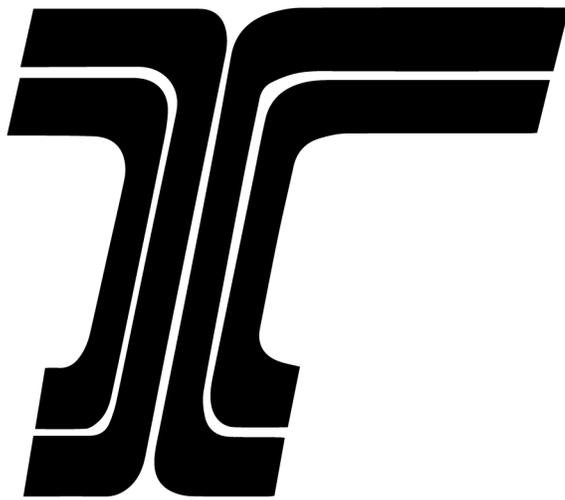




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Oregon Transit and Housing Study

Literature Evaluation and Documentation

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Prepared for the Oregon Department of
Transportation by HDR, ECONorthwest,
Parametrix and Multicultural Collaborative

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Acronyms and Abbreviations

FDOT	Florida Department of Transportation
FMLM	first mile and last mile
ODOT	Oregon Department of Transportation
OTC	Oregon Transportation Commission
PTD	Public Transportation Division
SAP	Strategic Action Plan
TOD	transit-oriented development

1 About the Transit and Housing Study

Transportation and housing have large, interrelated impacts on Oregonians' quality of life. Not only do they comprise the two largest expenses for a typical household—the policy choices that governments make about transportation and housing affect environmental and physical health outcomes, economic mobility, educational and cultural opportunities, the financial well-being of households and more (USDOT 2007).

A desire to better understand the benefits of aligning housing and transportation policies has grown across the state, prompted by declining housing affordability and concerns about transportation's contributions to climate change. In 2021, the Oregon State Legislature asked the Oregon Department of Transportation (ODOT) to study policies and actions that could improve households' quality of life through increasing housing opportunities with easy connections to transit. In addition, the Oregon Transportation Commission (OTC)—the body responsible for setting statewide transportation policy—worked with ODOT to adopt a 2021-23 *Strategic Action Plan* (SAP) that includes climate equity and addressing climate change as key goals, along with improving access to active and public transportation and taking steps to address congestion in the Portland region.

This study is being conducted during a time when the State, ODOT, and other state agencies are taking actions to address affordable housing and the role of public transportation in addressing issues such as climate change. Recent actions include the Governor's [Executive Order 20-04](#): Directing State Agencies to Take Actions to Reduce and Regulate Greenhouse Gas Emissions, and the state legislature has recently passed and continues to propose legislation to address the lack of housing and affordable housing, which has been exacerbated due to COVID-19 and wildfires. This study provides an opportunity for ODOT to work with other agencies, departments, and community partners to develop transportation and housing strategies to improve accessibility and affordability for households in Oregon.

While ODOT is first and foremost a transportation agency and housing is not directly a part of its mission or vision, the agency seeks a better understanding of transportation and housing connections and recognizes that better alignment of housing and transportation can help achieve SAP goals. With these goals in mind, ODOT is pursuing this Transit and Housing Study for the following reasons:

- ODOT recognizes the bidirectional relationship between transportation planning and land use decisions and understands that a well-designed transportation system can bring economic value to a region by improving the connection between communities and their destinations, can enable vibrant neighborhoods where commercial and social activities take place and can reduce the need for major transportation investments in the future.
- ODOT and its partners also recognize the importance of ensuring transportation, transit and housing plans work together, reinforcing the importance of partnerships and coordinated planning.

- ODOT helps fund multimodal transportation systems, transit and coordinated land use and transportation plans. This study can inform those plans and funding allocation.
- ODOT's Public Transportation Division (PTD), planners, project leaders and other staff throughout the agency can work to help implement or promote the results of this study.
- This work will help implement the Oregon Public Transportation Plan, which calls for integration of plans, supporting transit with housing and other topics to be addressed in this study.
- ODOT understands that regional plans that neglect social and environmental impacts can negatively affect housing affordability, cause displacement, and increase greenhouse gas emissions via sprawl and long commutes (Chapple and Loukaitou-Sideris 2019). This can also contribute to racial and economic segregation of neighborhoods.

As this Transit and Housing Study progresses, a glossary of key terms will accompany each Transit and Housing Report. Throughout each document, an asterisk (*) denotes that a term is defined in the glossary, which is organized by topic area. The asterisk (*) is only provided on the first instance of the word.

This Transit and Housing Study will provide a foundation and understanding of how housing and public transportation ("transit") are linked and affect households' quality of life. At the study's conclusion, the goal is to identify actionable strategies that ODOT, local housing and planning departments, tribal governments, and transit providers can take, given the unique circumstances throughout Oregon.

2 Purpose of this Literature Review

In the larger context of the Oregon Transit and Housing Study, this literature review explores the existing research on the relationship between locating transit-supportive housing near transit routes and stations and the related role of first mile and last mile (FMLM) transit connections. ODOT understands that transportation policy can influence land use patterns and travel behavior, including household transportation costs, equitable access to transportation (specifically transit), the presence of low-income housing and even the overall housing supply. By addressing these issues, ODOT can help improve a given household's access to quality housing and the jobs and services a region offers, helping improve the social and health outcomes for Oregonians. This report explores the literature surrounding the benefits and gaps in co-locating housing and transit.

This report is organized as follows.

- Policies, practices and/or barriers to the co-location of transit service, FMLM connections and housing.
- The role of access to transit and FMLM connections.
- Prioritized actions to create steps for success.
- Potential barriers to transit-supportive development.

