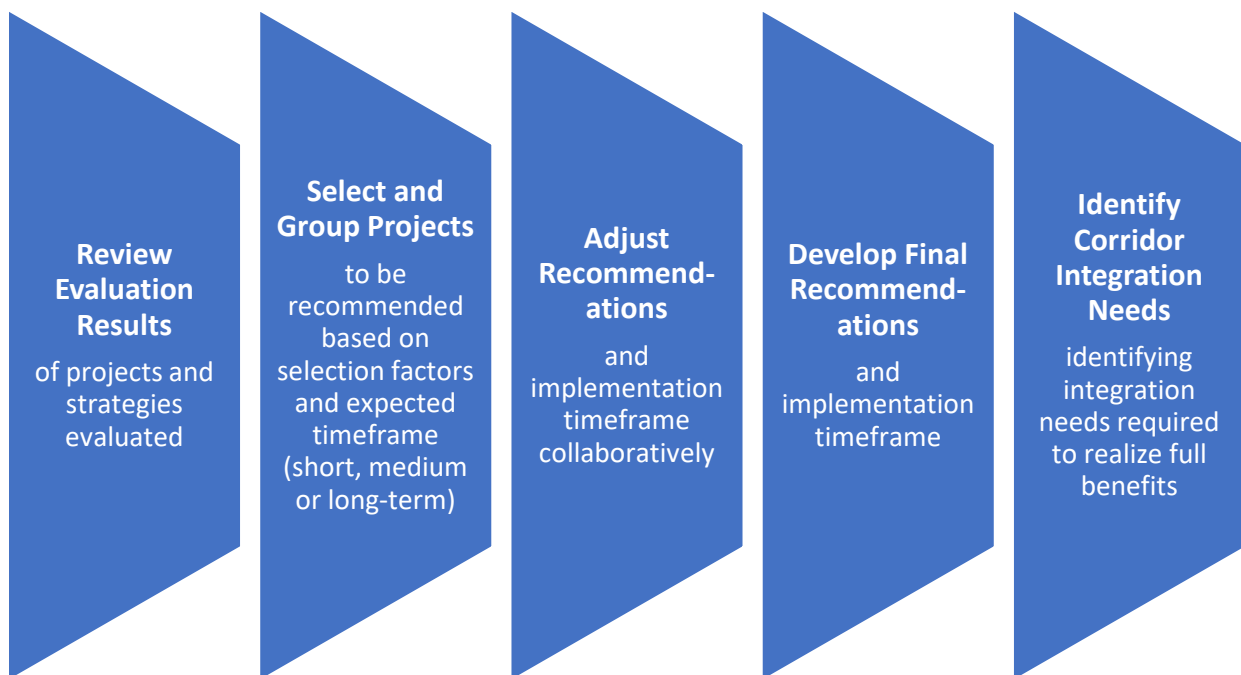


Figure 4. Corridor Project Selection and Prioritization Process

Project Selection and Implementation Timeframe Factors

The process to select projects and assign an implementation timeframe goal is a qualitative valuation, utilizing the results of the corridor project analysis/evaluation from the previous step. The main factors for consideration are those linked to the primary corridor goals and objectives, although they are not the only factors for the corridor team to consider. After deciding which projects to recommend within performance groups, an expected implementation timeframe goal is assigned.

Primary Evaluation Factors

The main factors in selecting projects to recommend are those linked to the primary corridor goals and objectives. To assist in making project recommendation decisions, the corridor team may wish to develop a scoring and weighting system linked to corridor objectives or set a performance threshold among the primary evaluation factors to warrant recommendation of an investment/improvement scenario or individual projects. The corridor team may also find it useful to categorize projects into three performance benefit categories: high-, medium- and lower-performing (or Tier 1, Tier 2, and Tier 3). The lowest performing projects or those that don't meaningfully address any corridor issues may be dropped from further consideration, with high and medium performing projects retained. Some lower-performing projects may be retained under special circumstances. Figure 5 provides an example of a decision-making framework for project selection.

