APPENDIX G

TRANSPORTATION MEMOS

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Transportation and Parking

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Introduction

This report provides analysis and documentation of the transportation considerations and campus data that will be used to inform future transportation infrastructure improvements and bond planning associated with the Portland Community Colleges (PCC) Facilities Plan.

In light of the COVID-19 viral pandemic, several of the initial analysis items in the work scope for Phase II of the Vision Plan are infeasible due to the closure of the school facilities and a temporary inability to evaluate campus field conditions under normal operating conditions. Thus, this phase has been reorganized to leverage existing data and reports in the interim, with the remaining work shifted to, at earliest, Fall of 2021.

Existing information that has been collected, synthesized, and presented includes the following transportation topics:

- Parking Demand Rates and Deficiencies
- Collision History and Safety Assessment
- Transportation Demand Management (TDM) Recommendations

Several project elements are being held until PCC can safely return to a reasonable level of campus activity and be studied further. The elements of Phase II that have been shifted to Fall 2021 include:

- Network Deficiencies and Opportunities
- Campus Shuttle Circulation & Microtransit Technology
- Campus Trip Generation Rates
    - A "big data" approach will be employed to understand trip generation and modal split characteristics specific to each campus. The benefit of this approach will be to understand travel demand without the influence of COVID-19 and to make informed decisions regarding trip generation for vehicles, bicycles, and pedestrians during different days of the week, terms of the year, and changes between academic years. A supplemental document focusing on trip generation will be provided following this planning document.

The subject of future travel and new mobility is presently in a state of tremendous flux. Internal operations and programming at PCC are shifting toward distance learning or hybrid learning in some instances. Online distance learning has been conducted at PCC for years, but the pandemic has accelerated the steady shift toward distance learning and is expected to be an option considered for parts of the PCC curriculum in the future. This disruption in the conventional campus operations day-to-day is expected to have several outcomes. The extent to which this disruption is realized is only speculative at the time of this report. The anticipated reopening of the school campuses in the Fall of 2021 will provide a basepoint of the future transportation demands at the PCC Campuses. Potential outcomes and the metrics for determining future changes are discussed in the Future Travel and New Mobility section.

Parking

PCC is characterized as a local commuter college system with a diverse student body. Many of PCC's students are older, have jobs, families, and commitments outside their educational pathway. Others are young high-school graduates bridging the gap to an undergraduate degree or gaining technical training. Many students are part-time and attend classes in conjunction with work and raising families. Most PCC faculty are also part-time and teach at multiple campuses, making several intercampus trips on a given day. All of these factors precipitate the need for a robust parking system.

PCC has a higher instance of alternative transportation participation than what similar institutions report leading to generally lower parking demand rates. The lower vehicle trip generation rates identified yield a lower need for vehicles to be parked, thus a lower parking demand. As campus enrollment expands, balancing the demand for greater parking availability, while expanding PCC's alternative transportation participation, can be considered diametrically opposing goals. For example, parking lots are primary drivers of urban "heat islands", an inefficient use of land, and often an expensive resource to obtain. However, abundant parking is also highly desired by students and staff as an essential service to making higher education possible. Assessing parking supply versus demand and the propensity for utilizing PCC property for other facilities is an ongoing consideration. Existing parking lots are depicted in the Campus Diagrams attached to this document.

Parking at college campuses is almost universally accepted as a highly valuable resource. Within a finite scarcity of this resource, many challenges can arise. Some recent parking challenges faced by PCC include minimum and maximum parking code requirements imposed by local jurisdictions. Restrictions to adding parking availability by local agencies is a common question received by PCC staff. Whereas parking minimums are a deterrent to PCC's promotion of TDM programs. Other challenges experienced at all campuses have been student parking in residential neighborhoods in the vicinity of campuses. Parking enforcement by PCC is an ongoing challenge.

Table 1 displays the current parking inventory at each PCC campus. As shown, the suburban campuses of Rock Creek and Sylvania have a significantly higher parking supply than the urban campuses. Additionally, standard ITE parking rates from the *Parking Generation Manual*1, Junior/Community College (Code 540) are provided for comparison.

Table 1: Parking Inventory Summary

Campus	General	Staff	ADA	Unmarked	Motorcycle	Other (Includes Reserved & Time Restricted)	Total	Spaces per 1000 Building GSF [a]
Cascade	821	39	34	0	0	24	918	2.6
Rock Creek	1,357	177	45	151	6	56	1,792	3.3
Southeast	684[b]	-	19	0	3	28	734	3.4
Sylvania	2,175	416	60	41	0	110	2,802	3.9
ITE Parking Rate for Junior/Community College (LUC 540)								3.71

Source: Lancaster Mobley, February 2015
a = Data provided by Walker Macy
b = Includes adjacent Slavic Church overflow parking
GSF = Gross Square Feet
LUC = Land Use Code

The average parking supply per 1,000 building gross square feet (GSF) for all PCC campuses is 3.3 parking spaces, lower than the ITE parking rate of 3.71 for similar institutions. The Cascade campus has the lowest parking supply at 2.6 spaces per GSF, whereas the Sylvania campus has the highest parking supply at 3.9 spaces per GSF. Considering the urban setting of the Cascade and Southeast campuses, it is noteworthy that Southeast has 30% more parking per GSF than Cascade, despite similar SOV mode splits. This is likely a product of the Southeast Campus students and staff having other influencing life-style factors precipitating greater parking demand.

The ITE standard parking generation rates for junior/community colleges lists an average peak period parking demand of 3.71 parking spaces per 1,000 GSF, with a range of 2.61 to 5.47 parking spaces per GSF. This suggests that PCC campuses are providing an average to lower parking space availability than peer sites studied.

Of the available trip generation and parking generation data amongst the PCC campuses and ITE data rates, there is a high correlation between peak hour trip generation and available parking. This suggests that trip generation is related to the amount of parking that is provided on-site. Higher parking supply generally leads to increase vehicle trip generation.

[1] Institute of Transportation Engineers (ITE), *Parking Generation Manual*, 5th Edition, 2017.

Parking Supply Maximizing Strategies

In conversations with PCC staff during a review of the Phase 1 Facilities Plan recommendations, several recommendations were identified and are presented below. These recommendations intend to maximize the efficacy of existing parking supply and make the most of this valuable resource in the future.

- Expand TDM program. TDM is a means of replacing parking and lowering local jurisdiction parking minimum requirements.
- Tiered parking rates or permits. More desirable parking locations, such as parking areas in closer proximity to campus entrances or parking lot access points could have a higher parking than less desirable parking locations. This increases parking fee revenue without disenfranchising lower income students.
- Explore parking efficiency and maximizing options. In recent years, staff parking area have been expanded to all students outside of normal classroom instruction hours (i.e. evenings and weekends). Generally, much of staff parking areas are considered preferred parking. It is recommended that PCC explore expanding this policy to include more times or consider removing staff parking restrictions entirely. Expanding parking supply to students during greater periods of time can improve utilization and improve access, particularly during high demand times such as finals week and during special events.
    - It should be noted that the staff-only parking permit program at the PCC Southeast Campus was terminated several years ago, but only lasted five years. An effective strategy may be to only enforce restrictions during the first two hours of class time when a majority of staff are arriving and remove restrictions thereafter.
    - This strategy will require staff contract negotiation.
- Make programmatic changes to scheduling (i.e. block schedules or later class times) to reduce peak parking demand time periods.
    - Consider potential increases in online distance learning options and hybrid classroom models.
    - In conjunction with potential distance learning expansion and alternative transportation participation increases, PCC should consider repurposing unused parking lots for other campus purposes.
- Expand EV parking capacity and charging stations.

Reducing parking in conjunction with distance learning expansion is a recommended strategy. Quantifying the parking reduction associated with distance learning will need to be monitored over time to meet the demand while maintaining the high alternative transportation mode split goals. Possible estimation of the effects of distance learning on parking demand can be calculated using the number of students enrolled in a class, the expected mode split rate, and the square footage of the classroom typically used. Depending on the single-occupancy vehicle mode split of the campus, moving a 30-student class fully online could reduce peak parking demand by up to 11 to 17 parking spaces.

It is recommended that PCC conduct a Parking Cost Comparative Analysis to better understand the real cost of per-space parking at each campus. This information will better support parking alternative initiatives and expansion of the TDM program. The total cost of a campus parking space includes multiple elements, including annual repaving operations, regular maintenance, permit monitoring, real estate value, and other supporting equipment costs. Understanding the real cost of parking can yield significant value to PCC in making data-driven decisions on conversion of parking to other uses, such as campus buildings or potential housing projects. Additionally, the annual costs incurred by PCC to support parking at each campus can then be monetarily compared to TDM program effectiveness. For example, a TDM strategy that costs X dollars to reduce parking by 10% is less than the Y dollars to support the reduced parking spaces in demand would be considered a cost-effective strategy for PCC to pursue. This approach has the capacity to build consensus and support for TDM expansion.

Safety Assessment

Most of the streets surrounding PCC campuses that are programmed for sidewalks already have sidewalks present. Adjacent higher classification roadways are typically high-speed, high-volume vehicular arterials, with long block lengths and generally disconnected walking environments. An auto-oriented street networks and land use mix limits the attractiveness of walking for transportation, with some notable exceptions. Bicycle facilities are often present alongside high speed and high-volume arterials, and lack physical protections for people bicycling, which discourages all but the most confident users of the network.

Generally speaking, retrofitting arterials to facilitate crossings for students and vulnerable users will require careful consideration to evaluate the feasibility of mid-block crossings and other treatments designed to mitigate the connectivity challenges presented by long, vehicular arterials. In addition, intersections nearby may be upgraded when feasible to improve visibility and conflicts with turning vehicles and other high-frequency collision actions. Additionally, pedestrian and bicycle facility projects are outside of PCC jurisdiction and relies upon the local public agency to implement improvements.

Using data obtained from the ODOT's Collision Analysis and Reporting Unit, a review of the most recent available five years of collision history (January 2013 to December 2017) adjacent to and near PCC campuses was performed. The collision data was evaluated based on the number of collisions, the type of collisions, the severity of the collisions, with a particular focus on active transportation collisions (i.e. pedestrians and bicyclists).

With regard to collision severity, ODOT classifies collisions in the following categories:

- Property Damage Only (PDO);
- Possible Injury – Complaint of Pain (Injury C);
- Non-Incapacitating Injury (Injury B);
- Incapacitating Injury – Bleeding, Broken Bones (Injury A); and
- Fatality or Fatal Injury.

Table 2 provides a summary of collision types and selected collision severities on streets within a quarter-mile distance of the edge of campus. This equates to a five-minute walk or a 2-minute bicycle ride distance from the campuses, reflecting the most frequently traversed areas by students and staff walking or bicycling around campus. The Campus Diagrams in the attachments depict these collisions.

Table 2: Collision Type & Severity Summary

Campus	Study Collision Type and Severity						Total P/B/S/F Collisions	All Collisions
	Pedestrian Fatal	Pedestrian Severe	Pedestrian Minor	Bicyclist Severe	Bicyclist Minor	Auto Severe		
PCC Rock Creek	0	0	5	0	1	2	8	89
PCC Sylvania	0	0	0	0	0	6	6	60
PCC Cascade	0	0	7	1	6	1	15	168
PCC Southeast	2	3	6	0	3	7	21	239

P/B/S/F = Pedestrian/Bicycle/Severe/Fatal Collisions

Key Findings

The collision analysis assessment finds that there is generally a correlation between higher volume, higher speed arterials and a higher incidence of vehicle collisions. The suburban PCC campuses have comparatively lower collisions in severity and frequency than adjacent neighborhood transportation facilities. Namely, NW 185th Avenue (*PCC Rock Creek)* south of NW West Union Road and SW Pacific Highway (*PCC Sylvania)* west of the I-5 freeway have a higher incidence of collisions along segments of roadway farther from the campus than nearby segments. Conversely, the major arterials bordering the urban PCC Campuses have a relatively high incidence of collisions in close proximity to campuses. This suggests a greater need for safety improvements near the urban neighborhood campuses. Although the suburban campuses have a collision history, the priority leans toward the urban campuses.

PCC Cascade

This campus had seven (7) pedestrian and seven (7) bicycle collisions occur within a quarter mile of campus. All of these collisions resulted in minor injuries, with the exceptions of one collision that resulted in a severe injury along N Killingsworth Street between N Missouri Avenue and N Michigan Avenue. One additional severe auto collision occurred at the intersection of N Killingsworth Street and N Minnesota Avenue.

13 out of 15 focus area collisions occurred along N Killingsworth between Maryland Avenue and Moore Avenue. N Killingsworth Street currently has several pedestrian friendly traffic calming measures, such as enhanced pedestrian crossings, curb bulb-outs, a 20-mph speed limit; however, no significant bicycle facilities traverse the campus east-west. Due to the presence of Interstate 5 canyon acting as a barrier, there is limited capability for bicyclists to travel east-west in the Humboldt neighborhood without using the heavily auto-trafficked N Killingsworth Street. For example, the closest east-west I-5 overpass with bicycle facilities is N Ainsworth Street, five blocks to the north. For short trips across I-5, this route option can be out of the way and not favorable to bicyclists. Although there are Class II Bicycle Lanes across I-5 on N Killingworth Street, several stop-controlled intersections with a high minor-street offset exist, posing a potential hazard to bicyclists. Incidentally, this is where most of these bicycle collisions exist. Vertically separated bicycle and pedestrian centric amenities are needed to improve safety within the Cascade campus vicinity.

PCC Rock Creek

Six (6) out of eight (8) severe or active transportation collisions occurred between PCC Rock Creek Driveway and NW 173rd Avenue. It is anticipated that recent infrastructure improvements, including a relocated access, a new traffic signal, improved sidewalks, intersection pedestrian crossings, and new bicycle lanes, all have significant value in separating pedestrians and bicyclists from automobiles, reducing mode conflicts, and thereby reducing collision risk. Collisions at PCC Rock Creek should continue to be monitored over the next few years.

PCC Southeast

The Southeast campus experienced the greatest number of total collisions (239) and study focus collisions (21) within the study area and time period. This occurrence can be reasonably anticipated by the high volume, high congestion arterials bounding two edges of the campus, including SE Division Street and SE 82nd Avenue (OR-213). 10 out of 21 collisions occurred along SE 82nd Avenue directly fronting school property.

Within the study time period, eleven (11) pedestrian collisions occurred, resulting in 2 fatal, 3 severe injury, and 6 minor injury collisions. One fatality occurred at the intersection of SE Division Street and SE 84th Avenue. The other fatality occurred at the intersection of SE Clinton Street and SE 82nd Avenue.

The study area also experienced three (3) bicycle collisions resulting in a minor injury and seven (7) auto collisions resulting in a severe injury. Five (5) collisions occurred at the intersection of SE Division Street and SE 82nd Avenue (Identified as a PBOT High Collision Network Intersection 2012-2016)

SE Division Street is currently undergoing major construction for a bus rapid transit (BRT) line that will connect Downtown Portland with the Gresham Transit Center. As part of this effort, Division Street is having access control medians installed to replace the existing two-way left-turn-lanes. Other geometric and operational improvements are programmed for the intersection of SE Division Street and SE 82nd Avenue to accommodate the BRT system and reduce collisions. In conjunction with the BRT construction, the *Outer Division Multimodal Safety Project (SE 80th to SE 174th Avenues)* is set to begin construction in the Spring of 2021. The multimodal safety project will construct new signalized crossings at SE 80th Avenue and SE 84th Avenue, install medians, construct enhanced protected bike lanes and electrify streetlights east of SE 82nd Avenue. All these improvements are projected to reduce collision risk within the vicinity of PCC. Collisions around the PCC Southeast campus should continue to be monitored following the planned infrastructure improvements.

PCC Sylvania

This campus had no reported active transportation collisions, consistent with the low active transportation mode share at this campus. Four (4) out of the (6) severe vehicular collisions occurred at SW Barbur Boulevard (OR-99W) and SW 60th Avenue. This intersection has an unusual configuration, with two closely spaced intersections, clustered signal operations, and the influence of high speed vehicles exiting the I-5 freeway via an off-ramp. Further coordination with ODOT should be conducted to implement safety improvements at the intersections.

