# City of Tigard Paid Parking Policy

**Winter 2018 • Urban Transportation Planning • USP 544**
**School of Urban Studies and Planning**
**Portland State University**


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UNIVERSITY OF OREGON

TRIMET

SCI Sustainable Cities Initiative

SCYP Sustainable City Year Program

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## About SCI

The Sustainable Cities Initiative (SCI) is a cross-disciplinary organization at the University of Oregon that promotes education, service, public outreach, and research on the design and development of sustainable cities. We are redefining higher education for the public good and catalyzing community change toward sustainability. Our work addresses sustainability at multiple scales and emerges from the conviction that creating the sustainable city cannot happen within any single discipline. SCI is grounded in cross-disciplinary engagement as the key strategy for improving community sustainability. Our work connects student energy, faculty experience, and community needs to produce innovative, tangible solutions for the creation of a sustainable society.

## About SCYP

The Sustainable City Year Program (SCYP) is a year-long partnership between SCI and a partner in Oregon, in which students and faculty in courses from across the university collaborate with a public entity on sustainability and livability projects. SCYP faculty and students work in collaboration with staff from the partner agency through a variety of studio projects and service-learning courses to provide students with real world projects to investigate. Students bring energy, enthusiasm, and innovative approaches to difficult, persistent problems. SCYP's primary value derives from collaborations resulting in on-the-ground impact and expanded conversations for a community ready to transition to a more sustainable and livable future.

## SCI Directors and Staff

Marc Schlossberg, SCI Co-Director, and Professor of Planning, Public Policy, and Management, University of Oregon

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## About TriMet

The Tri-County Metropolitan Transportation District of Oregon was created by the Oregon Legislature in 1969 to operate and oversee mass transit in the Portland Metropolitan region. This public entity was formed by the legislature as a municipal corporation to replace the multiple private interest mass transit companies that previously operated in Multnomah County, Clackamas County, and Washington County; the counties that make up TriMet.

In addition to operating bus lines, light rail, and paratransit in the defined Tri-Metropolitan district, TriMet also connects to external mass transit services to provide wider blanket coverage for the region. TriMet's nationally recognized transit system provides more than 100 million rides annually, and carries 45% of rush hour commuters going into the downtown Portland area. TriMet not only moves people, but helps build sustainable cities by improving public health; creating vibrant, walkable communities; supporting economic growth; and working to enhance the region's livability.

Several civic leaders have been highlighted as key Figures in the creation, establishment, and ultimate success of TriMet. Governor Tom McCall is credited with the initial call for the creation of the public corporation; other key contributors include Congressman Earl Blumenauer, Rick Gustafson, Dick Feeney, and Mayor Neil Goldschmidt. All were instrumental in shaping the organization itself, as well as the land use, civic development, and transformation policies that make TriMet the success that it is today.

The vision and efforts of these individuals and countless others have borne fruit. Recently, TriMet celebrated the second anniversary of the opening of its most recent light rail line. Since its inauguration the 7.3-mile MAX Orange Line has experienced continued growth, having a six percent year-to-year increase in ridership. Illustrating the holistic approach that has been a part of TriMet from its inception, there have been wider community benefits such as a positive impact on employment and a focus on sustainable practices such as bio-swales, eco-roofs, a first-in-the-nation eco-track segment, solar paneling, and regenerative energy systems.

TriMet is a key partner in the region's Southwest Corridor Plan and Shared Investment Strategy. Eleven partner agencies are participating in planning for a new 12-mile light rail line in southwest Portland and southeast Washington County that will also include bicycle, pedestrian, and roadway projects to improve safety and access to light rail stations. Southwest Corridor stakeholders include Metro (the regional government), Washington County, Oregon Department of Transportation, and the cities of Beaverton, Durham, King City, Portland, Sherwood, Tigard, and Tualatin. This collaborative approach strives to align local, regional, and state policies and investments in the Corridor, and will implement and support adopted regional and local plans. These initiatives and outcomes from participation with the UO's Sustainable City Year Program will help develop ideas that are cost effective to build and operate, provide safe and convenient access, and achieve sustainability goals while supporting the corridor's projected growth in population and employment.

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## Introduction

The Southwest Corridor Plan introduces MAX light rail to outer Southwest Portland, Tigard, and other Portland-area suburbs along the I-5 corridor. As part of this project, TriMet and the city of Tigard are investigating a Park and Ride facility near the MAX stop planned for Tigard's central business district (CBD). This report examines the viability of this Park and Ride, analyzes a number of scenarios for its implementation, and makes broad recommendations for Tigard's parking strategy in light of its land use visions.

The report was produced in collaboration with University of Oregon's Sustainable City Year Program and TriMet's Southwest Corridor planning. The research and writing for this report was done by Portland State University students as part of the USP 544: Urban Transportation Planning course. The project was led by Dr. Aaron Golub, Professor of Urban Studies and Planning at PSU.

The report concludes that building a Park and Ride will be necessary to meet projected demand for transit parking in the next 20 years, and that it will be most effective in conjunction with an on-street metered parking program and shared parking in downtown Tigard lots.

## Goals & Vision

Tigard envisions a walkable downtown with dense, mixed-use development. Tigard and TriMet envision a strong transit-based commuting future. The Southwest Corridor Plan is intended to support both visions. Therefore, the goal of the parking strategy is to meet projected demand for parking in Tigard while encouraging walking, biking, and transit use.

## Methodology

Students split into several groups to research the following questions:

- What is the configuration and quantity of parking supply and demand at the proposed Tigard CBD MAX station?
- What are key stakeholders' visions for the central Tigard area, and how do parking policies and investments fit into that vision?
- How do parking policies and investments shape parking demand? How can that knowledge be leveraged to improve parking planning in central Tigard?
- What emerging technologies are being used to manage parking? How could these be applied to the Tigard downtown area?

## Existing Conditions

The study area for this project is the ¼ mile radius around two potential MAX stop locations on Ash Avenue or Hall Boulevard. Within the study area, 103 spots are currently provided by a Park and Ride facility built near the Ash Avenue location for the Westside Express Service (WES). Outside of the ¼ mile radius, there are other parking lots underused during daytime hours, which may be of use if commuters prove willing to walk longer distances than assumed. One such parking lot is at the Rite Aid and Value Village north of the study area, which contains about 108 spaces.

There are 175 unpriced street parking spots in the area, mostly concentrated in Downtown Tigard. The Downtown Tigard spots are on two-hour meters. Surrounding the proposed MAX stop locations are parking areas that belong to nearby residences, businesses, and government buildings. On a typical weekday, the parking lots in Downtown Tigard do not reach full capacity. During the lunch hour from 12:00 pm to 1:00 pm (Figure 1), there are areas that remain largely unused. Between 5:30 pm and 6:30 pm, the off-street parking lots begin to clear up in the downtown portion of the city. However, the parking lots belonging to the large retail stores fill up as people tend to shop for their groceries after work (Figure 2).