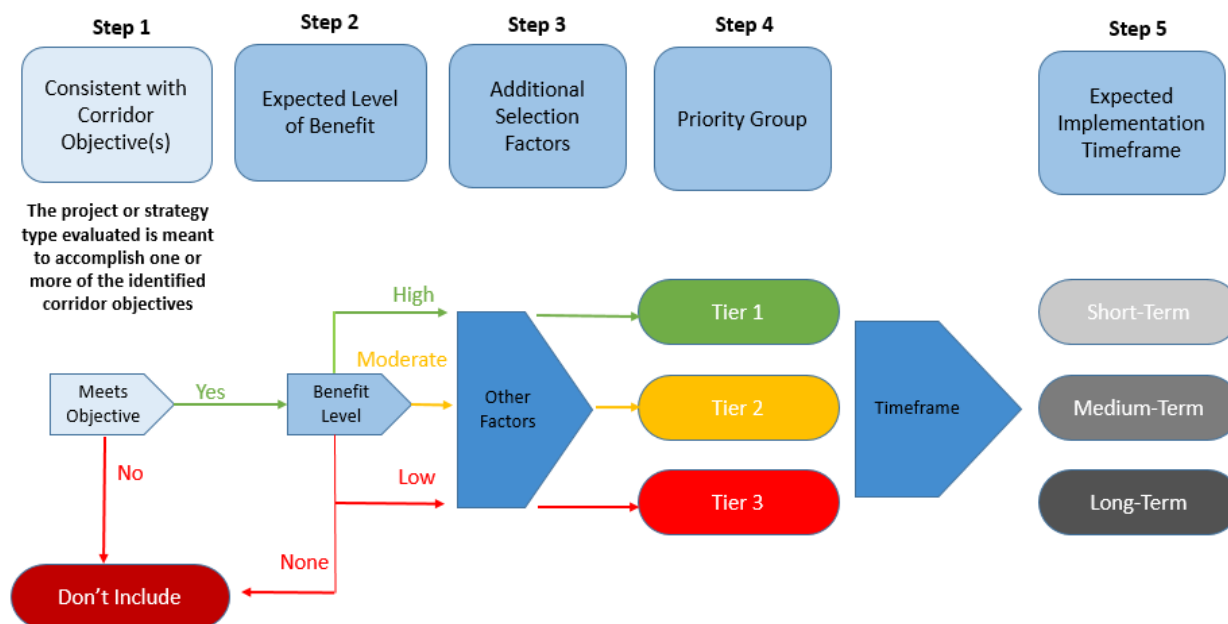


Figure 5. Sample Project Selection Framework

Additional Selection Factors

After evaluating the primary factors, additional factors need to be considered when selecting projects to recommend and their timeframe goal to implement. The corridor team will discuss and decide upon what those additional factors to utilize in their

decision-making. Among the additional factors to inform corridor project recommendations are suggestions illustrated in Table 12.

Benefit/Cost Results • Estimated total project benefits and lifecycle costs (capital plus support, maintenance, and operating costs) • Environmental concerns Project Deliverability or Feasibility • Reasonableness of schedule • Committed vs. uncommitted funds • Unusual construction or Operation and Maintenance costs or methods required Project Sequencing • Steps or prerequisites Matching Funds / Funding Leverage • Can be from federal, state, regional, local, or private sources Regional or Statewide Significance • Equity/regional concerns • Multi-jurisdictional improvement • VMT generation • Evacuation routes/emergency access Other • System continuity • Unusual technical or institutional integration options • Politics • Interregional travel

Table 12. Examples of Additional Project Selection Factors

Collaboratively Adjust Recommendations

After reviewing the initial scenario evaluation results, the project selections and implementation timeframe goals, the team meets to collaboratively adjust those project recommendations and implementation timeframe goals. This discussion is based on group discussion of the full range of selection factors, with the goal being to achieve consensus on final recommendations.

Develop Final Recommendations and Implementation Timeframes

Once accepted by the corridor team, the selected and prioritized projects are considered recommendations of the Corridor Plan and are meant to feed into Caltrans

District System Planning process and regional transportation planning process. This recommended set of multimodal solutions for the corridor address the identified issues and opportunities along estimated implementation timeframes. Project recommendations fed into these processes become eligible for consideration as pre-PID project candidates when funding programs are open. Calls for projects at the federal, state, regional or local level draw from these pre-PID project candidates for possible funding and implementation. Funding will also be a metric for implementation timeframes, especially when the funding sources are competitive programs that do not have guarantees.

