Smart Mobility: A Caltrans Handbook

Draft
for Review by Smart Mobility Framework Technical Advisory Committee

May 11, 2009

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Preface

The new millennium has been a period of fast change for everyone in California concerned with transportation. On the one hand, we have new awareness of global climate change and the gravity of its impacts. On the other hand, we are called upon to respond to emerging values and priorities of communities throughout the state. These include the desire to give social equity and environmental justice concerns a more central role in transportation decisions and also to give a heightened emphasis to livability. Against a backdrop of continued demand for a very high level of personal mobility, these challenges deepen the complexity of already-complex challenges in the transportation sector.

These challenges come at a time of dramatically limited financial resources, making prudent and effective expenditure of funds a vital element of any successful solution. Solutions must address as well the State's anticipated population growth, with expectations that there will be 50 million Californians by 2030.[1] The State's demographic, environmental, economic, and quality of life challenges are relevant to virtually every dimension of public policy. This Handbook focuses on the role of mobility in meeting these challenges, as an essential ingredient in meeting people's needs for full participation in society, a contributor to environmental quality, and a significant factor in supporting economic activity.

The interrelated challenges posed by these issues have not gone unanswered. The widespread endorsement of sustainability principles highlighting the "3Es" of environment, economy, and equity is a basis for decisions and actions that comprehensively address contemporary challenges. Caltrans has embraced the principles and incorporated them into the California Transportation Plan (CTP).

The CTP and other Caltrans activities, notably the Department-sponsored Regional Blueprint Planning Programs, reflect the recognition that a full set of transportation strategies includes initiatives to address land use and development. This Smart Mobility Handbook takes a broad view of available strategies and introduces new approaches to solving the mobility crunch faced by the State's households and businesses. It places new concepts and tools alongside well-established ones. It calls for participation and partnership by agencies at all levels of government, as well as private sector and community involvement.

The Smart Mobility Framework emphasizes travel choices, healthy, livable communities, reliable travel times for people and freight, and safety for all users. This vision supports the goals of climate change intervention and energy security. The Handbook lays the foundation for Caltrans and partner agencies to actively and successfully pursue the Smart Mobility vision, and gain its many benefits.

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[1] State of California, Department of Finance, *Population Projections for California and Its Counties 2000-2050, by Age, Gender and Race/Ethnicity,* Sacramento, California, July 2007. accessed 3/26/09 from http://www.dof.ca.gov/HTML/DEMOGRAP/ReportsPapers/Projections/P3/P3.php

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Executive Summary

This Handbook establishes a foundation for Caltrans' Smart Mobility Framework with concepts, tools, and resources that respond to today's transportation challenges. Smart Mobility is an approach that addresses:

- **The State's mandate to address climate change**. A positive and integrated approach to the State's transportation future is an urgent need if the State's goals for reduction of greenhouse gas emissions are to be achieved.
- **The need to reduce per capita vehicle miles traveled**. Reduced auto use will lower greenhouse gas emissions and emission of conventional pollutants, reduce petroleum consumption and associated household transportation costs, and minimize negative impacts on air quality, water quality, and noise environments.
- **Demand for a safe transportation system that gets people and goods to their destinations**. Smart Mobility must be achieved with vigilant attention to the objective of serving the needs of the State's people and businesses. It emphasizes the application of land use strategies and the use of transit, carpool, walk, and bike travel to satisfy travel needs through a shift away from higher-polluting modes.
- **The commitment to create a transportation system that advances social equity and environmental justice.** The California Transportation Plan and has already set forth a commitment to the 3 Es of equity, environment, and economy. Smart Mobility integrates social equity concerns into transportation decisions and investments.

This Handbook:

- Focuses attention on Smart Mobility as an overall approach to respond to the State's interrelated challenges of mobility and sustainability.
- Introduces four principles that shape the Smart Mobility Framework: Location Efficiency, Reliability, Health and Safety, and Stewardship. Each is defined and discussed as a foundation for Smart Mobility.
- Presents tools for incorporating Smart Mobility into policy, planning, and programming: Smart Mobility Place Types (Chapter 3) and Performance Measures for Smart Mobility (Chapter 4).
- Includes, in an extensive Resources section, materials that illustrate best practices and provide research evidence of the benefits of a Smart Mobility approach.
- Creates a foundation for implementing Smart Mobility with projects and programs that apply the concepts, methods, and resources included here.

This Handbook is organized into the following six chapters:

Chapter 1: Introduction

- Purpose and Organization of the Smart Mobility Handbook (Section 1.1)
- History of the Smart Mobility Framework Effort (Section 1.2)
- Relationship to California Transportation Plan, Caltrans Strategic Plan, and SB 375 Implementation (Section 1.3)
- Next Steps (Section 1.4)

Chapter 2: Understanding Smart Mobility

- Definition and reasons for a Smart Mobility Approach (Sections 2.1, 2.2)
- Visions of a Smart Mobility Future (Section 2.3)
- Benefits that can be gained by Smart Mobility (Section 2.4)
- Four principles that help to shape the Smart Mobility Framework (Section 2.5)
- The factors of regional accessibility and complete community design, which are keys to location efficiency (Section 2.5)

Chapter 3: Smart Mobility Place Types

- The concept and uses of Smart Mobility Place Types (Section 3.1)
- The seven Place Types for use in Smart Mobility Framework activities (Exhibit 6)
- How Place Types relate to Location Efficiency, and opportunities to yield Smart Mobility benefits (Section 3.2)
- How Place Types can change to improve Location Efficiency (Section 3.2)
- How the generalized Place Types introduced in the Handbook can be tailored for use in real places (Section 3.4)
- The Smart Mobility Framework and associated activities and investment priorities for each of the Place Types (Section 3.5)

Chapter 4: Performance Measures for Smart Mobility

- The purpose of Smart Mobility performance measures (Section 4.1)
- Definition of 20 performance measures and their relationship to Smart Mobility principles (Section 4.2)
- Comparison of the Smart Mobility measures to established Caltrans performance measures, and identification of the methods and data used to apply the Smart Mobility measures (Section 4.3)
- Description of how the measures apply in different place types and on facility types (Section 4.4)

- Relationship of the performance measures to Caltrans Strategic Growth Framework pyramid (Section 4.5)
- Summary of the benefits of Smart Mobility performance measures to Caltrans policy-making, planning, project development and prioritization (Section 4.6)

Chapter 5: Handbook Conclusions

- Subsequent steps in the Smart Mobility Process, including creation of a set of implementation checklists prioritizing implementation activities to be undertaken by state, regional, and local agencies.
- Some of the implications of the Smart Mobility Approach for Caltrans and partner agencies.

Chapter 6: Resources

- A three-part resources section providing tools, examples, and research findings all relevant to the Smart Mobility Framework.

Moving Forward with Smart Mobility

This Handbook identifies some of the implications of the Smart Mobility Framework in order to illustrate the far-reaching consequences of this new approach. These include:

- **Shifts in Transportation Agencies' Roles**. The Smart Mobility Framework requires several significant shifts in the role of the Department and other transportation agencies. These include:
  - Directing activities to support lower personal vehicle use, while meeting objectives for accessibility, equity, and economic growth.
  - Incorporating into transportation agencies' core missions the creation of secure funding sources for both transit capital improvements and operations, in light of the extremely significant role of transit in a Smart Mobility future.
  - Institutionalizing a new tool for context-sensitive solutions—Smart Mobility Place Types—which are introduced in the Handbook as a way to create the best fit between people, communities, and transportation
  - Consistent application of Smart Mobility performance measures and elimination of the use of performance measures that will work against Smart Mobility outcomes.
- **Interregional Network Role**. Introduction of location efficiency as a Smart Mobility principle emphasizes the factors of complete community design and regional accessibility. Caltrans has responsibility for developing, maintaining, and operating a multi-modal transportation network which has a higher-level function with respect to goods movement, inter-regional, interstate, and cross-border travel. These functions

must be integrated into the Smart Mobility Framework in order to deliver support for economic stewardship, connectivity, and the reliability that is valued by freight shippers and carriers.

- **An Emphasis on Integrated Transportation and Land Use Planning.** Planning is an essential tool in the Smart Mobility Framework. Through the Blueprint planning program, Caltrans has already demonstrated its commitment to supporting planning activities with a Smart Mobility focus.
- **Respecting unique, locally-based approaches to Smart Mobility.** A Smart Mobility approach does not require that all partner agencies use precisely the tools and methods that are presented in this Handbook, but rather that partner agencies pursue supportive outcomes with compatible approaches. The innovation and unique local perspective reflected in the work of different agencies is a great benefit to the development and implementation of the Smart Mobility Framework.
- **Positioned to respond to emerging requirements for sustainable communities planning.** The Handbook is a resource for Caltrans and partner agencies. As of the Handbook's release date in April 2009, implementation of the Smart Mobility Framework is optional. However, work on developing the framework is being undertaken concurrent with work to define implementing activities associated with SB 375 of 2008 relating to sustainable communities planning. The Handbook is available as a basis for program requirements should they arise in connection with SB 375 implementation or climate change intervention programs.
- **Continued innovation with respect to sustainability and Smart Mobility practices.** The Smart Mobility Framework will continue to evolve, innovate, and reinvent itself new opportunities for planning, designing, and operation of the State's transportation system emerge over time.

1 Introduction

Chapter 1 explains:

- Purposes and Organization of the Smart Mobility Handbook (Section 1.1)
- History of the Smart Mobility Framework Effort (Section 1.2)
- Relationship to California Transportation Plan, Caltrans Strategic Plan, and SB 375 Implementation (Section 1.3)
- Next Steps (Section 1.4)

1.1 About the Smart Mobility Handbook

This Handbook establishes a foundation for Caltrans' Smart Mobility Framework with concepts, tools, and resources that respond to today's transportation challenges. Material in the Handbook is relevant to all agencies and organizations concerned with the State's transportation system, from local governments to State agencies. It:

- Focuses attention on Smart Mobility as an overall approach to respond to the State's interrelated challenges of mobility and sustainability.
- Presents tools for incorporating Smart Mobility into policy, planning, and programming: Smart Mobility Place Types (Chapter 3) and Performance Measures for Smart Mobility (Chapter 4).
- Includes, in an extensive Resources section, materials that illustrate best practices and provide research evidence of the benefits of a Smart Mobility approach.

This Handbook's chapters are:

1. **Introduction:** briefly describes the context for the Smart Mobility Framework project, the project's phases, and the organization of this Handbook
2. **Understanding Smart Mobility:** Presents Smart Mobility applications, definitions, visions, benefits, and principles.
3. **Smart Mobility Place Types:** Introduces Smart Mobility place types and provides guidance for each of eight place types relevant to Smart Mobility applications in different parts of the state. Includes references to best practices and resources relevant to specific place types and to the overall approach
4. **Performance Measures for Smart Mobility:** Presents and describes a set of performance measures selected in order to measure the benefits of implementing the Smart Mobility principles.

5. **Handbook Conclusions:** Briefly discusses some of the implications of the Smart Mobility approach as it relates to selected activities.

6. **Resources:** A three-part resources section provides tools, examples, and research findings relevant to the Smart Mobility Framework.

Glossary: Defines key terms.

1.2 The Smart Mobility Framework Effort

The Smart Mobility Framework effort began when the US EPA's Smart Growth Office selected Caltrans as one of six 2007-2008 recipients of "Smart Growth Implementation Assistance" grants. The Office of Community Planning (OCP) in the Caltrans Division of Transportation Planning (DOTP) is the sponsor of the Smart Mobility Framework, with the Governor's Office of Planning and Research and the State Department of Housing and Community Development as partners. The EPA award provided technical support to Caltrans for initial work in developing a "Smart Mobility Framework" to assist with implementation of multi-modal and sustainable transportation strategies in California.

Phase One of the effort, with EPA's support, resulted in a preliminary set of Smart Mobility principles, along with supplemental material. These were the focus of a stakeholder workshop in September 2008. Participants came from within Caltrans and from stakeholders and partners throughout the State. Following the workshop, the material was revised and released as the Smart Mobility Framework Phase 1 report (available at www.dot.ca.gov/hq/tpp/offices/ocp/smf.html). The first section of that report, "Definition and Principles" is incorporated into Section 2 of this Handbook in expanded form.

The creation of this Handbook and related activities to distribute it, receive feedback, and revise it, is part of a second project phase supported by Caltrans Planning & Research funds.

1.3 Handbook Status

The Handbook is not a policy document—the California Transportation Plan includes the formal statement of Caltrans' policies for the statewide transportation system. The Handbook does not address all of the Department's values and goals—the 2007-2012 Caltrans Strategic Plan includes the Caltrans mission statement along with objectives and strategies. While much of the material in these documents is mutually supportive, this Handbook is unique in its focus on a Smart Mobility approach. Ultimately, implementing this approach may mean using the Smart Mobility principles, place types, and performance measures as the basis for changes to the Department's plans and practices. Specific opportunities to align Smart Mobility with Caltrans activities and activities of partner agencies will be highlighted in a set of Smart Mobility checklists to be included in a later version of the Handbook.

Many important components of Smart Mobility are already recognized by Caltrans. These include context sensitive solutions, complete streets, and environmental justice. The California Transportation Plan (CTP) includes a "mobility pyramid" that reflects the need for a full toolbox of techniques to meet the State's transportation needs. These range from system monitoring to system completion, and include operational improvements and land use strategies (see Section 2.1). The Handbook emphasizes careful selection of strategies from the pyramid based on context, objectives, and likely impacts based on the use of Smart Mobility performance measures.

At the time of publication of this review version of the Smart Mobility Handbook, the emphasis of this project is on offering concepts, resources, and strategies that may be implemented at the option of any interested organization. However, that may change when the path for implementing the State's climate change and sustainability planning statutes (The California Global Warming Solutions Act of 2006 and Senate Bill 375 of 2008) becomes firmly established. Other initiatives, such as the on-going development of California's comprehensive Climate Adaptation Strategy, may also be supported by the Smart Mobility Framework.

1.4 Next Steps

Like the project's initial work products, the Handbook will be circulated for comment and will be revised before it is finalized. Participation by partners, stakeholders, and others interested is welcome and will be essential to improve the quality, accuracy, and effectiveness of the material in this document and the Smart Mobility Framework effort as a whole.

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2 Understanding Smart Mobility

Chapter 2 explains:

- Definition and reasons for a Smart Mobility Approach (Sections 2.1, 2.2)
- Visions of a Smart Mobility Future (Section 2.3)
- Benefits that can be gained by Smart Mobility (Section 2.4)
- Four principles that shape the Smart Mobility Framework (Section 2.5)
- The factors of regional accessibility and complete community design, which are keys to location efficiency (Section 2.5)

Key Concepts from Chapter 2:

Smart Mobility is a basis for policy and action that responds to the transportation needs of the state's people and businesses, the mandate to address climate change, and the commitment to a transportation system that advances social equity and environmental justice.

The Smart Mobility Framework rests on four principles: Location Efficiency, Reliability, Health and Safety, and Stewardship.

Location Efficiency is created by two key factors that contribute to Smart Mobility outcomes. These factors—Regional Accessibility and Complete Community Design—contribute to reduced average vehicle trip length, reduced per capita vehicle trips, and greater mode share for trips by walk, bike, and transit.

Smart Mobility principles must be introduced into a wide range of activities undertaken by many public and private organizations, so this Handbook is not limited to discussing activities led by Caltrans.

2.1 What Is Smart Mobility?

Smart Mobility is meeting the transportation needs of people and freight, while enhancing California's economic, environmental, and human resources.

Smart Mobility is an overarching basis for policy and action that coordinates many of Caltrans' existing activities and the activities of other public and private organizations. To be successful in attaining a Smart Mobility future that offers meaningful benefits, Smart Mobility principles must be introduced into a wide variety of activities. These include:

- **Planning and Programming:** Decision making by all levels of government pertaining to infrastructure investments, transportation operations and services, funding, and development policy.

- **Standards and Guidelines:** Standards for transportation facilities such as the Caltrans Highway Design Manual, municipal street design standards, and land development regulations including local zoning and subdivision codes, are included in this category.
- **Implementation—Transportation Projects and Programs:** Scoping, design, and construction of transportation projects including new facilities, maintenance and preservation; operational improvements, programs, and services including transit, traffic control, incident management, traveler information, demand management, etc.
- **Implementation—Development and Conservation Projects and Programs:** Investments in new construction, infill, rehabilitation, and repair are included in this category, as are conservation activities such as land acquisition and ecological restoration. Private sector firms undertake the great majority of these activities.
- **Decision Support:** Activities providing the technical and non-technical basis for determining how Smart Mobility will be implemented across the state to reflect local context, values, and priorities. Decision support includes activities as varied as freeway system monitoring, Caltrans Local Development Review programs, visual simulation, community engagement, and funding for all Smart Mobility applications.
- **Performance Measures:** Evaluation and screening tools used in planning, programming, and ongoing monitoring are included in this category and are the focus of Section 4 of the Handbook.

These applications reflect the range of transportation activities included in the California Transportation Plan's "mobility pyramid," as shown in Exhibit 1.

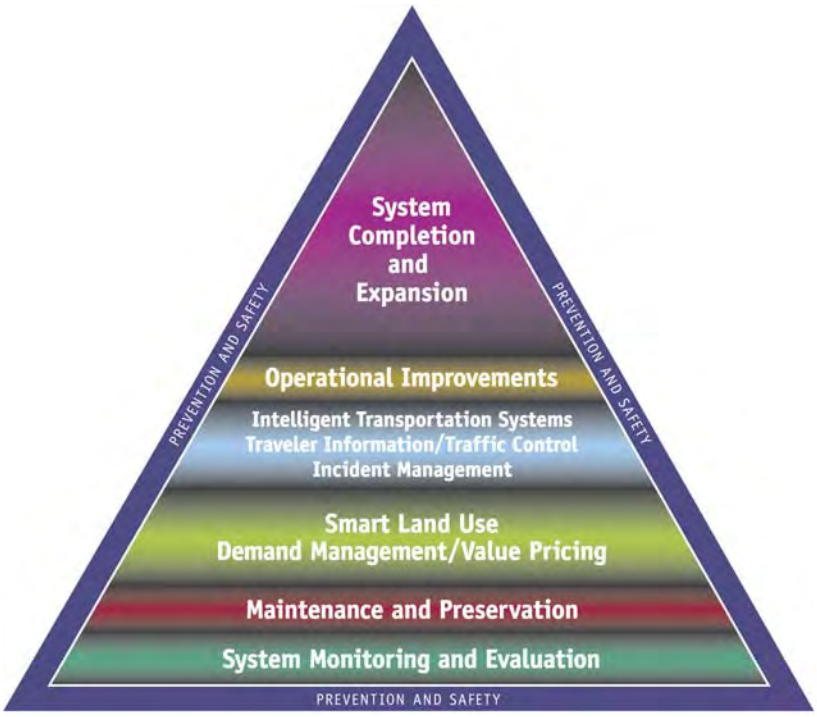

Exhibit 1. Mobility Pyramid and Smart Mobility Applications

		Planning and Programming	Standards and Guidelines	Implementation		Decision Support	Performance Measures
				Transportation Projects and Programs	Development and Conservation Projects and Programs		
Pyramid Mobility Strategies	System Completion	■	■	■			
	Operational Improvements	■	■	■			
	ITS, Traveler Information, Traffic Control, Incident Management	■	■	■			
	Smart Land Use, Demand Mgmt, Value Pricing	■	■	■	■		
	Maintenance and Preservation	■		■	■		
	System Monitoring and Evaluation	■		■		■	■
	Safety	■	■	■			

Given both the scope of these applications and the magnitude of the challenges ahead, the success of Smart Mobility depends on strong relationships between Caltrans and other State agencies as well as regional and local organizations. Caltrans is the primary sponsor of this Handbook, but Smart Mobility's effectiveness will be determined in part by its reach beyond the Department. Attaining Smart Mobility benefits will require public support and the committed and coordinated actions of:

- **Transportation Agencies:** including all of Caltrans' functional divisions, the California Transportation Commission, local government planning and public works departments, regional transportation planning agencies and MPOs, transit operators, Congestion Management Agencies, and agencies administering transportation sales taxes.
- **Agencies with Land Use Authority:** Counties, cities, and tribal governments.
- **Partners in State Government:** The Department of Housing and Community Development and the State Office of Planning and Research are partners in the Smart Mobility effort. Establishing a Smart Mobility program is likely to require continued cooperation with additional entities including the Air Resources Board, the California Energy Commission, the Resources Agency, and the California High Speed Rail Authority. Many of these partners are sources for information and policy that is being used as input into the Smart Mobility Framework effort.

- **Regional Planning Agencies:** The State's regional planning agencies have a particularly influential role in Smart Mobility because of their control over the majority of transportation funding decisions, their leadership of Blueprint planning programs leadership in the creation of the "Sustainable Communities Strategies" under SB 375. Regional efforts have provided valuable technical analysis as well as examples of new approaches to large scale planning that pursue Smart Mobility aims.

2.2 Why Smart Mobility?

The issues addressed in this Handbook are national—even global—in scope. A national panel of experts convened by the American Association of State Highway and Transportation Officials (AASHTO) described the concerns that are propelling this period of change as follows: "America's transportation system … faces the challenges of congestion, energy supply, environmental impacts, climate change, and sprawl that threaten to undermine the economic, social, and environmental future of the nation" (AASHTO Draft Vision Statement—Sustainable Transportation for America). California can be a national leader in facing these challenges by implementing the Smart Mobility Framework's principle and tools in the full range of functional activities at the Headquarters and District levels.

Smart Mobility addresses:

- **Mandate to address climate change**. The urgent need for a positive and integrated approach to the State's transportation future is reflected in the State's pioneering legislation, the California Global Warming Solutions Act of 2006, and Senate Bill 375 of 2008. Successful implementation of both statutes will require action at all levels of government as well as by the private sector and the public.

  California's transportation sector produces almost 40% of the State's greenhouse gas emissions. The State's Climate Change Proposed Scoping Plan recognizes three avenues to reducing this quantity to meet the goals expressed in AB 32 and the Governor's Executive Order S-3-05: through changes in the vehicle fleet, changes in fuel, and changes in vehicle use. Smart Mobility addresses the latter path to greenhouse gas reduction by responding to the transportation needs of people and goods with mobility system changes that reduce reliance on single occupant vehicles. Recognizing that the State's contributions to combating global climate change need to be undertaken in concert with improving communities, climate change is just one of several important drivers of the Smart Mobility approach.

