Livable Transit Corridors: Methods, Metrics, and Strategies

DETAILS

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TRANSIT COOPERATIVE RESEARCH PROGRAM

TCRP RESEARCH REPORT 187

Livable Transit Corridors: Methods, Metrics, and Strategies

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TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, adapt appropriate new technologies from other industries, and introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions,* published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transportation Association (APTA), *Transportation 2000,* also recognized the need for local, problem-solving research. TCRP, modeled after the successful National Cooperative Highway Research Program (NCHRP), undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes various transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

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FOREWORD

By Dianne S. Schwager
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TCRP Research Report 187: Livable Transit Corridors: Methods, Metrics, and Strategies presents practical planning and implementation strategies to enhance livability in transit corridors. This Handbook provides a resource for planning practitioners, policy makers, and other stakeholders to measure, understand, and improve transit corridor livability.

This Handbook provides a definition of transit corridor livability and a set of methods, metrics, and strategies—framed within a five-step visioning and improvement process—that communities can use to improve livability in their transit corridors. This process provides transit corridor stakeholders with a set of tools and techniques that can help in planning and building support for corridor improvements, screening alternatives in preparation for environmental review, identifying a corridor's livability needs, and developing an action-oriented set of strategies for improving transit corridor livability and quality of life. To assist Handbook users in this process, a spreadsheet-based Transit Corridor Livability Calculator tool is also available for download from the TRB website (trb.org) by searching "TCRP Research Report 187."

The Handbook presents five steps for planning livable corridors: Step 1: Initiate Project; Step 2: Assess the Corridor; Step 3: Identify Goals; Step 4: Develop a Vision; and Step 5: Implement Strategies.

Much of the project research is presented in the eight appendices that accompany this Handbook:

- Appendix A: Goals and Related Strategies.
- Appendix B: Description of Implementation Strategies.
- Appendix C: Coordination and Collaboration Strategies.
- Appendix D: Livable Transit Corridor Typology.
- Appendix E: People and Place Livability Combinations.
- Appendix F: Metrics, Methods, and Data.
- Appendix G: Statistical Analysis of Metrics and Typology Categories.
- Appendix H: Calculator User Manual.

The research was performed by CFA Consultants, with Christopher E. Ferrell, Principal Investigator, and Bruce S. Appleyard, Deputy Principal Investigator. The research methods included quantitative, statistical measurement and modeling of over 350 transit corridors in the United States as well as focused qualitative data collection and analysis of 17 case study corridors. Quantitative analysis was primarily used to identify the metrics that worked best to characterize the livability and quality of life outcomes of transit corridors, while qualitative analysis served to identify and evaluate the state of the practice of livability improvement strategies.

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Handbook Introduction

While livability has received increasing attention in planning and policy circles recently, agreement as to how to define, measure, and create it has been elusive. This is especially true in terms of the livability benefits of transit investments. While livability definitions tend to boil livability down to serving diverse people with diverse opportunities (RITA Office of Research, Development, and Technology 2011), most have not been specific enough to measure it consistently and implement it effectively. Furthermore, getting specific about livability—particularly when focusing on the livability benefits of transit-supportive investments—may cause those who do not care for transit to dismiss it.

This Handbook offers a bridge between these objectives: it provides a definition broad enough for all but specific enough to be useful. It provides a measurable and actionable definition of transit corridor livability that is based on core, widely accepted values that can make it universally acceptable. Using this definition, the Handbook offers a set of methods, metrics, and strategies embedded within a five-step visioning and improvement process that communities can use to improve livability in their transit corridors. This process, and the methods, metrics and strategies it employs, provides transit corridor stakeholders with a set of tools and techniques that can help in planning and building support for corridor improvements, screening alternatives in preparation for environmental review, identifying a corridor's livability needs, and developing an action-oriented set of strategies for improving transit corridor livability and quality of life.

What This Handbook Is (and Is Not) Designed to Do

This Handbook is designed to provide the following:

- A clear and precise understanding of transit corridor livability that is also flexible enough to account for local values and aspirations—it is not one-size-fits-all.
- A practical, powerful, and empirically based set of analytic tools for measurement, which are designed to supplement but not replace established travel demand, transit quality of service, or traffic operations tools.
- A clear, step-by-step visioning process for building corridor coalitions, not for top-down planning.
- A comprehensive menu of implementation goals and strategies that provides options without being prescriptive.

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Why Plan for Livability?

There are a number of important benefits to planning transit systems and their surrounding communities for enhanced livability. Livability planning techniques and implementation strategies can help:

- Increase transit ridership, walking, and bicycle use;
- Increase the number of people who can perform many of their daily activities within their communities;
- Provide more affordable housing opportunities;
- Provide more opportunities for a community's residents, workers, and visitors to make healthy lifestyle choices through active transportation modes such as walking and cycling; and
- Increase public participation and equity in the planning process.

Why Plan Transit Corridors?

There are several important benefits to planning transit systems and their surrounding communities at the corridor level. Transit corridor-level planning helps to:

- Increase transit ridership by creating consistent and connected corridor station areas;
- Provide more economic development opportunities beyond immediate station areas;
- Increase the distance people will be willing to walk or bike by integrating transit services on a corridor-wide basis;
- Provide desirable land uses and amenities linking neighborhoods to transit;
- Provide transit-accessible activities and opportunities that serve the full spectrum of residents' needs;
- Bring urban design, infrastructure, and streetscape improvements to areas not typically covered by plans focused on the quarter- to half-mile radius of transit stations, which helps create consistent and connected corridor station areas (Urban Land Institute-Los Angeles 2013);
- Provide more economic development opportunities beyond immediate station areas, which leverages private investment with public investment collateral to transit and economic development (Urban Land Institute-Los Angeles 2013); and
- Decrease the "first-mile/last-mile" problem of transit station access, which increases the distance people will be willing to walk or bike and integrates transit services on a corridor-wide basis (Urban Land Institute-Los Angeles 2013).

Defining Transit Corridor Livability

The Handbook defines livability as *people having good access to opportunities they can use in the pursuit of improvements to their quality of life.*

This is a definition of livability for all.

The Handbook's definition combines this "access to opportunities" statement with refined and transit-specific versions of the Livability Principles developed by the Partnership for Sustainable Communities—a collaboration between the U.S. Department of Transportation, the Environmental Protection Agency, and the Department of Housing and Urban Development (U.S. Department of Housing and Urban Development et al. undated). The new Transit Corridor Livability Principles are summarized and presented along with the original principles that inspired them in Table 1.

Table 1. Comparison of the Partnership's Livability Principles with the Transit Corridor Livability Principles.

Partnership for Sustainable Communities' Livability Principles	Transit Corridor Livability Principles
Provide more transportation choices	High-quality transit, walking, and bicycling opportunities
Promote equitable and affordable housing	Mixed-income housing near transit
Enhance economic competitiveness	Transit-accessible economic opportunities
Coordinate and leverage federal policies and investments	Accessible social and government services
Support existing communities	Vibrant and accessible community, cultural, and recreational opportunities
Value communities and neighborhoods	Healthy, safe, walkable transit corridor neighborhoods

Transit Corridor Livability Visioning

This Handbook uses the transit corridor livability definition as a foundation to present a set of assessment methods, metrics, and implementation strategies that metropolitan planning organizations (MPOs), councils of governments (COGs), large transit agencies that have multi-jurisdiction service areas, and other stakeholders can use to improve their transit corridors. Corridor-level planning, scenario-based planning, and placemaking techniques are all embedded within a familiar and effective stakeholder-led visioning process for building livable transit communities based on a national review of best practices.

Corridor-Level Planning and MPO/COG Leadership

Transportation planners are increasingly embracing corridor-level methods for coordinating transportation and land use investments. This Handbook is designed to fit into that trend, but like the concept of livability, corridor planning brings with it a host of challenges.

Two categories of challenges are common to both transit corridor and livability planning efforts: jurisdictional and interdisciplinary. Jurisdictional challenges arise because corridors often cross governmental boundaries. Corridor-level planning requires coordination and collaboration among overlapping jurisdictions. Cross-jurisdictional collaboration requires stakeholder leadership at the regional level that can mediate, broker, and incentivize common corridor livability development goals.

Building livability also requires an interdisciplinary approach to planning, calling for cooperation among public and private stakeholders that may not be used to working together. Planning pays off when stakeholders who hold different but intersecting interests work together to clarify and commit to goals (desired outcomes) and strategies (general methods) (Mintzberg and Quinn 1996). The transit corridor livability methods, metrics, and strategies provided in this Handbook are embedded within a process of stakeholder engagement using the scenario planning and visioning process. This visioning process is designed to address both jurisdictional and interdisciplinary challenges common to transit corridor livability planning, but success requires leadership that can work collaboratively.

Because of their regional perspective and multidisciplinary contacts, MPOs and COGs are uniquely suited to be leaders in planning and building livable transit corridors. However, many

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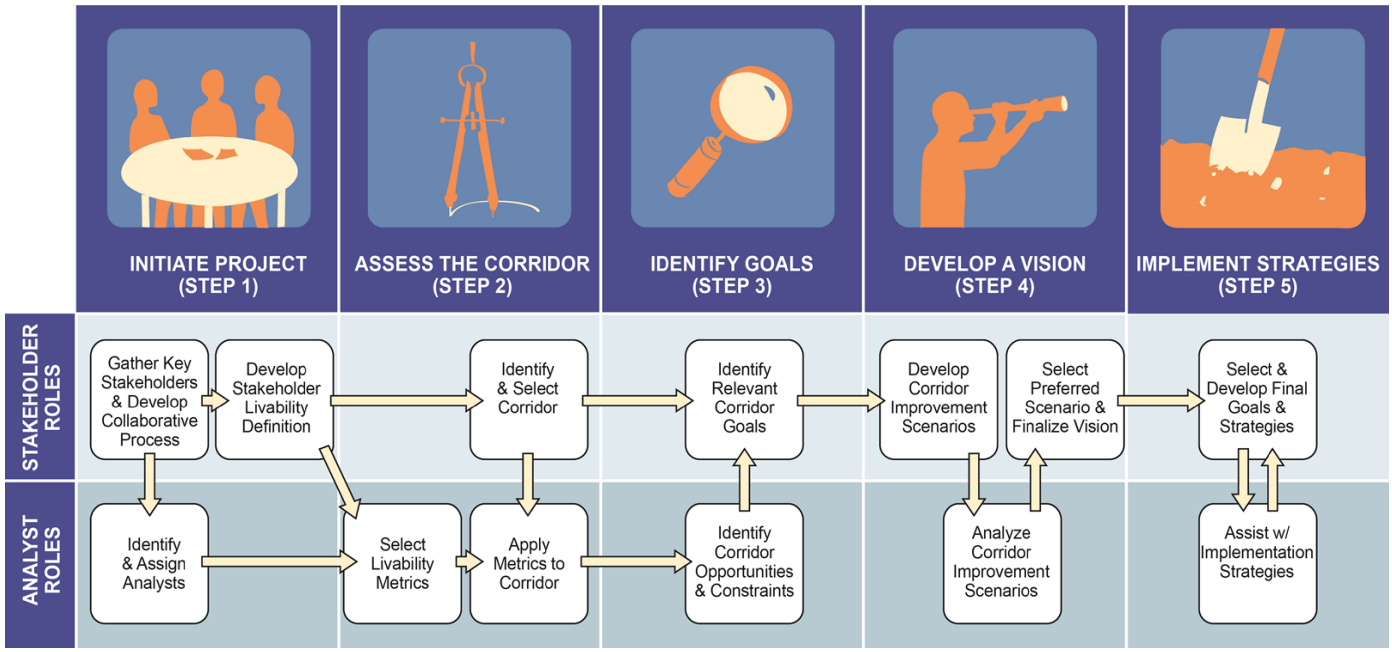
transit agencies that provide services to multiple local jurisdictions can also play this leadership role. This Handbook is designed for an audience of public agencies with regional responsibilities, but can be used by anyone interested in building livable communities.

Transit Corridor Livability Assessment

This Handbook provides a five-step, best-practices process for analyzing, envisioning, and improving livability in a transit corridor, as illustrated in Figure 1. The process provides a guide for evaluating transit corridor needs and making decisions to promote livability. Handbook users can employ this process and its supporting method, metrics, and strategies as a broad-based planning exercise that will help coordinate stakeholder actions as well as a supplement to existing planning processes such as the development of a regional transportation plan (RTP), a transportation improvement program (TIP), or project screening in preparation for an environmental review alternatives analysis.

The Handbook addresses each step as a separate section.

- **Step 1: Initiate Project**—presents a transit corridor livability definition and provides the building blocks for a Livable Transit Corridor Typology. These definitional foundations are used to provide the tools and techniques needed by stakeholders to articulate a vision for improving livability in a transit corridor. Users are provided guidance on the methods they can use to establish a transit corridor livability stakeholders group, analysis team, project development process, and working transit corridor livability definition.
- **Step 2: Assess the Corridor**—offers a set of methods and metrics that corridor stakeholders can use to evaluate existing livability strengths and needs as they proceed with livability improvements. These assessment methods can also be used to compare their corridor to others in the United States and identify the best goals and strategies to adopt for implementation. Handbook users can employ the metrics provided in Section 2 to identify the study corridor's strengths



Note: The process substeps shown in this diagram are summarized with names that do not always directly correspond to each sub-step presented in this Handbook.

Figure 1. Transit corridor livability visioning and improvement process steps.

and needs for livability improvements. This step uses a combination of metric values and professional judgments to classify the study corridor according to the Transit Corridor Livability Typology. Table 2 presents these metrics and their associated Transit Corridor Livability Principles.

- **Step 3: Identify Goals**—provides a visioning process that combines stakeholder engagement, fact-finding analysis, and collaborative goal setting. The goals listed in this section can help stakeholders reach consensus and take actions that build livable transit corridors. The goals provide critical assistance by clarifying intentions, identifying means, prioritizing resources, and gaining stakeholder agreement in the pursuit of livability.
- **Step 4: Develop a Vision**—outlines actions stakeholders can use to determine what they want their corridor to look like. Using the metrics-identified strengths and needs and general transit corridor livability planning goals, corridor improvement scenarios are identified and analyzed.
- **Step 5: Implement Strategies**—offers a menu of strategies that will help corridor stakeholders meet the goals selected from Step 3. Strategies can also be identified and selected using the Livable Transit Corridor Typology.

Table 2. Transit Corridor Livability Principles and their metrics.

Transit Corridor Livability Principles	Factor Category[1]	Factor Name	Metrics
High-quality transit, walking, and bicycling opportunities	Place	Urban form	Transit employment accessibility (weighted employment within 45-minute transit commute)
	People	Transit and non-auto service quality	Corridor transit service coverage (aggregate frequency of transit service per square mile)
Mixed-income housing near transit	Place	Mixed-income housing	Corridor housing unaffordability (percent of income spent for housing)
	People	Economically and age-diverse population	Income diversity (average variance of census block group household incomes in corridor from corridor-wide average household income)
Transit-accessible economic opportunities	Place	Employment opportunities	Corridor jobs density (employees/acre)
	People	Consumer opportunities	Corridor retail jobs density (corridor retail employees/acre)
Accessible social and government services	Place	Effective services	Corridor transit ridership balance (ratio of the sum of each corridor's boardings and alightings)
	People	Accessible services	Corridor health care opportunities (health care employees/acre)
Vibrant and accessible community, cultural, and recreational opportunities	Place	Urban form	Corridor density (population/acre)
	People	Cultural & recreational opportunities	Access to culture & arts (corridor entertainment employees/acre)
Healthy, safe, and walkable transit corridor neighborhoods	Place	Pedestrian-oriented environment	Corridor pedestrian environment (intersection density)
	People	Neighborhood safety	Corridor pedestrian collisions per daily 100,000 pedestrians

[1]Two factors were identified for each principle—people and place factors—based on an analysis of the common components of existing livability definitions found in the literature. Place factors describe the functional and physical attributes of a corridor that shape the livability opportunities available in a transit corridor; people factors describe the services that people derive from the livability opportunities in that same corridor.

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In designing for livability, the community engagement process must involve a diverse set of stakeholders. This requires a commitment to engage those often left out of the typical planning process but who are nevertheless representative of the corridor. This process offers methods for an MPO or a COG (hereafter referred to jointly as "MPOs") to lead a collaborative analysis, visioning, and planning process for improving livability in a transit corridor. MPOs can be natural leaders in this process. Their focus is regional, their work requires collaboration with a wide variety of public and private stakeholders, and they influence or control large transportation funding resources.

The Transit Corridor Livability Calculator Tool

To assist Handbook users in this process, a spreadsheet-based Transit Corridor Livability Calculator tool is also available for download. The Calculator provides the data necessary to estimate 10 of the 12 metrics used in the Handbook to gauge livability for user-defined transit corridors in most metropolitan areas of the United States. The Calculator presents these metric scores as they compare to the average metric scores from over 250 transit corridors from across the country, then guides users through a process of transit corridor livability analysis, goals-setting, and strategies selection. A step-by-step Calculator User's Manual is included in Appendix H of this Handbook.

SECTION 1

Initiate Project (Step 1)

Introduction

This section provides an overview of the recommended methods used to initiate a transit corridor livability project. Initiate Project (Step 1 in Figure 1) involves three substeps:

- Step 1.1: Organize Stakeholders and Develop Collaborative Process.
- Step 1.2: Develop Stakeholder Transit Corridor Livability Definition.
- Step 1.3: Organize and Establish Focus Groups.

Suggested approaches for stakeholders undertaking each of these steps are discussed below.

Step 1.1: Organize Stakeholders and Develop Collaborative Process

Creating opportunities consistent with the Transit Corridor Livability Principles (outlined in Table 1) requires the support of numerous stakeholders. Stakeholder outreach, education, coordination, and engagement not only inform decision making, but also cultivate support for livable transit corridor goals. Broadly accepted goals form the foundation of successful livable transit corridor partnerships and help stakeholders apply their energy and resources toward shared aspirations and agreed upon strategies.

Typical transit corridor livability coalition stakeholders include metropolitan planning organizations (MPOs) and COGs, transportation agencies, municipal governments, state-level agencies and departments, private developers and business interests, educational and social service providers, cultural institutions, advocacy groups, and community members. (For a description of typical stakeholder types see Appendix C.)

Coordination and Collaboration Strategies for Project Initiation

Coordination and collaboration are critical for responding to local issues, building support among corridor stakeholders, and developing paths to implementation. Coordination and collaboration take two basic forms: interjurisdictional cooperation among government agencies, and community engagement with nongovernment stakeholders. Interjurisdictional cooperation can be between governments and between agencies, even when the agencies reside within the same government.

Interjurisdictional cooperation includes:

- Shared information—gathering and synthesizing data relevant to corridor planning.
- Corridor focus—examining issues of interjurisdictional importance along corridors.
- Shared vision—making multilateral agreements that transcend geographic boundaries and local perspectives.

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Effective community engagement includes:

- Outreach and education—disseminating public information and inviting broad-based participation.
- Community assessments—understanding local issues and aspirations through the eyes of stakeholders (McConville 2013).
- Meaningful input—giving diverse stakeholders meaningful opportunities to influence and shape decision making.

For more discussion, see Appendix C.

Organize the Stakeholder Team

Get organized as soon as possible. Stakeholders generally volunteer their time (either as individuals or as paid representatives of other organizations with other duties) so it is important to make the most of their involvement, quickly building momentum toward action. Since transit corridor livability initiatives generate the most benefits when they *effectively* address a wide range of issues and topics, the team or organization created should reflect the diversity of backgrounds stakeholders bring as well as the diversity of disciplines the livability initiative will address. It also is important not to take on too much, thus losing focus and wasting limited planning resources.

The complexity of the team depends on the scope of the transit corridor livability vision, the levels of interest and motivation stakeholders have for the effort, and the resources available. For example, limited funds available for developing Los Angeles's "Orange Line BRT [bus rapid transit] Corridor Improvement Plan" necessitated creating a team that mostly concentrated on transportation, land use, and urban design interventions. This focused scope and vision was reflected in the makeup of their planning team, which was limited to stakeholders with interests and capabilities in these areas.

Formal establishment of the corridor stakeholder group as a legally recognized entity may be desirable when the team has some combination of the following expectations:

- Long-term dedicated and dependable revenue streams available for the planning and implementation efforts.
- A wide scope of planning issues and diversity of disciplines to be addressed and that may require formal relationships between public and private stakeholder organizations.
- There is a need for full-time staff and/or contracting authority to hire consultants.

Informal team organizations are more typical since they tend to be flexible and less costly to administer. Organizational structures (both formal and informal) for transit corridor and livability teams can range from a single stakeholder team or committee charged with all aspects of planning and strategy implementation to large groups of committees, each focused on particular aspects of the project. Figure 2 illustrates the organizational structure for Livable Roanoke Valley in southwestern Virginia.

Typical organizational structures include the following committees:

- Steering and Oversight.
- Technical Advisory.
- Issue-based Focus Groups.

Steering and Oversight Committee

Many livability and transit corridor planning efforts organize their stakeholders within systems of tiered committees under the umbrella of a steering or oversight committee. This entity is

Source: Graphic provided by The Partnership for a Livable Roanoke Valley.

Figure 2. Organizational plan for Livable Roanoke Valley.

responsible for setting the vision and goals for the overall team and often makes high-level decisions pertaining to funding, contracting, and policies. The steering committee also sets up and manages the overall committee and staff administrative structures.

The steering committee works best when a process for meetings and decision making are clearly established in writing as soon as possible. Meeting agendas and rules of order that are followed with regularity establish clear expectations for roles, responsibilities, and standards of respectful and equitable discourse among stakeholders. Because formality can also suppress open and creative communications, there should be sufficient time and opportunities for stakeholders to discuss issues less formally as well.

Technical Advisory Committee

While analysts play an important role in measuring existing and forecasting future conditions, they are not always recognized for the critical role they play in helping identify goals, select strategies, and determine outcomes in the planning process, especially when there are diverse stakeholders and interests. Analysts should have a mandate from their management to work together collaboratively to reflect this diversity.

Working within established protocols of their own agencies comes naturally to staff unless they have experience working in multiagency partnerships. Transit agencies, for example, often conduct operational analysis and planning activities with internal agency staff. The downside of this approach is that each partner agency's analyst can feel little incentive to collaborate with analysts and planners from other partner agencies, missing opportunities to develop a multi-disciplinary set of goals, strategies, and implementation activities.

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To prevent this "silo effect," consider forming a collaborative technical advisory subcommittee, staffed by analysts from all relevant stakeholder agencies, to set standards, select methods, and assign analysis work tasks collaboratively.

Alternatively, hiring consulting analysts to provide these services, rather than stakeholder agency staff, can also help prevent the silo effect.

Focus Groups

For broad-scope transit corridor livability initiatives engaging a diverse collection of stakeholders, issues, and strategies, consider creating focus groups (subcommittees) that can target specific themes and issues. Since the areas each group will focus on is best determined after the stakeholders define and adopt a set of Transit Corridor Livability Principles in Step 1.2, guidance on defining and forming focus groups is provided in Step 1.3.

Recommended Practice: Organizing the Team

Establish a Steering and Oversight Committee and a Technical Advisory Team as soon as possible to create a sense of momentum and purpose for the stakeholders. Define and establish focus groups once the Steering and Oversight Committee has adopted a working transit corridor livability definition.

Step 1.2: Develop Stakeholder Transit Corridor Livability Definition

Early in the collaborative process, it is important to develop a working definition for transit corridor livability that is agreeable to all stakeholders, but specific enough to guide the visioning and implementation work to come. A working definition will help guide later decisions related to identifying, analyzing, planning, and building livable transit corridors. This Handbook provides a framework for stakeholder groups to define a common understanding of transit corridor livability. This definition has two parts: a transit corridor definition and a definition of livability.

While the transit corridor livability definition and its principles were designed to be universally applicable, different stakeholder groups may emphasize or de-emphasize elements of this Handbook's definition based on local values and political realities. However, caution is warranted since the stakeholders' working definition and its principles will affect the metrics they use and ultimately shape the corridor strengths and needs they identify.

The definition provided in this Handbook comprises six Transit Corridor Livability Principles based on the Livability Principles developed by U.S.DOT, HUD (Housing and Urban Development), and the EPA (Environmental Protection Agency) (U.S. Department of Housing and Urban Development et al. undated). As shown in Table 2, each Principle is made up of a "People" and a "Place" factor. Brief descriptions of each Principle and its factors are provided below:

- **High-Quality Transit, Walking, and Bicycling Opportunities:** Opportunities for high-quality transit, walking, and bicycling are distinguished by a combination of non-auto transportation service quality (the people factor) with urban form characteristics (the place factor). High-quality urban form characteristics can be described as transit-oriented development (TOD) and other compact development patterns that increase the accessibility of people to employment and services without the need for a car. Non-auto transportation service quality characteristics include comprehensive and high-frequency transit services, and complete and direct sidewalk and bicycle facility networks.
- **Mixed-Income Housing Near Transit:** Transit corridors with equitable and affordable housing opportunities have a combination of an economically and age-diverse population (the people

Community Engagement and Equity Planning Strategies Implementation: Corridors of Opportunity in the Twin Cities

Community engagement plays a central role in identifying and addressing social and economic needs in less advantaged communities, such as communities with large shares of low-income households and immigrants. In Minneapolis-St. Paul, the Corridors of Opportunity (COO) initiative sought to understand how all kinds of people along a transit corridor define their needs. The initiative emphasized the creation of programs to increase benefits to underserved populations and worked to identify and minimize potential negative impacts. A Housing and Urban Development (HUD) grant made the COO possible and was dedicated to outreach activities administered by community-based organizations doing corridor-level outreach and engagement. Micro-grants were made for outreach activities and emphasized two-way conversations to provide people with real opportunities for input.

This led to programs benefiting disadvantaged neighborhoods, including programs for small business development, such as entrepreneurial training, professional skill building, small business loans, and support for identifying and leasing in emerging TOD locations. A grant to a Native American community group led to charrettes and planning activities to change a station area with overpasses and other pedestrian barriers into a place with a network of pedestrian-friendly routes and community destinations, such as a farmers' market.

A co-benefit of these community-based planning activities is the expansion of community organization capabilities. Activities built relationships among community organization leaders and public agencies and officials, as community members and organizations have remained involved with COO implementation.

Source: Ruch and Partnership for Regional Opportunity: Corridors of Opportunity (2013).

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factor) and adequate mixed-income housing (the place factor). Corridors with people from diverse social and economic backgrounds can provide opportunities for residents and visitors to feel kinship within it, while also offering opportunities for people from different backgrounds to mingle, interact, find common ground, and possibly create new community identities in the process. Corridors with adequate mixed-income housing provide housing rental and ownership opportunities that are affordable to people of diverse economic and social backgrounds.

- **Transit-Accessible Economic Opportunities:** Transit corridors with good economic opportunities have a combination of high-quality and quantity of consumer opportunities (the people factor) and an ample supply of employment (the place factor). Corridors with high concentrations of employment provide transit-accessible means for residents and visitors to earn decent incomes. Corridors with ample consumer opportunities provide retail outlets, both large and small, that offer a competitive consumer marketplace accessible without the need of a car.
- **Accessible Social and Government Services:** The quality, quantity, and accessibility of social and governmental services (both public and private) are important elements in creating a truly livable transit corridor. Livable corridors tend to have high-quality, effective social and government services (a people factor) that are accessible (the place factor). Corridors with highly accessible services provide high concentrations of health care, social welfare, and government service outlets around transit stations. Corridors with high-quality social and governmental services are distinguished by a high level of coordination between different levels and branches of government and privately run providers, including highly integrated transportation and land uses that use the full capacities of their transit, pedestrian, and bicycling facilities.
- **Vibrant and Accessible Community, Cultural, and Recreational Opportunities:** Transit corridors with vibrant and accessible community, cultural, and recreational opportunities have both numerous and diverse artistic, entertainment, and recreational venues (the people factor) organized in compact, bicycle- and pedestrian-accessible locations near transit (the place factor).
- **Healthy, Safe, and Walkable Transit Corridor Neighborhoods:** The most livable transit corridors also have healthy, safe, and walkable communities near transit nodes and beyond. People in these corridors are encouraged to walk and exercise more when they feel they can do so safe from traffic (the people factor). Pedestrian safety and willingness to walk and bicycle are enhanced when the street network is designed in a pedestrian-oriented fashion, providing a grid street network with the most direct routes possible for people to reach their destinations (the place factor).

The more differences between the definition and associated metrics provided in this Handbook and those used by the stakeholders, the more difficult it will be to compare the study corridors to the typology and the metric scores of the corridor cases from around the United States provided herein. Therefore, it is recommended that stakeholders determine the most appropriate transit corridor livability definition for their purposes based in part on the advice of their analysts.

Step 1.2.1: Define Your Transit Corridor

Travel corridor definitions typically include physical (place) and functional (people) characteristics. Place characteristics such as transportation facilities and urban form are often used to define a corridor's physical boundaries (Blair 2011, City and County of Denver undated, Porter 2012). The ways people use a corridor—its functional or activity pattern characteristics—can also help define boundaries [Smith 1999, Delaware Valley Regional Planning Commission (DVRPC) 2007, Miami Dade County Transit 2011, Reconnecting America and American Public Transit Administration undated].

This Handbook provides a variety of transit corridor definition criteria for analysts to choose from. Most define transit corridor boundaries using both physical and functional characteristics.

A transit corridor consists of a transit alignment (the physical transit line at the center "axis" or "spine" of the corridor), a catchment or buffer area (the width or area of influence of the transit line that extends outward from the corridor alignment), and its length. Some corridors also contain a wide variety of land uses, activity patterns, and travel conditions (among other characteristics) that suggest it should be viewed as a collection of segments.

Analysts and stakeholders can consider (but are not limited to) the following criteria to determine a transit corridor's alignment, catchment, length, and segments.

Transit Alignment

The transit alignment can be thought of as the axis or spine of a corridor. Beyond this fundamental criterion, this Handbook leaves the selection of other criteria to the analyst's discretion. However, this Handbook recommends using one, or a combination, of the following criteria for identifying transit alignments.

Corridor Service Configuration. The general operating configuration of transit within a proposed or existing corridor generally takes one of two forms:

- Fixed-guideway: rail and bus services operate in their own, dedicated guideways.
- Mixed-mode: rail and bus services operate in mixed-traffic, general purpose lanes.

Transit Mode. A corridor can be centered on a high-capacity transit line or a collection of other fixed-guideway and/or mixed-mode transit lines. The following descriptions are not exhaustive definitions of transit mode types, but a general guide to use when determining what transit alignment is suitable to consider when defining a corridor. More detailed definitions can be found in *Urban Transit: Systems and Technology* (Vuchic 2007).

- Local, express, or rapid bus: a bus line (or collection of bus lines running on a common street) with peak period headways of 10 minutes at most and 20 minutes in the off-peak.
- BRT: a line running mostly in a fixed-guideway or a dedicated lane/right-of-way.
- Streetcar: electrically powered rail transit running primarily in mixed traffic on city surface streets.
- Light rail transit (LRT): an LRT line with continuous service throughout the day, running primarily on a fixed-guideway.
- Heavy rail/rapid transit (HRT): a line running exclusively on a fixed-guideway with continuous service throughout the day.
- Commuter rail (CR): a line with continuous service throughout the day and average station spacings no greater than 5 miles. This Handbook considers CR lines with station spacing longer than 5 miles to provide insufficient coverage of service to its interstation areas for consideration of livability impacts.

Transit Level of Service Provided. Select the transit alignment based on the identification of the transit route/line with the highest frequency and/or extent of service provided in the area of interest.

Length

Determining the best length for a corridor can be tricky because long corridors have more variation of characteristics (land uses, activity patterns, and travel patterns), while short corridors may not include enough of both trip origins and destinations (see Internal Capture subsection below). In other words, a corridor needs to be long enough to be relatively self-contained [containing enough origins (housing) and destinations (employment)] without being so long that it varies in character significantly over its length. While a very long corridor may capture more of its

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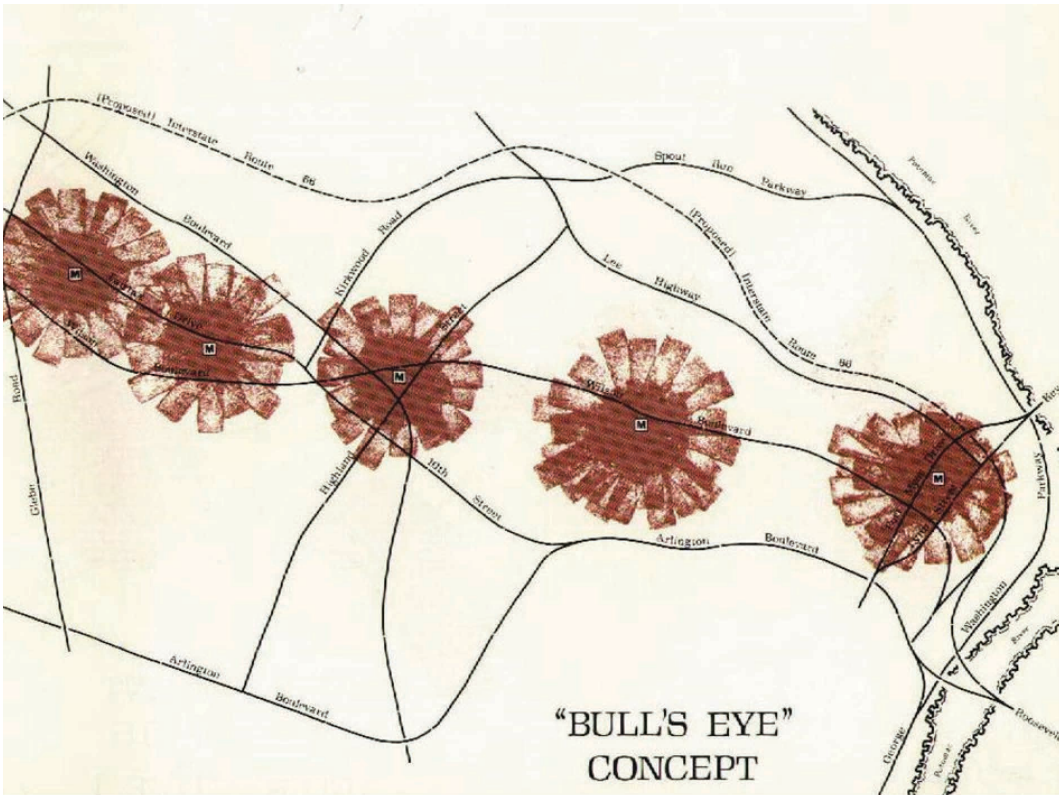
Virginia's Orange Line Corridor: An Early Example of Transit Corridor Planning

Metropolitan Washington, D.C.'s Orange Line (Rosslyn-Ballston) Corridor is an early, successful example of corridor-level TOD planning. In the 1960s, county officials successfully lobbied to change the planned alignment of the Metro line, moving it away from its planned above-ground route parallel to Interstate 66 (where it would bypass established commercial centers) to an underground alignment with stations at key activity centers. The extensive planning efforts that followed are an early example of corridor-level TOD coordination across jurisdictional boundaries that directed high-density development to station areas with what they termed the "bulls-eye approach." This approach targeted the highest-density development within a quarter-mile of stations, with intensities tapering off at further distances (Figure 3).

daily trips internally (containing both origins and destinations) and therefore may yield higher livability metric scores in some cases, the analyst will miss identifying critical shortcomings and needs in subsections of the corridor that are masked by its sheer size.

Analysts might consider breaking up very long corridors into segments that can be evaluated separately or combined for analysis as a single unit, depending on their needs. It is strongly recommended that whatever criteria chosen to determine length, the corridor should NOT include



Source: Courtesy of Arlington County Government (undated).

Figure 3. Washington, D.C.'s Rosslyn-Ballston corridor "bull's eye" concept plan.

corridors with stations BOTH within and outside of central business districts (CBDs) (see CBD discussion below). Otherwise, consider selecting from the following criteria when determining corridor length.

Minimum Number of Stations. A corridor will have at least three consecutive stops or stations. Otherwise, there is no lower limit on the measured length of the transit line.

Internal Capture. A trip between end points should be of practical length for normal daily activities; that is, a corridor captures a substantial portion of origins and destinations of trips within it. Internal capture can be evaluated based on the local knowledge and judgments of the analysts or using a more quantitative approach.

Quantitative approaches use travel survey data to identify trip ends and calculate the standard deviation of trips that begin and end within similar corridors from the region, state, or nation. Corridor lengths that include both trip ends within one standard deviation (or two depending on the preferences of the analyst) of total corridor trips with both origins and destinations within its boundaries could be considered to have sufficient internal capture. Table 3 provides internal capture means and standard deviations for a sample of transit corridors in California, Texas, and Florida.

As discussed above, the analyst needs to be aware that longer corridors will yield greater levels of internal capture, but also contain significant variations in built form and travel patterns that may be best analyzed as separate segments. Similarly, short corridors will have more consistent characteristics internally, but may not be long enough to contain sufficient numbers of origins and destinations. The analyst must balance these competing needs using professional judgment and local knowledge of the corridor and how it functions.

Catchment Area

Consider the following criteria to determine a corridor's catchment area (width).

Maximum Reasonable Walking Distance. The width of a study corridor is a uniform distance as determined by the existing transit access research literature (such as 1 mile from high-capacity transit—including BRT—and ½ mile from each local, express, or rapid bus line alignment, as used for this Handbook's research).

Station Access Travel Patterns. Using station access survey data (most likely collected by the transit agency operating the corridor's transit services), the corridor's catchment can be defined by mapping the trip origins and destinations within one standard deviation (or two, depending on the analyst's preference) of distance to the nearest transit station, compared to other corridors from the region, state, or nation. Alternatively, the method described above for determining length by calculating internal capture rates using travel survey data could be used.

Table 3. Internal capture (all modes and trip types) mean and standard deviation values for transit corridors.

	Corridor Internal Capture Values (All Modes and Trip Types)	
Corridor Type	Mean (μ)	Standard Deviation (σ)
Outside of CBD	63.2%	15.0%
Inside of CBD	58.7%	20.6%

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Land Use Patterns. Using qualitative or quantitative assessment methods of the study corridor's land uses, identify a corridor's boundaries so it includes both residential areas (origins) and activity centers (destinations).

Travel Market Potential. Direct ridership models, travel demand forecasting models, and other ridership projection methods can be used to identify the travel market potential for a proposed transit alignment and its surrounding corridor.

CBDs

CBDs are important components of livable transit corridors. A transit corridor that provides quick and convenient access to a vibrant CBD will be highly livable. However, as discussed previously, it is strongly recommended that whatever criteria the analyst chooses for determining length, the corridor should NOT include stations both within and outside CBDs since these areas are often substantially different from one another. If CBD station areas are included in a corridor that also includes station areas outside the CBD, the CBD's livability opportunities will likely dominate the metric scores of the entire transit corridor. As a result, analysts may inadvertently overlook the livability strengths and needs in the non-CBD areas of the corridor.

Corridors that are entirely within a CBD can be analyzed separately (and with caution) using this Handbook's methods and metrics. However, the statistical analysis performed to develop these methods and metrics used data from corridors outside of CBDs. Therefore, while the same concepts underpinning this Handbook's methods and metrics should apply to transit corridors inside of CBDs, CBDs are unique urban places with their own transportation and land use dynamics, and therefore the authors of this Handbook strongly urge analysts to use these methods with caution and to primarily rely on their own (and those of other stakeholders) professional judgments and knowledge of transit corridors within CBDs.