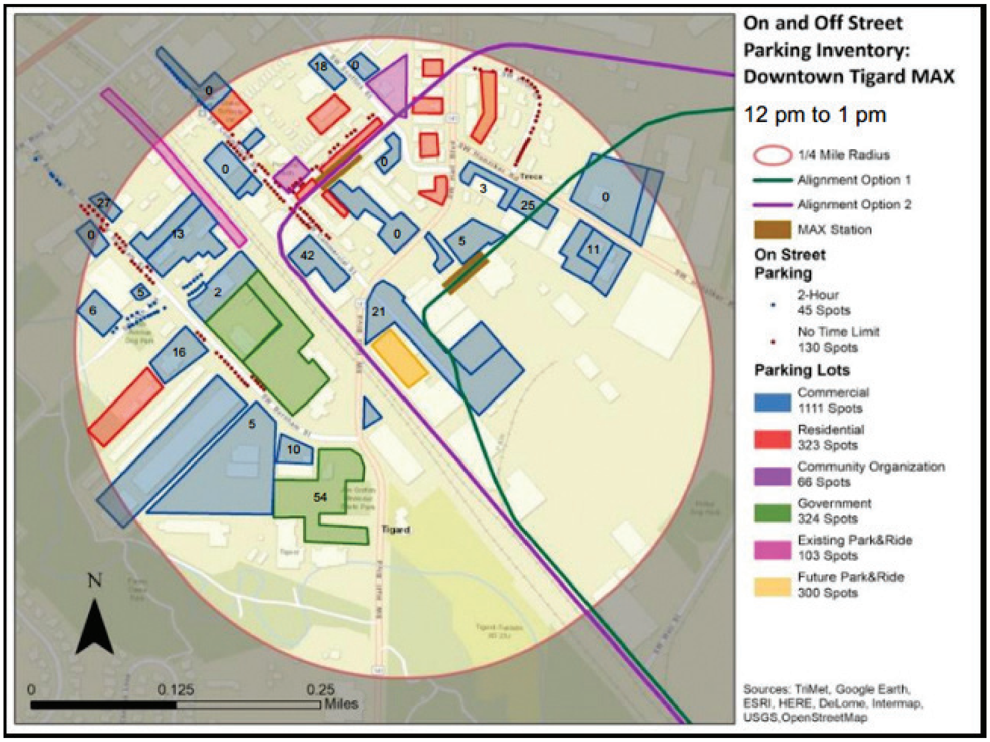

*Figure 1: Available spots in Downtown Tigard from 12:00 pm to 1:00 pm*

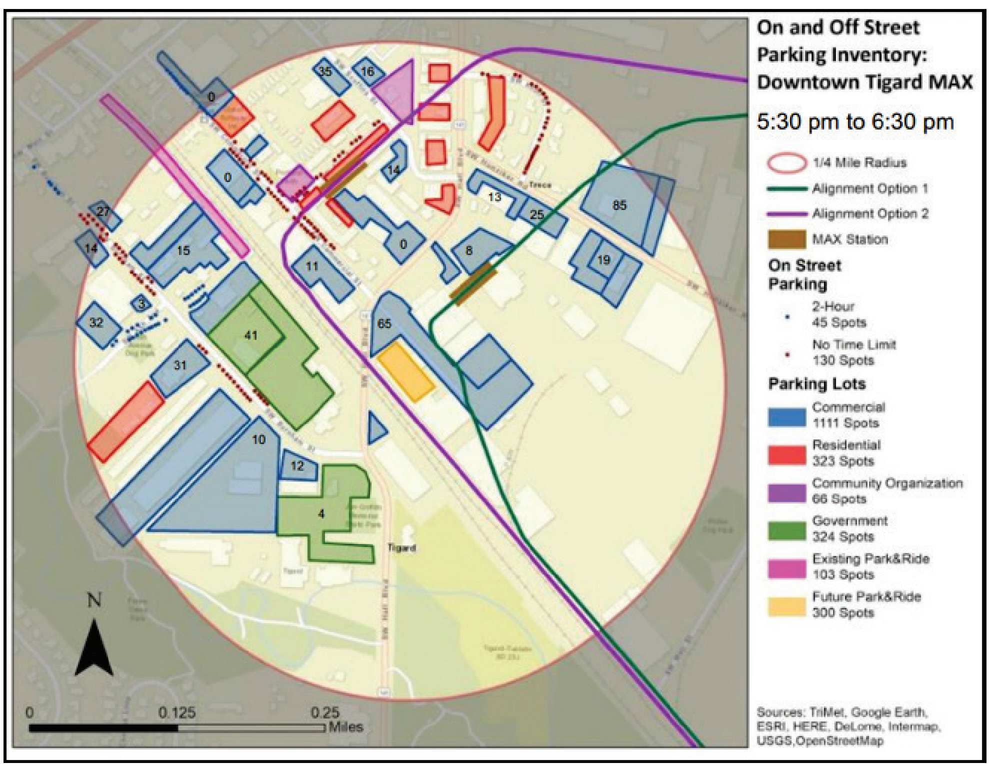

*Figure 2: Available spots in Downtown Tigard from 5:30 pm to 6:30 pm*

## Community Engagement

The stakeholder engagement team interviewed several people connected with TriMet, the city of Tigard, and Metro. The team also interviewed a fellow urban planning student who lives in Tigard and commutes to Portland. This was a preliminary outreach effort to develop some concepts and some direction for broader community engagement.

During interviews, the following priorities emerged:

- Rebalance parking between downtown south (near capacity at peak hours) and other areas (currently underutilized)
- Ensure employee parking downtown
- Promote alternative modes to get to transit centers
- Integrate new technologies and policies for bike/car pricing into the entire TriMet system
- Guarantee parking for TriMet riders
- Plan for potential future demand for parking as downtown revitalizes
- Avoid prices that would discourage parking
- Incorporate equity and ADA considerations, including access for low-income people
- Ensure collaboration between TriMet and Tigard
- Ensure system-wide equity in parking policies throughout the Southwest Corridor

Stakeholders did not always share the same priorities. For example, Tigard and TriMet did not agree in whether the Park and Ride should be available for non-transit users. However, resolving these differences is not the intent of this report.

## Future Conditions

It is difficult to predict how many people will try to park in Downtown Tigard, since so much about local goals and visions is changing. The best available estimate of future demand is an unconstrained projection done by Oregon Metro for the year 2035 (Figure 3).

| Station | Capacity | Demand |
|---|---|---|
| Tigard Transit Center | 403 | 843 |

*Figure 3: Oregon Metro capacity-demand projections for relevant light rail stops*
*Source: Oregon Metro*

There are some caveats involved in using these projections, as they are unconstrained by capacity and they are isolated to Park and Ride facilities. They do not mean that there will be 843 drivers searching for parking near Tigard Transit Center in 2035. Drivers will have other alternatives: commuting by car, biking to the transit center, finding alternative places to park, taking the bus or Westside Express Service, working from home, and so on. There are also discretionary trips that will not be made if parking is not available.