- **Need to reduce per capita vehicle miles traveled and gain multiple benefits**. An overall objective of reducing the average number of auto miles traveled by the average Californian captures a number of priorities. Reduced auto use will reduce greenhouse gas emissions and emission of conventional pollutants, reduce petroleum consumption and associated household transportation costs, and reduce negative environmental impacts on air quality, water quality, and noise environments.

- **Need to respond to people's need to reach their destinations.** Smart Mobility must be achieved with vigilant attention to the objective of serving the needs of the State's people and businesses. It emphasizes the application of land use strategies and the use of transit, carpool, walk, and bike travel to satisfy travel needs through a shift away from higher-polluting modes. The benefits don't just affect the physical environment—they affect public health as well, because reduced auto use is associated with more physically active travel that contributes to better health, lower transportation household cost, and greater reliability.
- **Commitment to create a transportation system that advances social equity and environmental justice.** The California Transportation Plan and GoCalifornia set forth a commitment to the 3 Es of equity, environment, and economy. Smart Mobility systematically integrates social equity concerns into transportation decisions and investments.

2.3 What Does a Smart Mobility Future Look Like?

The State's most populous regions have begun to answer this question by investigating alternative ways to accommodate future growth through the Regional Blueprint Planning program supported by Caltrans. The California Transportation Plan (CTP) provides a basis for a statewide Smart Mobility approach, envisioning a balanced transportation system that promotes sustainability, defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs. The 3 Es of Sustainability are advanced by a Smart Mobility approach.

Exhibit 2: Future Visions from the Blueprint Planning Programs

In Southern California, SCAG's Compass Blueprint Growth Vision encourages:

- Focusing growth in existing and emerging centers and along major transportation corridors
- Creating significant areas of mixed-use development and walkable communities
- Targeting growth around existing and planned transit stations
- Preserving existing open space and stable residential areas

See: www.compassblueprint.org/about.

In the Sacramento Region, SACOG's Growth Principles are:

- Transportation choices
- Mixed-use developments
- Compact development
- Housing choice and diversity
- Use of existing assets
- Quality design
- Natural resources conservation

See: www.sacregionblueprint.org.

In the San Diego Region, SANDAG defines Smart Growth as:

> "…a compact, efficient, livable, and environmentally sensitive urban development pattern which focuses future growth and infill development close to jobs, services, and public facilities to maximize the use of existing infrastructure and preserve open space and natural resources."

The vision associated with SANDAG's smart growth approach includes:

- Higher-density development
- Mixed land uses
- Appealing community design
- Walkable streets in areas near public transit

See: www.sandag.org.

The eight-county San Joaquin Valley Regional Valley Blueprint effort has resulted in seven blueprint principles that include:

Principle #1: Sustainable Planning and Growth, described as:

> "New growth patterns that meet the needs of the present, without compromising the ability of future generations to meet their own needs, within well-defined cities and communities."

Associated with the principle are strategies which target growth in specifically identified areas with an emphasis on:

- Efficient design
- Land conservation
- Infill
- Redevelopment

See: www.sjvalleyblueprint.com.

The San Francisco Bay Area's regional planning activities took shape with the Smart Growth Strategy Regional Livability Footprint Project. Activities supported by Caltrans' Blueprint program come under the banner of "FOCUS: A development and conservation strategy for the San Francisco Bay Area." FOCUS is:

> "…a regional development and conservation strategy that promotes a more compact land use pattern for the Bay Area."

The Bay Area's four regional agencies are united in the program which links land use and transportation by encouraging the development of complete, livable communities in areas served by transit, and promotes conservation of the region's most significant resource lands.

FOCUS directs financial assistance and other resources to selected Priority Development Areas (PDAs) and Priority Conservation Areas (PCAs). For all of the PDAs, FOCUS promotes planning for and developing complete communities.

See: www.BayAreaVision.org.

Significant features envisioned by both the CTP and the Regional Blueprint Planning efforts are:

- **Meaningful travel choices created by:**
  - A transportation system with facilities and services that offer highly-connected multimodal networks with complete streets
  - Development and urban design characteristics that create **communities where walking, bicycling, and transit use are common choices**—including density levels that contribute to shortening many trips and supporting productive transit use.
- A supply of **housing that allows people of all incomes and abilities to live within reasonable distance of jobs**, schools, and other important destinations, so travel doesn't take too big a bite out of household time and budgets.
- **Facilities for all modes that are designed and operated to enhance their surroundings,** and that support economic development by creating favorable settings for investment in development and revitalization.
- Sensitive **environmental areas, natural and agricultural resources protected from adverse impacts** of transportation and development.
- An **inter-regional network for longer-distance travel and freight movement**, connecting the State's towns, cities, and regions to each other, to major intermodal freight transfer points, and to national and international destinations via air and ground transport.
- **Distinctive communities and places** that reflect their own histories, contexts, and economic foundations, and that use Smart Mobility principles in ways that are appropriate to their communities.

Creating a Smart Mobility future that realizes the aspirations emerging from these regional planning efforts as well as meeting statewide objectives will require shared goals and cooperative efforts by State, local, and regional agencies, including Caltrans and the California Transportation Commission (CTC), the State Department of Housing and Community Development (HCD), the Governor's Office of Planning and Research (OPR), California Air Resources Board (CARB), and other State agencies and departments.

Regional transportation planning agencies and metropolitan planning organizations (RTPAs, MPOs), county congestion management agencies, as well as regional and local transit agencies and air districts must be included. Local governments play an essential role because they hold authority for land use and development decisions that must lead the way in building a Smart Mobility future. The basis for this type of shared commitment has gained considerable strength as a result of programs such as regional blueprint planning grants and legislative mandates contained in AB 32, California's Global Warming Solutions Act, and SB 375. Because of this need for consistent, complementary action, this Handbook cites Smart Mobility strategies for many agencies, not just for Caltrans.

2.4 What Are Smart Mobility's Benefits?

Smart Mobility is about changing the way the transportation system performs so that negative environmental and social impacts are reduced and options for people and businesses are increased. Understanding of the potential for these benefits to be gained is based on practical evidence as well as a long history of research investigating the relationship between the built environment and travel behavior. In recent years, a body of research has emerged that specifically focuses on strategies for compact communities, or smart growth. Ample evidence is available to demonstrate the long-term opportunity to yield the benefits listed below. Citations for a number of key research findings associated with Smart Mobility topics are in of the resource section this Handbook (Chapter 6).

Smart Mobility outcomes, achievable over a long-term time frame, include:

- **Improved accessibility** making it convenient for people to reach the goods, services, and activities they need. Accessibility—people's ability to reach their destinations—can improve even when traffic congestion is a problem. Improvements can result when housing, jobs, and shopping become closer together, when non-driving modes are more efficient, or when both types of changes occur. Good accessibility is one reason why households in central, accessible locations have been shown to drive up to 50% less than households in peripheral locations.[2]
- Smart Mobility will create the right conditions for **reducing the average length and number of vehicle trips** that Californians make, thereby reducing energy consumption and greenhouse gas emissions.
- **Greener mobility** strategies that reduce the environmental impacts of travel by

  (1) Reducing vehicle miles traveled (VMT) as a result of improved accessibility,

  (2) Increasing use of lower-polluting modes, and

  (3) Transitioning to cleaner fuels and vehicles

  Such strategies are likely to be essential parts of the Sustainable Communities Strategies required by SB 375. The Air Resources Board's Proposed Scoping Plan highlights these three different and necessary pathways to greener mobility as they relate to climate change.
- **Social equity** will be supported by ensuring that historically underserved communities receive a fair share of the benefits of transportation system improvements. Improved accessibility itself has social equity benefits, by making walk and bike trips competitive choices—thereby improving access for non-drivers and decreasing the impact of transportation costs on household budgets.

[2] "Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use—Studies in Chicago, Los Angeles and San Francisco," John Holtzclaw, et al, 2002.

- **Greener transportation facilities and operations** that reduce direct environmental impacts such as habitat destruction, stormwater pollution, and greenhouse gas emissions, as well as avoiding indirect impacts on land development patterns, such as fostering sprawl.
- **Improved public health** will result from fewer serious crashes, fewer pollutant emissions, and more physically-active travel among all population groups.
- **Reduced energy costs and vulnerability to price escalation** will be achieved as the State becomes less dependent on petroleum consumption.
- **Economic development** will be achieved by minimizing the distance between housing and job centers, revitalizing distressed urban and suburban communities, limiting public infrastructure expenditures to serve far-flung developments, and creating attractive communities that draw and retain talented workers as well as residents.

These benefits will be realized over time as transportation options, land use patterns, and household and business choices evolve consistent with Smart Mobility. Some of these goals will take a long time to realize. Smart Mobility strategies are most likely to result in desired benefits as part of comprehensive programs. "Comprehensive" will mean including in the Smart Mobility Framework some difficult choices. While it is appealing to imagine that Smart Mobility's benefits can be reached through strategies that simply make different travel choices more convenient, there is convincing evidence that stimulating Smart Mobility's benefits will also require deterrents to certain travel behaviors.

For example, traffic congestion is consistently demonstrated to spur public transportation ridership when quality transit services are available. Congestion pricing, parking fees, and bridge tolls help to reduce single occupant vehicle travel. The combined impact of these different sets of strategies has been addressed by Dr. Susan Handy of UC Davis. She explains that both types of strategies—those that improve accessibility and those that manage mobility—are needed:

> "Together, they balance the need to ensure access to needed and desired activities with the imperative of reducing the environmental impacts of driving." [3]

This Handbook focuses on putting accessibility-enhancing strategies into place. However, mobility-management strategies will also be required to achieve the greatest and most reliable gains.

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[3] Handy, Susan. "Accessibility- Vs. Mobility-Enhancing Strategies for Addressing Automobile Dependence in the U.S., Prepared for the European Conference of Ministers of Transport, May 2002. Accessed 3/26/09 from http://www.des.ucdavis.edu/faculty/handy/ECMT_report.pdf.

Exhibit 3: Smart Mobility and Smart Growth: Ideas, Examples, and Inspiration

Helping to shape visions of Smart Mobility are ideas and practices from smart growth, new urbanism, and transit oriented development.

- The New York State Department of Transportation defines Smart Growth as: "sensible, planned, efficient growth that integrates economic development and job creation with community quality-of-life by preserving and enhancing the built and natural environments." See: www.nysdot.gov/programs/smart-planning
- The New Jersey and Pennsylvania DOTs offer ten themes of Smart Transportation including "Build Towns Not Sprawl." See the rest, and case study examples, at: www.smart-transportation.com/themes.html
- The U.S. EPA's 10 Smart Growth Principles are online at: www.epa.gov/dced/about_sg.htm
- For additional information on smart growth, see: www.smartgrowth.org
- The principles of New Urbanism are online at: www.cnu.org/charter
- The Ahwahnee Principles are available at: www.lgc.org/ahwahnee/principles.html
- For resources on transit oriented development, see: www.reconnectingamerica.org

2.5 Smart Mobility Principles

Progress toward attaining Smart Mobility's benefits can best be achieved through focus on a set of key principles. These principles can direct activities in each of the six application areas introduced in Section 2.1.

To achieve mobility goals as well as broader societal objectives, these principles must consistently be implemented with a focus on social equity. Social equity in transportation has two components. The first is to ensure that no group receives disproportional burdens or benefits from transportation investment decisions. The second is that the transportation system allows everyone "…to participate fully in society whether or not they own a car and regardless of age, ability, ethnicity, or income."[4] A transportation system designed to provide social equity ensures that low-income individuals, the young and elderly, persons with disabilities, and disadvantaged individuals in rural and urban areas have access to safe and reliable transportation.

The four Smart Mobility principles of Location Efficiency, Reliability, Health and Safety, and Stewardship are described below.

[4] Caltrans' 2001 Director's Policy-21 on Environmental Justice establishes a commitment to incorporating Environmental Justice into its programs, policies, and activities "to ensure there are no disproportionate adverse impacts, particularly on minority and low-income populations."

1. Location Efficiency: Integrating Land Use and Transportation

Location Efficiency—Statement of Principle: By investing in transportation infrastructure and services to create location efficiency, the ability to achieve high levels of non-motorized travel and transit use, reduced vehicle trip making, and shorter average trip length while satisfying people's accessibility needs is improved.

Location Efficiency—Discussion: Location efficiency is an emerging concept being introduced in Caltrans activities for the first time in the Smart Mobility Framework; it describes the fit between the physical environment and the transportation system that can lead to Smart Mobility benefits. Two "location efficiency factors" determine to a large extent the potential for achieving Smart Mobility benefits. These are

1. **Regional Accessibility**: the extent to which location and the multimodal transportation system combine to make destinations available at the regional, interstate, and even international scales, and
2. **Complete Community Design**: the extent to which development pattern and the transportation system at the neighborhood and area scale combine to support convenience, non-motorized travel, and efficient vehicle trips.

These factors have been shown in recent research, in California and nationally, to be key to affecting transportation system performance (summaries of key research are included in Chapter 6). Regional accessibility is consistently found to be a powerful influence on travel behavior. Research and real-world experience consistently points also to the value of certain community design characteristics in supporting Smart Mobility outcomes. These are the characteristics of "complete communities" that offer:

- A mix of retail businesses and frequently-needed services that are conveniently located from home and work.
- Places that are appealing, safe, and practically-reached by walk and bike trips.
- High-quality urban design that successfully integrates different development types and densities.
- Public facilities and services—including schools, public open space, and quality public realm—well distributed throughout the area.
- Reliable transit service and streets and roads in a state of good repair.

These elements of complete community design, as well as elements of regional accessibility are shown in Exhibit 4. Each of the elements provides a basis for ranking or scoring the quality of a neighborhood, area, or community with respect to the location efficiency factors.

Exhibit 4: Elements of Smart Mobility Factors

Complete Community Design Elements	Regional Accessibility Elements
Building and use intensity	Closeness to urban centers and major employment centers
Land use mix	High level of multimodal circulation system connectivity to other parts of the region
Convenient access to variety of destinations by walk and bike for all users	High level of multimodal access to major institutions and neighborhoods throughout the region for all users
Multimodal circulation network connectivity	Connectivity to regional destinations provided by the freeway and arterial system
Well-connected complete street system forming small blocks	Access to airports, port facilities, interregional passenger rail terminals
Multimodal circulation network connectivity to the region	Multimodal circulation network connectivity to the local network of collector streets, local transit, bike routes
Proximity to local destinations including parks and schools from all neighborhoods	High level of multimodal access to regional parks and open space, places of higher learning, health care and cultural institutions for all users

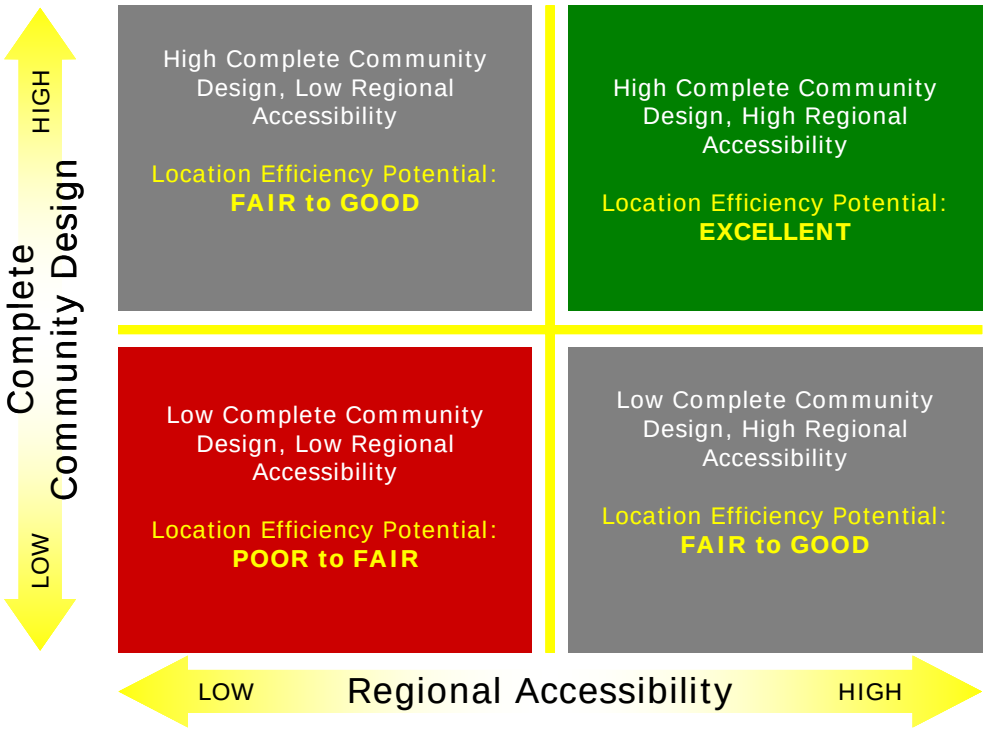
Evaluating these two factors illustrates the conditions necessary for location efficiency to be achieved. As shown in Exhibit 5, the greatest potential to achieve location efficiency—and thus gain positive Smart Mobility outcomes—is when ranking on both factors is high. Practical application of the location efficiency concept is described in Section 3: Smart Mobility Place Types.

As detailed in Section 3.5, Guidance for Smart Mobility Place types, the principle of location efficiency means that transportation activities would focus on:

- Prioritizing system and service improvements that serve places with good regional accessibility, higher densities of population and jobs, and mixed land uses, or improvements that support evolution of these characteristics.
- Creating a more highly connected network to support both complete community design and regional accessibility, thereby promoting Smart Mobility outcomes, recognizing that some parts of the state need a more highly-connected interregional network while others may need more connectivity at the local scale to provide walkability and choice of routes.

- Diversifying travel choices in all locations with an emphasis on serving all users through Complete Streets and the supportive land use and urban design elements of complete community design.
- Addressing interregional travel needs in a way that supports location-efficiency in urbanized areas and avoids unintended growth inducing effects contrary to the Smart Mobility Framework.

Exhibit 5: Location Efficiency Factors



2. Reliability: Manage, Reduce, and Avoid Congestion through Operational and Strategic Actions

Reliability—Statement of Principle: This principle emphasizes reliability for all modes in transportation planning and operational activities.

Reliability—Discussion: Operational strategies will focus on congestion avoidance and reduction through:

- Addressing non-recurring congestion through incident management and work zone planning.
- Implementing operational improvements (including ITS) across modes.
- Using pricing to help manage peak-period demand.

Strategic planning for long-term reliability will diversify and increase the flexibility of the system by:

- Offering walk, bike, and transit options that allow people to choose reliable travel modes, thereby opting out of congestion. A focus on complete streets facilities has been formalized by Caltrans in Deputy Directive 64-R1: Complete Streets: Integrating the Transportation System, and in State statute through 2008 amendments to Sections 65040.2 and 65302 of the California Government Code
- Favoring transportation investments in locations with location efficiency factors that allow Smart Mobility benefits to be realized.
- Establishing secure long term funding for transit capital and operating expenses so that investments and services can stimulate private sector investments in land development and revitalization.
- Prioritizing bus movements on state highway facilities to improve transit reliability, consistent with Caltrans Deputy Directive 98, Integrating Bus Rapid Transit into State Facilities.
- Improving the ability to respond and adapt to natural and human-made disasters and changes.

3. Health and Safety: Improve Public Health and Reduce Serious Injuries

Health and Safety—Statement of Principle: This principle joins together concerns from different but related parts of the public health spectrum. Positive outcomes relating to multiple health concerns can be reached through various strategies, such as providing walk/bike access and incorporating pollutant exposure criteria into school siting decisions.

Health and Safety—Discussion: An emphasis on health and safety calls for the Department and partners to:

- Promote travel by walking, bicycling, and transit to reap benefits to individual health as well as to system reliability. A focus on complete streets requires changes in the circulation network throughout the state to accommodate multimodal travel. Complete community design that increases the number of trips that can comfortably and conveniently be made by walking, bicycling, and transit complements the creation of complete streets. Safe Routes to School is one program focusing on a specific trip type to make it safe and appealing.
- Design, manage, and operate the system to minimize fatalities and serious injuries through various methods, including speed management and access management. These measures can work best in concert with a comprehensive set of traffic safety initiatives ranging from teen driver education to vehicle safety improvements to improvements in emergency services, as is reflected in Caltrans' Strategic Highway Safety Plan (SHSP)
- Reduce public exposure to toxic pollutants generated by the transportation sector. The issue of exposure to diesel exhaust is of particular concern because of its

serious health impacts and the rising volume of freight movement. Reducing public exposure will include approaches that consider vehicle technology and alternative fuels, and siting of sensitive land uses (e.g., schools, hospitals, etc.), multimodal freight system management, and highway operations.

4. Stewardship: Protect and Enhance All of California's Resources

Stewardship—Statement of Principle: The Department's activities, as well as those of other public entities, should protect and enhance the State's transportation system and the built and natural environments. Environmental stewardship includes actions to address climate and energy sustainability.

Stewardship—Discussion: Caltrans has a long-standing commitment to stewardship. The Smart Mobility principle extends its definition to include stewardship of the built environment, and of climate and energy sustainability. This expanded approach to stewardship can help Caltrans and other public agencies prioritize scarce resources by evaluating return on investment—not only in terms of transportation assets but also in terms of economic performance, natural resources, energy sustainability, and community measures.

- **The State's transportation assets.** Smart Mobility emphasizes asset management not just as prudent conservation of the state's infrastructure investments, but also as an important way of supporting re-investment in established urban areas.
- **California's built and natural environments.** State and federal environmental laws focus on avoiding and mitigating adverse environmental impacts. Smart Mobility goes beyond statutory requirements to call for transportation investments and programs that add value to their surroundings, whether they are urban centers, rural towns, or protected lands. The practice of Context Sensitive Solutions, institutionalized through Caltrans Director's Policy 22, is one component of realizing this broad approach to stewardship.
- **Climate and energy sustainability.** The October 2008 Climate Change Scoping Plan from the California Air Resources Board (ARB) identifies 38% of the State's total greenhouse gas emissions as attributable to the transportation sector, the single largest contribution of any sector. Smart Mobility benefits are an essential part of implementing AB 32, the Global Warming Solutions Act of 2006, as has been recognized by the State Legislature and ARB. Legislative findings adopted as part of SB 375 note that "without improved land uses and transportation policy, California will not be able to achieve the goals of AB 32." Land use and pricing strategies are necessary components of the emissions reduction program called for in the adopted Scoping Plan as Measure T-3, Regional Transportation Related Greenhouse Gas Targets.