Transportation Demand Management

A review of the PCC campuses and the relative walkability, bicycle friendliness, and access to transit was evaluated to gauge the existing alternative transportation environment. Walk score serves as one of many metrics available to determine the quality of active transportation facilities near each campus and identify needed areas of improvement. Each campus's walk, bike, transit, and calculated composite score were identified and are listed in Table 3.

Table 3: Alternative Transportation Score by Campus[2]

Campus	Walk Score	Bike Score	Transit Score	Composite score
Cascade	93	100	57	83
Rock Creek	22	62	35	40
Southeast	90	99	54	81
Sylvania	20	42	38	33

As shown, the urban setting campuses of Cascade and Southeast are high scoring for both walking and biking, with generally good transit and many public transportation options. Suburban setting campuses (i.e. Rock Creek and Sylvania) have lower scores in all categories, pointing toward a car-dependent environment with minimal bicycle infrastructure and few public transportation options. Evidently, the need for increased infrastructure is more prevalent at the western campuses than the inner-city campuses.

A recommendation identified in the 2012 Transportation Demand Management (TDM) Plan[3] was to develop transportation mode split targets. The need for modal targets is still necessary for the future of each campus, but after a decade of changes institutionally and regionally, a revisit of this recommendation is imperative for the long-term vitality of the campuses. The Cascade Campus TDM Plan is a prime example of a customized college-wide TDM Plan, specific to the needs and character of the PCC campus.

An appropriate baseline objective for campus mode splits can be derived from the regional goals set forth by the Washington County 2040 Transportation Plan and the Portland Transportation System Plan. Rock Creek and Sylvania campuses most closely represent the Washington County 2040 target mode split of 45%, whereas the eastern Portland neighborhoods of Southeast and Cascade have a more aggressive target for campuses (65%)..[4] As identified in the previous Phase 1 Transportation Element of the PCC Facilities Plan, several campuses are found to be falling short of meeting the local mode split target (includes carpooling, transit, shuttle ridership, biking, and walking). Based on a 2017 survey of student and staff means of transportation to and from the four PCC campuses, one was identified to be exceeding its target goal, two were within a close margin, and a fourth that needs further improvement. It should be noted that the alternative transportation goals for the eastern Portland neighborhoods is an aggressive target, intended to be reached over a 20-year time horizon.

[2] https://www.walkscore.com/

[3] https://www.pcc.edu/resources/parking/documents/FINALTDM_Report_2012-03-13.pdf

[4] https://www.portlandoregon.gov/transportation/article/659564

Continued support and expansion of the TDM program will likely meet and exceed the modal split goals within the target timeframe of 2040.

A comparison of the regional alternative transportation target that each campus resides in and the current split are presented in Figure 1.

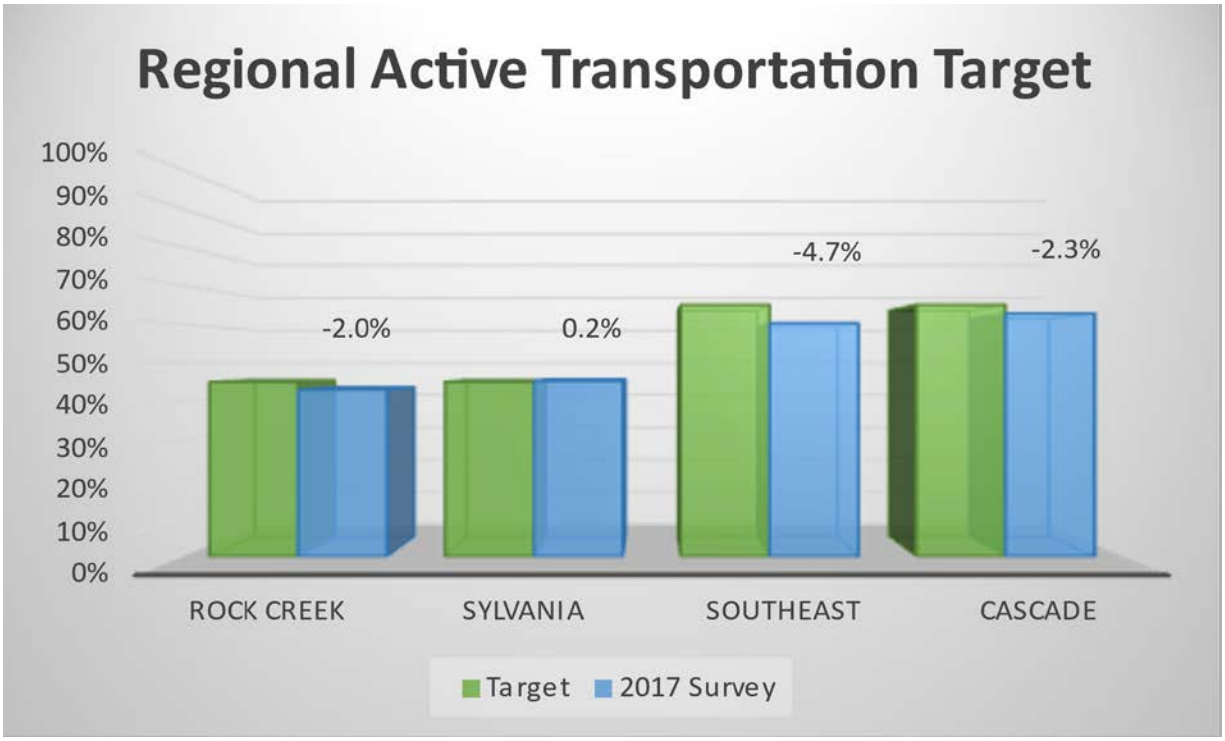

FIGURE 1: REGIONAL ALTERNATIVE TRANSPORTATION TARGET BY CAMPUS

As shown, the Southeast Campus is identified to have the greatest deficit of alternative transportation participation, whereas the suburban setting campuses are within reach of meeting their goal. Consistent with the high parking constraints at the Southeast and Cascade campuses, PCC should leverage the existing public infrastructure for alternative transportation modes to decrease single-occupancy vehicle mode choice. Aligning on-campus amenities and facilities with off-campus infrastructure (i.e. bike lockers near bike lanes or green streets, enhanced waiting areas near bus stops, shuttle locations with easy access on and off corridors, direct pedestrian access sidewalks to main entrances) increase the effectiveness and use propensity of these improvements. Further coordination with transportation agencies would be a recommended approach to achieving this.

A closer look at PBOT Planning Horizon 2035 Mode Share goal and how PCC campuses compare as a whole and within the urban settings, some clear trends are apparent. As shown in Figure 2, PCC already exceeds the mode share goal of transit/shuttle ridership and carpooling. However, PCC campuses fall short of meeting the walk and bike mode share targets.

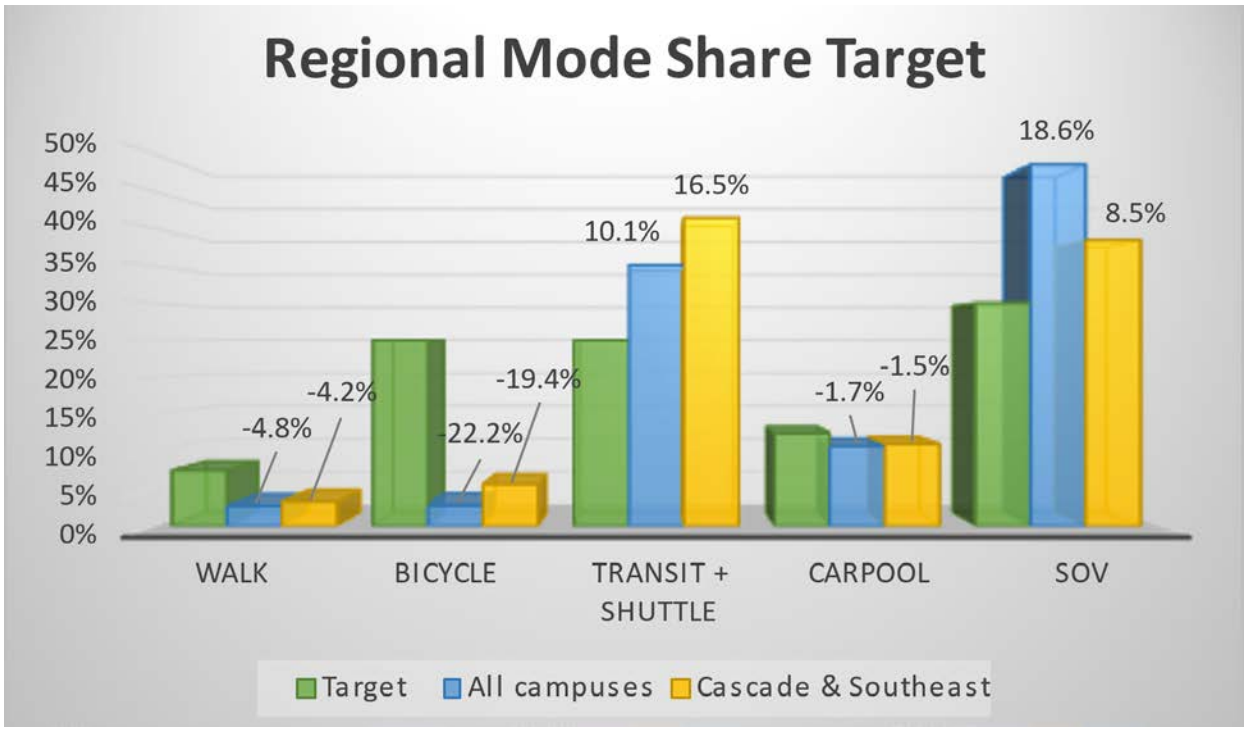

FIGURE 2: REGIONAL MODE SHARE TARGET

Offsetting single-occupancy vehicle driving with increase walking and bicycling to and from campus is a key element of the PCC's long range transportation planning.

The 2012 Transportation Demand Management (TDM) Plan[5] provided much of the framework that is currently used by the Transportation Department team. PCC's Transportation and Parking Services staff has been utilizing the past TDM documentation and applying strategies to manage transportation demand, while working to create a sustainable approach that will reduce the number of single-occupancy vehicles traveling to campus by providing desirable options for alternative modes and still providing a well-managed parking program. The Transportation Department recently provided a summary of the TDM efforts that have been conducted and what has been planned for future development (see attachments).

Many programs have been applied from the past TDM work and are provided in a summary in the attachments. Respective to the existing mode share strengths and weaknesses of the PCC campuses, and the identified areas of needed improvement, a few clear goals arise from the data:

- A safe and accessible walking environment is needed to and from each campus
- Adequate biking amenities and facilities are needed to meet future demand
- Shuttle and transit ridership programs are effective and should maintain growth
- Refining utilization rather than expanding parking capacity to single-occupancy vehicles improves existing facilities without reducing alternative transportation goals

[5] https://www.pcc.edu/resources/parking/documents/FINALTDM_Report_2012-03-13.pdf

The regional transportation mode split targets serve as an appropriate baseline goal to achieve for each campus. However, in congruence with PCC's core themes of economic sustainability and equitable student success, providing better transportation alternatives and amenities are further achieved by reducing single-occupancy vehicle use and increasing equitable alternatives to students without vehicle ownership.

Strategies to Support Alternative Transportation Modes

The transportation team reviewed the 2012 TDM Study and the summary of past TDM policies applied, evaluated existing conditions in the field, and met with PCC's Transportation and Parking services staff to determine the most effective and necessary improvements to stimulate growth in alternative transportation mode choice. From this the team identified the 15 highest priority strategies that have the most utility in achieving greater alternative transportation participation. The recommended strategies are outlined in Table 4.

Table 4: Top Recommended District Wide Improvements

Target Mode	Strategy	Additional Information
All	Increase parking permit costs to reinvest in shuttle and other programs	Conduct a detailed study to evaluate costs and impacts for parking fee increases
Pedestrian	ADA (ramp upgrades, van accessible spaces, signage, loading zones)	Sylvania Campus is only campus below requirements. Enhanced facilities exceeding the minimum standard is recommended long-term
	Implement and Monitor Pedestrian Wayfinding Sign Packages	Plan for regular review and updates
Bicycle	Bike amenity expansion	Expand shower availability with locker rooms
	Expand short-term and long-term storage options	Decentralize storage areas to provide total campus coverage and ease of use to users Goal of 25% mode split
Shuttle	Revisit Wi-Fi on Shuttles	Need to wait for technology to improve, wide use of 5G technology anticipated to meet data needs and reduce high costs. Improved streaming service options are anticipated.
	Subsidized transit program	Expand existing program
Transit	PCC Purple Line Shuttle (Cascade – PMWTC – Southeast – PMWTC – Cascade) to MAX Station connection	Additional permit coordination efforts with TriMet are needed
Ride-Share	Expand Radio Cab service knowledge	Guaranteed ride home program is a favorable safety feature for students and staff
	Discounted rate program for ride share service	Preferred vendor exploration needed

Target Mode	Strategy	Additional Information
EV	Improve EV Charge Card Collector Connectivity	Transitioning to SEMA connect, should be monitored moving forward
	Expand EV Charging	Add additional electric vehicle stations to meet future demand
SOV	Flexible parking	Flexible parking rules, tiered parking rates, time-based parking via license plate cameras
	Explore programmatic effects of reducing parking demand peaks	Block scheduling

It is recommended that PCC update the 2012 TDM Plan. Over the last decade, there has been a significant increase in TDM research and new strategies to effectively reduce vehicular travel and parking demand. It is recommended that a comparative analysis with other Universities and Colleges be conducted to evaluate the effectiveness of implemented practices. In addition, it is recommended that the TDM Plan update include campus-specific alternative transportation goals, prioritize district-wide strategies in a tiered system targeting each mode of alternative transportation, and estimate costs associated with the highest priority strategies. The current big data-driven analysis being conducted by Lancaster Mobley regarding campus trip generation and travel patterns will provide valuable insight that can be leveraged in an updated District-wide TDM Plan.

Future Travel and New Mobility

Research was conducted regarding the growing industry and economic trends that is expected to affect PCC over the next few decades. Over the last several years, a number of new modes of transportation have emerged and/or grown, including scooters and related light vehicles, electric bicycles, and ride-sharing applications like Uber and Lyft. Additionally, key transit projects are currently being planned along Portland's Southwest Corridor and Powell-Division Corridor, presenting new opportunities to travel to and from the Sylvania campus and Southeast campus, respectively. The potential to encourage travel via these modes along with the inherent trade-offs were considered in this analysis, along with other potential TDM measures and potential for community-supportive measures. Three growing trends were identified as having the greatest impact to transportation. These trends include:

- Electric Vehicles (EV)
- License Plate Reader – Time Based Parking
- Distance Learning

All of these trends carry a single common denominator – technological advancement. Notably, the Covid-19 pandemic has seen an acceleration toward these growing trends that were in place before its outset. Preparing for the advent of new technology in everyday campus transportation operations will benefit PCC campuses when these trends fully arrive.

Both organic market growth and agency mandates are leading toward a future of a high proportion of electric vehicles making up the automobile market. Emissions standards and consumer demands are forcing an acceleration of electric vehicles. Improved technology is yielding increasingly inexpensive electric vehicle models every year. Electric vehicles will be more widely affordable and no longer reserved for higher disposable income individuals. New EV sales by the year 2030 are estimated at 27% to 30%. Millions of new vehicle sales will require the infrastructure for mass charging. Notably, PCC has already anecdotally experienced customer conflicts at the limited charging sites available on campus. Unplugging of vehicles at charging stations has led to conflicts on campus. Clearly, demand already exceeds supply. If these trends continue, it is reasonably anticipated that 10% to 15% of parking spaces will have EV charging capability demand. Alternatively, improved efficiency and battery storage technology may offset the demand. Similarly, there is not a gasoline pump at every conventional automobile parking space. Another potential solution is finding opportunity for shared charging stations with the local community or other nearby enterprises to offset the cost burden of this infrastructure. PCC should monitor future EV growth and demand to install more EV charging spaces.