Some of these alternatives are preferable to others; for example, it would be more in line with project goals to see increased bike parking than to see more car commutes. Managing demand without discouraging transit use will therefore be a key element of this future Park and Ride. Some options are discussed later in this report.

There is another development that could dramatically affect the outlook for 2035: autonomous vehicles (AVs). If continuously circulating personal or for-hire AVs take the place of personal automobiles in regional commutes, then the demand for parking would be much lower than projected. Oregon has not yet written its policies and regulations on AVs, but it seems likely that Uber will try to bring its rental AV service to the Portland area within a few years.

To illustrate the transformative potential of this technology, the policy team created a rough sketch of the comparative time and cost tradeoffs for different commute modes (Figure 4). AVs have a clear time advantage over other modes.

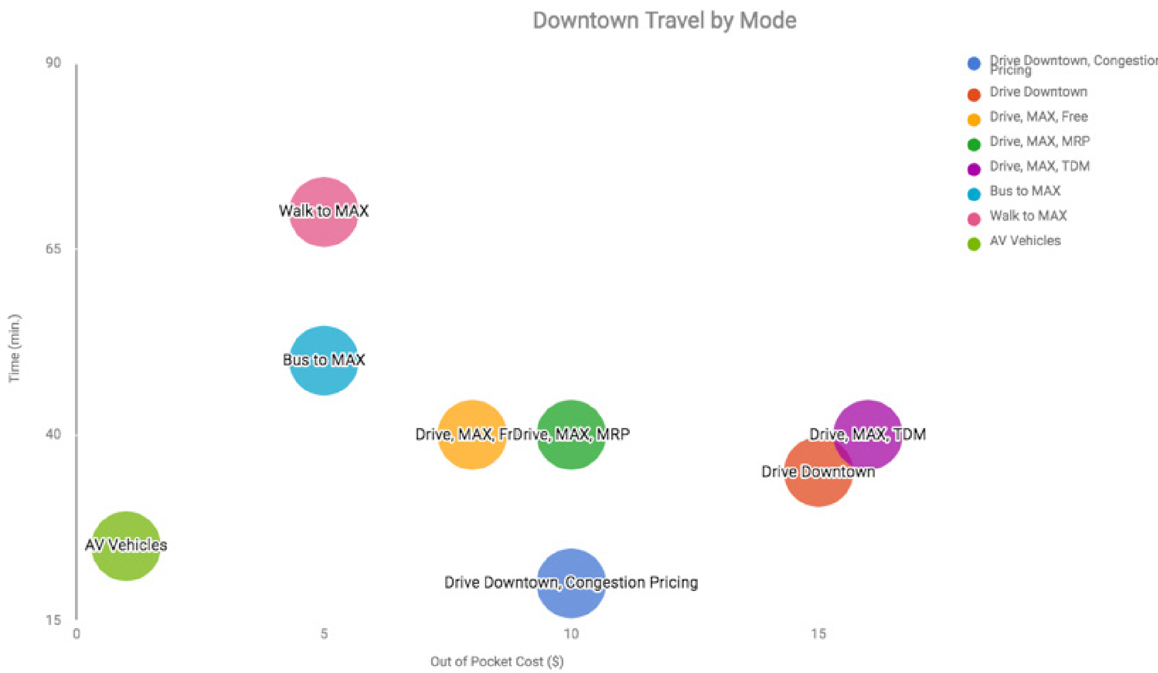


*Figure 4: Time and cost tradeoffs of Downtown Portland commute modes*

# Behavioral considerations

Considering the different ways that travel demand management can help or hinder project goals. Park and Ride facilities have been shown to effectively increase transit ridership, reduce travel costs for users, and provide benefits to the community at large (Rutherford and Chris, 1986). In Chicago, Park and Rides add an estimated 0.6 to 2.2 transit boardings per parking stall provided (Merriman, 1998). However, making parking too easy can encourage people to drive when they could be arriving by another mode (Habib, 2013). Managing parking demand while not discouraging use can be done with a number of strategies, including parking fees, station design, encouraging other modes, and transit-oriented development. Despite the wealth of research on parking and transit, literature focusing specifically on Park and Ride facilities is relatively scarce (Duncan, 2013).

This report summarizes research relevant to the proposed Southwest Corridor facilities in Tigard. However, external validity may be limited as the parking facility, transit system, and local contexts are all unique. Factors like local urban form, existing infrastructure for other transportation modes, and demographics will all impact the applicability of the reported findings and studies.

## Fees

Parking fees allow transit providers to regulate demand, influence other mode choices, and recover some of the cost of construction and operation (Jacobson, 2016). Much has been written about the challenges of subsidized parking (Shoup, 2011). Methods have been developed to actively manage occupancy for on-street parking with demand-based pricing in San Francisco and Los Angeles (Pierce, 2013; Ghent, 2014). The context of these strategies—

short-term, urban, and on-street—is different than a suburban Park and Ride facility. However, the goal of optimizing occupancy is the same. Uncertainty of parking availability is a significant factor in a driver's decision to use Park and Ride, and officials at Chicago's Metra see potential users get discouraged when lots are over 85% full (Chen, 2015). Parking can spill over into the surrounding neighborhoods when a Park and Ride facility is over 95% full. For these reasons, mid-line transit stations should be designed for 80% occupancy and end-of-line stations 75% (Coffel, 2012).

Setting the ideal parking price is important to manage demand. To start, Coffel (2012) recommends keeping the total price of parking and transit below the price to park in the central business district. Users of San Francisco's BART system are willing to pay for a secure parking space and to pay even more for a reserved parking space (Shirgaokar, 2005). Reserved parking spaces encourage drivers to continue using transit. Sound Transit in Seattle has reduced fares for high occupancy vehicles and for vehicles that arrive later in the morning after the commuter rush (Sound Transit, 2015). Strasbourg, France, charges for its Park and Ride facilities, but allows free parking for holders of monthly transit passes. Both Strasbourg and Amsterdam, the Netherlands, include transit passes for multiple people with their parking fees to further incentivize transit use (Kodransky, 2011).

Payments should be fast and easy for drivers to process; smart cards or other quick transaction technologies may encourage more transit users (Shaheen, 2005). When enforced, residential permits and metered parking in the surrounding area are necessary for managing spillover (Kodransky, 2011). Enforcement is necessary to ensure compliance with parking fees and intended facility use. Enforcement techniques include on-site staff, cameras, and license plate readers (Cherrington, 2017).