- Equity implications.
- Key findings.
- Conclusions.

As a literature review, this report cites prominent research studies that investigate these topics and provide insights to ODOT and its partner agencies as they work to better integrate housing and transportation policy development and design. While the purpose of the overall Transit and Housing Study is to evaluate the benefits of locating transit-supportive housing (affordable, attainable, and market-rate) near transit routes and stations, quantifying benefits for combined housing and transportation household costs is difficult to ascertain and can take years to bear out. Often, housing that develops in response to transit investments is expensive and any transportation savings due to location efficiency tend to be consumed by bid-up rents or property values. It is for this reason that this report explores the relationship between transit-supportive housing near transit stations and transit based on research findings within the literature.

The current solutions provided to address affordable housing focus on either increasing the supply of affordable homes or subsidizing low income individuals to help them cover household expenses. The challenges with these approaches are that they are not holistic and do not account for the burden both housing and transportation costs place on low-income households. Increasing accessibility to jobs and services in urban areas would increase the overall affordability of the region. Therefore, it is important when designing transit systems or adding premium transit services (bus rapid transit, streetcar, light-rail, etc.) to factor in the location and availability of housing to help meet desired mobility and accessibility goals (FDOT 2020). The articles and reports selected provide valuable insights and lessons learned on how to achieve housing and transportation goals.

Housing is one of the most significant expenses for an individual or a household. For many, owning or renting a home provides stability, a means to generate wealth and access to the benefits of a city/urban area. For others, affordable housing* is out of reach, leading to challenges in how they conduct their lives and adoption of coping strategies. These strategies include cohabitation, working more hours, cutting back on other expenses, or living further away from job centers in areas where housing is more affordable. Having a stable, decent, affordable home, is essential to every area of a person's life (FDOT 2020). This inability to access affordable housing could be a barrier to people's ability to enjoy the benefits of living in urban areas and other communities.

3 Policies, Practices, and/or Barriers to the Co-location of Transit Service, First Mile and Last Mile Connections and Housing

For transit to influence the affordability of rural and urban areas, it is necessary to identify policies and practices that encourage the integration of transit service with the urban environment and the development of new housing. In 2013, Jennifer Dill used regression analysis to highlight this relationship by examining the drivers of ridership at the transit stop level for three different transit systems in Oregon. As part of the research, her team

(Dill et al. 2013) found that levels of transit service, transportation infrastructure, land use and socio-demographic variables help predict ridership levels. Except for Rogue Valley Transit, a small urban system, the level of transit service at the stop level (such as frequency) has the greatest impact on ridership.

Table 1 summarizes the relationships between the variable groups. Dill et al. found that land use accounted for approximately 4-5 percent of the variance in the TriMet (Portland area) and Lane County models and 17 percent in the Rogue Valley model. It is unclear as to why there is a large difference between the models and requires further analysis. The project team did find, however, higher job accessibility, total employment and percentage of land used for multi-family residential housing are positively associated with higher ridership (Dill et al., 2013).

Table 1. Relative Influence of Variables on Stop Level Ridership

	TriMet (%)	Lane County (%)	Rogue Valley (%)
Socio-demographic Variables	24	11	14
Transit Service Variables	41	46	24
Transportation Infrastructure Variables	1	1	1
Land Use Variables	4	3	17
Unexplained by the Model	31	38	47

Highlighted cells indicate variables with the greatest influence on ridership.

This report identified the following policy implications for improving transit ridership:

- Improving transit level of service is an important tool to leverage transit ridership.
- Promoting a pedestrian-friendly built environment around transit stops or stations can increase ridership.
- Better integrating land use development with transit investments, focusing on multifamily housing and pedestrian-oriented commercial land use is important for transit ridership. Therefore, increased transit ridership can be a potential benefit to the co-location of transit and housing.
- Focusing further research, as well as transit planning, at the transit stop level is important as it is the spatial scale by which users experience transit.
- There may be further aspects of the urban design or “quality” of the local built environment that are important for ridership that are not captured in this study.

One of the limitations of Dill’s approach is the unexplained portion of the model, which ranges from 31 to 47 percent. In the more populous urban areas (TriMet and Lane County), these other factors could include the cost of using transit, travel time to jobs and services, or FMLM connections. As for the 47 percent left unexplained for Rogue Valley Transit, Sloop et al. suggests this could be tied to the level of integration of the transit system with the local land use and community design decisions, with the emphasis on ease of access to the transit system and siting of transit facilities (Sloop et al. 2013). This discrepancy could also be tied to the amount of access to surrounding communities or large employment centers since providing intercity transit to small urban and rural areas

is challenging due the high cost and dispersed, small population (Twaddell & Emerine 2007).

3.1 Strategies for Smaller Communities

While it is an earlier report, Parsons Brinckerhoff presents strategies for small urban agencies in the planning, designing and locating of transit facilities such as shelters, signage and other passenger infrastructure (Sloop et al. 2013). This report affirms that transit systems and their associated facilities function best when they are well integrated with local land use and community design decisions. Because transit can be an important element of a city's economic and growth management strategies, the coordination of transit and community design is essential. According to this study, three fundamental transit components should be considered together when planning for transit:

- Transit routing.
- Relationship between transit facilities and surrounding destinations.
- Transit site location and design.

When these three elements are woven together, they can advance local economic and quality-of-life objectives. The relationship between good transit design and community design is reciprocal. The location of transit routes and facilities can encourage and direct growth. A walkable and well-connected community sets the stage for transit—whether the system exists, is yet to come or will be expanded in the future. As connectivity to transit stops or stations improves, people, especially between the ages of 25 and 44, are more likely to live near these stations. Firms that typically locate closer to transit stations include retail, restaurants, lodging, education, and health care (Nelson and Hibberd 2019).