License plate reader technology is growing in popularity and college campuses nationwide.

- Ensures payment compliance
- Provides greater convenience
- Security features
- Can monitor demand and trends in real time
- Can set variable rates during peak demand times to discourage single occupancy vehicle use

Future Analysis Topics

As stated previously in this memorandum, the Covid-19 viral pandemic had unexpectedly altered the analysis process for Phase 2 of the PCC Facilities Plan. Two primary topics will require further evaluation at the onset of the PCC campuses returning to in-person instruction.

Campus Trip Generation Rates

Due to the recent closure of PCC campuses, a trip generation study specific to each campus is not viable at this time. It is anticipated that it will be some time before normal curriculum and campus operations return to pre-pandemic conditions. Additionally, with the proliferation of distance learning and reorganization of internal operations at PCC campuses, it is likely that the future traffic generation may look very different. In spite of this, new technology has made it possible to look back in time at traffic generation for a defined location using the power of big data. *Streetlight Insight*[6] is a big data provider that consolidates and visualizes complex multi-mode traffic patterns using aggregated cell phone signals. Streetlight data can be used for a variety of campus purposes, including:

[6] https://www.streetlightdata.com/

- Quantify changes in trip generation by time of day, day of week, semester-to-semester, and year-to-year.
- Anticipate and plan for special events.
- Optimize bike and pedestrian infrastructure.
- Identify origin and destination patterns of PCC students and staff.
- Determine intercampus travel on a day-to-day basis.
- Ride sharing use to and from PCC campuses.

Exploration of specific campus functions using cloud based digital data storage services (big data), such as *Streetlight Insight*, can be employed to make data driven decisions on infrastructure planning and trends, particularly as it relates to long-term parking needs.

Network Deficiencies and Opportunities

An assessment of existing conditions in the vicinity of each campus will be further studied at the return of in-person instruction. This includes an assessment of networks for vehicular travel, transit infrastructure and headways, and infrastructure for cycling and walking. User experience and mode conflicts will be of particular importance for this effort.

Campus Shuttle Circulation & Microtransit Technology

It is recommended that a study be conducted to determine how PCC shuttle circulation functions on each campus and between campus locations. Close examination of how the proposed future curriculum programming impacts travel needs across PCC locations, particularly with respect to the current operation of the PCC Shuttle system will be an essential element to this analysis. It is anticipated that the upcoming "Big Data" trip generation study will identify existing inter-campus travel demand patterns, providing insight into the reduced travel impact by the shuttle program.

Additionally, the potential for microtransit technology as a supplemental alternative to the shuttle program should be explored. Microtransit is a technology-enabled transit service that typically uses multi- passenger/pooled shuttles or vans to provide on-demand or fixed-schedule services with either dynamic or fixed routing. This has the opportunity to provide greater transportation area coverage to PCC students and staff within a defined region around each campus. Campus shuttle stops are depicted in the Campus Diagrams found in the attachments.

It is recommended that PCC conduct a study that compares the utility of a PCC-funded shuttle program versus a partnership with TriMet to expand bus service options. The existing shuttle service provides the highest level of connectivity between campuses and to local TriMet connection hubs; however, the service is also an expensive operation to maintain. A benefit analysis study and further coordination with TriMet to explore partnership options will serve to identify the better alternative or the appropriate combination of alternatives.

The currently available campus shuttle annual ridership data is presented in Figure 3. As shown, there has been a steady decrease in ridership since the 2012-2013 school year. Several factors were analyzed as potential drivers of this drop in ridership, including gasoline prices, enrollment, and distance learning expansion.

Much of the ridership fluctuations can be attributed to variable gasoline prices – higher prices have a high correlation to higher ridership. Additionally, there is a consistent drop in enrollment since the 2011-2012 enrollment peak, finding a moderate correlation. Expansion of distance learning identified a minor correlation. However, the data also suggests a compounding relationship between enrollment and ridership. This pattern of higher proportions of ridership with higher overall enrollment is largely due to a static parking supply. Limited parking supply alongside higher gasoline prices incentivized greater shuttle ridership as parking demand exceeded supply by a greater nominal amount and for a greater amount of time throughout a given day. Effectively, a reduction in parking supply, or an increase in associated costs will lead to a higher proportion of student shuttle ridership.

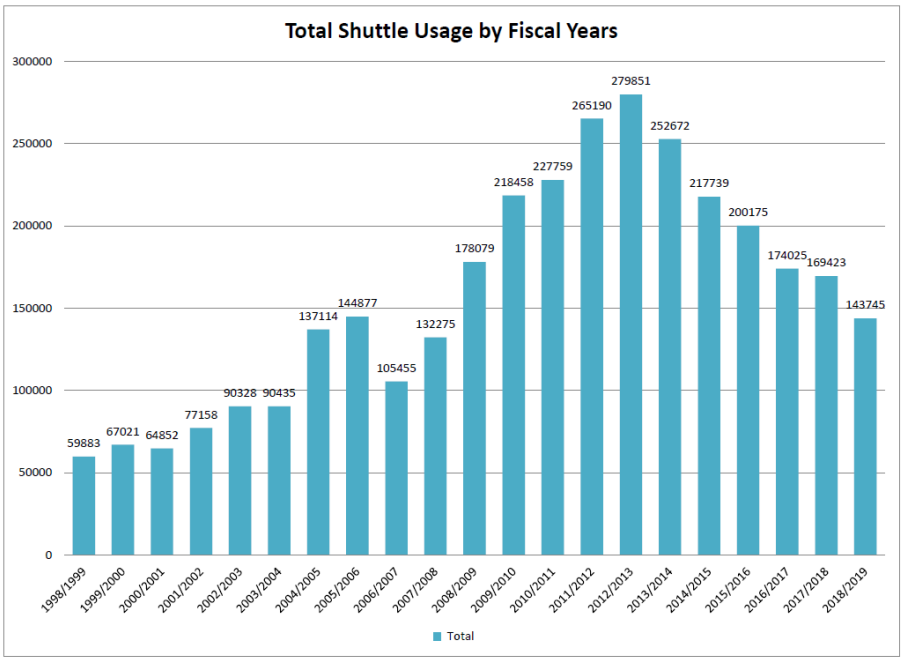

FIGURE 3: SHUTTLE RIDERSHIP BY YEAR

Preliminary existing system-wide infrastructure needs were defined with a goal of creating a more robust multimodal future transportation network. Achieving a more favorable modal split can be achieved by improving shuttle service. Additionally, all shuttles should be upgraded to have ADA servicing capability. Older vehicles without this functionality should be phased out. Two of the 15 shuttle fleet do not meet ADA requirements, both of which are 2004 vehicles, the oldest in the fleet.

Campus Specific Capital Improvement Projects

Phase 1 of the Facilities Plan, developed in late 2017, identified several capital improvements related to transportation and traffic infrastructure. Throughout the Phase 2 stakeholder interview process and in conjunction with campus site visits, several priority projects are recommended to be implemented or facilitated as the campuses expand and improve service and amenities. Capital projects are described here for each campus.

All PCC Campuses

Transportation Hubs

Integrating the myriad of transportation modes available at each PCC campus into a centralized, single transportation hub at each campus that provides ease of access to students and staff was identified as a high priority. Bringing together the existing transportation options available (i.e. TriMet buses, PCC shuttles, Transportation Network Companies (Lyft, Uber, etc.), ride-share, bicycle amenities) alongside future mobility options (i.e. microtransit) has the ability to streamline alternative transportation mode options. A single transportation hub can give users multiple options for the best route to their destination.

Well-known deterrents to alternative transportation modes are headway wait times and locations that feel sequestered from central locations. For example, a student leaving campus would not have to experience wait times for a single bus route but have alternatives within just a few feet. Students will not have to walk out of their way to get from one transportation option to another to evaluate choices. This will reduce the desire for single occupancy vehicle preference by reducing trip times.

Additionally, end-of-trip facilities were identified as a desired amenity to be incorporated into transportation hubs. End-of-trip facilities include a myriad of accommodations for alternative transportation modes, particularly bicycles. Some of these options include:

- Short- and long-term parking, e-bike charging capabilities
- Showers, changing rooms, and lockers, and towels
- Bicycle repair stands and spares vending machines
- Water bottle fill stations

Cascade Campus

Local Roadway Coordination

Coordination with PBOT and local utilities should take place to make active transportation improvements along the N Borthwick Mall, which bisects the campus. This will allow PCC to provide enhanced pedestrian connectivity between campus buildings. Potential roadway acquisition via street vacation would provide PCC Cascade with greater autonomy over roadways that have campus building frontage on both sides of the roadway. Options for agency coordination or the acquisition of the roadway includes the ability to manage parking regulations, improve bikeway options, sidewalk widening for enhanced pedestrian facilities, or street closure for the added element of safety for students and staff navigating across campus.

Rock Creek Campus

Signage Improvements

Improved pedestrian wayfinding signage from The NW Springville Road pedestrian pathway up to the main campus was identified as a need to augment the recent access improvements at the main entrance to the campus. From the campus access at NW Springville Road up to the main campus is over a quarter mile long, and due to the topography of the entrance area, it is not readily apparent to pedestrians the safest and most direct route to the main campus. These improvements are expected to help keep pedestrians out of the vehicle right-of-way by preventing pedestrian crossings, keep

pedestrians on the east/south side of the roadway, and create a more pedestrian-centric walking environment.

Southeast Campus

PBOT Greenway Alignment[7]

PBOT has a planned greenway, the "70s Greenway", that will cross SE Division Street at SE 78th Avenue and travel around the western edge of the campus. It is recommended that PCC coordinate and integrate future campus plans at PCC Southeast with PBOT to facilitate this planned capital improvement project. Planning for bicycle amenities such as maximizing the effectiveness of bicycle lockers, wayfinding, and connection points to the rest of the campus can allow PCC to make the most of this improvement and increase bicycle mode choice.

Division Street BRT[8]

TriMet is constructing a 15-mile-long Bus Rapid Transit (BRT) line that will connect the NW Pearl District with Gresham via the Division Street Corridor. The BRT line will reduce travel times up to 20%, increase headways to 12 minutes, and increase capacity with new articulated buses, and implement transit signal priority. Integrating future improvements and transportation programs of the campus to maximize the propensity of transit ridership will help improve upon the campus alternative transportation mode share goals.

Sylvania Campus

Bike Lane Connection

Constructing bicycle facilities along local roadways was identified as a preferred project. Bicyclists are found to most commonly use the Kerr Parkway entrance which does not currently have bicycle facilities. Constructing these facilities is anticipated to create a more bicycle-friendly environment and improve bicycle mode choice.

Continuous Sidewalks

Constructing a continuous walkway around entire campus was identified as a preferred project. Pedestrians currently do not have access to continuous connectivity. Enhancing the pedestrian environment is anticipated to improve onsite safety and reduce vehicle-pedestrian conflict areas.

Automated Vehicle Connection

The 2040 Regional Transportation Plan has a planned light rail project connecting Portland to Tualatin in 30 minutes. This project is expected to greatly enhance connectivity throughout the southwestern Portland suburbs. With this project creates the opportunity for a transfer connection between the main campus and the future SW 53rd Avenue station. It is recommended that a plan for an automated vehicle connection with coordinated, timed headways taking students and staff the approximately one half-mile distance to capitalize on the light rail project and promote alternative transportation. In November 2020, voters rejected Measure 26-218 (also known as Get Moving 2020), a proposal to fund the Southwest Corridor Light Rail Project and many other transportation programs across the region. At this time, the project is on hold until funding is identified.

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[7] https://www.portland.gov/transportation/pbot-projects/construction/70s-neighborhood-greenway-ne-sacramento-se-flavel
[8] https://trimet.org/division/

Attachments:

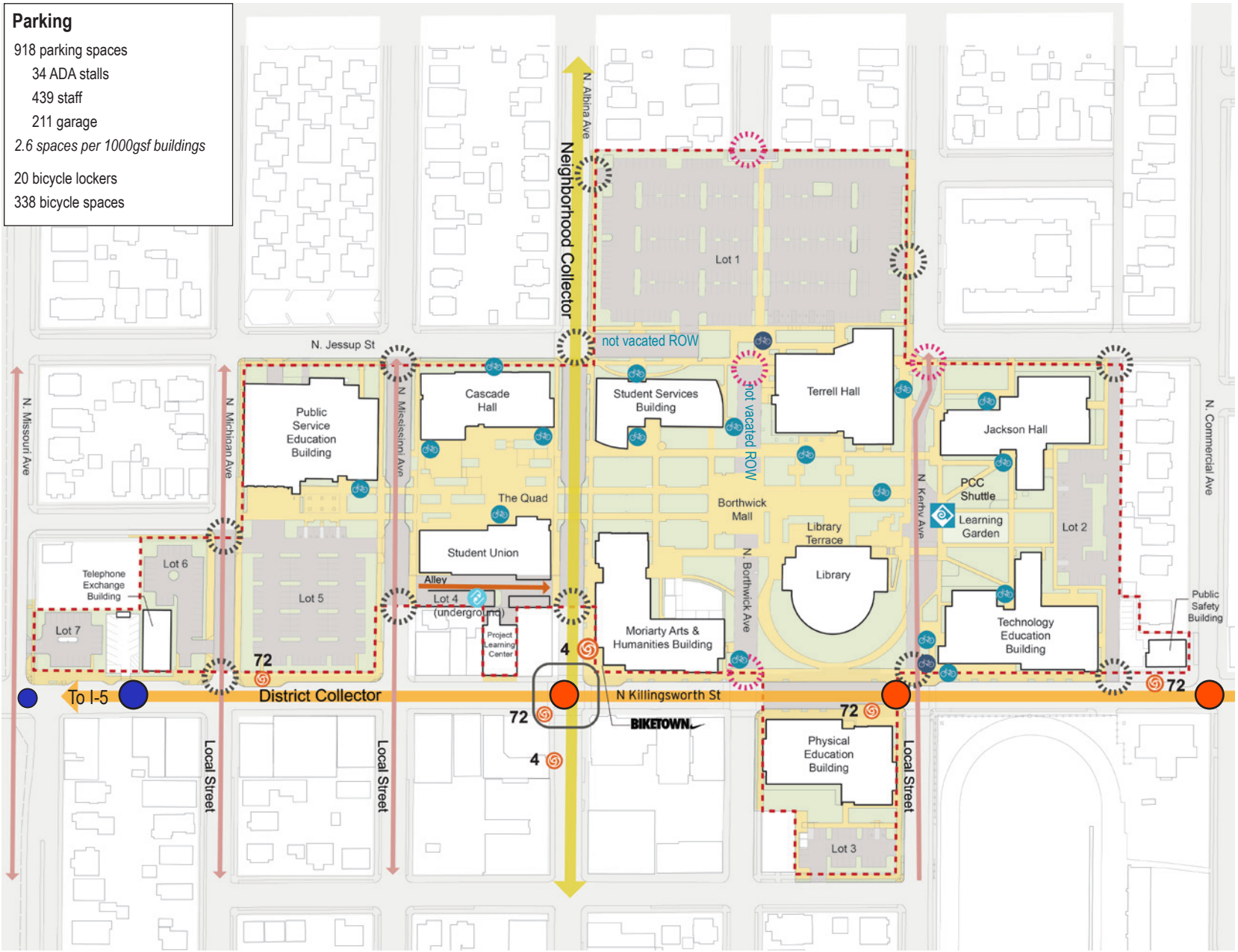
Campus Circulation Diagrams

Parking

918 parking spaces
- 34 ADA stalls
- 439 staff
- 211 garage

2.6 spaces per 1000gsf buildings

20 bicycle lockers
338 bicycle spaces



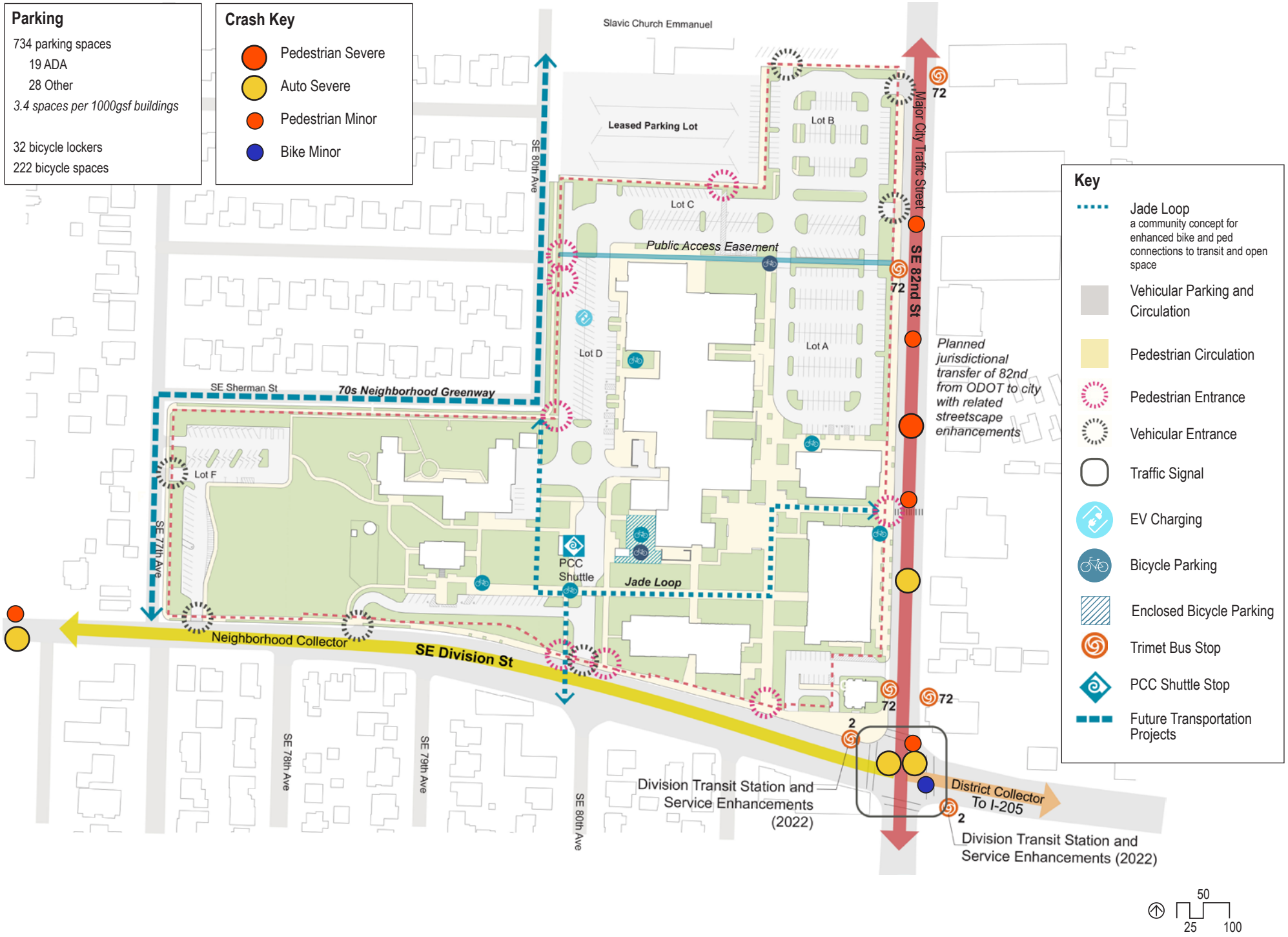
Crash Key

- Pedestrian Severe
- Bike Severe
- Bike Minor

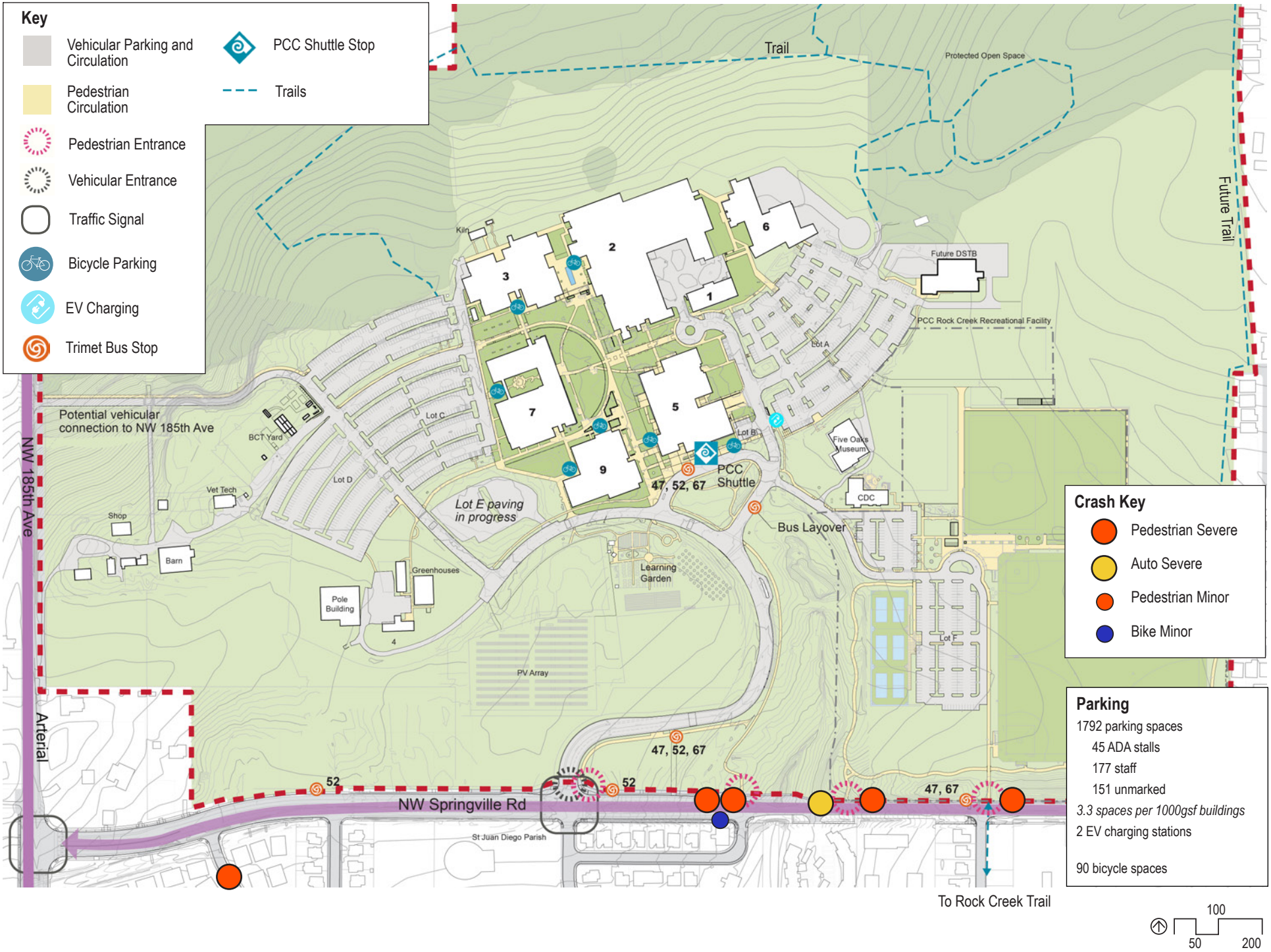
Key

- Bicycle Parking
- Bicycle Lockers
- Vehicular Parking and Circulation
- Pedestrian Circulation
- Pedestrian Entrance
- Vehicular Entrance
- Traffic Signal
- Trimet Bus Stop
- PCC Shuttle Stop

50
25 100


Parking
734 parking spaces
19 ADA
28 Other
3.4 spaces per 1000gsf buildings
32 bicycle lockers
222 bicycle spaces
Crash Key
Pedestrian Severe
Auto Severe
Pedestrian Minor
Bike Minor
Slavic Church Emmanuel
Leased Parking Lot
Lot B
Lot C
Lot D
Lot A
Lot F
Public Access Easement
SE 80th Ave
Major City Traffic Street
SE 82nd St
72
Planned jurisdictional transfer of 82nd from ODOT to city with related streetscape enhancements
SE Sherman St
70s Neighborhood Greenway
SE 77th Ave
PCC Shuttle
Jade Loop
Neighborhood Collector
SE Division St
SE 78th Ave
SE 79th Ave
SE 80th Ave
Division Transit Station and Service Enhancements (2022)
District Collector To I-205
2
Division Transit Station and Service Enhancements (2022)
Key
Jade Loop
a community concept for enhanced bike and ped connections to transit and open space
Vehicular Parking and Circulation
Pedestrian Circulation
Pedestrian Entrance
Vehicular Entrance
Traffic Signal
EV Charging
Bicycle Parking
Enclosed Bicycle Parking
Trimet Bus Stop
PCC Shuttle Stop
Future Transportation Projects
50
25
100


FUTURE CONNECTION TO SW 53RD MAX STATION
To I-5
District Collector
SW 49th Ave
FUTURE ROUNDABOUT / ENTRANCE IMPROVEMENTS
Neighborhood Collector
SW Lesser Rd
Note: Additional on-street parking along perimeter roads
Portland
Lake Oswego
Minor Arterial
Lesser Park
Bus Layover Zone
The Grove
PCC Shuttle
44
78
44, 78
BK
CT
HT
PAC
LIB
CC
TCB
ST
SS
AM
CDC
SCB
HP
CSB
Lot 1
Lot 2
Lot 3
Lot 5
Lot 7
Lot 8
Lot 9
Lot 10
Lot 11
Lot 12
Lot 13
Lot 14
G St
H St
I St
J St
K St
LG
No crashes within map extents
Parking
2802 parking spaces
60 ADA stalls
416 staff
41 unmarked
3.9 spaces per 1000gsf buildings
110 bicycle spaces
Key
Vehicular Parking and Circulation
Pedestrian Circulation
Pedestrian Entrance
Vehicular Entrance
Traffic Signal
EV Charging
Bicycle Parking
Trimet Bus Stop
PCC Shuttle Stop
Future Transportation Projects
Trails
100
50
200


Key
Vehicular Parking and Circulation
Pedestrian Circulation
Pedestrian Entrance
Vehicular Entrance
Traffic Signal
Bicycle Parking
EV Charging
Trimet Bus Stop
PCC Shuttle Stop
Trails
Trail
Protected Open Space
Future Trail
Kiln
Future DSTB
PCC Rock Creek Recreational Facility
Lot A
Lot B
Lot C
Lot D
Lot E paving in progress
Lot F
Potential vehicular connection to NW 185th Ave
BCT Yard
Vet Tech
Shop
Barn
Greenhouses
Pole Building
4
PV Array
Learning Garden
PCC Shuttle
47, 52, 67
Bus Layover
Five Oaks Museum
CDC
NW 185th Ave
Arterial
NW Springville Rd
52
47, 67
St Juan Diego Parish
To Rock Creek Trail
Crash Key
Pedestrian Severe
Auto Severe
Pedestrian Minor
Bike Minor
Parking
1792 parking spaces
45 ADA stalls
177 staff
151 unmarked
3.3 spaces per 1000gsf buildings
2 EV charging stations
90 bicycle spaces
100
50
200

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Memorandum

To: **Rebecca Ocken & Michael Kuehn**
Portland Community College

From: **Nick Mesler, EIT**
Todd Mobley, PE

Date: **December 20, 2021**

Subject: **PCC Campus & Centers Big Data Transportation Analysis and Findings**

Introduction

The purpose of this memorandum is to quantify trip generation characteristics of the Portland Community College (PCC) Campuses & Centers. With this information, site specific information regarding transportation demand trends, alternative transportation behavior, and origin and destinations for the 12 active campuses and centers can be derived.

This analysis effort was precipitated by the Portland Community Colleges Master Facilities Plan project. Due to the recent closure of PCC campuses, a trip generation study specific to each campus was not a viable option at the time of the planning effort. Additionally, it is anticipated that it will be some time before normal curriculum and campus operations return to pre-pandemic conditions. Additionally, with the proliferation of distance learning and reorganization of internal operations at PCC campuses, it is likely that the future traffic generation may look very different from pre-COVID 19 conditions. In spite of these occurrences, new technology has made it possible to look back in time at traffic generation for a defined location using the power of big data.

Streetlight Insight is a big data provider that consolidates and visualizes complex multi-mode traffic patterns using aggregated cell phone signals. Streetlight data can be used for a variety of campus purposes, including:

- Quantify changes in trip generation by time of day, day of week, semester-to-semester, and year-to-year.
- Determine multi-modal travel activity (i.e. people on foot and people on bikes).
- Determine intercampus travel on a day-to-day basis.
- Identify origin and destination patterns of PCC students and staff.

Identify commute characteristics (i.e. travel time, distance, average speeds) Exploration of specific campus functions using cloud based digital data storage services (big data), such as *Streetlight Insight*, can be employed to make data driven decisions on infrastructure planning and trends, particularly as it relates to long-term parking needs.

The data analysis conducted is summarized in this memorandum. Specific analyses include:

- trip generation rates at active campuses and centers under pre-pandemic conditions for three (3) travel modes (driving, walking, and biking)
- temporal traffic patterns at all active campuses and centers
- inter-campus and -center travel demand
- regional travel to PCC facilities via an origin and destination zip code study
- commuter characteristics

Analysis Methodology

The analyses presented in this document are based on big data information provided by a third-party vendor *Streetlight Data, Inc (Streetlight). Streetlight* indexes and processes approximately 40 billion anonymized location records from smart phones and navigation devices in connected cars and trucks on a monthly basis. Additional sources such as parcel data and digital road network data are then used to condense this data to meaningful information in the context of where drivers, walkers, and bicyclists are travelling to and from throughout any given day. *Streetlight* then processes this data algorithmically into location data points over time into contextualized, aggregated, and normalized travel patterns. The data is then validated using 1,000s of traffic counters and embedded sensors throughout the United States and Canada. Data can then be retrieved from the *Streetlight* database for specific locations and timeframes.

Streetlight travel metrics have been validated with an R^2 value of 0.98 for vehicular travel, which is considered to be a very high confidence in the data. People travelling on foot and people travelling on a bicycle similarly have been found to have a high validity correlation between *Streetlight* count data and traditional permanent counters, with an R^2 value ranging from 0.75 to 0.91. This is considered to be a high correlation.

Specific to PCC campuses and centers, transportation data retrieval was conducted using several notable analysis parameters in order to maintain consistency across different analyses. These include:

- October 2019
    - This month was chosen as the most recently available month of October without the effects of COVID-19. October 2019 has historically been used by PCC to conduct traffic counts and transportation demand surveys. In order to maintain consistency with past efforts, this month was chosen for regional analyses and daily and weekly trends.
    - October is also considered an ideal month as there are few significant holidays effecting travel patterns. Additionally, October is not known for temperature or weather extremes that would also effect travel behaviors. The entire month of October is within a typical enrollment term (Fall Quarter).
    - Analysis across multiple terms or years assumed the following normal enrollment months for analysis: October (Fall Term), February (Winter), April (Spring), and July (Summer).

Site Trip Generation & Activity

The following section summarizes analysis of trip generation and temporal site activity at PCC campuses and centers for three modes of transportation (vehicular, bicycle, and pedestrian).

Vehicular Activity

Trip Generation

A trip generation study was conducted in order to determine the daily number of trips generated by the various PCC Campuses and Centers. The "big data" approach is employed to understand trip generation specific to each campus with the benefit of understanding travel demand without the influence of COVID-19 and to make informed decisions regarding trip generation for vehicles during different times of day, days of the week, terms of the year, and changes between academic years.