Equitable impacts of new parking fees should be considered. Sound Transit analyzed its parking permit program for Park and Ride facilities around the Seattle Metro area (Sound Transit, 2015). It found that the permits did not create "disparate negative impacts to minority riders" nor a "disproportionate burden on low income riders." However, it did recommend using strategies to help balance the disparate distribution of benefits, including:

- Reduced permit prices for lower income users
- Reserving some spaces for non-permit users
- Free parking later in the morning (benefiting those with non-traditional work schedules)
- Reduced or free permits for high occupancy vehicles (HOVs)

## Design

Shirgaokar and Deakin (2005) found that BART Park and Ride users preferred stations that are well lit and have good visibility; have nearby amenities like water, toilets, and snacks; and have real time availability monitoring. A separate investigation into the feasibility of smart parking technologies at a BART Park and Ride station found that a lack of available parking likely reduces transit ridership, and that real time information about parking availability and transit arrivals would likely increase transit ridership (Shaheen, 2005).

Dunphy (2003) provides four guidelines for Park and Ride provision:

- Position parking away from the platform. This is high value real estate that can be used for other development.
- Share the parking with other businesses or social centers that will use it during off-peak commuting hours.
- Build a structure for better use of the land and charge for parking to offset the additional construction cost.
- Wrap the perimeter with mixed uses to hide the parking inside.

Kiss-and-ride, or rider drop-off and pick up, can also alleviate parking demand. Station design can have a big impact on user adoption of kiss-and-ride. We recommend providing easy access curb space and it is recommended to provide a separate entry for drop-offs and pick ups that avoids the parking lot entirely, to minimize congestion. Convenient short-term parking (15, 30, or even 60 minutes) is also helpful and should be in a priority area. Kiss-and-ride must have clear signage that encourages use as an alternative to parking and is easy for first time or occasional riders to navigate (Schank, 2002).

## Other Modes

Arriving to transit by other modes can reduce the demand for automobile parking. Parking for bicycles, motorcycles, vanpools, and carpools should be provided and located in priority locations because they are more space efficient than automobiles (Coffel, 2012). These modes may be encouraged with lower parking prices as well, similar to Sound Transit's lower rates for HOVs.

Bicycle infrastructure can significantly lower parking demand with relatively little space and money. BART Park and Ride facilities combined bicycle investments with automobile parking fees and traffic calming measures outside the Park and Ride. They saw a 69% increase of people bicycling to their stations in the ten years after these measures were implemented (Cervero, 2013).

## Applications to the Southwest Corridor

Along the Southwest Corridor, there are three pricing data points available to help predict commuting behavior: Portland SmartPark garages, street parking in the City of Portland, and cost of transit (Figure 5).

| Scheme | Pricing | Cost (8 hours) |
|---|---|---|
| SmartPark | Daily | $12-$15 |
| Street Parking | Hourly | $16 |
| TriMet | Varies | $5 |

*Figure 5: Parking pricing across Portland parking options*
*Source: Portland Bureau of Transportation*

Commuting by car emerges as a substantially more costly endeavor, even without taking into account the highway congestion pricing set to be introduced in the next decade. However, the increased collection and distribution costs and travel time of riding transit may still deter some riders.

Another important consideration is that people are more positive about and willing to pay for parking if the revenue is used for their direct benefit (Shoup, 2011). The Portland Bureau of Transportation is piloting a permit program in Northwest Portland that puts the bulk of permit fees toward investments in pedestrian infrastructure and subsidies for alternative transportation modes. The City of Tigard could consider implementing a similar program in its own parking policies.

Finally, the technological possibilities for parking management are continually expanding. For any strategy that Tigard and TriMet adopt, there is probably a technology that can help with implementation. A list of potential technologies can be found in Appendix A. The technology team recommends that solutions include a centralized and integrated website and app, provide real-time parking information, and use a single vendor for mobile payments. More importantly, the team recommends that the strategy drive the use of technology, not vice versa.

## Scenarios

This report will consider three scenarios separately: a no-build scenario where parking demand is managed without a new Park and Ride facility; a build scenario where the Park and Ride facility functions as existing Park and Rides currently do; and a third scenario in which the facility incorporates travel demand management (TDM) strategies from the start. For each scenario, we also include details of its interactions of these scenarios with TDM in the City of Tigard.

| | Tigard TDM | No Tigard TDM |
|---|---|---|
| No-Build | 1.a | 1.b |
| Traditional Build | 2.a | 2.b |
| Nontrad: Uniform Pricing | 3.a.i | 3.b.i |
| Nontrad: Transit-Only | 3.a.ii | 3.b.ii |
| Nontrad: Hybrid | 3.a.iii | 3.b.iii |

*Figure 6: Scenarios*

### Parking Management (TDM) in Tigard

Policies that reduce or redirect demand for Tigard parking spots could take a variety of forms. Demand reduction could be achieved by the following methods:

- The current two-hour meters could be more rigorously enforced.
- Street parking could be priced.
- A permitting program could ensure that employees are able to find parking near work.
- The underused lots show potential for more shared parking agreements.

Other programs could improve access by other modes:

- Improved wayfinding and pedestrian connectivity
- Bike share
- Shuttles and circulators
- Improved transit connections and timing
- Bicycle safety and infrastructure
- Improved bicycle storage
- Discount programs at local merchants for non-auto arrivals
- Public information and training

#### Scenario 1.a: No-Build, Tigard TDM

The rationale for a no-build scenario is that AVs seem likely to enter the Oregon market before the Southwest Corridor MAX line is constructed. This could alter the calculus for commuters and result in a lower demand for parking than TriMet has forecasted.

This scenario would require TDM strategies in Tigard. Stakeholders in Tigard would need to craft more shared parking agreements between organizations, and existing street parking would need to be priced to keep demand at manageable levels.

There is significant risk in spending the money to build a parking structure and then seeing demand for parking drop as driving habits change. Although parking garages are often built with low 10-foot ceilings, we recommend that any build option include 12-foot ceilings to allow a larger variety of purposes should TriMet find a better use for the structure in future. High ceilings would also leave room for a mechanical car stacking system.

### Scenario 1.b: No-Build, No Tigard TDM

Parking in this scenario would likely become unworkable by 2035; demand would exceed capacity, discouraging transit use and creating parking conflicts in Tigard. For these reasons, Scenario 1.b is not recommended.

### Scenario 2.a: Traditional Park and Ride, Tigard TDM

TriMet has historically provided free parking at its Park and Ride facilities, enabling commuters to pay solely for their transit fare. Although intended for transit users, these facilities are, practically speaking, open to any vehicle.

Many users would likely switch to using the Park and Ride if the city of Tigard enhanced its TDM. Depending on the extent of demand, this may be positive to increase utilization, or burdensome if people who would otherwise park downtown are taking up spots for transit users.