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3 Smart Mobility Place Types

Chapter 3 explains:

- The concept and uses of Smart Mobility Place Types (Section 3.1)
- The seven Place Types for use in Smart Mobility Framework activities (Exhibit 6)
- How Place Types relate to location efficiency, and opportunities to yield Smart Mobility benefits (Section 3.2)
- How Place Types can change to improve location efficiency (Section 3.2)
- How the generalized Place Types introduced in the Handbook can be tailored for use in real places (Section 3.4)
- The Smart Mobility Framework and associated activities and investment priorities for each of the Place Types (Section 3.5)

Key Concepts from Chapter 3:

Seven place types are introduced as a tool for planning and programming. These place types are: Urban Centers, Close-in Compact Communities, Compact Communities, Suburban areas, Rural and Agricultural Lands, Protected Lands, and Special Use Areas.

The most reliable and most powerful Smart Mobility outcomes will be in places with a high degree of location efficiency, which will be those places with high ranking for both complete community design and regional accessibility.

Using place types as a planning and programming tool requires a focus on place type transitions over time. Places should be identified as primarily fitting into one of two categories:

- Anchored places—those planned to remain as their present type, and
- Transitional places—those that will be targeted for significant change, “evolving” over time to a different place type in order to reach a higher level of Smart Mobility benefits through location efficiency.

Guidance is provided that describes, for each place type, appropriate activities related to Smart Mobility in three categories:

- Planning
- Transportation Projects and Programs
- Development and Conservation Projects and Programs

3.1 Introduction

The Smart Mobility Framework introduces Smart Mobility Place Types. The Place Types are a tool for a general classification of towns, cities, and larger areas to be used as a basis for making investment, planning, and management decisions that advance Smart Mobility. Each place type creates a distinct context for transportation investments and distinct opportunities to gain Smart Mobility benefits. Using place types is one way to integrate transportation and land use planning, since all places include both components.

Application of Place Types

The place types are for the following uses:

- Broadly categorizing areas at the scale of towns, cities, and regional subareas in order to identify the appropriate Smart Mobility Framework
- Identifying appropriate integrated transportation and land use planning activities (these can become part of ongoing local and regional planning activities with broad community engagement, such as General Plan updates and preparation of Sustainable Communities Strategies)
- Identifying broadly types of transportation projects and programs that should be considered as possible priorities in order to yield Smart Mobility benefits
- Identifying broadly types of land use, community development and conservation activities that should be considered as possible priorities in order to yield Smart Mobility benefits.
- Identifying resources and techniques that will support planning, investment and program decision-making
- Bringing attention to opportunities for investments and programs to influence change in places so they achieve higher levels of location efficiency and therefore greater potential to gain Smart Mobility's benefits.

These activities may be undertaken by Caltrans, partner agencies at all level of government, and non-governmental organizations. Each is discussed in connection with each place type in Handbook Section 3.5.

The place types are introduced and described in Exhibit 6. These place types are necessarily broad, and detailed mapping would show that types often co-exist in small areas. The place types are intended to be applied at a generalized level of detail, with the understanding that detailed planning for specific places will provide greater differentiation of locations. In fact, within any large area designated as one of the place types, there will typically be subareas with the character of other places. The State's size and complexity makes this variation inevitable. There are, for example, protected open space lands even within high-rise urban centers.

Exhibit 6: Smart Mobility Place Types

Place Type	Summary Description (existing or planned character)	Rank on Smart Mobility Factors		(Preliminary) Examples
		Complete Community Design	Regional Accessibility	
1. Urban Centers	High density, mixed use places with high jobs-housing ratios overall, well-connected street networks, high levels of transit service and pedestrian supportive environments. Transit-oriented development (TOD) fits into all of the urban place types.			
1a. Urban Cores	Central cities and downtowns of major cities, with full range of horizontally- and vertically-mixed land uses and with high capacity transit stations/corridors present or planned. Hubs of transit systems with excellent transit coverage, service levels, and intermodal passenger transfer opportunities.	Highest	Highest	Downtowns of Long Beach, San Francisco, San Jose, Sacramento, Los Angeles, San Diego, Oakland
1b. Urban Centers	Major activity centers within urban areas, with full range of horizontally- and vertically-mixed land uses and with high capacity transit stations/corridors present or planned.	High	High	Irvine, Berkeley, Palo Alto, Pasadena, Walnut Creek, Santa Rosa, Century City, Fresno, Stockton, Bakersfield, Modesto
2. Close-in Compact Communities	Located near Urban Core or Urban Centers, close-in compact communities are comprised primarily of housing but with scattered mixed use centers and arterial corridors forming the skeleton of the transportation system. Housing is varied in density and type. Transit is available to connect neighborhoods to multiple destinations, with an emphasis on serving commute trips. This place type includes:			
2a. Close-in Centers	Small and medium sized downtowns, Transit Oriented Developments, institutions, lifestyle centers, and other centers of activity.	High	High	Downtowns of San Rafael, Brea, Carlsbad, Orange, Santa Monica and Playa Vista, Uptown San Diego
2b. Close-in Corridors	Arterial streets with a variety of fronting development types, with frequent transit service and transfer opportunities.	Medium	High	San Pablo Avenue, Alameda County,

Place Type	Summary Description (existing or planned character)	Rank on Smart Mobility Factors		(Preliminary) Examples
		Complete Community Design	Regional Accessibility	
2c. Close-in Neighborhoods	Walkable neighborhoods with housing in close proximity to shops, services, and public facilities, as well as good multimodal connections to urban centers. Housing density varies from medium to high. Fine-grained circulation network of streets with high comfort for pedestrians and bicyclists.	High	High	Midtown, Curtis Park, and Land Park Sacramento, Rockridge Oakland, Fillmore and Mission District SF, Little Italy San Diego
3. Compact Communities	Historic cities and towns as well as newer places characterized by a high degree of complete community design. While most compact communities are outside of metropolitan regions, some are on the periphery of metropolitan regions.	High	Moderate to Low	Eureka, San Luis Obispo, Paso Robles
4. Suburban	Community design characterized by a low level of integration of housing with jobs, retail, and services, poorly connected street networks, low levels of transit service, large amounts of surface parking, and significant areas of poor walkability. Density varies greatly among suburban places.			
4a. Centers	Mid-size and small downtowns, lifestyle centers, or other activity centers embedded within suburban areas.	Moderate	Variable	Moderate to High density examples: typical areas of Orange County and Inland Empire counties. Low to Moderate density examples: Central Valley, Salinas Valley and Sierra foothill suburbs
4b. Corridors	Arterial streets with a variety of fronting development types, frequently characterized by poor walk and bike environments, low land use efficiency and poor aesthetics.	Low	Variable	
4c. Dedicated Use Areas	Large tracts of land used for commercial purposes such as business or industrial park or warehousing, or for recreational purposes such as golf courses.	Low	Variable	
4d. Neighborhoods	Residential subdivisions and complexes including housing, public facilities and local-serving commercial uses, typically separated by arterial corridors.	Low to Moderate	Variable	

Place Type	Summary Description (existing or planned character)	Rank on Smart Mobility Factors		(Preliminary) Examples
		Complete Community Design	Regional Accessibility	
5. Rural and Agricultural Lands	Settlement pattern with widely-spaced towns separated by farms, vineyards, orchard, or grazing lands. The rural and agricultural place type may include tourist and recreation destinations which can significantly affect land uses, character and mobility needs. Rural and agricultural lands include:			
5a. Rural Towns	Rural towns provide a mix of housing, services and public institutions in compact form that serve surrounding rural areas. They vary in size from crossroads with single clusters of commercial uses to towns offering a full range of retail and service businesses. Towns may also be the focus of tourist and recreational activity or gateways to recreation areas in protected lands.	Moderate to High	Low	Hillmer, St. Helena, Ferndale, Mariposa
5b. Rural settlements and Agricultural Lands	Scattered dwelling units and supporting commercial uses and public facilities, no significant subdivisions and limited non-agricultural industrial or commercial land use, and lands in agricultural or grazing use.	Very Low	Low	
6. Protected Lands	Lands protected from development by virtue of ownership, long-term regulation, or resource constraints.	Very Low	Variable	National forest and National Park, lands held in perpetuity by land trusts.
7. Special Use Areas	Large tracts of single use lands that are outside of, or poorly integrated with, their surroundings.	Low	Variable	Airports, large industrial facilities, military installations

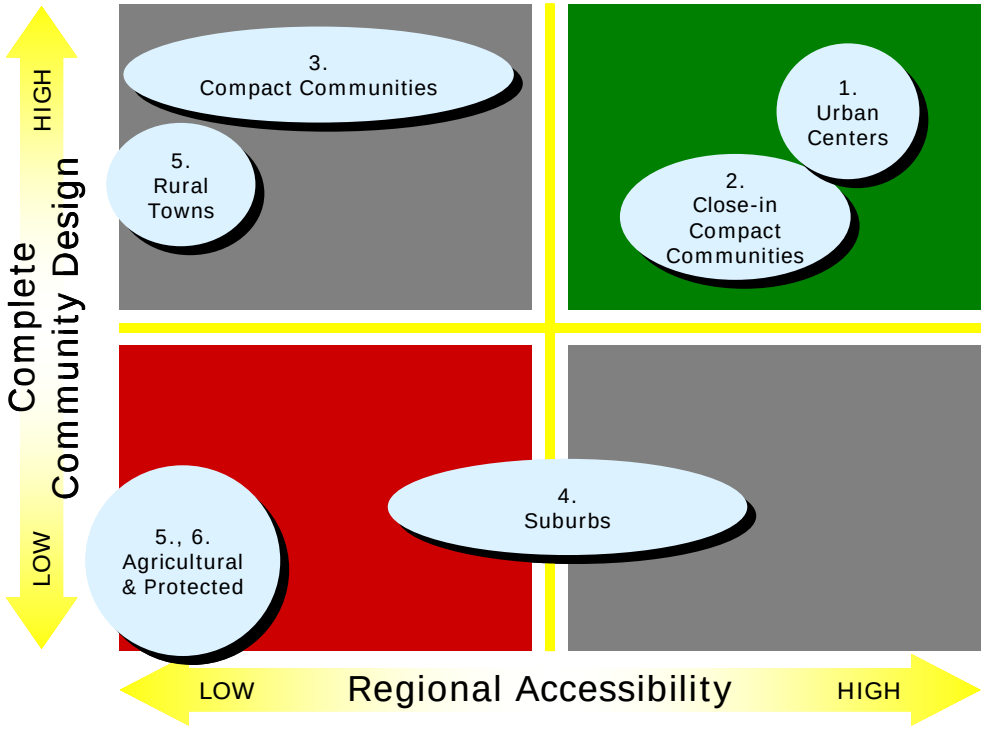
3.2 Place Types and Location Efficiency

The place types are distinguished in large part based on the two "location efficiency factors" introduced in Section 2 in connection with the principle of Location Efficiency: complete community design and regional accessibility. For urbanized areas, the place type system distinguishes between places based on their size, their transportation system characteristics, role in their regions, mix of activities, and design character.

The two location efficiency factors, and the elements that comprise them that are identified in Exhibit 5, are identified based on review of the extensive research literature addressing the relationship between built environment, transportation system characteristics, and travel behavior. The Handbook's Resources section (Chapter 6) includes a summary of selected research that synthesizes over 200 studies of this topic that together support this approach. Together, the two factors significantly influence how places function with respect to mobility and what types of investments will catalyze the Smart Mobility benefits described in Section 2.4. Of course, other factors also play significant roles in determining travel behavior. Notably these include socioeconomic characteristics including household income, age, employment status, and gender.

The most reliable and most powerful Smart Mobility outcomes will be in places with a high degree of location efficiency, which will be those places with high ranking for both factors: complete community design and regional accessibility. Exhibit 7 shows how the place types compare with respect to location efficiency potential.

Exhibit 7: Smart Mobility Place Types and Location Efficiency Potential



Special Note regarding agricultural and protected lands: Agricultural and protected lands sufficiently large to be identified as "places" (rather than patches within other place types) will not achieve direct Smart Mobility outcomes. However, there is a location-efficient model for infrastructure investment in these places, in which low rankings on both location efficiency factors is appropriately matched with low infrastructure investment. The discussions below identify the multiple contributions to a Smart Mobility future made by these place types.

3.3 Place Type Transitions

With significant population and economic growth projected for the State in the coming decades, change in a certainty in California communities. The place type tool, in combination with the Smart Mobility principles, sets the stage for strategic decision making about which transportation programs and projects represent a Smart Mobility approach as cities and towns change over time.

Using place types as a planning and programming tool requires a focus on place type transitions over time. Through planning, investment decisions, and policy-making involving local communities, places should be identified as primarily fitting into one of two categories:

Anchored Places. Places planned to remain as their present type, in which ranking on the Smart Mobility factors may change somewhat but will not vary significantly over time. In these places, investment decisions would be based on enhancing Smart Mobility factors. For example, regional accessibility in an urban core area might be improved with express commute buses to outlying employment centers, or by increasing the supply of affordable housing within walking distance of high capacity transit. Such changes will yield Smart Mobility benefits without changing a place type designation. Generally, urban centers, compact communities, protected lands, and lands in long term agricultural use are anchored in their present place type. Investment emphasis in anchored places would be focused on maintenance and enhancement to maximize Smart Mobility benefits.

Transitional Places. These places will be targeted for significant change, "evolving" over time to a different place type in order to reach a higher level of Smart Mobility benefits through location efficiency. For example, a large suburban business park might be slated to evolve into a true downtown through the addition of housing, neighborhood park, and school, and complete streets. These fundamental changes would represent a transition from a suburban dedicated use area to a close-in urban compact community center. In transitional places, investment emphasis is on supporting evolution to different place types with greater potential for Smart Mobility benefits.

Exhibit 8 provides an overview of transition possibilities and possible investment emphasis in anchored places. In most cases, planning and policy-making activities including community engagement will be essential in determining whether locations are anchored or transitional, and, if they are transitional, what their future form will be.

Some of the place type designations represent a clear call for transition over time, while others can function successfully with respect to Smart Mobility under either anchored or transitional scenarios. As discussed further in the "Smart Mobility Framework" descriptions for each of the place types in Section 3.5, Guidance for Place Types, there is a prescriptive implication to designating places in the "Rural and Agricultural Lands" and "Protected Lands" categories. Infrastructure investments should not induce changes in these places that will lead to their conversion to places with low location efficiency. Similarly, designation of suburban places indicates emphasis on transition in order to achieve the elements of Complete Community Design that contribute to location efficiencies.

The designations as "anchored" or "transitional" place types apply generally and point to overall investment and management strategies. Exceptional locations will certainly be found.

Exhibit 8: Place Type Transitions

Place Type	SM Emphasis	Ultimate Place Type
Urban Centers		Urban Center
Close-in Compact Communities	or	Close-in compact communities or Urban Centers
Compact Communities		Compact Communities
Suburban		
Centers		Depending on regional accessibility and development intensity: • Close-in compact communities, • Urban Centers, or • Compact Communities.
Corridors		
Dedicated Use Areas		
Neighborhoods	or	Depending on regional accessibility and level of change attainable in complete community design ranking: • Suburban neighborhoods, • Close-in Complete Community neighborhoods, or • Complete Communities
Rural Towns	or	Depending on level of change attainable in community size and development intensity: • Rural Towns or Compact Communities
Rural Settlements	or	Depending on level of change attainable in community size and development intensity: • Rural Towns or Compact Communities
Agricultural lands		Agricultural lands
Protected Lands		Protected Lands
Special Use Areas	or	Variable depending on specific characteristics
Anchored Place Types		Investment emphasis is on maintenance and enhancement to maximize Smart Mobility benefits.
Transitional Place Types		Investment emphasis is on supporting evolution to different place type with greater potential for Smart Mobility benefits.

3.4 Matching the Place Types to Real Places

The Smart Mobility place types are general. The guidance presented in section 3.5 for achieving Smart Mobility in these places will be relevant in many cases, but variation and a greater level of differentiation will be needed to fit particular circumstances. Many places will have characteristics of multiple place types and judgment, data and creativity will be needed to craft appropriate distinctions and strategies.

The place type guidance in the next section will be most helpful when the following points are considered during the process of making planning and investment choices:

- Small variations in place type often do not affect the ability to attain Smart Mobility benefits. Differences that are important with respect to community character, market value, or appropriate use may not necessarily be important with respect to mobility outcomes.
- The Smart Mobility factors of complete community design and regional accessibility are consistently significant, so place rankings on these factors should almost always be important factors in making transportation investment, planning and management decisions.
- The resources, references, and best practices identified in this Handbook can be helpful in developing additional place types specific for the region or jurisdiction being reviewed, or refining the place types presented here.
- Empirical data from the selected locality or others with well-matched characteristics should be used to support the need to define additional place types or to confirm the relevance of the Smart Mobility place types.

A number of California agencies are already using place types in their planning efforts. Materials from these efforts cited in the Handbook's Resources section provide useful models for more detailed and region-specific types that are consistent with Smart Mobility aims.

3.5 Guidance for Place Types

This section of the Handbook presents, for each of the seven place types introduced in Exhibit 6, guidance for implementing the overall Smart Mobility Framework. For each place type, the guidance provides the following:

Smart Mobility Framework

The guidance describes the focus of a Smart Mobility approach for the place type with respect to complete community design, regional accessibility, and distinguishing factors that will help to guide investment decisions. This section highlights the relevance of the Smart Mobility principles.

Key Activities

The guidance describes activities related to Smart Mobility that are appropriate in each place type, along with candidate types of investment and operational strategies. For each place type, these are grouped into the following three categories:

- **Planning:** Key activities are listed. These relate to both places that have the place type characteristics described and those that will transition to the place type.
- **Transportation Projects and Programs.** Likely priorities are listed for each place type. The lists:
  - Indicate a range of possible implementation priorities—from maintenance to new construction to operations and services—and are provided without regard for what agency is responsible for implementation.
  - Provide examples of appropriate and, in some cases, less effective project types.
  - Help to highlight similarities and differences between place types.

  Used in combination with planning activities and application of Smart Mobility performance measures, these lists should assist in scenario planning, evaluation, and programming. Because these lists are of necessity general, refinements will need to be made to reflect conditions and opportunities in specific locations. The sequence of presentation does not imply priority.
- **Development and Conservation Projects and Programs**. Likely priorities are listed for each place type. Development projects are in most cases dependent on private sector investments. The lists highlight the types of projects and programs that typically need to be implemented in order to achieve Smart Mobility outcomes. Public agencies can set the stage for implementation through infrastructure investment, planning, and zoning, incentives and other regulatory and investment support. The sequence of presentation does not imply priority.

Other Handbook sections address performance measures for different place types (Chapter 4), references providing support for Smart Mobility applications when they are relevant to a particular place type (Resources Section 6.1) and general references for the place type approach (Resource Section 6.1).

Urban Centers

Smart Mobility Framework

Urban centers are the places that combine high levels of activity connectedness with the lowest vehicle miles traveled per capita of any place type. They are the leading candidates for multimodal strategies for both local and regional travel. A high share of both commute and discretionary trips should be made by transit, walk, and bike. Investments in expanded roadway capacity should be very limited, with major investments instead focused on transit capacity. Urban cores are the places for transportation hubs that offer connections within and beyond the region—to the interregional road system, intercity rail, and international airports.

Auto ownership is typically lower than anywhere else in the region, with positive implications for mode share, amount of land dedicated to parking, and cost of parking as a component of development costs. While some variation is inevitable, all locations in urban centers should have a high degree of activity connectedness. Location efficiency can affect mode choice and length of many trip types because of mixed use and the centrality of regional destinations such as cultural, medical, and educational institutions. Key challenges include maintaining livability and providing a high quality and coverage of transit services despite typically high costs.

Relevance of Principles

- ***Location efficiency*** is at its highest in urban centers, stemming from very high levels of activity connectedness in places where transit, walk, and bike trips compare favorably with SOV travel.
- ***Reliability*** is a key principle guiding investment and operations in urban centers. One dimension is providing people with the ability to conveniently use walk, bike, and high-capacity transit modes on dedicated right of way. Another is an approach to street and intersection operations that focuses on providing reliable travel times through traffic and incident management rather than seeking to relieve recurrent congestion in these high-activity areas. A high level of network connectivity increases reliability by connecting origin/destination pairs with multiple routes, making trips more direct, and supporting multiple ways to travel.
- ***Stewardship*** of the built environment guides facility design in urban centers, with the goal of streets and transit facilities that contribute to placemaking, quality public realm, and valuable settings for private investment. A high level of transit use and non-motorized travel reduces per-capita air quality, climate, and energy impacts.
- The principle of ***Health and Safety*** is interwoven with ***stewardship*** of the built and natural environment, with a high level of physically active travel and compact development footprint contributing to positive health outcomes while reducing per capita green house gas emissions. By providing attractive nonmotorized and transit travel options, urban centers can minimize the adverse impacts of vehicle travel.

Planning

Key activities:

- Designate locations that have the full range of characteristics described for urban cores and centers, and those planned to evolve to urban cores and centers.
- For evolving centers, identify those land use, urban design, and transportation characteristics to be introduced or enhanced in order to improve Complete Community Design ranking.

- Designate locations that have the full range of characteristics described for urban cores and centers, and those planned to evolve to urban cores and centers.
- For evolving centers, identify land use, urban design, and transportation characteristics to be introduced or enhanced in order to improve Complete Community Design ranking.
- Adopt and apply performance and development standards that encourage high-density, mixed-use infill development such as multi-modal LOS and reduced parking requirements.
- Identify areas that have high "latent" location efficiency; i.e., where land use, urban design patterns, and demographic characteristics can improve Smart Mobility outcomes if a fuller range of transportation facilities and services were present.
- Address social equity and environmental justice concerns in part through equitable and comprehensive coverage and quality of transportation services.