Segments

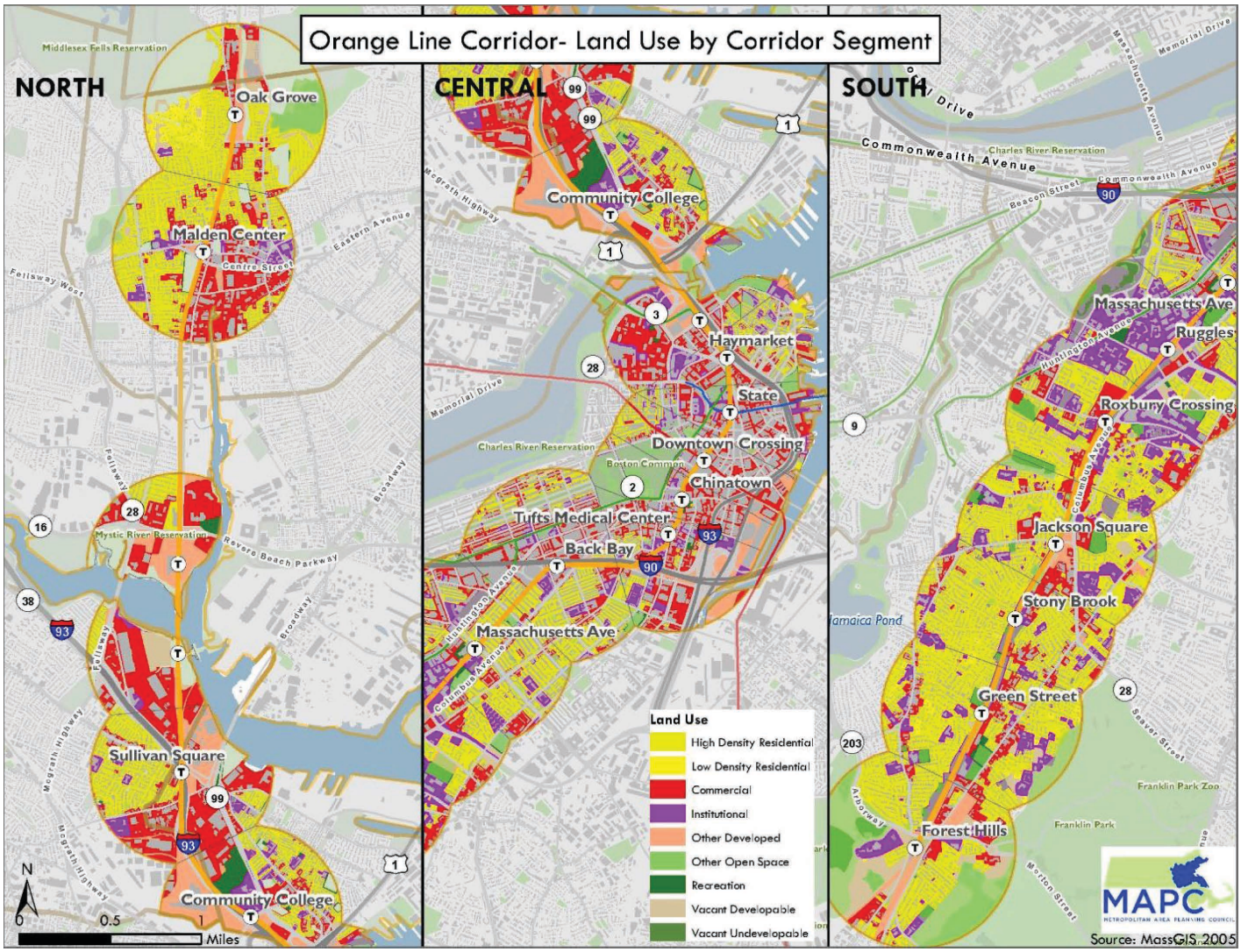
A corridor can be broken up into segments based on several criteria. Each segment can be analyzed separately or combined for analysis as a whole, depending on the needs of the stakeholders and analysts. The following criteria can be considered for identifying corridor segments.

Station-to-Station Travel Patterns. Use boarding and alighting data for the transit alignment's stations/stops to identify groups of stations (segments) that are primarily trip origins (residential) and those that are primarily trip destinations (activity centers).

Land Use Patterns. Assess the corridor qualitatively or quantitatively to group station areas with similar land use patterns into common corridor segments.

Boston's Orange Line Corridor: Identifying Distinct Corridor Segments

Boston's Orange Line corridor plays a critical role in the region. Roughly one-quarter of the region's residents and 300,000 jobs are located near one of the Orange Line's 20 stations. The character of the corridor is diverse, ranging from dense, jobs-rich downtown Boston (the Central segment), to mixed commercial-residential areas of the north segment, to the largely residential areas along the south segment. The Orange Line's planners recognized these distinct corridor segments early in the process of creating their corridor plan, and analyzed them individually as well as at the station and corridor levels (see Figure 4).



Source: Metropolitan Area Planning Council (2013).

Figure 4. Boston's Orange Line analysis segments with existing land uses.

Jurisdictional Boundaries. Use city, service area, or other jurisdictional boundaries to create corridor segments. Caution is recommended since jurisdictional boundaries often are irrelevant in terms of the functional characteristics of a corridor and the ways people use them.

Step 1.2.2: Define Livability for Your Corridor

Livability is about access to quality-of-life opportunities. The most livable communities offer numerous and diverse opportunities (choices) for people to improve the quality of their lives. Figure 5 illustrates how people convert livability opportunities into quality-of-life outcomes in a transit corridor.

Opportunities come in many forms, and people's ideas of what makes a community livable are often different. A useful livability definition must be *general* enough to be inclusive. This Handbook's livability definition seeks to accommodate as many different perspectives as possible and says that *livability occurs when people have good access to opportunities they can use in the pursuit of improvements to their quality of life.*

Figure 5. People convert livability opportunities into quality-of-life outcomes.

A definition must also be *specific* enough to be useful. Without specificity, measurement and implementation become difficult, if not impossible. This Handbook's definition is also based on the Partnership for Sustainable Communities' Livability Principles (U.S. Department of Housing and Urban Development et al. undated) (and other definitions found in the literature) to identify and evaluate key livability opportunities, thereby making it as specific as possible.

Based on the Partnership's principles, this Handbook offers a set of Transit Corridor Livability Principles. These principles state that a livable transit corridor provides accessibility to opportunities and choices including (1) high-quality transit, walking, and bicycling opportunities; (2) mixed-income housing near transit; (3) transit-accessible economic opportunities; (4) vibrant and accessible community, cultural, and recreational opportunities; (5) accessible social and government services; and (6) healthy, safe, walkable transit corridor neighborhoods. A comparison of the Transit Corridor Livability Principles above and those developed by the Partnership for Sustainable Communities was shown in Table 1.

The definition and principles used in this Handbook are based on the hypothesis (generated from a review of the existing literature) that transit corridor opportunities are composed of both people and place opportunities. People and places are two key themes found in many livability definitions. People and places interact with each other to create opportunities for corridor residents, workers, and consumers to improve quality of life for themselves and their families (Puget Sound Regional Council 2012). Livability enhances quality of life by enhancing people and place opportunities.

Table 4 identifies key people and place opportunities (factors) for each of this Handbook's principles based on concepts found in the livability literature. This can help analysts and decision makers identify and measure how these ideal characteristics interact to provide transit corridor livability opportunities in their corridors.

People and place factors can interact to create more opportunities than the sum of their parts. Figure 6 illustrates how these factors can combine to affect the livability opportunity outcomes in a transit corridor. Each factor is discussed in terms of high and low levels of transit corridor opportunities (Puget Sound Regional Council 2012). Specific combinations of these characteristics and the degree to which they reinforce each other also help determine transit corridor livability.

For example, Figure 7 illustrates how transit-oriented urban form (a place factor) provides a diverse set of land use and urban design qualities that can—under the right circumstances—interact with and reinforce a diverse set of travel options, including high-quality transit, walking, and bicycling services (a people factor). In this simplified diagram, each pairing of a people and place factor creates a set of four combinations with varying transit, walking, and bicycling opportunities. Each corridor can be assessed according to these opportunities and classified as one of the four descriptions shown in Figure 7.

Table 4. People and place factor components of transit corridor livability.

Transit Corridor Livability Principles	Factor Category	Factor Name
High-quality transit, walking, and bicycling opportunities	Place	Urban form (transit employment accessibility)
	People	Transit and non-auto service quality
Mixed-income housing near transit	Place	Mixed-income housing
	People	Economically and age-diverse population
Transit-accessible economic opportunities	Place	Employment opportunities
	People	Consumer opportunities
Vibrant and accessible community, cultural, and recreational opportunities	Place	Urban form (residential density)
	People	Cultural and recreational opportunities
Accessible social and government services	Place	Accessible services
	People	Effective services
Healthy, safe, walkable transit corridor neighborhoods	Place	Pedestrian-oriented environment
	People	Neighborhood safety

The darkest box (the upper-right quadrant) represents the most livable corridors, as they have the most diverse transit, walking, and bicycling opportunities (people factor) and a diverse set of land use activities (place factor), as might be found in TOD. Therefore, livability opportunities are generated not merely by the diversity of people or place opportunities in isolation, but by their interactions.

More extensive discussion of the other people and place interactions for the other Transit Corridor Livability Principles is provided in Appendix D.

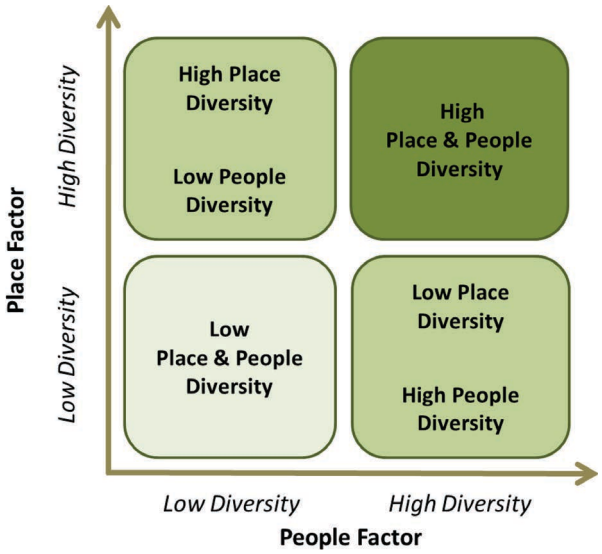


Figure 6. People and place factor interactions.

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Partnership Principle: *Provide More Transportation Choices*
Handbook Principle: *High-Quality Transit, Walking & Bicycling Opportunities*

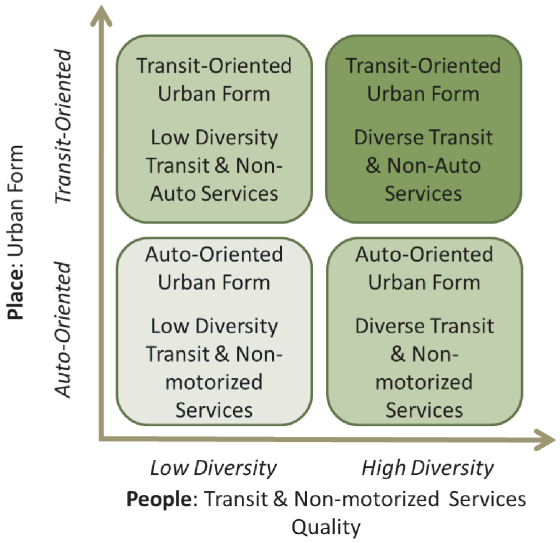

Figure 7. Urban form (place) and transit/non-auto service quality (people) factor interactions.

Recommended Practice: Choosing Transit Corridor Livability Definitions

Develop definitions for your transit corridor (boundaries) and livability in collaboration with stakeholder decision makers, planners, and analysts, blending local values, aspirations, and context with the definitions provided in this Handbook. If there are previous planning studies for your corridor that define the boundaries or livability differently (for example, with a buffer of two miles instead of one around the transit line), then your stakeholders will need to determine how important it is that the current study you are undertaking is consistent with these previous definitions. It is important to remember that *the more differences there are between your definitions and those outlined in this Handbook, the more difficult it will be to use this Handbook's methods to guide your selection of goals and strategies.* Therefore, consider carefully how much the methods and definitions you select differ from those provided in this Handbook. If comparison to the national transit corridor metric baselines provided in this Handbook is an important part of the stakeholders' analytic and collaborative processes, then aim to minimize the definitional and methodological differences between those provided herein and those selected for use.

Step 1.3: Organize and Establish Focus Groups

Consider organizing a set of focus groups composed of interested stakeholders with appropriate expertise, with each focus group designed around the Transit Corridor Livability Principles adopted by the stakeholders in Step 1.2. These principles can be made into clear, concise mission statements for each focus group. Over the course of the planning and implementation process, each group can adopt a set of goals and strategies that clearly articulates their mission (as determined by their assigned principle) and the means to achieve them.

Figure 2 shows how Livable Roanoke Valley's focus groups fit into their larger organizational structure. In the San Francisco Bay Area, Alameda County's Eden Area Livability Initiative designed

Defining Livability in Practice: Partnership for a Livable Roanoke Valley

The Roanoke Valley in southwestern Virginia (including Roanoke City and Salem) has developed a set of livability initiatives based on a definition that reflects community values and aspirations. Facing a number of social and economic challenges, the Roanoke Valley-Alleghany Regional Commission and the Council of Community Services created the Partnership for a Livable Roanoke Valley in 2011. In a two-year-long visioning and planning process, these partner agencies engaged the wider community in a process to articulate a vision, principles, goals, and strategies for improving livability in their region.

The eight Livability Guiding Principles, listed below, are written in language specific to their community, but the themes are familiar and compare well to the Partnership for Sustainable Communities' Livability Principles outlined in Table 2.

- Protect the beauty and ecology of the Roanoke Valley.
- Provide a healthy and equitable quality of life for all of our citizens.
- Celebrate the diversity of our region and its contribution to our culture.
- Embrace both our traditions and new innovations to create economic vitality.
- Anticipate and adapt to change with responsible leadership.
- Build on the assets of our local communities to strengthen our regional collaboration.
- Invest in regional infrastructure improvements that meet the communities' needs of the 21st century.
- Promote excellence in education, job training, and a culture of lifelong learning.

While this Handbook separates definition/principles from goals and strategies for the sake of clarity, Livable Roanoke Valley's articulation of a set of actionable and measurable principles, goals, and strategies based on local values and aspirations provides a solid foundation for the multiagency, multisector partnership process.

Sources: Roanoke Valley-Alleghany Regional Commission (2015a and 2015b).

Designing Livability Principle-Based Focus Groups: San Francisco Bay Area's Eden Area Livability Initiative

The Eden Area Livability Initiative's working (focus) groups are designed and organized to address the key themes of interest to and expertise of community stakeholders.

- Agriculture and Environment Working Group: Provides educational opportunities in the school system and surrounding community about agriculture (farming, ranching, and equestrian) while seeking park and open space opportunities in the urban built out environment.
- Economic Development Working Group: Promotes private economic investment in Eden Area and attracts both businesses and customers.
- Education Working Group: Advocates and provides avenues for increasing resources and opportunities for all schools and students in the Eden Area.
- Governance Working Group: Enhances local self-governance.
- Public Safety and Realignment Working Group: Establishes guidelines and protocols regarding licensed and unlicensed housing establishments such as group homes, care facilities, halfway houses, and other therapeutic treatment facilities to ensure quality of service and safety of the community and program residents. Works to prevent crime and reduce recidivism.

Source: Eden Area Livability Initiative (2015).

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Table 5. Recommended focus groups according to Handbook's Transit Corridor Livability Principles.

Handbook's Transit Corridor Livability Principles	Recommended Focus Groups
High-quality transit, walking, and bicycling opportunities	Transportation and land use coordination
Mixed-income housing near transit	Affordable and equitable housing
Transit-accessible economic opportunities	Economic opportunities development
Vibrant and accessible community, cultural, and recreational opportunities	Culture and recreation
Accessible social and government services	Social and government services
Healthy, safe, walkable transit corridor neighborhoods	Safe and healthy neighborhoods

their process—including five working (focus) groups—with the goal "to encourage planning and action across disciplines and interest areas." This diversity of stakeholders and interests is reflected in the focus groups they formed and in the text of each group's goal statements (Eden Area Livability Initiative 2015).

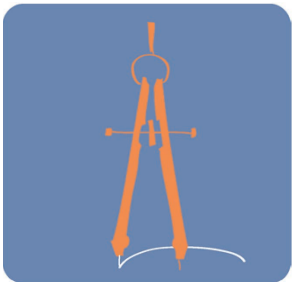
Recommended Practice: Establishing Focus Groups

Establish focus groups to oversee the planning and implementation of each of the stakeholders' Transit Corridor Livability Principles. Table 5 provides a list of recommended focus groups designed to address each Transit Corridor Livability Principle. The names and goals of each group are subject to stakeholder preferences and needs, and should be tailored to directly address the principles articulated by the stakeholders.

SECTION 2

Assess the Corridor (Step 2)

Introduction



This section provides an overview of the recommended methods used to assess livability in transit corridors. Assessment (Step 2 in Figure 1) involves the following three substeps:

- Step 2.1: Select Livability Metrics.
- Step 2.2: Identify and Select Study Corridor(s).
- Step 2.3: Apply Metrics to Corridor(s).

Discussion of recommended approaches for MPOs and their partners undertaking each of these steps is provided below.

Step 2.1: Select Livability Metrics

Select the metrics for analysis based on data availability, the technical experience of available analysts, the level of detail needed to identify and select strategies, and the interests of the corridor stakeholders.

This Handbook provides one metric to represent each people and place characteristic associated with each Transit Corridor Livability Principle (see Table 2). These metrics are NOT intended to represent the complete variety of factors that one might associate with livability. Rather, they are offered as indicators that suggest potentially useful avenues for further investigations.

Appendix E presents these metrics and their data sources, which can be used to quickly and routinely assess livability in a transit corridor, and assesses the availability and quality of each data source.

Step 2.2: Define and Select Study Corridor(s)

Define the study corridor's boundaries using the corridor definition criteria described in Step 1 and the following substeps.

Step 2.2.1: Identify General Study Area

Identify the general area within your region of interest based on stakeholder input and transit expansion planning documents. This often requires a political and collaborative decision between stakeholders rather than a technical or analytical one. Full participation and collaboration between regional stakeholders can help ensure that the most relevant study areas are identified.

Validating the Metrics: Corridor Non-auto Internal Trip Capture

To validate the metrics used in this Handbook, the research team used the metric scores for 31 transit corridors in the United States to predict a proxy indicator of quality of life (QOL) using an ordinary least squares (OLS) linear regression model. The proxy QOL indicator selected was the non-auto internal trip capture rate for each transit corridor in the sample. This model tested the hypothesis that the more livability opportunities in a corridor, and the higher its metric scores, the more QOL it would provide, and the more transit, pedestrian, and bicycle trips that would both start and end inside the corridor's boundaries.

Model results (see Appendix G) confirmed this hypothesis, suggesting that transit corridors with the most livability opportunities also internally capture the highest proportion of the trips they generate. All independent variables—the livability metrics—were statistically significant and the model predicted more than 90 percent of the variation of the internal capture indicator scores. These findings suggest that the metrics are valid and useful measures of transit corridor livability.

Step 2.2.2: Select Corridor Alignment, Length, Catchment, and Segments

Identify the primary existing or planned transit line within the general study area. Criteria for defining the boundaries of a corridor should be taken from the definition of a transit corridor developed by stakeholders in Step 1 of this Handbook.

Recommended Practice: Defining Corridor Boundaries

The analyst should represent the boundaries of all study corridors in a geographic information system (GIS) program (for example, see Figure 8). This will make the data collection, processing, and metrics calculation steps easier.

Step 2.3: Apply Metrics to Corridor(s)

Use the following process to complete the assessment step, using the metrics stakeholders selected in Step 2.1.

Step 2.3.1: Collect Data

Collect the data recommended in Appendix E for each metric selected for your study corridors by your technical advisory team. It is usually best to collect data in the most disaggregated form available. In other words, given the choice between gathering U.S. Census data at the census tract or census block group levels, choose the block group level, which is smaller. The GIS files recommended above that analysts develop for identifying their study corridor boundaries are ideally suited for selecting the data inside those study corridors from larger data files.

Figure 8. Example of a study corridor's boundaries mapped in GIS.

Step 2.3.2: Data Preparation

Prepare the data collected for calculating your metrics. All the data for metrics calculation should be in a single database file. The most effective approach to data preparation is to process and store the data in a set of geo-referenced GIS files.

Step 2.3.3: Metrics Calculation

Using the metrics selected in Step 2.1 and the spatial data processing capabilities of the analysts' GIS program, calculate the existing-conditions metrics for each study corridor and, if appropriate, each corridor segment. An overview of the data calculation methods for each metric is provided in Appendix E.

Recommended Practice: Selecting and Calculating Metrics

One easy way to measure the livability opportunity characteristics of a transit corridor is to use the Transit Corridor Livability Calculator included as a companion piece to this Handbook. The Calculator provides data for most metropolitan-area census block groups in the United States that can be used to measure the corridor-level people and place characteristics for user-defined transit corridors in the United States. Table 6 shows the data included in the Calculator for each metric.

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Table 6. Transit corridor livability metrics, data sources, and their availability in the Calculator tool.

Metric	Data Source(s)	Included in Calculator?
Transit employment accessibility (weighted employment within 45-minute commute)	EPA's Smart Locations Database (SLD) 2010 D5br: Jobs within 45-minute transit commute, distance decay (walk network travel time) weighted	Yes
Transit service coverage (aggregate frequency of transit service per sq. mile)	SLD D4d: Aggregate frequency of transit service (D4d) per square mile	Yes
Housing unaffordability (percent of income spent for housing)	HUD's Housing Affordability Index Dataset (HAI) hh_type1_: housing cost as a percent of income for the regional typical household (HH), defined as: avg. HH Size for region, median income for region, average number of commuters per HH for region	Yes
Income diversity (variance from regional median household income)	National Historical Geographic Information System (NHGIS), 2010 Census ID B19013: Coefficient of variance of block group median household income compared to either the metro area or the state median; closer to zero means less diversity, closer to one means more	Yes
Jobs density (employees/acre)	SLD D1c: Gross employment density employees (jobs)/acre on unprotected land, 2010	Yes
Retail jobs density (retail employees/acre)	SLD D1c_Ret10: Gross retail employment density employees (jobs)/acre on unprotected land	Yes
Transit balance of ridership flows	Transit agency route/line data Inbound (to CBD) daily boardings/inbound daily alightings	No
Health care opportunities (health care employees/acre)	SLD D1c8_Hlth10: Gross health care (8-tier) employment density employees (jobs)/acre on unprotected land	Yes
Population density (population/acre)	SLD D1b: Gross population density (people/acre) on unprotected land	Yes
Access to culture and arts (corridor entertainment employees/acre)	SLD D1c_Ent10: Gross entertainment employment density employees (jobs)/acre on unprotected land	Yes
Pedestrian environment (intersection density)	SLD D3bmm4: Intersection density in terms of intersections having four or more legs per square mile	Yes
Pedestrian collisions per 100,000 pedestrians	Transportation Injury Mapping System (TIMS) 2010 Pedestrian collisions per 100,000 pedestrians	Yes California Only

The recommended way to calculate the average metric scores for the corridor of interest is by entering a list of census block group ID numbers into the Calculator for all metrics with data available (see Appendix H). For all corridors and associated metrics where Calculator data are not available or are insufficient, obtain data from comparable data sources and use a standard GIS software package to calculate metric values as needed.

SECTION 3

Identify Goals (Step 3)

Introduction

What livability issues do the stakeholders want to focus their efforts on? In this step, stakeholders begin to answer this question through a systematic process to develop preliminary, applicable goals for their transit corridor. Stakeholder preliminary goals are identified and agreed upon based on their collaborative discussions as well as the corridor's strengths and needs identified through the metrics data collection and analysis. Identifying goals (Step 3 in Figure 1) involves two substeps:

- Step 3.1: Identify Relevant Goals.
- Step 3.2: Identify Corridor Strengths and Needs.

Although they are described sequentially, they are best done in tandem, with the identification of strengths and needs leading to the consideration of goals, and discussions about goals leading to further investigations of strengths and needs. The goals identified in Step 3 lead to the identification and implementation of strategies in Steps 4 and 5.

Step 3.1: Identify Relevant Goals

The Transit Corridor Livability Goals summarized in Table 7 provide a touchstone for identifying a corridor's relative strengths and needs. Handbook users should review these goals and, based on the collective knowledge and expertise of the stakeholders, consider how well the study corridor's characteristics address each goal. The goals also help define and provide context for identifying the initial list of corridor livability strengths and needs identified using the metrics in Step 3.2. Develop an applicable list of aspirational goals for the study corridor that can be augmented and refined as corridor strengths and needs are identified.

Step 3.2: Identify Corridor Strengths and Needs

Develop an initial list of corridor strengths and needs by comparing the metric scores for the study corridor to either or both of the following baselines:

- The best-fit Livable Transit Corridor Typology category
- A representative sample area from within the study corridor's region.

Consider using the following process to complete Step 3.2, using the metrics stakeholders selected in Step 2.1.

Table 7. Transit Corridor Livability Principles and goals summary lookup table.

Transit Corridor Livability Principles	Goal	
	Name	**Description**
High-quality transit, walking, and bicycling opportunities	Regional Access	Integrate corridor transit, nonmotorized modes, and land uses to provide convenient access to economic, social, and other livability opportunities.
	Regional Connectivity	Promote pedestrian and bicycle routes that offer reasonably direct routes to local destinations and transit stations/stops.
	Demand Management	Encourage travel decisions that favor alternatives to the car and optimize use of available transit capacity.
Mixed-income housing near transit	Affordability	Provide sufficient affordable housing that fits the needs of an area's workforce and disabled, elderly, and low-income residents, and offer affordable transportation options.
	Variety	Allow and encourage diverse housing options that reflect the variety of households and housing needs along a corridor.
Transit-accessible economic opportunities	Jobs and Housing	Offer a range of employment opportunities and align jobs along the corridor with the skills of residents who live, or may live, along the corridor.
	Vitality and Growth	Promote economically and culturally vibrant corridor districts. Structure new growth along transit corridors and away from sensitive land.
	Reuse	Encourage the reuse of previously developed land that has become vacant or underutilized.
Vibrant and accessible community, cultural, and recreational opportunities	Recreation	Provide small parks and other recreational opportunities within walking distance of most transit-oriented homes, and provide larger parks and recreation facilities along transit corridors while maintaining compact walkable development near transit stations/stops.
	Cultural Enrichment	Offer opportunities for cultural enrichment.
	Community Facilities	Provide and maintain schools and community service facilities, such as libraries and post offices, within walking distance of most homes, while making efficient use of land near transit and major destinations.
Accessible social and government services	Essential Services	Provide convenient transit access to health care and other essential social services.
	Infrastructure and Government Services	Promote effective and safe infrastructure and other government services, while supporting other livability goals.

Table 7. (Continued).

Transit Corridor Livability Principles	Goal	
	Name	Description
Healthy, safe, and walkable transit corridor neighborhoods	Mix of Uses	Provide retail conveniences, recreation, basic services, and cultural destinations close to transit stations/stops and within walking distance of most homes and jobs.
	Walking and Biking Environments	Provide pedestrian and bicycling paths that are safe, attractive, and support community life.
	Street-Oriented Buildings	Line streets with building facades that have generous windows, frequent entrances, and attractive features, and generally avoid parking lots or blank walls along streets. Enhance connectivity with building entrances that face streets or are connected to the circulation network via a pedestrian path.
	Context-Sensitive Design	Respect historic, scenic, and other characteristics of established districts that are important for aesthetic cohesion and represent community preferences. Embrace and integrate historic and other cultural resources when possible, such as through adaptive reuse.
	Environmental Health	Avoid exposure of residents and workers to noise, pollutants, or toxins resulting from corridor land use relationships and construction activities. Improve health in underserved neighborhoods impacted by industries.

Step 3.2.1: Typology Classification

Identifying which typology category best matches your study corridor is equal parts art and science. While the typology and the principles are useful, descriptive tools, they are by no means definitive or absolute. While such precision may have been technically possible, these and other methods in this Handbook were specifically designed to be flexible enough to be useful to a wide variety of people and places. Context is critical and the people and places within a corridor can only be understood within the context of that corridor and its region. The typology, metrics, and methods provided herein are intended to be flexible tools for understanding corridors and the places within them, and, in doing so, provide a process for goal setting, strategies selection, and ultimately, policy and programing. Therefore, analysts and stakeholders should always interpret the typology, the metrics, and methods provided in this Handbook within the context of their own local knowledge and understanding of their study corridor.

Three basic corridor types have been defined and categorized according to common sets of characteristics among transit corridors in the United States that represent idealized qualities of corridor livability.

- **Emerging Transit Corridors** serve lower-density, segregated-use communities with limited transit service. While they generally score low on livability metrics scales due to infrequent transit service, have relatively few transit- and pedestrian-accessible destinations, and have an auto-orientation in transportation and land use patterns, these corridors can offer many opportunities for future livability enhancements, in particular when transit services and new major transit-accessible destinations (activity centers) are developed.
- **Transitioning Transit Corridors** are well on their way to providing high-performing livability conditions but still offer considerable opportunities for improvement. They include emerging corridors that have been transformed by the development of new major transit-accessible

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destinations (activity centers) in at least one location along the corridor as well as urban revitalization and redevelopment opportunities, either due to an abundance of underutilized land, or older, sometimes economically depressed transit-oriented neighborhoods.

- **Integrated Transit Corridors** provide a high level of livability performance. They contain both high-capacity and local transit services, dense and diverse destinations, reasonably direct pedestrian routes along enhanced walking environments, and balanced jobs and housing. Livability opportunities in these corridors include significant improvements gained from high transit service frequencies and "first-mile/last-mile" station-to-destination access enhancements.

Analysts can use a combination of metric values from Step 2, local stakeholder knowledge, and professional judgments to classify the study corridor according to the idealized characteristics of each category as shown in the Transit Corridor Livability Typology in Figure 9.

Each corridor type—shown in columns—is rated in terms of the diversity of and accessibility to opportunities these corridors generally provide. As such, they represent idealized qualities of corridor livability: not hard-and-fast rules. Each corridor type was designed by combining the people and place factor for each principle and identifying those combinations that reflect categories from typologies found in the literature, as well as statistical modeling of transit corridors from around the United States.

PRINCIPLES	FACTORS		CORRIDOR TYPE		
			EMERGING	TRANSITIONING	INTEGRATED
High quality transit, walking & bicycling opportunities	Place	Urban Form	Low	Medium	High
	People	Transit & Non-Auto Services	Low	Medium	High
Mixed-income housing near transit	Place	Mixed-Income Housing	Low	Medium	Medium
	People	Economically & Age-Diverse Population	Low	Medium	Medium
Transit-accessible economic opportunities	Place	Employment Opportunities	Low	Medium	High
	People	Consumer Opportunities	Low	Low	High
Accessible social & government services	Place	Accessible Services	Low	Medium	High
	People	Effective Services	Low	Medium	High
Vibrant & accessible community, cultural & recreational opportunities	Place	Urban Form	Low	Medium	High
	People	Cultural & Recreational Opportunities	Low	Low	High
Healthy, safe & walkable transit corridor neighborhoods	Place	Pedestrian-Oriented Evironment	Low	Medium	High
	People	Neighborhood Safety	Low	Medium	High

Figure 9. Transit Corridor Livability Typology.

The boxes at the intersections of each column and row represent the quality of the combined people and place factors, ranked as "low," "medium," or "high." Rankings of "high" signify the more accessibility to livability opportunities a corridor can achieve.

Figure 10 illustrates how corridors (represented by the black polygon lines) generally fall into the three typology categories depending on how well they rate in terms of the Transit Corridor Livability Principles. A similar graph is provided for each study corridor in the Calculator based on the aggregation of metric scores.

A variety of corridor subcategories are associated with each corridor type, as illustrated in Figure 11, to help analysts and stakeholders identify appropriate implementation strategies (see Step 5.2). More detailed discussion of the typology framework for livable transit corridors is provided in Appendix D.

Using stakeholder knowledge and judgments, a study corridor can be classified qualitatively using the typology category descriptions above. These judgments are even more effective when used in tandem with the quantitative methods described below.

Identifying the Best-Fitting Typology Category: Individual Metric Score Matching

Handbook users can also classify their outside-of-CBD corridors by matching their individual metric scores (as calculated in Step 2.3) to the average (mean) values presented in Table 8. Compare the existing-conditions metric values for the study corridor to the average metric values associated with the typology and listed in Table 8. Look for the typology category that best matches your corridor's metric values. The typology category with the most closely matching mean values and study corridor metric values suggests the best-fitting typology category.

Recommended Practice: Identifying the "Best-Fit" Typology Category

Look for the typology category that best matches your corridor's metric values and the descriptions provided for each category. The Transit Corridor Livability Calculator can help identify the best-fit typology category based on existing-conditions metric scores. Step-by-step instructions

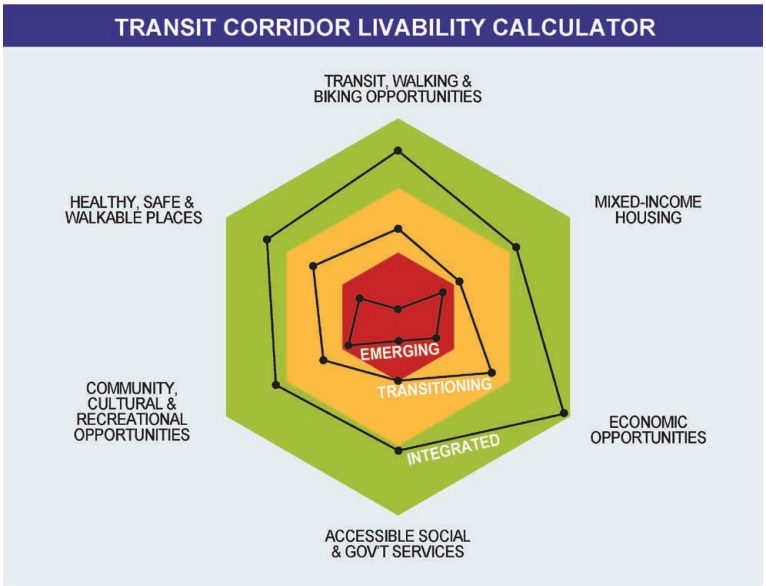

Figure 10. Composite diagram from the Transit Corridor Livability Calculator comparing the three transit corridor typology categories.

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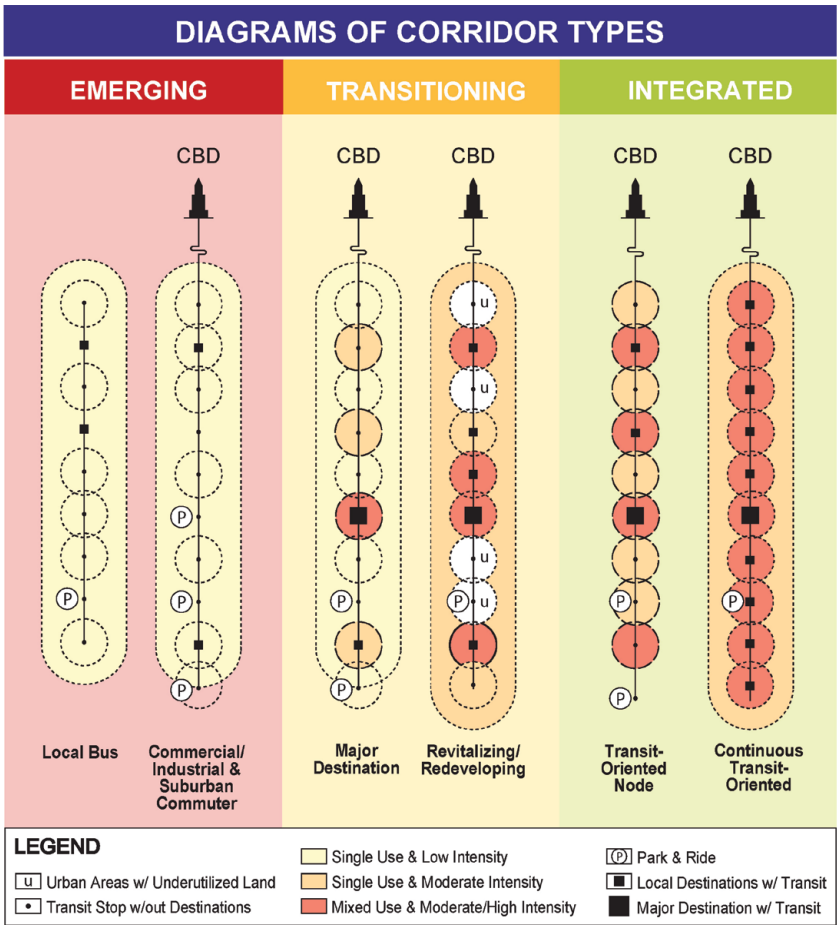

Figure 11. Livable Transit Corridor Typology categories.

Table 8. Mean metric values for outside-of-CBD corridors by corridor type.

Metric	Mean Values by Outside-of-CBD Corridor Type		
	Emerging	Transitioning	Integrated
Transit employment accessibility (weighted employment within 45-minute commute)	8,512	23,547	48,471
Transit service coverage (aggregate frequency of transit service per square mile)	440	1,873	7,473
Housing unaffordability (percent of income spent for housing)	32.09	30.41	29.50
Income diversity (variance from regional median household income)	0.347	0.358	0.380
Jobs density (employees/acre)	3.59	8.73	29.43
Retail jobs density (retail employees/acre)	0.509	0.919	2.419
Transit corridor ridership balance (RB)	0.193	0.236	0.353
Health care opportunities (health care employees/acre)	0.80	2.19	4.29
Population density (population/acre)	10.08	20.46	39.90
Access to culture and arts (corridor entertainment employees/acre)	0.48	1.23	4.89
Pedestrian environment (intersection density)	85.0	115.9	167.7
Pedestrian collisions per 100,000 pedestrians	13.0	8.0	5.0

for using the Calculator to perform this function can be found in the Calculator User's Manual included in Appendix H.

A Note of Caution: The metric averages presented in Table 8 are estimates derived from quantitative analysis (and in the case of pedestrian collisions per 100,000 pedestrians, qualitative assessment of quantitative findings) of more than 250 outside-of-CBD transit corridors in the United States. However, in the case of the Housing Unaffordability and Income Diversity metrics, the differences between these average values for the three typology categories are small. While this suggests that these two metrics may not be well-suited to describing transit corridor livability conditions, this Handbook's authors elected to retain and present them on theoretical grounds, since they are consistent with the Transit Corridor Livability Principles. Statistical analysis also supports this decision. Analysis of variance (ANOVA) results found that all the metrics used in this Handbook (including Housing Unaffordability and Income Diversity) have average values for each typology category that are significantly different from each other and that these differences are consistent with the theoretical hypotheses posed prior to analysis (see Appendix G for presentation of these results). Nevertheless, this Handbook's authors advise analysts to use the metrics and mean values presented herein with caution, and let local knowledge and professional judgments play a prominent role in identifying the best-fit typology category.

Step 3.2.2: Identify Initial List of Corridor Livability Strengths and Needs

Identify those metric scores for the study corridor that are closer to the average values for other corridor categories shown Table 8 than they are to the best-fit corridor category. These high and low scores represent existing strengths and needs that stakeholders may be able to leverage and build on to further enhance their corridor's livability.

For example, the metric scores and rankings for a Transitioning Corridor—the San Francisco Bay Area's Richmond BART (Bay Area Rapid Transit) Line corridor—provided in Table 9 suggest the following strengths:

- **Pedestrian environment** (intersection density): This Transitioning Corridor has a pedestrian-oriented, walkable environment more typically found in Integrated Corridors.
- **Neighborhood safety** (pedestrian collisions per 100,000 daily pedestrians): It also is safer for pedestrians than other corridors in its typology category.

Now identify those metrics for the study corridor with scores that are well below the typology category average values using Table 8. These scores represent livability needs in your corridor. Metric scores and rankings for the San Francisco Bay Area's Richmond BART Line corridor in Table 9 suggest the following needs (where livability improvement efforts can be focused):

- **Transit service coverage** (aggregate frequency of transit service per square mile): Transit service coverage is low compared to other Transitioning Corridors.
- **Income diversity** (variance from regional median household income): Income diversity is low compared to other Transitioning Corridors.
- **Transit corridor RB:** The corridor's low RB metric score suggests this corridor operates more as a suburban commuter (Emerging) corridor.