3.2 Strategies at the State Level

While Dill et al and the Parson Brinckerhoff report highlight strategies at the local level, Michelle Byars evaluated state-level strategies to reduce overall vehicle miles traveled and potentially increase transit ridership (Byars et al. 2017). The strategies range from new fees and changing how transportation is funded, to working with larger employers to implement transportation demand management programs. To address barriers between the co-location of transit service and housing, Byars recommends creating grant programs or incentives to encourage infill development. Examples of this approach include:

- California
 - California Senate Bill 744, signed into law in 2015, reduces parking requirements for some affordable housing projects, in addition to establishing density bonuses.
 - California Senate Bill 743, signed into law in 2013, facilitates infill development by moving the state away from a focus on motor vehicle levels-of-service to a focus on the impacts of vehicle miles traveled in assessing transportation impacts under the California Environmental Quality Act.

- Florida is changing state policy to encourage “mobility fees,” which are one-time fees charged for new development to provide for mobility needs. These fees ensure that development mitigates its impacts on the system in approximate proportionality to those impacts. Once paid by the developer, the fees are fairly distributed among the governmental entities responsible for maintaining the impacted transportation network. They also help to promote compact, mixed-use and energy-efficient development as an incentive for developers to choose more central locations for their projects.
- Connecticut offers zoning flexibility that promotes dense development near transit.

These are not the only strategies that could be implemented by states to encourage better transit and housing connections. In their 2020 report on Affordable Housing and Transit, the Florida Department of Transportation (FDOT 2020) analyzed the relationship between housing affordability and public transportation. The report illustrates the connection between transit investments and system design on accessibility for low-income* and affordable housing* residents and how improving accessibility may lower transportation costs for these households. At the state level, the report recommends FDOT encourage greater coordination between transit providers and affordable housing communities by expanding outreach on route changes to include public housing authorities and more thoroughly analyzing the impact on affordable housing when developing long-range transit plans.

3.3 Importance of First Mile and Last Mile Connections

Transit, however, is only effective in changing behavior and lowering household transportation costs when riders can easily access it. FMLM is the problem of getting to transit (first mile) and getting to your destination (last mile). FMLM is an essential concept for transit providers. Improving access to and from transit for a wider breadth of people will ultimately expand rider catchment. The Regional Transportation District for Denver, Colorado addressed this challenge by developing the First and Last Mile Strategic Plan (the Plan) in 2019 (Regional Transportation District 2019). The Plan aims to improve transit accessibility by empowering local jurisdictions, transportation management associations and other partners to understand the range of available FMLM solutions and then apply those solutions to specific station areas. The recommended strategies center on five themes:

- Reuse and improvements of existing infrastructure.
- New infrastructure.
- FMLM general guidance.
- Transportation demand management.
- Transportation service.

Each theme will be discussed in later sections of this report. The Plan is intended to guide discussion on how to better integrate transit into the community during the implementation of new service (Regional Transportation District 2019).

3.4 Addressing the Needs of Low-income Households and the Potential for Gentrification

Transit-oriented development (TOD), a subset of transit-supportive development, can stimulate reinvestment; improve low-income residents' access to economic, educational and other opportunities; and reduce their transportation costs. People between ages 25 and 44 appear most attracted to living near transit stations (Nelson and Hibberd 2019) due to reduced commute times and transportation costs. However, in planning for these developments, it is important to listen to the needs of low-income communities. Additionally, the improved proximity to transit may contribute to gentrification* (Padeiro et al. 2019). TOD projects may change spatial patterns, urban visual settings and accessibility levels. Newly built developments or housing rehabilitation can also trigger declines in housing affordability and upward social filtering, meaning current residents selling their homes for higher prices to relocate elsewhere in the community. This could create an attraction, potentially leading to displacing the original residents that the transit station was intended to serve (Padeiro et al. 2019).

Therefore, considering the needs of low-income households is necessary in planning for TODs or other transit investments. The benefits of TOD include lowering overall transportation costs, increasing employment and wealth and improving public health and safety (Harris 2012). Communities have concerns about displacement of residents, small businesses and community gathering places as neighborhoods change, particularly communities of color, which are often disproportionately low-income. Willow Lung-Amam recognizes the challenges low-income communities face and the concern they have about equitable distribution of the cost and benefits associated with new transportation projects. Many community-based organizations are coming together to ensure the communities they represent have a voice during the construction of transit projects. As a result, there is growing knowledge on transit justice and equitable TOD (Lung-Amam et al. 2019).

As part of her research, Lung-Amam examined the role of neighborhood-based advocacy in setting terms for an equitable TOD agenda in Langley Park, Virginia as part of the Washington D.C. Purple Line Extension. Her research found four key challenges to planning equitable development in Langley Park: (1) working across inter-jurisdictional lines in a fragmented, segregated region; (2) protecting and producing quality, affordable housing amidst forces of decline; (3) maintaining small business affordability and helping them to adjust; and (4) sustaining meaningful engagement among diverse, low-income residents and business owners (Lung-Amam et al. 2019). One of the key findings was that TOD investments create opportunities to build cross-sector, cross-jurisdictional coalitions that can fill critical gaps in neighborhoods where residents lack established venues and face significant participation barriers.

This challenge of transit investments and housing opportunities is not limited to urban or even suburban areas. Almost 40 percent of rural residents lack access to any local transit service. Among rural communities with transit services, demand-responsive transit is more common than fixed-route transit. Rural areas typically lack the population and job densities necessary to support fixed-route transit. Rather, demand-responsive service is more desirable to cover a population dispersed over a larger area. However, many rural

areas lack resources and commitment to coordinated transportation and land use planning (Twaddell and Emerine 2007).