Transportation Projects and Programs

Likely priorities in urban centers:

- Direct service by high capacity transit serving local and regional destinations.
- Creation and improvement of major transportation hubs connecting modes for intercity and international travel as well as intra- and inter-regional movement.
- Pedestrian facilities with high amenity levels.
- Extensive network of bicycle facilities.
- Projects that achieve equity aims by providing service, facility, and connectivity improvements to provide an equivalent level of activity connectedness to all population groups and all location-efficient places.
- Convenient opportunities for multimodal and transit transfers for all urban center users.
- For all facilities, high degree of design compatibility with surroundings.
- Investment in existing roadway facilities to protect asset value and provide customer satisfaction.
- Transit stations accessed primarily by interconnecting transit, walking, bicycling, typically with very limited associated parking.
- Operating strategies to optimize use of existing roadway capacity.
- Pricing of parking and roadway capacity.
- Allocation of street space to benefit high-occupancy and non-motorized modes ("complete streets")—e.g. road diets and other cross section changes.
- Carshare and bikeshare programs

Development and Conservation Projects and Programs

Likely priorities in urban centers:

- High density mixed-use development.
- Mixed-income housing in highly-accessible locations.
- Employment centers, major institutions, and regional attractions having complete community design features.
- High density development complemented by high quality public realm and convenient access to a variety of public open spaces.
- Design character that reflects both generally desired complete community design features and the particular design traditions and styles of the location.

Close-in Compact Communities

Smart Mobility Framework

Close-in compact communities have high location efficiency based on the presence of both complete community design and regional accessibility elements. They exhibit completeness in relation to land use and activities, a high level of connectivity of transportation networks, and excellent accessibility to a range of destinations throughout their regions. Achieving Smart Mobility benefits requires a high level of local transit service, safe and convenient walking throughout, and moderately-sized arterial streets that allow for successful integration into their surroundings. Transit oriented developments may be important centers in these areas. Complementing these elements is good multimodal connectivity to employment centers throughout the region, as well as to special institutional uses in nearby urban centers.

Building new freeways can be enormously damaging to close-in compact neighborhoods and are typically not appropriate. This is because they deter walking and biking by creating barriers between portions of the community, they introduce noise, air quality and vibration impacts, and they are generally incompatible with Complete Community Design character.

Relevance of Principles

- ***Location efficiency*** is potentially very high in close-in compact communities, providing excellent activity connectedness and multimodal level of service overall in an environment where people choose transit, walk, and bikes for many trips.
- ***Reliability*** is a key principle guiding investment and operations on major streets to provide people with the ability to conveniently walk and bike. Network connectivity contributes significantly to reliability by offering route options to all modes. A high level of network connectivity increases reliability by connecting origin/destination pairs with multiple routes, making trips more direct, and supporting nonmotorized travel.
- ***Stewardship*** of the built environment guides facility design in close-in compact communities, with the goal of streets and transit facilities that contribute to placemaking, quality public realm, and valuable settings for private investment.
- The principle of ***Health and Safety*** is interwoven with ***stewardship*** of the natural environment, with a high level of physically active travel and a compact development footprint contributing to positive health outcomes while reducing per capita greenhouse gas emissions.

Planning

Key activities:

- Designate close-in compact community locations, distinguishing those that have achieved the full range of characteristics described for centers, corridors, or neighborhoods. In these places, maintenance and enhancement of appropriate community design characteristics is the long term goal.
- Designate locations evolving to close-in compact communities from suburban or rural places, identifying land use, urban design, and transportation characteristics to be introduced or developed in order to create centers, corridors, and neighborhoods with essential complete community design features such as multimodal network connectivity, strong presence of local-serving retail and service uses, and well-integrated public facilities.
- Identify locations where multimodal connectivity to urban centers can be improved.
- Adopt and apply performance and development standards that encourage moderate-density, mixed-use infill development, such as multi-modal LOS and reduced parking requirements.

Transportation Projects and Programs

Likely priorities in close-in compact communities:

- Complete streets projects.
- Reliability and efficiency measures to optimize use of street and freeway capacity
- Street network connectivity including an extensive networked bicycle facilities and continuous pedestrian facilities with high amenity level.
- Continued investment in existing facilities to protect asset value.
- Addition of HOV systems on freeways that provide access to urban centers.
- Transit centers and high capacity transit stations accessed primarily by walking, bicycling, and interconnecting transit, with managed parking supply.
- High capacity transit linking neighborhoods to employment centers and regional institutions in urban centers.
- Local transit with excellent coverage providing connections to high capacity transit lines.

Development and Conservation Projects and Programs

Likely priorities in close-in compact communities:

- Because many close-in compact communities are older parts of their regions, emphasis may be on neighborhood enhancement and revitalization rather than on new development.
- Preservation and addition of affordable housing
- Where housing or commercial uses are to be added, complementary priority given to maintaining or improving public safety and other services as well as providing access to open space and other contributors to livability.
- Where many residents lack access to basic daily needs such as full-service supermarkets, creating complete neighborhoods should be a priority from both the Smart Mobility and livability perspective. Availability of these services is an important element in reducing both vehicle trips and trip lengths while responding to quality of life concerns.

Compact Communities

Smart Mobility Framework

Compact communities offer the Smart Mobility benefits associated with Complete Community Design elements, but without the benefits of regional accessibility that are created by central location in a metropolitan region. Many Smart Mobility benefits can be achieved in compact communities. However, because these places are either outside of or peripheral to metropolitan regions, as well as being small concentrations of activity when compared to major urban cores, prospects for transit use and other benefits of regional accessibility are limited. Nonetheless, Complete Community Design elements such as compact development form, land use mix, relatively high densities, and centrally-located public institutions create efficiencies and opportunities for walk and bike trips to be important modes and for average vehicle trip length to be shortened. Particularly in areas with nearby large employment centers, rideshare may be an important Smart Mobility mode, and its share may exceed transit share for commute trips.

Relevance of Principles

- ***Location efficiency*** is often higher in compact communities than in surrounding areas, which may be rural or agricultural lands or isolated suburban neighborhoods. The priority is on maintaining transportation facilities and services that have a good fit with Complete Community Design elements, retaining those elements. Increased development footprint should be avoided unless there is significant population or economic growth that justifies urban expansion.
- ***Reliability*** is provided through convenient walk and bike trips, and is likely to be a priority for transit operations given the fact that these areas typically cannot support high service frequency.
- ***Stewardship*** is particularly important with respect to the historic character that adds uniqueness to many of the state's compact communities, making compatibility of facilities with their surroundings particularly important. Stewardship of natural resources and agricultural production capacity means carefully planning any outward growth of compact communities, and maintaining a compact development footprint.
- ***Health and Safety***: Pedestrian and bicyclist safety, walkability, and good bicycling facilities are keys to achieving health objectives, with Complete Community Design supporting walking and biking through bringing destinations into proximity.

Planning

Key Activities

- Designate areas where there are opportunities to increase location efficiency through an emphasis on complete community design and on providing a range of multimodal transportation facilities and services.
- Designate areas that will evolve to become compact communities. These will typically be either (1) suburban neighborhoods, corridors and centers outside of or peripheral to metropolitan regions, or (2) rural settlements appropriate for future urbanization.

Transportation Projects and Programs

Likely priorities in compact communities:

- Pedestrian facilities with high amenity levels.
- Extensive network of bicycle facilities; bike sharing program.
- Projects that achieve equity aims by providing service, facility, and connectivity improvements to provide an equivalent level of activity connectedness to all population groups and all location-efficient places. .
- Convenient opportunities for multimodal transfers and transit transfers.
- High degree of design compatibility for all facilities.
- Continued investment in existing roadway facilities to protect asset value.
- Allocation of street space to benefit fronting land uses and non-motorized modes ("complete streets")—e.g. road diets that reduce the number of through travel lanes and other cross section changes.

Implementation: Development and Conservation Projects and Programs

Likely priorities in compact communities:

- Moderate-to-high density mixed-use development.
- Mixed-income housing in highly-accessible locations.
- Cultural, medical, and educational destinations in locations with excellent activity connectedness.
- Appropriate design character for all development in this place type.

Suburban

Smart Mobility Framework

Relative to the principle of location efficiency, suburban development is characterized by both low complete community design and regional accessibility. Suburban places will be impacted by these factors for years to come. Achieving Smart Mobility benefits in suburban areas is difficult, as is creating the elements of Complete Community Design and regional accessibility. These challenges point to the importance of minimizing the creation of new suburban places, i.e. places ranking poorly relative to both of the Smart Mobility factors. This does not mean that all lower-to-moderate density development should be prevented. Efforts should be made to influence the form of new development so that new compact communities or close-in compact communities are encouraged and new suburban development characteristics are is not.

New lower-density development should be in the form of urban neighborhoods or compact communities that are characterized by complete community design and whenever possible by high regional accessibility. All levels of government should work together to minimize new suburban places with poor location efficiency, since it will work against efforts to control greenhouse gas emissions and maintain a healthy economy.

The overall Smart Mobility strategy for suburban places is to transition suburban centers and corridors to close-in compact centers and corridors. Higher density development with Complete Community Design elements would be concentrated in these transition areas. Larger suburban centers may transition to urban centers, which will create regional accessibility benefits for surrounding suburban areas. The implementation possibilities identified below reflect this emphasis on transition away from suburban centers and corridors.

In suburban places, freeway and arterial widening projects, including HOV systems, should be undertaken only when it can be demonstrated that they are unlikely to generate increased pressure on outlying lands for suburban expansion. For the same reason, new interchanges on existing freeways should be constructed only where they are tied directly to adopted local and regional plans for new location efficient growth.

Relevance of Principles

- A high level of Location Efficiency is difficult to achieve in suburban places, which is the main reason for the Smart Mobility Framework emphasis on transformation to other place types. Because activity is relatively concentrated, suburban opportunities for location efficiency are best in suburban centers.
- The principle of Reliability supports an approach to street and intersection operations that focuses on providing reliable travel times through traffic and incident management rather than seeking to relieve recurrent congestion in these auto-dependent areas. As connectivity improves it will offer benefits by connecting origin/destination pairs with multiple routes, making trips more direct, and supporting nonmotorized travel and a modest level of transit use.
- Health and Safety principles direct attention in particular to conditions on suburban arterials, many of which lack basic accommodation for bicyclists and pedestrians. Slower speeds and improved facilities will address paramount safety concerns as well as promoting public health outcomes.
- Stewardship priorities underlie the Smart Mobility Framework for transitioning away from suburban places to compact communities and urban centers, with a focus on change in suburban centers and corridors.

Planning

Key Activities:

- Identify centers and corridors that can be transformation into more location-efficient places. Plan for them in terms of land use, urban design character, and transportation services. Given the high level of public investment and the lengthy time horizon required to stimulate these changes, locations should be prioritized to align with market potential and other community objectives.
- Identify near term opportunities to improve health and safety through active travel, safe routes to school programs, and traffic safety initiatives.

Transportation Projects and Programs

Likely priorities in suburban places:

- Investments that improve the operational efficiency of existing arterial and freeway corridors.
- Projects that improve connectivity leading to shorter average trip lengths and increased non-auto mode share.
- Investments in "complete streets" and safe routes to school measures that improve conditions for walking and bicycling.
- Access management and speed management on the arterial system.
- Where there are concentrated employment centers, commute transit service and rideshare promotion.

Development and Conservation Projects and Programs

Likely priorities in suburban places:

- Where these places occur along high capacity transit corridors between cities, transit oriented development focused on high capacity transit stops and stations with managed parking and car and bike share at stations.
- Strategic redevelopment of commercial corridors and dedicated use areas such as large shopping malls and business parks, in order to incorporate complete community design elements.
- Complete community design elements for all new construction.

Rural and Agricultural Lands

Smart Mobility Framework

Rural settlements will continue to depend on a high level of automobile use because origins and destinations are dispersed and congestion is a relatively minor concern. A Smart Mobility approach should focus on:

- Maintaining and creating walkable rural towns in designated locations.
- Accommodation of community-serving businesses in rural towns and commercial clusters.
- Safety for all modes on rural roads.
- Limiting significant SOV capacity expansions to avoid inducing unplanned growth.
- Preventing circulation network patterns and/or subdivision patterns that will lead to suburbanization.
- Adequate freight capacity for movement of inputs and products.
- In areas with strong tourism component in the local economy, weekend and holiday season visitor-oriented transportation services focused on customer satisfaction and compatibility with area character.

In active farming, vineyard, and grazing areas, the emphasis of Smart Mobility strategies will be on providing access for workers, suppliers, and delivery of products, and on minimizing direct and indirect adverse impacts of transportation facilities on the agricultural economy. These adverse impacts can include fragmentation of agricultural lands into patches that threaten viable operations, and growth inducing effects that can result in new development in inappropriate locations and forms. Lands in agricultural production are often in a relatively complex pattern with rural settlements.

Agricultural lands and protected lands (discussed below) offer urban form benefits, helping to shape the development footprints of both urban areas and rural towns. In some cases, roads can have a positive function as separators between agricultural and urban properties.

Relevance of Principles

- **Location efficiency** works differently in rural towns than in rural settlements and agricultural lands. In towns, location efficiency derives from Complete Community Design elements. Central location of public facilities such as schools, hospitals, libraries, and post offices in rural towns is a major Complete Community Design objective. In rural settlements, location efficiency is achieved when infrastructure investments are appropriately scaled to the overall modest level of travel demand.
- **Health and Safety** will be addressed through a focus on safety for motorists, pedestrians, and bicyclists on rural roads. Enabling nonmotorized transportation in rural towns through Complete Community Design features will contribute to active living.
- **Stewardship** has multiple focuses in Rural and Agricultural places. First is the protection of rural character and agricultural resources through concentrating development in towns and compact communities. Stewardship of the rural roads system through asset management is another component. Support for concentrating activities in walkable rural towns and maintaining the rural character of agricultural settlements aims to prevent impacts to natural resources that can be caused by dispersed activities, rural subdivisions, and inappropriate road network connectivity**.**
- As in other place types that are unlikely to support scheduled transit, **Reliability** is relevant to the availability and quality of demand-responsive transit and intercity transit services.

Planning

Key activities:

- Map areas that are to retain rural identity for the long term.
- Differentiate rural towns from surrounding settlements.
- Create cooperative planning processes with Caltrans when rural town main streets are part of the State Highway System.
- Designate lands for long-term agricultural use and distinguish them from rural towns and settled areas with different mobility needs.
- Identify transition areas between urban and suburban places and agricultural/rural ones.
- Identify key routes for goods movement.

Transportation Projects and Programs

Likely priorities in rural and agricultural places:

- Outside of towns, safety improvements to walking and bicycling facilities on rural roads.
- Inside towns, walking and bicycling facilities focused on connectivity and comfort
- Demand-responsive transit and inter-city transit connecting to major destinations such as hospitals and community colleges.
- Park and ride lots associated with freeway interchanges and regional transit services if there are concentrated work destinations within commute distance.
- Network connectivity enhancements within towns.
- Visitor-oriented transportation services, particularly in locations with periods of very strong weekend or holiday peak demand.
- Network connectivity including required access to inter-regional network needed for movement of agricultural goods and inputs.

Some transportation project and program types are generally detrimental to Smart Mobility aims in rural and agricultural places. Therefore, the following policies will generally apply in anchored rural towns, rural settlements and agricultural lands:

- No new freeway interchanges because pf the risk that they will induce traffic and land use changes contrary to local and regional plans as well as disrupting agricultural activities.
- No road widenings or other projects that can increase speeds or remove on-street parking in rural towns.
- No improvements to network connectivity outside of designated rural towns except when required for goods movement.

Development and Conservation Projects and Programs

Likely priorities in rural and agricultural lands:

- Public facilities located in or, for larger facilities such as schools, immediately adjoining rural towns.
- Full range of needed services in rural towns.
- Housing in rural towns meeting the needs of permanent and seasonal rural workers.
- Where it does not presently exist, establishment of regulatory and taxation framework that supports long-term agricultural uses consistent with planning.
- Appropriate design character for all development in this place type.

Protected Lands

Smart Mobility Framework

Protected lands have a resource management focus, low complete community design ranking and low regional accessibility. The Smart Mobility Framework emphasizes the provision of transportation infrastructure to and through protected lands only when consistent with resource preservation and management, or when required for connectivity.

Lands protected from development have the following roles in a Smart Mobility vision:

- Helping to shape development patterns of both urban areas and rural settlements.
- Providing natural setting for urban areas with habitat, watershed, and other resource values as well as providing aesthetic value.
- Serving as receiving areas for mitigation activities and/or density transfers arising from other place types.

Relevance of Principles

- **Stewardship** of natural resources is the primary principle directing Smart Mobility Framework and actions.
- **Location efficiency** dictates that because protected lands have an extremely low level of land use activity there should be a correspondingly low level of investment in transportation infrastructure.
- **Reliability** is a factor in those protected lands that are used for resource management or recreation, with a focus on maintaining access through extreme weather events and maintaining roads in good repair for goods movement and an appropriate level of public access.
- **Health and Safety**. Protected lands include areas of natural hazard where limited or no access is appropriate.

Planning

Key Activities:

- Use of resource maps in delineating all place types.
- Identification of protected lands where commercial uses such as timber operations require capacity for goods movement.

Transportation Projects and Programs

Likely priorities for protected lands:

- Capacity and connectivity increases only when consistent with resource preservation and management requirements and planned levels of public access.
- Connectivity increases through protected lands should occur only when no other options are available to provide required interregional connectivity requirements.
- Where public access and recreational use is permitted, bicycle facility, and trail projects.

Implementation: Development and Conservation Projects and Programs

Likely priorities for protected lands:

- For any lands not fully protected, projects and programs should assure permanent retention in open space / resource conservation status.

Single Use Areas

Smart Mobility Framework

Places as diverse as military installations, airports and ports, and large industrial zones are included in this category. This variety means that there is not be a consistent Smart Mobility approach for this place type. The emphasis is on using the full set of principles, decision support tools, and performance measures to craft distinct approaches to each single use area.

Relevance of Principles

All of the principles should guide investment activities in single use areas.

- **Location efficiency** is typically low by virtue of the fact that these areas will not offer the benefits of complete community design. In fact, adverse impacts generated by some of these areas mean that principles such as public health and safety may best be achieved through separation rather than integration with other activities.
- **Reliability** is particularly relevant when single use areas are employment centers drawing workers from surrounding places.
- **Stewardship** relates to both the economic benefits provided by many single use areas, and to the possibility of negative environmental effects. When single use places include essential functions with respect to regional and State economies, they may receive high investment priority even if they have low location efficiency.

Planning

Key activities:

Delineation of special use areas with particular attention to:

- Access and connectivity needs specific to use and location.
- Role of the area as a local, regional, and subregional trip generator of passenger trips or goods movement, particularly during peak hours.
- Issues regarding health, safety, and environmental impacts arising from the particular activities and mobility characteristics of the use (such as health concerns associated with diesel exhaust emissions from traffic generated by port facilities).
- Long-term plans such as decommissioning of military installations or transition away from industrial use. These plans may shift areas presently in single use into a different place type.
- Surrounding context and level of connectedness to surroundings.

Transportation Projects and Programs

Derived from information gained during Planning.

Development and Conservation Projects and Programs

Derived from information gained during Planning.

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4 Using Performance Measures to Advance Smart Mobility

Chapter 4:

- Identifies the purpose of Smart Mobility performance measures (Section 4.1)
- Defines 20 performance measures and their relationship to Smart Mobility principles (Section 4.2)
- Compares the Smart Mobility measures to conventional Caltrans performance measures, and identifies the methods and data used to apply the Smart Mobility measures (Section 4.3)
- Describes how the measures apply in different place types and facility types (Section 4.4)
- Relates the performance measures to the California Transportation Plan "mobility pyramid" (Section 4.5)
- Summarizes the benefits of Smart Mobility performance measures to Caltrans policy-making, planning, project development and prioritization (Section 4.6)

Summary of Chapter 4:

California transportation agencies can integrate Smart Mobility principles into policies, planning and project development activities through a set of 20 performance metrics within five broad performance categories: **Safety, Mobility, Economy, Environmental Quality, and Customer Satisfaction.** Socio-economic equity is reflected within each of the broad measures and the majority of the individual performance metrics. All 20 Smart Mobility metrics are similar to performance measures presently used by Caltrans, but 12 are redefined to better achieve the following Smart Mobility objectives:

• Multi-Modal Focus	• Speed Suitability	• Activity Connectedness	• Climate/Energy Sustainability
• Network Management	• Land Use Efficiency	• Economic Productivity	

The 12 re-defined metrics are:

✓ Modal Accidents, Severity	✓ Activity Connectedness	✓ ROI Nexus	✓ Speed Suitability
✓ Productivity Lost to Congestion	✓ CO_2 Emissions	✓ Modal Travel-Time Mobility	✓ Network Optimization
✓ Land Use Efficiency	✓ Modal Travel-Time Consistency	✓ VMT relative to Climate Target	✓ Multi-Modal LOS

Use of the new measures would place Caltrans within the growing group of state DOTs and regional agencies implementing similar Smart Mobility performance measures. As a group, the proposed measures facilitate Caltrans' role in context-sensitive solutions, regional blueprints, RTP sustainable communities strategies, corridor system management plans, interstate commodity movement and are applicable in a full range of Caltrans studies:

CTP	California Transportation Plan	NEPA	National Environmental Policy Act
SGMP	Statewide Goods Movement Plan	IGR	Intergovernmental Review
RTP	Regional Transportation Plan	CSMP	Corridor System Management Plan
TCR	Transportation Concept Report	PID	Project Initiation Documents
HiCOMP	Highway Congestion Monitoring Program	PDD	Project Development Documents
CEQA	California Environmental Quality Act	TOps	Traffic Operations Analysis

Place types, as defined in Chapter 3, affect the relative degree of emphasis applied to individual Smart Mobility performance measures. Different user needs and physical and natural environments dictate that:

- Within certain performance measures, the degree of emphasis applied to different travel modes and user groups should vary by place type.
- The priority applied to individual performance metrics should vary as a function of place type.

Which performance measures are emphasized and how they are calculated also varies by transportation facility type. Freeways, expressways, arterials, collectors, and rural highways each differ in terms of emphasis on access versus through traffic and use by different modes of travel. An integrated consideration of place types and facility types should be engaged when selecting and applying Smart Mobility performance measures for different situations.

Use of the recommended performance measures will ensure that larger economic, social, and environmental considerations are addressed. Use at all stages of planning and project development assures that projects will be consistent with Caltrans highest-level vision and strategic objectives and will be analyzed comprehensively through sound planning and engineering principles and in response to the natural and built environment and the needs of the traveling public.