Note: It is important to perform reasonableness checks on metric values to make sure they are consistent with professional judgments and local knowledge of the study corridor. Unquestioned acceptance of the metric values and rankings can lead to misconceptions about the corridor's livability needs or potential for improvements.

Use a combination of the metrics-identified strengths and needs (identified in Step 3.2) and the preliminary list of goals identified here to select and refine a portfolio of final goals best suited for improving livability in the study corridor. Table 10 provides an example of goals identification using the metric scores for the San Francisco Bay Area's Richmond BART Line Corridor.

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Table 9. Example ranking of metric values for the San Francisco Bay Area's Richmond BART Line corridor.

Transit Corridor Livability Principles	Factor		Measure (Metric)	Mean Values by Outside-of-CBD Corridor Type			San Francisco/ Richmond BART Line	
	Category	Name		Emerging	Transitioning	Integrated	Values	Ranking
High-quality transit, walking, and bicycling opportunities	Place	Urban form	Transit employment accessibility (weighted employment within 45-minute commute)	8,512	23,547	48,471	23,449	Average
	People	Transit and non-auto service quality	Transit service coverage (aggregate frequency of transit service per square mile)	440	1,873	7,473	**1,120**	**Need**
Mixed-income housing near transit	Place	Mixed-income housing	Housing unaffordability (percent of income spent for housing)	32.09	30.41	29.50	30.20	Average
	People	Economically and age-diverse population	Income diversity (average variance of corridor block group incomes from corridor mean)	0.347	0.358	0.380	**0.290**	**Need**
Transit-accessible economic opportunities	Place	Employment opportunities	Jobs density (employees/acre)	3.59	8.73	29.43	6.87	Average
	People	Consumer opportunities	Retail jobs density (retail employees/acre)	0.509	0.919	2.419	1.04	Average
Accessible social and government services	Place	Effective services	Transit corridor RB	0.193	0.236	0.353	**0.163**	**Need**
	People	Accessible services	Health care opportunities (health care employees/acre)	0.80	2.19	4.29	2.32	Average
Vibrant and accessible community, cultural, and recreational opportunities	Place	Urban form	Population density (population/acre)	10.08	20.46	39.90	21.18	Average
	People	Cultural & recreational opportunities	Access to culture and arts (corridor entertainment employees/acre)	0.48	1.23	4.89	1.19	Average
Healthy, safe, and walkable transit corridor neighborhoods	Place	Pedestrian-oriented environment	Pedestrian environment (intersection density)	85.0	115.9	167.7	**156.0**	**Strength**
	People	Neighborhood safety	Pedestrian collisions per 100,000 pedestrians	13.0	8.0	5.0	**3.18**	**Strength**

Table 10. Example identification of applicable strategic goals using metric values for the San Francisco Bay Area's Richmond BART Line corridor.

Transit Corridor Livability Principles	Metric	Goals Identification		
		Strengths	Needs	Goals
High-quality transit, walking, and bicycling opportunities	Transit employment accessibility (weighted employment within 45-minute commute)			
	Transit service coverage (aggregate frequency of transit service per square mile)		✓	• Regional access • Regional connectivity • Demand management
Mixed-income housing near transit	Housing unaffordability (percent of income spent for housing)			
	Income diversity (variance from regional median household income)		✓	• Affordability • Variety
Transit-accessible economic opportunities	Jobs density (employees/acre)			
	Retail jobs density (retail employees/acre)			
Accessible social and government services	Transit corridor RB		✓	• Essential services • Infrastructure and government services
	Health care opportunities (health care employees/acre)			
Vibrant and accessible community, cultural, and recreational opportunities	Population density (population/acre)			
	Access to culture and arts (corridor entertainment employees/acre)			
Healthy, safe, and walkable transit corridor neighborhoods	Pedestrian environment (intersection density)	✓		
	Pedestrian collisions per 100,000 pedestrians	✓		

SECTION 4

Develop a Vision (Step 4)

Introduction

This section outlines the actions corridor stakeholders can take to develop a vision for their transit corridor. Visioning (Step 4 in Figure 1) involves three substeps:

- Step 4.1: Develop Corridor Improvement Scenarios.
- Step 4.2: Analyze Corridor Improvement Scenarios.
- Step 4.3: Select Vision.

Stakeholders should first engage in a collaborative process to outline improvement scenarios for their corridors, based on the work done in Step 3. Then corridor analysts can estimate the outcomes of these scenarios and prepare necessary data for evaluating these scenarios using traditional planning analysis methods.

Step 4.1: Develop Corridor Improvement Scenarios

Engage your stakeholders in a visioning process to determine what they think their corridor should ultimately become. These scenarios should be "what if" exercises that help stakeholders identify the likely outcomes of different improvement strategies. Scenarios should engage the full range of Livability Principles, factors, goals, and strategies outlined in this Handbook, with emphasis placed on those goals identified in previous steps and their associated strategies.

Many of the most beneficial outcomes from livability improvements are realized from the interactions between disciplines that are often kept separate. The most effective comprehensive livability scenario planning efforts will include and leverage these disciplinary "silos," breaking down barriers between land use, transportation, housing, economic development, and social services providers to name a few.

The Lincoln Land Institute report "Opening Access to Scenario Planning Tools" identifies three critical components of scenario planning: collaboration, capacity building, and creation of an open environment for engagement. The report defines these as follows:

> Collaborative problem solving facilitates resolution of interrelated issues that cannot be resolved by one organization alone. Capacity building is needed to enable individuals and organizations to apply scenario planning methods and tools effectively to their specific planning concerns. An open environment for information sharing and education will help accelerate the use and improvement of scenario planning tools in multiple settings (Holway et al. 2012).

The importance of collaboration and an open environment called for in this passage cannot be emphasized enough. In a survey of U.S. scenario planning projects, Bartholomew found that with a handful of notable exceptions, most scenario planning efforts fail to achieve the level of public engagement necessary to achieve their goals. Sixty percent of all projects that concluded with the selection

of a preferred scenario failed to involve the public in this critical decision. Bartholomew concludes that the "planners' agenda" is subtly (and sometimes not so subtly) working to frame the problems and script the solutions in the form of value-laden scenarios. By the time the public is involved, the planners have already decided on their preferred scenarios and outcomes (Bartholomew 2007).

Recommended Practice: Developing Action-Oriented Scenarios

Consult the following scenario planning guides and resources to help design livability improvement scenarios for your transit corridor:

- Federal Highway Administration and Volpe Center. 2010. *FHWA Scenario Planning Guidebook.* Federal Highway Administration, Washington D.C. Available at: http://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/scenario_planning_guidebook/guidebook.pdf.
- Oregon Sustainable Transportation Initiative. 2013. *Scenario Planning Guidelines Resources for Developing and Evaluating Alternative Land Use and Transportation Scenarios.* Oregon Department of Transportation, Salem, OR. Available at: http://www.oregon.gov/ODOT/TD/OSTI/docs/Scenario%20Planning%20Guidelines/ODOT-Guidelines-April2013-red.pdf.
- Envision Utah. 2014. *A Guide to Regional Visioning: Mapping the Course for Successful Community Engaged Scenario Planning.* Envision Utah, Salt Lake City, UT. Available at: http://envisionutah.org/images/guidebook-images/ScenarioPlanningGuidebook.pdf.

In close collaboration with stakeholders, develop planning-level sketches, diagrams, and other presentation materials that will help stakeholders envision what the corridor will look like once the livability planning and implementation process is complete. The Transit Corridor Livability Calculator provides data for 10 of the 12 metrics for most U.S. census block groups. Create scenarios for the study corridor by adding or subtracting from the metric scores to reflect the implementation of different strategies. Evaluate and display for stakeholders the likely outcomes of each scenario's strategies once they are implemented and their effects are manifest.

Step 4.2: Analyze Corridor Improvement Scenarios

Provide comparisons of the livability metric scores for existing and future scenarios for the study corridor. Describe the strengths and needs identified in the analysis above, the preliminary list of goals selected in Step 3, and the likely outcomes from pursuing those goals.

Re-engage the corridor stakeholders, presenting the analysis results for likely outcomes from the scenarios they defined in Step 4.1. Design the public involvement and stakeholder engagement processes to ensure they are robust and inclusive.

Step 4.3: Select Vision

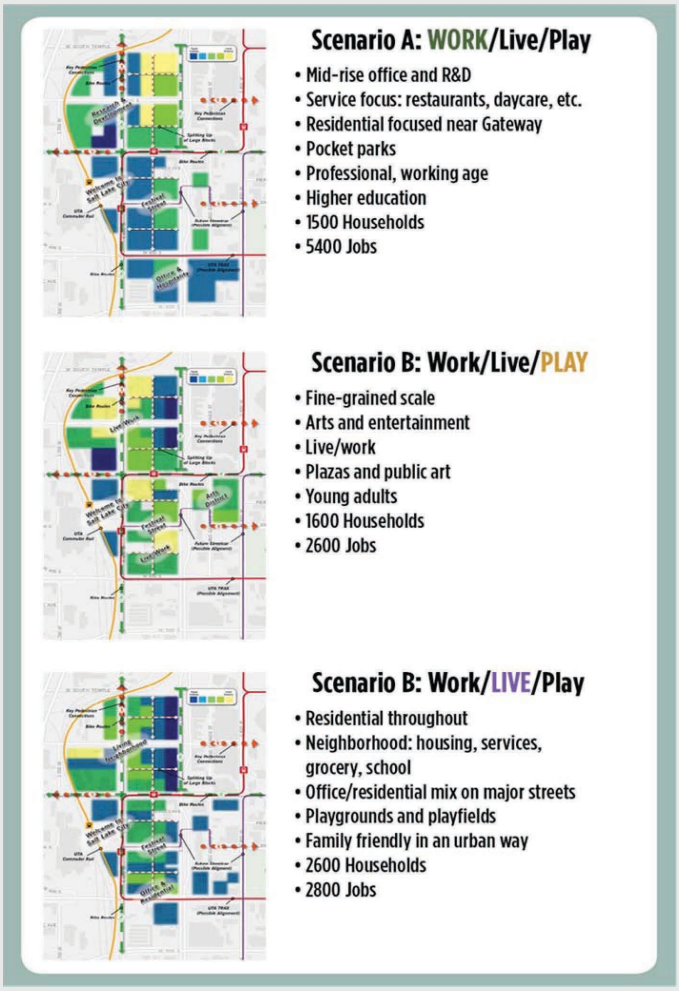
Using the collaborative processes outlined in the steps above, select the preferred corridor vision scenario based on stakeholder preferences. This vision will serve as the touchstone for creating a more detailed implementation plan—including goals and strategies—in Step 5.

Recommended Practice: Developing Supporting Materials for the Vision

Develop supporting materials for the vision that illustrate the key aspects of the plan for each focus group (as recommended in Step 1.1) or Transit Corridor Livability Principle (as recommended in Step 1.2.2). For example, Figure 12 provides a land use concept plan for the North Fifth Street Corridor in North Las Vegas, Nevada.

Defining and Analyzing Scenarios: Envision Utah's Depot District Scenario Plans

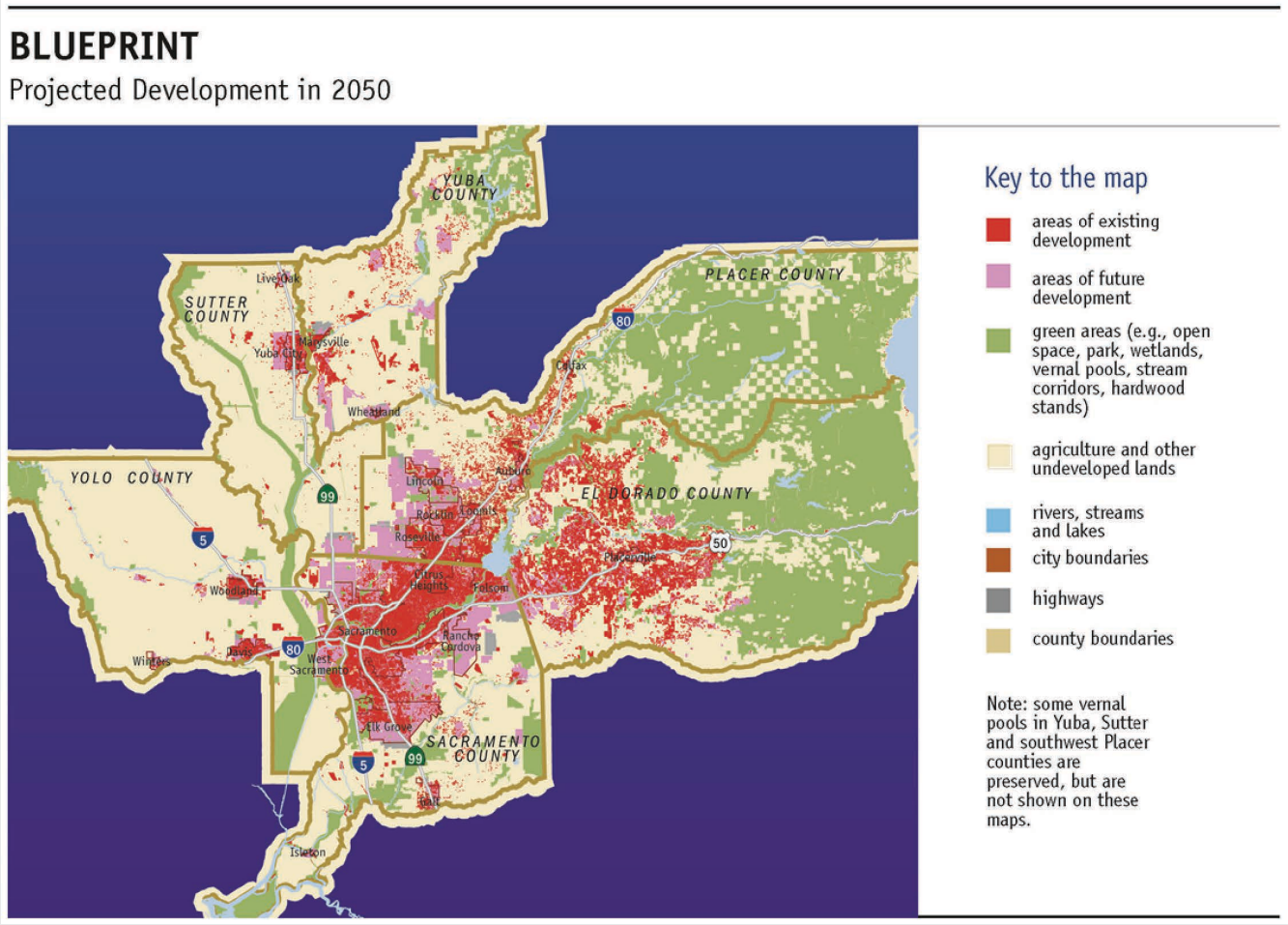
Envision Utah conducted a visioning process using scenario-based planning tools to develop a series of scenarios for the Depot District in downtown Salt Lake City. Envision Utah worked in close collaboration with local officials and community members to identify a series of viable scenarios. These scenarios were evaluated using a collection of modeling tools, producing a series of outcome indicator values for each scenario.



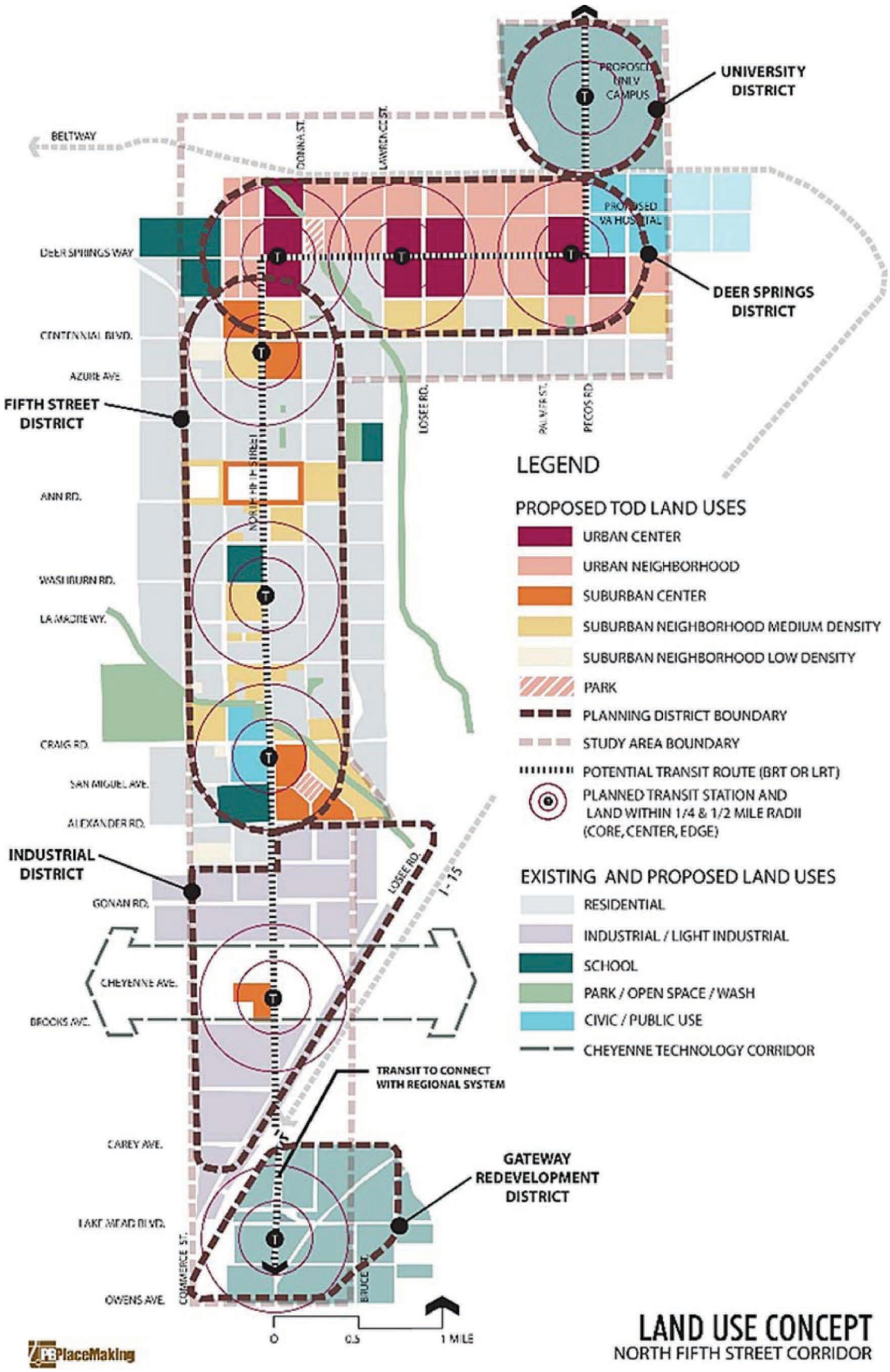
Source: Envision Utah (2014).

Collaboration and Public Involvement for Successful Scenario Planning: Sacramento's Regional Blueprint Project

The Sacramento Area Council of Governments (SACOG) initiated a stakeholder and community-led scenario planning effort in 2002 to develop a regional transportation and land use vision plan. After developing the business-as-usual, base-case scenario, SACOG and their partners coordinated nearly 40 neighborhood and countywide workshops. Workshops began at the neighborhood level where participants were provided with table maps and easy-to-use computer modeling programs that would provide immediate feedback to the groups on their proposed scenarios. The results of these workshops were integrated into a larger set of regional scenarios for further testing, refinement, and workshopping (Sacramento Area Council of Governments 2004).



Source: Federal Highway Administration (undated).



Source: City of North Las Vegas and PlaceWorks (2006).

Figure 12. Land use vision for the North Fifth Street Corridor Plan in North Las Vegas, Nevada.

SECTION 5

Implement Strategies (Step 5)

Introduction

Implementation strategies link corridor goals to tangible actions. Strategies can identify methods for addressing needs, assigning responsibilities, and finding and prioritizing resources.

Selected strategies should be tailored to the unique needs and strengths of the study corridor and recognize available tools. Appendix B, Description of Implementation Strategies, offers a menu of strategies, but Handbook strategies are NOT prescriptive. Handbook users are encouraged to modify and add to the strategies provided herein to create a comprehensive list of implementation strategies, tailored to the unique needs and strengths of the study corridor. After assessing corridor needs using metric indicators (Step 2), examining goals (Step 3), and setting a vision supported by stakeholders (Step 4), have stakeholders review, consider, and commit to suitable implementation strategies (Step 5). Engage corridor stakeholders in the development of strategies to ensure they are comprehensive and reflect the specific setting.

Implementation (Step 5 in Figure 1) involves three substeps:

- Step 5.1: Examine Menu of Possible Strategies.
- Step 5.2: Link Goals to Strategies.
- Step 5.3: Develop and Adopt Corridor Recommendations.

Step 5.1: Examine Menu of Possible Strategies

A wide range of strategies are available to promote livable transit corridors. Decision makers and stakeholders should familiarize themselves with available strategies, including those summarized below. Stakeholders' cursory review of possible strategies should inform discussion on the most appropriate strategies for building corridor livability. Strategies listed below were compiled based on planning literature, case studies, and professional experience.

Strategies are organized within two general categories:

- **Governance Frameworks** describe common ways that governments address livability needs along transit corridors.
- **Livability Strategies** are associated with the Livability Principles with which they most closely relate.

For more detailed descriptions and explanations of these strategies, see Appendix B.

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Government Frameworks

Government frameworks are the vehicles for instituting the Livability Strategies shown below. Government frameworks occur at all scales: federal, state, regional, city, and station area. Literature, interviews, and case studies pointed to the following more common implementation vehicles.

State and Federal Frameworks

State Declarations. Declarations by state governors can, through executive action, direct state resources (and influence decisions by regional agencies and local governments) toward livability-enhancing strategies such as compact development, transportation choices, and affordable housing.

Federal Programs. These support community revitalization, transportation alternatives, and other actions that promote livability, often through grants and technical assistance.

Regional Frameworks

Regional Plans. Regional plans embrace a wide spectrum of livability goals and connect these to TOD, with authority invested in regional plans varying among states.

TOD Guidelines. Advisory guidelines encourage livability through features like connectivity, local destinations, and pedestrian-oriented buildings.

TOD Strategic Plans. These are action plans that actively promote TOD by funding station area plans, offering developer incentives, dedicating land to public-private partnerships, and cultivating community engagement.

Location-Specific Planning

Station Area Plans. These promote transit-oriented, pedestrian-friendly districts and typically address a range of planning factors in a location-specific way.

Corridor Plans. These organize land use and transportation to address livability concerns, such as jobs-housing balance and large-scale transportation investments, which cannot be adequately addressed with station area or regional plans.

Grant Programs

Technical Assistance Grants. These grants address livability needs by helping local jurisdictions overcome specific obstacles to building livable transit corridors, such as by addressing development feasibility, infrastructure needs, or parking and transportation demand.

TOD Implementation Grants. Grants can give direct assistance—for both planning and capital investments—to promote transit corridor livability, such as the development of infrastructure financing plans or the funding of complete streets. In brownfield locations (sites with abandoned and aging industrial uses), grants can help overcome implementation barriers with site investigations and site cleanup activities.

Incremental Approaches

Livable transit corridor activities must sometimes rely on incremental planning steps to build political support, using smaller commitments followed by more comprehensive efforts. Pedestrian safety plans, urban design guidelines, and affordable housing inventories are

examples of incremental planning efforts that can become foundational cornerstones of larger corridor plans.

Livability Strategies

The following Livability Strategies are organized by the Transit Corridor Livability Principle to which they most closely relate. Handbook users should be aware that many strategies apply to multiple principles and their related goals. (For more on goals, see Section 3 and Appendix A.)

High-Quality Transit, Walking, and Bicycling Opportunities

Opportunities for high-quality transit, walking, and bicycling are a combination of non-auto transportation service quality with urban form characteristics. High-quality urban form characteristics can be described as TOD and other compact development patterns that increase the accessibility of people to employment and services without the need for a car. Non-auto transportation service quality characteristics include comprehensive and high-frequency transit services as well as complete and direct sidewalk and bicycle facility networks.

Connected Network Planning. Highly connected transportation networks encourage walking and bicycling by providing direct routes to destinations, including transit. Network connectivity can be promoted with district-level planning and by retrofitting circuitous routes.

Circuitous Route Retrofits. Circuitous route retrofits add pedestrian and bicycle connections across superblocks and in other settings where streets do not provide local connections. They can be promoted by local planning and by government grants.

Compact Development. Walkable districts with greater density increase housing, support local "walk-to" retail and services, and boost transit ridership. They can be promoted using infrastructure investments, zoning regulations, and other TOD-related tools.

Alternative Modes. The availability of alternative modes such as walking, bicycling, and transit, and incentives for their use, offers greater travel choices, better access, and reduced reliance on the car. Related strategies include providing free transit passes, secure bicycle parking, and enhanced pedestrian and bicycle environments (see "Complete Streets" below).

Transit Pass Subsidies. These can be provided by landlords, developers, employers, and universities to encourage residents, employees, and students to use transit and limit car use.

Parking Management and Requirements. Parking can be managed to reduce car use. Strategies such as leasing parking separately from other rent (and at market-based prices) can be paired with alternative modes and reduced zoning requirements to allow development to be built at higher intensities (see "Compact Development").

Transit Frequency and Reliability. Opportunities for access are enhanced by more frequent transit service and predictable transit schedules. Specific approaches include separating transit from potential sources of congestion and providing real-time departure information.

Last-Mile Shuttles. "Last-mile" shuttles connect corridor trunk transit lines with major corridor destinations to increase transit use and reduce car use.

Mixed-Income Housing Near Transit

Transit corridors with equitable and affordable housing opportunities have a combination of an economically and age-diverse population and adequate mixed-income housing. Corridors

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with people from diverse social and economic backgrounds can provide opportunities for residents and visitors to feel kinship within it while also offering opportunities for people from different backgrounds to mingle, interact, find common ground, and possibly create new community identities in the process. Corridors with adequate mixed-income housing provide housing rental and ownership opportunities that are affordable to people of diverse economic and social backgrounds.

Location Efficiency. Housing-plus-transportation (H+T) cost indices influence location decisions made by residents, employers, and developers, by communicating the benefits of access to transit, distance to destinations, and compact mixed-use development. Location-efficient mortgages are being offered to homebuyers in some high-density, transit-rich urban areas as a way to bring more investment to these communities and increase the availability of affordable housing.

Housing Production and Targets. Government agencies and nongovernment organizations can offer real estate expertise and financial assistance to help developers, landowners, and financial institutions overcome barriers to housing production to increase affordability.

Regulatory Streamlining. Housing production can be encouraged by addressing regulatory obstacles to development, such as excessive parking requirements, restrictive setback and height requirements, high fees, and lengthy development approval processes.

Housing Assistance. Low-income households can receive direct assistance from government to rent housing, such as with Section 8 vouchers, which are generally administered at the local level and limited to qualifying properties, such as those near transit.

Inclusionary Housing. Local jurisdictions can require residential development projects to make a certain percentage of housing units affordable to middle- and low-income households. Inclusionary housing relies on ongoing administration by landlords and monitoring by government.

Local Housing Trust Funds. Development fees or real estate transfer taxes can be assessed to residential and/or commercial properties for the production of affordable housing. Housing trust funds are gathered by local governments and used to leverage grants and financing, often in partnership with affordable housing developers.

Anti-displacement Strategies. Rising rents can force residents out of neighborhoods. This can be addressed with programs that reduce tax burdens among low-income households, with below-market inclusionary housing, low-income housing production, and relocation assistance.

Transit-Accessible Economic Opportunities

Transit corridors with good economic opportunities have a combination of a high quality and quantity of consumer opportunities and an ample supply of employment. Corridors with high concentrations of employment provide transit-accessible means for residents and visitors to earn decent incomes. Corridors with ample consumer opportunities provide retail outlets, both large and small, that offer a competitive consumer marketplace accessible without the need of a car.

Regional Competitiveness. Strategies for smart growth, TOD, and corridor planning can promote economic opportunities and the economic health of metropolitan areas, such as by exchanging real estate information, fostering partnerships, and efficient infrastructure.

Station Area Profiles. Station area profiles gather land use, real estate, demographic, and other information to inform policy making and communicate development opportunities to municipal governments, developers, and other stakeholders.

Financial Feasibility and Incentives. Financial factors can deter developers from investing in corridor livability and TOD, but can be addressed by identifying financial barriers and offering incentives.

Land Assemblage and Joint Development. Transit agencies and municipalities can encourage TOD and corridor livability by helping to assemble small parcels and by making public land available for development through public-private joint development activities.

Predevelopment Assistance. Predevelopment and site investigation funding helps developers through critical due diligence activities such as market studies and cleanup of contaminated parcels, and can target livable transit corridor opportunities.

District Financing and Value Capture. District-level financing can underwrite capital improvements in a station area or subarea of strategic importance, using tools such as local improvement districts and developer impact fees.

Activity Center Master Plans. Activity centers create nodes of commercial and cultural activity. Activity centers generally result from large-scale master planning efforts and public-private partnerships to facilitate land acquisition and development activities.

Jobs-Housing Alignment Activities. Corridor-level planning tools can help regions attain jobs-housing balance, such as with spatial analysis of jobs versus housing that are accompanied by "carrots and sticks" for developing jobs and housing in certain locations.

Social Investments. Issues affecting low-income and other disadvantaged communities can be addressed through community-based planning activities and economic development programs, such as job training and small business assistance. Programs can target location-efficient places to leverage a range of additional benefits.

Accessible Social and Government Services

The quality, quantity, and accessibility of social and governmental services (both public and private) are important elements in creating a truly livable transit corridor. Corridors with highly accessible services provide high concentrations of health care, social welfare, and government service outlets around transit stations. Corridors with high-quality social and governmental services are distinguished by a high level of coordination between different levels and branches of government and privately run providers and include highly integrated transportation and land uses that use the full capacities of their transit, pedestrian, and bicycling facilities.

Partnerships with Service Providers. Local and regional planners can work with area hospitals, universities, non-governmental organizations (NGOs), and other social service providers to build new and expand existing facilities along transit corridors.

Accessible Community Services. Direct and inviting pedestrian and bicycle connections to health and other social services enhance livability.

Efficient Infrastructure and Services. Compact development patterns allow community resources to be used efficiently and can help leverage a wider array of community benefits compared to low-intensity and less-connected places.

Community Safety. Safety and security are essential to livability and are shaped by physical environments, government services, and community policing.

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Vibrant and Accessible Community, Cultural, and Recreational Opportunities

Transit corridors with vibrant and accessible community, cultural, and recreational opportunities have a combination of numerous and diverse artistic, entertainment, and recreational venues organized in compact, bicycle- and pedestrian-accessible locations near transit.

Public Art. Public art enriches communities and can be promoted as part of transit infrastructure improvements and through local zoning.

Cultural Destinations. Cultural destinations can be encouraged through joint development for new destinations and by supporting the revitalization of established cultural districts.

District Revitalization. Revitalization is a tool for expanding destinations in established districts along transit corridors. The revitalization of urban districts saves cultural assets through reinvestment, while encouraging infill on underused sites.

Recreation and Open Space. Transit and other infrastructure improvements can result in new recreation and open-space facilities. Recreation and open space can also be created using zoning, financing districts, and development agreements.

Sense-of-Place Guidelines. Architectural guidelines can be developed to maintain the unique, valued character of a place. The guidelines can emphasize a place's character-defining features in new construction and building additions, as well as preservation and adaptive reuse of historic resources.

Healthy, Safe, and Walkable Communities

The most livable transit corridors also have healthy, safe, and walkable communities near transit nodes and beyond. People in these corridors are encouraged to walk and exercise more when they feel they can do so safe from traffic and crime. Pedestrian safety and willingness to walk and bicycle are enhanced when the street network is designed in a pedestrian-oriented fashion, providing a grid street network with the most direct routes possible for people to reach their destinations.

Complete Streets. Complete streets emphasize pedestrians and bicyclists. MPOs and local jurisdictions can promote them with design standards, education, and direct funding.

Walk and Bike Safety Audits. Safety audits can identify where pedestrians or bicyclists are at risk for collision with motor vehicles in order to target funding for needed improvements.

Traffic Calming. Traffic calming supports walking and bicycling to transit and other destinations, by introducing features like crosswalk improvements, speed tables, and pedestrian-activated blinker lights.

Pedestrian and Bicycle Network Maintenance. Pedestrian and bicycle access is maintained through ongoing maintenance and repairs, which make walking and biking safer and more attractive.

Form-Based Codes. Form-based codes provide a clear, easily administered format, focusing on key design characteristics that determine how buildings should relate to streets in order to encourage walking and support community life. These codes are organized and illustrated to be easy to use.

TOD Guidelines. See TOD Guidelines description under "Government Frameworks."

Zoning Overlay Districts. Zoning can be amended as an overlay district to address many factors found in form-based codes and TOD guidelines, and to provide incentives for development near transit.

Crime Prevention through Environmental Design (CPTED). CPTED recognizes that physical factors can attract crime and other unwanted behavior, and that these physical factors can be addressed through development codes, design guidelines, master plans, and design review.

Step 5.2: Link Goals to Strategies

Based on examination of metrics and goals (Steps 2 and 3), Handbook users should identify pertinent strategies by examining Tables 11 through 16, which connect goals to promising strategies, and Table 17, which connects corridor types to possible strategies.

Strategies that Relate to Goals

Goals defined in Section 3 are connected to specific Livability Strategies in Tables 11 through 16.

Strategies for Corridor Types

An optional path to identifying strategies is through typology. The Handbook defines a transit corridor typology to provide users with a framework to more easily identify corridor strengths and needs, and connect these to appropriate implementation strategies. Three basic corridor types are defined: Emerging, Transitioning, and Integrated. Characteristics of these corridor types are described in Step 3.2.1, and in greater detail in Appendix D. Strategies connected to specific typology categories are summarized Table 17.

Table 11. Strategies for building high-quality transit, walking, and bicycling opportunities.

Goals	Strategies
Regional Access Integrate corridor transit, nonmotorized modes, and land uses to provide convenient access to economic, social, and other livability opportunities.	• Connected network planning • Circuitous route retrofits • Transit frequency and reliability • Last-mile shuttles • Compact development • Activity center master plans • Jobs-housing alignment • Station area profiles • Regional competitiveness
Regional Connectivity Promote pedestrian and bicycle routes that offer reasonably direct routes to local destinations and transit stations/stops.	• Connected network planning • Circuitous route retrofits • Last-mile shuttles • Complete streets • Pedestrian and bicycle network maintenance
Demand Management Encourage travel decisions that favor alternatives to the car and optimize use of available transit capacity.	• Alternative modes • Parking management and requirements • Transit pass subsidies • Zoning overlay districts

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Table 12. Strategies for encouraging equitable and affordable housing near transit.

Goals	Strategies
Affordability Provide sufficient affordable housing that fits the needs of an area's workforce, disabled, elderly, and low-income residents and that offers affordable transportation options.	• Location efficiency • Transit pass subsidies • Housing production and targets • Regulatory streamlining • Inclusionary housing • Local housing trust funds • Anti-displacement strategies • Land assemblage and joint development • Station area profiles (development site identification)
Variety Allow and encourage diverse housing options that reflect the variety of households and housing needs along a corridor.	• Housing production and targets • Regulatory streamlining • Inclusionary housing • Local housing trust funds • Anti-displacement strategies • Land assemblage and joint development • Form-based codes (housing type flexibility) • Station area profiles (development site identification)

Table 13. Strategies for encouraging transit-accessible economic opportunities.

Goals	Strategies
Jobs and Housing Offer a range of employment opportunities and align jobs along the corridor with the skills of residents who live, or may live, along the corridor.	• Mix of uses • Jobs-housing alignment • Activity center master plans • Station area profiles (to identify jobs or housing growth opportunities)
Vitality and Growth Promote economically and culturally vibrant corridor districts. Structure new growth along transit corridors and away from sensitive land.	• Compact development • Regional competitiveness • Financial feasibility and incentives • Land assemblage and joint development • District financing and value capture • Social investments • Station area profiles (for economic trends and opportunities)
Reuse Encourage the reuse of previously developed land that has become vacant or underutilized.	• Financial feasibility and incentives • Land assemblage and joint development • District financing and value capture • Predevelopment assistance • Social investments

Table 14. Strategies for encouraging accessible social and government services.

Goals	Strategies
Essential Services Provide convenient transit access to health care and other essential social services.	• Partnerships with service providers • Accessible community services • Connected network planning • Last-mile shuttles
Infrastructure and Government Services Promote effective and safe infrastructure and other government services, while supporting other livability goals.	• Compact development • Efficient infrastructure and services • Community safety • Walk and bike safety audits • CPTED

Table 15. Strategies for encouraging vibrant and accessible community, cultural, and recreational opportunities.

Goals	Strategies
Recreational and Community Facilities Provide small parks, other recreational and community opportunities, and schools within walking distance of most transit-oriented homes; provide schools as well as larger parks and recreational facilities along transit corridors, while maintaining compact walkable development near transit stations/stops.	• Recreation and open space • Mix of uses • Connected network planning • Station area profiles (to identify underserved areas)
Cultural Enrichment Offer opportunities for cultural enrichment.	• Public art • Cultural destinations • District revitalization
Context-Sensitive Design Respect historic, scenic, and other characteristics of established districts that are important for aesthetic cohesion and community identity. Integrate historic and other cultural resources when possible.	• District revitalization • Sense-of-place guidelines • Form-based code • Station area profiles (to identify cultural assets)

Table 16. Strategies for encouraging healthy, safe, walkable transit corridor neighborhoods.

Goals	Strategies
Mix of Uses Provide retail conveniences, recreation, basic services, and cultural destinations close to transit stations/stops and within walking distance of most homes and jobs.	• Compact development • Form-based codes • TOD and other guidelines • Zoning overlay districts • Cultural destinations • Recreation and open space • Activity center master plans
Walking and Biking Environments Provide pedestrian and bicycling paths that are safe, attractive, and support community life.	• Complete streets • Connected network planning • Walk and bike safety audits • Traffic calming • Pedestrian and bicycle network maintenance • Community safety • CPTED • Circuitous route retrofits
Street-Oriented Buildings Line streets with building facades that have generous windows, frequent entrances, and attractive features; generally avoid parking lots or blank walls along streets. Enhance connectivity with building entrances that face streets or are connected to the circulation network via a pedestrian path.	• Form-based codes • TOD and other design guidelines • Zoning overlay districts • CPTED

Table 17. Strategies associated with corridor types.

Transit Corridor Livability Principle	Corridor Type		
	Emerging	Transitioning	Integrated
High-quality transit, walking, and bicycling opportunities	• Connected network planning • Circuitous routes retrofits • Compact development • Last-mile shuttles		• Parking management
Mixed-income housing near transit	• Location efficiency • Housing production and targets • Housing assistance		• Anti-displacement strategies • Inclusionary housing • Local housing trust funds
Transit-accessible economic opportunities	• Station area profiles • Financial feasibility and incentives • Activity center master plan		• Jobs-housing alignment • Social investments
Accessible social and government services	• Access to services • Efficient infrastructure		• Community safety
Vibrant and accessible community, cultural, and recreational opportunities	• Cultural destinations	• District revitalization	• Public art
Healthy, safe, walkable transit corridor neighborhoods	• Complete streets • Traffic calming • Form-based codes • TOD guidelines		• Walk and safety audits • Pedestrian and bicycle network maintenance

For Emerging Corridors, strategies are often concerned with adding accessible destinations, improving connectivity, and encouraging compact development for its associated benefits. Transitioning Corridors face some of these same challenges, but to a lesser extent. Transitioning Corridors can have accessible destinations and older, transit-oriented neighborhoods that can serve as a foundation for expanding TOD patterns throughout the rest of the corridor. Integrated Corridors exhibit high levels of performance on average, but gentrification and housing affordability can present acute challenges. Enhancements can continue to be made in Integrated Corridors, such as aligning jobs and housing, maintaining pedestrian and bicycle networks, and so on.