A trip generation study was conducted for each campus and center (14 total). Data analysis was conducted for the entire month of October 2019, with data filtered to only include Monday through Thursday, which are considered to be typical instructional days at PCC. October 2019 was in typical instructional operations for the entire month with minor holidays or weather events effecting travel demand. Peak hours are defined as the highest hour from 7-9 AM for the morning peak hour and 4-6 PM for the evening peak hour. Trip generation locations were studied with a few notable exceptions that are not best served by this method of analysis, these include:

Downtown Center – no on-site parking makes raw trip generation analysis via big data difficult, as users are likely to park off-site and complete the trip to the Downtown Center by walking. Thus, raw trip generation rates were too low to be considered realistic values.

Oregon Manufacturing Innovation Center (OMIC) – as of the Fall 2019, this center was not open for regular instruction. Thus, this center was excluded from the study.

Hillsboro Center – this location shares a common location with a multi-story parking structure which serves nearby business workers and patrons, including most notably, the Tuality Community Hospital. A trip generation study here would also capture traffic not related to the center; thus, this location was excluded from the study.

Maritime Welding Training Center – this site shares common space with other businesses and operations on Swan Island. A trip generation study here would also capture traffic not related to the training center; thus, this location was excluded from the study.

Vanport Building – as of the Fall 2019, this center was not open for regular campus activities. Thus, this center was excluded from the study.

Willow Creek Center – this location shares a common location with a large parking lot that also serves as a park-and-ride for the Willow Creek Transit Center. A trip generation study here would also capture traffic not related to the center; thus, this location was excluded from the study.

Table 1 displays the average peak hour trip generation for both the morning and evening peaks at all relevant campuses and centers and also includes an average daily traffic value. As shown, the morning peak hours experience significantly higher inbound than outbound traffic. The highest trip generator campus was identified to be the Sylvania campus.

Table 1: Campus and Center Trip Generation

Campus/Center	Morning Peak Hour			Evening Peak Hour			Weekday Total
	In	Out	Total	In	Out	Total	
Cascade	328	11	339	68	266	334	3,860
Rock Creek	616	25	641	395	347	742	9,210
Southeast	438	41	479	82	207	289	3,850
Sylvania	1,040	24	1,064	198	596	794	10,082
CLIMB Center	18	0	18	2	18	20	178
Newberg Center	28	1	29	4	4	8	230
PMWTC	196	62	258	32	205	237	4,348
Swan Island Trades Center	24	0	24	51	7	58	318

It should be noted that the Rock Creek Campus has joint facilities with the Washington County Museum and the Tualatin Hills Park & Recreation District (THPRD) athletic facilities. Therefore, non-college affiliated person trips are made to and from the campus. Nearly all morning peak period trips are PCC trips, but because of the shared parking lot and park trip generation, it is likely that there are a notable number of THPRD trips. Similarly, the Oregon Museum of Science & Industry (OMSI) uses the CLIMB Center parking lot during non-school operation hours, primarily during weekends but also during events.

Table 2 below displays the identified rates at each PCC campus based on Full-Time Equivalent (FTE) student data for Fall 2019. FTE is calculated based on the total head count of students in regard to the total number of credit hours taken versus a full course load. Specifically, FTE is calculated using the following formula:

FTE = (# of contact hours)(# of weeks)/510

This data is available on the PCC website. FTE was found to have a higher correlation to trip generation that total headcount, yielding a lower range of variability in the data. As shown, the morning peak hour generates an average of 96% inbound travel and 4% outbound travel at 0.37 trips per FTE. The evening peak hour generates an average of 32% inbound travel and 68% outbound travel at 0.30 trips per FTE. The average weekday trip generation is identified to be 3.76 trips per FTE. Overall daily trip generation was found to be highest at the Rock Creek Campus, and lowest at the Cascade Campus.

Table 2: Campus Trip Generation Rates

Campus	FTE Students[1]	Morning Peak Hour			Evening Peak Hour			Weekday Total
		In	Out	Total	In	Out	Total	
Cascade	1,427	97%	3%	0.24	20%	80%	0.23	2.71
Rock Creek	2,127	96%	4%	0.30	53%	47%	0.35	4.33
Southeast	941	92%	9%	0.51	28%	72%	0.31	4.09
Sylvania	2,565	98%	2%	0.41	25%	75%	0.31	3.93
Average		**96%**	**4%**	**0.37**	**32%**	**68%**	**0.30**	**3.76**

1 = Fall 2019 Data

Is should also be noted that the Rock Creek peak hour per student trip generation was found to be within 5% of study conducted in Fall 2012, showing a high level of confidence in the data presented above. These trip generation values also show relative consistency over the last decade. These trip generation rates should be utilized to quantify future transportation impacts as the campuses expand to a greater number of students.

Time of Day

A study of each campus and center was conducted in terms of trip activity throughout the day. Data analysis was conducted for the entire month of October 2019, with data filtered to only include Monday through Thursday, which are considered to be typical instructional days at PCC.

The average traffic activity (inbound and outbound) on an hourly basis at all relevant campuses and centers are shown in Figure 1 and Figure 2, respectively. As shown, most campuses and centers experience a surge in activity during the 8-9 AM time period, corresponding with staff commuting and early morning class start times. Demand then fluctuates throughout the day with each block schedule time period. It should be noted that many of the training centers experience peak demand in the evening hours, corresponding with class time taking place after traditional working hours.

Figure 1: Campus Hourly Traffic

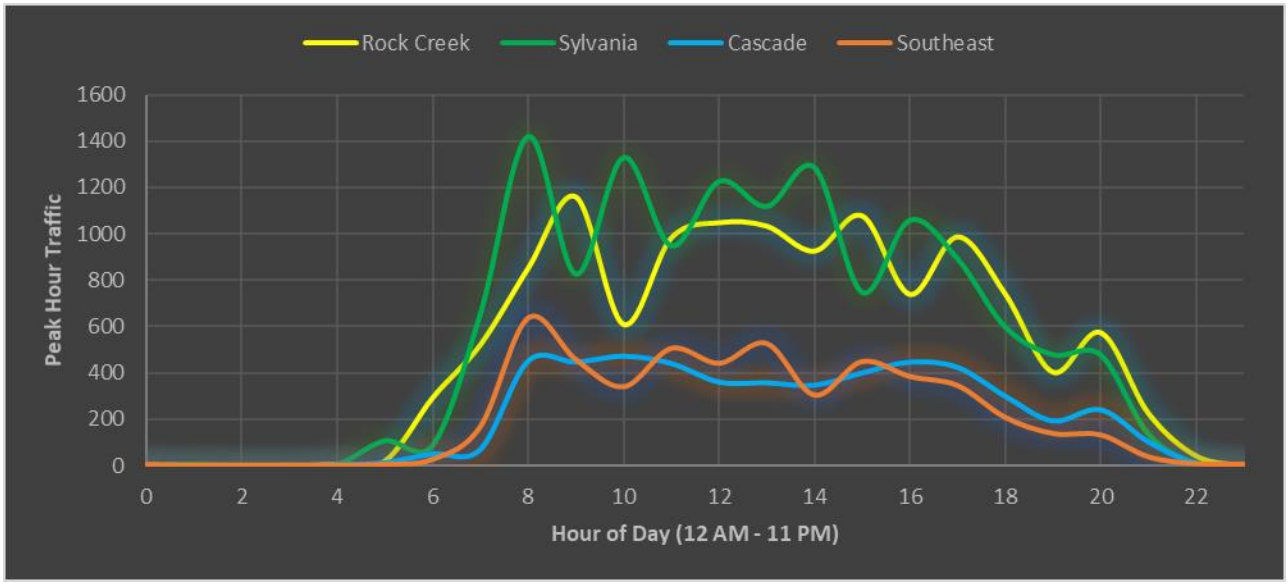
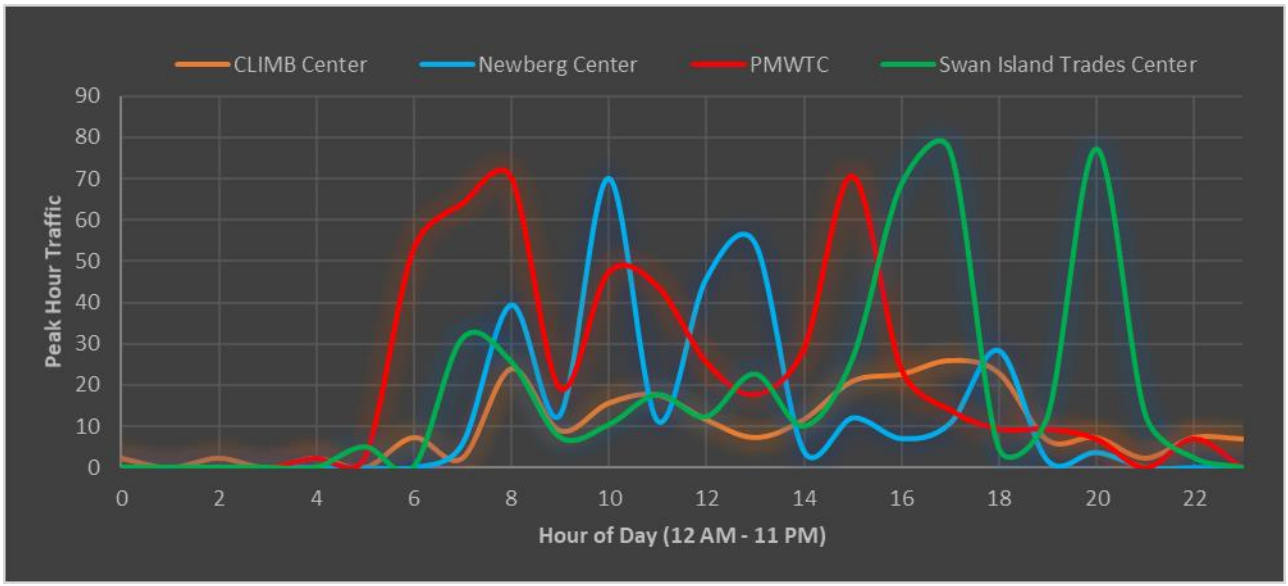


Figure 2: Center Hourly Traffic



Day of Week

A study of each campus and center was conducted in terms of trip activity throughout the days of the week. Data analysis was conducted for the entire month of October 2019. Tuesday was found to experience the highest traffic activity of any day of the week in most cases. Generally, Monday through Thursday experience little variation in traffic activity, with a considerable drop on Friday and Weekends at campuses. Some centers; however, continue to experience significant traffic activity on Fridays and Saturdays, indicative of instructional workforce training taking place. Notable centers include the CLIMB Center and PMWTC. The average daily traffic by day of week at all relevant campuses and centers are shown in Figure 3 and Figure 4, respectively.

Figure 3: Campus Hourly Traffic

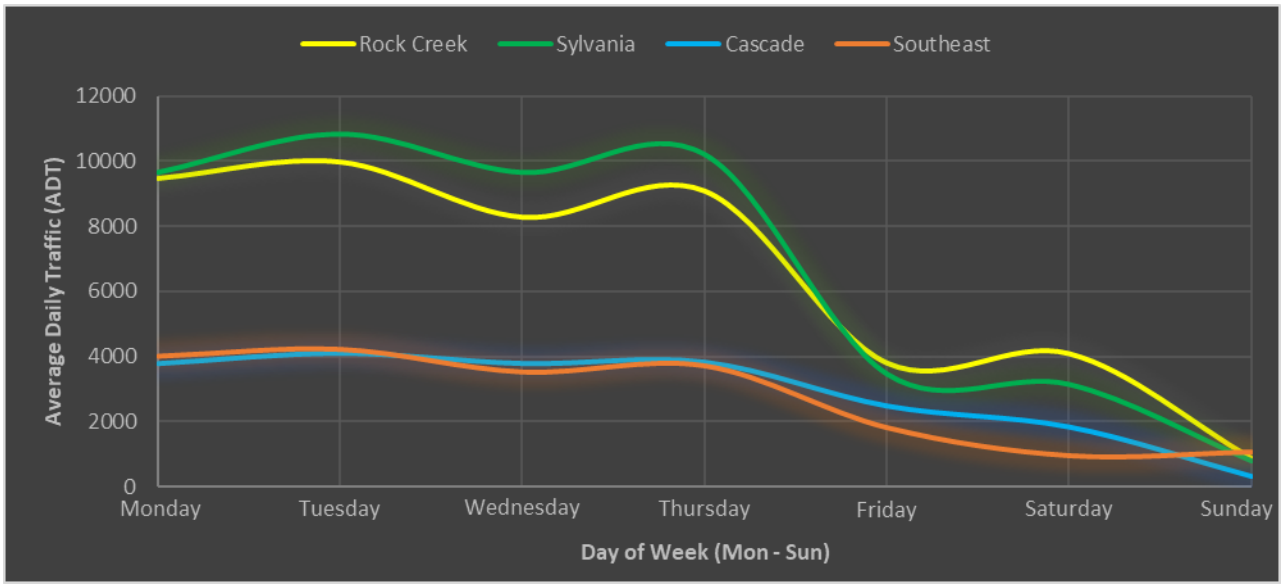
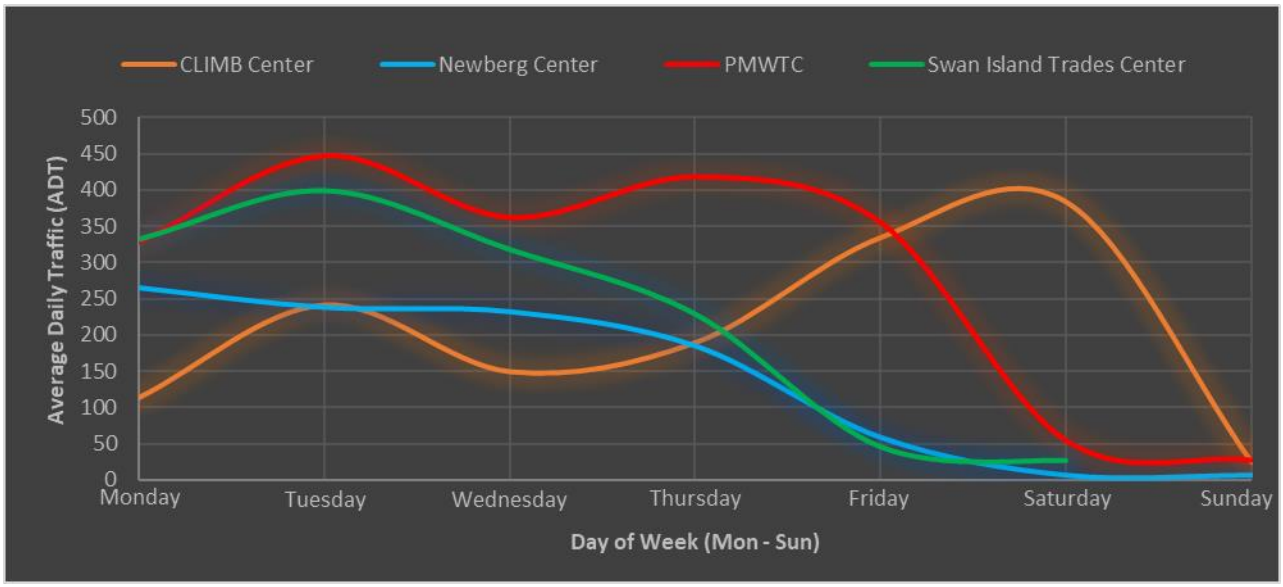


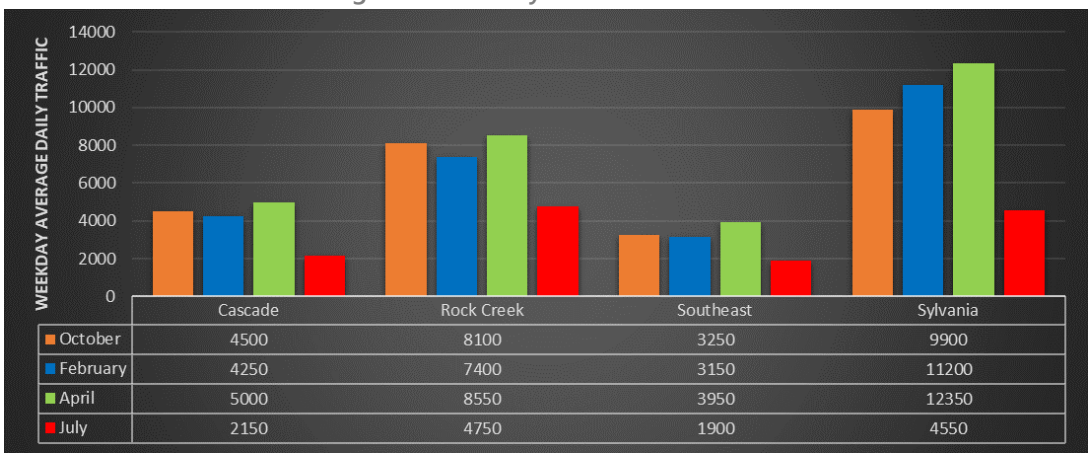
Figure 4: Center Hourly Traffic



Trends by Term

A study of each campus was conducted in terms of average daily traffic (ADT) on a typical weekday during different instruction periods. Data analysis was conducted for the entire month of October (Fall Term), February (Winter), April (Spring), and July (Summer), averaged across yeas 2016 through 2019 to remove anomalies in data. Generally, Fall, Winter, and Spring terms experience similar traffic, with approximately 50% less traffic in the summer term. In most cases, October represents an average of the three main instructional terms, with the exception of the Sylvania campus. Figure 5 represents the campus trends term by term across the four (4) main campuses.