4.1 Performance Measures: Definition and Purpose

Performance measures are quantified evidence of the consequences of a decision or action. In planning and engineering, they represent focused summary variables that are both reflective of public concerns and useful to decision-makers—fact-based, agreed-upon indicators of important trends. Performance measures are an efficient means to present information about a community or system. They clarify issues by presenting key data in a concise format. Performance measures have been an important tool for governmental policy development and implementation for decades.

Transportation performance measures predict or monitor the operation or service provided by the transportation system. Smart Mobility Performance Measures (SMPMs)

are indicators that demonstrate and measure the relationship between transportation networks and the ecology, economy, and communities in which they are located and serve. SMPMs may be further defined as regularly updated performance measures that help transportation planners, engineers, and managers take into account the full range of economic, social, and environmental impacts of their decisions.

SMPMs can help transportation professionals to evaluate progress towards implementing the principles of Smart Mobility and attaining Smart Mobility benefits. They are invaluable tools for decision-making at both the planning and project level.

4.2 Smart Mobility Performance Measures

Caltrans and other transportation agencies currently use five general types of performance measures to plan, design, evaluate, and monitor the transportation system:

- Safety,
- Mobility,
- Economy,
- Environmental quality, and
- Customer satisfaction.

Each of these broad criteria is quantified through a series of individual metrics which, together, produce a complete and objective assessment of system performance. For example, metrics used to quantify safety performance include accident rates and the relationship between roadway design parameters and traffic speeds. Metrics related to mobility and economy include travel times and costs, respectively. Metrics related to customer satisfaction include “level of service.”

The five broad performance measures and many of the individual metrics can be used to compare benefits/ impacts afforded to different population groups, providing the basis for equity analysis of proposed transportation projects and programs. Specific examples will be discussed below in connection with individual performance metrics and their applications.

The five over-arching performance measures are conceptually consistent with the Smart Mobility Principles described in Chapter 2, although as discussed below, many of the individual metrics presently used by California transportation agencies to implement the performance measures are not. As a broad measure, mobility is closely aligned with the Smart Mobility principles of Reliability and Location Efficiency, in that built environments that place activities closer to one another improve mobility. Economy and environmental quality relate closely to the Smart Mobility principles of Location Efficiency, Reliability, and Stewardship. As performance measures, safety and customer satisfaction represent tangible criteria by which to assess Smart Mobility principles of Reliability, and Health and Safety.

However, certain individual metrics currently applied by California transportation agencies are inconsistent with Smart Mobility principles. For example, one conventional mobility metric is travel speed. Designing facilities for high travel speeds often induces greater amounts of travel, increasing vehicle miles and emissions and energy consumption. High speed highways can also increase the geographic spread of development, reducing location efficiency and producing environmental impacts on rural and protected lands that otherwise might not be deemed suitable for development. High speeds also raise health and safety concerns.

Another example of a conventional performance metric that is at odds with Smart Mobility principles is traffic Level of Service (LOS). As commonly applied, traffic LOS often leads to widening or increasing the flow rate on roadways and intersections in order to accommodate more traffic at lower levels of delay. However, the consequences of such capacity expansions often include compromising the comfort and safety afforded pedestrians and bicycles, and making substantial investments in infrastructure that, due to normal traffic peaking, is underutilized the majority of the time.

Other metrics commonly applied by Caltrans and partner agencies are in close agreement with Smart Mobility principles. These include, for example: transit, pedestrian and bicycle mode share, universal accessibility (ADA), energy consumption, criteria pollutant emissions, noise impacts, and impacts on environmentally sensitive land.

Exhibit 9 identifies 20 performance metrics through which Caltrans can achieve the objectives of the Smart Mobility Framework. The measures were identified through a review of current practices in California and other states, as well as the outcomes of the September 2008 Smart Mobility Framework workshop, additional research on successful Smart Mobility planning, and interviews with key Caltrans staff. While most of the measures are presently applied within one or more planning, operations, or project development functions, as presented in Exhibit 9, many have been revised to be more consistent with the Smart Mobility Principles presented in Chapter 2.

Exhibit 9: Smart Mobility Performance Measures

Performance Measure	Smart Mobility Metric	Intended Smart Mobility Outcomes
Safety	Modal Accident Rates, Severity	Minimize accident rates and severity for all users
	Speed Suitability	Minimize accident severity, maximize context sensitivity, reliability
Mobility	Modal Travel-Time Mobility	Maximize modal options for reaching destinations within reasonable time.
	Modal Travel-Time Consistency	Maximize modal options for reaching destinations with reliable consistency in travel time.
	Activity Connectedness	Arrange multi-modal transportation networks and land development patterns to minimize regional aggregate travel distances among trip origins and destinations
	Universal Accessibility (ADA)	Minimize number of inaccessible places
	Pedestrian & Bicycle Mode Share	Maximize choice of walking and cycling over driving
	Transit Mode Share	Maximize choice of transit travel over driving
Economy	Productivity Lost to Congestion	Minimize delays in inter-city goods movement corridors, and maximize modal options available for commuting.
	Network Optimization	Maximize the number of travelers and travel reliability through system management, with minimum investment and footprint devoted to physical infrastructure
	Return on Investment (ROI) Nexus	Maximize State domestic product and minimize user cost per dollar of transport investment.
Environmental Quality	VMT per capita relative to AB32 Target	Maintain climate stability by maintaining VMT and GHG below AB32 Target
	Energy Consumption	Minimize dependence on fossil fuels, GHG and criteria pollutant emissions
	Emissions, including CO_2	Minimize VMT per capita and optimize modal network performance to protect air quality and climate by minimizing GHG and criteria pollutants
	Noise Impacts	Minimize percent of population and number of sensitive receptors impacted
	System Condition	Optimize net current asset value for each modal facility type, e.g. highways, bridges, railways, trails
	Wetland, Ecological Impacts	Maximize area of functional wetlands, sensitive and priority habitats remaining
	Land Use Efficiency	Minimize the "footprint" created by transportation facilities and related land development patterns on the pre-existing natural and built environment
	Materials Reuse, Recycling	Minimize net consumption of construction and maintenance inputs
Customer Satisfaction	Multi-Modal LOS	Maximize customer satisfaction, perception of travel experience in terms of comfort and convenience.
	(see also speed suitability above)	

The above list contains several important changes to the performance metrics conventionally employed by Caltrans and partner agencies. The redefined metrics include:

- Modal Accident Rates and Severity
- Speed Suitability
- Modal Travel-Time Mobility
- Modal Travel-Time Consistency
- Activity Connectedness
- Productivity Lost to Congestion
- Network Optimization
- ROI Nexus
- VMT per capita relative to AB32 Target
- CO_2 Emissions
- Land Use Efficiency
- Multi-Modal LOS.

The changes to performance measure definitions relate to the following overall Smart Mobility objectives.

- **Multi-Modal Metrics**—Several metrics that presently focus on motorized transportation are extended in the Smart Mobility Framework to consider all transportation system users, regardless of travel mode. New multi-modal measures recommended to replace auto-oriented measures include multi-modal accident considerations, travel time, reliability (travel time consistency), and Level of Service. Implementing multi-modal metrics relies primarily on data and methods already available to Caltrans and other agencies, and on methods currently under development in other states or at the national level, including the new multi-modal LOS methods expected in the 2010 edition of the *Highway Capacity Manual* from the Transportation Research Board.
- **Speed Suitability**—Smart Mobility strongly suggests altering the conventional use of "design speed" as a means of determining acceptable design features for highways and conventional roadways. Design speed is normally determined almost entirely based on facility type, with deviations permitted only in response to the most extreme alignment constraints. A concept more in keeping with Smart Mobility principles is "speed suitability", which involves:
  - Determining a context-sensitive target speed for a new facility or a redesign, taking into consideration the adjoining activities, land use and place type and the multi-modal users of the facility, and

  - Designing the facility to enforce the target speed through physical design features and speed management techniques such as signal coordination.

  Implementation of speed-suitability practices may require the development of a recommended practice and standards that expand existing design speed standards to a matrix of suitable speeds related to both facility type and context or place type.

- **Activity Connectedness**—Location efficiency and stewardship considerations demand the integrated evaluation of the transportation system and the land use patterns it serves. Transportation decisions that encourage or accommodate sprawl land use patterns are in conflict with Smart Mobility. Activity Connectedness is a metric that accounts for the travel distances and modal connections available among all activity centers within a region. It also addresses secondary effects that connectivity has on induced development and induced travel.

  Transportation planning and design decisions generally derive from comparison of alternatives: build versus no-build, relative degrees of modal emphasis, one corridor versus another, alternative alignments and/or access provisions, greater capacity or speed versus lower. Each alternative is associated with a land use development pattern including the effects of induced public can private real estate investment. Conventional transportation network analysis tools can quantify the relative spatial separation among all land uses within a region and indicate the degree to which the physical arrangement of land use and transportation provides destination accessibility for all residents by one or more travel modes while minimizing overall vehicle miles of travel. The Activity Connectedness metric objective is to minimize the total travel miles within a region by reducing the separations between workers and jobs, shoppers and shopping places, families and schools, residents and civic or recreation or entertainment activities.

- **Climate Change Considerations**—AB 32 and SB 375 require that transportation and land use be planned in concert with one another, so that all mandated Regional Transportation Plans (RTPs) contain “sustainable communities strategies” and that all land use and transportation plans and environmental assessments include carbon-dioxide (CO2) greenhouse gas analyses. These requirements will affect how Caltrans and regional and local planning organizations measure the performance of their plans and projects. Consequently, the list of recommended metrics for the Smart Mobility Framework includes:

  - Quantification of the vehicle miles traveled (VMT) resulting from a regional or corridor transportation proposal relative to the regional VMT targets to be set in 2010 under SB 375, and
  - CO_2 analysis within plan or project air quality emissions assessment.

- **Land Use Efficiency**—The Smart Mobility principles of location efficiency and stewardship emphasize reducing the overall development footprint of urbanized areas including transportation facilities. The Land Use Efficiency metric is a single measure of successful minimization of the impacts of a transportation decision, whether it is a transportation plan and its accommodated land use, a corridor

analysis of alternative transportation modes or context-sensitive solutions, or a project alignment design. The Land Use Efficiency metric quantifies the acres of land consumed by the transportation project and associated land development in total and individually for types of sensitive land, including agricultural land, wetlands, and habitat. Several regional agencies within the state are developing sophisticated models to forecast the effects of land value, accessibility and other factors on development patterns. In other regions, land use efficiency assessments may rely on the expertise of real estate and economics experts.

- **Network Optimization—**Economic, environmental, mobility, and safety benefits all accrue from prudent management of the transportation network. The Network Optimization metric is a means of measuring the degree to which a certain infrastructure investment accommodates the greatest number of travelers with the minimal of travel instability. The investment may be quantified in terms of capital and operating/ maintenance cost, cost of natural resources and environmental impacts, and opportunity or land efficiency costs. Travel stability is important as it measures the degree to which the transportation system is reliable, supports certain types of economic activity, and minimizes CO2 and other emissions per vehicle mile traveled

  The degree to which the network is optimized is a measure that takes into consideration the role of parallel and access-oriented transportation facilities and services in serving travel demand, as well as intelligent transportation systems (ITS) strategies such as signal coordination, ramp metering, and in-vehicle and roadside technology capable of reducing vehicle headways. It is also a more complete measure than the conventional metrics, such as facility capacity expressed in terms of peak vehicle throughput on a single network link. Measuring Network Optimization can require relatively sophisticated analysis with corridor level simulation tools and can require collecting more complete data than is presently included in routine practice, such as modal utilization levels on all transportation facilities and services in a travel corridor, and traffic delay at existing congestion points. However, tools for performing such analysis have been state-of-practice on individual transportation studies industry-wide, and data collection methods are becoming more efficient. Much of the data needed for such analysis can be collected on an as-needed basis rather than routinely.

- **Productivity over Convenience—**California's economy and its role in national and international commerce are important criteria influencing the State's transportation investment and impact decisions. Smart Mobility principles recognize the need for a reliable multi-modal transportation system for interregional and interstate travel. A conventional mobility measure, lost time due to congestion, can be a misleading indicator as not all time has similar impacts to the State's economy. For purposes of Smart Mobility, the measure is transformed from aggregate time lost to productivity lost. With the revised measure, the per hour cost of delay to recreational trips would be less than for a work-related trip, which in turn would be considered less costly to State productivity than delay to commercial freight movement.

Consistent with current practice, equity considerations apply fully within each Smart Mobility performance measures. All metrics are to be applied equitably across all socio-economic groups. Multi-modal metrics should be expressed individually by mode of transportation for both passengers and freight, and should be expressed in terms of user experience. Evaluation of roadway pricing strategies, for example, should take into consideration the proportions of affected travelers within different income strata and ethnic populations and present the relative degrees of benefit and impact to each affected group. Reporting should also identify the relative numbers of affected individuals within each group. In some cases, impacts should be presented, instead of simply in dollars or time lost, in terms of cost as a percentage of income. For equity assessment, the following performance metrics that should be quantified in terms of comparative benefits and impacts to individual socio-economic groups: modal accident rates and severity, speed suitability, modal travel-time mobility, modal travel-time consistency, activity connectedness, ADA accessibility, pedestrian and bike mode share, transit mode share, productivity lost to congestion, network optimization, ROI nexus, VMT per capita, energy consumption, emissions, noise impacts, land use efficiency, and multi-modal LOS

Exhibit 10 relates each of the proposed Smart Mobility performance measures and all of the individual metrics to the Smart Mobility Principles presented in Chapter 2.

Exhibit 10: Relationship between Performance Measures and Smart Mobility Principles

Performance Measure	Smart Mobility Metric	Smart Mobility Principles			
		Location Efficiency	Reliability	Health, Safety	Steward-ship
Safety	Modal Accident Rates, Severity		■	■	
	Speed Suitability		■	■	■
Mobility	Modal Travel-Time Mobility	■			■
	Modal Travel-Time Consistency		■		
	Activity Connectedness	■	■	■	■
	Universal Accessibility (ADA)	■		■	
	Ped & Bike Mode Share	■		■	■
	Transit Mode Share	■			■
Economy	Productivity Lost to Congestion	■	■		
	Network Optimization		■	■	■
	ROI Nexus	■	■		■
Environmental Quality	VMT per capita relative to AB32 Target	■			
	Energy Consumption	■			■
	Emissions, including CO_2	■		■	■
	Noise Impacts	■		■	
	System Condition		■	■	■
	Wetland, Ecological Impacts	■			■
	Land Use Efficiency	■			■
	% of Materials Reuse, Recycling				■
Customer Satisfaction	Multi-Modal LOS	■	■	■	■
	(see also speed management above)				

As a group, the proposed Smart Mobility performance measures facilitate Caltrans' deliberate, active engagement in certain types of planning presently occurring at the regional and local level.

- **Context-Sensitive Solutions—**Many California cities are proposing context-sensitive designs or retrofits for major routes through their communities. This involves reconsideration of transportation facility's role within its immediate environment, and it often leads to reconsideration of established design principles as "target speed." Target speed represents the desired upper limit of traffic speed deemed appropriate for a roadway segment based on its facility

type and contextual place-type. Design features such as curvature and sight distances are then set in order to manage traffic flow at the desired target speed. The proposed Speed Suitability performance measure specifically addresses this situation as does Multi-Modal LOS.

- **Regional Blueprints**—Smart Mobility performance metrics such as Activity Connectedness reinforce compatible, location efficient placement of land development and transportation elements. This is consistent with regional Blueprints. A key objective in most blueprints is the minimization of VMT while insuring that accessibility is maintained through the proximity or connectivity among travel origins and destinations. A related blueprint theme is Land Use Efficiency through minimizing the footprint of development and transportation on sensitive lands.
- **RTP Sustainable Communities Strategies**—As they prepare their next RTPs, California MPOs will be required to develop sustainable communities strategies in response to recent California legislation (AB 32 and SB 375). Preserving mobility through Activity Connectedness and convenient multi-modal travel options (Modal Mobility) will be essential strategies to minimize unnecessary vehicle miles traveled (VMT) and to reduce energy consumption, emissions, air quality and climate impacts.
- **Corridor System Management Plans**—As local agencies and the real estate development industry attempt to deal with dramatically changed economic and market conditions, there is growing emphasis on infill development in congested areas. This places additional emphasis on Network Optimization strategies rather than capacity increases to accommodate traffic volumes through system and speed management and operational efficiency, such as ITS.
- **International Trade**—Particularly in the Los Angeles region where truck activity generated by shipping ports significantly impact the highway system, there is increasing regional emphasis on placement and sizing of infrastructure in accordance with moving international, interstate and intra-state goods and products, monetized in terms of return on investment (ROI).

4.3 Comparison of Smart Mobility Measures with Conventional Caltrans Performance Measures

Exhibit 11 compares the proposed 20 Smart Mobility Performance metrics (SMPMs) with measures presently employed by Caltrans and partner agencies in planning, operations, and project development activities, indicating that 12 of the Smart Mobility metrics represent adjustments to current practice. Italicized terms highlight the distinctions with respect to the current metric.

Exhibit 11: Smart Mobility Performance Measures and Metrics

Performance Measure	Conventional Metric	Smart Mobility Metric
Safety	Accident Rates and Severity	*Modal* Accident Rates and Severity
	Design Speed	Speed *Suitability*
Mobility	Highway Travel-Time Mobility	*Modal* Travel-Time Mobility
	Highway Travel-Time Consistency	*Modal* Travel-Time Consistency
	General Accessibility	*Activity Connectedness*
	ADA Accessibility	Universal Accessibility (ADA)
	Ped & Bike Mode Share	Ped & Bike Mode Share
	Transit Mode Share	Transit Mode Share
Economy	Time Lost to Congestion (VHD)	*Productivity* Lost to Congestion
	Capacity, Volume/Capacity	*Network Optimization*
	Return on Investment (ROI)	ROI *Nexus*
Environmental Quality	Vehicle Miles Traveled (VMT)	VMT per capita *relative to AB32 Target*
	Fuel Consumption	Energy Consumption
	Emissions	Emissions, *including* CO_2
	Noise Impacts	Noise Impacts
	System Condition	System Condition
	Wetland, Ecological Impacts	Wetland, Ecological Impacts
	Reductions in ag. land, habitat	*Land Use Efficiency*
	Materials Reuse, Recycling	Materials Reuse, Recycling
Customer Satisfaction	Level of Service	*Multi-Modal* LOS

Note: *Italicized* terms indicate differences between the recommended definition and the current metric.

All 20 of the metrics listed in the above table relate to Smart Mobility principles and should be applied in assessing transportation planning and project decisions under the Smart Mobility Framework. Of the 20, the following eight SMPMs remain essentially the same under the Smart Mobility Framework as they presently are in current project planning and evaluation processes:

- ADA Accessibility,
- Pedestrian and bicycle mode share,
- Transit mode share,
- Energy consumption,
- Noise impacts,
- System condition,

- Wetland and ecological impacts, and
- Material reuse and recycling.

The remainder of this chapter focuses on the 12 performance measure metrics whose proposed definitions and applications differ from those conventionally applied by Caltrans and other California agencies.

Exhibit 12 describes the differences between the Smart Mobility performance metrics and current practices. The remainder of the chapter addresses the range of specific applications proposed for the revised performance measures in terms of Caltrans functional areas and decision processes, and identifies the methods, tools and data needs related to applying each new metric.

Exhibit 12: Differences between Existing Definitions of Performance Metrics and Smart Mobility Definitions

Performance Measure	Smart Mobility Metric	Definition of Metric		Benefits of Smart Mobility Definition
		Existing Definition	Smart Mobility Definition	
Safety	Modal Accident Rates, Severity	Vehicular accident rates and severity.	Accident rates and severity for all users including transit users, pedestrians, cyclists.	Ensures that safety evaluations for all project types specifically consider impacts on safety for all travelers.
	Speed Suitability (Target speed, speed management)	Design that achieves highest traffic speed commensurate with facility function	Physical and operational design that achieves acceptable traffic flow commensurate with road function at speeds compatible with context and safety for all modes	Encourages transportation networks that achieve functional objectives while allowing individual elements to address environmental and context objectives. Designs system elements to be compatible with safety needs and to efficiently serve Smart Mobility travel choices.
Mobility	Modal Travel-Time Mobility	Minimal vehicular travel time from place to place	Equitable travel-time advantage for users of all modes, availability of accurate traveler information	Supports State economy and commitments to public by promoting efficiency and productivity for all forms of passenger travel and freight transport
	Modal Travel-Time Consistency	Predictability of vehicular travel time, allowing for routine differences based on time and day.	Predictability of travel time for users of all modes allowing for routine differences based on time and day.	Supports State economy, minimizes energy and emissions, and serves public by promoting efficiency and productivity for all forms of passenger travel and freight transport.
	Activity Connectedness	Travel time to selected destinations via the most efficient modes available, generally auto travel with resulting impacts on energy use and CO_2	Ability to reach all destinations safely and comfortably by all travel modes.	Emphasizes personal mobility through location efficiency of transportation and land use and creation of multi-modal connections to all destinations.

Performance Measure	Smart Mobility Metric	Definition of Metric		Benefits of Smart Mobility Definition
		Existing Definition	Smart Mobility Definition	
Economy	Productivity Lost to Congestion	Time delay for intra- and inter-urban passengers and goods.	Focus on inter-city travel and goods movement by road and rail.	Shifts emphasis from intra-urban passenger travel (for which location efficiency and accessibility are more in keeping with Smart Mobility) to the economic value of travel, emphasizing State and Federal commerce, commodity trade routes and long distance passenger movement, whether by highway or rail
	Network Optimization (Capacity, Operations Management)	Provision of physical capacity on streets and highways (lane miles) sufficient to serve projected peak volume of traffic.	Balanced capacity and network efficiency management (including ITS) sufficient for stable traffic flow.	Stable flow provides mobility while reducing excessive concentrations of traffic and resultant impacts on fuel consumption and emissions, and takes into account the benefits of an interconnected transportation network.
	ROI Nexus	VMT per lane mile, revenue generation per lane mile	Person miles and revenue per lane mile or transit vehicle mile	Nexus accounts for fairness of relationship b/t user charges and burden user places on system.
Environmental Quality	VMT per capita relative to AB32 Target	Accommodation of maximum amount of VMT	Minimizing the need to travel to VMT levels within regional targets set under AB32 and SB375	Accommodates mobility and accessibility needs while minimizing unnecessary travel and reducing greenhouse emissions to conform with State climate law.
	Emissions, including CO_2	Magnitudes of criteria pollutants	Magnitudes of criteria pollutants and greenhouse gas emissions relative to AB32 targets.	Addresses climate change impacts at the project and regional levels in addition to PM, NOx and other air quality impacts.
	Land Use Efficiency	Acres of agricultural land and habitat consumed	Acres of agricultural and habitat land consumed; Levels of development density, diversity, design, and destination accessibility achieved.	Measures not only direct effect of land consumed but indirect effect of shifting development to other sensitive or inefficient locations, by including consideration of induced development and allowing estimation of VMT increases resulting from greater geographic spread.
Customer Satisfaction	Multi-Modal LOS	Optimized traffic speed, minimized delay	Optimal efficiency and comfort balanced among all modes	Designs transportation infrastructure to be compatible with and to efficiently serve Smart Mobility travel choices.
	(see also speed management above)			

Exhibit 13 lists Caltrans functions and decisions that would be affected by the adoption of each new SMPM. The objective is that SMPMs would be used by all Caltrans functional units and decision-making processes. The exhibit identifies the most prominent specific examples of performance measure applications, distinguishing between planning activities, such as the corridor system management planning, versus more focused activities, such as designing interchange improvements or commenting on a local government's CEQA documents. The table also indicates other transportation agencies that have implemented each SMPM (or a similar one) in recent years. The list is not comprehensive, but contains several representative examples for each measure. It focuses on other state DOTs, but also includes California MPOs and cities to illustrate the manner in which adopting the SMPMs will help Caltrans align its evaluation criteria with those already employed by regional and local jurisdictions throughout the state.