Some implementation strategies are generally associated with each corridor type and its common characteristics, as summarized in Table 17. Implementation strategies are described under "Livability Strategies" (above) and are explained in Appendix B. Also note that corridors vary, and the typology and associated strategies for corridor types serve only as a guide. Handbook users should also consider the spectrum of goals and list of possible strategies described in Step 5.2.

Step 5.3: Develop and Adopt Corridor Recommendations

In this step, Handbook users identify and agree upon the final tasks necessary to create a comprehensive corridor guidance document.

Step 5.3.1: Compile and Develop Strategies

Compile strategies identified in Steps 5.1 and 5.2, as well as any other strategies that emerged during the process. Define strategies in more depth, such as by addressing how a strategy would be applied in a project-specific way. Consider governance questions, such as how state and local

laws may allow or limit strategies. Clarify each strategy's purpose and objectives and identify stakeholders who may be involved with implementing the strategy.

Step 5.3.2: Set Priorities and Connect with Resources

Identify priorities, such as by evaluating critical needs, ways to leverage resources, and stakeholder strengths. Suggested approaches to setting priorities include the following.

Look for strategies listed more than once. Priority might be given to strategies that address multiple goals and are associated with the corridor typology. To identify strategies that leverage multiple goals and corridor type, refer to Step 5.2.

Critically examine strategies using local knowledge and professional judgment. Promote discussion among decision makers, stakeholders, and professional staff, using their expertise to identify promising strategies. Consider local conditions and regional precedents.

Build on stakeholder strengths. Consider stakeholders' capacity to implement strategies. Stakeholder strengths may include technical skills, available resources, leadership capabilities, and legislative or regulatory powers. Match each strategy with stakeholders who have the capacity to help implement it. When setting priorities, consider where stakeholders, or multiple stakeholders, can substantially contribute to a strategy's successful implementation.

Encourage people and place compatibility. Where a strong people or place factor is coupled with a weaker one, a strategy to address the weaker factor may leverage big livability benefits. Based on the strengths and needs analysis (Step 2), look for people and place factor pairings where one factor has a high metric score and its matching factor has a low score.

Target available resources. Funding vehicles and grant programs that are already established will make some strategies more easily realized in the near term. For example, established business improvement districts or infrastructure financing districts might provide funding vehicles for implementation. Established grant programs should also be considered.

Step 5.3.3: Package Corridor Recommendations

Create a comprehensive guidance document containing pertinent strategies, implementation priorities, responsibilities, resources, and other relevant matter. Preface discussion on strategies with a summary of corridor metrics, goals, and vision (adapted from Steps 2 through 4).

Communicate corridor recommendations to decision makers and stakeholders, and seek commitments to adopt and implement corridor recommendations. Engage in cooperative and collaborative efforts that lay the groundwork for broad-based support. The advancement of corridor livability will require sustained attention and effort, which should continue to be informed by the results of this Handbook.

APPENDIX A

Goals and Related Strategies

Introduction

The Transit Corridor Livability Principles outlined in this Handbook provide a framework for understanding livability and help identify possible implementation strategies. Handbook goals describe preferred end-state aspirations and cover a complete spectrum of livability concerns. Consequently, this Handbook's goals and their associated strategies should NOT be viewed as prescriptive, one-size-fits-all planning tools, but rather, a flexible menu of possible actions for further consideration. As such, the goals establish the framework for assessment metrics (in Step 2 "Assess the Corridor") and corridor visioning (in Step 3: "Identify Goals" and Step 4: "Develop a Vision"). When evaluating a particular corridor, goals should be considered qualitatively in combination with assessment metrics to identify a corridor's strengths and needs. This will inform strategic planning and the selection of suitable implementation strategies.

This Appendix presents the goals as they are associated with the Transit Corridor Livability Principles. The goals embody essential attributes for each Principle. This section defines each goal and briefly discusses its importance. Each goal is connected to a menu of related implementation strategies.

Tables A-1 through A-6 provide menus of possible strategies. To better understand strategies noted, refer to Appendix B.

Goals Associated with Livability Principles

The following goals define desirable end-state conditions associated with the Handbook's six Livability Principles:

- High-Quality Transit, Walking, and Bicycling Opportunities
- Mixed-Income Housing Near Transit
- Transit-Accessible Economic Opportunities
- Accessible Social and Government Services
- Vibrant and Accessible Community, Cultural, and Recreational Opportunities
- Healthy, Safe, and Walkable Transit Corridor Neighborhoods

High-Quality Transit, Walking, and Bicycling Opportunities

Table A-1 provides a summary of the goals and related strategies for this Principle.

Regional Access

Integrate corridor transit, nonmotorized modes, and land uses to provide convenient access to regional economic, social, and other livability opportunities.

Table A-1. Strategies for building high-quality transit, walking, and bicycling opportunities.

Goals	Strategies
Regional Access Integrate corridor transit, nonmotorized modes, and land uses to provide convenient access to regional economic, social, and other livability opportunities.	• Connected network planning • Circuitous route retrofits • Transit frequency and reliability • Last-mile shuttles • Compact development • Activity center master plans • Jobs-housing alignment • Station area profiles • Regional competitiveness
Regional Connectivity Promote pedestrian and bicycle routes that offer reasonably direct routes to regional destinations and transit stations/stops.	• Connected network planning • Circuitous route retrofits • Last-mile shuttles • Complete streets • Pedestrian and bicycle network maintenance
Demand Management Encourage travel decisions that favor alternatives to the car and optimize use of available transit capacity.	• Alternative modes • Parking management and requirements • Transit pass subsidies • Zoning overlay districts

Access strategies enable residents and employees along a corridor to walk, bicycle, or ride transit to destinations that offer livability opportunities. Higher jobs and housing densities enhance transit service and—together with the availability of local destinations—reduce reliance on the car (Holtzclaw et al. 2002). Access strategies can also make transit investments and operations more efficient, as ridership increases and includes a wider variety of trip types, including during non-commute hours.

Regional Connectivity

Promote pedestrian and bicycle routes that are reasonably direct routes to regional destinations and transit stations and stops.

Walking and bicycling connections enable community members to access livability opportunities locally and provide easier access to transit service and livability opportunities regionally and along a transit corridor. Connections must be reasonably direct (not long or circuitous) for walking to be a practical option; direct routes also encourage higher levels of bicycling. Distributing traffic among multiple parallel routes, instead of widely spaced collector and arterial roads, can lower traffic volumes and encourage developers to front buildings toward major streets (Victoria Transport Policy Institute 2012). Complete and connected sidewalks, in particular, are key elements in any pedestrian network system.

Demand Management

Encourage travel decisions that favor alternatives to the car and optimize use of available transit capacity.

Demand management policies and programs can promote alternative modes, reduce traffic impacts, relieve traffic congestion, and better allocate limited transportation resources (such as parking) by influencing personal mode choice and time-of-travel decisions. Key demand management strategies include frequent and convenient transit service, improved parking management, and effective site planning.

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Mixed-Income Housing Near Transit

Table A-2 provides a summary of the goals and related strategies for this Principle.

Affordability

Provide sufficient affordable housing that fits the needs of an area's workforce and disabled, elderly, and low-income residents and that offers affordable transportation options.

Affordable housing provides an opportunity to people of all economic strata to live in transit corridors, and allows communities to retain a workforce serving local industries and businesses. Local governments can promote affordable housing by encouraging its production and by providing direct assistance to renters and first-time homebuyers along transit corridors (U.S. Government Accountability Office 2009).

Market-based housing options (housing not provided by the public sector) can also be expanded by eliminating or reforming restrictive planning and permitting procedures and standards. Note that new construction can displace low-income households. Consider policies that offer low-income households the opportunity to remain in neighborhoods and the social networks that their neighborhoods support (McConville 2013). Car-free and low-mileage housing options also promote affordability by avoiding the high costs associated with auto ownership (Center for Transit-Oriented Development 2010). Transit corridors can play a vital role in enhancing affordability by improving access, even as funds available for affordable housing stay constant (Center for Transit-Oriented Development 2009).

Affordable housing near transit also benefits persons with limited mobility and—when paired with safe paths to local destinations—provides them with greater independence. Transit access also can reduce public sector costs associated with delivering services to mobility-challenged persons. Dial-a-ride and other paratransit services typically offer infrequent service and have operating costs that present a fiscal challenge to many communities.

Table A-2. Strategies for encouraging equitable and affordable housing near transit.

Goals	Strategies
Affordability Provide sufficient affordable housing that fits the needs of an area's workforce, disabled, elderly, and low-income residents, and that offers affordable transportation options.	• Location efficiency • Transit pass subsidies • Housing production and targets • Regulatory streamlining • Inclusionary housing • Local housing trust funds • Anti-displacement strategies • Land assemblage and joint development • Station area profiles (development site identification)
Variety Allow and encourage diverse housing options that reflect the variety of households and housing needs along a corridor.	• Housing production and targets • Regulatory streamlining • Inclusionary housing • Local housing trust funds • Anti-displacement strategies • Land assemblage and joint development • Form-based codes (housing type flexibility) • Station area profiles (development site identification)

Variety

Allow and encourage diverse housing options that reflect the variety of households and housing needs along a corridor.

Communities benefit from a diverse range of housing choices. Housing variety offers a wider range of choices that reflect different household preferences and financial means, and supports people at different life stages. Diverse housing also enables the local workforce to be better aligned with an area's employment opportunities.

Transit-Accessible Economic Opportunities

Table A-3 provides a summary of the goals and related strategies for this Principle.

Jobs and Housing

Offer a range of employment opportunities and align jobs along the corridor that match the skills of residents who live, or may live, along the corridor.

Regional economies benefit when both jobs and workforce housing cluster around transit. This arrangement yields more efficient transport costs and offers access to a larger, more diverse labor pool (Center for Transit-Oriented Development 2011). Access to quality education and training is a means to advance economic opportunities of people who live in a corridor.

Jobs-housing matching can play a critical role in reducing car travel, expanding balance, and enhancing economic and social vitality (California Planning Roundtable 2013). Corridor planning can also support regional economic strategies that may exist (both adopted and informal), particularly around the workforce and economic development needs associated with key industry clusters.

Vitality and Growth

Promote economically and culturally vibrant corridor districts. Structure new growth along transit corridors and away from sensitive land.

Table A-3. Strategies for encouraging transit-accessible economic opportunities.

Goals	Strategies
Jobs and Housing Offer a range of employment opportunities and align jobs along the corridor with the skills of residents who live, or may live, along the corridor.	• Mix of uses • Jobs-housing alignment • Activity center master plans • Station area profiles (to identify jobs or housing growth opportunities)
Vitality and Growth Promote economically and culturally vibrant corridor districts. Structure new growth along transit corridors and away from sensitive land.	• Compact development • Regional competitiveness • Financial feasibility and incentives • Land assemblage and joint development • District financing and value capture • Social investments • Station area profiles (for economic trends and opportunities)
Reuse Encourage the reuse of previously developed land that has become vacant or underutilized.	• Financial feasibility and incentives • Land assemblage and joint development • District financing and value capture • Predevelopment assistance • Social investments

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Compact growth helps to put complementary land uses within walking distance of each other and transit. At the local level, land use mix can also provide economic development benefits, much as cultural uses can affect urban revitalization.

Compact growth also requires less infrastructure than more diffuse development patterns, making it more affordable to build and maintain over time (Smart Growth America 2013) and has been shown to enhance economic productivity and job creation (Kramer & Sobel 2013). Sensitive land, such as areas with valuable natural habitats, highly productive farmland, and unique scenic resources, can be more easily protected when growth is compact.

Urban infill and revitalization helps to increase livability opportunities within established urban districts that have declined economically but remain accessible by transit. Infill and revitalization can help reverse economic decline, and put more housing and jobs near transit. The adoption of comprehensive and mutually reinforcing strategies may be needed, however, to encourage private investments and guide public improvements (Reconnecting America and Center for Transit-Oriented Development 2013). Strategies can "capture" the value added to urban areas as infill and revitalization occur. "Value capture" can occur by reserving the increasing tax increment to finance local improvements, and also results from growing assessments, developer dedications, and various forms of tax revenue growth (Center for Transit-Oriented Development 2009).

Reuse

Encourage the reuse of previously developed land that has become vacant or underutilized.

The reuse of underutilized sites can complement corridors by delivering uses that may be in short supply, such as housing in job-rich corridors, jobs in bedroom communities, and retail and services needed locally. Reuse can also spin off economic benefits and serve as a catalyst for additional private investment nearby (Kramer & Sobel 2013). Reuse of large properties originally developed in an auto-oriented fashion has the potential to knit together underutilized land and adjacent properties into a coherent pedestrian-friendly fabric.

Accessible Social and Government Services

Table A-4 provides a summary of the goals and related strategies for this Principle.

Essential Services

Provide convenient transit access to health care and other essential social services.

Transit access to health care, job training programs, day care, community colleges, and other community services benefit community members in terms of convenience, cost, and

Table A-4. Strategies for encouraging accessible social and government services.

Goals	Strategies
Essential Services Provide convenient transit access to health care and other essential social services.	• Partnerships with service providers • Accessible community services • Connected network planning • Last-mile shuttles
Infrastructure and Government Services Promote effective and safe infrastructure and other government services, while supporting other livability goals.	• Compact development • Efficient infrastructure and services • Community safety • Walk and bike safety audits • CPTED

independence—especially for community members who cannot drive because of age, income, or disability. Corridor planning and implementation initiatives can emphasize transit-oriented health care within a corridor.

Infrastructure and Government Services

Promote effective and safe infrastructure and other government services, while supporting other livability goals.

At all levels, government provides vital services such as public safety, infrastructure, and economic development. Limited resources require that services be provided efficiently and effectively, and be conducted in ways that leverage a full range of livability goals.

Vibrant and Accessible Community, Cultural, and Recreational Opportunities

Table A-5 provides a summary of the goals and related strategies for this Principle.

Recreational and Community Facilities

Provide small parks, other recreational and community opportunities, and schools within walking distance of most transit-oriented homes. Provide schools, post offices, and libraries as well as larger parks and recreational facilities along transit corridors, while maintaining compact walkable development near transit stations/stops.

Parks and other recreational facilities provide opportunities for physical activity and support mental and social well-being. They also add economic value to communities and help stabilize declining neighborhoods (Harnik and Welle 2009). Near transit, small parks help to maintain compact walkable environments, but larger parks may not be appropriate, especially since park use is more affected by easy access than park size (Giles-Corti et al. 2013).

Modest facilities can have a big impact. In many communities, small neighborhood and "pocket parks" are more heavily used. Underutilized land can often be "reclaimed" for recreation,

Table A-5. Strategies for encouraging vibrant and accessible community, cultural, and recreational opportunities.

Goals	Strategies
Recreational and Community Facilities Provide small parks, other recreational and community opportunities, and schools within walking distance of most transit-oriented homes; provide schools, post offices, and libraries as well as larger parks and recreational facilities along transit corridors, while maintaining compact walkable development near transit stations/stops.	• Recreation and open space • Schools and community facilities • Mix of uses • Connected network planning • Station area profiles (to identify underserved areas)
Cultural Enrichment Offer opportunities for cultural enrichment.	• Public art • Cultural destinations • District revitalization
Context-Sensitive Design Respect historic, scenic, and other characteristics of established districts that are important for aesthetic cohesion and community identity. Integrate historic and other cultural resources when possible.	• District revitalization • Sense-of-place guidelines • Form-based code • Station area profiles (to identify cultural assets)

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such as when vacant lots become community gardens or when "parklets" are created along oversized roadways.

Schools, libraries, post offices, and other community facilities should be accessible by transit, bicycle, and pedestrian. Efficient urban formats help maintain compact walkable development patterns, such as when school campuses are also used for community programs and recreation (Kanters et al. 2013).

Cultural Enrichment

Offer opportunities for cultural enrichment.

Life is enriched when residents and employees can participate in an array of cultural activities, such as music, performance, art, crafts, and celebrations. Participation depends on having facilities and ongoing programs.

Context-Sensitive Design

Respect historic, scenic, and other characteristics of established districts that are important for aesthetic cohesion and represent community member preferences. Embrace and integrate historic and other cultural resources when possible, such as through adaptive reuse.

Established districts sometimes have historic resources, scenic resources, or aesthetic qualities that community members care about and that help make districts distinct. Consider ways to protect valuable resources and emulate the best aspects of a specific place with the design of streets and buildings while also allowing transit-oriented intensification.

Healthy, Safe, Walkable Transit Corridor Neighborhoods

Table A-6 provides a summary of the goals and related strategies for this Principle.

Mix of Uses

Provide retail conveniences, recreation, basic services, and cultural destinations close to transit stations and stops, and within walking distance of most homes and jobs.

Livability is enhanced when homes and jobs are within walking distance of local retail, community facilities, amenities, and transit. Trip-chaining occurs when conveniences are available near transit and increases the rate of transit use (Cervero 2006). Community and cultural destinations, such as theaters, museums, and places of worship, also enhance livability.

Walking and Biking Environments

Provide pedestrian and bicycling paths that are safe and attractive and that support community life.

Walking and bicycling environments are important public spaces (Gyorgyfalvy 2010). If designed to be welcoming and safe, walking and biking environments provide access to local destinations, offer social gathering places, promote healthful and economically stable communities (Shoup and Ewing 2013), and increase transit use (Lee 2012). Traffic calming features reduce traffic speeds and reduce pedestrians' and bicyclists' exposure to injury; traffic lanes can be sized to reduce the potential for serious and fatal pedestrian injuries (Daisa 2006); and traffic lanes can sometimes be eliminated to expand pedestrian and bicycle facilities (Speck 2013).

Table A-6. Strategies for encouraging healthy, safe, walkable transit corridor neighborhoods.

Goals	Strategies
Mix of Uses Provide retail conveniences, recreation, basic services, and cultural destinations close to transit stations/stops and within walking distance of most homes and jobs.	• Compact development • Form-based codes • TOD and other guidelines • Zoning overlay districts • Cultural destinations • Recreation and open space • Activity center master plans
Walking and Biking Environments Provide pedestrian and bicycling paths that are safe, attractive and that support community life.	• Complete streets • Connected network planning • Walk and bike safety audits • Traffic calming • Pedestrian and bicycle network maintenance • Community safety • CPTED • Circuitous route retrofits
Street-Oriented Buildings Line streets with building facades that have generous windows, frequent entrances, and attractive features, and generally avoid parking lots or blank walls along streets. Enhance connectivity with building entrances that face streets or are connected to the circulation network via a pedestrian path.	• Form-based codes • TOD and other design guidelines • Zoning overlay districts • CPTED

Street-Oriented Buildings

Line streets with building facades that have generous windows, frequent entrances, and attractive features, and generally avoid parking lots or blank walls along streets. Enhance connectivity with building entrances that face streets or are connected to the circulation network via a pedestrian path.

Building facades can support or deter walking and bicycle use. People walk less and there are greater incidents of crime where streets are lined by blank walls and parking lots. Streets and other pedestrian and bicycle environments are more attractive and discourage inappropriate behavior when building facades with windows and entrances are nearby (Zelinka and Brennan 2001; Loukaitou-Sideris 1999). Street-oriented buildings also encourage social interaction.

APPENDIX B

Description of Implementation Strategies

Introduction

Strategies provide paths to implementation. Strategies can identify courses of action, set priorities, link to resources, and assign responsibilities. This appendix describes important implementation strategies cited in Section 5 and Appendix A, and can be referred to as Handbook users consider and compile a list of potential strategies.

This Appendix provides guidance by offering a preliminary menu of strategies. Selected strategies should be tailored to the unique needs and strengths of the study corridor with serious consideration of available resources and tools. Strategies compiled below are NOT prescriptive and Handbook users are encouraged to customize strategies. Any strategy—whether taken directly as-written from this Handbook or customized—will require serious stakeholder commitment to the overall process of corridor-level planning.

This overview of implementation strategies synthesizes case study literature and interview findings. Most strategies are broadly recognized professional practices. This Appendix has three subsections:

- **Government Frameworks** describes vehicles for instituting the "Livability Strategies" described later. Government frameworks include:
  - state and federal guidance,
  - regional frameworks,
  - location-specific plans for corridors and station areas,
  - grant programs, and
  - recognition that incremental steps are often required.
- **Livability Strategies** describes a menu of implementation tools, which are organized according to the Handbook's Transit Corridor Livability Principles.
- **Strategies for Corridor Types** outlines strategies associated with whether a corridor is emerging, transitioning, or integrated. For descriptions of corridor types, see Appendix D.

Government Frameworks

State and Federal Guidance

State and federal livability-related guidance often comes in the form of overarching principles and generalized recommendations. While they defer authority to local planning efforts, this high level guidance can play a vital role in encouraging the adoption of implementation of livable transit corridor strategies.

State-Level Declarations

Declarations by state governors can, through executive action, direct state departments and influence decisions by regional agencies and local governments. In Pennsylvania, the governor called for comprehensive transit-oriented planning by issuing the "Keystone Principles for Growth, Investment and Resource Conservation" in 2005. The Keystone Principles call for state agencies to make decisions that emphasize redevelopment, efficient infrastructure, transportation choices, compact development, job opportunities, business-related sustainability efforts, housing opportunities, and regional planning (Governor's Economic Cabinet, Commonwealth of Pennsylvania 2005).

In Massachusetts, the governor's office established "Sustainable Development Principles" to guide state agency policies and programs. These principles call for compact development, social equity, affordable housing, economic development, transportation choice, and coordination among stakeholders. The principles are a touchstone as the state funds infrastructure and planning activities, and precipitated the development of Massachusetts' "Smart Growth Toolkit," an educational guide that uses case studies to highlight successful strategies.

Federal Programs

Federal programs for smart growth and livability have jump-started transit-oriented livability initiatives in regions across the country. The sizable Livable Communities Act (LCA) grants leverage planning and investments focusing on community revitalization, affordable housing, brownfield cleanup, and integrating land use and transportation. LCA grants went to local jurisdictions and NGOs, with an emphasis on partnerships, community participation, and social equity.

The federal New Starts program funds transportation improvements. Several MPOs cite ways that New Starts programs leveraged community livability objectives, such as by funding pedestrian and bicycle connections to stations.

In Minneapolis-Saint Paul, a HUD Sustainable Communities Planning Grant improved livability along corridors as part of the region's "Partnership for Regional Opportunity" program. Diverse projects were funded, including TOD studies, predevelopment and planning grants, small business supports, demonstration projects for TOD benefits, and community engagement. A large part of this HUD grant was dedicated to community engagement and developing the leadership capacities of community-based organizations.

Regional Frameworks

Regional frameworks offer comprehensive transit-oriented planning and implementation tools. Regional frameworks allow a "whole system" perspective on transportation, land use, and other factors relating to livability, and coordinates actions across jurisdictional boundaries.

Regional Plans

Regional plans can be designed to express a host of livability goals for transit access along corridors. Livability is at the heart of the Chicago area's regional plan, "Go to 2040." Its introduction declares: "While development should fit the local context, community choices about land use and housing should also emphasize principles that improve livability, such as:

- support for transit, walking, and bicycling
- a range of housing options
- environmental protection
- access to green space
- design, aesthetics, and local historic character." (Chicago Metropolitan Agency for Planning 2014)

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"Go to 2040" promotes development of comprehensive plans, ordinances, and regulations consistent with walkable compact development and educating decision makers. The plan recommends supporting local comprehensive planning and compact development through grant programs, infrastructure investments, technical assistance, and collaboration among municipalities. It stresses that housing affordability should factor into transportation costs and encourages local communities to allow mixed uses and higher densities within "location-efficient" areas near transit. Counties and municipalities can increase density by providing density bonuses in exchange for affordable units; creating transit overlay districts, or using form-based codes to address community fit. A "Public Participation Plan" accompanies "Go to 2040" (Chicago Metropolitan Agency for Planning 2010).

TOD Guidelines

While TOD guideline documents do not address the complete spectrum of livability concerns, they cover many aspects of livability and model a type of document that could promote livability. Dallas Area Rapid Transit's (DART's) TOD Guidelines illustrate livability factors typically addressed, including (but not limited to):

- Maintaining compact development patterns,
- Mixing complementary land uses,
- Providing pedestrian and bicycle connectivity,
- Constructing street-facing buildings,
- Avoiding street-facing parking lots and blank walls, and
- Encouraging community-serving recreation and destinations (Dallas Area Rapid Transit District 2008).

Minneapolis-Saint Paul's "Handbook for Transit-Oriented Development Grants" provides clear guidance and criteria for TOD program grant applicants (see "TOD Implementation Grants" above) (Metropolitan Council 2014b). To compete for funds, proposed projects are evaluated across the following factors:

- Urban Design: Evaluation criteria include active pedestrian-oriented first floors, buildings' transparency, street-oriented architecture, minimal setbacks, and shared amenities.
- Land Use: Evaluation criteria include transit- and retail-supportive uses, avoiding auto-oriented uses, and providing local conveniences and services.
- Mobility: Evaluation criteria include parking and transportation features that reduce the supply of parking and encourage alternative modes of transportation. Bike facilities and pedestrian-oriented features are also noted, such as short blocks, direct paths, and trail amenities (Metropolitan Council 2014a).

TOD Strategic Plans

In 2013, the Metropolitan Council of the Twin Cities (Met Council) adopted a "TOD Strategic Action Plan" (SAP) that provides high level guidance to promote supporting TOD by:

- Collaborating with partners to promote TOD, including technical assistance and stakeholder engagement;
- Leveraging limited resources, such as with strategic planning and incentives for development;
- Joint development and strategic land acquisition; and
- Focusing on implementation, including administration of the TOD grant program (Metropolitan Council 2013).

Met Council's TOD principles offer a touchstone when developing strategies for TOD implementation:

- Collaboration: engaging all levels of government, the private sector, regional institutions, and the public to implement a shared vision.

- Equity: connecting all residents to opportunities such as good jobs, transportation choices, safe and stable housing, a range of parks and natural areas, and vibrant open spaces.
- Stewardship: using resources prudently to help ensure the region's financial, social, and environmental sustainability, now and for future generations.
- Integration: aligning and coordinating policies, plans, resources, and actions both within and outside of the Met Council to more effectively achieve regional and community goals.
- Accountability: identifying appropriate indicators and measuring outcomes to evaluate the effectiveness of goals and policies (Metropolitan Council 2013).

Met Council emphasizes coordination and collaboration, as implementation requires actions of public, private, and nonprofit partners at the regional, municipal, corridor and district levels.

Location-Specific Planning

Comprehensive plans for specific areas or corridors promote implementation by recognizing local conditions and opportunities and by connecting broad goals to implementation measures. Planning around corridors and station area plans encourage solutions that cut across disciplinary boundaries.

Station Area Plans

Station area plans focus on areas within comfortable walking distance of transit. These transit-oriented and pedestrian-friendly districts are building blocks for livable transit corridors. Station area plans must integrate a range of planning factors. Common elements for station area plans include, but are not limited to:

- Local destinations and complementary uses,
- Network connectivity,
- Complete street design,
- Community recreation and open space,
- Building-street relationships, and
- Market feasibility and financing strategies for upfront costs.

Corridor Plans

In spite of their utility in addressing planning goals, few corridor-level plans were discovered as part of case study research. Nevertheless, the corridor-level plans examined are noteworthy. In Minneapolis-Saint Paul, the Corridors of Opportunity (COO) program emphasizes whole system approaches to organizing land use and transportation. Under the COO, action plans spring from corridor-specific analysis and provide station area parameters that local jurisdictions can build on, such as by adopting station area plans. The corridor action plans provide action-oriented and aspirational guidance. Based on interviews conducted for this Handbook, the following suggestions were identified for developing guidance for encouraging corridor-level planning:

- Develop a process to identify infrastructure needs and redevelopment sites at least five years before opening a new transit line.
- Identify infrastructure needs that should be in place on opening day, and within 10, 20, and 25 years.
- Identify local, state, and federal funding sources for infrastructure projects.
- Identify a clear vision for each station area in the corridor.
- Assemble management teams of neighborhood residents, city staff, and elected officials that will implement the vision.

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Grant Programs

Grants from governments and NGOs can help overcome obstacles to livable transit corridors. Grant criteria can target particular livability goals.

Technical Assistance Grants

Technical assistance grants are sometimes used by MPOs to help local jurisdictions overcome obstacles to TOD and address livability needs. Technical assistance grants can have a narrow focus and can be used for such things as area plans, development feasibility studies, street improvement plans, and parking and transportation demand management recommendations.

TOD Implementation Grants

Met Council's TOD grants program promotes moderate- to high-density development and affordable housing near transit. TOD grants can be used for both planning and capital projects. Minneapolis-Saint Paul region applicants can apply for funding from the Livable Communities Demonstration Account (LCDA) and the Tax Base Revitalization Account (TBRA). LCDA funding goes toward parcel assembly, placemaking activities, complete streets, energy efficiency installations, pedestrian and bicycle infrastructure, and planning activities. TBRA funding goes to site investigation, cleanup of polluted land or buildings, and other predevelopment needs, such as market studies, legal work, community workshops, site capacity studies, traffic studies, and contaminated site investigations.

Grant programs come with guidance on best practices, such as use of Met Council's "Handbook for TOD" discussed above (see "TOD Guidelines"). Funding priorities are guided by a TOD SAP developed by Met Council in collaboration with government and other stakeholders. TOD program staff who administer implementation-focused grants have real estate experience that enables them to work closely with developers, landowners, and financial institutions to overcome barriers to development.

Incremental Approaches

Sometimes sweeping comprehensive corridor plans are not possible, but each planning effort along a corridor can help build support with the public and helped attract politicians to the cause.

In the Village of Niles, Illinois, near Chicago, Milwaukee Avenue was an arterial highway characterized by aging highway commercial uses and high traffic volumes. Sidewalks were missing along most of the auto-oriented corridor, and rights-of-way were frequently used as an extension of parking lots. In response, the Village looked to create a community focal point to take advantage of relatively high levels of bus commuters along the corridor.

In 2006, after months of planning, the Village adopted the "Milwaukee Avenue Plan." The plan profiled land use and transportation conditions along the corridor, and featured a real estate market analysis that looked at not only retail opportunities but also possibilities for office and multifamily residences that might occur with redevelopment (Village of Niles 2006).

However, planners and decision makers chose to take an incremental approach and land use changes were avoided in this plan. Plan recommendations focused on planning principles and illustrative design concepts for street improvements and redevelopment. Street concepts addressed pedestrian-oriented fundamentals like maintaining continuous sidewalks, reducing curb cuts, increasing landscaping, and introducing consistent decorative elements. Attractive illustrations described concepts to inspire property owners, and showed new buildings fronting

onto Milwaukee Avenue with parking in the rear. "Next steps" call for additional planning and design to position the community for street construction grants and possible land use and zoning changes.

The Village of Niles used the 2006 plan to seek funding for street improvements from the Regional Transportation Authority (RTA), the Chicago Metropolitan Agency for Planning (CMAP) and the Illinois Transportation Enhancement Program (ITEP). A series of separate project-level planning documents were prepared for sidewalks, landscaping, street furnishings, pedestrian crosswalks, intersection design, and designation of Milwaukee Avenue as a BRT network.

As incremental improvements were made, the Village applied for and received a Local Technical Assistance grant from CMAP for a Bicycle and Pedestrian Plan. Adopted in 2014, it provides explicit design guidance for improvements along Milwaukee Avenue in the form of multimodal streets improvements. The Plan also recommends mixed-use development and increased land use densities, to promote transit- and pedestrian-oriented redevelopment (Sam Schwartz Engineering D.P.C. and Farr Associates 2014). These land use recommendations led to subsequent changes in local zoning.

Livability Strategies

This section contains a wide range of implementation strategies, but cannot be exhaustive given the countless settings and governance tools available. These strategies are the most prominent and often used, as identified in case studies and literature searches. They are organized by the Livability Principle to which they most closely relate, and many strategies apply to multiple Transit Corridor Livability Principles and their related goals. (For more on goals and related strategies, see Section 3 and Appendix A.)

Building High-Quality Transit, Walking, and Bicycling Opportunities

Strategies can encourage a wide range of transportation choices and transit-oriented environments to people who live and work along a transit corridor.

Connected Network Planning

Highly connected transportation networks encourage walking and bicycling by providing direct routes to destinations. "Connectivity" is the extent to which networks are connected and can be promoted with district-level planning. The most common planning tools used to pursue these strategies include station area plans and pedestrian/bicycle master plans that have diagrams or standards to establish new, or retrofit existing, networks. Los Angeles's Metro promotes the development of pedestrian mobility plans for station areas. Los Angeles's Metro has provided some direct funding for pedestrian and bike connections between the Orange Line BRT stations and surrounding neighborhoods. Along Los Angeles's Orange Line, station area profiles have been developed, flagging locations where connectivity improvements are needed (see also "Land Use Profiles") (Raimi + Associates et al. 2012).

Transportation network connectivity is also addressed by TOD guidelines, which offer general guidance for direct connections and interconnected street patterns, such as in Met Council's "Handbook for Transit-Oriented Development Grants" (Metropolitan Council 2014b).

Circuitous Route Retrofits

Circuitous route retrofits are a specific tool for adding pedestrian and bicycle routes, where existing routes are overly circuitous. Overly circuitous routes are often attributable to superblocks

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(such as in commercial areas), cul-de-sacs (such as in residential areas), and loop roads (that do not connect through).

Area plans can be instrumental in mitigating circuitous routes. Fremont, California's City Center came about where superblocks containing shopping centers surrounded by arterial roadways provided few local streets and made walking to a regional transit station impractical. Fremont's "City Center Community Plan" calls for a fine-grain network of pedestrian routes in the near term, and the creation of local streets as redevelopment occurs. The plan includes financing mechanisms for new pedestrian routes and local streets (Raimi + Associates and Sargent Town Planning 2012).

Bellevue, Washington's, "Subarea Plan" calls for completion of a pedestrian corridor that cuts through the center of multiple superblocks. Phase 1 improvements create tree-lined paths across the parking lots and terminate in a regional shopping mall. Long-term, redevelopment will be used to establish a pedestrian-oriented shopping street lined by new buildings (City of Bellevue undated).

Circuitous routes can also be addressed through government assistance. In Minneapolis-St. Paul, LCA grants promote connectivity by funding targeted improvements, such as missing street or path connections that—if provided—will reduce the distance to destinations and expand networks (Metropolitan Council 2014a).

Shuttle bus service can also help mitigate effects of highly circuitous routes, where direct connections for pedestrians and bicyclists are not provided (see "Last-Mile Shuttles").

Compact Development

Density can improve livability by increasing the supply of housing, supporting a wider variety of local walk-to retail and services, and boosting transit ridership, which justifies improvements to transit levels of service. Strategies that increase density include density zoning bonuses, mixed-use zoning codes, specific plans, reduced on-site parking standards, "unbundling" rent from parking, using parking lifts, and taking advantage of shared-parking and off-site arrangements among complementary uses (see "Demand Management").

Compact development also delivers more efficient community infrastructure and services. When infrastructure is less spread out, per capita and per household costs go down, both upfront capital costs and costs for ongoing repairs and maintenance. With greater efficiency, limited public resources can be more fully leveraged, not just for infrastructure improvements but also to address other livability needs (see "Efficient Infrastructure and Services").

Alternative Modes

Alternative modes refer to transportation options other than the dominant mode in the United States—the private, single-occupant automobile. Alternative modes include walking, bicycling, transit use, and carpooling. Incentives for alternative modes offer greater travel choices, provide better access, and reduce reliance on cars, all of which support walkable mixed-use districts (see "Compact Development"), affordability (see "Location Efficiency"), and other social and economic benefits.

Alternative modes are associated with livability goals and strategies, including, but not limited to:

- Transit availability and affordability, such as providing free transit passes (see "Transit Pass Subsidies") and offering easy-to-use transit service (see "Transit Frequency and Reliability") .
- Bicycle facilities and availability, such as bike paths, secure bicycle parking, lockers and showers for bike commuters, and low-cost bike rentals such as bike-share programs.

- Enhanced pedestrian environments, such as continuous sidewalks lined by street trees and street-oriented buildings (see "Complete Streets" and "Form-Based Codes").
- Carpool facilities and programs, such as preferential parking for carpools, carpool lanes, and employer-funded carpool vehicles.

The availability of alternative modes can be leveraged through education and marketing, such as by providing information on travel options to employers and employees, and with advertising and special events, such as annual bike-to-work days.

Transit Pass Subsidies

Among strategies for alternative modes, transit pass subsidies deserve special mention. Transit subsidies can include free or low-cost transit passes, and employer commuter-check programs that allow employees to pay for transit with pretax dollars. Transit pass subsidies can be provided by landlords and can be required or incentivized as part of new development; often they are tied to a commensurate reduction in on-site parking requirements. Companies also provide transit pass subsidies, not only as a benefit to employees, but also to reduce demand for on-site parking (which may be expensive to construct) or to reduce traffic congestion (which may be a condition for allowing a company to expand).

Met Council's COO program educates employers on the significant cost of providing free on-site parking, as compared with the costs of promoting alternative modes such as employee transit pass programs, carpool incentives, and realistic bicycling options. The program also encourages employers to locate near transit, such as by promoting location opportunities along transit corridors and describing workforce demographics (Metropolitan Council 2014a).

MPOs and transit agencies can encourage, and local jurisdictions can require, that employers, multifamily housing developers, schools, and other organizations purchase transit passes in bulk and provide transit passes to users at a discount. Transit passes can be built into rents, homeowners' association fees, and covenants that stay with a property regardless of ownership. Residential development near transit can include transit pass subsidies to leverage additional housing-plus-transportation affordability (see "Location Efficiency") (McGraw et al. 2014).

Parking Management and Requirements

A principal way to manage parking demand is to communicate market-rate costs associated with parking to motorists. Free parking does not reflect the cost of providing parking nor does it signal that parking demand may exceed supply.

Landlords and employers can unbundle the rent for parking from the rent for a residential unit or commercial space, so potential parking consumers are aware of its price. This allocates parking using supply-and-demand principles, and enables users of alternative modes to enjoy cost savings.

Municipalities can also price public garage and street parking so demand matches supply. When parking that is in demand is priced fairly, motorists can chose to park in less desirable locations or avoid reliance on the car by using alternative modes.

Development intensities increase when parking demand is managed, which helps to boost the production of housing and the availability of walk-to retail (see "Compact Development"). On-site parking can displace other uses and activities, and high construction costs associated with on-site parking makes some potential development projects financially infeasible, especially when parking must be provided in a multilevel parking garage or below grade.

Municipal zoning requirements can play the biggest role in how well parking is managed. When on-site parking requirements exceed actual demand, they increase supply, reduce parking

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prices artificially, subsidize car use, and undermine the affordability of alternative modes. On-site parking standards can be determined by analyzing comparable case studies and the extent to which residents or employees can use alternative modes. Minimum on-site parking standards can be eliminated altogether, and maximum on-site parking standards have been imposed by some cities to create market demand to fully utilize available parking.

Transit Frequency and Reliability

Opportunities for access are enhanced by more frequent transit service and predictable transit schedules. Frequent transit service allows easy access to destinations that are not within walking distance of home or work, but providing frequency depends on ridership levels (see "Compact Development"), transit system operating costs, and available resources.

Transit service reliability (adhering to schedules) makes transit use more convenient and easier to coordinate with daily activities, even when service is less frequent. Common strategies include separating transit from potential sources of congestion, such as with dedicated BRT lanes, signal prioritization, and queue-jump lanes at congested intersections; timed transfers between transit vehicles; and providing real-time departure information to avoid long wait times (Fan and Guthrie 2013).

Last-Mile Shuttles

Last-mile shuttles connect corridor trunk transit lines with major destinations peripheral to the corridor. Convenient shuttles encourage transit use and lessen reliance on the car. Case studies suggest that most regions rely on local bus service to provide last-mile transit connectivity, but service levels for connecting buses can vary. Timed transfers between last-mile shuttles and the trunk transit lines they serve have been shown to improve service reliability and transit ridership. Over time, sufficient shuttle and bus services in a station area can replace the need for station park-and-ride lots, freeing up land for TOD.