Identify Corridor Integration Opportunities

While the output of the corridor analysis is a recommended set of projects and strategies, it is also important to identify overall corridor integration options of those recommended projects and strategies. This section of the Corridor Plan should clearly identify any project and strategy integration options necessary for the benefits of the recommended corridor projects and strategies to be realized. The combination of promising strategies can be summarized in a Corridor Integration Opportunities section of the Plan outlining how the corridor is expected to operate, including recommended technical, organizational, and institutional arrangements necessary for the benefits of the corridor improvements to be fully realized.

Publish and Implement Corridor Plan

Outcome: An adopted and published Corridor Plan that defines how a corridor is performing, why it is performing that way, and recommends projects and strategies that achieve corridor goals and objectives. Documented consensus around recommendations, priorities, performance measures, and responsibilities. Recommendations made ready to be implemented by the corridor partnership.

The corridor planning process is documented with the publication of the Corridor Plan, which can be in any appropriate format (printed plan, electronic document, or any other format that is appropriate for the specific circumstances). The adopted Corridor Plan documents how a corridor is performing today (and estimates for the future), why it is performing that way, and recommends projects and strategies that achieve the corridor goals and objectives agreed upon by its partners. The Corridor Plan includes an implementation schedule, as well as the identification of responsibilities by different partner agencies. In parallel, formal technical, institutional, and organizational arrangements can be initiated among the corridor partners, including use cases about how the corridor is expected to operate under different conditions.

Publication of the Corridor Plan does not represent the end of the corridor planning process but is an important milestone that will be revisited by the corridor team in future review cycles. It should be officially adopted by the lead agency and core partners. After its adoption, it can be officially used to identify project candidates for funding programs or planning efforts that identify future investment opportunities. Figure 6 is a suggested outline for a published Corridor Plan.