Exhibit 14 identifies the primary methods, tools and data sources for accurately and consistently measuring each SMPM. Many of the tools and data are readily available, thus facilitating implementation of SMPMs in the near-term.

Exhibit 13: Applications of Smart Mobility Performance Measures

Performance Measure	Smart Mobility Metric	Applicable Caltrans Functional Groups and Decisions		Precedent Use by other State DOTs and CA Agencies
		Planning	Project Development	
Safety	Modal Accident Rates, Severity	CTP, RTP, SGMP, IGR, CSMP	CEQA, PID, TOps, Design	MnDOT, FDOT, Caltrans
	Target speed, speed management	RTP, SGMP, IGR, CSMP	CEQA, PID, PDD, TOps, Design	Many cities use coordinated traffic signal system to manage speed and direct traffic
Mobility	Modal Travel-Time Mobility	CTP, RTP, SGMP, IGR, CSMP	CEQA, PID, TOps, Design	FDOT, NJDOT, Idaho DOT, Cities of San Francisco, Sacramento
	Modal Travel-Time Consistency	CTP, Blueprints, RTP, SGMP, IGR, CSMP	CEQA, PID, TOps, Design	MnDOT, VaDOT, FDOT, Idaho DOT
	Activity Connectedness	CTP, Blueprints, RTP, SGMP, IGR, CSMP	CEQA, PID, Design	MTC, SANDAG, SACOG
Economy	Productivity Lost to Congestion	CTP, Blueprints, RTP, SGMP, IGR, CSMP	CEQA, PID, TOps, Design	FDOT, MnDOT, SANDAG
	Network Optimization	CTP, Blueprints, RTP, SGMP, IGR, CSMP	CEQA, PID, TOps, Design	NY DOT, NJ DOT, PA DOT
	ROI Nexus	CTP, Blueprints, RTP, SGMP, IGR, CSMP	CEQA, PID, TOps, Design	FDOT, MTC
Environmental Quality	VMT per capita relative to AB32 Target	CTP, Blueprints, RTP, SGMP, IGR, CSMP	CEQA, PID, Design	NY DOT; CA Regions and Cities/Counties with Climate Action Plans (developing)
	Emissions, including CO_2	CTP, Blueprints, RTP, SGMP, IGR, CSMP	CEQA, NEPA, PID, TOps, Design	MTC, SANDAG, Fresno Blueprint
Customer Satisfaction	Land Use Efficiency	CTP, Blueprints, RTP, SGMP, IGR, CSMP	CEQA	FDOT, Idaho DOT, NJ DOT, Penn DOT, WSDOT
	Multi-Modal LOS	CTP, Blueprints, RTP, TCR, HiCOMP, SGMP, IGR, CSMP	CEQA, NEPA, PDD, TOps, Design	FDOT, NJDOT, cities of San Francisco, San Jose, Sacramento
	(see also speed management, as another measure of customer satisfaction)			

Acronym Key

CTP	California Transportation Plan	NEPA	National Environmental Protection Act
SGMP	Statewide Goods Movement Plan	IGR	Intergovernmental Review
RTP	Regional Transportation Plan	CSMP	Corridor System Management Plan
TCR	Transportation Concept Report	PID	Project Initiation Documents
HiCOMP	Highway Congestion Monitoring Program	PDD	Project Development Documents
CEQA	California Environmental Quality Act	TOps	Traffic Operations Analysis

Exhibit 14: Methods, Tools, and Data Needs

Performance Measure	Smart Mobility Metric	Guidelines and Methods	Tools Needs	Data Needs
Safety	Modal Accident Rates, Severity	Accident Analysis, by type, severity, and modes involved; exposure level by mode, intersection conflicts for bikes and peds.	SWITRS, Bike & Ped Environmental Quality, National Transit Database Safety and Incident Modules	Accident data; field data on ped and bike facilities
	Speed Suitability	CA Highway Design Manual multimodal revision; implementation of Caltrans Complete Streets Guidelines, implementation of ITE/CNU Context Sensitive Design for Major Urban Thoroughfares	New recommended practice and standards that expand existing design speed standards to a matrix of suitable speeds related to both facility type and place type. Simulation Models	Needed data includes average travel speed as % of target speed; design standards for target speed.
Mobility	Modal Travel-Time Mobility	Statistical analysis of travel time by mode. Network travel times between representative O/D pairs (peak, off-peak),	Includes PeMS, other real-time traffic detection, and analysis systems.	Speed data
	Modal Travel-Time Consistency	Statistical analysis of travel time variance by mode	Real-time traffic detection and analysis systems.	Historical travel time data for OD pairs
	Activity Connectedness	Quantification of mode-specific aggregate travel distance among all regional trip productions and attractions. Estimation of overall vehicle miles of travel. Analysis of auto, transit, ped, bike, travel times, and mode shares.	Conventional network analysis tools quantify degree to which the physical arrangement of land use and transportation provides destination accessibility for all travel modes. Other tools: Modal travel time surveys, counts by mode; GIS	Historical modal travel time data for OD pairs

Performance Measure	Smart Mobility Metric	Guidelines and Methods	Tools Needs	Data Needs
Economy	Productivity Lost to Congestion	Caltrans Delay Index with different value of time by trip purpose and vehicle type, Lost lanes due to congestion, VMT by speed-range "bin", vehicle hours of travel, vehicle hours of delay (VHD), person hours of delay (PHD), user cost per mile.	Calibrated model with freight other commercial modes	Historical OD data by trip purpose, including freight and commercial
	Network Optimization	Analysis of persons served, saturation flow rate, vehicle and person throughput, bottleneck volume/capacity, % of demand served, speed as % of target speed, queue lengths.	Real-time traffic detection and analysis systems; simulation models.	Historical travel time/capacity analysis data
	ROI Nexus	Benefit/ cost analysis by person miles and revenue per lane mile or transit vehicle mi, annual travel cost per household, life cycle capital and operating cost analysis	Real--time traffic detection and analysis systems by segment and mode	Revenues and costs per mile by mode
Environmental Quality	VMT per capita relative to AB32 Target	VMT, taking into consideration total VMT and VMT per capita and other factors influencing GHG such as speeds, stops, layovers, fleet.	Calibrated Models.	Historical VMT by time of day and facility type.
	Emissions, including CO_2	Quantification of criteria and CO2 emissions and CO2 per capita.	Caltrans/ARB link-grid models, EMFAC.	VMT by time of day and facility, traffic speed profile, vehicle fleet profile.
	Land Use Efficiency	Quantification of acres of land consumed by the transportation project and associated land development in total and individually for types of sensitive land, including agricultural land, habitat, wetlands impacted	GIS for sensitive land classifications	Land use inventories
Customer Satisfaction	Multi-Modal LOS	Measurement of maximum individual delay, duration of congestion, freeway volume and density, average speed as percent of posted speed, amount of freeway travel below 35 mph, queuing, queue spillback, transit vehicle delay, transit passenger delay	HCM 2010, including Ped and Bike LOS tools.	Facility geometric data and traffic counts by mode, other field data
	(see also speed management above)			

4.4 Implementing Smart Mobility Performance Measures in Different Place Types

Exhibit 15 and Exhibit 17 describe the manner in which, under the Smart Mobility Framework, each of the new performance measures defined above relate to the individual place types described in Exhibit 6. Place type affects the relative degree of emphasis that should applied to the primary measures of safety, mobility, economy, environment, and customer satisfaction and to the use of individual metrics within each SMPM. Different place types are characterized by different user needs and physical and natural environments and demand. Place type influences the application of performance measures through two primary distinctions:

- Within certain performance measures, the degree of emphasis applied to different travel modes and user groups should vary by place type.
- The priority applied to individual performance measures and metrics should vary as a function of place type.

Which performance measures are emphasized and how they are calculated will vary by transportation facility type as well as place type. Freeways (Interstate and State jurisdiction), Expressways, Interchanges, Arterials (Principal and Minor), Collectors, and Rural Highways each have different primary functions—combining varying degrees of emphasis on access, conducting through traffic, and accommodating different degrees of use by different modes of travel. An integrated consideration of place types and facility types in Smart Mobility decisions creates a two-dimensional perspective on appropriate SMPMs for different cases.

Modal Emphasis by Place Type

Exhibit 15 describes the manner in which the distinctions among place types and facility types influence the degree of emphasis placed on different user groups and transportation modes within multi-modal performance measures. Multi-modal SMPMs include:

- Modal accident rates and severity,
- Target speed management,
- Modal travel-time mobility,
- Modal travel-time consistency,
- Activity connectedness,
- Pedestrian and bicycle mode share,
- Transit mode share, and
- Multi-modal Level of Service.

The primary distinction in applying these multi-modal measures on different facilities in different place types is:

- **Freeways**—Weighting of modes within performance measures should be oriented toward truck and automobile modes and express buses, with primary emphasis on traffic flow efficiency, regardless of place type.
- **Expressways and Interchanges**—Performance measures should be oriented toward an equivalent prioritization of autos, trucks, and buses, while preserving and enhancing basic safety comfort and convenience for non-motorized modes.
- **Arterials and Conventional Rural Highways**—In urban centers, close-in community centers, compact communities, rural towns, and suburban centers, performance measure should emphasize safety, comfort, and convenience for non-motorized modes, local transit, with lower emphasis on efficiency for autos and trucks. In corridors and dedicated use areas, performance measures should be oriented toward an equivalent prioritization of autos, trucks, and buses, while preserving and enhancing basic safety comfort and convenience for non-motorized modes.
- **Collectors**—In almost all place types, performance measure should emphasize safety, comfort, and convenience for non-motorized modes, local transit, with lower emphasis on efficiency for autos and trucks.

Examples appear following the exhibit, demonstrating how to apply Exhibit 15 to prioritize modal emphasis within multi-modal measures. Additional guidelines on choosing which performance measures to apply for different facility types located in different place types are provided below.

Exhibit 15: Framework for Integrating Place Type and Facility Type in Weighing Modal Priorities in Planning and Project Evaluation Criteria

Place Type		Modal Emphasis by Facility Type*					
		Freeway	Express-way	Inter-change	Arterial	Collector	Rural Hwy
Urban Centers	Urban Cores						N/A
	Urban Centers						N/A
Close-in Compact	Centers						N/A
	Corridors						N/A
	Neighborhoods						N/A
Compact Communities							
Suburban	Centers						
	Corridors						
	Dedicated Use						
	Neighborhoods						
Rural	Towns						
	Settlements/Ag						
Protected Lands							
Special Districts							

*Key to modal emphasis:

- Weighting of modes within performance measures should be oriented toward truck and automobile modes and express buses, with primary emphasis on traffic flow efficiency
- Performance measures oriented toward equivalent prioritization of autos, trucks, and buses, while preserving basic safety comfort and convenience for non-motorized modes.
- Performance measure emphasis placed on safety, comfort and convenience for non-motorized modes, local transit. Lower emphasis on efficiency for autos and trucks.

For example, as illustrated below:

A. An arterial segment through a "suburban center" (small downtowns, activity centers) would emphasize safety, comfort, and convenience for non-motorized modes and local transit, with lower emphasis on efficiency for autos and trucks, as noted by the symbol.

B. A planning study for an arterial located in a "suburban corridor" place type (varied, low intensity land uses) would use performance measures that prioritize autos, trucks, and buses at an equivalent level, while preserving basic safety, comfort, and convenience for non-motorized modes, as denoted by the symbol in the exhibit.

C. Regardless of place type, freeway analysis would employ performance measures weighted toward truck and automobile modes and express buses, with primary emphasis on traffic flow efficiency, as denoted by the symbol in Exhibit 15.

Place Type		Modal Emphasis by Facility Type*					
		Freeway	Express-way	Inter-change	Arterial	Collector	Rural Hwy
					A		
Suburban	Centers						
	Corridors					B	
	Dedicated Use		C				
	Neighborhoods						

Performance Measure Relative Priority by Place Type

Many if not most of the performance measures have applicability in transportation planning, traffic operations and project development in most place types; the difference is one of emphasis. Exhibit 16 indicates a generalized ranking of key performance measures for three of Caltrans' primary facility types—Freeways, Arterials, and Rural Highways—that applies to all place types. Not all of the 20 SMPMs described above appear on Exhibit 16. This is not to imply that excluded SMPMs (e.g. Noise and Wetlands) are not important to measure and track, only that their importance depends on specific geographic variables and not upon the nature of the place type and roadway facility type.

Exhibit 16 shows that several performance measures emerge as high or medium priority for all place types: Modal Accident Rates, Speed Management, Travel Time Consistency, and Emissions, including CO_2. The priority assigned for the accident rate measure is high for all facility types in all place types. This reflects the fact that accidents not only have direct costs, but are also a major cause of delay and the productivity losses that are a consequence of delay.

Return on Investment, by contrast, ranks lower in importance for Arterials compared to the other two facility types, since arterial improvements are frequently less capital intensive and can be implemented incrementally. This contrasts with freeway improvements, which nearly always represents a major investment. Rural highway investments tend to be high relative to their level of use, so in this instance as well it is imperative to maximize the productivity of such investment.

On the other hand, Network Optimization and Speed Management rank higher for Arterials than for freeways and rural highways. Arterials with more points of access and more traffic controls have greater need and opportunities for real time traffic management to keep flows at optimal levels and to ensure predictable travel times.

Exhibit 16: General Performance Measure Priority

Priority Performance Measures—All Place Types			
Priority	**Freeways**	**Arterials**	**Rural Highways**
Highest	1. Modal Accident Rates 2. Return on Investment	1. Speed Management 2. Modal Accident Rates 3. Network Optimization	1. Modal Accident Rates, 2. Return on Investment
Medium	1. Speed Management 2. Travel Time consistency 3. Emissions and CO_2	1. Emissions and CO_2 2. Travel Time consistency	1. Speed Management 2. Travel Time consistency 3. Emissions and CO_2
Lower	1. Network Optimization 2. Modal Travel Time 3. VMT re AB32 Target 4. Multimodal LOS	1. VMT re AB32 Target 2. Modal Travel Time 3. Return on Investment	1. Network Optimization 2. Modal Travel Time 3. VMT re AB32 Target

Exhibit 17 provides illustrations of how place type considerations may serve to elevate the priority of certain performance measures. For example, in urban and suburban areas freeways tend to be congested during peak periods, thus Network Optimization become a priority performance measure for freeways in urban cores, urban centers and close-in compact centers and corridors.

In Exhibit 17 Multi-Modal LOS emerges as a potential additional priority measure for Arterial evaluations in urban and suburban centers, reflecting that in these environments Arterials support other modes beyond private and commercial

vehicles—e.g., pedestrians, bicycles, and local transit with frequent stops. (While freeways will require Multimodal LOS analysis, this analysis will be limited to vehicles and transit since non-motorized traffic is not permitted).

Activity Connectedness is shown on Exhibit 17 as an important performance measure for Arterial evaluation in most urban and suburban place types. Similarly, Land Use Efficiency is elevated in priority in areas where land costs are high and opportunities to make short and non-motorized trips are great—i.e. in all urban and suburban place types except Corridors. In Corridors, Productivity Lost to Congestion emerges as a key additional performance measure, reflecting the need to efficiently serve through movement of high-value traffic (i.e., freight) and, to a lesser extent, commute traffic. Finally VMT with respect to AB32 targets emerges as a higher priority performance measure in suburban place types, since VMT per capita tends to be higher in suburban areas compared to regional averages.

Exhibit 17: Examples of Additional Priority Measures by Place Type for Freeways and Arterials

Place Type		Additional Priority SMPMs by Facility Type	
		Freeway	Arterial
Urban Centers	Urban Cores	a. Land Use Efficiency b. Productivity c. Capacity/Operations Mgt	a. Multi-Modal LOS b. Activity Connectedness a. Land Use Efficiency
	Urban Centers	a. Land Use Efficiency b. Productivity c. Capacity/Operations Mgt	a. Multi-Modal LOS b. Activity Connectedness c. Land Use Efficiency
Close-in Compact	Centers	a. Land Use Efficiency b. Productivity c. Capacity/Operations Mgt	a. Multi-Modal LOS b. Land Use Efficiency c. Activity Connectedness
	Corridors	a. Activity Connectedness b. Productivity c. Capacity/Operations Mgt	a. Activity Connectedness b. Productivity
	Neighborhoods	a. Activity Connectedness b. Land Use Efficiency c. Emissions/CO_2	a. Land Use Efficiency b. Activity Connectedness
Compact Communities		a. Activity Connectedness b. Land Use Efficiency	a. Multi-Modal LOS b. Land Use Efficiency c. Activity Connectedness
Suburban	Centers	a. Activity Connectednes b. Land Use Efficiency c. VMT re AB32 Target	a. Multi-Modal LOS b. Activity Connectedness c. Productivity d. VMT re AB32 Target
	Corridors	a. Activity Connectednes b. Land Use Efficiency c. VMT re AB32 Target	a. Productivity b. Activity Connectedness c. VMT re AB32 Target
	Dedicated Use	a. Activity Connectedness b. VMT re AB32 Target c. Productivity	a. Land Use Efficiency b. Activity Connectedness
	Neighborhoods	a. Activity Connectedness b. Land Use Efficiency	a. Multi-Modal LOS b. Land Use Efficiency c. Activity Connectedness

For example, evaluation of an arterial facility in a suburban center would take into account the following arterial performance measures from Exhibit 16:

- Speed Management
- Modal Accident Rates
- Network Optimization
- Emissions and CO_2
- Travel Time Consistency
- VMT re AB32 Target
- Modal Travel Time
- Return on Investment.

…as well as the following place-type-specific performance measures from Exhibit 17:

- Multi-Modal LOS
- Activity Connectedness
- Productivity
- VMT re AB32 Target.

For the multi-modal performance measures in the above list (accidents, speed management, travel time consistency, travel time, LOS, and activity connectedness), the analysis would emphasize safety, comfort, and convenience for non-motorized modes and local transit, with lower emphasis on efficiency for autos and trucks, as indicated in Exhibit 15.

The analysis of many performance measures should address equity considerations, comparing the benefits/ impacts across socio-economic and ethnic groups. The equity analysis should quantify the following performance metrics individually for each affected group: modal accident rates, speed suitability, modal travel-time mobility, modal travel-time consistency, activity connectedness, productivity lost to congestion, network optimization, ROI nexus, VMT per capita, emissions, noise impacts, land use efficiency, and multi-modal LOS

In summary, Exhibit 15, Exhibit 16, and Exhibit 17 together provide overall guidance on the appropriate application of Smart Mobility performance measures and metrics to critical planning and engineering activities. While these criteria and priorities do not represent strict standards, and should be applied in concert with reasonable professional judgment, their use should enable Caltrans and its partner agencies to integrate the Smart Mobility principles of Location Efficiency, Reliability, Health and Safety, and Stewardship into future planning and project development decisions.

These Smart Mobility performance measures and metrics should be developed initially as needed on a plan-by-plan, project-by-project basis. They are not intended to represent a statewide monitoring system. Caltrans and other State agencies should be alert to opportunities to systematically collect input data for SMPMs, just as traffic volumes and accident data are now routinely collected statewide.

4.5 Relationship to Mobility Pyramid

The Smart Mobility performance measures described above are consistent with and fully supportive of Caltrans "mobility pyramid" as presented in the California Transportation Plan (see Section 2.1 for the pyramid).

Exhibit 18 depicts this relationship by indicating the alignment between each of the Smart Mobility performance metrics and the elements of the mobility pyramid. As illustrated in the pyramid, the foundational element is System Monitoring and Evaluation, which also provides the informational foundation of the Smart Mobility Framework performance measures. System monitoring and evaluation supplies essential data for the measurement of fifteen Smart Mobility metrics, including accidents, speeds, travel-time mobility and consistency, vehicle miles traveled and other performance indicators.

The other elements of the pyramid represent outcomes of Caltrans strategic planning and system operations activities. As shown in Exhibit 18, Caltrans success in each of these areas is captured in at least 5 and as many as 20 of the Smart Mobility performance metrics. System Completion and Expansion, the top tier in the pyramid, is correlated with all 20 of the Smart Mobility measures in one of the following ways.

- Twelve of the Smart Mobility metrics, including accident rates, are used to evaluate the benefits and costs and potentially to justify system completion and expansion projects.
- The remaining eight Smart Mobility metrics, including energy consumption and emissions, are used to assess the impacts of potential system completion and expansion projects.