Best practices to overcome these challenges in rural areas include:

- Access management to preserve capacity and manage land use on arterials and highways.
- Growth management to preserve corridors and enable more efficient use of services and public infrastructure.
- Compact growth strategies, such as TODs, to concentrate housing, jobs, shops, services and healthcare in existing centers to increase opportunities to meet multiple needs in a single trip.
- Street connectivity to minimize travel distances and increase modal options by planning for a grid network and roads that serve multiple developments.
- Complete streets to provide safe and direct connections between destinations that are designed for use by people walking, bicycling, driving and accessing transit.
- Transit planning in rural areas allows for ridesharing, demand-responsive transit, car-sharing and bike-on-bus.

On average, transportation is the second largest household expenditure after housing, and transportation costs are directly related to a key housing characteristic: location. As families move farther from central cities and other job centers in search of cheaper housing, their transportation costs often increase significantly. For low- and moderate-income households, this tradeoff can be particularly challenging. The combined cost of housing and transportation increases with distance from job centers, with the impacts felt most heavily by lower income households (Center for Transit-Oriented Development 2014). The problem of affordable housing is getting worse. In a 2016 analysis of rental properties, the research found that between 2000 and 2010, affordability worsened for households at the 20th and 40th percentiles of the local income distribution in 236 of the 238 largest metropolitan statistical areas, and worsened in every metropolitan area studied for households at the 60th and 80th percentiles (Boarnet et al. 2017). This decrease in affordability was driven by an increase in rent along with a lack of income growth among renters.

Research shows that while the typical household spends approximately 19 percent of its income on transportation, households living in auto-dependent neighborhoods spend around 25 percent. This decreases to 9 percent in neighborhoods where they can easily walk, bicycle or take transit to access jobs and other daily needs. Additionally, the development of well-planned public transit systems can help increase the supply of affordable units by lowering household transportation costs that may lead to additional funds for more expensive homes. FDOT's Affordable Housing and Transit Report explored this relationship by evaluating how transit planning practices affect accessibility for low-income residents and affordable housing communities. This was accomplished by examining current transit provider practices in Florida, at major system redesigns and in Capital Improvement Grant Applications (FDOT 2020).

The overall lesson from the report is increasing affordability must be a priority throughout the transit planning process. Premium transit systems are costly. It is critical to ensure funds are allocated properly and transit is available and convenient to those who use it most. Additionally, establishing partnerships with other agencies such as housing, community development, local jurisdictions, public and private non-profit developers, etc., can lead to improved affordability. The Federal Transit Administration recognizes this and has made strides in addressing the challenges associated with TODs and specifically the increase in land value created by premium transit, resulting in a loss of affordable housing (FDOT 2020).

TOD, often planned in partnership with land use planning departments and transit agencies, are typically planned to attract further investments from private developers who design and implement TOD. These investments usually follow urban design practices focused on creating attractive and walkable public spaces. This often results in attracting one-person households and young professionals who are most likely to fill the newly constructed TOD housing. Because the incoming population are typically higher-income renters, lower-income renters may be priced out. However, the amount TODs contribute to gentrification is still open to debate. Low-income groups might continue to dominate the neighborhoods in transit-served areas since public transportation stations might discourage higher income people from moving in due to traffic congestion, shortage of large and comfortable apartments, fewer parking spaces and crime. In addition, lower transport costs derived from newly built stations could offset diminishing affordability issues in other areas, thus resulting in relatively low combined housing and transport costs (Padeiro et al. 2019).

Regardless, the possibility of the loss of affordable housing in TODs is the central point of the Willow Lung-Aman et al. article, *Mi Casa no es Su Casa: The Fight for Equitable Transit-Oriented Development in an Inner-Ring Suburb* (2019). To plan for and address the needs of low income and minority communities when making transit investments, planners and decision makers must provide an opportunity to comment and take steps to preserve affordable housing. This is accomplished through community-based, cross sector coalitions to establish more equitable and inclusive TOD processes, plans and policies (Lung-Amam et al. 2019).

To protect housing in TODs or transit-supportive development, the U.S. Housing and Urban Development Report, *Creating Connected Communities*, presents strategies to promote the development of accessible, affordable housing in connected communities and to support established neighborhoods. The strategies include:

- Identify existing affordable housing resources and neighborhoods with strong existing connections.
- Work with local, regional and state partners to preserve and promote affordable housing.
- Facilitate the development of compact development patterns and affordable, accessible housing.
- Create places for people, recognizing unique demographic differences.
- Connect the city's economic development strategy with its transportation planning approach.

While these strategies are geared toward small- to medium-sized cities, the lessons learned and the varying approaches are applicable to larger urban areas.

States also have a role in helping maximize the social benefits of affordable housing in TODs. In a report created for the National Center for Sustainable Transportation and the State of California, Boarnet et al. identified the following policies (Boarnet et al. 2017):

1. Increase the supply of affordable housing units, particularly in TODs—in doing so, focus on relatively high-density figures and relatively low inclusionary zoning requirements.
2. Offer more aggressive subsidies for the development of affordable rental housing units in TODs and near transit—such increases could be funded by shifting existing subsidies from ownership units to rental units or lowering the cap on mortgage interest deductions.
3. Incentivize landlords to keep existing units affordable after initial covenants have expired—this is especially true for Section 8 housing. Potential policy changes could include lengthening contract terms for landlords, reducing the administrative burden on landlords and/or offering funds to defray the costs of housing Section 8 tenants.