Figure 5: Term by Term ADT Trends

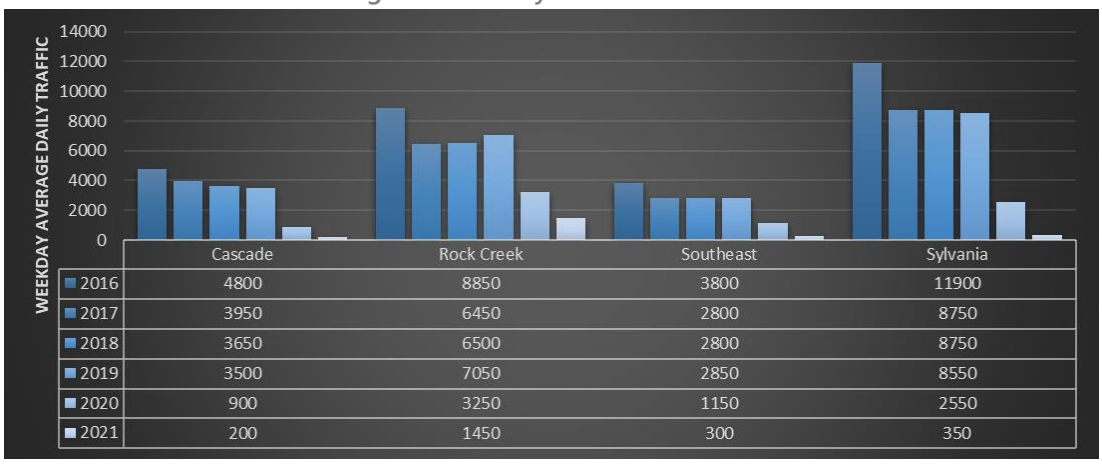


	Cascade	Rock Creek	Southeast	Sylvania
October	4500	8100	3250	9900
February	4250	7400	3150	11200
April	5000	8550	3950	12350
July	2150	4750	1900	4550

Annual Trends

A study of each campus was conducted in terms of average daily traffic (ADT) on a typical weekday during different instructional years. Data analysis was conducted by averaging the term by terms identified in Figure 5 across each year between 2016 and 2021. 2016 was found to have significantly higher ADT than years 2017-2019, by approximately 29-37%). This corresponds to FTE enrollment data, which was higher in 2016, but only by 4-13%. A precipitous drop in ADT was identified in the years 2021-2021, due to the COVID-19 pandemic school closure. Some traffic demand is still identified in the year 2020 as school was in regular operation for the first two months of the year, and for the year 2021 as some support staff and ancillary uses of the campuses were still functioning throughout the year. Additional year 2021 traffic is likely related to non-PCC traffic such as the Southeast campus church parking lot, THPRD at the Rock Creek campus, and various ongoing construction projects. Figure 6 represents the campus trends term by term across the four (4) main campuses.

Figure 6: Year by Year ADT Trends



	Cascade	Rock Creek	Southeast	Sylvania
2016	4800	8850	3800	11900
2017	3950	6450	2800	8750
2018	3650	6500	2800	8750
2019	3500	7050	2850	8550
2020	900	3250	1150	2550
2021	200	1450	300	350

Note: 2021 data only represents the average of the Winter and Spring terms.

A study of ADT data on a seasonal and annual basis was conducted to understand a cross-section of macro-daily trip generation trends. This approach provides the highest level of accuracy for determining the ADT rate at the four (4) main campuses. Data analysis was conducted for the entire month of October (Fall Term), February (Winter), April (Spring), and July (Summer), across yeas 2016 through 2019 to remove anomalies in data. ADT data was compared to FTE enrollment data provided by PCC. In all instances, the trip generation rates provided previously in Table 2 is lower than the four-year, multi-term average by 2-17%. The true ADT trip generation representative of different terms and years is best represented by the term average, as this removes scheduling and other confounding variables present in travel activity. Table 3 displays the campus ADT trip generation rates for all terms and available data years, with term, annual, and total averages also provided. Notably, trip generation was highest in 2016, consistent with higher overall enrollment.

Table 3: Campus ADT Rates

Campus	Term	2016	2017	2018	2019	Term Average
Cascade	Winter	3.84	2.87	2.52	2.84	3.02
	Spring	4.63	3.27	3.33	3.52	3.69
	Summer	3.14	3.27	4.13	3.39	3.48
	Fall	3.30	3.12	2.72	2.72	2.97
	Average	**3.73**	**3.13**	**3.17**	**3.12**	3.29
Rock Creek	Winter	4.48	2.99	3.40	3.63	3.63
	Spring	5.48	3.64	3.91	4.53	4.39
	Summer	8.08	5.61	4.96	5.21	5.96
	Fall	3.51	3.32	3.25	4.29	3.59
	Average	**5.39**	**3.89**	**3.88**	**4.41**	4.39
Southeast	Winter	5.22	3.12	3.27	3.21	3.70
	Spring	5.09	3.92	5.99	4.41	4.85
	Summer	6.21	5.76	3.86	6.51	5.58
	Fall	3.16	3.20	2.77	4.04	3.29
	Average	**4.92**	**4.00**	**3.97**	**4.54**	4.36
Sylvania	Winter	5.49	3.97	3.81	4.08	4.34
	Spring	6.24	4.22	4.82	4.73	5.00
	Summer	5.67	5.01	4.65	4.23	4.89
	Fall	3.53	3.20	3.49	3.99	3.55
	Average	**5.23**	**4.10**	**4.19**	**4.25**	4.44

Pedestrian & Bicycle Activity

This section summarizes analysis of trip generation and temporal site activity at each campus for people travelling on foot and people travelling on bicycles.

Active Transportation Trip Generation

A trip generation study of pedestrians and bicycles was conducted in order to determine the daily number of active transportation trips generated by the PCC Campuses. Table 4 below displays the nominal values for an average time period of Fall, Winter, and Spring in 2018 and 2019. This approach was taken to provide the most consistent results. These values will notably vary day to day, particularly as a result of weather conditions or schedule changes; however, the pedestrian and bicycle values are strong indications of the typical active transportation demand for the various campuses.

As shown, the morning peak period was identified as having higher pedestrian and bicycle trip generation than the evening peak period. The Southeast and Cascade campuses identified the highest per headcount pedestrian trip generation in all cases, whereas the Sylvania campus is the lowest. The Cascade and Southeast campuses identified a higher per headcount bicycle trip generation rate, whereas the Rock Creek campus is the lowest.

Table 4: Campus Active Transportation Trip Generation Rates

Campus	FTE	Headcount	Morning Peak Hour (7-9)		Evening Peak Hour (4-6)		Weekday (ADT)	
			Pedestrian	Bicycle	Pedestrian	Bicycle	Pedestrian	Bicycle
PCC Cascade	3,486	8,197	72	10	123	19	1,513	120
PCC Rock Creek	2,040	10,604	9	30	12	7	439	64
PCC Southeast	839	5,441	26	8	40	7	623	88
PCC Sylvania	2,482	12,291	25	17	24	15	378	78

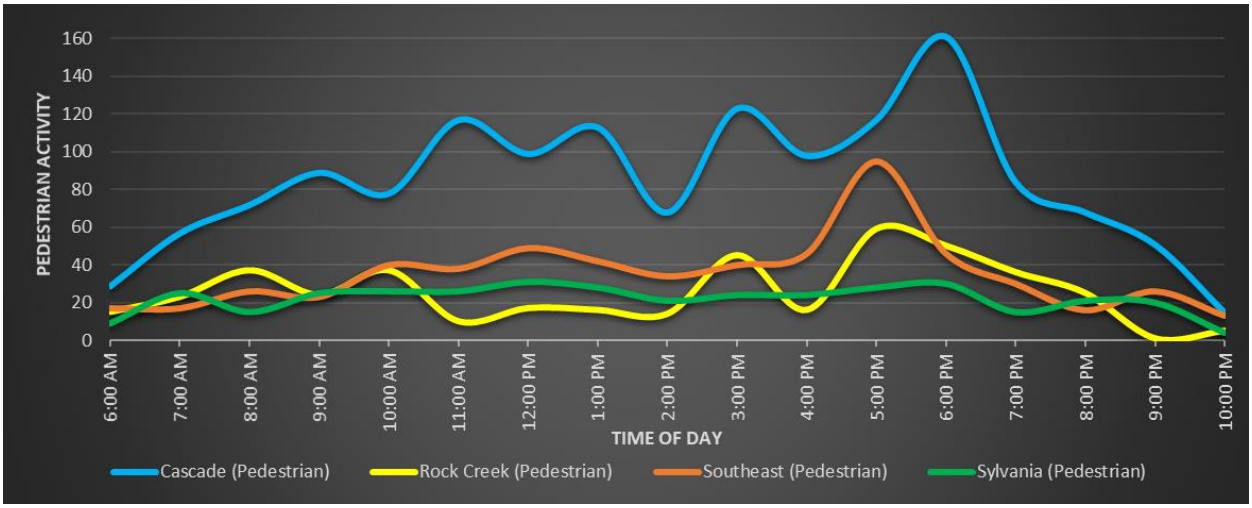
Note: Values represent the nominal number of pedestrian or bicycle activity at each campus.
High pedestrian trip rates are indicative of potentially multiple trips being made to and from the campus per day by a single person. For example, a student may arrive to campus in the morning, leave campus for lunch, and return in the afternoon for additional classes.

Time of Day

A study of bicycle and pedestrian activity on each campus was conducted in terms of trip activity throughout the day. Data analysis was conducted for representative month periods for the Fall-Spring terms in 2018 and 2019, with data filtered to only include Monday through Thursday, which are considered to be typical instructional days at PCC. No significant variations were identified across weekdays, but a drop in pedestrian and bicycle activity was identified on weekends, consistent with vehicular demand trends.

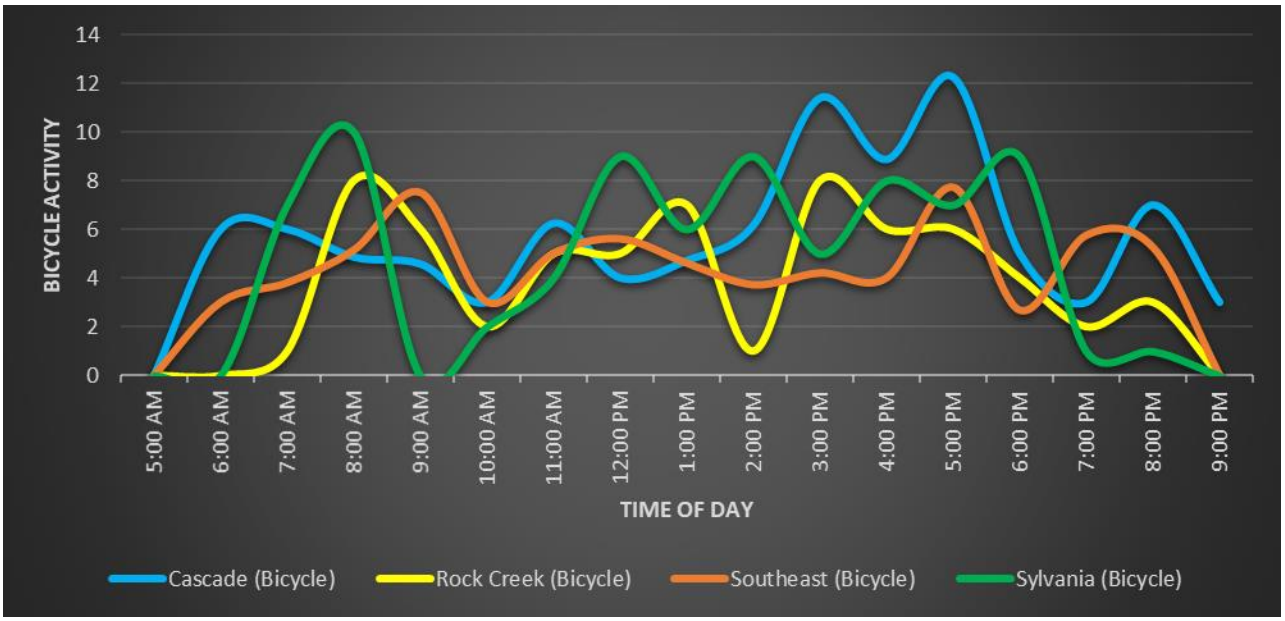
Figure 7 and Figure 8, respectively, display pedestrian and bicycle activity (inbound and outbound) on an hourly basis at each campus. As shown, the campuses follow a general trend of consistent activity pedestrian activity, with a peak in the 5-7 PM afternoon period, corresponding with the warmest times of day after most class times. The urban Cascade and Southeast campuses were identified to have the highest pedestrian activity.

Figure 7: Campus Hourly Pedestrian Traffic



Bicycle activity surges during the 7-10 AM time period, corresponding with early morning class start times. Activity is also notably higher during the midday period, 12 AM to 2 PM during lunch time and with another peak in the evening period from 4-6 PM. Bicycle activity was identified to be the highest at the Cascade and Southeast campuses.

Figure 8: Campus Hourly Bicycle Traffic



Trends by Term

A study of each campus was conducted in terms of average pedestrian and bicycle trip generation on a typical weekday during different instructional periods. Data analysis was conducted for the entire month of October (Fall Term), February (Winter), April (Spring), and July (Summer), averaged across yeas 2018 and 2019. The fall term was identified to have the highest pedestrian trip generation, whereas the spring term has the highest bicycle trip generation. Fall term pedestrian trip generation was found to be 14% higher than the Fall-Spring term average. Spring term bicycle trip generation was found to be 36% higher than the Fall-Spring term average. Figure 9 and Figure 10 represent the campus trends term by term across the four (4) main campuses for pedestrian and bicycle trip generation, respectively.