Exhibit 18: Relationship Between Smart Mobility Performance Measures and Caltrans Mobility Pyramid

		Strategic Growth Plan Framework							
Performance Measure	Smart Mobility Metric	System Monitoring + Evaluation	Prevention + Safety	Maintenance + Preservation	TDM + Value Pricing	Smart Land Use	ITS + Incident Management	Operational Improvements	System Completion + Expansion
Safety	Modal Accident Rates, Severity	□	■				■	■	▲
	Speed Suitability	□	■				■	■	▲
Mobility	Modal Travel-Time Mobility	□				■	■	■	▲
	Modal TripTime Consistency	□	■				■	■	▲
	Activity Connectedness					■		■	▲
	ADA Universal Accessibility		■	■		■			▲
	Ped & Bike Mode Share		■		■	■		■	▲
	Transit Mode Share	□			■	■	■		▲
Economy	Productivity Lost to Congestion	□			■	■	■	■	▲
	Network Optimization	□			■		■	■	▲
	ROI Nexus	□			■	■	■	■	▲
Environmental Quality	VMT/capita vs. AB32 Target	□			■	■		■	Δ
	Energy Consumption	□		■	■	■	■	■	Δ
	Emissions, including CO_2	□			■	■	■	■	Δ
	Noise Impacts	□		■		■		■	Δ
	System Condition	□		■					Δ
	Wetlands, Ecology			■		■			Δ
	Land Use Efficiency			■		■		■	Δ
	Materials Reuse, Recycling	□		■					Δ
Customer Satisfaction	Multi-Modal LOS	□			■	■	■	■	▲
	(Customer Satisfaction also related to speed management, see above)								

Legend

- □ System Management and Evaluation provides data used to evaluate Smart Mobility performance
- ■ Performance Measure is used to evaluate attainment of Strategic Growth Plan objective
- ▲ Performance Measure is used for project justification and design
- Δ Performance Measure is used to measure project impacts

4.6 Concluding Comments

The foregoing discussion of the 20 Smart Mobility Performance Measures illustrates how these performance measures collectively compile data that can be used by decision-makers both within Caltrans and beyond. Properly chosen and analyzed, they will permit comprehensive evaluation of transportation projects for all facility types in all the varied place types served by State highway systems and the regional and local transport systems that the State system connects together.

Using these recommended performance measures will ensure that larger economic, social, and environmental considerations and concerns will be addressed. More importantly, consistent use of the performance measures at all stages of planning and project development means that projects will be analyzed comprehensively from the time of plan and project initiation. Environmental impact mitigation will not be developed in response to projects as add-ons. Instead, transportation projects will be fundamentally designed to be responsive to the natural environment they are embedded within and the human environment they serve.

5 Handbook Conclusions: Putting Smart Mobility to Work

This Handbook presents concepts, tools, techniques, and references that all fit under the banner of "Smart Mobility." To achieve the benefits that can be made possible by a Smart Mobility approach, Smart Mobility tools and techniques must be consistently and comprehensively put to work. Recognizing the many challenges of "mainstreaming" them into the work of many partner agencies at different levels of government as well as into Caltrans' functional divisions and districts, the final version of the Handbook will include a set of implementation checklists prioritizing specific implementation activities to be undertaken subsequently by state, regional, and local agencies.

Some of the implications of the Smart Mobility Framework are identified here in order to illustrate the far-reaching consequences of this new approach. These include:

- **Shifts in Transportation Agencies' Roles**. The need for several significant shifts in the role of the Department and other transportation agencies is signaled by the Smart Mobility Framework. The Framework is supported by CARB's AB32 Scoping Plan, which specifically references the Smart Mobility Framework and emphasizes that changes to personal vehicle use must accompany changes in fuels and vehicles.

  Shifts to a Smart Mobility approach will include:

  - Directing activities to support lower personal vehicle use, while meeting objectives for accessibility and economic growth.
  - Incorporating into transportation agencies' core missions the creation of secure funding sources for both transit capital improvements and operations, in light of the extremely significant role of transit in a Smart Mobility future.
  - Aligning investments and programs with Smart Mobility place types, which means:
    - Using Smart Mobility Place Types as a basis for context sensitive solutions broadly and for context sensitive facility design specifically.
    - Participating in integrated land use and transportation planning activities, such as blueprints, RTP sustainable communities strategies, and general plan updates as a partner seeking advancement of complete community design and regional accessibility elements consistent with place type planning.
    - Refining planning, programming, and evaluation activities so they are context sensitive and aimed at supporting transitioning or anchored place types.
    - Possible revisions to the Caltrans Highway Design Manual to advance location efficiency factors in appropriate for different contexts.
    - Consistent application of Smart Mobility performance measures and elimination of the use of performance measures that will work against Smart Mobility outcomes.

- **Interregional Network Role**. The introduction of location efficiency as a Smart Mobility principle emphasizes the factors of complete community design and regional accessibility. Caltrans has responsibility for developing, maintaining, and operating a multi-modal transportation network that has a high-level function with respect to goods movement, inter-regional, interstate, and cross-border travel. These functions must be integrated into the Smart Mobility Framework in order to deliver support for economic stewardship, connectivity, and the reliability that is valued by freight shippers and receivers. This will require that Caltrans carefully consider the selection and prioritization of Smart Mobility performance measures on the basis of facility type and place type. For example, Network Optimization, ROI Nexus, and minimizing Productivity Lost to Congestion will be primary performance measures for rural highways, interstates, and other freeways within rural, protected, and special use places and other interregional settings.
- **An Emphasis on Integrated Transportation and Land Use Planning.** Planning is an essential tool in the Smart Mobility Framework. Through the Blueprint planning program, Caltrans has already demonstrated its commitment to supporting planning activities with a Smart Mobility focus. However, using the Smart Mobility Place Types requires a higher commitment to planning and a more specific planning mission that will involve public agencies, non-governmental organizations, and a wide range of community stakeholders.

  A starting point for these planning activities is the identification of places through the "lens" of Smart Mobility Places Types, and a differentiation between places where activities enhancement of Location Efficiency factors and places where activities emphasize transitions. These designations are critical and will need to be aligned in activities from local government through regional planning. After place types are designated and long-term objectives expressed, specific Smart Mobility applications can be selected.
- **Respecting unique, locally-based approaches to Smart Mobility.** Some regional and local agencies have already established their commitment to Smart Mobility. Their work has provided inspiration for this Handbook, as is made clear by the references to regional policy, resources, models, and analyses throughout. A Smart Mobility approach does not require that all partner agencies use the precise tools and methods that are presented in this Handbook but rather that partner agencies pursue the same outcomes with compatible approaches. The innovation and unique local perspective reflected in the work of different agencies is a great benefit to the development and implementation of the Smart Mobility Framework.
- **Positioning to respond to emerging requirements for sustainable communities planning.** As is noted in the Handbook's introduction, this material is introduced to serve as a resource for Caltrans and partner agencies. As of the Handbook's release date in April 2009, implementation of the Smart Mobility Framework is optional. However, work on developing the framework is being undertaken concurrent with work to define implementing activities associated with

SB 375 of 2008 relating to sustainable communities planning. The Handbook is available as a basis for program requirements should they arise in connection with SB 375 implementation or climate change intervention programs.

- **Continued innovation with respect to sustainability and Smart Mobility practices.** A wide variety of evolving interests will continue to influence transportation policy and planning in California. Federal funding through economic stimulus packages and the federal reauthorization bill will likely place additional emphasis on the Smart Mobility principles expressed here. Demographic trends and real estate market economics will continue to place emphasis on location efficiency and cost-effective mobility. Rising environmental and climate concerns will place greater importance on green building practices such as ecological street design incorporating natural stormwater drainage systems, and transportation system management. New technology for energy generation and vehicle fleets will change the design requirements of the street and highway system, and new information and communications technology will improve facility and vehicle management practices. The Smart Mobility Framework will continue to evolve, innovate, and reinvent itself as these forces exert different influences and open new opportunities for planning, designing, and operation of the State's transportation system over time.

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6 Resources

6.1 Resources for Smart Mobility Place Types

Resources for Specific Place Types

Urban Centers

A more detailed approach to place types focusing on Transit Oriented Development:

- *Station Area Planning* by the Center for Transit Oriented Development.

New design guidance for major city streets:

- Recommended Practice: *Walkable Urban Thoroughfares: A Context Sensitive Solutions Approach* (forthcoming, published as an ITE Proposed Recommended Practice as *Context Sensitive Solutions for Designing Major Urban Thoroughfares in Walkable Communities*).

Close in Compact Communities

A rating system for neighborhood development oriented to environmental and energy efficient design.

- LEED for Neighborhood Development (LEED-ND) pilot program, available at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148.

Rural and Agricultural Lands

An investigation of the ties between the Sacramento region's urban and agricultural places, shedding light on a number of key issues with relevance to other areas of the State:

- SACOG Rural Urban Connections Strategy, online at: http://www.sacog.org/rucs/.

Performance measures for the following seven main performance categories: safety, system preservation, mobility, accessibility, reliability, productivity, and return on investment:

- Caltrans Performance Measures for Rural Transportation Systems, Caltrans, 2006.

There is considerable overlap with the Smart Mobility approach, though the overall focus of the 2006 document is narrower, and the level of technical detail deeper than is provided here. An online technical supplement to the publication is also available.

Data for decision makers for use in assessing present status, reviewing trends, and planning for the future of the state's agricultural land resources.

- The California Farmland Mapping and Monitoring Program (FMMP) including Important Farmland Maps, which combine resource quality (soils) and land use

information. Data are also released in statistical formats in program reports. See: http://www.conservation.ca.gov/dlrp/fmmp/Pages/Index.aspx.

Protected Lands

Best Practices highlighted at "Building Conservation into Infrastructure Planning," a California Agency Leaders' Briefing held in June, 2008:

- From California, the Regional Advanced Mitigation Planning Working Group, the Delta Risk Management Strategy for Levee Repair and San Diego's Transnet Environmental Mitigation Program.
- From Florida, the State's Efficient Transportation Decision Making Program.
- From North Carolina, Ecosystem Enhancement Program jointly established by the Department of Transportation and Partner agencies.

Understanding of the impact of roads on natural landscapes and human communities from the new field or Road Ecology.

- The UC Davis Road Ecology program, online at: http://roadecology.ucdavis.edu.

The Federal Highway Administration's publication: Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects *is the product of an inter-disciplinary effort* that began with a shared vision of an enhanced and sustainable natural environment, combined with the view that necessary infrastructure can be developed in ways that are more sensitive to terrestrial and aquatic habitats.

- http://www.environment.fhwa.dot.gov/ecological/eco_index.asp.

General Resources for Place-Based Approaches to Planning and Design

The Urban Transect

The "urban transect" is a highly-developed place classification system which is described in detail in the "Smart Code,**"** a model design code for regulating land development, street design and other public realm components. The transect is the basis for the "context zones" used in the proposed ITE Recommended Practice: "*Context Sensitive Solutions for Designing Major Urban Thoroughfares in Walkable Communities*." The Smart Code introduces six transect zones, designated T-1 through T-6, that focus on community design and represent a continuum of urbanism, with T-1 including protected lands and T-6 including urban centers. The transect largely fails to address the quality of regional accessibility which is critically important to location efficiency. For that reason, and because this effort has a goal of crafting a place type system specifically for application in California, the Smart Mobility place types do not directly apply the urban transect.

To highlight the usefulness of available material relating to application of the transect in addressing complete community design, Exhibit 19 shows how the Smart Mobility Place Types relate to the urban transect categories.

Exhibit 19: Relationship of Smart Mobility Place Types to Transect Zones

Place Type	Smart Code Transect Zones
1. Urban Centers	
1a. Urban Core	T5, T6
1b. Urban Centers	T4, T5
2. Close-in Compact Communities	
2a. Close-in centers	T4, T5
2b. Close-in corridors	T4, T5
3. Compact Communities	T3, T4, T5
4. Suburban	See note below
5. Rural and Agricultural Lands	
5a. Rural Towns	T3, T4
5b. Rural settlements and Agricultural Lands	T1, T2
6. Protected Lands	T1
7. Special Use Areas	n/a, Districts

Note regarding relevance of the transect to suburban place types: The transect zones represent place types that have the characteristics of traditional urbanism, so places that lack Complete Community Design elements are not recognized by any of the transect zones.

Most localities using a transect-based approach do so through form-based zoning. Resources include:

- **Smart Code**. The smart code is a model land development ordinance that uses the transect as the basis for form-based coding that is tailored to the specific location where it is applied. The focus of the Smart Code is on community design and site design features, which are important components of a Smart Mobility approach but which omit reference to regional accessibility. The Smart Code is available for download at www.smartcodecentral.com.
- **Form-Based Codes**. Form-based codes typically are organized through a system of place types that are customized for the area being regulated. SACOG has produced a downloadable Form-Based Codes Handbook to assist cities and counties in the Sacramento region that may want to develop form based codes. It provides background information on what a form-based code is, when to use it, and a guide on how to create one, along with regional case studies that provide different community prototypes with alternative approaches to developing a form-based code. The SACOG handbook is available for download at http://www.sacog.org/projects/form-based-codes.cfm.

- Extensive examples as well as guidance on preparing form-based codes are included in the book *Form Based Codes* by Paul Crawford, Dan Parolek, and Karen Parolek (John Wiley & Sons, 2008). The book's authors are associated with The Form-Based Codes Institute, which provides training and resources for practitioners, as well as a website, www.formbasedcodes.org.

Other Place-Based Applications

- Examples of smart growth strategies from the full range of transect zones are featured in "This is Smart Growth" from the Smart Growth Network, which can be downloaded from http://www.smartgrowth.org/library/articles.asp?art=2367&res=1024.
- The States of New Jersey and Pennsylvania, in the jointly-produced *Smart Transportation Guidebook*, present 10 themes for Smart Transportation. Two of these: "Build towns not sprawl" and "Understand the context; plan and design within the context" are particularly supportive of a place-based approach. The Guidebook introduces seven context areas, describing them according to quantitative characteristics and illustrating compatible thoroughfare types for the different contexts. The focus of the context area presentation is on thoroughfare design. The guidebook is online at http://www.smart-transportation.com/guidebook.html.
- Use of place types in regional planning exercises is common, and has been incorporated in various ways into a number of the Blueprint planning activities. In addition to the SACOG Blueprint, both the SCAG Compass Blueprint and SANDAG's Regional Comprehensive Plan (RCP) use place-based approaches for some part of their efforts. SANDAG's RCP includes a Smart Growth Concept Map that features seven smart growth "categories" that have considerable overlap with the Smart Mobility place types presented here. The map and related information are online at http://www.sandag.cog.ca.us/index.asp?projectid=296&fuseaction=projects.detail.
- Place-based VMT Analysis. SACOG staff has conducted an analysis that establishes four different categories of places based on VMT per capita. Accompanying the information on VMT is information about the characteristics of the areas with respect to activities, community design, circulation network, transit proximity and bike/walk mode share. The analysis, which was presented at the February 2009 meeting of the Regional Targets Advisory Committee, is particularly valuable because it provides evidence of the Smart Mobility benefits associated with both of the characteristics that are proposed here as the focus of the place types: regional accessibility and community design. Consistent with the Smart Mobility Framework, the SACOG work suggests that areas be identified that can change their performance through land use, urban design, and transportation system change over time.

6.2 Evidence Supporting Location Efficiency Benefits

Selected Evidence on VMT, Mode Share and Urban Development

The results of over 80 research and scenario testing projects are synthesized in three recent studies that support the Handbook's emphasis on location efficiency as part of a comprehensive Smart Mobility Framework. Readers should consult the full documents for complete information about analysis methods and findings. Highlights are included here.

Source: Ewing, Reid et al. Growing Cooler: The Evidence on Urban Development and Climate Change: Executive Summary, Urban Land Institute, Washington D.C., 2008.

- **Based on**: Review of prior research on the relationship between urban development, travel and CO_2 emissions from motor vehicles, focusing on benefits that can be gained from compact development.
- **Take away quote:** "Regardless of the (analysis) approach, researchers have found significant potential for compact development to reduce the miles that residents drive."
- **Key Findings:**
  - ***Compact Development vs. sprawl:*** An analysis of many studies finds that households living in developments with twice the density, diversity of uses, accessible destinations, and interconnected streets when compared to low-density sprawl drive about 33 percent less.
  - ***Public Health Effects:*** "Studies show that residents of communities designed to be walkable both drive fewer miles and also take more trips by foot and bicycle, which improves individual health."
  - ***Total Estimated VMT Impact:*** Smart growth could, with land use changes alone, reduce total transportation-related CO_2 emissions from current trends by 7 to 10 percent as of 2050. Complementary measures, such as higher fuel prices and carbon taxes, would further decrease VMT.
  - ***Demographic change and housing demand:*** Changing demographics, shrinking households, rising gas prices, and lengthening commutes are contributing to increased consumer demand for smaller homes and lots, townhouses, and condominiums near jobs and other activities.

Source: Rodier, Carolyn, "A Review of the International Modeling Literature: Transit, Land Use, and Auto Pricing Strategies to Reduce Vehicle Miles Traveled and Greenhouse Gas Emissions." August 1, 2008 submission to the Transportation Research Board Annual Meeting.

- **Based On:** 24 studies, 16 of which are in the US.
- **Take-away quote:** "Even improved calibrated travel models are likely to underestimate VKT reductions from land use, transit, and pricing policies."
- **Key Findings:**
  - ***Benefits of Land Use Strategies Over Time:*** The results of land use and transit strategies are fully realized over the course of several decades. Their use is a challenge when regulations emphasize near-term compliance.
  - ***Comprehensive Approaches:*** "Combined scenarios" involving land use, transit and pricing strategies consistently result in greater vehicle kilometers traveled (VKT) reductions than do single-strategy scenarios, in both the short and longer term.
  - ***Range of Benefits Expected:*** "Land use and transit scenarios may reduce VKT by 2% to 6% during a 10-year time horizon, and these figures may increase by approximately 2 to 5 percentage points at each future 10-year increment."

Source: Ewing, Reid. "Travel and the Built Environment—A Meta-Analysis," US EPA Smart Growth Office, 2008.

- **Based on:** 52 prior studies, all from 1996 or later.
- **Take-away quote:** "Almost any development in a central location is likely to generate less automobile travel than the best-designed, dense, mixed-use development in a remote location."
- **Key Findings:**
  - ***Importance of Regional Accessibility:*** The dominant effect on VMT is destination accessibility
  - ***Importance of Density:*** Density is the single most powerful element of complete community design among those influencing trip making, mode choice and vehicle miles traveled
  - ***Walk trips:*** The number and likelihood of walk trips is about equally influenced by diversity, design, and destination accessibility
  - ***Transit Trips:*** The number and likelihood of transit trips is most strongly influenced by destination accessibility, then transit access, and then design
  - ***Comparison of Compact vs. Conventional (suburban) neighborhoods:*** The studies surveyed consistently find that compact, walkable neighborhood

characteristics result in significantly lower VMT than conventional neighborhoods.

Evidence on Mixed Use and Transit Oriented Development

Two new studies that together examine the performance of over 250 locations focus on specific development types that aim to create location efficient places: mixed use development and transit oriented development. Results of both support the Handbook's emphasis on location efficiency as an important part of a comprehensive Smart Mobility Framework. Readers should consult the full documents for complete information about analysis methods and findings. Highlights are included here.

Source: Ewing, Reid et al. "Traffic Generated by Mixed-Use Development: A Six-Region Study Using Consistent Built Environmental Measures," Paper presented at the 2009 Annual Meeting of the Transportation Research Board.

- **Based On:** Travel and land use data from 239 mixed use development sites in six U.S. regions, and travel diary data from those regions.
- **Take-Away Quote:** "on average, a total of 29% of the total trip ends generated by mixed-use developments put no strain on the external street network, generate very few vehicle miles traveled, and should be deducted from ITE trip rates for stand-alone developments."
- **Key Findings:**
  - ***Location Efficiency Factors:*** The primary factors affecting the reduction in automobile travel associated with large mixed use development projects are:
    - The total amount of population and employment on the site.
    - The jobs / housing balance within the site.
    - The density of development on the site (floor area ratio).
    - The size of households and their auto ownership characteristics.
    - The amount of employment within walking distance of the site.
    - The pedestrian-friendliness of the site (small blocks and sidewalks).
    - The density of bus stops within the mixed use development, presence or absence of an internal rail station.
    - Regional transit accessibility measured in terms of jobs reachable within a 30 minute transit ride of the site.
  - ***Importance of Regional Accessibility:*** For vehicle trips, better regional accessibility to jobs shortens average vehicle trips. This effect is as significant as the effects associated with internal capture of trips with mixed-use developments, and conversion of some external trips from auto to alternate modes.
  - ***Walking Factors:*** Among variables studied, the strongest influences on walking are intersection density, and jobs within one mile of the project boundary. [Intersection density can be classified as a complete community design element, while job proximity is a measure of regional accessibility.]

Source: PB Placemaking, Robert Cervero, Center for Transit Oriented Development and Urban Land Institute, "Effects of TOD on Housing, Parking and Travel," TCRP Report 128, Final Draft, August 1, 2008.

- **Based on:** Data on 17 TOD projects in 4 regions, and literature review.
- **Take-Away Quote:** "This study reports that commuters living in transit oriented developments typically use transit 2 to 5 times more than other commuters in their regions, with TOD transit mode share varying from 5% to near 50%."
- **Key Findings:**
  - ***Quality of Transit Service:*** Transit ridership is heavily influenced by travel times which vary markedly across the regions studied. Connectivity is also a key ridership factor.
  - ***Regional Accessibility:*** As the transit network links to more job centers, educational opportunities and cultural facilities, transit use increases.
  - ***Importance of Density in TOD:*** The most effective strategy for increasing TOD ridership is to increasing development densities in close proximity to transit.
  - ***TOD and Parking:*** The research confirms that the ITE's published trip generation and parking generation rates underestimate automobile trip reduction for TOD housing. Findings are that "Over a typical weekday period, the 17 surveyed TOD-housing projects averaged 44% fewer vehicle trips than that estimated by the ITE manual.
  - ***TOD and Car Ownership:*** Households living in TOD are almost twice as likely as other households to not own a car, and own almost half the number of cars of other households. There are two reasons for these differences: TOD households are relatively small households, and they may choose not to own "extra" cars due to transit's proximity.

6.3 Best Practices for Smart Mobility

This section summarizes examples from other agencies relevant to Smart Mobility. Exhibit 20 lists the documents referenced in this section as well as elsewhere in the Handbook and identifies the relevance of each document to Smart Mobility applications and principles.