4 The Role of Access to Transit and First Mile and Last Mile Connections

FMLM provides an opportunity to increase access to transit in urban areas. It helps overcome barriers by providing a seamless connection between a rider's origin, the transit stops and their destination through improved walkway and bikeway connections, transportation network companies, micromobility and mobility as a service concept. Improving these connections is the focus of the Denver Regional Transportation District's First and Last Mile Strategic Plan. This is accomplished through identifying transit station typologies, based on land use, that have unique transit contexts and influence recommendations. In addition, overlays are created to provide additional contexts that may apply in certain station areas to inform recommendations. The typologies, overlays, FMLM strategies toolkit and representative transit locations analyses contained within the Plan are intended to guide users on how to complete their own FMLM plan for one or more stations (Regional Transportation District 2019).

Below is the four-step process to guide local governments and other agencies through the FMLM analysis and application of strategies:

- Step 1: Identify a station typology and any overlays.
- Step 2: Choose a representative transit location that is similar to the station of interest.
- Step 3: Conduct analysis for each focus area.
- Step 4: Apply toolkit strategies.

Toolkit strategies include curbside management, adding charging stations, wayfinding, bike and micromobility parking and shuttle services. To implement these strategies,

transit providers should form partnerships and coordinate with local jurisdictions, private mobility services and stakeholders in the region.

Because effective transit can be a key element of a city's economic development and growth management strategies, improving the FMLM is not limited to urban areas. It is also important to improve these connections to local businesses along main streets in small cities. If main streets are to prosper, transit must serve businesses in downtowns. The Transit in Small Cities Report (Sloop et al. 2013) provides examples of the ways transit routes can provide better linkages in small city downtowns. For example, if an intercity transit service went through four cities, and in each city the bus service moved off the main street, creating a 5-minute side street "detour," the length of the route would be extended by 20 minutes. This has implications for system operation and the attractiveness of the transit service. Adding length to a trip increases operational costs and may result in less service. It can also result in less revenue if potential transit passengers instead choose to drive because of the extra time required for transit.

However, transit design is only one part of the effective transit service equation. The other part is creating an accessible environment. An accessible environment enables all users, regardless of mode or physical limitations, to access transit safely. However, transit providers often have little or no direct responsibility for the quality of the connections to and from a transit facility. Therefore, it is important that transit providers understand the key components that contribute to a high-quality, accessible environment so they can work effectively with local governments and developers during the land use planning and development process. The following elements are important to achieve an accessible environment (Sloop et al. 2013):

- Accessibility for people with mobility issues must be considered as described in the Americans with Disabilities Act requirements.
- The transit stop should be clearly visible to pedestrians/cyclists from a distance.
- The site layout and building design should allow for direct movements between transit, land uses and surrounding areas.
- Sidewalks should be present along site frontages and connect to sidewalks and streets on adjacent and nearby properties.
- Secure and convenient bicycle parking should be available.

In addition, well-sited, well-designed transit facilities can help set the stage for economic development and a self-sufficient community. The location and design of transit facilities and nearby destinations should complement each other and provide value. Transit planners should consider how existing and planned land uses could increase ridership.

The United States Department of Housing & Urban Development produced a report called *Creating Connected Communities: A Guidebook for Improving Transportation Connections for Low and Moderate-Income Households in Small to Mid-Sized Cities*, which highlighted the importance of improving FMLM connections. "The ease and time of traveling between a bus or train stop and someone's home, workplace, or other destination is a critical factor in whether that individual will use transit" (prepared by Center for Transit-Oriented Development, 2014 for U.S. Department of Housing and Urban Development). Providing the last mile connection may be as simple as filling a gap

in the sidewalk or adding bicycle racks on buses to allow riders to easily access destinations within several miles of a bus stop.

The State also shares in improving FMLM through investments in bicycle and pedestrian infrastructure. Research suggests that the connection between bicycle and pedestrian infrastructure and the amount of biking and walking are influenced by several factors, including infrastructure extent and quality, street network characteristics and promotional programs available for travelers. The most common way for states to invest in active transportation is through grant programs that allocate funding to local governments. Many states have adopted bicycle and pedestrian plans, and several have established grant programs for local governments to fund facilities. Examples of state programs promoting these investments include:

- California Active Transportation Program.
- California Sustainable Transportation Planning Grant Program.
- Oregon Active Transportation Section.
- Connect Oregon.
- Washington Pedestrian and Bicycle Program.
- Washington Small City Sidewalk Program.
- North Carolina Bicycle and Pedestrian Planning Grant Initiative.

Other state strategies include bicycle and pedestrian education and public outreach and complete streets initiatives.

4.1 Prioritized Actions to Create Steps for Success

It is not just providing transit service or improving FMLM connections that improve mobility and accessibility options for community residents and low-income individuals. It also includes providing supportive land use and a range of transportation options. This is echoed by the Dill et al. 2013 report. Her research showed that improving job accessibility around transit stops increased transit ridership. In addition, having more land dedicated to multifamily residential and commercial land uses also derives a positive ridership impact. Echoing the findings on FMLM connections, Dill et al. also found that multiuse pedestrian and bicycle paths, as well as bike lanes, improve transit ridership. Addressing inefficient linkages around transit stops or stations is also important in attracting new developments (Dill et al. 2013). This means not requiring transit users to cross multilane highways, circumventing long blocks and addressing additional commute times associated with reaching elevated station platforms (Nelson and Hibberd 2019).