### Scenario 2.b: Traditional Park and Ride, no Tigard TDM

At current occupancy rates, there would likely be no change in Tigard. However, if the TriMet demand forecast proves accurate, the gap between Park and Ride capacity and demand would be 440 spaces and transit-related parking would spill over into existing Tigard spaces.

### Scenario 3: Nontraditional Park and Ride

In this set of scenarios, the Park and Ride would be constructed with an eye towards charging for usage or limiting its usage to transit users. The following scenarios explore these possibilities alongside TDM strategies, or lack thereof, in Tigard.

### Scenario 3.a.i: Uniform pricing, Tigard TDM

In this scenario, TriMet could charge for parking for all users. This facility would behave similarly to parking garages throughout the region: users would approach the gate, take a ticket, park, and pay either before or while leaving later in the day.

The benefit of this solution is that it provides access to downtown Tigard shoppers and employees while allowing some cost recovery for TriMet. The downside is that it would limit access and raise costs for transit users. Given TriMet projections, allowing equal access to non-transit users may severely limit the facility’s capability as a Park and Ride.

### Scenario 3.b.i: Uniform pricing, no Tigard TDM

In this scenario, there is likely to be very little spillover from Tigard into the Park and Ride, because it will not be competitive with parking downtown. This would help keep it available to transit riders while also providing parking to Tigard shoppers and employees as necessary.

### Scenario 3.a.ii: Transit Use Only, Tigard TDM

The facility could be reserved for transit users. This would require a gating system with Hop Pass integration so transit users could be identified. TriMet could decide whether to charge these users a fee for using the facility, allow them to use the card simply for identification, or to initiate their transit trip. After parking, users would use the transit system as normal.

The benefit of this solution is that it guarantees access to transit users. The downside is that it would likely result in underutilization on weekends and evenings.

### Scenario 3.b.ii: Transit Use Only, no Tigard TDM

There would be no likely change in use of the Park and Ride without Tigard TDM, but it is possible that there would be occasional peak-hour spillover into Tigard. Existing and projected problems with demand exceeding capacity in downtown Tigard would persist.

### Scenario 3.a.iii: Hybrid facility, Tigard TDM

Finally, TriMet could implement a hybrid facility with priority to transit users and secondary use for visitors to Downtown Tigard who wish to pay for parking.

This alternative requires technology to enable dynamic use of the facility. There are numerous options. During the morning rush hour, the facility would be reserved for transit users. If, by a specified time, the facility is at capacity, it remains restricted to transit users only. Alternatively, if the facility is under some capacity threshold, for example 85%, the facility can open to other users like a standard parking garage. The specifics of this interaction, whether users take a ticket to enter, pay at the exit, etc., are implementation details.

As with other solutions, Hop Fastpass could be integrated to ensure only transit users are utilizing the facility during the restricted time. If fare was taken at the garage entrance, it would prevent anyone with a Hop card from parking without actually using the transit system.

### Scenario 3.b.iii: Hybrid facility, no Tigard TDM

The same comments apply as with Scenario 1.a.iii; the difference in this scenario would be that there would be less utilization of the Park and Ride by Downtown Tigard users because it would cost less to park in street and open lot parking.

## Evaluation

The comparison of projected demand and current supply for transit parking makes it clear that the no-build scenario is not feasible. It also suggests that demand for parking will exceed the capacity of the Park and Ride without additional TDM measures.

Figure 7, below, illustrates the projected relationship between supply and demand. It shows sufficient parking spaces available with a Park and Ride when the line first opens, but insufficient parking by the year 2035.

| | **WES Demand** | **WES Supply** | **Tigard No TDM Demand** | **Tigard TDM Demand** | **Tigard Supply** | **Net Parking Demand (Tigard No TDM)** | **Net Parking Demand (Tigard TDM)** |
|---|---|---|---|---|---|---|---|
| **Base Case (2018)** | 103 | 103 | 916 | NA | 1435 | 519 | NA |
| | | | | | | | |
| **Future 2025 (Opening year of MAX)** | | | | | | | |
| | MAX+WES Demand | MAX+WES Supply | Tigard No TDM Demand | Tigard TDM Demand | Tigard Supply | Net Parking Supply (No Tigard TDM) | Net Parking Supply (Tigard TDM) |
| No-Build (1.a) | 560.5 | 103 | 1205.4 | 1081 | 1435 | -227.8 | -103.5 |
| Traditional Build (2.a) | 560.5 | 403 | 1205.4 | 1081 | 1435 | 72.2 | 196.5 |
| Nontrad: Uniform Pricing (3.a/b.i) | 504.4 | 403 | 1205.4 | 1081 | 1435 | 128.2 | 252.6 |
| Nontrad: Transit-Only (3.a/b.ii) | 560.5 | 403 | 1205.4 | 1081 | 1435 | 72.2 | 196.5 |
| Nontrad: Hybrid (3.a/b.iii) | 504.4 | 403 | 1205.4 | 1081 | 1435 | 128.2 | 252.6 |
| | | | | | | | |
| **Future 2035 (Metro projection year)** | | | | | | | |
| | MAX+WES Demand | MAX+WES Supply | Tigard No TDM Demand | Tigard TDM Demand | Tigard Supply | Net Parking Supply (No Tigard TDM) | Net Parking Supply (Tigard TDM) |
| No-Build (1.a) | 843 | 103 | 1784.3 | 41% | 1435 | -1089.3 | Depends on TDM |
| Traditional Build (2.a) | 843 | 403 | 1784.3 | 30% | 1435 | -789.3 | Depends on TDM |
| Nontrad: Uniform Pricing (3.a/b.i) | 759 | 403 | 1784.3 | 28% | 1435 | -705 | Depends on TDM |
| Nontrad: Transit-Only (3.a/b.ii) | 843 | 403 | 1784.3 | 30% | 1435 | -789.3 | Depends on TDM |
| Nontrad: Hybrid (3.a/b.iii) | 759 | 403 | 1784.3 | 28% | 1435 | -705 | Depends on TDM |

*Figure 7: Parking Demand and Supply*

Meeting demand for parking is just one measure of the different alternatives identified. For comparison's sake, four different evaluation metrics have been identified based on goals shared during interviews and engagement with TriMet, Metro, and city of Tigard staff, including a walkable downtown with dense mixed-use development and a transit-based commuting future. Each solution has been given a binary score to reflect its relative ability to fulfill each attribute. "0" means that the scenario is relatively unlikely to meet this goal, and "1" means that it is relatively likely.

| Scenario | Downtown balance | TriMet Consistency | Guaranteed rider parking | Demand reduction |
|---|---|---|---|---|
| 1.a | 1 | N/A | 0 | 0 |
| 1.b | 0 | N/A | 0 | 0 |
| **2.a** | 1 | 1 | 0 | 1 |
| 2.b | 0 | 1 | 1 | 0 |
| 3.a.i | 1 | 0 | 0 | 1 |
| 3.b.i | 0 | 0 | 0 | 1 |
| 3.a.ii | 1 | 1 | 1 | 1 |
| 3.b.ii | 0 | 1 | 1 | 0 |
| 3.a.iii | 1 | 0 | 1 | 1 |
| 3.b.iii | 0 | 0 | 1 | 1 |

*Figure 8: Evaluation Matrix*

By this measure, the nontraditional Park and Ride restricted to transit users, combined with Tigard TDM, meets all four goals to some degree. It is not completely consistent with other Park and Rides in that it has barriers for non-transit users, but this policy is one that could be adopted at other Park and Rides as the HOP card becomes more widespread.