Improving connecting bus service to LA's Orange Line has been suggested in one study as the best way to increase access to affordable housing along the corridor. The study notes that relatively little multifamily housing is within a quarter mile of the Orange Line. Within a few miles, high concentrations of low-income households are along local bus lines that connect to the Orange Line, but bus service improvements are needed to shift travel decisions (Raimi + Associates et al. 2012).

Generally, last-mile shuttles to major employers, hospitals, and other destinations are initiated and operated by these users, but can be operated by transit agencies and funded by community benefits district financing. One example is in Emeryville, California, where the free Emery-Go-Round serves employees, residents, and shoppers, and is funded by commercial property owners within a transportation business improvement district (Emeryville TMA undated).

Mixed-Income Housing Near Transit

The following strategies can promote more equitable and affordable housing for people along a transit corridor.

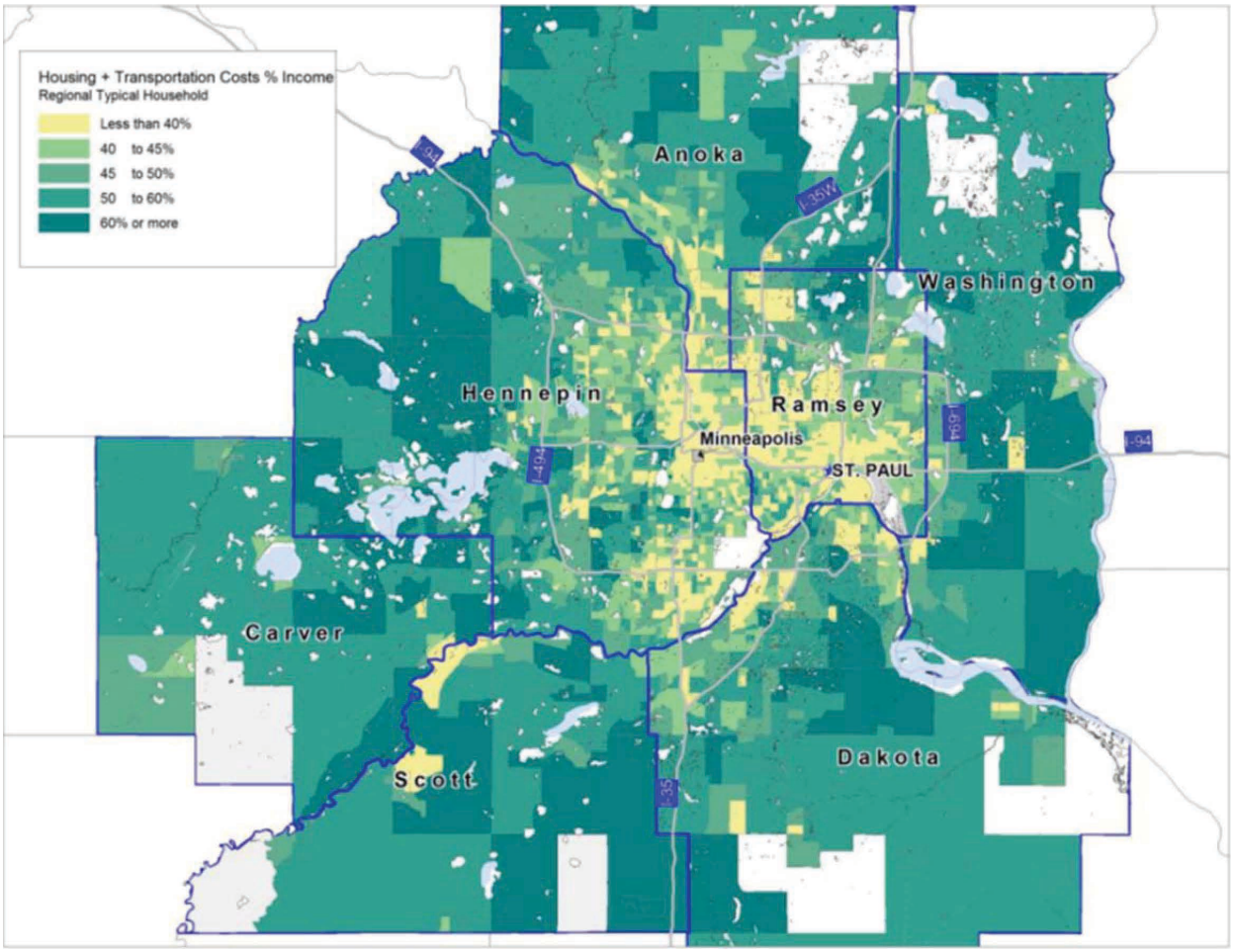
Location Efficiency

"Housing-plus-transportation cost savings made possible with good transit access are key to the success of affordable-by-design projects," says one Minneapolis-St. Paul COO report (Fan and Guthrie 2013). Producing housing near transit may be more effective at promoting affordability than inclusionary requirements in auto-reliant locations.

The report encourages the use of "housing-plus-transportation" (H+T) cost indices to communicate real costs and benefits when location decisions are made by residents, employers, and developers. According to another COO report, location-efficient transit-oriented households provide the following benefits:

- Less neighborhood traffic,
- Fewer vehicle-miles traveled (VMT),
- Lower foreclosure rates,
- Lower household bankruptcy rates,
- More stable real estate values, and
- Higher observable growth rates (McGraw et al. 2014).

H+T affects the availability of low-income housing and strengthens low-income household budgets, particularly in transit-oriented environments (see Figure B-1). In the San Francisco Bay Area, TransForm launched GreenTRIP (TransForm undated), a program that demonstrates reduced trip generation associated with housing projects close to transit and containing transportation demand management features. The tool is effective at convincing municipalities and developers to reduce on-site parking, which lowers construction costs and boosts production of affordable housing. Lower trip generation also can avoid traffic impacts that require expensive mitigations.



While housing costs at the outskirts of regions are often lower, the combined cost of H+T can render such locations much less affordable, as is illustrated by the Center for Neighborhood Technology's analysis for the Minneapolis-St. Paul region.
Source: McGraw et al. 2014. H+T ® Index, Center for Neighborhood Technology.

Figure B-1. Housing versus H+T affordability.

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H+T affordability is also promoted by location-efficient mortgages (LEMs). LEMs broaden the pool of eligible home buyers, by recognizing that lower transportation costs help a household's ability to cover a mortgage (McGraw et al. 2014).

Housing Production and Targets

Housing targets are a way that MPOs and other regional and state agencies encourage and allocate housing across jurisdictions in equitable ways. Cities are required to zone for and promote production of affordable housing using California's Regional Housing Needs Allocations (RHNA) and Minnesota's Affordable and Life-Cycle Housing Opportunities Amount (ALHOA). Under both programs, local jurisdictions prepare their own affordable housing plans that pledge zoned capacity and local programs for affordable housing, such as housing assistance, building rehabilitation grants, waivers of municipal fees, housing impact fees to finance housing trust funds, and affordable inclusionary requirements. Grant assistance can seek to leverage social equity benefits by supporting TOD studies and demonstration projects, predevelopment and planning, small business programs, and community engagement (California Department of Housing and Community Development 2010; Minnesota Code § 473.254).

Government agencies and NGOs can also offer real estate expertise and financial assistance to help developers, landowners, and financial institutions overcome barriers to housing production to increase affordability. The Met Council encourages affordable housing production with a Housing/Transit-Oriented Development Loan Program, technical assistance grants (see "TOD Implementation Grants"), and the Affordable Housing Trust Fund and High Density Corridor Housing Program (Metropolitan Council 2013).

Broadly speaking, affordable housing strategies play an important role in Minneapolis-St. Paul's COO system. The COO specifically emphasizes the importance of having housing developers deliver large levels of new housing in transit-oriented locations (Partnership for Regional Opportunity: Corridors of Opportunity 2016). Compact affordable-by-design projects have economies of scale that encourage financially feasible development with little or no public subsidy, such as by increasing allowable densities or decreasing the size of dwellings.

Regulatory Streamlining

Housing production can be encouraged by addressing regulatory obstacles. Transit-accessible locations tend to have higher land costs and more difficulty in attaining development approvals. TOD zoning, in which a developer can build by right, can level the playing field between transit-oriented and automobile-reliant locations. Obstacles can also be eliminated by allowing higher densities, reducing minimum parking requirements, and permitting shallow building setbacks. While form-based concerns deserve to be addressed, one should recognize that design flexibility can reduce developer risk.

In multiple case studies, the Urban Land Institute (ULI) examined how development regulations create obstacles to housing and TOD generally. The city of Minneapolis asked a ULI advisory panel to tell it whether it is pursuing the right strategies to achieve its TOD vision. In addition to calling for land assemblage and district-level financing tools, the panel held that good projects may be stopped by excessive parking requirements, restrictive setback and height requirements, high fees, unnecessary limitations on use, and lengthy development approval processes. The panel called for zoning that accounts for development feasibility, allows by-right approvals, and in other ways encourages private development (Urban Land Institute, Rose Center of Minneapolis 2010).

Housing Assistance

Low-income households can receive direct assistance from government to rent housing, such as with Section 8 vouchers. Rent subsidy vouchers are generally administered at the local level

and limited to qualifying properties. Government pays the property owners an amount in excess of the voucher's value to encourage landlord participation and long-term agreements.

Long-term housing assistance agreements eventually expire, however, and property owners may not renew their participation, particularly when market conditions have increased rents significantly. This can lead to evictions of low-income tenants and undermines neighborhoods' stability (see "Anti-Displacement Strategies").

Voucher programs can give preference to properties near transit to leverage H+T affordability (see "Location Efficiency"). The federal government encourages location efficiency indirectly as part of plans required for federal funding. As of 2008, however, there were "currently no direct incentives through HUD- and FTA-funded programs for locating affordable housing near transit . . . [although] HUD and FTA will assess the feasibility of encouraging and/or providing targeted incentives for financing affordable housing near transit" (Federal Transit Administration and Housing and Urban Development 2008).

Inclusionary Housing

Inclusionary housing refers to municipal and county planning ordinances that require that a certain percentage of new development be set aside for occupancy by families of very low, low, and moderate income. Inclusionary housing relies on ongoing administration by landlords and monitoring by government (Powell and Stringham 2005).

While inclusionary policies can provide additional affordable units in residential projects that are being built, such requirements place an additional economic burden on developers and may reduce the economic feasibility of some projects and reduce housing production (see "Housing Production and Targets" and "Regulatory Streamlining").

Local Housing Trust Funds

Development fees or real estate transfer taxes can be assessed to residential and commercial properties for the production of affordable housing. Housing trust funds are gathered by local governments and used to leverage grants and financing, often in partnership with affordable housing developers. Housing trust funds can be found throughout the United States, and several states have adopted legislation that encourages or enables local jurisdictions to dedicate public funds to affordable housing (Center for Community Change undated).

Housing trust funds can play a vital role in promoting low-income housing generally, and the funds can be applied to transit-oriented locations. In Seattle, housing and smart growth advocates have pushed for expanding housing trust funding and targeting its application in transit-oriented communities (Valdez 2014).

Anti-Displacement Strategies

Rising rents can force residents out of neighborhoods, which can be addressed with programs that reduce tax burdens among low-income households, below-market inclusionary housing, low-income housing production, and relocation assistance. Development can displace residents and raise rents as a locale becomes more favored. Tax abatement, property value increment exemption, and tax credits are ways to help reduce property tax burdens among low-income households. Land trusts can add stability by serving as a financial vehicle for retaining affordable housing. In Minneapolis, development applicants must evaluate how many existing dwellings and residents might be displaced as a result of a development project, and adopt strategies to address impacts, such as replacement of affordable units, relocation assistance, and direct compensation (Metropolitan Area Planning Council undated).

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Transit-Accessible Economic Opportunities

These strategies can enhance employment, retail, and other economic opportunities for individuals who live and work along transit corridors, and in the process, enhance the region's economic competitiveness.

Regional Competitiveness

Strategies for TOD and corridor planning can promote economic opportunity and the economic health of metropolitan areas. As illustrated by the conclusions of the Delaware Valley Regional Planning Commission (DVRPC) in its report "Linking Transit, Communities and Development," "[O]ur regional economy can better compete . . . when we plan and act as a region rather than as a set of counties and municipalities that happen to be located in close proximity." The report makes the point that land use and transportation planning are connected to economic development by

- Exchanging information,
- Fostering communication, and
- Leveraging transportation and other infrastructure (Delaware Valley Regional Planning Commission 2003).

All the counties represented by DVRPC offer financial assistance in the form of business development resources such as technical support, low-interest loans, and tax credits; infrastructure and real estate development incentives such as tax increment financing and tax abatements; and workforce training and placement programs. Counties also maintain an inventory of development opportunity sites near transit (see "Station Area Profiles") (Delaware Valley Regional Planning Commission 2003).

Economic justifications for TOD are stressed across all the case studies reviewed for this Handbook, and help encourage broad support for TOD, even where decision makers give TOD social and environmental benefits less emphasis. DART provides market-based evidence on the economic performance of TOD versus conventional development in a 2014 report called "Development Impacts of the Dallas Area Rapid Transit Light Rail System," "[B]enefits of development near light rail stations [are] not only felt by the individuals who have increasingly used the service, but also by developers who continue to see business opportunities near rail stations, and by local governments that receive increased property tax revenues associated with development." The report notes that the value of properties near transit significantly exceeds similar properties not associated with transit (Clower et al. 2014).

Station Area Profiles

Across the nation, MPOs and transit agencies compile information profiles to direct resources toward transit-accessible areas with the greatest potential for positive change. The information sets the stage for informed policy making and helps communicate opportunities to municipal governments and developers. LA's "Orange Line Bus Rapid Transit Sustainable Corridor Implementation Plan" and DVRPC's "Linking Transit, Communities and Development: Regional Inventory of Transit-Oriented Development Sites" gather similar information for station areas, such as existing land use, zoning designations, inventories of housing and jobs, infrastructure capacity, pedestrian and bicycle connections, pending improvements, and development opportunity sites (Raimi + Associates et al. 2012; Delaware Valley Regional Planning Commission 2003).

In the Boston area, the Metropolitan Area Planning Council's (MAPC's) "Orange Line Opportunity Corridor Report," brings together demographic, economic, transportation, land use

characteristics, and walkability scores, along with descriptions of recent and anticipated development activity to:

- Prioritize infrastructure investments,
- Identify land acquisition and joint development opportunities,
- Initiate policy and zoning changes to intensify land use,
- Connect concentrations of low-income households with anti-displacement programs,
- Solicit developer interest to help implement plans, and
- Bring together public and private stakeholders (Metropolitan Area Planning Council 2013).

In Dallas, the city's Office of Economic Development has created a series of station area profiles that describe major development sites, recent real estate activity, and policies and programs promoting economic development (City of Dallas, Dallas Office of Economic Development 2010).

Financial Feasibility and Incentives

Financial incentives are a common strategy used for economic development, often at the corridor scale. Minneapolis-St. Paul's COO jobs-housing paper found that high land costs associated with transit-accessible sites can deter developers. It recommended that where market forces have not reached a feasibility tipping point, financial incentives such as density bonuses, tax abatements, and grants for site preparation be considered (see "TOD Implementation Grants") (Fan and Guthrie 2013).

Another common strategy for overcoming financial obstacles is to provide an annotated bibliography of available financing tools and funding sources. Examples include capital grants for transportation and infrastructure improvements, technical assistance grants, economic development incentives, and mortgage assistance within TODs.

Land use regulations also influence development feasibility. Additional density increases future revenues and can be allowed by right—in recognition of TOD's advantages—or with a density bonus to leverage additional livability features. Parking reductions also improve the bottom line for development because of the high cost of providing parking on site (see "Regulatory Streamlining").

Land Assemblage and Joint Development

Transit agencies and municipalities can help make TOD feasible by helping to assemble small parcels and by making public land available for development through public-private joint development activities. In urbanized areas, smaller parcels make it difficult for development to attain sufficient economies of scale to be economically feasible. Consequently, acquisition and assemblage of parcels can play a vital role. Financial resources for these activities include land banking activities, land assemblage tax credits, and government-sponsored redevelopment.

Transit agencies and municipalities often have land resources near transit that can be leveraged to enhance livability. Joint development refers to the joining of public land with private development capital and expertise to attain goals. According to interviews conducted for this Handbook, The Fort Worth Transit Agency (The "T") has teamed with the Fort Worth Housing Authority to develop a mixed-use master plan at the city's Texas and Pacific rail station on T-owned land. The master plan emphasizes the production of affordable housing, and will also contain market-rate housing, retail, community services, and recreational open space. A nonprofit housing developer, Fort Worth South, is the master developer and will be responsible for financing infrastructure.

In addition to development on The T's land, some acquisition and assemblage of other parcels is expected, and the city has undertaken planning to coordinate development. The master

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plan effort emerged out of a market study on housing demand in the vicinity and subsequent conversations between The T and the Housing Authority. Housing will have urban design characteristics to promote density and walkability.

MPOs can take an active role in encouraging development on land they control, or can leverage by partnering with local jurisdictions and housing authorities to acquire and assemble key parcels. The Minneapolis-St. Paul Met Council's Land Acquisition for Affordable New Development (LAAND) program makes loans to acquire land for affordable housing projects, with criteria including proximity to public transit and consistency with existing community plans. In addition, the region's Hiawatha Land Assembly Fund program has acquired, assembled, and prepared TOD opportunity sites since the 1990s, and used $5 million of Federal Congestion Mitigation and Air Quality (CMAQ) funds. The fund created a one-time source for property acquisition along the Hiawatha Line, with acquisitions first occurring in downtown Minneapolis and then elsewhere along the corridor (Metropolitan Council 2013).

"Patient money" fronted by government is sometimes needed as a development catalyst. "Strategic Acquisition Fund for Transit-Oriented Development," a report developed for the Minnesota Housing Finance Agency and Metropolitan Council, notes that acquisitions and assemblage requires significant effort and carries relatively high financial risk. In places where development seems too risky, municipalities can increase development activity by reducing or deferring development fees. For priority projects, governments and foundations can participate financially with low-cost loans or as "first-loss" investment partners (McGraw et al. 2014).

Predevelopment Assistance and Brownfields

In Minneapolis-St. Paul, the LCA grants encourage TOD where there are economic and environmental obstacles. Predevelopment and site investigation funding helps developers through critical due diligence activities such as conducting market studies, investigating and cleaning up contaminated sites, performing critical legal work, and building support among local stakeholders. To be eligible, projects must be proximate to LRT, BRT, commuter rail, or high-frequency express bus stations (Metropolitan Council undated).

Brownfields—sites with abandoned and aging industrial uses—can present opportunities for growth along transit with industrial sites that may require cleanup of contaminants—often an expensive and risky proposition. Predevelopment assistance can be essential for brownfield redevelopment. Along Philadelphia's North Broad corridor, industrial land within a few blocks of transit has been reclaimed for new residential development, replacing blight with housing opportunities and economic support for local businesses (The Philadelphia City Planning Commission 2005).

District Financing and Value Capture

District-level financing can underwrite capital improvements in a station area or subarea of strategic importance. Several district-level financing tools are available (Urban Land Institute 2010).

Local Improvement Districts. Local improvement districts (LIDs) and business improvement districts (BIDs) use parcel-based assessments. The revenue from these assessments can leverage ongoing services as well as public improvements. In turn, BID/LID services and improvements leverage higher levels of economic activity and private investment. BID/LID services are generally established with a majority of property owners.

Revenue Bonds. Revenue bonds can pay sizable upfront costs but must be adopted by area property owners. These bonds require a revenue stream to service the debt.

Developer Impact Fees. Developers can be assessed impact fees, which can be pooled to finance area infrastructure improvements. To raise revenues from fees, private development must be financially feasible.

Tax Credits. A variety of federal tax credits could be used for TOD and related infrastructure based on eligibility, such as New Markets Tax Credits and historic and energy tax credit programs.

Parking Increment. By increasing parking rates at meters and in publicly owned garages, the increment above the current rate can be used to help pay for infrastructure improvements. In Portland, Oregon, a meter rate increase of 25 cents per hour raised a $28 million bond to finance a streetcar downtown.

Tax Increment Financing. Tax increment financing (TIF) allows governments to retain future increases from property tax revenues (that is, the increment above prior tax revenues) to finance local projects. Bonding against future revenues can leverage significant capital for

- Street improvements,
- Lot assemblage,
- Site remediation,
- Assistance to displaced residents and businesses,
- Job training within corridor and vicinity,
- Attracting uses that serve the community,
- Direct rehabilitation of structures, and
- Traffic improvements, including traffic calming.

Value-Capture Financing. Value-capture tools, such as TIF, allow governments to leverage revenues during financial upswings resulting from public planning and investments. Although value capture can finance improvements and yield community benefits in strong markets, it has more limited application where market forces are marginal or largely absent (Mathur 2014). Interviews conducted for this study found that while value-capture financing tools are being widely considered and used in transit corridors across the country, there was also an emerging sense that while they work well in healthy real estate markets, development subsidies and other incentives may be needed in more challenged markets. In these difficult market conditions, value-capture tools may be counterproductive.

Activity Center Master Plans

New activity centers typically result from large-scale master plans and can create new nodes of commercial and cultural activity. This is especially important for Emerging Corridors, which are characterized by single-use, low-intensity development (see Appendix D). Activity center master plans can also address a corridor's jobs-housing balance by emphasizing jobs or housing creation.

Activity centers can be constructed in "greenfield locations," in low-intensity emerging areas, or as part of the redevelopment in urban areas. Unlike historic downtowns that grew incrementally over time, activity centers typically result from master planning (to guide character, use, and intensity) and public-private partnerships (to facilitate implementation such as through land acquisition and infrastructure financing).

Bloomington, Minnesota, redeveloped an underutilized site along the Hiawatha LRT Line through the "Bloomington Central Station Development Plan." High-intensity development complements other uses on the LRT line. The plan creates a mixed-use node near the regional airport and gives employees at the Mall of America new housing options, helping to address corridor-level jobs-housing balance. Transportation strategies for the high-intensity mixed-use

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district included parking garages (financed as part of districtwide infrastructure) and aggressive transportation demand management programs. Walkability is promoted with complete streets, public open space, and local conveniences (City of Bloomington 2013).

Near Portland, Oregon, the Blue Line LRT corridor has had relatively few major transit-accessible destinations farther out from Portland. The city of Hillsboro acquired underutilized land west of and adjacent to downtown to create a civic and cultural center with direct transit access. The activity center has helped support the revitalization of the downtown that it abuts (City of Hillsboro 2010).

The Village of Niles, Illinois, grew without a downtown, and community leaders have recently expressed their desire for an activity center. Along the Milwaukee Avenue transit corridor, two clusters of larger commercial parcels have been identified as future activity centers. The Village's "Pedestrian and Bicycle Plan" emphasizes fine-grain connections in these areas; and land use planning was underway at the time of this writing to allow increased intensities and offer incentives for the redevelopment of designated activity center areas (Sam Schwartz Engineering D.P.C and Farr Associates 2014).

Jobs-Housing Alignment Activities

In 2009, the Federal Highway Administration found that across all modes, commute trips between job and home resulted in 623 trillion VMT and 28 percent of total annual VMT. When there is a mismatch between the location and number of jobs and homes, workers often take jobs that are far from where they can afford housing. Increased transit service can help close this location gap when job and housing opportunities are near reliable transit (East-West Gateway Council of Governments 2012). When they are not, coordinated land use planning and transit service expansions can help to reduce the location gap. (For economic effects on households from the combined cost of housing and transportation, see "Location Efficiency.")

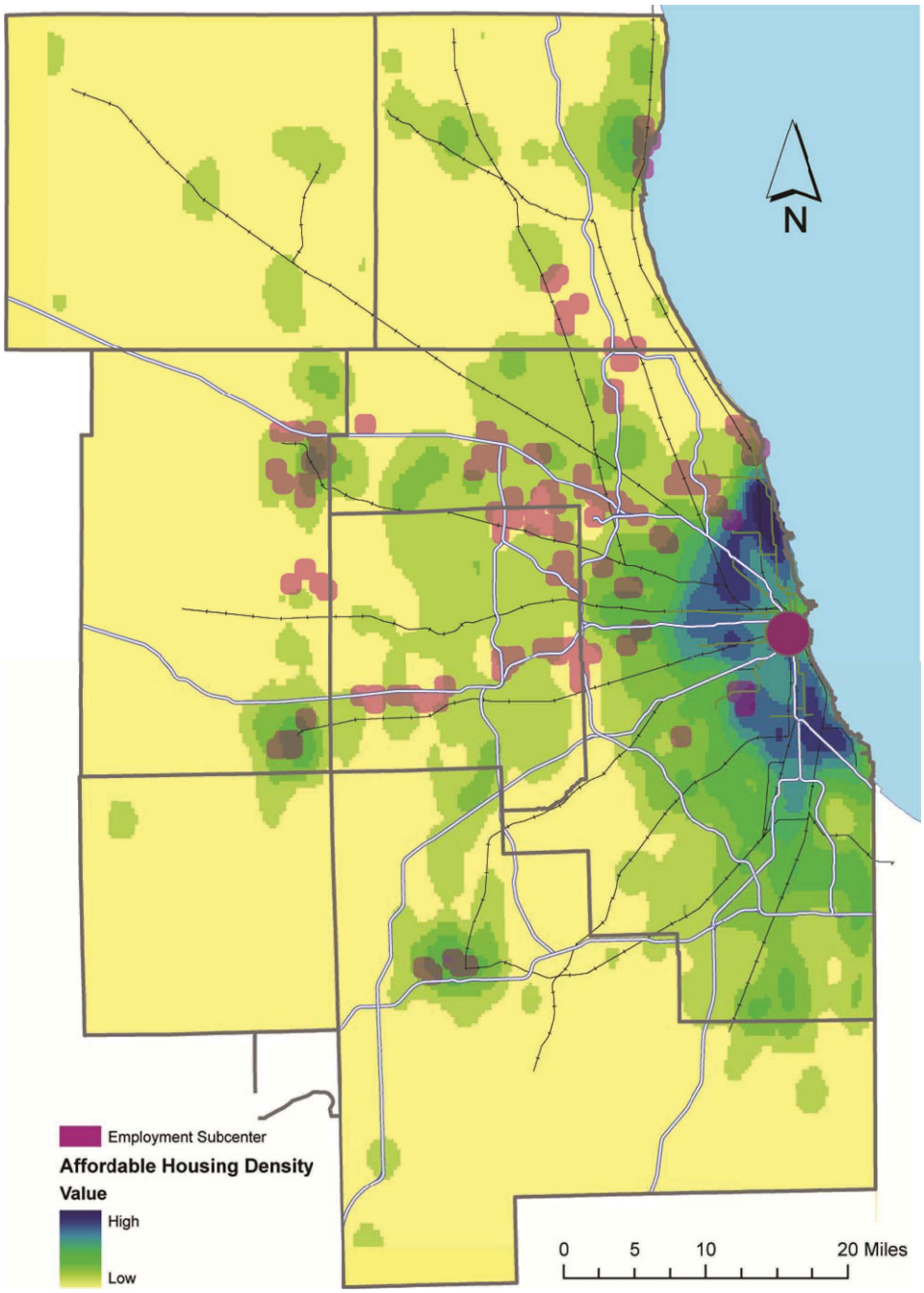
Furthermore, jobs-housing strategies can better utilize available transit capacity, such as by encouraging jobs or housing near certain transit stations. For example, job centers in the "reverse commute direction" can leverage transit capacity when job growth occurs.

Regional and corridor-level planning tools for attaining jobs-housing balance compare the location of job concentrations to available housing (see Figure B-2). For example, in its report "Jobs-Housing Balance: CMAP Regional Snapshot Report," the CMAP focuses on:

- The dimensions of jobs-housing balance, including the location of job centers;
- The density of jobs and housing, concentrations of affordable housing;
- Local jobs-housing ratios;
- Commute patterns;
- Travel time from areas of affordable housing to jobs; and
- Opportunities for corrective job and housing growth, such as housing opportunity sites near suburban job centers (Chicago Metropolitan Agency for Planning 2008).

Spatial analysis of jobs and housing can be generalized, as illustrated by CMAP's "Jobs-Housing Balance" report, or can be specific to transit station areas and corridors, such as the Center for Transit-Oriented Development's (CTOD) approach for regional Los Angeles (see Figure B-3). In "Creating Successful Transit-Oriented Districts in Los Angeles," CTOD measures the mix and intensity of jobs and housing across seven transit corridors, and evaluates the relative balance of jobs and housing within each corridor. Such corridor-level analysis helps to determine where job or housing growth should be targeted (Center for Transit-Oriented Development 2010).

Policy tools to achieve jobs-housing balance can be characterized as "carrots and sticks." "Carrots" include planning and capital grants, public-private joint development initiatives, and

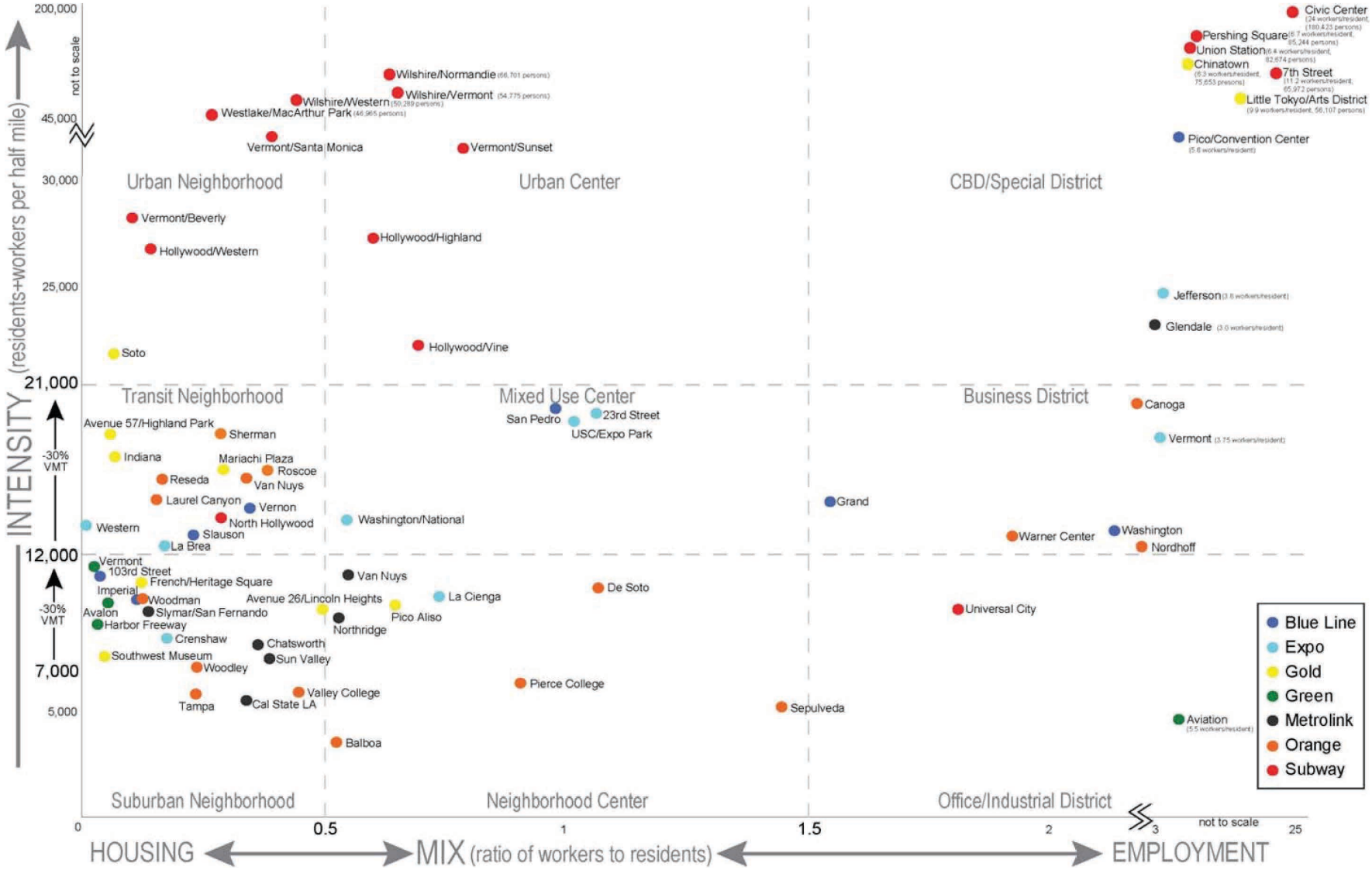


While the Chicago region's affordable housing is concentrated in urban neighborhoods and inner suburbs, most employment sub-centers are concentrated in outer suburbs with limited transit options. Source: Chicago Metropolitan Agency for Planning (2008).

Figure B-2. Regional patterns of jobs and housing.

regional infrastructure investment priorities. "Sticks" include local land use plan compliance with regional jobs-housing balance objectives and limits to regional infrastructure investments, assuming such governance tools are available.

Corridor-level planning can provide analysis and make recommendations that are more fine-grained. Corridor plans can synthesize critical station area land use information to identify opportunities and challenges. Information databases can be used to balance jobs and housing,



By graphing the housing versus employment intensity within walking distance of each light rail station, planners in Los Angeles gain insights as to jobs-housing balance. Here, each LRT corridor has its own color and the whole LRT system is shown. Alternatively, a graph with only one corridor shown allows planners to quickly surmise the jobs-housing performance of that corridor.
Source: Center for Transit-Oriented Development (2010).

Figure B-3. Station area snapshot of jobs and housing.

set priorities for land acquisition and joint development, and boost land use by development incentives (Center for Transit-Oriented Development 2010).

Another approach for jobs-housing balance is to encourage major employers to locate near transit and in parts of the region having relatively affordable housing. In the Twin Cities, the COO initiative includes outreach to and research on developers, employers, and business leaders to leverage private-sector job creation in transit-oriented locations. This research provides stakeholders with workforce demographics along transit corridors and relates the economic advantages of transit-oriented locations (Fan and Guthrie 2013).

Social Investments

Community engagement plays a central role in identifying and addressing social and economic needs in less advantaged communities. In the Twin Cities, social needs are addressed by the COO initiative, which has programs that can identify community's needs and leverage resources, maximize benefits, and minimize impacts. Grant recipients must be within eligible transit-oriented areas and must include in the planning process populations who tend to be underrepresented in decision making (such as people of color, immigrants, and people with disabilities) (Fan and Guthrie 2013).

Another benefit of the COO's community-based planning activities is by expanding the capacity of community organizations; as a result, community members and organizations have remained involved in the process throughout TOD-related implementation activities. This deeply embedded level of involvement has also built active and productive relationships among community organization leaders, public agencies, and officials.

Programs benefiting disadvantaged neighborhoods include help for small business development, such as entrepreneurial training, professional skill building, small business loans, and support for identifying and leasing in emerging TOD locations. Met Council also works in partnership with larger employers to encourage employment and training persons from disadvantaged communities. The program is organized around three Ps: procurement (buy from local small businesses), personnel (hire from local disadvantaged populations), and placemaking (enhance walking, bicycling, transit, and community building) (Central Corridor Funders Collaborative 2011).

Another workforce program is focused on jobs and job skills along Minneapolis-St. Paul's Green Line. The program began with analysis and demand estimate of job skills needed by employers along the corridor, and then worked with job skills programs and other social service providers to connect with disadvantaged populations and teach job skills that are in demand.

Accessible Social and Government Services

These strategies can help support the well-being of persons along a corridor by enhancing and leveraging health and community services.

Partnerships with Service Providers

Local and regional planners can work with area hospitals, universities, NGOs, and other social service providers to build new and expand existing facilities along transit corridors. For example, the City of Oakland, California, the Bay Area Rapid Transit District (BART), and the San Francisco Bay Area's MPO, the Metropolitan Transportation Commission, worked closely with social services providers to support the development of the Fruitvale BART Transit Village, building a new home for a Head Start childcare center and a community health clinic called La Clinica de la Raza (Scully 2005).

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The city of Hillsboro, Oregon, chose to locate and construct a new civic center complex with government offices and other public services adjacent to Portland's Metropolitan Area Express's (MAX's) Blue Line light rail station. Shortly after the civic center was completed, Pacific University located its new Health Professions Campus adjacent to a MAX light rail station. The move was facilitated proactively through coordination and support from the city of Hillsboro, Washington County, the TriMet transit agency, and Metro regional government (TriMet 2010).

MPOs can also proactively encourage social services along corridors, particularly corridors with high concentrations of low-income households. In Minneapolis-St. Paul, Met Council reached out to job skills programs and other social service providers to encourage their presence along the Green Line (Metropolitan Council 2014c).

Local development codes can offer clear incentives for public uses, such as by exempting community facilities from floor-area-ratio (FAR) limits and parking requirements, or by allowing high FARs and providing other favorable development standards for hospital facilities within walking distance of transit.

Accessible Community Services

Safe and direct pedestrian and bicycle connections to health and other social services enhance access. Plan policies can explain how new paths can be created or how new buildings can face existing street connections to establish more inviting connections. Capital improvement plans can give priority to making such improvements to provide access to health care and social services, especially to serve disadvantaged populations who rely on transit.

Shuttle service between transit stations and hospitals and other major service providers allows services in more peripheral locations to be connected with a livable transit corridor (see "Last-Mile Shuttles").

Efficient Infrastructure and Services

Compact development patterns allow community resources to be used efficiently and help leverage a wider array of community benefits. Compact development in transit corridors reduces the cost of infrastructure and other public facilities, as compared with low-intensity and less-connected places. Compact development also reduces the ongoing costs of delivering municipal and social services. Many planning and finance tools are available to deliver more efficient infrastructure and services by promoting compact development patterns. Compact development tools can be targeted along transit corridors to leverage infrastructure and services, and provide for the long-term fiscal health of corridor communities.

Conversely, the provision of infrastructure can encourage compact development. Infrastructure financing districts and assistance can make vacant and underutilized sites near transit more appealing to private investors. Through infrastructure, communities can also leverage more from development, such as affordable housing, public open space, and pedestrian-oriented development patterns.

Community Safety

Safety and security are essential to livability, and are shaped by physical environments, government services, and community policing. Community policing brings police and community members together to identify and address problems associated with crime and unwanted behavior. Recent mode choice research has found that people are more likely to choose to walk, bicycle, or ride transit in low-crime neighborhoods (Ferrell et al. 2015). Typically, safety planning efforts and police resources are organized within walkable geographies, which can be an accompaniment to

station area planning and programs. Community policing programs include community member outreach and education, neighborhood watch activities, foot and bicycle police patrols, and increasing officers' connections to citizens they serve (Carter et al. 2003).

Physical conditions that deter crime and unwanted behavior place activity and eyes on the street through the orientation and extent of building fronts, windows, and building entrances, which can be addressed by development codes and guidelines (Clarke undated) (see "Crime Prevention through Environmental Design" and "Form-Based Codes").

Lighting also affects safety along pedestrian and bicycle routes (Farrington and Welsh 2002). Public lighting that enhances corridor safety can be promoted with grants and district-level financing programs. Private light sources, such as architectural and security lighting, can be encouraged through design guidelines and cooperation with property owners.

Vibrant and Accessible Community, Cultural, and Recreational Opportunities

These strategies can help enrich corridors with community, cultural, and recreational facilities and programs.

Public Art

"Arts on the Line" was the first program of its kind in the United States, and dedicated one percent of capital improvements to public art along Boston's Red Line corridor. Boston's transit agency—the MBTA (Massachusetts Bay Transportation Authority)—requires station designs to incorporate art, with community members participating in the art selection process. The MBTA program limits art to placements on functional elements already required for the construction of the facility. Artists help design lighting, fences, plazas, benches, and retaining walls. Durable materials are required, such as ceramic tile, bronze, steel, glass, and concrete. Ongoing maintenance costs are factored into the art selected and its final design (Massachusetts Bay Transportation Authority undated).

Public art, particularly functional art, is an integral part of the transit station design process for LA's Orange Line. Orange Line art elements include sculpted seating at platforms, terrazzo paving, and ornate metalwork. Specialized artwork gives variability and a specialized identity to individual stations (Federal Transit Administration 2011).