Augmenting supporting land uses and infrastructure, the integration of transit facilities into the community expands the range of transportation options. The location of routes and facilities can encourage and direct growth. A walkable and well-connected community sets the stage for transit, whether the system exists, is yet to come or will be expanded in the future (Sloop et al. 2013). When integrating a transit facility into the community, the following elements should be considered:

- **Sight lines** – A clear line of sight to the transit facility, whether it is a bus stop or a transit center, from adjacent streets allows transit patrons an easy way to orient themselves and recognize where they are.
- **Destinations** – Transit facilities should be located within a short walk of a range of popular destinations, such as service businesses, restaurants and medical or educational institutions, to promote frequent and regular transit use.
- **Connections** – The relationship between buildings, streets, sidewalks and transit facilities should be assessed to determine if a linked series of spaces, visual landmarks and available routes make it easy to access the facility.
- **Transit Operations** – Consider the impacts on the operation of the transit system from siting a facility in a given location.

Coordinated transportation and land use planning can also limit sprawling development, increase travel choices and improve street connectivity in all types of rural communities. The goals should be to:

1. Set a regional framework for where and how development should occur.
2. Improve local accessibility.
3. Enhance community design.

Achieving these goals requires collaborative partnerships, a focus on quality of life and sustainability, public involvement and education, and strong local leadership. These goals can be achieved through regional plans, corridor plans, Department of Transportation rural consultation programs and local comprehensive and master plans (Twaddell and Emerine 2007).

New transit access can bring much needed opportunities and investment to disadvantaged and disinvested neighborhoods but can also raise the threat of gentrification and displacement (Lung-Aman 2019). TOD also creates opportunities to build cross-sector, cross-jurisdictional coalitions that can fill critical gaps in neighborhoods where residents lack established venues. At the state level, the most influential action to create environments conducive to a range of transportation options is implementing different pricing strategies or user fees, such as tolls for auto traffic or shaping transportation investments (Byars et al. 2017).

In creating these new spaces and improving access to a range of mobility options, it is important to engage the public, especially low-income people and communities of color. In her review of the Washington D.C. Purple Line, Willow Lung-Aman identified the importance of community-based, cross-sector organizations in balancing the costs and benefits of TOD and improved transit service. Transit planning efforts need to push concepts including transit equity, establishing accessibility, respecting individual rights, prioritizing disadvantaged groups, reducing inequalities of opportunity, and mitigating transportation externalities. Given the shifting metropolitan dynamics of poverty, inequality and redevelopment, these expanded conceptual and analytical lenses can better address the complex forces that impact disadvantaged communities' abilities to fight for their right to remain in place and benefit from new transit investments (Lung-Aman 2019).

5 Potential Barriers to Transit-supportive Development

For the purposes of this discussion, transit-supportive development is defined as the utilization of effective and predictable transit to encourage surrounding development that, in turn, supports transit. While the previous research highlights actions that can be taken by the State, local jurisdictions, tribes and transit providers to improve accessibility, mobility and connections to housing through transit-supportive development, potential barriers do exist. Dill et al.'s research suggests that a balancing act exists between transit service and creating a walkable and bikeable environment. In addition to looking at the role of separate socioeconomic, land use and transit variables on transit ridership, her team examined the combination of having high levels of transit service and high proximity density or pedestrian-friendly environments on transit ridership. The model found that, if headways are long and transit is infrequent, density or pedestrian design immediately around the transit stop or station could have a positive impact on ridership to mitigating the long headways. However, in places with high density and pedestrian design and frequent service or shorter headways, there is a negative impact or downward pressure on ridership from headway changes at stops with high density or better pedestrian design (Dill et al. 2013). This suggests that there is a possibility of diminishing returns that greater investments in pedestrian infrastructure or increased development activity could decrease transit ridership along premium transit lines if a person is able to meet their non-home-based needs within walking distance of their origin. The change in work behavior associated with COVID-19 could exacerbate this situation. This is not to discourage transit investment or transition to premium modes. Rather, it is a factor to take into consideration as station area plans are developed.

Incorporating transit facilities into the urban environment after development has already occurred can be difficult. Therefore, it is important for transit providers to be involved early in transportation and land use planning processes to identify opportunities to create transit-supportive developments. The Transit in Small Cities primer recognizes this strategy. For example, when comprehensive land use plans are updated, transit providers at a minimum should “review the proposed update” and provide comments on provisions that affect transit. Key questions that should be posed during the update to the comprehensive plan should include (Sloop et al. 2013):

- Are areas planned for development or redevelopment accessible to transit and do the future land uses have the population density to support transit?
- Can efficient, convenient transit service be provided to targeted areas?
- Are there destinations within the city that generate substantial pedestrian traffic (such as a downtown or a grouping of residential apartments) within walking distance of transit?
- Is a high-quality pedestrian environment with good circulation envisioned for areas close to transit?
- Is bicycle access to transit appropriately addressed?

- Are there schools, hospitals, or other community centers that could benefit from transit?

This involvement in the planning process by transit providers to address barriers to transit-supportive design should continue into the development of, or updates to, land use and transportation standards and guidelines. Here the transit provider should focus on encouraging strategies to improve access to transit stops or stations and create an environment that supports alternative transportation modes through effective design. To ensure that opportunities are not missed, the needs of the transit providers should be made known to other departments and included in local planning documents such as Long Range Transportation Plans, Transit Service Plans and Statewide Transportation Improvement Plans (Sloop et al. 2013).

Effective transit funding can also pose a barrier to transit-supportive development as well as integrating affordable housing into transportation projects. The lack of an overarching transit vision for the community makes it difficult to foster coordination between new developments and transit service. As a result, little attention may be paid to the transit system, thereby creating challenges in establishing partnerships and developing funding strategies. This places the burden on municipal budgets to operate the system, leaving few opportunities for greater investments in transit-supportive developments (Center for Transit-Oriented Development 2014).