# Conclusion

On the basis of stakeholder engagement and the analysis presented here, we recommend the following:

**Accessibility**

- Equity systemwide and throughout Tigard should be addressed with any new parking policy, with an emphasis placed on outreach in disadvantaged communities.
- In order to ensure all users are able to get to the station safely, the parking policy should include specific language regarding multi-modal and ADA compatible facilities.

**Parking Policies**

- The City of Tigard and TriMet should work together to develop a pay structure for parking that balances demand for the Southwest Corridor MAX line and the demand of businesses and customers in all areas of downtown Tigard.
- This will likely require the City of Tigard to price or in some way limit its parking availability, as demand far outstrips supply in all of our scenarios.
- Analysis of parking facility alternatives should include usage of shared parking among TriMet, downtown Tigard businesses, customers, and nearby residents.

We have presented a number of build alternatives and possible pay structures. By any measure, it appears that both building a Park & Ride and employing TDM strategies will be necessary to absorb forecast demand. However, much will depend on the feasibility of implementation, the evolution of the Southwest Corridor project, and negotiation between the primary stakeholders.

# Appendix A: Technologies

This is a list of technologies that may be useful in implementing TDM in downtown Tigard or in TriMet's Park and Ride. It is divided into payment meters, mobile phone apps, and occupancy sensors.

**Variably priced parking meters**

- UCLA Case Study: Charges variable prices throughout the day; remotely updated without touching the meters
- IPS Smart Meters: http://www.ipsgroupinc.com/
    - Customers can pay with cash, card, mobile applications, NFC/contactless and Bluetooth Low Energy (BLE)Dynamic rate structures
    - Integrated with PARK SMART mobile app
    - City has access to parking trends and real-time and historical occupancy data
    - Digital screens communicate messages to users (i.e. "No Parking – Street Sweeping," which can save drivers from receiving a citation when parking is prohibited or "Free Parking")
- Solar meters: https://www.portlandoregon.gov/brfs/article/157993
    - 10-watt solar panel that recharges the meter's sealed lead acid batteries
    - Rechargeable, last 5-7 years
    - Cost: As of May 2010, each SmartMeter costs $7,500
- Parking meter cards: https://www.columbus.gov/publicservice/parking/Parking-Meter-Card/
- Occupancy Sensors: sensors placed in every curb space, sense changes in the earth's magnetic field when a ton of metal is parked above
- Data on occupancy rates allow the City to adjust curb parking prices in response to the occupancy rate
    - https://www.accessmagazine.org/fall-2013/sfpark-pricing-parking-demand/

**Apps**

Parking Kitty: https://www.parkingkitty.com/

- Consistent with what the City of Portland uses.
- Easily pay for parking using your mobile phone, get reminders when your session is about to expire, extend time if you need a few extra minutes at your destination
- Performance prices become more acceptable with making the payment is fast and convenient

Parkwhiz: https://www.parkwhiz.com/how-it-works/

- Allows you to shop for, reserve and pre-pay for a parking spot near your destination.

ParkingPanda: https://www.parkingpanda.com/how-it-works

- Compare prices at parking lots and garages
- Find, reserve, and pay for on-demand parking

The Path to Park: http://nelsonnygaard.com/wp-content/uploads/2014/11/AustinParkingStrategy_web.pdf (page 47)

- Supports ParkingPanda
- On-street guidance pictograms showing high, medium, or low probability of open parking
- On-street "tap-on" feature to get current rates, time limit, restrictions, etc.
- Purchase parking in advance for a city-operated off-street parking facility
- Process mobile payment at parking facilities using the vehicle's license plate as identification
- Provides a mechanism for the city to download the data for offline reporting

Online Parking Resources: An integrated parking website or app that would serve as a primary resource for all parking related matters.

- Example: https://www.denvergov.org/content/denvergov/en/home-page.html

## Real-time parking information/Wireless Sensor Networks (WSN) and Reservation-based Smart Parking System (RSPS):

**Popular technologies**: Sensors installed in the pavement, radar and/or magnetic sensors installed in overhead traffic architecture (streetlamps), and live video cameras installed in overhead traffic architecture.

**Examples**:

- Siemens: Intelligent Parking Solutions
    - A GPS-guided parking system that informs drivers on open spaces in real time.
    - Uses radar sensors that can be installed in lampposts, stop lights, etc.
    - Use of radar means that there is less invasion of privacy.
    - System can make suggestions for nearby public transit options and detect illegally parked cars (for traffic patrols).
    - System also provides parking passes.
    - **Distinctive quality**: App will guide drivers to areas where there is a higher potential for open spaces before indicating an open space.
- CAME Parkare Optima System
    - Best used in parking structures and lots (VIDEO)
    - Overhead volumetric presence/ultrasound LED sensors light up when a car fills the space below. Signal is sent to central system, which informs drivers of levels or lots with more spaces via overhead LED signs.
    - Example can be seen at PDX parking structures.
    - **Distinctive quality:** Sensors can also pick up temperature (for fire safety) and reduce electricity bills by only turning on the lights when someone is passing by.
- Smart Parkings In-Ground Vehicle Detection Sensors
    - Battery-powered infrared and magnetic sensors drilled into the ground send info to communications devices installed on lampposts. (VIDEO)
    - Real-time sensors communicate lengths of stay and payment confirmation to central module. Data can be used in future planning for both on- and off-street parking.
    - Can be used with pay stations, pay-by-phone, attendant handheld devices, and SmartApp. App allows users to pay for a specific time and add time remotely.
    - **Distinctive Quality:** Easy to install and integrate into an existing parking space.
- CloudParc
    - Multiple cameras installed on street lamps and other infrastructure identify filled spaces using artificial intelligence. (VIDEO)
    - Capable of dynamic space pricing.
    - Allows users to find nearest available spot, set time, and pay through Apps.
    - CloudPark cameras also report on street traffic and provide incident data .
    - **Distinctive Quality:** Ability to read license plates allows for remote ticketing and
    - security surveillance.

# Appendix B: Annotated Bibliography

Bos, Ilona, Eric Molin, Harry Timmermans, and Rob van der Heijden. 2003. "Cognition and Relative Importance Underlying Consumer Valuation of Park and Ride Facilities." Transportation Research Record: Journal of the Transportation Research Board 1835 (1):121–27. https://doi.org/10.3141/1835-15.