Figure 9: Campus Hourly Pedestrian Traffic

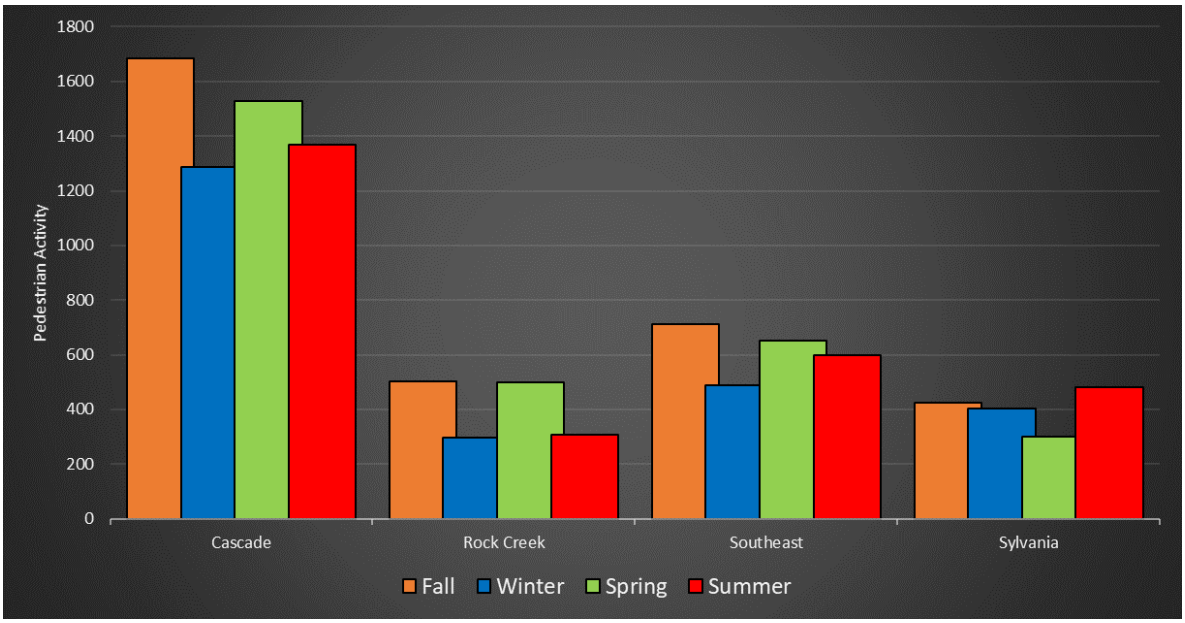
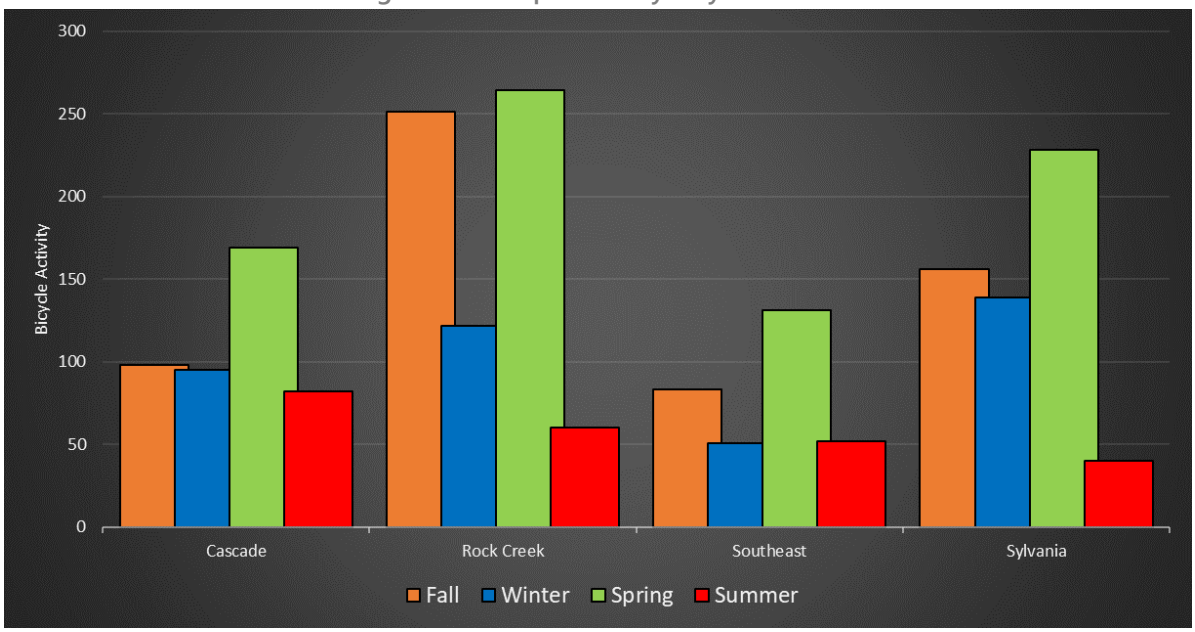


Figure 10: Campus Hourly Bicycle Traffic



Inter-Facility Travel Activity

PCC is a decentralized college system with several campuses and centers, providing a myriad of educational and job training programs. Due to the nature of this system, it is common for students to travel between campuses and centers for different classes or instructional periods. Additionally, professors commonly travel between campuses and centers for class time, meetings, or back to their primary office room. Understanding the travel patterns occurring directly between campuses and centers provides PCC with the ability to fully understand the impact of decentralization and how class scheduling, the PCC shuttle program, and other transportation options are presently contributing to PCC's trip generation.

Origin & Destination Analysis

An origin and destination analysis was conducted between PCC campuses and centers to quantify how many average daily trips travel between the 13 PCC facilities (the Oregon Manufacturing Innovation Center (OMIC) was excluded from this analysis as the center was not operational as of October 2019). As the name suggests, an origin-destination analysis represents movement through geographic space, from an origin to a destination. In this instance, these locations are the PCC campuses and centers. This information can inform to what extent students and staff travel between the many campuses and centers on a daily basis. With this, conclusions can be drawn on the value of particular PCC shuttle connections or how class scheduling increases travel demand at PCC campuses. For example, if a student has to travel to multiple campuses for class instruction, this can increase the system-wide trip generation.

Table 5 on the following page displays an origin and destination matrix for all campuses and centers studied. Each row represents an origin, whereas each column represents a destination. Using the big data platform, *Streetlight Insight*, geotagged cell phone data that is tracked throughout a given day, which passes through one campus or center location before travelling to another is represented as one inter-facility trip. Each cell represents the average number of daily trips travelling from one origin to another destination. High instances of inter-facility travel are denoted in red, with moderate demand denoted in purple, minor travel demand denoted in blue, and no average daily travel is left blank. It should be noted that although an individual may travel to multiple campuses and centers throughout the week or month, this information only indicates average travel on the same day.

As shown in Table 5, there is a strong relationship between the Cascade and Sylvania campuses, with many trips occurring between these two locations on a daily basis. Other notable locations of high demand include:

- The Sylvania Campus and the CLIMB Center
- The Sylvania Campus and the Downtown Center
- The Rock Creek Campus and the Willow Creek Center
- The Cascade Campus and the Downtown Center
- The Cascade Campus and the CLIMB Center

Average Daily O&D (October 2019) Origin ↓ / Destination →	Cascade Campus	Rock Creek Campus	Southeast Campus	Sylvania Campus	CLIMB Center	Downtown Center	Hillsboro Center	Newberg Center	PMWTC	Swan Island Trades Center	Willow Creek Center	TOTAL
Cascade Campus		3	12	119	15	15			9		3	176
Rock Creek Campus	1			4	4	4	2				38	53
Southeast Campus	20			2	15	15			2	2	3	59
Sylvania Campus	166	8	1		54	54		2	2	6	1	294
CLIMB Center	20		9	47		4	1			3	2	86
Downtown Center	27		2	9	7							45
Hillsboro Center	3			3	5	5						16
Newberg Center				2	4	4						10
PMWTC	14		3	4	3	3						27
Swan Island Trades Center	8		5	7	6	6						32
Willow Creek Center	10	24	2	3	5	5	7			3		59
TOTAL	269	35	34	200	118	115	10	2	13	14	47	857

High
Major
Minor
1
0

Table 5: Origin & Destination Matrix (October 2019 Data)

Figure 11 displays the same data as Table 5 in a geospatial format. Each line represents travel to and from a campus or center. Thicker, redder lines represent high inter-facility travel demand. Thinner, greener lines represent low inter-facility demand. Clearly, it can be interpreted that the PCC Cascade and PCC Sylvania campuses have the highest incidence of inter-campus travel. It is reiterated that these lines represent average travel patterns within a singular day, and are not an aggregate of multiple days or weeks.

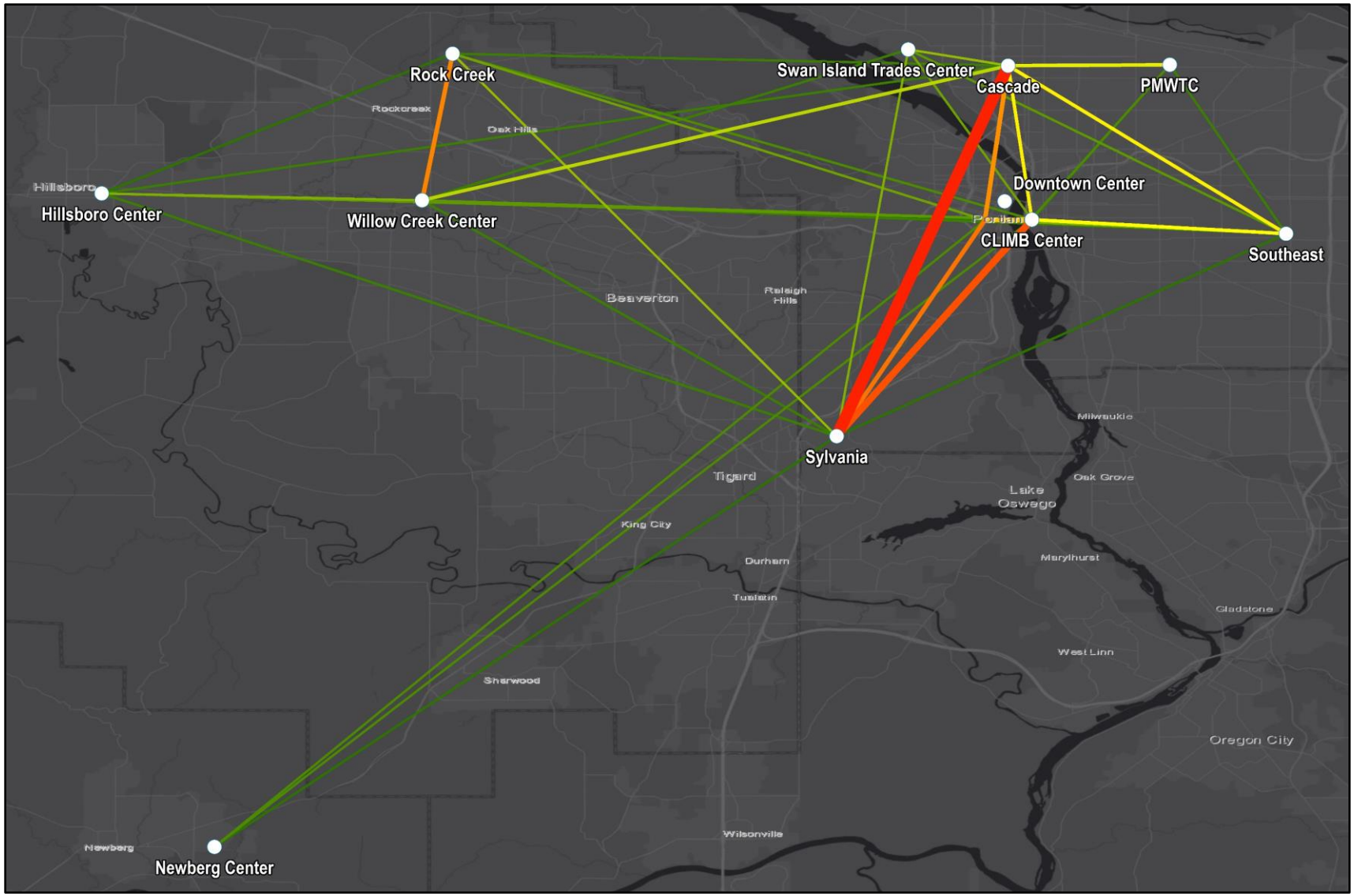


Figure 11: Origin & Destination Map (October 2019 Data)

Shuttle Relationship

Based on the origin and destination information provided in the previous section, there is notable travel demand trends between particular campuses and centers. PCC currently operates an in-house shuttle program which provides free weekday transportation between PCC campuses, some centers, and some transit centers. Figure 12 displays a diagram of the six (6) primary shuttle lines. PCC shuttle lines with route descriptions are provided below:

- Blue line (Rock Creek – Sylvania – Rock Creek)
    - Includes stop at the TriMet Sunset Transit Center
- Green line (Cascade – Sylvania – Cascade)
- Orange line (Sylvania – Downtown – Sylvania)
    - Downtown stop at SW Broadway & SW Hall Street (3 blocks from the Vanport Building)
- Purple line (Cascade – PMWTC – Southeast – PMWTC – Cascade)
- Red line (Cascade – Rock Creek – Cascade)
    - Includes stop at the TriMet Sunset Transit Center
- Yellow line (Southeast – Sylvania – Southeast)
    - Includes stop at SE 47th Avenue & SE Hawthorne Boulevard for TriMet transit connections
    - Includes stop at SE 16th Avenue & SE Hawthorne Boulevard for TriMet transit connections
- Swan Island Evening Shuttle
    - Connects Swan Island Trades Center, MWTC, and the Rose Quarter

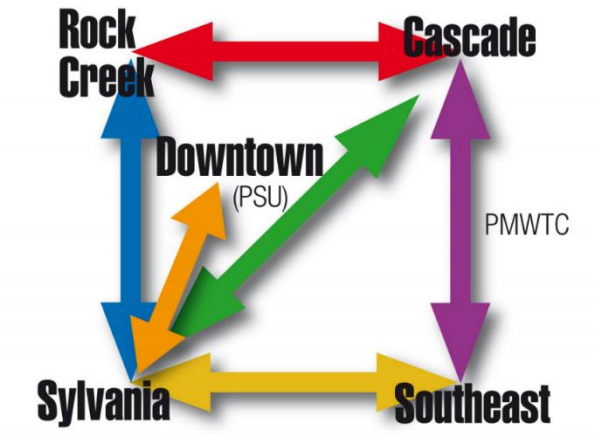


Figure 12: PCC Campus Shuttle Diagram

The origin and destination study affirms that many of the existing routes are consistent with the existing demand patterns. However, several routes also have low connection demand. As PCC expands or reduces the shuttle program in the next few years, higher demand routes should be prioritized for both frequency and service.

Regional Travel

This section discusses regional travel demand patterns between PCC campuses and centers throughout the greater Portland Metropolitan Area.

Zip Code Study

A zip code study was conducted for all PCC campuses and centers to determine where students and staff attending or working at PCC travel to and from on a daily basis. This analysis identified the average daily number of trips travelling from a local zip code to a PCC campus or center. A total of 512 nearby zip codes were analyzed for each of the 14 facilities. Figure 13 below graphically represents the zip codes in the Portland metro area that have the highest number of trip connections. It should be noted that zip codes with marginal trip routing are removed from this map. As shown, the highest frequency zip code is located in North Portland, with other high zip codes in Washington County and Southeast Portland.