The State can encourage infill development to reduce barriers to developing transit-supportive development. Local decisions can be influenced by requiring cities to adopt comprehensive or general plans that lay out their visions for growth and development. California, Arizona, Connecticut, Delaware and Maryland require general plans that detail how a region will grow and how it will reduce greenhouse gas emissions. This approach allows flexibility and accounts for local conditions when meeting reduction goals for the State. However, research on local climate action found that state or national policies should give local communities as much latitude as possible to tailor local actions to local needs and opportunities (Byars et al. 2017). Table 2 identifies additional state level strategies to encourage infill development to support transit-supportive development.

Table 2. State Level Strategies to Support Transit-supportive Development

Planning Requirements
<ul style="list-style-type: none"> • Arizona. Legislation requires cities, towns, and counties to adopt a general plan that addresses land use and circulation. • Connecticut. Conservation and Development plan outlines six statewide growth management principles (incorporating priorities of compact growth, housing

opportunity, transportation corridors, resource conservation, environmental protections and integrated planning) that aim to coordinate future development. These six principles outline, among other considerations, the need to redevelop and revitalize areas with existing infrastructure and to concentrate development around transportation hubs and corridors.

- **Delaware.** Comprehensive plans have been required from localities since the inception of the Shaping Delaware's Future Act in 1995.
- **Maryland.** Smart, Green, and Growing program requires Maryland's counties to track and annually report growth-related indicators to the Maryland Department of Planning.

Other Strategies

- **Connecticut.** Public Act 08-182 outlines new performance-based planning and programming requirements wherein actions must be consistent with the six Growth Management Principles, designating "Priority Funding Areas."
- **Florida, 2009.** Proposal to enact "mobility fees" to discourage new road construction by putting higher development fees on developments further from a city core.
- **Massachusetts.** Chapter 40R/40S substantially increases the supply of housing and decreases its cost by increasing the amount of land zoned for dense housing.
- **New Mexico.** Transfer of Development Rights Program is a voluntary, incentive-based, market-driven approach to preserving agricultural land, open space and other critical resources while encouraging development in designated county growth areas.
- **Virginia.** House Bill 2 developed prioritization processes to evaluate projects by congestion mitigation, economic development, accessibility, safety, environmental quality and land use coordination (in areas with a population over 200,000).
- **NE states.** (Maryland, Delaware, Connecticut, New Jersey, Vermont, New York, Massachusetts, Pennsylvania, Maine) direct state funding to geographic areas designated for growth or infill development and constrain investments in areas designated for open space or rural preservation.

Transit-supportive development poses a challenge in that transit investments create conditions for increased rents or property values (Nelson and Hibberd 2019). TODs and transit-supportive development could lead to displacement of low-income individuals. While this impact is typically localized, it is difficult to extrapolate the impact of state policies on TOD development on gentrification (Padeiro et al. 2019). Therefore, it is important to include the local communities in efforts to revitalize communities through transportation investments (Lung-Amam et al. 2019).

6 Equity Implications

This section discusses equity implications, positive and negative, including transit-supportive development's potential to increase accessibility of underserved communities to housing, jobs and other services via transit.

With any transit-supportive development, it is important to take into consideration the equity implications associated with it. Equity, in transportation planning, recognizes that the decisions in how investments are made in transportation infrastructure have either positive or negative impacts on traditionally disenfranchised communities. In low-income

communities of color across the United States, concerns about the equitable distribution of the costs and benefits of new transportation projects are common (Lung-Aman). Planners need to be aware of these impacts as they propose recommendations on changes to the transportation network, land uses, or investments in the community.

The impact of transportation decisions on low-income/rent-burdened individuals is illustrated in the FDOT Affordable Housing and Transit Report (FDOT 2020). As part of the report, the researchers looked at the impact of transit system redesigns on rent-burdened households. A transit system redesign represents a point in time where the system changes immediately from one service delivery model to another. This analysis was conducted for three transit networks: Central Ohio Transit Authority, Jacksonville Transportation Authority, and Palm Tran. Table 3 shows the results of these redesigns on accessibility to businesses for the general population and rent-burdened individuals.

Table 3. Transit System Redesigns and Accessibility Impacts

System	Percent Change in Accessibility to Business After Transit System Redesign			
	Population	Rent Burdened Individuals	0-vehicle HHs	Businesses
Palm Tran	-0.05	+0.09	+0.44	+0.33
Central Ohio Transit Authority	-1.59	-3.97	-1.94	-2.25
Jacksonville Transportation Authority	-11.86	-22.82	-7.89	-11.57

While transit network redesigns are shown to boost ridership, especially if service is preserved in core areas, the amount of transit service dedicated to providing coverage versus enhancing ridership can greatly affect accessibility for rent-burdened individuals. The Jacksonville Transportation Authority, for example, built their redesign around existing and planned bus rapid transit lines. This decision did increase ridership; however, overall accessibility, especially in suburban areas, decreased by 23 percent for rent-burdened individuals. Lower accessibility via transit to jobs and services could increase reliance on personal automobiles, thereby increasing household transportation costs. As this study did not quantify the impacts, it is difficult to assess the overall impact of transit system redesigns on household budgets. The report recommends additional research to address this study limitation.

This connection is also discussed in the Creating Connected Communities Report. The report recognizes that creating connected communities through improvements in transit, bicycle and pedestrian infrastructure can help to reduce households' transportation costs, connect workers to jobs, and facilitate upward mobility (Center for Transit-Oriented Development 2014). Providing low- and moderate-income households with many different transportation options and opportunities for affordable housing can help families

achieve upward mobility by reducing the combined cost of housing and transportation. As discussed above, transportation costs are, on average, the second largest household expenditure after housing and can vary significantly by location and land use context. Households living in connected communities with access to transit and a mix of jobs and services spend just 9 percent of their household budgets on transportation, compared with 19 percent for the average U.S. household. It is important for cities and housing developers to consider location and accessibility in siting affordable housing due to the impact on residents' quality of life.