Local zoning can also encourage public art as part of private investment, and such incentives can be targeted near transit to make a more livable corridor. Bloomington's Central Station Master Plan provides a density bonus for public art, and art is often encouraged as part of a local design review process (City of Bloomington 2013).

Cultural Destinations

"Extending the Vision for North Broad Street" is a corridor-focused advocacy plan for one of Philadelphia's principal cultural and institutional corridors. The corridor has underused and distressed properties, but also significant cultural assets and Temple University's Medical Center. To promote cultural and economic vitality, the plan provides a framework for development and recommends specific public- and private-sector investments and actions including:

- Preservation and reuse of existing assets, including technical assistance
- Reuse of industrial buildings as art and residential lofts
- Context-sensitive development on vacant and underused sites
- Expansion of convention center and cultural venues
- New neighborhood grocery stores

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- Public art
- Commercial and way-finding signage programs
- Other district identity and branding features (The Philadelphia City Planning Commission 2005).

The City of Philadelphia also works with property owners to encourage the use of parking lots for farmers' markets and community events (The Philadelphia City Planning Commission 2005).

Joint development can emphasize the creation of cultural resources. In Minneapolis, the city, Hennepin County, and neighborhood organizations negotiated with a school district to acquire a site for a mixed-use project to create a market plaza along the Hiawatha Line. The plaza would host cultural events, entertainment, and retail uses (Gilyard 2010).

In Los Angeles, the ULI emphasized the importance of branding the identity of cultural nodes to cultivate them as destinations. Branding can be cultivated with way-finding signage, distinct street improvements, and special events (Urban Land Institute-Los Angeles 2013).

Transit-accessible cultural destinations are also encouraged through the revitalization of urban districts, as discussed below.

District Revitalization

Revitalization is a tool for expanding destinations in established districts along transit corridors. The revitalization of urban districts occurs through reinvestment, reuse, and infill on underused sites.

Along Philadelphia's Broad Street corridor, a wealth of theaters, libraries, and the university are mixed with economically challenged areas marked by vacant storefronts and properties falling into disrepair. An inclusive process resulted in a corridor plan that focuses on the retention of existing community assets, such as with historic preservation, public art, and street enhancements, while encouraging the renovation of existing buildings and infill development on underused lots. A special-services district supports façade improvements, ongoing street cleaning, graffiti abatement, public safety programs, and marketing campaigns (The Philadelphia City Planning Commission 2005).

In Saint Louis, the Great Streets Initiative for South Grand promotes cultural vitality through building an authentic sense of place, comfortable and safe walking environments, economic vitality, and community open space (DW Legacy Design Foundation 2010).

Recreation and Open Space

In the 1970s, decision makers reached agreement to construct Boston's Orange Line after years of contentious debate over using that corridor alignment as a freeway. As told by Neal Pierce and Robert Guskind in *Breakthroughs: Recreating the American City*, the freeway was touted by engineers and bureaucrats, while support for transit resulted from effective community engagement. By building rail instead of freeway, land was made available to create parks, trails, and other public facilities along the Orange Line right-of-way (Pierce and Guskind 1993).

Recreation and open space can also be created using finance mechanisms for parks and community facilities, such as financing districts and development agreements (see "District Financing and Value Capture"). Ongoing expenses associated with public recreation can be addressed with park conservancies, nonprofits responsible for ongoing maintenance and stewardship, where park districts have insufficient resources for new spaces. Met Council has provided predevelopment funding to encourage park conservancies in recreation-deficient locations (Metropolitan Council, Partnership for Regional Opportunity 2014).

Sense-of-Place Guidelines

Architectural guidelines can be developed to maintain the unique, valued character of a place. The guidelines can emphasize a place's character-defining features in new construction and building additions, as well as preservation and adaptive reuse of historic resources. Cultural opportunities for livability include a sense of connection with a locale, its geography, and history.

Architectural guidelines can also encourage new construction to have a look and features that reinforce attributes for the local context. Regional context is visually communicated through the use of local building methods and traditions, and can be emulated through the selection of materials, color, roof form, the size and proportion of openings, prevailing structural systems, the rhythms of structural bays, cornice treatments, and so on.

Sense-of-place guidelines can be used in new emerging areas, but are particularly important to maintain compatibility with historic buildings in established urban areas. While infill development and intensification can play a vital role in revitalizing established areas by increasing activity and opportunities (see "Compact Development"), the unique architectural traditions of a place can inspire architects to avoid an aesthetic sameness from simply applying modern construction techniques and materials.

The protection of historic resources also promotes cultural livability opportunities. Existing historic buildings of architectural merit exhibit the artisanship and craft of past generations. Historic resource surveys can identify potential assets so their protection can be planned for, a step that can be part of station area planning (see "Station Area Profiles"). The reuse and intensification of historic assets can often be accommodated through context-sensitive design.

Healthy, Safe, and Walkable Transit Corridor Neighborhoods

These strategies can help make pedestrian-oriented places where people feel healthier and safer.

Complete Streets

Essential ingredients for livability are streets designed for the comfort and safety of pedestrians and bicyclists. "Complete streets" balance the needs of multiple transportation modes, and encourage walking or biking for many trips. Sidewalks that are protected from traffic are common to most complete streets, and bicycle facilities are incorporated into compete streets networks.

Jurisdictions that fund and construct roadways can implement complete streets with design standards. MPOs and interest groups can help effect that outcome through education. The design of complete streets also benefits from the participation of diverse stakeholders to present a balance of perspectives. MPOs can also influence the design of streets when they have funding authority.

Walk and Bike Safety Audits

Safety audits can identify where pedestrians or bicyclists are at risk for collision with motor vehicles. Specific roadway segments or general network conditions can be considered. Factors include visibility, pedestrian and bicyclist refuge areas, crosswalks, traffic speed controls, and safety signage. Audits generally recommend improvements and guide funding decisions.

For Philadelphia's "North Broad Street Safety Audit," near-term funding priorities focus on near-term, low-cost items such as striping crosswalks and refuge islands and improved signal phasing. Mid-term priorities include bike lanes, "road diets" (that is, repurposing vehicle lanes as pedestrian or bicycle facilities), and traffic calming features. Long-term high-cost items included context-sensitive sidewalk improvements and road diets (Delaware Valley Regional Planning Commission 2009).

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Traffic Calming

"Traffic Calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for nonmotorized street users." (Institute of Transportation Engineers 2015) Traffic calming supports walking and bicycling to transit and other destinations by enabling pedestrians and bicyclists to feel safe. Traffic calming measures include narrowing lanes, crosswalk improvements, speed tables, and pedestrian-activated blinker lights (Lockwood 1997).

Traffic calming addresses a wide array of livability concerns. It can be implemented with roadway design manuals, street improvement plans, master plans, safe-routes-to-school programs, and capital grants.

Pedestrian and Bicycle Network Maintenance

Pedestrian and bicycle networks help establish and enhance corridor livability as long as ongoing funding is secured for maintenance and repairs. In the case of pedestrian routes, lack of maintenance can result in uplifted sidewalks, tripping hazards, potholes, standing water, and other safety concerns. Maintenance may also have an economic dimension, as the success of shopping districts relies in part on the cleanliness of sidewalks. Bicycle facilities are safer and better used when relatively smooth pavement is maintained.

Form-Based Codes

"A form-based code is a land development regulation that fosters predictable built results and a high-quality public realm by using physical form as the organizing principle for the code" (Form-Based Codes Institute 2016). Form-based codes provide clear standards for design features that are critical for more walkable environments, such as regulations that ensure pedestrian-oriented buildings.

As measurable standards, form-based codes offer reliable urban design results through an administrative process and without relying on discretionary forms of review. Development projects that conform to a form-based code can generally be entitled more quickly and with less uncertainty than under conventional development codes where pedestrian-oriented urban design may be expected but is not spelled out.

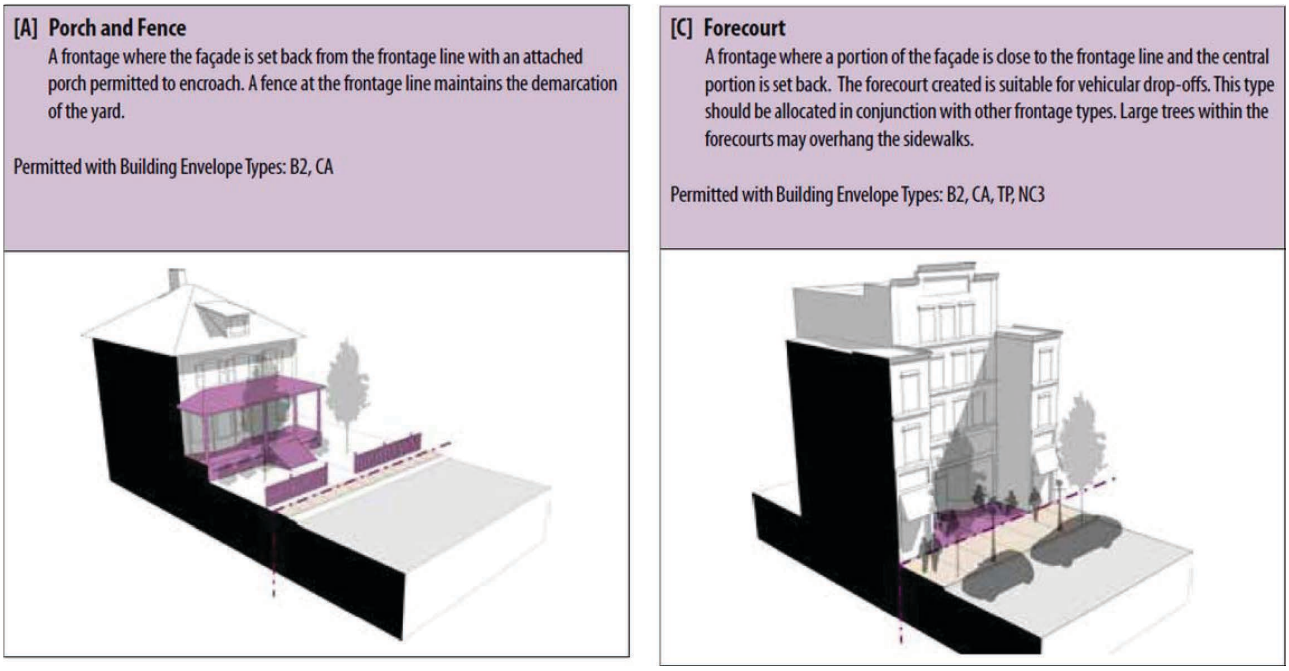
To help encourage development and walkability near transit, MPOs, such as the San Francisco Bay Area's Metropolitan Transportation Commission and Minneapolis-Saint Paul's Metropolitan Council, provide technical assistance grants to local jurisdictions for form-based codes.

Form-based codes focus on key pedestrian-oriented design characteristics for how buildings should relate to streets to encourage walking and support community life (see Figure B-4). Form-based codes require that most of a block's street frontage comprise building fronts with main entrances and windows, and that parking should be placed behind or below buildings. Form-based development patterns line walking routes with activity and visual interest, and place "eyes on the street." In the absence of form-based provisions, connectivity of pedestrian networks surrounding transit can suffer, as streets may be lined by blank walls and parking lots.

Form-based codes feature clear diagrams and illustrations, and typically address the design of streets, as well as buildings. Form-based streets standards emphasize sidewalks, street trees, public amenities, and other features that make walking more attractive.

TOD Guidelines

To inspire pedestrian-oriented development patterns near transit, MPOs often develop form-based guidelines that also emphasize opportunities and needs associated with transit, such as



Form-based codes describe key design characteristics for more walkable places. Clear guidance is given by illustrating acceptable street-oriented building types and architectural features.
Source: Citizens for Modern Transit (2013).

Figure B-4. Form-based guidance.

land use intensity, local destinations adjacent to stations, connectivity, and easy access to transit stations (see "TOD Strategic Plans" and "TOD Guidelines"). Met Council—the Minneapolis region's metropolitan planning organization—provides an easy-to-use checklist for local jurisdictions working to develop TOD (see Figure B-5).

Zoning Overlay Districts

Zoning can be amended as an overlay district to address many factors found in form-based codes and TOD guidelines and to provide incentives for development near transit. Overlay districts are applied in addition to or "on top of" existing zoning, making them easier to adopt.

MPOs and other government entities can develop model ordinance language for overlay zoning, which local jurisdictions can use if they choose. For example, the Commonwealth of Massachusetts has a model ordinance for a TOD Overlay District, which covers uses, parking requirements, and building relationships, in a format that can be readily adopted (Commonwealth of Massachusetts undated).

Along Minneapolis's Hiawatha corridor the city adopted zoning overlay districts near transit stations to encourage higher densities by reducing parking requirements, allowing shared parking, and prohibiting auto-oriented uses. Minneapolis grants an automatic increase in allowable FAR/density when a project includes affordable housing or ground-floor retail. Along shopping streets, overlay districts can also have build-to lines and active ground-floor requirements to maintain continuous storefronts (City of Minneapolis 2011).

Crime Prevention Through Environmental Design (CPTED)

CPTED recognizes that physical conditions can affect whether a place is prone to crime and other unwanted behavior. Accessible locations that are not easily seen can invite crime, such as

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Urban Design

1. Are first floor uses "active" and pedestrian-oriented?
2. Are buildings placed and designed to encourage access to and from the station?
3. Are building designs interesting by themselves and visually appealing?
4. Do buildings come all the way to the street or build-to line?
5. Do buildings avoid placing blank walls along sidewalks and walkways?
6. Do buildings incorporate architectural features that convey a sense of place and relate to the street and pedestrian environment?
7. Does the station area provide high quality, publicly-accessible space for people to sit, mingle, and/or recreate?
8. Are streetscape amenities present, including seating, pedestrian-scale lighting, trees and landscaping, and awnings to provide enclosure and protection from the element?
9. Are sidewalks in good condition?
10. Is the walking environment pleasant?

Land Use

1. Are auto-oriented land uses minimized within the station area?
2. Will the planned mix of uses attract people around the clock and throughout the week?
3. Are uses available near the station that would be conveniences for surrounding residents, commercial tenants and transit patrons, e.g. coffee and newspapers, grocery stores, daycare and drycleaners?
4. Are commercial uses concentrated?
5. Is the station area secure (low vacancy rate, buildings are well-maintained, safe)?
6. Will new and existing residents and tenants generate enough demand to support proposed retail uses?

Mobility

1. Does the topography lend itself to comfortable walking?
2. Does the station area incorporate a well-connected, pedestrian-oriented network that is directly connected to the station?
3. Do pedestrian pathways and buildings incorporate universal design principles for accessibility?
4. Are curb cuts kept to a minimum?
5. Are most of the roads through a project designed for speeds less than 30 miles per hour?
6. Are sidewalks and intersections designed for safe movement by all users, including pedestrians of all ages and abilities?
7. Are streets designed to provide access for bicycles or is there a planned network of bicycle routes?
8. Is parking located behind buildings or underground?

Met Council's *Handbook for Transit-Oriented Development Grants* is accompanied by form-based guidelines, but distills considerations into easy-to-use checklists.
Source: Metropolitan Council 2014b.

Figure B-5. The Minneapolis region's TOD checklist.

where sightlines are obstructed or where blank walls, instead of windows, face streets. Lighting, maintenance, graffiti abatement, and other factors are also considered by CPTED.

Designers, planners, and police officers can undergo CPTED training to identify and correct problematic conditions, whether on public or private land. Development codes, design guidelines, master plans, and design review can address CPTED concerns (Clarke undated).

Strategies for Corridor Types

While every transit corridor is unique, characteristically similar corridors often face similar challenges. This Handbook defines three basic corridor types: Emerging, Transitioning, and Integrated Corridors. Users can identify suitable strategies for their corridor by examining the corridor type with which it is most closely associated and referring to Step 5.3 in the Handbook. Refer to Table B-1 and Appendix D for further discussion on corridor types and related strategies.

Table B-1. Strategies associated with corridor types.

Transit Corridor Livability Principle	Corridor Type		
	Emerging	Transitioning	Integrated
High-quality transit, walking, and bicycling opportunities	• Connected network planning • Circuitous routes retrofits • Compact development • Last-mile shuttles		• Parking management
Mixed-income housing near transit	• Location efficiency • Housing production and targets • Housing assistance		• Anti-displacement strategies • Inclusionary housing • Local housing trust funds
Accessible economic opportunities	• Station area profiles • Financial feasibility and incentives • Activity center master plan		• Jobs-housing alignment • Social investments
Accessible social and government services	• Access to services • Efficient infrastructure		• Community safety
Vibrant and accessible community, cultural, and recreational opportunities	• Cultural destinations	• District revitalization	• Public art
Healthy, safe, and walkable transit corridor neighborhoods	• Complete streets • Traffic calming • Form-based codes • TOD guidelines		• Walk and safety audits • Pedestrian and bicycle network maintenance

APPENDIX C

Coordination and Collaboration Strategies

Coordination and collaboration are vital to tailoring analysis and decisions to a particular corridor. Coordination and collaboration can be critical for defining local aspirations, understanding local issues, and customizing strategies to be accepted and effective. Broadly accepted goals form the foundation of successful livable transit corridor partnerships, helping stakeholders and government agencies to apply their energy and resources toward shared aspirations and agreed upon strategies.

Planning for livability requires that stakeholders have an opportunity to understand—and help others understand—key issues and provide meaningful input on options and proposals. For informed decisions, planning relationships need to be explained clearly and reliably, along with the benefits and impacts of proposed strategies. When a corridor is planned using coordination and collaboration, the goals and strategies reflect the insights and aspirations of all stakeholders.

Stakeholders with an interest in livability are diverse. The following are common stakeholders and their areas of interest:

- **Regional agencies** provide transportation planning and financing (e.g., MPOs) and land use coordination services (e.g., COGs) across municipal and county boundaries within metropolitan areas. MPOs are typically responsible for preparing regional transportation plans (RTPs) and regional transportation improvement programs (RTIPs) that provide important opportunities to transit corridor plans and projects to receive funding and political support from local, state, and federal agencies.
- **Transportation agencies** are concerned with access along corridors generally and have specific concerns relating to transit ridership levels, capital investment decisions, and ongoing operational decisions across various modes and at the local and regional scale.
- **Municipal governments** set land use and standards for private development and have direct authority over local streets and infrastructure. Municipal policies also relate to housing, economic development, and other dimensions of livability.
- **State departments** have responsibility for complementary policies pertaining to transportation, housing, the environment, economic development, and social services. State departments of transportation (DOTs) are responsible for creating statewide transportation improvement programs (STIPs) where, like in the case of RTIPS, transit corridor improvement planning efforts can receive crucial financial and political support.
- **Private developers and business interests** deliver most nongovernment investments, including most forms of development within regulatory limits and procedures.
- **Advocacy groups** represent an array of concerns that may focus on a locale (e.g., community groups) or a specific interest (such as affordable housing or bicycling).
- **Community members** who live or work along a corridor are central stakeholders, regardless of whether they are represented by an organization.

Effective planning for livable transit corridors requires coordination and collaboration on several levels. Corridor planning requires consideration of issues by diverse corridor stakeholders, each with a stake in associated outcomes. Livability targets a full spectrum of human needs, so livability planning requires participation by stakeholders to be responsive. Coordination and collaboration also cultivate broad-based support among stakeholders, which enables decision makers at all levels of government to successfully advance livable corridor planning principles.

Coordination and collaboration must target both interjurisdictional cooperation and community engagement to succeed. Interjurisdictional cooperation addresses the multifaceted nature of livable transit corridors. Complete and integrated corridors only arise through separate but connected actions on the part of transit agencies, local governments, regional organizations, service care providers, real estate investors, and others. Active community engagement also plays a vital role, since it communicates the importance of livable corridor planning and its implications at the local level, while providing nongovernment stakeholders with opportunities for input as strategies and implementing actions are developed. Input by community stakeholders is important for aligning decisions with community values, mitigating potential negative impacts, and leveraging local benefits.

Interjurisdictional Coordination

A complete set of transit corridor livability opportunities can only be attained with strategies that encourage collaboration across jurisdictional boundaries. The actions of many government agencies and local jurisdictions need to be aligned. Each jurisdiction has specific interests and limited authority, but few have a mandate to consider corridor livability in a holistic, integrated way.

Pennsylvania's "Keystone Principles for Growth, Investment and Resource Conservation" recognizes the need for greater coordination among government agencies regarding decisions and investments surrounding land use, transportation, and economic development, generally. The Keystone Principles prioritize state investments and coordination activities around smart growth criteria, including site location, infrastructure efficiency, land use density and diversity, affordable housing, job creation, and enhancement of environmental and cultural resources (Governor's Economic Cabinet, Commonwealth of Pennsylvania 2005).

Pennsylvania's Keystone Principles show how states can play the role of stakeholder orchestrator, providing policies, rules, guidelines, and a forum for different governmental actors to collaborate. This statewide directive set a framework for the Philadelphia region's "Land Use, Transportation, and Economic Development Plan" (LUTED), which sets transportation investment priorities and promotes smart growth principles. LUTED was developed with an advisory committee comprising interested agencies at the state, regional, and local level (Delaware Valley Regional Planning Commission 2008).

Intergovernmental coordination, particularly at the corridor level, also benefits when regional government takes an active role. Livable corridor planning requires coordinated guidance by MPOs, transit agencies, and local governments, both between governments and among agencies within the same government. Jurisdictional coordination acknowledges that implementation involves numerous players, including government agencies, social service providers, and private developers.

Interjurisdictional cooperation often occurs by sharing information, approaching corridors as an integrated unit, and working together to develop a shared vision. Chicago's "Go to 2040" regional plan supports coordination among local jurisdictions and regional agencies and notes that "[w]ith local autonomy over land use comes responsibility to consider how those decisions shape a community's livability, including how they affect neighboring communities and the

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region as a whole. As a region, we need to implement policies and investments that make livability the highest priority. Intergovernmental approaches are often the best way to solve planning problems in housing, transit, economic development, and other areas, . . . [including] collaborative planning groups that are organized around a transportation corridor. . . . At a less formal level, coordination between municipalities is beneficial for information sharing . . . [and] fostering networked collaboration to share ideas and strategies. . . ." (Chicago Metropolitan Agency for Planning 2010).

Interjurisdictional coordination for livable corridor planning benefits from the following strategies:

- Shared information—gathering and synthesizing data relevant to corridor planning.
- Corridor focus—examining issues of interjurisdictional importance along corridors.
- Shared vision—making multilateral agreements that transcend geographic boundaries and narrow perspectives.

Shared Information

When government agencies convene to focus on a corridor, livability issues and opportunities are understood more completely. Corridors are geographic areas that—with comprehensive planning—can offer high levels of livability opportunities. Jurisdictions should appreciate the benefits of corridor-focused planning and think about livability issues through that lens.

Good information sets a foundation for understanding issues that cross jurisdictional boundaries at the corridor level. Shared information improves access to data for planning purposes by governments and also nongovernment stakeholders such as developers and health providers.

Station Area Profiles. Station area profiles can identify issues for interested jurisdictions to consider. These profiles gather information relevant to planning decisions, such as land use patterns, inventories of development opportunity sites, market assessments for TOD uses, and levels of connection between stations and surrounding areas. While they often lead to a shared vision among multiple jurisdictions, they can also be used where jurisdictions are not ready or are unable to initiate a process for arriving at a shared vision.

Network and Corridor Assessments. Profiles can be the basis for analyzing and creating a larger system of transit catchment areas, and can help prioritize corridors for further planning. For Los Angeles, the Center for Transit-Oriented Development (CTOD) authored "Creating Successful Transit-Oriented Districts" to "[e]ducate public agency staff, advocacy groups . . . and policymakers on the benefits of TOD, and best practices in TOD policymaking and implementation. . . . Given the fragmentation of public agencies within the City of Los Angeles and other local jurisdictions, and the multi-department structure required to plan and implement TOD, many local government and private actors do not fully understand the regulatory, planning, and implementation steps needed to promote successful TOD." The report defines goals (similar to this Handbook's Livability Principles) and evaluates performance for light rail station areas and for the city as a whole. Shared information in the report provides a foundation for future decision making, as CTOD concludes by noting that its "station profile sheets, affordability index, and other screen mapping all provide data-driven tools to understand the performance of station areas . . . to more comprehensively and systematically plan for transit-oriented districts . . ." (Center for Transit-Oriented Development 2010, pp. 9–10).

Background Reports. Shared information also includes reviews of existing planning documents, including adopted plans and studies. Relevant documents set a framework for moving forward. Adopted plans set policy and regulator parameters and may offer implementation tools;

existing studies highlight issues relevant to livability planning. Two types of studies are most common:

- Studies focused on TOD market opportunities and overcoming barriers to feasibility.
- Studies that develop station area profiles to guide decisions on how to target policies and resources.

Corridor Focus

Focus on the corridor and how multiple factors need to come together to enhance livability. Address challenges along the corridor in multifaceted and integrated ways that includes cooperation among jurisdictions.

Convening Interested Agencies. The development of the "Orange Line Bus Rapid Transit Sustainable Corridor Implementation Plan" in Los Angeles, California, offers a case in point. Throughout the development of the plan, the Southern California Association of Governments (SCAG) and the consultant team worked closely with community members, NGOs, and public agency staff at Metro, LA's transit agency, and the city of Los Angeles. The process included one-on-one stakeholder interviews, public workshops, an online survey for each station area, Corridor Working Group meetings, and meetings with individual neighborhood councils and neighborhood associations (Raimi + Associates and Sargent Town Planning 2012).

Local governments can also convene agencies and develop partnerships to address issues. The Village of Niles, Illinois (a suburb adjacent to the city of Chicago), has been working to advance livability along the Milwaukee Avenue corridor by getting the attention of area's transit agency, highway authority, and MPO to receive funding for corridor-level planning and implementation (Camiros Consultants 2014). Such leadership by decision makers and planners is sometimes needed to highlight corridor opportunities and attract the interest and support of other political decision makers.

Community Assessments. Community assessments can also be initiated by nongovernment organizations with an interest in the issues faced by particular corridors. The Urban Land Institute (ULI) is a nonprofit research and education organization, which often convenes panels of experts to consider special urban challenges. In 2013, ULI published a Transit Corridor Report that examined three transit corridors in Los Angeles. In a short time, ULI experts in planning and development generated comprehensive assessments of each corridor's development potential and made recommendations relating to policy and regulatory changes, physical improvements, and overcoming obstacles to implementation (Urban Land Institute-Los Angeles 2013).

Because organizations such as ULI operate outside of government, they can initiate public discourse more easily, particularly around controversial issues. One ULI recommendation was to designate a staff person in the Los Angeles Mayor's office to focus on each corridor of interest, by facilitating discussion among city departments and other agencies, to address corridor concerns in a more integrated way (Urban Land Institute-Los Angeles 2013).

Shared Vision

Interjurisdictional visioning and plan development provide forums for goal setting and decision making that transcend narrow perspectives and geographic and organizational boundaries.

Common Goals. Shared goals align policies across jurisdictional boundaries, so separate actions add up to increased livability along a corridor. Coordination occurs in the process of working together to implement shared goals, not only after goals are adopted. Interjurisdictional

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cooperation can go beyond goal setting to include implementation programs, but must be accompanied by modes of governance (joint powers agreements and memorandums of understanding, for example) that allow such actions to occur.

Prioritizing Investments. A shared vision encourages more systematic ways of prioritizing corridor livability and TOD-related investments, such as the phasing of new development and intensification of stations with significant land opportunities. Because corridor livability and TOD integrate issues and disciplines, there are diverse funding sources that would better promote livability if brought under a single plan umbrella (Center for Transit-Oriented Development 2010).

Partnerships. A shared vision aligns the actions of regional and local jurisdictions. Interviews conducted for this Handbook found that in many areas, including Fort Worth, Texas, Philadelphia, Pennsylvania, and Minneapolis-St. Paul, to name a few, transit agencies, MPOs, and local governments are working closely with each other to encourage TOD. Often, these agencies partner to create a TOD Guidebook, conduct economic development studies, and coordinate master planning activities to gain developer interest. Public-private partnerships can be critically important as well, with many regions focusing on working closely with affordable housing developers, often on publicly owned properties.

Public investment in transit can leverage private investment and coordinate funding sources to promote more effective TOD planning and implementation.

Community Engagement

Community engagement makes planning more responsive to local needs, builds broad-based support, and helps remove barriers to implementation. It enables participants to examine issues together, find connections, articulate values, discuss priorities, and anticipate implementing actions. Strive for broad-based participation when conceiving of and implementing decisions, and reduce barriers to participation by low-income, minority, and other populations who tend to be underrepresented (McConville 2013). The results are decisions tailored to issues and perspectives unique to each corridor, greater transparency in decision making, and higher levels of agreement moving forward.

The St. Louis region's East-West Gateway COG's "Public Engagement Plan" sums up the importance of community engagement this way: "Meaningful engagement is critical because it ensures that the widest cross section of citizens can weigh in. . . . Furthermore, engagement can improve the resulting plan by considering development from a variety of perspectives, lending it greater legitimacy because the very people whose lives it will impact have helped develop it." (Public Agenda and FOCUS St. Louis et al. 2012)

Fundamental components for effective community engagement include:

- Outreach and education—disseminating public information and inviting broad-based participation.
- Community assessments—understanding local issues and aspirations through the eyes of stakeholders.
- Meaningful input—giving diverse stakeholders meaningful opportunities to have a say and collaborate.

Outreach and Education

Outreach and education encourages anyone with a stake in corridor livability to participate as plans are formulated. Reach out to diverse stakeholders to understand planning issues, evaluate

options, develop shared objectives, and coordinate implementing actions. Outreach invites broad-based participation, such as with public information campaigns using traditional media and new media. Education keeps the public informed of issues surrounding livable corridor planning and upcoming decisions, helps community members understand the effects of corridor plans at the local level, and explains how plans respond to local issues and concerns.

Lessons Learned. A 1960s attempt to build a freeway in Boston's southwest corridor met strong community opposition. Plans for the freeway were replaced by cooperative planning through outreach and education, which is credited with redirecting land and money for the freeway toward transit (Boston's heavy rail Orange Line) and neighborhood-serving land uses (Pierce and Guskind 1993).

MBTA planning for the Orange Line focused on community outreach "to build consensus within the bureaucracy and neighborhoods." MBTA helped lead an effort characterized as "people power." Two principles guided community engagement: "One was that we'd look at everything together. And the second was that we wouldn't do anything that we didn't talk to people in the neighborhood about." The Orange Line opened with broad community support in 1987 (Pierce and Guskind 1993).

Encouraging Participation. Outreach that draws people into the planning process can help address skepticism around the benefits of livable corridor planning. "In order to engage the full participation of community members in the planning process, and thus gain broad support for future development or other changes that make neighborhoods more transit supportive, there needs to be more education about TOD planning concepts [and best practices], and the potential benefits of density as well as other [practices] that make station areas more transit supportive" (Center for Transit-Oriented Development 2010) and livable. A variety of communication and outreach techniques are available and hands-on workshops and interactive online tools can boost participation and inform decisions.

Public Participation Planning. Outreach and education have become broadly accepted as part of the mission of MPOs and other government agencies. The CMAP has a Public Participation Plan that details how CMAP should maintain "a proactive public participation process . . . that provides complete information, timely public notice, full public access to key decisions, and supports early and continuing involvement of the public in developing and implementing regional plans and capital programs." To encourage participation, messages need to make planning issues relevant to each target audience (Chicago Metropolitan Agency for Planning 2013).

Informed Decision Making. Education plays a vital role in helping raise awareness around the relationship between transit and livability, and the need for integrated planning. The East-West Gateway Council of Government's "TOD Framework Master Plan" developed partly as a way to better inform decision makers of alternative development patterns. "In a metropolitan area that is growing relatively slowly and that has traditionally followed lower-density suburban patterns of growth over the last several decades, leaders from throughout the region have continued to search for appropriate strategies to promote transit-oriented development. . . . [T]his regional TOD study helps metropolitan areas similar to St. Louis understand what TOD means for smaller and mid-sized cities that have instead focused on suburban sprawl over the last several decades" (East-West Gateway Council of Governments 2013).

St. Louis' "TOD Framework Master Plan" succeeds as a guiding document not because it makes strong recommendations—it doesn't. It focuses on issues that matter to decision makers, including these basic components:

- A regional demographic and market analysis,
- Site analysis and development feasibility analysis for each station area,

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- An outline of key issues impacting development viability at station areas,
- Recommendations for local jurisdictions, Metro, and other stakeholders, and
- A menu of available implementation tools (East-West Gateway Council of Governments 2013).

Outreach Techniques. Strive for broad-based participation when conceiving of and implementing decisions and reduce barriers to participation by low-income, minority, and other populations who tend to be underrepresented. A host of outreach and education techniques are available, including traditional and new media, public forums and workshops, and surveys and questionnaires. Interactive, hands-on participation can boost participation and provide opportunities for meaningful input. Education is also vital, as stakeholders can appreciate plans more—and participate in more meaningful ways—when conditions and considerations are explained clearly and reliably. Outreach techniques include:

- Resources and guidelines for workshops and other forms of outreach,
- Traditional media (newspapers, radio and television),
- New media (internet and social media), and
- Targeted outreach (for example, interviews, focus groups, language translation, direct outreach at events like farmers markets) (Lennertz 2013).

Underrepresented Populations. Targeted outreach is particularly important for encouraging participation among population groups who otherwise might not be engaged. This includes low-income households, immigrants, people of color, small business owners, and youth. Interviews conducted with public agency staff in the Minneapolis-St. Paul region found that their Partnership for Regional Opportunity program uses a host of proactive and integrated strategies for including underrepresented populations in decisions. The program combines direct outreach emphasizing two-way conversations to provide people with opportunities for input with a corridor-level steering committee representing a cross section of interests and selected grant recipients. Results include programs that target the needs of underrepresented populations, such as programs for small businesses, including entrepreneurial training, professional skill building, small business loans, and assistance with leasing in emerging TOD locations (Metropolitan Council undated).

Conditions and Assessments

Develop a thorough understanding of livable corridor strengths and needs by engaging stakeholders with diverse yet intersecting interests (see Sections 2 and 3 of this Handbook). Local conditions and stakeholder aspirations can be understood through community engagement, where stakeholders have an opportunity to frame local issues, articulate aspirations, and tailor strategies.

Planning agencies can miss conditions and opportunities that are readily understood by community members. Local conditions and aspirations can be revealed in several ways including, but not limited to:

- Station area and corridor-level analysis,
- Community workshops on issues and aspirations, and
- Design charrettes to explore local issues and opportunities.

Meaningful Input

Direct Dialogue. Community engagement helps to align recommendations with stakeholder interests and preferences. Inclusive dialogue allows direct input from constituents who will be affected by corridor plans and an opportunity to address their issues and concerns. While agencies and planners focus on a vision for a corridor as a whole, inclusive dialogue can reveal

local opportunities and allows local interests to advocate for context-sensitive interventions. Engagement creates more transparency around decision making and tends to broaden support for recommendations.

The CMAP's "Public Participation Plan" (PPP) "seeks to develop a proactive public participation process in northeastern Illinois that provides complete information, timely public notice, full public access to key decisions, and supports early and continuing involvement of the public in developing regional plans and capital programs." The PPP further asserts that:

- The public should have opportunities for input in decisions that affect their lives, and have information needed for informed input.
- The participation process should capture the interests and needs of all participants.
- The public's contribution should be considered in the decision-making process, and the process should communicate how participants' input influenced the decisions that were made (Chicago Metropolitan Agency for Planning 2013).

Steps for Public Decision Making. The East-West Gateway's "Public Engagement Plan" for their Regional Plan for Sustainable Development (RPSD) says that "[m]eaningful citizen engagement is critical because it will ensure that the widest cross section of citizens can weigh in on the plan, the RPSD is well understood, and ultimately, the RPSD is accepted by citizens and elected officials" and stakeholders. "Furthermore, public engagement can improve the resulting plan by considering sustainable development from a variety of perspectives, lending it greater legitimacy because the very people whose lives it will impact have developed it. . . . [The RPSD] is not meant as a prescriptive or strict protocol; rather at each step along the way, local leaders and stakeholders can consider how best to tailor both the principles and the meeting structure to the local context" (Public Agenda and FOCUS St. Louis et al. 2012).

The "Public Engagement Plan" was developed by a nonpartisan research and public engagement organization—Public Agenda with FOCUS St. Louis. The organization facilitated brainstorming and conversation, using real-time polling, prioritization exercises, and online information and surveys. Community members are given a voice in decision making through the following process:

- Articulate values,
- Collect information,
- Foster awareness,
- Articulate priorities, and
- Consider scenarios (Public Agenda and FOCUS St. Louis et al. 2012).

At the local level in St. Louis, community workshops and advisory committees gave community members opportunities to shape the Great Streets Initiative along South Grand Street. Community engagement to develop a corridor plan used the following process:

- Review analysis,
- Develop project goals,
- Evaluate alternatives, and
- Comment on recommendations (DW Legacy Design Foundation 2010).

APPENDIX D

Livable Transit Corridor Typology

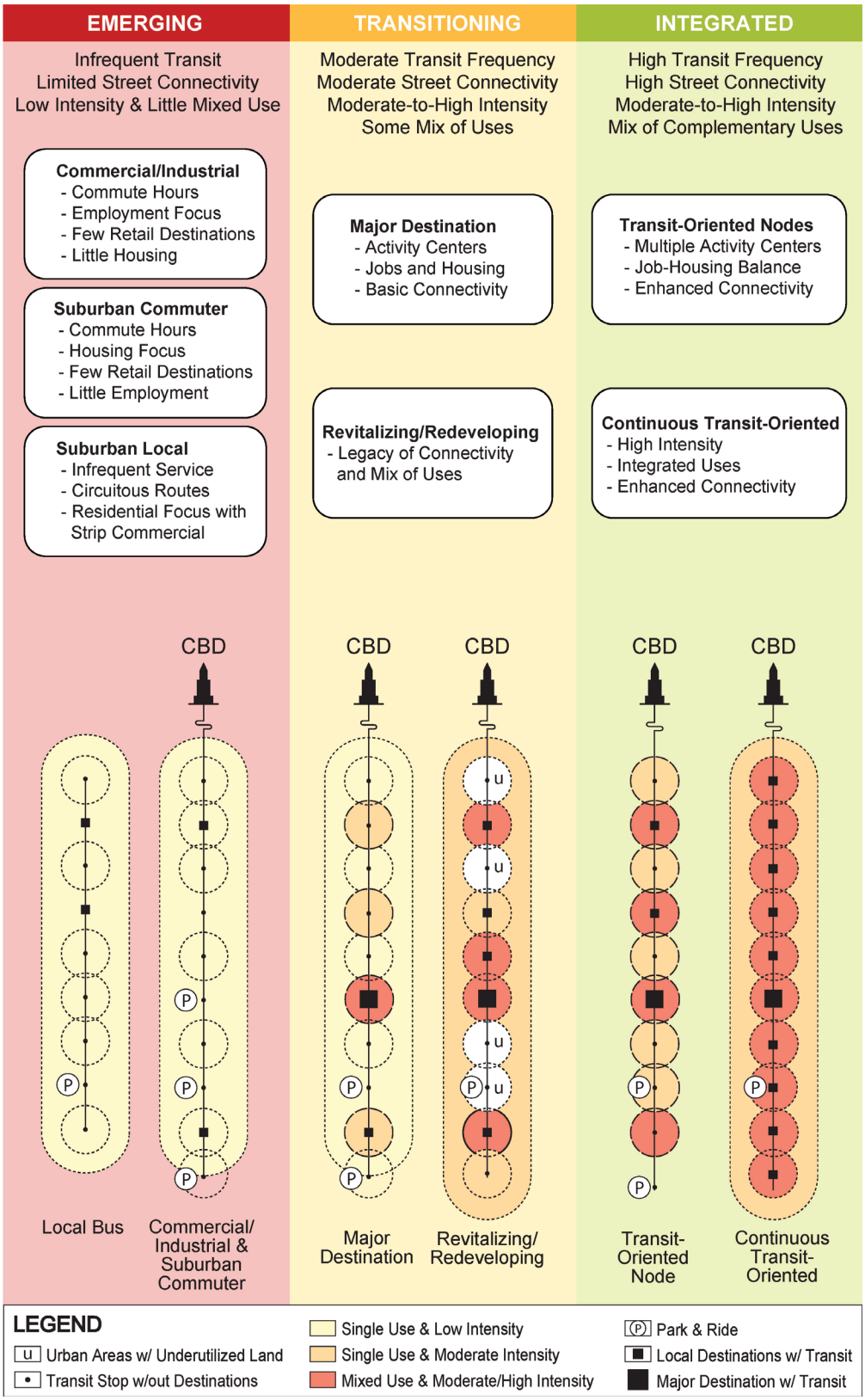
While every transit corridor is unique, characteristically similar corridors often face similar challenges. The Livable Transit Corridor Typology can help to match planning strategies to characteristically similar corridors. This method has been applied at the scale of the transit-oriented district by several metropolitan planning organizations (MPOs). For example, as a way to prioritize planning grants and public investments, Metro, the Portland-area MPO, has categorized transit station areas according to market readiness and urban form (TriMet et al. 2011). This Handbook's Livable Transit Corridor Typology can also be used to prioritize planning and investments and point to additional ways to effectively implement its Livability Principles.