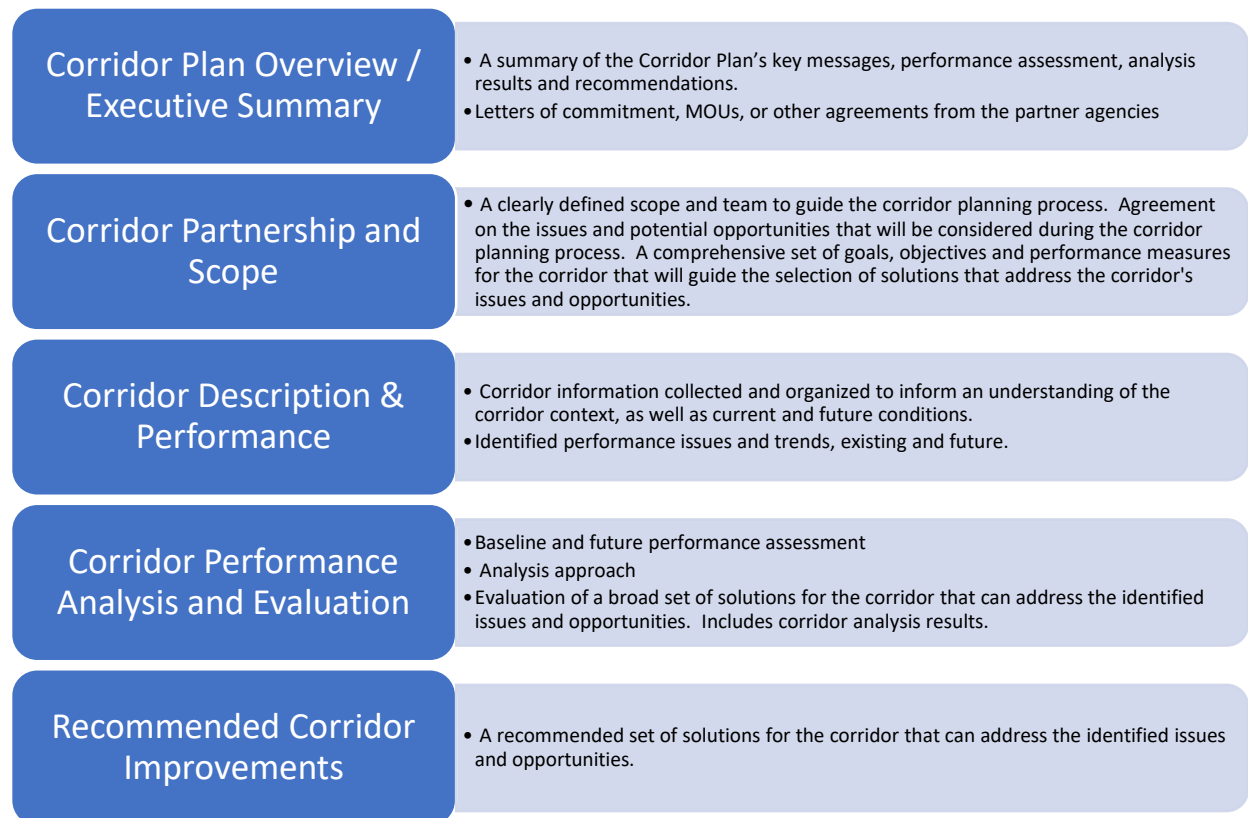


Figure 6. Outline for a Corridor Plan

Monitor and Evaluate Progress

Outcome: Ongoing reporting on corridor performance.

Ongoing reporting on corridor performance is conducted to evaluate the effectiveness of recommended projects and strategies on corridor performance over time. Corridor objectives may also be re-assessed and refined by the corridor team. The Corridor Plan may also identify triggers and events that may necessitate the update of the Plan and a reassessment of strategies. Examples of conditions that may warrant revisiting the Corridor Plan include: technological disruptions or advancements, major new economic, population or environmental changes in the corridor, or significant new regional or statewide planning initiatives.

The results of the corridor planning process are revisited over time by monitoring corridor performance indicators and evaluating the effect of implemented projects and strategies on those indicators. The lead agency and corridor team need to ensure mechanisms are in place for ongoing monitoring and evaluation. The mechanisms should include a plan for monitoring of corridor performance indicators, regular updates of the corridor performance assessment and publication of results. When the corridor team meets to review updated performance assessment results, it is also a good time to reassess the corridor objectives and other approaches to the Corridor Plan to ensure the right issues are still being addressed.

Develop Corridor Performance Monitoring Plan

Developing a Corridor Performance Monitoring Plan ensures a process is in place to regularly conduct corridor performance assessments and report on corridor performance indicators.

Evaluate Corridor Performance Effectiveness

Determine the ongoing effectiveness of implemented strategies by regularly updating the corridor performance assessment initially done earlier in the corridor planning process.

Assess Impacts on Other Plans

Assess the impacts that implementation the Corridor Plan has on other plans such as the CTP, Caltrans SMP and modal plans, RTPs and other planning efforts.

Assess and Refine Corridor Objectives

Following the latest results of the corridor performance assessment, the corridor team should meet to discuss the results and determine if any refinements or adjustments should be made to the corridor objectives, performance assessment or evaluation approach.

Publish Corridor Performance Assessment Results

The results of regular corridor performance assessments should be published to monitor progress over time and help keep corridor partners engaged in the outcome of the corridor planning process.

Appendix A – Laws, Regulation and Policies Pertaining to Corridor Planning

The following is an incomplete listing federal and state laws and regulations that relate to corridor planning.

Federal Law or Regulation

Title 23 United States Code Section 135 (Statewide Transportation Planning)

Defines required statewide transportation planning practices and processes.

Title 23 CFR Part 450.322 (d) (Congestion Management Process)

Defines the CMP, a systematic approach based on the principles of objectives-driven, performance-based planning. A CMP is required to be used in Transportation Management Areas (TMAs) - urbanized areas with a population over 200,000 and should be considered in non-TMA areas. Federal law also states that a congestion management process shall be developed, established, and implemented as part of the planning process (Title 23 CFR Part 450.322(d) and https://ops.fhwa.dot.gov/plan4ops/focus_areas/cmp.htm).

Fixing America's Surface Transportation (FAST) Act

Current funding and authorization bill to govern United States federal surface transportation spending.