Studies the relative importance of Park and Ride features based on stated preference surveys of Dutch drivers.

Results show a strong desire for frequency and reliability of transit, a minimum number of transfers, and confidence that there will be an available parking spot. Other lesser important factors include the overall cost of the trip and the time needed to find a spot.

Cervero, Robert, Benjamin Caldwell, and Jesus Cuellar. 2013. "'Build It and They Will Come'." Journal Of Public Transportation 16 (4):83–105.

Investigates investment in bicycle facilities at BART Park and Ride locations in the San Francisco Bay area.They provided bike parking, secure lockers, and repair facilities. They also began to charge for auto parking and implemented traffic calming measures. After these measures were started, they saw a 69% increase of cycling to transit between 1998 and 2008.

Cherrington, Linda K., Jonathan Brooks, James Cardenas, Zachary Elgart, Luis David Galicia, Todd Hansen, Kristi Miller, et al. 2017. "Decision-Making Toolbox to Plan and Manage Park and Ride Facilities for Public Transportation: Research Report and Transit Agency Case Studies." Washington, DC. https://doi.org/10.17226/24820.

Exhaustive guide for Park and Ride facilities. Discusses costs and benefits for facility options based on multiple case studies from a variety of transit agencies.

Chen, Chunmei, Jianhong (Cecilia) Xia, Brett Smith, Doina Olaru, John Taplin, and Renlong Han. 2015. "Influence of Parking on Train Station Choice under Uncertainty for Park and Ride Users." Procedia Manufacturing 3 (Ahfe):5126–33. https://doi.org/10.1016/j.promfg.2015.07.537.

Developed a preference model for Park and Ride facilities based on parking price, uncertainty of parking availability, and other factors in Perth, Australia's rail transit system. Found that drivers were risk averse and preferred Park and Ride stations that were most likely to have available parking.

Coffel, Kathryn, Herbert S. Levinson, Paul Ryus, Joseph L. Schofer, Conor Semler, Jamie Parks, David Sampson, and Carol Kachadoorian. 2012. "Guidelines for Providing Access to Public Transportation Stations." Washington, DC. https://doi.org/10.17226/14614.

Provides extensive and detailed guidelines for transit station access design based on research and case studies. Chapter 10 is dedicated to automobile access and Park and Ride. Recommends providing priority parking for motorbikes (because they require relatively little space), convenient kiss-and-ride access to reduce parking demands, and that the total transit price (including parking and fare) to be less than the cost to park in the central business district. Also provides detailed guidelines for transit oriented development.

Duncan, Michael. 2010. "To Park or to Develop: Trade-off in Rail Transit Passenger Demand." Journal of Planning Education and Research 30 (2):162–81. https://doi.org/10.1177/0739456X10385935.

Compares ridership from Park and Ride facilities versus TOD for the San Francisco Bay area BART system. TOD requires a very high density to approximate the same number of transit trips as a Park and Ride facility. However, TOD has other benefits that may outweigh the Park and Ride. A combination of TOD and reduced parking could be a better balanced solution: each housing unit will offset the ridership of one parking space.

Duncan, Michael, and Robert K. Christensen. 2013. "An Analysis of Park and Ride Provision at Light Rail Stations across the US." Transport Policy 25. Elsevier:148–57. https://doi.org/10.1016/j.tranpol.2012.11.014.

Provision of Park and Ride facilities are considered at 17 municipalities across the country. Compares Park and Ride with TOD and identifies factors that could influence provision of one over the other.

Dunphy, Robert, Deborah Myerson, and Michael Pawlukiewicz. 2003. "Successful Development Around Transit." 10-11. Washington, DC.

A transit design guide for TOD. A brief section on parking outlines four principles for Park and Ride design: keep parking away from the platform (a 5 to 7 min walk), share the parking with adjacent businesses/centers, use a structure and charge parking fees to pay for it, wrap the parking structure with mixed uses.

Ghent, Peer. 2014. "Optimizing Performance Objectives for Congestion Pricing Parking Projects," no. 2530:101–5. https://doi.org/10.3141/2530-12.

Evaluates the effectiveness of LA Express Park, Los Angeles' demand-based pricing strategy based on SFpark in San Francisco. Prices vary based on time of day and location. Adjustments of up to $1/hr were made monthly with a minimum rate of $0.50/hr (to cover the cost of operating the program). The program has shown to be effective at keeping parking occupancy between the target 70-90%. Communication to the public and a revenue-neutral design made it seem fair to users. Argues that occupancy optimization is more important than revenue optimization. Saw an increase in revenue from upgrading to more reliable and secure parking meters.

Habib, Khandker, Mohamed Mahmoud, and Jesse Coleman. 2013. "Effect of Parking Charges at Transit Stations on Park and Ride Mode Choice." Transportation Research Record: Journal of the Transportation Research Board 2351:163–70. https://doi.org/10.3141/2351-18

Investigates the effect of mode choice as parking rates are increased at Vancouver, BC, region Park and Ride facilities. Data are based on a stated preference survey given to Park and Ride users. Results show two groups of responses: riders who would continue parking even with higher costs and riders who would stop using the parking facility to avoid the higher costs. Those who choose to avoid are more likely to take transit for the entire trip than to drive.

Jacobson, Lisa, and Rachel R. Weinberger. 2016. "Transit Supportive Parking Policies and Programs." Washington, DC. https://doi.org/10.17226/23493.

A comprehensive guide to parking and transit. Thorough overview of station parking considerations and a strong source for additional research.

Kepaptsoglou, Konstantinos, Matthew G Karlaftis, and Zongzhi Li. 2010. "Optimizing Pricing Policies in Park and Ride Facilities: A Model and Decision Support System with Application." Journal of Transportation Systems Engineering and Information Technology 10 (5):53–65. https://doi.org/10.1016/S1570-6672(09)60063-5.

Develops a pricing model to optimize revenue for a Park and Ride rapid transit station near Athens, Greece. The facility is in a densely developed area with a number of commercial activities and civil services with limited parking availability. The parking is shared with transit users and visitors to the area. Sharing the parking with other uses provides the benefits of efficient use of limited space, improved security, and the potential for transit revenue while maintaining reduced parking rates for transit riders. However, shared use can exacerbate congestion in the neighborhood, complicate the parking fee strategy, and intensify peak demand. The pricing model developed charges non-transit users significantly more than transit users during weekdays. On weekends, all parking users are charged the same lower rate to encourage trips to the area. Per hour costs to park increase over time to encourage turnover.

Kilcoyne, Ron, Aspet Davidian, Christian Bauer, Christof Spieler, Crystal Benjamin, Daniel Rowe, Doug Moore, et al. 2015. “Transit Parking 101.” Washington, DC. http://www.apta.com/resources/standards/Documents/APTA SUDS-UD-RP-008-15.pdf.