"A focus at the corridor scale should make it possible to represent interactions among stations and neighborhoods and thereby assess their compatibility and codependence." (Moore et al. 2007) Livability can be more fully leveraged if transit agency decisions and local development decisions are informed by better understanding a corridor's general characteristics and needs, as highlighted by understanding common ways that corridors can progress (Moore et al. 2007).

The following corridor type descriptions offer guidance for how to approach a particular corridor, based on the corridor type with which it is most closely associated. Three corridor types have been defined to describe relative levels of performance and suggest how corridors can progress toward higher levels of livability:

- **Emerging Corridors** are found in low-density, use-segregated communities. They generally score low on livability metrics because of infrequent transit service, primarily focused on commuting hours; relatively few transit- and pedestrian-accessible destinations; and auto-oriented transportation and land use patterns.
- **Transitioning Corridors** are well on their way to providing high-performing livability conditions but still offer considerable opportunities for improvement. Some would be classified as Emerging if not for the development of a major activity center in a least one location along the corridor. Transitioning corridors also include older transit-oriented neighborhoods where investments in enhancing transit services and economic development can help propel these corridors toward increased livability.
- **Integrated Corridors** score high on this Handbook's livability metrics. They contain many transit-oriented destinations, have direct routes and enhanced walking environments, and balanced jobs and housing.

These categories provide a framework that can help Handbook users identify the goals and planning strategies best suited for the existing conditions and desired outcomes for their corridors. Each category is described in detail below and illustrated with case studies. Figure D-1 illustrates and provides a summary description of each typology category.



Emerging Corridors have few destinations accessible by transit or on foot; Transitioning Corridors offer a significant but incomplete set of destinations; Integrated Corridors offer access to a complete range of opportunities.

Figure D-1. Corridor characteristics and performance (CBD = central business district).

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Emerging Corridors

As greenfield low-intensity (suburban, low-density, low-diversity) development occurs, the transit services provided are typically infrequent, local bus routes. Such new growth areas are typically developed with use-segregated, auto-oriented urban form patterns, dominated by residential or commercial/industrial uses at lower densities. Lower-intensity uses are associated with lower demand for public transit, and do not deliver sufficient market support for retail and other local destinations to bring them within walking distance of most homes or jobs. Pedestrian access to transit and local destinations is further encumbered by the circuitous street patterns featured in most new developments.

Emerging Corridors provide a starting point for transit service but often perform poorly in attaining livability goals. A corridor will likely remain Emerging as long it stays at a relatively low intensity, lacks transit-accessible destinations, and delivers few transit-accessible opportunities. Emerging Corridors can achieve higher levels of livability by intensifying development and by attracting major destinations to transit-accessible locations along a corridor, a process that is described below under "Transitioning Corridors."

Transit modes vary along Emerging Corridors. Low-intensity areas must often rely on bus service. High-capacity heavy and light rail sometimes serve Emerging Corridors, but often make use of historic rail infrastructure or are placed in freeway rights-of-way. Infrastructure investments to create new high-capacity transit services are rare because of the lower ridership levels associated with lower land use intensities. (The presence or addition of major destinations may justify such investments, as described in "Transitioning Corridors.")

In Emerging Corridors, transit service tends to be infrequent because of lower land use intensities. Commuter transit service may be offered only during peak periods. Transit service intended for residents' access to local destinations may be available during commute and non-commute hours, but with widely spaced headways. Stops or stations are often widely spaced as well, designed to provide fast line-haul service to regional activity centers. Because long station spacing provides less service coverage within these corridors (since station access trips are longer) only limited land use changes can occur.

Strengths and Needs

Many Emerging Corridors share the following opportunities for livability strengths:

- Vacant or underutilized land development opportunities,
- Historic rail or road rights-of-way that can be used for transit investments, and
- Support for transit investments by local residents frustrated by existing congested road conditions.

Livability enhancement needs typically found in Emerging Corridors include:

- Low population and employment densities,
- Separated land uses,
- Low quality and frequency of transit services,
- Auto-oriented land uses and street designs,
- Auto-dominated travel patterns, and
- Long travel distances to employment centers.

Three common types of Emerging Corridors are:

- Commercial/industrial,
- Suburban commuter, and
- Local bus.

Commercial/Industrial

Commercial/Industrial Emerging Corridors are dominated by employment uses that are generally low-rise and low-intensity, and may have little housing, retail, or cultural activities. Transit service is generally limited to commute hours, with little or no service at other times. Typical transit modes include:

- Commuter rail or newer light rail services along historic rail alignments.
- Express or local commuter bus services along major arterials with limited hours of operation.

Case Study Example: Sacramento's Gold Line Light Rail Corridor

The Gold Line corridor along U.S. Route 50 east of Sacramento, California, was part of the original light rail system opened in 1987. This corridor—defined here as running from Historic Folsom Station (the line's terminus) to Butterfield Way station—primarily contains commercial and industrial uses near the rail line, with its stations and low-density suburban residential uses further out. Key activity centers in and near this corridor include Mather Air Force Base (just beyond a mile from Mather Station), the Rancho Cordova Town Center mall (Zinfandel Station), and the Rancho Cordova Town Center (Cordova Town Center). While this corridor has traditionally been dominated by commercial and industrial uses, recent efforts—particularly by the City of Rancho Cordova—have seen it become the focus of TOD plans and development activities (Bizjak 2004), raising its prospects for elevating its livability in the future.

Suburban Commuter

Suburban Commuter Corridors offer high-speed transit service between low-density, use-segregated residential areas and employment centers. They may have some limited neighborhood commercial uses but offer few employment opportunities. Suburban Commuter Corridors are largely car-dependent except for commute trips. Access to transit stations is primarily designed to accommodate park-and-ride, auto drop-off, or bus access modes.

Station access transit services are generally limited to peak periods in these corridors, while the line-haul commuter line provides frequent service during the peaks and infrequent service (or in some of these corridors, no service) during the off-peak periods. Typical transit modes include:

- High-speed commuter, heavy or light rail, and BRT along historic rail alignments or freeway rights-of-way.
- Commuter bus service along major arterials with limited hours of operation.

Case Study Example: Cleveland's Blue Line

Cleveland's Blue Line corridor has light rail transit service between downtown Cleveland and Shaker Heights, providing regional access to residents who live at relatively low densities. However, employment opportunities are rare along this corridor between its terminus at Van Aken Center and Shaker Square, as is pedestrian- or transit-based access to cultural destinations, health care, and major retailers. The relative lack of these opportunities within this Suburban Commuter Corridor is mitigated by the access to a higher diversity of opportunities available to corridor residents in the CBD, but transit service is generally limited to commute hours, and the travel time between outlying stations and the CBD is high.

Local Bus

Local Bus Corridors offer limited local bus service that is generally used by residents to access nearby, within-corridor destinations. Low-density housing typically is in walking distance of bus

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stops in Local Bus Corridors, and "strip commercial" uses may be located between the arterial bus route and residential areas.

Local Bus Corridors generally follow arterial and collector roadways, with auto-oriented land uses and street network patterns. Buses along the route share lanes with other traffic, requiring little in the way of transit infrastructure investments. In areas with lower-intensity land uses, transit service often follows circuitous routes in order to serve a larger area.

Circuitous routes and closely spaced bus stops result in long travel times, especially if transit is used for commuting. Because of this high time cost, individuals who are transit dependent (because of income, age, or disability) comprise a high proportion of Local Bus Corridor transit ridership, and may rely on the bus for access to health care, grocery stores, and other essential needs.

Case Study Example: Camelback Road, Phoenix

The Camelback Road corridor in Phoenix is an example of a Local Bus Corridor. Camelback Road is an arterial roadway flanked by low-intensity suburban commercial, which, in turn, is surrounded by low-density residential. Single-story retail and office buildings face parking lots. Arizona State University and local planners have been exploring how the arterial can intensify in walkable, transit-oriented ways to take advantage of growing market support for infill and redevelopment of aging commercial uses (Arizona State University, School of Planning 2007).

Transitioning Corridors

Transitioning Corridors have the potential to be highly livable, but often lack key opportunities that will catalyze a high quality of life. They can occur in both suburban and urban areas. In suburban areas, Transitioning Corridors often resemble use-segregated Emerging Corridors but have developed new, major, transit-accessible destinations in at least one location along the corridor. Such major destinations are usually included within activity centers—mixed-use nodes at moderate to high densities.

In urban locations, Transitioning Corridors may be found in areas that originally developed as transit-oriented neighborhoods, but economic trends and regional growth patterns have left these areas in a state of neglect or decline. These corridors often have many underutilized sites (for example, vacant parcels, excessive parking, and otherwise low-intensity development). Stops or stations are often widely spaced in suburban and exurban Transitioning Corridors, providing fast service to activity centers. However, redeveloping, older areas may have legacy transit services with short station spacings, making these corridors attractive for transit-oriented development.

A corridor will likely remain Transitioning as long its transit is focused on fast commuter services to activity centers, neglecting transit service coverage within the corridor. Low-intensity development patterns—particularly around stations—also hinder livability improvements. Livability gains in Transitioning Corridors require coordinated land use and economic and transit improvements.

Strengths and Needs

Most Transitioning Corridors share the following opportunities for livability enhancements:

- Vacant or underutilized land development opportunities;
- Concentrated employment centers within the corridor or nearby;
- Transit-oriented design and street networks ready for transit investments; and
- Economic development opportunities with good accessibility to regional jobs.

Livability enhancement needs typically found in Transitioning Corridors include:

- Separated land uses;
- Economically challenged neighborhoods; and
- Transit services focused on high-speed access to activity centers (particularly CBDs), often with few intra-corridor transit options.

Two common types of Transitioning Corridors are

- Major destination and
- Revitalizing/redeveloping.

Major Destination Corridors

Major Destination Corridors are distinguishable from Emerging Corridors by the presence of a large travel destination around at least one station. These destination nodes are usually activity centers (master-planned, mixed-use developments). These key stations introduce significant new transit-accessible opportunities for retail, cultural, and community activities. Destination nodes are also employment centers and can have housing at moderate to high densities, creating a better jobs-housing balance. Destination nodes generally have moderate intensities overall, with the potential for higher intensities associated with Transit-Oriented Nodes Corridors (see "Integrated Corridors").

Outside of destination nodes, Major Destination Corridors are surrounded by low-density residential and/or commercial uses. Activity centers along these corridors may offer walkable and bikable connections to transit and local destinations, but street connections are not always direct. Activity centers are often auto-oriented, with larger blocks that must be traversed by pedestrian and bicycle paths.

Along Major Destination Corridors, frequent transit service may be available during commute hours, with infrequent service during non-commute hours. Typical transit modes include:

- Commuter, heavy, or light rail along historic rail or newer highway alignments;
- Express bus service along major arterials;
- Light rail or BRT as part of more recent capital projects; and
- Local bus service and shuttle bus service.

Case Study Example: Washington, D.C.'s Metro Orange Line

Washington, D.C.'s, Metro Orange Line in Northern Virginia is a good example of a Major Destination Corridor. This area has undergone rapid employment densification along its inner stations (near the Washington, D.C.-Virginia border), while much of the rest of the corridor has remained relatively residential and suburban. Therefore, while retail and overall employment opportunities are high in this corridor, housing and travel options are relatively low outside its activity centers. The lack of coordination between these transit-accessible activity centers and the mostly suburban development patterns surrounding them indicates that the livability benefits these corridors offer in terms of employment diversity are somewhat compromised by a lack of diverse corridor travel options.

Revitalizing/Redeveloping Corridors

Revitalizing/Redeveloping Corridors often have large amounts of underutilized land, such as vacant sites, excessive parking lots, and low-rise buildings. These conditions often exist where economic decline and disinvestment has occurred, such as in urban areas that grew initially around access to streetcar lines that have since been abandoned. These corridors present opportunities

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to reposition communities economically. In locations with growth, Revitalizing/Redeveloping Corridors can include attractive neighborhoods with high livability potential to combine new and existing homes and industries. In locations projected to lose population, Revitalizing/Redeveloping Corridors offer opportunities to increase parks, urban agriculture, and other community-supportive uses.

Along these corridors, frequent transit service may be available during commute hours, with infrequent service during non-commute hours. Typical transit modes include

- Commuter, heavy, or light rail along historic rail alignments;
- Express bus service along major arterials;
- Light rail or BRT as part of more recent capital projects; and
- Local bus service and shuttle bus service.

Case Study Example: Chicago's Green Line/Lake Street El

In late 1991, the Chicago Transit Authority (CTA) faced a large budget shortfall. At the same time, the Green Line elevated train was experiencing low ridership as Chicago's west side experienced a protracted period of economic and population decline, and CTA proposed that the Green Line be closed. The Center for Neighborhood Technology (CNT) joined with other organizations to stimulate urban revitalization along the Green Line to maintain service and turn blighted neighborhoods around. CNT's Green Line initiative focused on stimulating infill development, enhancing public safety, increasing jobs, and strengthening local shops and community institutions that were already in place. The city of Chicago was an important partner in implementing revitalization measures along the Green Line, including the remaking of the severely blighted Horner public housing project into a mixed-use, mixed-income, high-density neighborhood. Federal Empowerment Zone and HUD HOPE VI grants helped support these efforts (Project for Public Spaces, Inc. 1997). In 2012, the city announced plans to build a Green Line station at Cermak Road as part of an effort to improve service quality to residential neighborhoods along the corridor, serve the nearby McCormick Place Convention Center, and build TOD on station-adjacent, vacant properties (Spielman 2011).

Integrated Corridors

Integrated Corridors are served by high-capacity transit modes, including HRT, LRT, CR, and/or BRT with dedicated bus lanes. Integrated Corridors also include nearly ubiquitous local bus service that extends the catchment area for high-capacity transit and connects transit users to more destinations during commute and non-commute hours.

Integrated Corridors have TOD conditions with destinations that have a dense, diverse set of opportunities, translating into higher levels of transit ridership. Such corridors have relatively balanced matches between the skills and incomes of the residents and the kinds of jobs and housing within their catchment area. Within walking distance of each transit station or stop of an Integrated Corridor, dense and diverse destinations also make it possible to make most daily and many occasional needs on foot.

Integrated Corridors typically have high levels of livability. The two general types of Integrated Corridors are:

- Continuous transit-oriented and
- Transit-oriented nodes.

Each type is served by high-capacity transit modes, local bus service, and dense, diverse destinations, but they differ in the extent of transit-oriented conditions beyond the immediate

vicinity of their transit stations (see descriptions below). Stops and stations are typically closely spaced in Integrated Corridors, providing comprehensive transit service coverage and opportunities for development intensification. Livability improvements in these corridors are usually focused on providing affordable housing opportunities, transit service improvements (such as last-mile station access services) and other non-auto operational enhancements.

Strengths and Needs

Most Integrated Corridors share the following opportunities for livability enhancements:

- Concentrated employment centers, within the corridor or nearby;
- Transit-oriented design and street networks ready for transit investments; and
- Economic development opportunities with good accessibility to regional jobs.

Livability enhancement needs typically found in Integrated Corridors include:

- Established, built-out land uses offer few development opportunities,
- High real estate prices can exclude low- and moderate-income residents, and
- High real estate prices makes transit right-of-way acquisition expensive.

Continuous Transit-Oriented Corridor

A Continuous Transit-Oriented Corridor is an extended urban area consisting of multiple TODs with overlapping and fine-grained transit-oriented connections and development patterns. Within this type of corridor, TODs merge and extend beyond the maximum (quarter- to half-mile) walking distance that limit standalone TODs.

Continuous Transit-Oriented Corridors are generally associated with established urban areas where there is a mix of uses and moderate or high density. Small blocks provide excellent street connectivity, with ubiquitous walking and bicycle routes. These areas generally were developed before freeways and high car-ownership rates made dispersed patterns of development possible.

Along Continuous Transit-Oriented Corridors, frequent service is available during commute and non-commute hours. Typical transit modes include:

- All high-capacity transit modes (heavy rail, light rail, BRT, and express bus) and
- Local bus service and shuttle bus service.

Case Study Example: Philadelphia's South Broad Street Line

Philadelphia's South Broad Street Line runs from Pattison (AT&T) Station to Lombard-South Station near downtown. South Broad Street has high-quality transit-oriented urban form throughout the entire corridor, with population density scores nearly triple the average of all cases studied for this Handbook's research. These urban form characteristics combine with high-quality transit services and nonmotorized services (intersection densities more than double the average) to provide a high level of transit and nonmotorized travel opportunities that are typical among Continuous Transit-Oriented Corridors. This high-quality transit-oriented urban area also provides a rich collection of economic opportunities, with retail job densities at over four times the study average. The corridor also has vibrant and expanding artistic communities, with nearly four times as many arts employees as the study average. This manifests in higher-than-average levels of livability in terms of both people and place across all the Transit Corridor Livability Principles.

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Transit-Oriented Nodes Corridor

Transit-Oriented Nodes Corridors possess all the characteristics of Integrated Corridors within the walkable vicinity of a transit station or stop. Outside the station areas, however, development patterns are low-density and tend to be auto-oriented.

Transit-Oriented Nodes Corridors are generally associated with mixed-use development in suburban settings, at moderate and high intensities. These corridors may include activity centers; master-planned suburban town centers; the redevelopment of "greyfields" (economically outdated uses or underused land), such as with vacant shopping centers; and incremental intensification with loose assemblages of multifamily, retail, and employment development projects.

As in Major Destination Corridors, walking and bicycle connections to transit and local destinations may be reasonably direct, but may rely on walking and bicycle routes that are separated from street connections that may be indirect.

Along Transit-Oriented Nodes Corridors, frequent service may be available during commute hours, with infrequent service during non-commute hours. Typical transit modes include:

- Heavy rail or light rail along historic rail alignments,
- Express bus service along major arterials,
- Light rail or BRT as part of more recent capital projects, and
- Local bus service and shuttle bus service.

Case Study Example: San Francisco Bay Area's BART Pittsburg-Bay Point Line

A good example of a Transit-Oriented Nodes Corridor is BART's Pittsburg-Bay Point Line in the eastern San Francisco Bay Area. This corridor has lower-density, single-family-home neighborhoods outside of station areas, but higher population and employment densities around key stations where TOD plans have begun to transform the corridor. These growing station-area nodes create inconsistencies between within-station and outside-of-station areas in terms of transportation and land use. While station areas are increasingly pedestrian- and transit-oriented in form and function, the areas beyond walking distance of these stations are decidedly auto-oriented (Cervero 1998).

APPENDIX E

People and Place Livability Combinations

As discussed in Section 2, each corridor type can be distinguished by its combination of people and place factors. The various combinations of these characteristics, and the degree to which these combinations are consistent with and mutually reinforce each other, help determine the quality of transit corridor livability. For ease of interpretation, these factors combine and interact along a simple continuum: low- to high-quality of transit corridor livability opportunities.

The discussion of people and place interactions for High-Quality Transit, Walking, and Bicycling Opportunities Principle is provided in Section 1. Additional discussion of the people and place interactions for the remaining Transit Corridor Livability Principles are provided in this appendix.

Mixed-Income Housing Near Transit

Affordable housing is a combination of the amount and diversity of housing for a variety of incomes (place), and the degree to which the housing in the corridor is available to a diverse population (people). Figure E-1 illustrates how these two factors interact to create mixed-income housing opportunities near transit, with the darkest box representing the highest level of livability opportunities.

Different combinations of these people and place factors create a set of four transit corridor livability categories with varying qualities of mixed-income housing and population diversity (including age, race, income, and education).

Transit-Accessible Economic Opportunities

While there are many important aspects of economic life, economic livability opportunities can be reduced to two essential components: employment (place) and consumer opportunities (people). Labeling these components as people and place factors may seem arbitrary—for example, employment is arguably as much about people as it is about place. However, this distinction is useful for this typology since retail usually moves to where people live, and decisions regarding location of nonretail employment generally relate to the quality of places, for example, access to markets, suppliers, or clusters of innovation.

Figure E-2 illustrates how employment and consumer opportunities interact, with the upper-right quadrant representing the highest level of livability opportunities. Varying combinations of these people and place factors create a set of four transit corridor livability categories with varying qualities of employment and consumer opportunities.

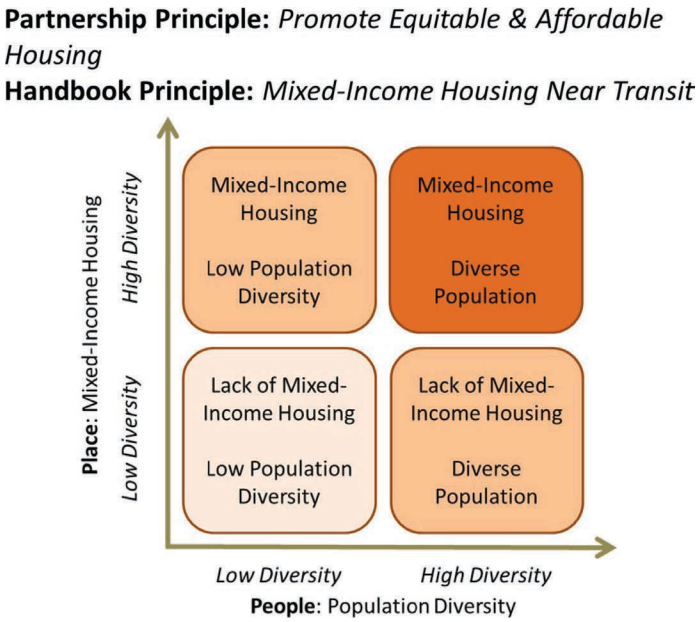

Figure E-1. Mixed-income housing (place) and population diversity (people) factor combinations.

Accessible Social and Government Services

Accessible government services provide an important foundation for building a community with rich livability opportunities. Effective planning and public policies (place) that address the needs and desires of corridor residents can encourage civic-mindedness and community involvement. Accessibility to critical services (people) such as education and health care are a direct result of effective governmental policies and public involvement. Figure E-3 illustrates how

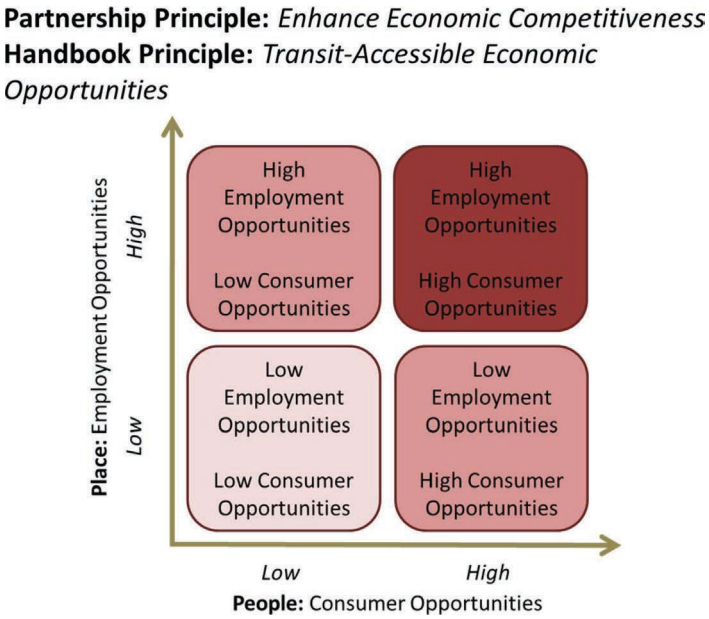

Figure E-2. Employment opportunities (place) and consumer opportunities (people) factor combinations.

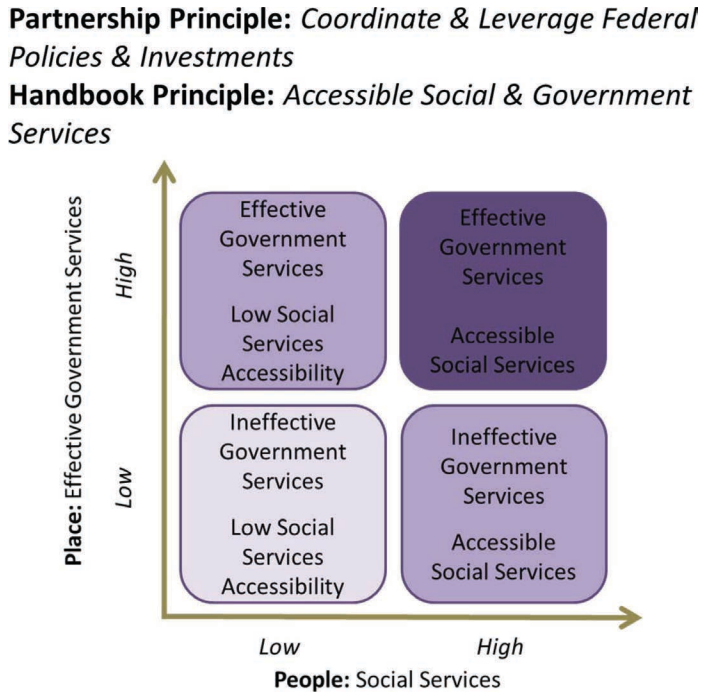

Figure E-3. Accessible social services (people) and effective government services (place) factor combinations.

corridor access to government services (place), and social services (people) opportunities interact, with upper-right quadrant representing the highest level of livability opportunities.

Vibrant and Accessible Community, Cultural, and Recreational Opportunities

Vibrant community, cultural, and recreational opportunities are (in part) a consequence of accessibility, and accessibility in a transit corridor is highly dependent on urban form patterns. Compact urban form patterns allow for more efficient use of the resources required to build and maintain streets, sewers, and energy infrastructure, to name a few. Well-designed public works investments—such as parks and other public spaces—create cost-effective cultural and recreational opportunities for people to enhance their quality of life.

Figure E-4 illustrates how urban form (place), and community, cultural, and recreational (people) opportunities interact, with the upper-right quadrant representing the highest level of livability opportunities.

Healthy, Safe, Walkable Transit Corridor Neighborhoods

Neighborhood safety is an important element of livability. In transit corridors, neighborhood design and infrastructure influence how people feel about walking and riding bicycles, thus affecting the physical health of the population. The combination of a pedestrian-oriented environment (place) and neighborhood safety from crimes and traffic collisions (people) can have important effects on public health and livability outcomes. These interactions are illustrated in Figure E-5 with the upper-right quadrant representing the highest level of livability opportunities.

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Figure E-4. Vibrant and accessible community, cultural, and recreational opportunities factor combinations.

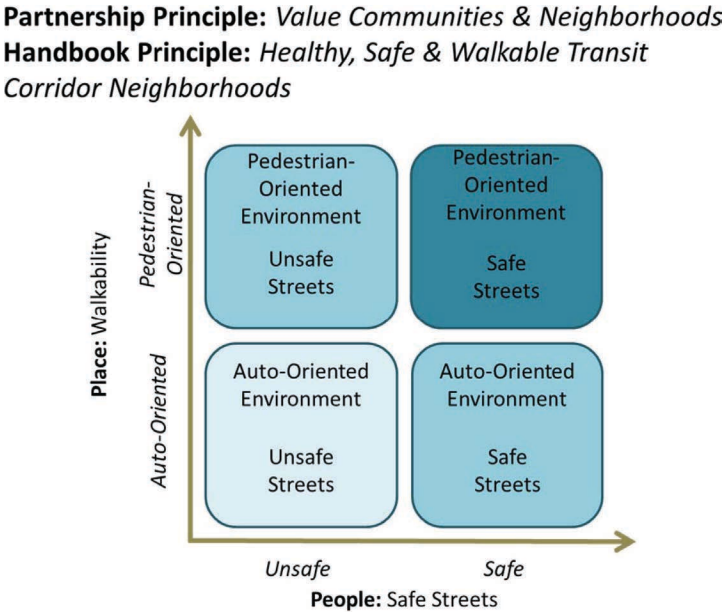

Figure E-5. Pedestrian-oriented environment (place) and neighborhood safety (people) factor combinations.

APPENDIX F

Metrics, Methods, and Data

This Appendix discusses the metrics, methods, and data sources this Handbook uses to measure transit corridor livability. This Appendix focuses on 11 of the 12 metrics used in Step 2 of this Handbook and in the Calculator. These measures and metrics were identified and selected based on the following criteria:

- Metrics found in research literature that were theoretically consistent with Transit Corridor Livability Principles, their people and place factors, and the Transit Corridor Livability Goals (described in Step 2).
- Metrics that would reasonably reflect the values and needs of people who live, work, and recreate in a corridor (relevance).
- Metrics that reflect the needs of a variety of stakeholders and corridor contexts (transferability).
- Metrics that are accurate and balanced when considering multiple goals (Haas and Fabish 2013).
- Metrics that are appropriate for corridor-level analysis.
- Metrics that are useful as performance measures for strategies.
- Metrics that are relatively easy for Handbook users to calculate.
- Metrics that use readily available data and can be obtained at a low cost to the Handbook users (Haas and Fabish 2013).

Table F-1 lists this Handbook's measures and metrics, the Transit Corridor Livability Principle each one illustrates, and data sources best used to calculate them. Each metric is categorized according to the concept it is measuring (that is, each metric has a "measure" name).

High-Quality Transit, Walking, and Bicycling Opportunities

Measure: Corridor Transit Frequency of Service

Metric: Aggregate Frequency of Transit Service per Square Mile

Calculation Method(s). Because of the complicated process involved in calculating this metric, it is recommended that analysts consult the EPA's Smart Location Database Version 2.0 User Guide (available at http://www2.epa.gov/sites/production/files/2014-03/documents/sld_userguide.pdf). Modifications to this metric's values for the purposes of scenarios analysis should be done using the methods EPA used to calculate this metric. Transit travel time data are typically calculated by MPOs for travel demand modeling forecasts.

Table F-1. Transit corridor livability analysis metrics and associated data sources.

Transit Corridor Livability Principles	Metric	Data Source(s)
High-quality transit, walking, and bicycling opportunities	Transit employment accessibility	EPA's Smart Locations Data Set (SLD) 2010 SLD ID D5br: Jobs within 45-minute transit commute, distance decay (walk network travel time) weighted
	Transit frequency of service coverage (aggregate frequency of transit service per sq. mile)	SLD SLD ID D4d: Aggregate frequency of transit service (D4d) per square mile
Mixed-income housing near transit	Housing unaffordability (percent of income spent for housing)	HUD's Housing Affordability Index Data Set (HAI) SLD ID hh_type1_: housing cost as a percent of income for the regional typical household, defined as: Avg. HH size for region, median income for region, average number of commuters per HH for region
	Income diversity (coefficient of variance of income within corridor)	National Historical Geographic Information System (NHGIS), 2010 Census ID B19013: Average of coefficient of variation of block group median household income compared to an average of a corridor's median
Transit-accessible economic opportunities	Jobs density (employees/acre)	SLD SLD ID D1c: Gross employment density employees (jobs)/acre on unprotected land, 2010
	Retail jobs density (retail employees/acre)	SLD SLD ID D1c_Ret10: Gross retail employment density employees (jobs)/acre on unprotected land
Accessible social and government services	Transit corridor ridership balance (RB)	Transit agency route/line data Inbound (to CBD) daily boardings/inbound daily alightings
	Health care opportunities (health care employees/acre)	SLD SLD ID D1c8_Hlth10: Gross health care (8-tier) employment density employees (jobs)/acre on unprotected land
Vibrant and accessible community, cultural & recreational opportunities	Population density (population/acre)	SLD SLD ID D1b: Gross population density (people/acre) on unprotected land
	Access to culture and arts (entertainment employees/acre)	SLD SLD ID D1c_Ent10: Gross entertainment employment density employees (jobs)/acre on unprotected land
Healthy, Safe and Walkable Transit Corridor Neighborhoods	Pedestrian environment (intersection density)	SLD SLD ID D3bmm4: Intersection density in terms of intersections having four or more legs per square mile
	Pedestrian collisions per 100,000 pedestrians	Transportation Injury Mapping System (TIMS) 2010 Pedestrian collisions per 100,000 pedestrians

Mixed-Income Housing Near Transit

Measure: Housing Unaffordability

Metric: Percent of Household Income Spent for Housing

Calculation Method(s). This metric was modeled by the Department of Housing and Urban Development (HUD) by estimating block-level aggregate income and block-level aggregate rent by apportioning from block group 5-year American Community survey totals, using the proportion of households and the proportion of renter-occupied housing units, respectively. Corridor totals are aggregated from these block-level estimates. The data for this metric comes from U.S. Census

sources, including the 5-year, 2005 to 2010, American Community Survey (ACS) and the 2010 Census (SF1 Form). Block-level data for this metric used in the Calculator and for the research supporting this Handbook were obtained from the HUD's Location Affordability Index dataset.

Measure: Racial, Income, Age, and (Dis)Ability Diversity

Metric: Corridor/Neighborhood Income Diversity Metric (Coefficient of Variance)

Coefficient of Variance (CV) is used to measure income diversity for transit corridors. The CV measures dispersion or how spread out values are from the mean and serves as a standardized method for measuring and comparing income diversity between corridors.

CV is defined as the ratio of the standard deviation to the mean for each sample set. As such, the larger CV value, the more dispersion and diversity in corridor incomes. Lower values indicate there is lack of diversity.

The data used for this calculation is the 2010 median income for each block group in the United States as recorded in the National Historic Geographical Information System. For the Handbook, the research team segmented out block groups contained within each corridor and performed a separate calculation for each corridor-segmented dataset. The mean and standard deviation for each corridor-segmented dataset were calculated and the ratio of these two numbers produced the CV for that corridor.

Transit-Accessible Economic Opportunities

Measure: Jobs Density

Metric: Corridor/Neighborhood Employees per Acre

Calculation Method(s). This metric provides the density of jobs that are accessible within the study corridor or neighborhood. Jobs density can be computed for small areas by dividing population by gross land area. Jobs data can be obtained from the Local Employment Dynamics (LED) Database from the U.S. Census. Corridor or neighborhood (block, block group, or census tract) area data can be obtained from the U.S. Census and downloaded from American FactFinder. While these data are easily downloaded from the Internet for geographic units as small as census block groups, they require some effort to aggregate to the corridor level.

Measure: Retail Jobs Density

Metric: Corridor Retail Employees per Acre

Calculation Method(s). This metric provides the density of retail jobs that are accessible within the study corridor or neighborhood. Jobs density can be computed for small areas by dividing population by gross land area. It is calculated in the same manner and uses the same data sources as described above for the Corridor/Neighborhood Employees per Acre metrics.

Accessible Social and Government Services

Measure: Public Infrastructure and Service Costs

Metric: Transit Ridership Balance (A Measure of Transit Corridor Capacity Utilization)

The purpose of the Ridership Balance (RB) metric is to provide a measure of transit corridor capacity utilization by gauging the balance (or imbalance) of ridership along a given corridor

and, by extension, present an intra-corridor performance measure of transportation and land use integration. This metric works on the assumption that travel is a derived demand influenced by the accessibility of land use origins and destinations within a transit corridor.

The RB metric is a proxy measure of how well a transit corridor investment has been utilized and leveraged by synergistic land use planning actions. In short, the RB metric is a measure of transportation and land use integration, how well the government investments in transportation have been leveraged for land use planning as well as other services (for example, local transit and shuttles).

Calculation Method(s). At its core, the RB metric is the ratio of the sum of a corridor's boardings and alightings, as summed by each station, traveling in a chosen direction, as shown in Equation F-1 below:

Equation F-1. RB Metric

$$RB = \text{for a chosen direction}, \frac{\sum \text{corridor station boardings}}{\sum \text{corridor station alightings}}$$

Note that neither CBD stations nor terminus stations are included in the RB metric calculation. Because these stations represent greater, extra-corridor catchment areas and thereby have greater influence on ridership than the intra-corridor stations, they would likely obscure intra-corridor land use/transportation integration performance.

Furthermore, the RB measure requires station-level boarding and alighting ridership numbers that are directionally split (for example, inbound, outbound, east, west)—the most important thing to do is to choose a direction for the RB measure for a specific corridor segment and stick to it. For example, if a CBD along the corridor for an inbound measurement is not available, the eastbound ridership data for those stations along that corridor can be used. Where possible, the inbound direction was used, in this instance defined as toward-the-CBD.

It is important to note, however, that the RB's toward-CBD inbound definition does not necessarily match the reported format of ridership data, typically assigning an inbound/outbound direction to an entire line which may pass through the CBD rather than having a terminus located there.

For example, the LA Metro Rail Gold Line passes through the Los Angeles CBD, from Atlantic station to Sierra Madre Villa (see Figure F-1), rendering a portion of the line's chosen direction for the RB measure to be actually heading in the outbound direction.

Therefore, prior to calculating the RB metric it may be necessary to swap the direction of the boarding and alighting data of some corridors; in other words, reassign the reported outbound-boardings as inbound-boardings and vice-versa (the same applying to the alighting data).

This is illustrated by the Sierra Madre-Chinatown corridor on the Metro Rail Gold Line (see Figure F-1). The corridor's reported inbound direction is toward the Sierra Madre Villa station. However, the CBD is situated nearer the opposite end of the corridor (Chinatown Station). Thus, to correctly calculate the corridor's RB metric, the directionality of this data must first be swapped.

The final step in calculating the RB metric is to invert all values greater than "1" (which happens when number of corridor station boardings in the numerator of the equation above is greater than the number of corridor station alightings in the denominator). For all values greater than "1," simply divide all alightings by all boardings. In doing so, all values will approach "1" as the ridership balance of the corridor is closer to perfect balance.

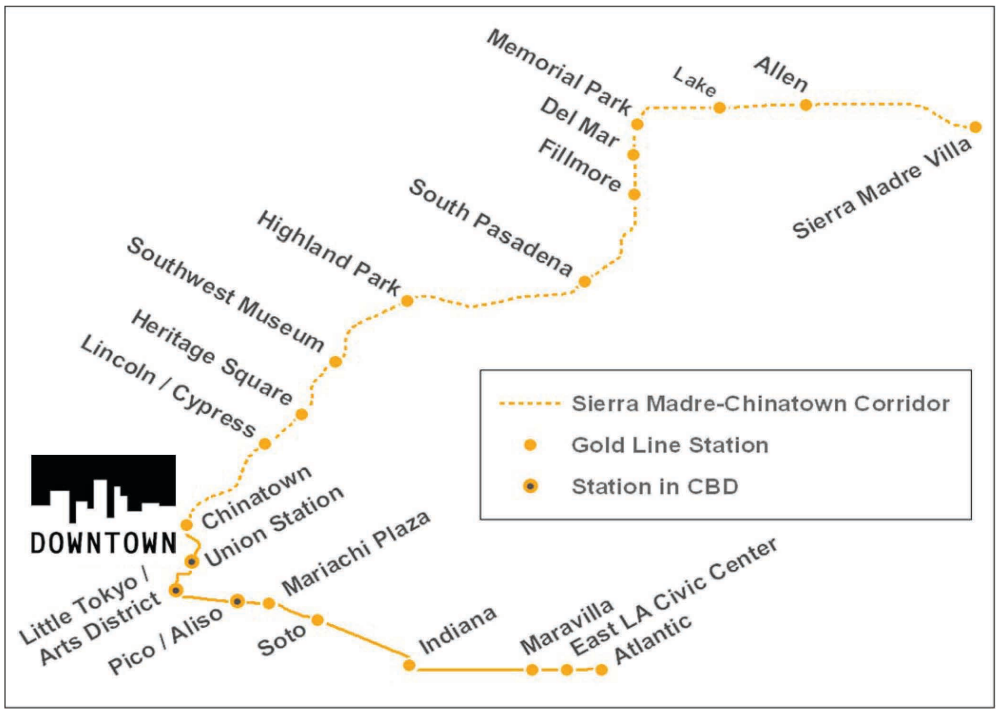

Figure F-1. The Gold Line's reported inbound terminus is Sierra Madre Villa, opposite the toward-CBD direction.