The State also plays a role in addressing equity associated with transportation investment in low-income communities. From a policy perspective, adopting funding strategies to disincentivize use of personal automobiles can be a regressive action. Increasing the fuel tax without correspondingly improving transit service or expanding investments in other modes could increase transportation costs for low-income households. Additionally, adopting cordon pricing strategies (a cost to drive into a specific area) in congested urban areas, such as those proposed by New York City, is considered a regressive tax. It could be offset by changes to other regressive taxes or through improving transit service. In Illinois, lawmakers in 2008 approved a long-term mass transit funding bill that provides free transportation to Illinois seniors (over 65 years old). This legislation provides \$494 million in new and recurring funding to Chicago Metro Area transit agencies, and another \$50 million to transit providers outside of the Chicago area (Byars et al. 2017).

California also recognizes that transit-supportive developments can be part of a more environmentally friendly and economically just future. Building affordable housing within TOD should be an important part of the state's housing affordability program, because building near rail can be a large amount of future California residential development. TOD affordable housing can also help support the operational efficiency of the state's massive investment in mass transit (Boarnet et al. 2017).

The challenge in balancing different strategies to improve other transportation modes with equity concerns is that new transit access or other transportation investments can bring much needed opportunities to disadvantaged and disinvested neighborhoods. These investments, however, can also raise the threat of gentrification and displacement (Lung-Amam et al. 2019). This is overcome through developing partnerships by explaining how transit-supportive development, such as TODs, can advance local economic development, downtown revitalization, and other community goals (Sloop et al. 2013). This is accomplished through developing public coalitions to create successful community consensus-building around equitable TOD goals as well as strategies for sustainable outcomes in inner-ring suburbs (Lung-Amam et al. 2019).

For example, the City of Seattle developed policies to address social equity in communities, including:

- Prioritizing and coordinating city investment in transit communities.
- Developing mixed-income transit communities.
- Prioritizing the preservation of affordable housing near transit.

The report also provides numerous tools to promote social equity in urban areas (Harris 2012). The top five tools include:

1. An early warning system for affordable housing that is at risk of converting to market rate (prevent displacement).
2. Inclusionary zoning (aims to build more affordable housing).
3. Policies enabling tenants the right of first refusal (prevents displacement).
4. Incentive zoning (aims to build more housing and or more affordable housing).
5. Multifamily housing tax exemption (aims to build more housing and or more affordable housing).

7 Key Findings

This literature review has identified the following key findings for consideration as ODOT, other state and local agencies, tribes and transit providers develop policies and strategies to help provide connections between transit and quality affordable housing, including:

1. Housing located within TODs is more expensive – Due to the attractive nature of TODs (amenities, proximity to jobs and services and/or access to other transportation options), housing in these developments is often of very high quality and in high demand, leading to higher prices. The higher prices, however, may be offset from the lower transportation costs leading a potential net gain in overall affordability for households. When planning for housing in TODs, ODOT and its partners could factor in transportation savings to determine if there is a net gain before identifying the number or magnitude of additional programs to increase housing access for low income individuals.
2. Transit ridership depends on a variety of factors – As Dill et al. points out, transit ridership is influenced more by the quality of the service than the areas it serves. Successful transit needs to be part of a well-connected network with amenities, sidewalks, and FMLM connections to minimize barriers to transit access. Land use variables, such as housing and job density, complement transit service by creating an environment and providing a ridership base to support higher frequencies and premium transit services.
3. Route changes and/or system redesigns – When designing new routes, evaluating changes to existing routes, or implementing a system redesign, it is important to evaluate accessibility changes to jobs and services for low income residents. This involves determining the location of jobs and services in relation to transit routes, measuring travel time changes for low-income residents and affordable housing communities and including agencies that represent low-income residents and affordable housing communities in the planning process. These efforts should help to preserve access for the groups and not leave them out of the conversation when transit investments are made.
4. Policies that disincentivize personal automobiles can harm low-income individuals – While increased gas taxes, congestion fees, parking restrictions, and other policies may be effective in decreasing personal automobile usage, a corresponding improvement in transit service and the availability of other transportation options is needed to avoid increasing transportation costs for low-income households.

5. Transit investments create the potential for gentrification and resulting displacement – This potential needs to be anticipated and addressed during the planning processes.
6. Integrated transportation and land use planning between transportation departments, transit providers and local jurisdictions on topics such as zoning; transportation and transit planning; development review; and ongoing monitoring can help break down the compartmentalization of transit and land use/housing decisions, improving the potential to achieve transit-supportive housing.
7. FMLM and the urban form matters – Convenient and safe multimodal connections between transit, housing and land use density create conditions for transit and housing integration.

8 Conclusion

Transportation is a significant driver of growth and access to new opportunities in communities. Transportation projects can be evaluated based on how the projects affect accessibility for our most vulnerable populations, such as low-income individuals, communities of color, the elderly and disabled individuals. This can be done through factoring in the placement of new infrastructure in the context of the overall community, developing a comprehensive transportation vision and engaging the public to develop coalitions to protect local interests. The review of articles and reports provides valuable insights and findings on the relationship between locating transit-supportive housing near transit routes and stations and the related role of FMLM transit connections.

As this Transportation and Housing Study progresses, the series of reports alongside the final report, synthesizing findings, will provide a foundation and understanding of how housing and public transportation are linked and affect households' quality of life.

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