Describes best practices for planning and operating transit parking facilities. Suggests different pricing possibilities, including charging extra for priority parking spaces or charging less for HOVs, charging more during the peak morning rush, and using technology to process payment and share occupancy information. Acknowledges the need for enforcement; a gated entry is simple but slows entry and exiting. It also considers strategies for working with laws that restrict parking fees by defining the program as a transit access strategy.

Kodransky & Hermann, G., M. 2011. “Europe’s Parking U-Turn: From Accommodation to Regulation.” Institute for Transportation and Development Policy.

Broad report of progressive parking policies in ten European cities. Documents how residential parking permits have been effective for managing spillover from parking charges in central business districts in multiple cities. Strasbourg, France, has focused on Park and Ride as a means to reduce the number of automobiles in the central city. They have found that 90% of their Park and Ride users were formerly exclusive car drivers. All of their facilities charge the same parking rate: a flat day fee -- which includes a full day transit pass for up to seven people -- or free parking for monthly transit pass holders. Munich, Germany, charges more for Park and Ride facilities that are closer to the central city. Amsterdam, the Netherlands, charges a flat day fee which includes transit passes for two people. Their Park and Ride facilities have clear wayfinding signage including integrated dynamic parking systems that guide drivers to open stalls. They also have a park-and-bike program where drivers can use a city-owned bike instead of transit.

Merriman, David. 1998. “How Many Parking Spaces Does It Take to Create One Additional Transit Passenger?” *Regional Science and Urban Economics* 28 (5):565–84. https://doi.org/10.1016/S0166-0462(98)00018-0.

Reports the effect of free Park and Ride provision on ridership on the Metra commuter rail system in the Chicago area. Depending on specific context and other factors, each parking space was found to result in 0.6 to 2.2 additional rail boardings at the station. References another study that had found each additional parking space at a station reduces boarding by 0.25 persons at another nearby station. This reduces the net additional ridership, but the increase is still positive.

Pierce, Gregory, and Donald Shoup. 2013. “SFpark: Parking by Demand.” Access 43 (Fall):20–28.

A case study of SFpark, San Francisco’s dynamic parking pricing plan. The cost to park on-street varies by block and time of day. Prices are based on observed occupancy with a target of 60-80% to reduce searching for parking. Prices are adjusted every two months.

Rutherford, G. Scott, and Chris A. Wellander. 1986. “Cost Effectiveness of Park and Ride Lots in the Puget Sound Area.pdf.” Seattle, Washington. https://www.wsdot.wa.gov/research/reports/fullreports/094.1.pdf.

Evaluates the costs and benefits of Park and Ride in the Seattle Metro region. These are quantified and compared for the user, the community at large, and the public agencies involved. The report finds that Park and Ride trips save the user money overall despite being slightly longer than driving alone. The investments made by agencies were not made up for by other system savings, however they are outweighed by user savings.

Park and Rides have increased transit ridership and are less costly to provide than other trips. They reduced traffic volumes, collisions, emissions, and energy consumption.

Schank, J L. 2002. “Encouraging Kiss-and-Ride at Commuter Railroad Stations.” Transit: Intermodal Facilities, Rail Transit, Commuter Rail, Light Rail Transit, Maintenance, and Ferry Transportation, no. 2:7–14. isi:000181144200002.

Studies the Park and Ride stations along the Long Island Rail Road and Metro North Railroad commuter lines serving New York City. The utilization of parking and dropping off (kiss-and-ride) were considered, and factors that influenced these uses were evaluated. Recommends five strategies to increase kiss-and-ride use: 1. Market kiss-and-ride as an attractive alternative to Park and Ride and include incentives to get people excited. 2. Provide plenty of short-term parking to ease picking-up and dropping-off with 15, 30, or even 60 minute zones. These should be in priority locations to encourage use. 3. Provide separate, easy access for kiss-and-ride that avoids the parking lot entirely. This is one of the most effective means to encourage use. 4. Provide plenty of curbside space for drop-offs and pick-ups. 5. Use signage that makes kiss-and-ride very easy to find, especially important for first time and occasional users, than that makes kiss-and-ride appear to be a more attractive alternative to parking.

Shaheen, Susan, Caroline J. Rodier, and Charlene Kemmerer. 2005. “Smart Parking Management Field Test: A Bay Area Rapid Transit (BART) District Parking Demonstration Final Report.” Transportation Research Record 2038. https://doi.org/10.3141/2038-08.

Investigates smart parking options and feasibility for a BART Park and Ride facility. Findings include: a lack of parking at suburban transit stations may hinder ridership, fast payment technology real-time parking information may have a positive impact on transit ridership.Shirgaokar, Manish, and Elizabeth Deakin. 2005. “Study of Park and Ride Facilities and Their Use in the San Francisco Bay Area of California.” Transportation Research Record: Journal of the Transportation Research Board 1927 (1927):46–54. https://doi.org/10.3141/1927-06.

A broad assessment of San Francisco Bay area Park and Ride facilities. Researchers inspected facilities, surveyed users, and conducted focus groups. They found a preference for facilities that are clean, safe, well lit, and comfortable to wait. Shelter and access to water, toilets, and vendors are important to respondents. Focus group participants were willing to pay $1-$2/day for secure parking and $3-$4 for reserved parking.

Shoup, Donald C. 2011. The High Cost of Free Parking. American Planning Association.

Parking provisions have significant negative impacts to the urban form, environment, and society. Subsidizing parking by requiring parking in new developments or providing low- or no-cost on-street parking shifts costs from the automobile users to the general public and encourages automobile use. Argues for alternatives that are more economically equitable — like pricing on-street parking based on demand — and environmentally sustainable — like subsidizing transit passes instead of parking.

Sound Transit. 2015. “Title VI Fare Equity Analysis Definitions & Data Sources.”

Sound Transit’s Title VI equity analysis for parking permits. The analysis did not find disparate impacts to minority riders nor a disproportionate burden on low income riders. It did, however, find a disparity on the receipt of benefits for minority and low income riders. These parking permits require a credit card to acquire, which many low income riders do not have access to. The report recommends strategies to minimize or mitigate the negative impacts for these riders. Strategies include: low cost or free HOV permits, free parking later in the morning for people with non-traditional work schedules (often low income riders), reserving some of the parking spaces for people without permits, and low income pricing. Recommends marketing the availability of these options to the public.

Willson, Richard, and Val Menotti. “Commuter Parking Versus Transit-Oriented Development: Evaluation Methodology.” *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2021, 2007, pp. 118–125., doi:10.3141/2021-14.

Creates a model to analyze the effects of implementing transit-oriented development at two BART transit commuter stations. These stations already have parking. The model evaluates developing the stations with moderate density and moderate parking strategies versus high density and aggressive parking strategies. The model predicts more ridership and higher revenue with high density and aggressive parking strategies.