Performance Measure 3 (PM3) - Moving Ahead for Progress in the 21st Century Act (MAP-21)

On January 18, 2017, the FHWA published a final rule in the Federal Register (82 FR 5970) that established performance measures State DOTs and MPOs will use to report on the performance of the Interstate and Non-Interstate National Highway System (NHS) to carry out the National Highway Performance Program; freight movement on the Interstate system to carry out the National Highway Freight Program; and traffic congestion and on-road mobile source emissions for the purpose of carrying out the Congestion Mitigation and Air Quality Improvement (CMAQ) Program. The rule addressed requirements established by the Moving Ahead for Progress in the 21st Century Act (MAP-21), and included six national performance measures related to System Performance, as follows:

- Percent of Reliable Person-Miles Traveled on the Interstate.
- Percent of Reliable Person-Miles Traveled on the Non-Interstate NHS.
- Percentage of Interstate System Mileage Providing Reliable Truck Travel Time (Truck Travel Time Reliability Index).
- Total Emissions Reductions by Applicable Pollutants under the CMAQ Program.

- Annual Hours of Peak-Hour Excessive Delay Per Capita (PHED).
- Percent of Non SOV Travel.

Federal regulations require State DOTs to establish and report annual targets related to each of these six performance measures by May 20th of each year. MPOs shall establish a target six-months after state DOTs establish targets (November 16th) by either: 1) Agreeing to plan and program projects so that they contribute toward the accomplishment of the state DOT system performance target for that performance measure; or 2) Committing to a quantifiable target for that performance measure for their metropolitan planning area. In addition, state DOTs and MPOs with NHS mileage in applicable urbanized areas must agree to single, unified PM3 targets for the PHED and Non-SOV performance measures.

State Law or Regulation

California Government Code Section 65086 (Transportation Planning and Programming).

Directs Caltrans, in consultation with partner agencies and jurisdictions, to carry out long-term SHS planning.

The 2017 Road Repair and Accountability Act (SB 1) - <http://rebuildingca.ca.gov/> ; http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB1 ; <http://www.catc.ca.gov/>) is a statewide transportation investment program to rebuild California by fixing streets, highways and bridges across California and targeting funds toward transit and congested trade and commute corridor improvements. These investments are primarily funded by an increase in the state fuel tax. This program is active and already funding projects. One of the main funding programs within SB 1 is the Solutions for Congested Corridors Program (<http://www.catc.ca.gov/programs/sb1/sccp/> ; <http://www.catc.ca.gov/programs/sb1/sccp/docs/sb1-sccp-final-adopted-guidelines-and-resolution-120617.pdf>), which requires that all projects nominated for this funding program must be in a multimodal corridor plan.

California Transportation Commission "Comprehensive Multimodal Corridor Plan Guidelines."

These guidelines are being developed pursuant to California Streets and Highways Code Section 2396 for the Solutions for Congested Corridors Program.

California Government Code Section 14522

Requires the California Transportation Commission adopt guidelines for the development of RTPs; the most recent guidelines were released in 2017 (<http://www.catc.ca.gov/programs/rtp/>). Chapter 2.7 of the 2017 RTP Guidelines state that RTPs should be prepared within the context of corridor planning efforts and other planning processes. Chapter 6.23 of the RTP Guidelines state that the RTP should identify priority corridors related to the federally required congestion management process (Title 23 CFR Part 450.322(d)).

State planning priorities and policy on containing growth in vehicle travel and reducing GHGs are enshrined in law (e.g. AB 32, SB 32, SB 375, and SB 743). These laws place a focus on containing growth in vehicle travel to achieve an array of state objectives, including greenhouse gas emissions reduction, improvement in air quality, environmental protection, improvement of public health, and fiscal soundness. Key metrics for measuring and modeling these outcomes include VMT and GHGs.

Sustainable Communities and Climate Protection Act (SB 375)

Supports the State's climate action goals to reduce GHG emissions through coordinated transportation and land use planning.

California Transportation Plan (SB 391)

Expanded the scope of the CTP by requiring that the plan address how the State will achieve maximum feasible emission reductions to attain a statewide reduction of GHG emissions.

Jobs and Economic Improvement Through Environmental Leadership Act (SB 743)

Created a process that changed the way that transportation impacts are analyzed under the CEQA.

California Global Warming Solutions Act (AB 32)

Established statewide GHG emissions targets and requirements.

Executive Order N-19-19 (2019)

Governor signed executive order requiring every aspect of state government redouble its efforts to reduce greenhouse gas emissions and mitigate the impacts of climate change while building a sustainable, inclusive economy.