Measure: Health Care Opportunities

Metric: Corridor/Neighborhood Health Care Opportunities (Health Care Jobs per Acre)

Calculation Method(s). Health care jobs density can be computed for small areas by dividing the number of health care jobs by gross land area. It is calculated in the same manner and uses the same data sources as described above for the Corridor/Neighborhood Employees per Acre metrics.

Vibrant and Accessible Community, Cultural, and Recreational Opportunities

Measure: Population Density

Metric: Corridor/Neighborhood Population per Acre

Calculation Method(s). Population density can be computed for small areas by dividing population by gross land area. Both can come from the U.S. Census and be downloaded from American FactFinder or EPA's Smart Location Database. While these data are easily downloaded from the Internet for small geographic units (as small as census block groups), they require some effort to aggregate to the corridor level. For existing-conditions analysis, this measure is calculated using the ACS data (U.S. Census), using the total population at the block level and then aggregating up to the corridor level.

Measure: Corridor Cultural Opportunities

Metric: Access to Culture and Arts (Corridor Entertainment Employees per Acre)

Calculation Method(s). Entertainment jobs density can be computed for small areas by dividing population by gross land area. It is calculated in the same manner and uses the same

data sources as described above for the Corridor/Neighborhood Employees per Acre metrics. This measure is calculated using the LED Database (U.S. Census), summing the number of Arts, Entertainment, and Recreation (AER) jobs [North American Industry Classification System (NAICS) 71] at the block level and then aggregating up to the corridor level.

Healthy, Safe, Walkable Transit Corridor Neighborhoods

Measure: Corridor Pedestrian Environment

Metric: Corridor/Neighborhood Intersection Density

Calculation Method(s). Street connectivity is computed for small areas either in terms of intersection density or percentage of four-or-more-way intersections. Starting with a national dataset of street centerlines, a national database of street intersection locations is produced, including for each intersection feature a count of streets that meet there. Intersections are counted in a GIS program and divided by land area to obtain intersection density. Four-or-more-way intersections are counted and divided by the total number of intersections to obtain the percentage of four-or-more-way intersections in a given area.

Measure: Corridor Pedestrian Collisions Rate

Metric: Corridor/Neighborhood Pedestrian Collisions per 100,000 Daily Pedestrians

Calculation Method(s). Disaggregate collisions data (individual collisions records with latitude/longitude location tags) are currently available for all of California, and the team anticipates that similar data will eventually be available for other states. Simple pedestrian collision rates (all casualties, including fatalities and injuries) can be calculated for California corridors by counting the number of pedestrian collisions in a corridor and dividing an estimate of the corridor's walking population. Equation F-2 provides the calculation formula for this metric.

Equation F-2. Daily Pedestrian Collision Rate Formula

$$PCR = \frac{\left(\frac{PC}{Pop * PS} * 100{,}000 \right)}{365}$$

Where,

PCR = Daily Pedestrian Collision Rate
PC = Total Annual Pedestrian Collisions
Pop = Total Population
PS = Pedestrian Mode Share percentage from Census Journey to Work data.

Data Availability

Table F-2 reports on the primary data sources needed by the Handbook users.

Table F-2. Data availability and quality assessment by source.

Data Source	Applicable Measures/Metrics	Data Availability Notes
U.S. Census/ACS	• **Population Density** (Population/Acre) • **Income Diversity** (CV of income within corridor)	**Availability:** *Excellent* Data are easily downloaded from the Internet for small geographic units (as small as census blocks) but requires some effort to aggregate to the corridor level. **Data Quality:** *Excellent*
Smart Location Database (EPA)	• **Population Density** (Population/Acre) • **Employment Opportunities** (Corridor Employees/Acre) • **Retail Opportunities** (Retail Employment/Acre) • **Access to Culture & Arts** (Corridor Entertainment Employees/Acre) • **Corridor Health Care Opportunities** (Health Care Employees/Acre) • **Pedestrian Environment** (Intersections/Acre) • **Transit Jobs Accessibility** • **Transit Frequency of Service Coverage** (Aggregate Frequency Of Transit Service per sq. mile)	**Availability:** *Very Good* Data are easily downloaded from the Internet for small geographic units (as small as census block groups) but requires some effort to aggregate to the corridor level. Data is generally available for U.S. metropolitan areas only. **Data Quality:** *Excellent*
LED Database (U.S. Census)	• **Employment Opportunities** (Corridor Employees/Acre) • **Retail Opportunities** (Retail Employment/Acre) • **Access to Culture & Arts** (Corridor Entertainment Employees/Acre) • **Corridor Health Care Opportunities** (Health Care Employees/Acre)	**Availability:** *Excellent* Data are easily downloaded from the Internet for small geographic units (as small as census blocks) but requires some effort to aggregate to the corridor level. **Data Quality:** *Excellent* Data for all states available except Massachusetts.
TIGER/Line Streets Shapefiles	• **Pedestrian Environment** (Intersections/Acre)	**Availability:** *Good* Data are easily downloaded from the Internet but requires substantial effort using GIS scripts to count intersections at the corridor level. **Data Quality:** *Very Good*
Transit Agency Websites	• **Corridor Line-Haul Mode** ("Dummy" Variables for Transit Modes) • **Corridor Line-Haul Mode Service Frequencies** (Peak Period Average Headways)	**Availability:** *Problematic* Data are easily found on the Internet, but it is time-consuming to gather data for each agency and route. **Data Quality:** *Very Good*

(continued on next page)

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Table F-2. (Continued).

Data Source	Applicable Measures/Metrics	Data Availability Notes
National Resources Inventory Parks and Open Space Inventory Database (USDA)	• **Corridor Park Coverage** (Park Acreage as % of Total Corridor Acreage) • **Corridor Park Density** (# Corridor Parks/Acre)	**Availability:** *Excellent* GIS data are easily downloaded from the Internet and purport to provide shape file data on park areas throughout the U.S. **Data Quality:** *Very Good*
National Transit Database (NTD)	• **Transit Cost Efficiency** (Transit Operating Expense per Person-Miles Traveled)	**Availability:** *Good* Historical data on transit agency expenses and ridership are easily downloaded from the Internet, but are only available at the agency level; our analysis requires corridor-level data. **Data Quality:** *Problematic*
Statewide Integrated Traffic Records System (SWITRS)	• **Pedestrian Collisions Rate** (Number of Corridor Pedestrian Collisions per Capita)	**Availability:** *Very Good (Outside California: Problematic)* California's SWITRS database provides detailed records of all recorded collisions in the state along with intersection-level geographic identifiers. Unable to find similar statewide dataset for states outside of California. **Data Quality:** *Very Good*

APPENDIX G

Statistical Analysis of Metrics and Typology Categories

Table G-1 provides factor analysis results for 10 of the 12 metrics used in this Handbook. The two factor variables produced in this process were then used (along with the remaining 2 of 12 total metrics) as independent variables in an ordinary least squares (OLS) linear regression model to predict a proxy quality-of-life indicator variable: the corridor non-auto internal trip capture rate.

Linear regression model results using the variables (factors) produced from the factor analysis model run plus the two remaining metrics—corridor pedestrian environment and corridor pedestrian collisions per daily 100,000 pedestrians—are shown in Table G-2.

Linear regression results suggest the collection of livability metrics (the independent variables) is a good predictor of transit corridor non-auto internal trip capture rates, and by inference, transit corridor quality of life. These findings helped the Handbook's research team validate the metrics.

Table G-3 provides analysis of variance (ANOVA) statistical analysis results suggesting that for the 250 outside-of-CBD corridors analyzed, the metrics used in this Handbook (including Housing Unaffordability and Income Diversity) have average values for each typology category that are significantly different from each other. These significant differences are consistent with the theoretical hypotheses posed prior to analysis and the values shown in Table 10 (see Step 3 for additional discussion of these results). These findings indicate that as a group, the 12 metrics used in this study are useful for distinguishing one typology category from another. Furthermore, since the linear regression model (see Table G-3) predicting corridor non-auto internal capture rates provided validation of the metrics, these ANOVA results also help validate the typology.

Table G-1. Factor (loadings) analysis results summary table for outside-of-CBD corridors.

Rotated Component Matrix[a]		
	Factor	
Metric	1	2
Transit employment accessibility	0.839	0.439
Corridor transit service coverage	0.795	0.486
Corridor housing unaffordability	-0.137	-0.845
Corridor income diversity		0.680
Corridor jobs density	0.925	
Corridor retail jobs density	0.897	-0.157
Corridor health care opportunities	0.705	0.522
Corridor density (population/acre)	0.754	0.463
Access to culture & arts	0.918	
Ridership balance	0.332	0.101

Notes:

N = 250 U.S. Transit corridors.

Extraction method: Principal component analysis.
Rotation method: Varimax with kaiser normalization.
[a]Rotation converged in 3 iterations.

Total Variation Explained: 71.69%.

Table G-2. OLS linear regression results predicting outside-of-CBD corridor non-auto internal capture rates.

Variable (Factor or Metric)	Coefficient	Significance
Factor 1: Transportation/Land Use/ Livable Opportunities Integration	0.043	***
Factor 2: Housing Affordability & Income Diversity	0.164	***
Pedestrian environment (intersection density)	0.355	***
Pedestrian collisions per 100,000 pedestrians	-0.256	***
Constant	0.093	**
Model Fit		
N[1]	31	
R Square	0.914	

Notes:

[1]Non-auto Internal Capture Rates developed for 31 transit corridors from California, Texas, and Florida National Household Transportation Survey Supplementary datasets.

** = $p < 0.05$

*** = $p < 0.01$

Table G-3. ANOVA results comparing average metric scores for each outside-of-CBD transit corridor typology category.

Variable (Metric)		Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	P-Value
Transit Jobs Accessibility	Between Groups	4.121E+10	2	2.061E+10	193.215	0.000
	Within Groups	2.655E+10	249	106644971		
	Total	6.777E+10	251			
Transit service coverage (aggregate frequency of transit service per square mile)	Between Groups	1182198429	2	591099214	128.986	0.000
	Within Groups	1136495917	248	4582645		
	Total	2318694345	250			
Housing unaffordability (percent of income spent for housing)	Between Groups	234.932	2	117.466	5.219	0.006
	Within Groups	5648.862	251	22.505		
	Total	5883.794	253			
Income diversity (variance from regional median household income)	Between Groups	.060	2	.030	6.161	0.002
	Within Groups	1.218	251	.005		
	Total	1.278	253			
Jobs density (employees/acre)	Between Groups	15694.037	2	7847.019	165.450	0.000
	Within Groups	11904.508	251	47.428		
	Total	27598.545	253			
Retail jobs density (retail employees/acre)	Between Groups	88.899	2	44.449	134.779	0.000
	Within Groups	82.778	251	.330		
	Total	171.677	253			
Transit balance of ridership flows	Between Groups	.350	2	.175	2.512	0.089
	Within Groups	4.732	68	.070		
	Total	5.082	70			
Health care opportunities (health care employees/ acre)	Between Groups	332.513	2	166.257	80.229	0.000
	Within Groups	520.143	251	2.072		
	Total	852.656	253			
Population density (population/acre)	Between Groups	23995.677	2	11997.839	191.116	0.000
	Within Groups	15757.190	251	62.778		
	Total	39752.868	253			
Access to culture and arts (corridor entertainment employees/acre)	Between Groups	459.856	2	229.928	157.497	0.000
	Within Groups	366.433	251	1.460		
	Total	826.288	253			
Pedestrian environment (intersection density)	Between Groups	174445.130	2	87222.565	97.357	0.000
	Within Groups	224871.842	251	895.904		
	Total	399316.972	253			
Pedestrian collisions per 100,000 pedestrians	Between Groups	43.936	2	21.968	4.630	0.013
	Within Groups	313.167	66	4.745		
	Total	357.103	68			

Notes: P-Values less than 0.100 are considered statistically significant, indicating there are significant differences between the average values of each typology group for that variable (metric).

APPENDIX H

Calculator User Manual

This appendix explains how to use the Transit Corridor Livability Calculator (the Calculator). The Calculator serves as a supplement to the Handbook for helping users through a process of transit corridor livability analysis, goals-setting, and strategies selection. However, users should be aware that the Calculator is NOT a predictive model and therefore is NOT designed to tell the user how and when to make corridor improvements and what specific outcomes will result. Furthermore, the Calculator is NOT a judgmental tool for making assessments about the relative value of a corridor. Rather, it is intended to be descriptive, providing insights about the key characteristics of these places and communities.

Nevertheless, the Calculator is designed to help corridor stakeholders analyze, identify, and assess a corridor's livability strengths and needs, based on the Transit Corridor Livability Principles. It does this by providing users the data for most of the transit corridor livability metrics (based on the Transit Corridor Livability Principles as defined in the Handbook) for an unlimited number of user-defined transit corridors across the United States. Users can then use the Calculator to create a graphic, dashboard visualization of that corridor's livability performance, showing how it ranks in terms of the Principles compared to a survey of over 250 transit corridors across the United States. This is accomplished by cross-referencing these metrics against threshold values associated with each transit corridor livability type identified within this research: Emerging, Transitioning, or Integrated.

At its core, the Calculator is a standalone series of linked Excel worksheets, which includes a nationwide dataset for 10 of the 12 Metrics described in this Handbook, provided at the census block groups (CBGs) level. The Calculator then aggregates these data from the CBGs in the user's specified corridor to calculate corridor-wide metric values.

The Calculator works through the following Calculator (C-)Steps:

- C-Step 1: Define Your Transit Corridor's Boundaries.
- C-Step 2: Identify Your Corridor's CBGs.
- C-Step 3: Insert Federal Information Processing Standard (FIPS) Code ID Numbers for Corridor CBGs in the **(1) Inputs** worksheet.
- C-Step 4: Determine Metrics to Be Used.
- C-Step 5: View the Livability Metrics in the **(2) Metric Scores** worksheet.
- C-Step 6: View and Evaluate Transit Corridor Livability Performance on the **(3) Livability Performance** worksheet.
- C-Step 7: View Individual Metric Performance and Select Strategies in the **(4) Strategy Selection** worksheet.
- C-Step 8: View Selected Strategy Information in the **(5) Strategy Summary** worksheet

The following sections provide instructions on completing each of these steps.

C-Step 1: Define Your Transit Corridor's Boundaries

As outlined in Step 1, Section 1 of the Handbook, defining your transit corridor is an important task in the Handbook's process as well as the Calculator's. The process of corridor identification is outlined in more detail in the following Handbook substeps:

- Step 1.2.1: Define Your Transit Corridor.
- Step 2.2: Define and Select Study Corridor(s) and Transit Modes.

C-Step 2: Identify CBG

Once you have defined the boundaries of your transit corridor, identify the CBG for your study area manually through the use of relevant maps and reports; this is best accomplished using any GIS software package (for example, see Figure H-1). This will make the data collection, processing, and metrics calculation steps easier.

A suggested approach is to select CBG features (such as zone centroids) that intersect with and fall within the corridor area. For this study, a 1-mile buffer around the corridor was used for transit lines outside of the CBD. It is important to note that the current version of the Calculator is solely calibrated for corridors outside of CBDs. The user should decide what buffer is appropriate for their particular corridor.

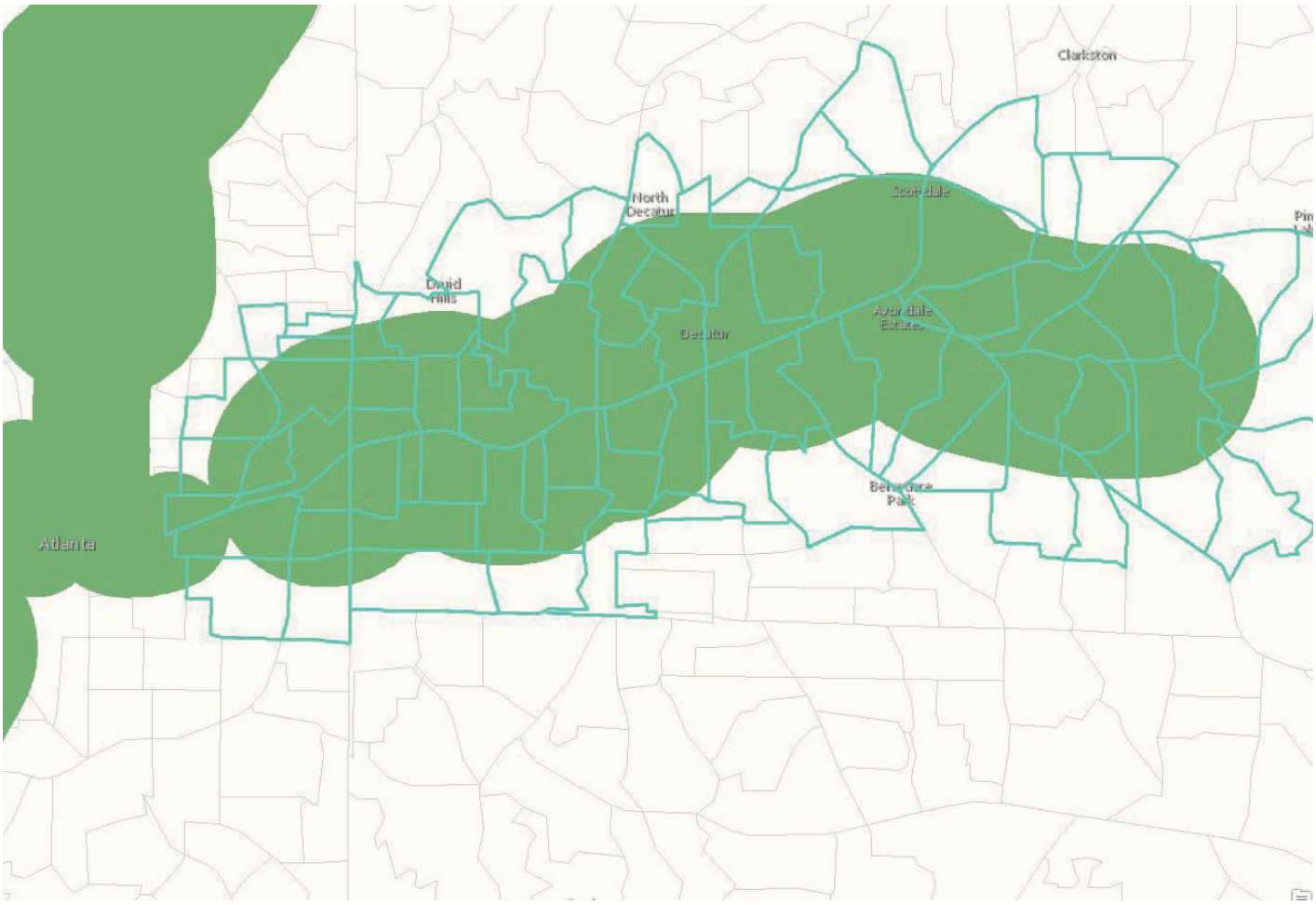

Figure H-1. Example of a study corridor buffer (in green) overlaid upon census block group boundaries (in blue).

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C-Step 3: Insert FIPS Code ID Numbers for Corridor CBGs

Copy the list of FIPS codes (GEOID10) for the census block group features that were selected from the users preferred corridor method, as outlined in Step 2 (for example, from a GIS program) and paste them into the ***(1) Inputs*** worksheet (see Figure H-3). Note that the Calculator uses the national FIPS coding system, as shown in Figure H-2.

C-Step 4: Determine Metrics to Be Used

The Livability Calculator provides data for the entire United States for 10 of the 12 metrics. The Calculator is designed to work with either the 10 metrics provided, or all 12 (of which two will need to be generated by the user).

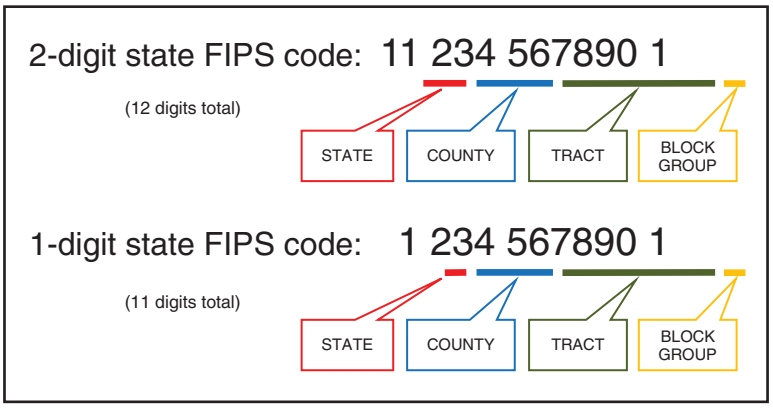
The additional two metrics are as follows:

- The Transit Corridor Ridership Balance (RB) metric (available in certain corridors).
- The Corridor Pedestrian Collisions per 100,000 Daily Pedestrians metric (data available in the Calculator for immediate use for California only).

Appendix F provides guidance on how to calculate all 12 metrics. See Figure H-3 for where to input these two additional metrics into the Calculator.

C-Step 5: View Your Corridor's Detailed Livability Performance in the Metric Scores Worksheet

The ***(2) Metric Scores*** worksheet displays your corridor's mean values for each livability metric, while also providing a graphical visualization of each metric's performance. Each chart shows how the individual metrics perform relative to the mean metric scores for the three typologies: Emerging (red), Transitioning (yellow), and Integrated (green). Each chart displays the z-score normalized values for each metric, based on the mean and standard deviation values for the transit corridors studied in the creation of the Handbook (see Figure H-4). Use this worksheet to confirm that the Calculator is producing metric values for your corridor by comparing the values shown in this worksheet to those shown prior to entering your CBGs in C-Step 3.



Note: No spaces should be placed between FIPS digits.

Figure H-2. FIPS code format.

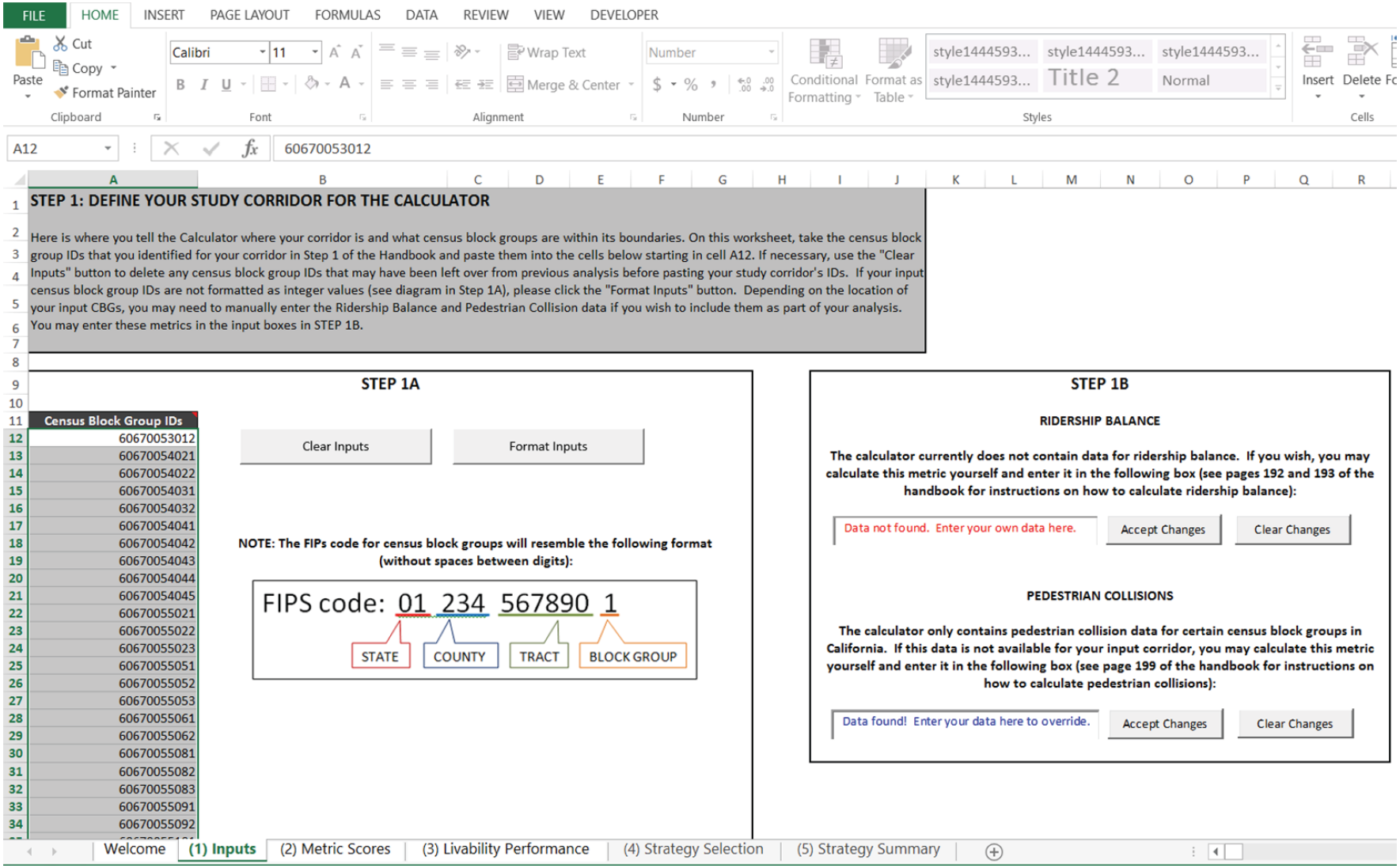


Figure H-3. Enter your corridor FIPS codes into the (1) Input Worksheet.

View the Livability Principle Performance by each of its metrics on the ***(2) Metric Scores*** worksheet. Each graph shows how the individual metrics perform relative to the mean metric scores for the three typology categories: Emerging (red), Transitioning (yellow), and Integrated (green). Use this worksheet to confirm the Calculator is producing metric values for your corridor.

Figure H-4. Metric Scores worksheet.

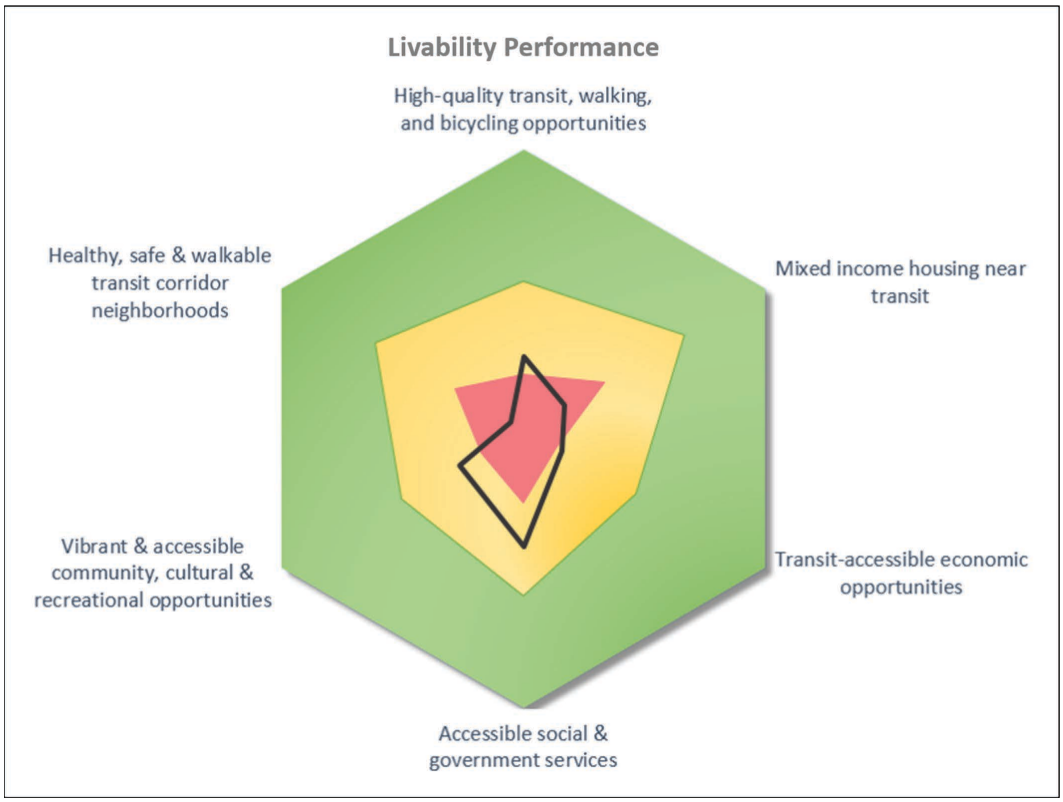
C-Step 6: View and Evaluate Transit Corridor Livability Performance on the (3) Livability Performance Worksheet

The Livability Graph worksheet shows the user how their study area corridor compares to the three corridor types. The so-called "RADAR" graph (titled "Performance of Input Corridor") maps the mean values for each of the Livability Principles of the input CBG as a polygon with a black outline and no fill (see Figure H-5). The shape of this polygon allows for a visual interpretation of the performance of the study corridor, allowing users to see how it performs on each of the Transit Corridor Livability Principles and in relation to each other. Values that fall within the red zone (in the center) are considered Emerging, values within the yellow zone are considered Transitioning, and values within the green zone are considered Integrated.

Users can also use the ***(3) Livability Performance*** worksheet to help identify their corridor's strengths and needs. Identify metric scores that fall above and below the average scores for the best-matching typology category for your corridor. Those that fall below can be considered needs, and those that fall above can be considered strengths.

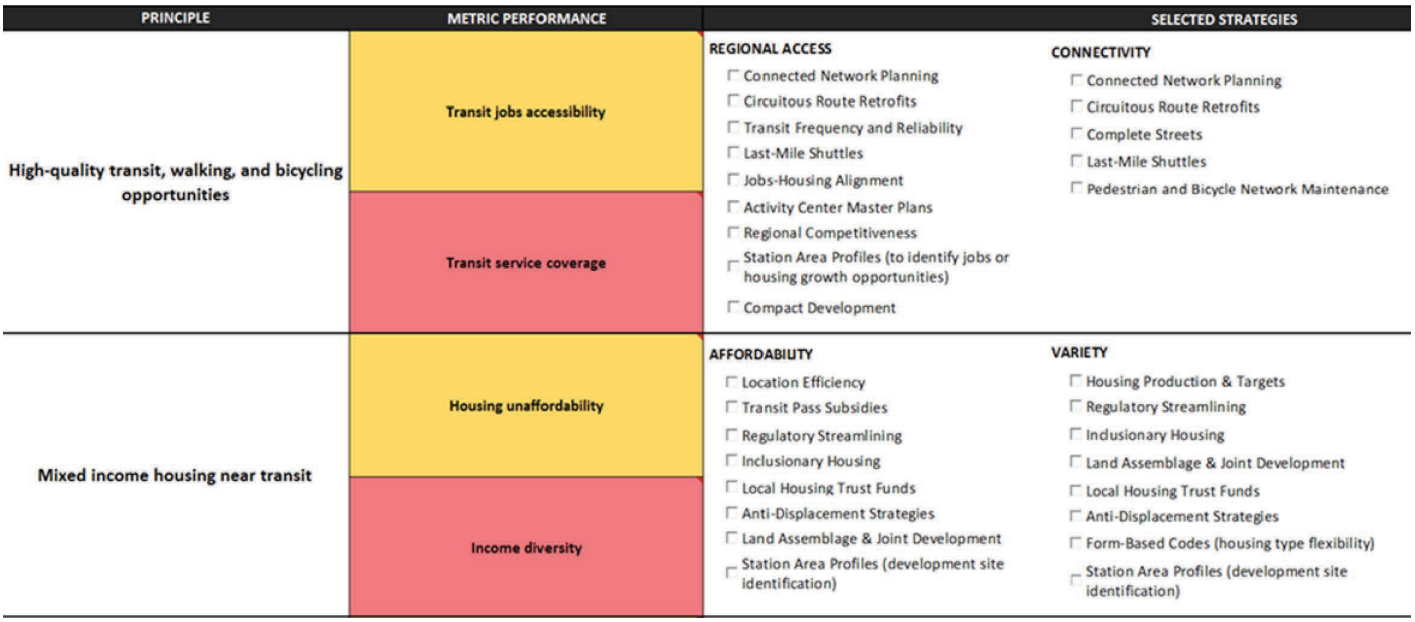
C-Step 7: View Individual Metric Performance and Select Strategies in the (4) Strategy Selection Worksheet

Once the transit corridor's livability performance has been calculated, and users are able to determine the livability strengths and needs of their corridor, the Calculator facilitates an



Evaluate your corridor's typology category using the Livability Performance Graph in the ***(3) Livability Performance*** worksheet. The Livability Performance Graph enables the user to compare the livability performance of the user-specified corridor inputs to the three corridor types. This worksheet also provides the aggregate scores (mean values) for each Livability Principle (based on CBGs inserted into the ***(1) Inputs*** worksheet).

Figure H-5. Livability Performance Graph.



Alongside a visualization of transit corridor livability performance, as shown in the ***(3) Livability Performance*** worksheet, the ***(4) Strategies Selection*** worksheet allows the user to explore Transit Corridor Livability Goals and strategies. The user can select strategies relevant to particular principles and metrics, based on their experiences and knowledge of their corridor/place of interest. Metrics are colored to indicate performance, allowing the user to identify and address areas of need as indicated by *red*- and *yellow*-colored factors.

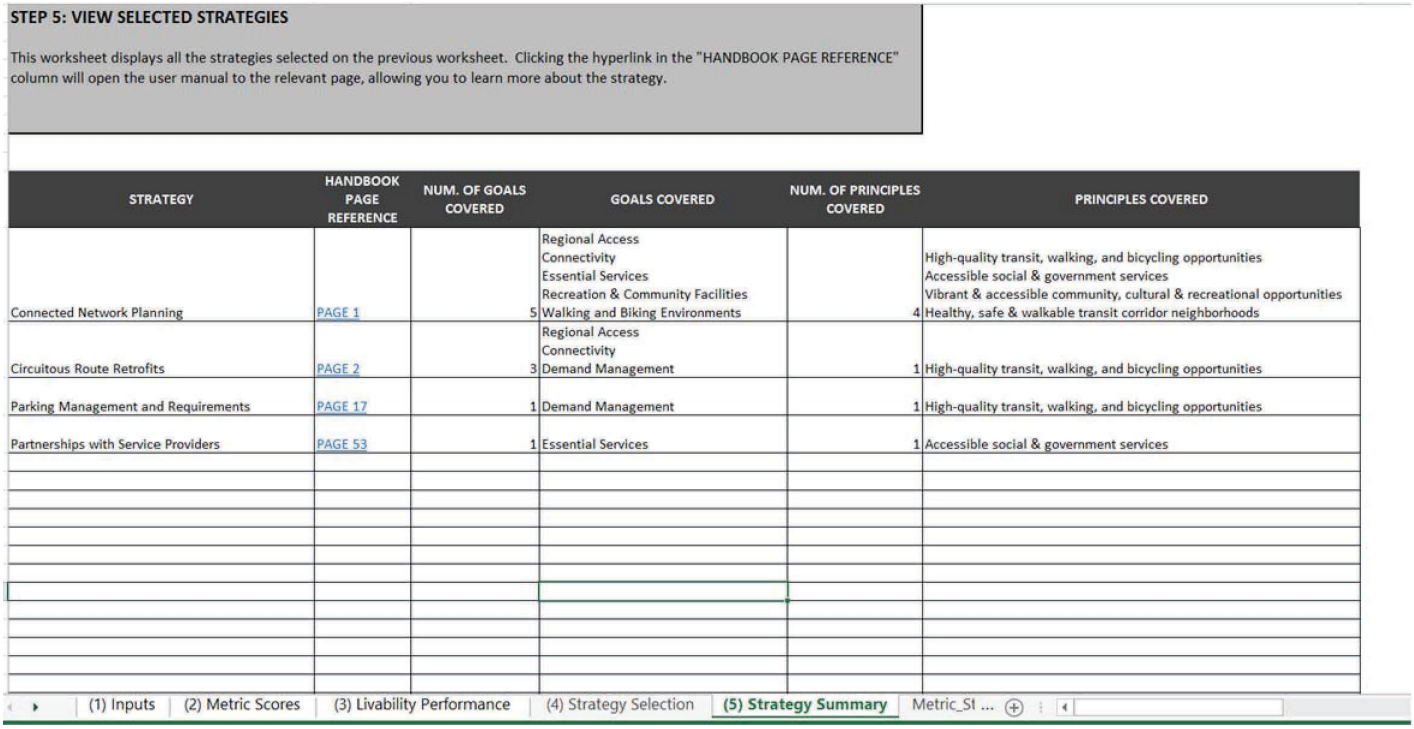
Figure H-6. Goals-Strategies Selection worksheet.

interactive strategy priority selection process on the ***(4) Strategy Selection*** worksheet (see Figure H-6).

Examine those factors within *red*- and *yellow*-colored boxes and consider the goals and associated strategies that might help address these areas of need. Focusing on these needs can help improve the livability of the corridor overall.

C-Step 8: View Selected Strategy Information in the *(5) Strategy Summary* worksheet

Once strategies have been selected in the ***(4) Strategy Selection*** worksheet, the user can view a summary table of the selected strategies in the ***(5) Strategy Summary*** worksheet. This table lists the goals and principles that are linked to each selected strategy, and the relevant page number in the Handbook is provided (see Figure H-7). Clicking on the Handbook page number will open the Handbook file to the relevant page, allowing the user to learn more about the selected strategy.



STEP 5: VIEW SELECTED STRATEGIES

This worksheet displays all the strategies selected on the previous worksheet. Clicking the hyperlink in the "HANDBOOK PAGE REFERENCE" column will open the user manual to the relevant page, allowing you to learn more about the strategy.

STRATEGY	HANDBOOK PAGE REFERENCE	NUM. OF GOALS COVERED	GOALS COVERED	NUM. OF PRINCIPLES COVERED	PRINCIPLES COVERED
Connected Network Planning	PAGE 1	5	Regional Access Connectivity Essential Services Recreation & Community Facilities Walking and Biking Environments	4	High-quality transit, walking, and bicycling opportunities Accessible social & government services Vibrant & accessible community, cultural & recreational opportunities Healthy, safe & walkable transit corridor neighborhoods
Circuitous Route Retrofits	PAGE 2	3	Regional Access Connectivity Demand Management	1	High-quality transit, walking, and bicycling opportunities
Parking Management and Requirements	PAGE 17	1	Demand Management	1	High-quality transit, walking, and bicycling opportunities
Partnerships with Service Providers	PAGE 53	1	Essential Services	1	Accessible social & government services

(1) Inputs | (2) Metric Scores | (3) Livability Performance | (4) Strategy Selection | (5) Strategy Summary | Metric_St ...

Based on user selected goals, this worksheet provides a comprehensive read-out of strategies selected on the previous ***(4) Strategy Selection*** worksheet. The ***(5) Strategy Summary*** worksheet lists the goals and principles that are linked to each selected strategy, and the relevant Handbook page number is provided. Clicking on the Handbook page number will open the Handbook file to the relevant page, allowing the user to learn more about the selected strategy.

Figure H-7. The (5) Strategy Summary worksheet.

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Abbreviations and acronyms used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAST	Fixing America's Surface Transportation Act (2015)
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TDC	Transit Development Corporation
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation

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