Exhibit 20: Master List of Reference Documents

			Smart Mobility Application					Smart Mobility Principles			
Best Practices Reference	**Source**	**Handbook Reference**	**Planning and Programming**	**Standards and Guidelines**	**Decision Support**	**Performance Measures**		**Location Efficiency**	**Reliability**	**Health & Safety**	**Stewardship**
Compass Blueprint	SCAG	Exhibit 2	■		■			■	■	■	■
Sacramento Regional Blueprint	SACOG	Exhibit 2	■		■			■	■	■	■
Regional Comprehensive Plan	SANDAG	Exhibit 2; 6.1	■		■			■	■	■	■
San Joaquin Valley Blueprint	SJV COGs	Exhibit 2	■		■			■	■	■	■
FOCUS	Bay Area Regional Livability Footprint Project	Exhibit 2	■		■			■	■	■	■
Walkable Urban Thoroughfares: A Context Sensitive Solutions Approach	Institute of Transportation Engineers	6.1		■	■			■	■	■	
LEED for Neighborhood Development	US GBC	6.1		■	■			■	■	■	■
Rural Urban Connections Study	SCOG	6.1		■	■			■	■	■	■
Performance Measures for Rural Transportation Systems	Caltrans	6.1				■		■	■		■
California Farmland Mapping and Monitoring Program	CA Dept. of Conservation	6.1	■		■						■
Eco-Logical Program	FHWA	6.1	■		■						■
Smart Code	Smart Code Central	6.1	■	■				■			
Form-based Codes Handbook	SACOG	6.1	■	■				■			
Form-Based Codes	John Wiley & Sons (book)	6.1	■	■				■			
This is Smart Growth	Smart Growth Network	6.1	■					■	■	■	■
Smart Transportation Guidebook	NJ DOT and PennDOT	6.1, 6.3	■	■	■			■	■	■	■
Place-based VMT analysis	SACOG	6.1			■			■			
State Highway Access Code	Colorado DOT	6.3	■	■					■		■
Strategic Investment Tool	Florida DOT	6.3	■		■	■			■	■	■
Efficient Transportation Decision Making	Florida DOT	6.3			■						■
Multi-modal Quality / Level of Service Tool	Florida DOT	6.3		■	■	■			■	■	
Socio-Cultural Effects Evaluation	Florida DOT	6.3			■				■	■	■

			Smart Mobility Application					Smart Mobility Principles			
Best Practices Reference	Source	Handbook Reference	Planning and Programming	Standards and Guidelines	Decision Support	Performance Measures		Location Efficiency	Reliability	Health & Safety	Stewardship
2030 Transportation Plan	Idaho Transportation Agency	6.3	■		■						■
2003 Statewide Transportation Plan	Minnesota DOT	6.3	■		■	■			■	■	■
Environmental Sustainability Rating Scorecard (Green Lites Program)	New York DOT	6.3		■	■					■	■
Climate Change / Energy Efficiency Team	New York DOT	6.3	■		■						■
Equity Analysis	SF Bay Area MTC	6.3						■	■	■	■
Sustainability Program	Oregon Department of Transportation	6.3	■					■	■	■	■
New Jersey Future in Transportation	New Jersey DOT	6.3	■		■			■	■	■	■
Transportation Project Mitigation Cost Screening Matrix	Washington DOT	6.3			■						■
Integrating Land Use and Transportation Investment Decision-Making	Washington DOT	6.3			■			■			
Climate Action Team	Washington DOT	6.3	■		■						■
Transportation Improvement Program 2008-2013	Denver Regional COG	6.3	■			■			■	■	
Destination 2030 and Vision 2040	Puget Sound Regional Council	6.3	■			■		■	■	■	■
Commonwealth Capital Policy	Mass. Office of Commonwealth Development	6.3			■			■	■	■	■
Transit Supportive Land Use Criteria	Federal Transit Administration	6.3	■		■			■			■
Secondary Street Acceptance Requirements	Virginia DOT	6.3		■				■	■		■
Multimodal Level of Service Analysis for Urban Streets	NCHRP Project Report 616	6.3				■		■	■	■	
Affordability Index	Brookings Institute	6.3	■		■	■		■			
TOD 101 and TOD 202 publications	Center for Transit Oriented Development	6.1, 6.3			■			■	■		■

Colorado DOT

State Highway Access Code

This permitting program has allowed the State to implement its access management program through a formalized process. It groups state roads into eight classification categories based on volume and speed. Each category has requirements that include minimum distances between access points. This enables access to be evaluated on a system network level rather than on a driveway by driveway basis. Since localities require state highway access permits prior to development approval, the standards are a mechanism for coordination of local land use with transportation system management.

Link: http://www.dot.state.co.us/AccessPermits/index.htm.

Florida Department of Transportation

Strategic Investment Tool

This Strategic Investment Tool encompasses 25 performance measures. The tool was used initially to determine priorities for the Strategic Intermodal System plan.[5] The SIS is a set of highway, aviation, port and rail projects associated with designated *Transportation Hubs* or *Interregional Corridors*. The measures are also used to identify emerging SIS priorities. The SIS concept grew out of the Economic Competitiveness goal in the 2020 Florida Transportation Plan.

There are five prioritization criteria, each corresponding to the appropriate SIS goal.

- Safety (more secure system for residents, businesses and visitors).
- Preservation (management of transportation facilities).
- Mobility (people and freight).
- Economic (competitiveness and diversification).
- Community and Environment (enriched quality of life and responsible environmental stewardship).

The 4 growth management criteria are an aspect of the SIS that is particularly relevant to the concept of Smart Mobility:[6]

- Consistent, to the maximum extent feasible, with respective adopted local government comprehensive plans (all modes).
- Projects listed as backlogged in local government comprehensive plan and / or concurrency management system. (highway).

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[5] The first plan was submitted to the Florida legislature in 2005.

[6] http://www.dot.state.fl.us/planning/systems/mspi/pdf/GMPres081205.pdf

- If applicable, project supports mobility within designated infill areas, redevelopment areas, downtown revitalization areas, or multimodal districts (all modes).
- Remove significant truck traffic from downtowns, historic districts or residential areas (highway and rail).

Link: http://www.dot.state.fl.us/planning/SIS/default.htm.

Efficient Transportation Decision Making (ETDM)

The initiative was originally conceived as a response the Environmental Streamlining provisions in the TEA-21 reauthorization bill. The framework is deployed in all three major phases of Planning, Programming and Project Development. The key innovative element of this process is the ***Environmental Screening Tool***—an Internet-accessible interactive database and mapping tool.

Link: http://www.dot.state.fl.us/emo/ETDM.htm.

Multi-modal Quality / Level of Service Tool

There are two primary implementation mechanisms for this program. The unique aspects of this effort are threefold:

1. A free tool based on the Highway Capacity Manual that produces LOS measures for bike, pedestrian, transit and road traffic performance in an integrated manner.
2. Bike and pedestrian measures validated with field research on user perception of the safety and comfort of facilities. This is more meaningful than measures of crowding on a sidewalk or in a bike lane that were previously available.
3. Its connected to Florida's statewide minimum LOS standards and guidance on Multimodal Planning Districts

Link: http://www.dot.state.fl.us/planning/systems/sm/los/default.htm.

See also: *Model Regulations and Plan Amendments for Multimodal Transportation Districts* http://www.dot.state.fl.us/planning/systems/sm/los/pdfs/MMTDregs.pdf.

Socio-cultural Effects Evaluation

This is an analytical method for evaluating the impact of potential transportation investments on quality of life in nearby communities. It provides a framework for bringing together both qualitative and quantitative measures—information gathered through public meetings, formal public surveys, GIS analysis of local amenities, etc. The analysis is tailored to each project and issues are selected from 54 key policy questions grouped into six categories: Social, Economic, Land Use, Mobility, Aesthetics, and

Relocation. The evaluation is embedded within the ETDM process mentioned above and Environmental Screening Tool is a key tool employed in the analysis.

Link: http://www.dot.state.fl.us/emo/pubs/sce/sce.htm.

Idaho Transportation Agency

2030 Transportation Plan

Innovative long range planning process that used a scenario evaluation tool (MetroQuest) to help stakeholders explore the implications of a variety of future investment strategies. Another unique aspect was the use of an executive "Vision Management Team" to guide the process.

Link: http://itd.idaho.gov/planning/futuretravel/ITD_Vision/Vision_Complete.pdf.

Minnesota DOT

2003 Statewide Transportation Plan

A good example of comprehensive performance measures integrated into long-rage planning. The measures for the State Plan were spread across 10 policy areas and included: ride quality, physical condition of infrastructure, travel time reliability, travel and flow management, travel speed, duration and extent of congestion, crash rate, fatalities, air quality, water quality, and land management. Each district level plan evaluated their investment plans against targets in each of these areas.

Link: http://www.oim.dot.state.mn.us/StatePlan/index.html.

New York DOT

Environmental Sustainability Rating Scorecard (Green Lites Program)

An evaluation tool for use by the DOT in evaluating its own project proposals against a "slate" of criteria relating to sustainability and environmental protection. The criteria are grouped into five categories, as follows: sustainable sites, water quality, materials and resources, energy and atmosphere, and innovation. No differentiation in relation to travel modes or community context is made.

Link: https://www.nysdot.gov/programs/greenlites.

Climate Change / Energy Efficiency Team

This initiative was established in September, 2007. It is structured around five working groups charged with crafting recommendations to improve energy efficiency and reduce greenhouse gases. Of particular relevance is the working group charged with:

> "Changing the way the department designs, constructs, rehabilitates, maintains and operates the transportation infrastructure under its control to reduce the amount of greenhouse gases produced by transportation. This includes explicitly considering climate change and energy efficiency when transportation plans are prepared, the capital program is developed and project alternatives are selected."

The effort is lead by the Deputy Commissioner. A broad group of state agency and private sector stakeholder are included in this collaborative effort.

Link: https://www.nysdot.gov/portal/page/portal/news/press-releases/2008/2008-04-21.

San Francisco Bay Area Metropolitan Transportation Commission

MTC Equity Analysis

MTC used accessibility measures to evaluate the equity implications of its Transportation 2030 Plan. Travel time by car and transit to key locations (schools, jobs, health services, etc.) were key measures. The analysis also attempted to quantify out of pocket savings associated with key investments and specifically tracked changes in VMT through low income and minority communities.

Link: http://www.mtc.ca.gov/planning/2030_plan/equity.htm.

Oregon DOT

Sustainability Program

A Department-wide Sustainability Plan based on 3 goals – Improve Safety, Move People and Goods Efficiently, Improve Livability and Economic Prosperity. These goals and the specific performance measures with each broad objective were applied to the: Oregon Transportation Investment Act III Bridge Replacement Program, ODOT Maintenance Environmental Management System, and Oregon Transportation Plan update.

Link: http://www.oregon.gov/ODOT/SUS/index.shtml.

New Jersey DOT, Pennsylvania DOT, Delaware Valley Regional Planning Commission

Smart Transportation Guidebook

This jointly produced document provides planning and design guidelines. It covers all aspects of the road network other than limited access highways. Six principles of Smart Transportation are identified:

1. Tailor solutions to the context
2. Tailor the approach

3. Plan all projects in collaboration with the community
4. Plan for alternative transportation modes
5. Use sound professional judgment
6. Scale the solution to the size of the problem

Link: http://www.smart-transportation.com/guidebook.html

New Jersey Department of Transportation

New Jersey Future in Transportation (FIT)

This initiative is a partnership between NJ DOT and the State Office of Smart Growth. It seeks to "integrate road building and community building." The central implementation mechanism of NJ FIT is toolbox of techniques that include "traditional capacity improvements and innovative techniques, with a focus on education and communication."

Link: http://www.state.nj.us/transportation/works/njfit.

Washington DOT

Transportation Project Mitigation Cost Screening Matrix

The tool is part of the Agency's Watershed Management Program. It incorporates a wide range of data (e.g. urbanization patterns, flood maps, topography, soil type, parks and cultural resources) to identify projects that would benefit from mitigation planning at the watershed level. The core output of the tool is a Mitigation Risk Index score that "estimates the percentage of land area within the project limits that will likely experience logistical difficulties or elevated costs for in right-of-way environmental mitigation."

Link: http://www.wsdot.wa.gov/Environment/Watershed/screeningtool.htm.

Implementing Transportation-Efficient Development: A Local Overview (Phase 1)

The report examined "relationships between local regulations and approved project proposals were examined in 19 study areas along two major state highway corridors in the central Puget Sound region."

Link: http://www.wsdot.wa.gov/Research/Reports/500/549.1.htm.

Strategies and Tools to Implement Transportation-Efficient Development: A Reference Manual (Phase 2)

Link: http://www.wsdot.wa.gov/Research/Reports/500/574.1.htm.

Transportation-Efficient Land Use Mapping—TELUMI (Phase 3)

The tool provides a streamlined methodology for examining the complex relationship between land use and travel behavior. The TELUMI is a set of maps that depicts how the region's urban form affects overall transportation system efficiency.

Link: http://www.wsdot.wa.gov/Research/Reports/600/620.1.htm.

Climate Action Team Implementation Working Group for Transportation

The group was set up to identify actions to reduce transportation related GHG emissions. It recommended specific steps to achieve the VMT reduction goals established by the legislature under HB 2815.

Link: http://www.ecy.wa.gov/climatechange/2008CAT_iwg_tran.htm.

Denver Regional Council of Governments

Transportation Improvement Program (FY 2008-2013)

Projects in the TIP were evaluated by a scoring system tailored to project type. The categories included: Current congestion, Safety, Cost-effectiveness, Condition of major structures, Long range plan score, Transportation system management, Multimodal connectivity, Matching funds, Project-related Metro Vision implementation and strategic corridor focus, Sponsor-related Metro Vision implementation.

Link: http://www.drcog.org/index.cfm?page=TransportationImprovementProgram(TIP).

Puget Sound Regional Council

Destination 2030 and Vision 2040

A wide range of performance measures were incorporated into these two complimentary long range plans (transportation and regional land use). The breadth of the performance measures is significant: mobility, safety, land use, environment, etc. PSRC's implementation of a monitoring system related to these measures is one of the most innovative aspects of this example.

Link: http://psrc.org/projects/mtp/d2030plan.htm.

Massachusetts Office of Commonwealth Development

Commonwealth Capital Policy

The Commonwealth Capital Policy provides financial incentives to communities that apply smart growth principles. Fourteen state funding programs are guided by the policy and the Commonwealth Capital Scores that emerge from OCD's smart growth scorecard. To date, nearly 300 communities have participated.

Link: www.mass.gov/Agov3/docs/smart_growth/Commonwealth%20Capital%20Summary%2009.rtf.

Federal Transit Administration

Transit Supportive Land Use Criteria

A comprehensive model for transit project evaluation that explicitly incorporates Smart Mobility Principles. There are three major rating categories, each with supporting factors scored with qualitative criteria—High / Medium / Low. Scores are averaged to produce an overall "Transit Supportive Land Use" rating for transit capital projects. This rating, in turn, is combined with the cost effectiveness rating to evaluate proposed capital projects.

Link: http://www.fta.dot.gov/planning/newstarts/planning_environment_2620.html.

Commonwealth of Virginia

Secondary Street Acceptance Requirements

The requirements establish new criteria for developer-built streets that are to be maintained by the Commonwealth of Virginia.

In a significant departure from previous policy, developers are now required to build streets that connect with the surrounding transportation network "in a manner that enhances the capacity of the overall transportation network and accommodates pedestrians, while also minimizing the environmental impacts of stormwater runoff by reducing the street widths and allowing the use of low impact development techniques."

Link: http://virginiadot.org/projects/ssar.

National Cooperative Highway Research Program

NCHRP Report 616: Multimodal Level of Service Analysis for Urban Streets

The Report presents the final recommended LOS models and draft Urban Streets chapter on urban street level of service for the 2010 Highway Capacity Model. Separate models are presented for auto, transit, bike and pedestrian LOS. These are combined in an integrated framework. The four modal LOS models re integrated in that they share the same rating system, share much of the same input data, and reflect intermodal effects of one mode on the perceived level of service of the other.

The related Web-Only User's Guide (Document 128) explores procedures for predicting traveler perceptions of quality of service and performance measures for urban streets.

Link: http://trb.org/news/blurb_detail.asp?id=9186.

Brookings Institute Urban Markets Initiative

The Affordability Index

A new information tool developed by the Urban Markets Initiative to quantify the impact of transportation costs on the affordability of housing choices. The second phase of the Brookings project models neighborhood-level data for 52 different metropolitan areas with results available through an interactive mapping website: http://htaindex.cnt.org/map_tool.

Link: www.brookings.edu/~/media/Files/rc/reports/2006/01_affordability_index/20060127_affindex.pdf

Center for Transit Oriented Development

TOD 101 and TOD 202 Series

The Center for Transit Oriented Development (TOD) offers a variety of best practices references that is continually updated. These include illustrated introductions to key topics relating to TOD in the TOD 101 and TOD 202 series, as well as publications that explore in greater depth detailed topics such as value capture and fostering mixed income housing near transit.

Link: http://reconnectingamerica.org/public/practices.

Glossary of Terms and Abbreviations

4D's	A set of land use and development pattern factors that have been shown to have statistically significant correlation with vehicle trip making and vehicle trip length. The 4D's are design (described principally as circulation network intersection density and sidewalk connectivity), diversity (mix of employment and housing), density (amount of housing and employment per unit of land area) and destinations (regional accessibility to employment)
Blueprint Program	A Caltrans-funded Program that provides funds for regional collaborative decision-making and adoption of plans that will achieve performance outcomes to foster more efficient land use patterns that: • Support improved mobility and reduced dependency on single-occupant vehicle trips. • Accommodate an adequate supply of housing for all incomes. • Reduce impacts on valuable habitat, productive farmland, and air quality. • Increase resource use efficiency. • Promote a prosperous economy. • Result in safe and vibrant neighborhoods. *From Caltrans FY 2007/08 Blueprint Grant Application*
CEQA	California Environmental Quality Act
CSMP	Corridor System Management Plan
CTP	California Transportation Plan
Complete Community Design	Characteristics of development pattern and transportation system at the neighborhood and district scale that combine to support convenience, non-motorized travel, and efficient vehicle trips.
Complete Neighborhoods	Areas that are predominantly housing with a mix of other uses and design characteristics that contribute to supporting convenience, non-motorized travel, and efficient vehicle trips.

Complete Streets	Streets designed and operated to enable safe access for all users so that pedestrians, bicyclists, motorists, and transit riders of all ages and abilities are able to safely move along and across the street. *Based on definition of Complete Streets from www.completethestreets.org)*
GHG	Greenhouse gas(es)
High capacity transit	High capacity transit vehicles make fewer stops, travel at higher speeds, have more frequent service, and carry more people than local service transit such as typical bus lines. High capacity transit includes options such as light rail, commuter rail, and bus rapid transit. *Based on Portland Metro definition from www.oregonmetro.gov/index.cfm/go/by.web/id=28462*
IGR	Intergovernmental review
Induced development	Real-estate investment and development that occurs in a transportation corridor as a result of transportation investment that improves travel capacity or efficiency within the corridor. The land development may be residential, commercial, industrial or activity center, may occur as a result of or in anticipation of the transportation project, and may be in response to any type of major transportation investment, including freeway extension or widening, new interchange or bridge, or rail station.
Induced travel	Travel that occurs as a result of a decrease in the generalized cost of travel, including both travel-time and out-of-pocket costs. Induced travel may be a result of changes to one or more of the following traveler choices: new trip generation, longer trips, trips to different destinations, reduced trip consolidation or "chaining," use of different modes, different travel routes, or travel at different times of day. Induced vehicle travel may occur as a result of roadway expansion. Induced transit travel may occur as a result of transit system or service expansion. *Based on Federal Highway Administration Definition from www.fhwa.dot.gov/Planning/itfaq.htm#q1*
ITE	Institute of Transportation Engineers
ITS	Intelligent transportation systems

Livability	Environmental and social quality of an area as perceived by residents, employees, customers and visitors. This includes safety and health (traffic safety, personal security, public health), local environmental conditions (cleanliness, noise, dust, air quality, water quality), the quality of social interactions (neighborliness, fairness, respect, community identity and pride), opportunities for recreation and entertainment, aesthetics, and existence of unique cultural and environmental resources (e.g., historic structures, mature trees, traditional architectural styles). *Based on definition of community livability from VTPI online TDM encyclopedia, www.vtpi.org/tdm/tdm97.htm*
Location Efficiency	The fit between the physical environment and the transportation system that can lead to Smart Mobility benefits. Two factors in achieving location efficiency are regional accessibility and complete community design. These can be complemented for stronger results by transportation demand management and pricing mechanisms.
LOS	Level of Service
MTC	San Francisco Bay Area Metropolitan Transportation Commission
Parking Management	Strategies aimed at making better use of parking supply through altering the amount, location and design, regulation, pricing, and management of on- and/or off-street parking.
Public Realm	The shared space of urbanized areas, often referred to as "the space between buildings," that includes the public right of way, open spaces including parks and plazas, and building facades.
Regional Accessibility	Characteristics of development pattern, geographic location, and transportation system that combine to make non-local destinations easily reached.
ROI	Return on Investment
SACOG	Sacramento Area Council of Governments
SANDAG	San Diego Area Association of Governments
SCAG	Southern California Association of Governments

Smart Growth	A planning, conservation, and development approach that is summarized in the following ten principles: 1. Mix land uses 2. Take advantage of compact building design 3. Create a range of housing opportunities and choices 4. Create walkable neighborhoods 5. Foster distinctive, attractive communities with a strong sense of place 6. Preserve open space, farmland, natural beauty, and critical environmental areas 7. Strengthen and direct development towards existing communities 8. Provide a variety of transportation choices 9. Make development decisions predictable, fair, and cost effective 10. Encourage community and stakeholder collaboration in development decisions *U.S. EPA Smart Growth Principles from www.epa.gov/piedpage/about_sg.htm.*
SMPM	Smart Mobility performance measures
SOV	Single-occupant vehicle
Stewardship	In the context of the Smart Mobility Framework, shared responsibility for essential assets and activities.
TOD	Transit Oriented Development
Urban	As used in the Smart Mobility Handbook, developed areas characterized by relatively great intensity of residential, commercial, and institutional uses. The urban Smart Mobility place types are: urban centers, close-in compact communities, compact communities, suburban communities, and some special use areas.
Urbanized	Developed areas, including all urban Smart Mobility place types and rural towns.
VKT	Vehicle kilometers of travel
VMT	Vehicle miles of travel

Walkability	The extent to which the built environment supports and encourages pedestrian movement by providing for pedestrian comfort and safety, connecting people with varied destinations within a reasonable amount of time and effort, and offering visual interest in journeys throughout the network. *Based on definition in "Designing the Walkable City" by Michael Southworth, in* Journal of Urban Planning and Development*, December 2005.*

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