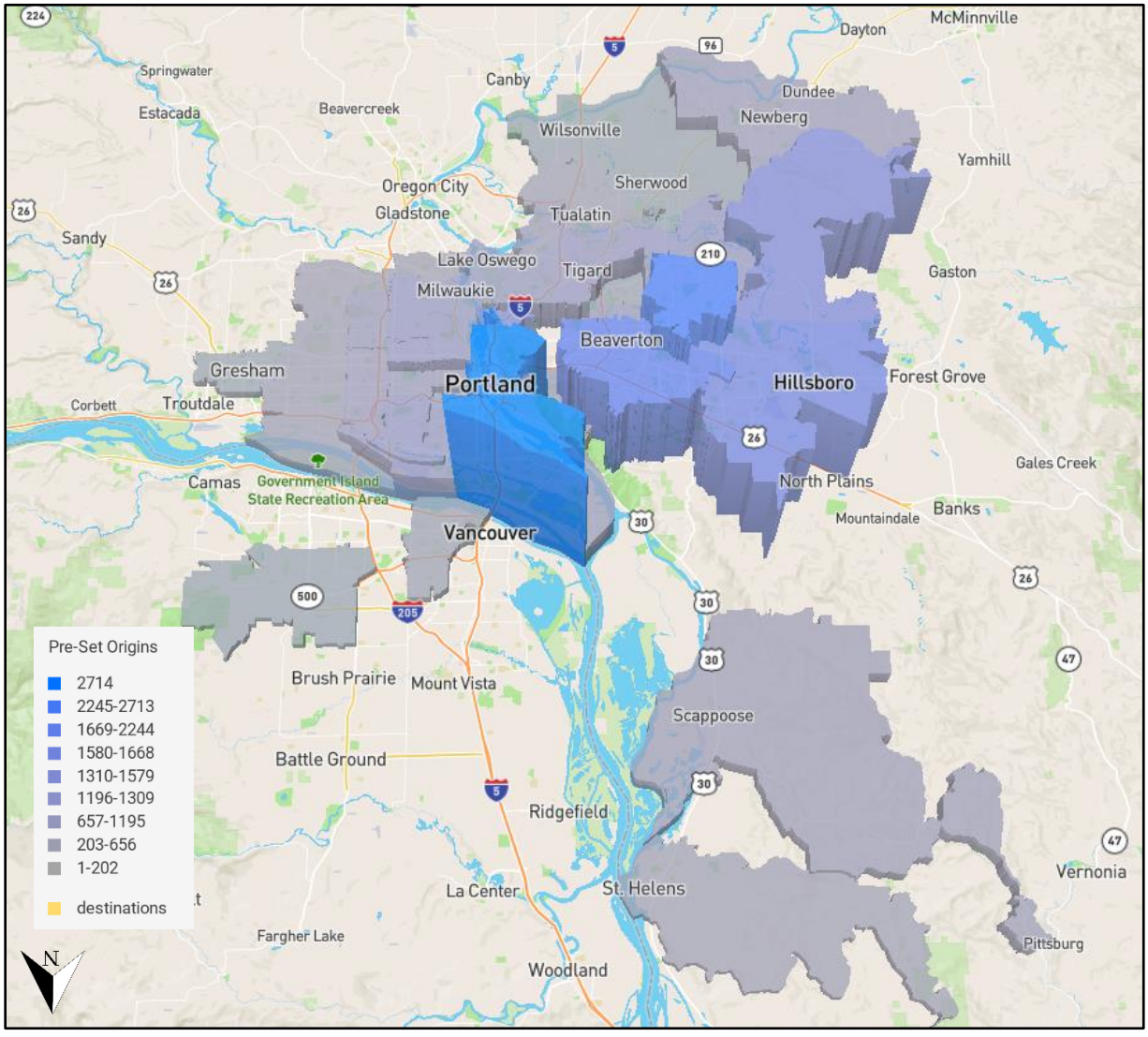


Figure 13: Zip Codes with Highest Trip Connections

Summary of Findings

Table 6 provided below lists the top ten zip codes with trip connections to PCC campuses and centers. The complete zip code study outputs for each campus and center are provided in the attachments. Regarding the zip code output map attachments, these can be interpreted as zip codes with the highest incidence of origin/destination trips travelling between a subject campus. Zip codes in red have very high travel demand patterns, whereas zip codes in blue have relatively lower travel demand patterns. Zip does are outlined in a thin black line whereas counties are outlined in a thicker black line. Cities are labeled with sizes relative to population. General observations are noted below:

- Overall, campuses tend to generate traffic from zip codes closest to the subject campus.
- Washington and Multnomah County accounted for the highest travel demand, with some traffic from Vancouver, southeastern Columbia County, and Newberg.
- Less travel demand from Clackamas County was identified than otherwise expected, likely due to competition with the Clackamas Community College (CCC) program.
- PCC Cascade identifies trips traveling a greater distance than other campuses, with a concentration in northern and northeastern Portland.
- PCC Rock Creek identifies trips traveling the shortest distance versus other campuses, with a concentration of trips throughout Washington County (notably Aloha, Hillsboro, and Beaverton) and western Portland.
- PCC Southeast Creek identifies trips traveling shorter distances travelled, with a concentration of trips throughout eastern Portland, Milwaukie, and Gresham.
- PCC Sylvania identifies trips traveling the greatest distance versus other campuses, with a concentration in southeastern Washington County (notably Tigard, Lake Oswego, and Tualatin) and northern Portland.

Table 6: Top Ten Zip Codes (October 2019 Data)

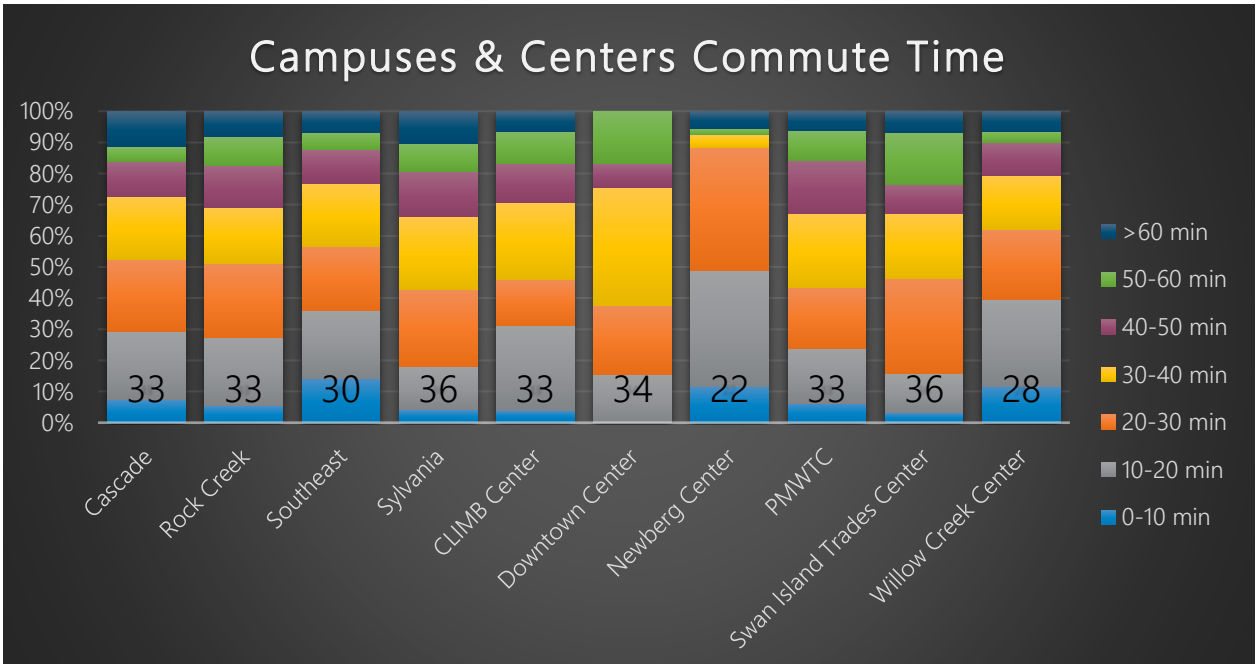
Rank	Zip Code	Total	Location Description
1	97217	2,893	N Portland (Arbor Lodge, Kenton, Humboldt, Hayden Island)
2	97006	2,053	Beaverton, Aloha, Hillsboro, Oak Hills, Cedar Hills, Cedar Mill, & Rock Creek
3	97123	1,639	NE Portland (Rose City Park, Central Northeast, Roseway, North Tabor)
4	97124	1,437	Hillsboro, Helvetia
5	97229	1,427	Washington County (Cedar Mill, Northwest Heights, Bethany, Rock Creek)
6	97218	1,062	NE Portland (Cully)
7	97214	933	SE Portland (Buckman, Sunnyside, Hosford-Abernathy)
8	97201	918	Hillsboro, Helvetia
9	97206	903	SE Portland (My. Scott-Arleta, Woodstock, Foster-Powell, Brentwood)
10	97215	891	SE Portland (Mount Tabor)

Trip Characteristics

This section describes commute time and distance distributions for each PCC campus and center. This information is provided as a tool within the big data platform *Streetlight Insight* and is provided for information purposes and to convey the driver experience for travel to PCC facilities. Note that the (OMIC Building) was not operational as of October 2019 and is therefore excluded from the study.

Commute Time

Figure 14 below displays the commute time distribution for each campus and center. The number corresponding to each facility represents the average commute time. As shown, nearly all campuses and centers experience an approximate average commute time of 30-36 minutes, with the exception of the Newberg Center at 22 minutes.



Commute Distance

Figure 15 below displays the commute distance distribution for each campus and center. The number corresponding to each facility represents the average commute distance. As shown, nearly all campuses and centers travel an average distance of 6-10 miles. The Sylvania campus is an outlier with an average commute distance of 11 miles, likely serving the greater Washington County area.

Figure 14: Commute Time Distribution

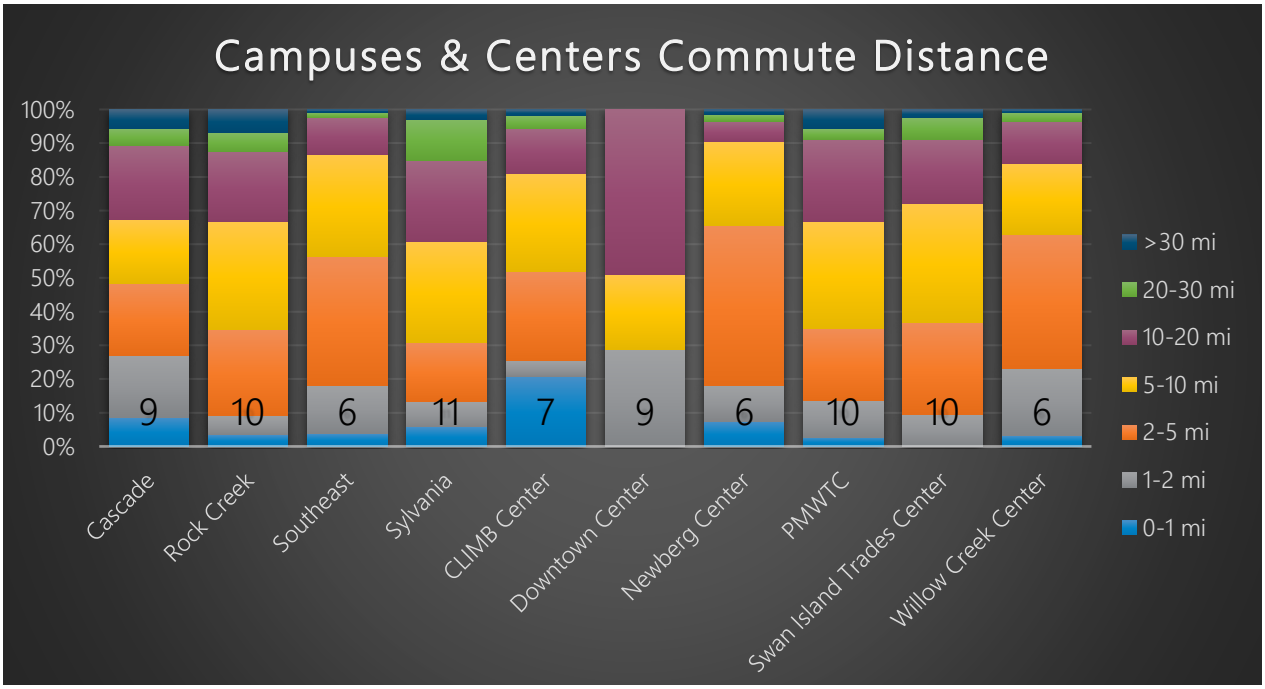


Figure 15: Commute Distance Distribution

Summary of Trip Characteristics Findings

The commute time and distance distributions find that is not a significant adversity experienced by students or staff travelling to any one of the PCC campuses and centers.

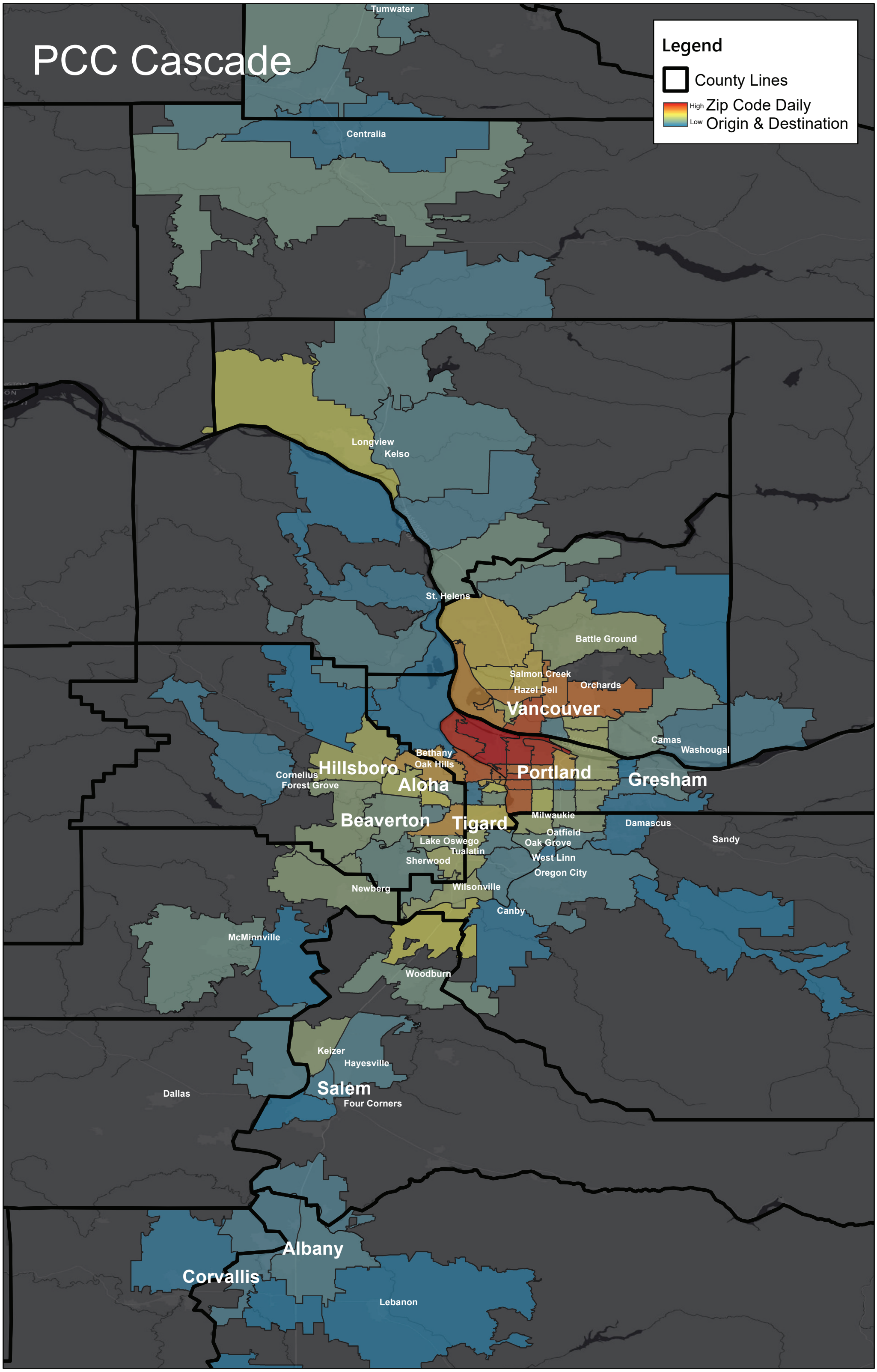
All Campuses & Centers

Legend

- County Lines
- High / Low Zip Code Daily Origin & Destination

Tumwater
Centralia
Longview
Kelso
St. Helens
Battle Ground
Salmon Creek
Hazel Dell
Orchards
Vancouver
Camas
Washougal
Bethany
Oak Hills
Hillsboro
Cornelius
Forest Grove
Aloha
Portland
Gresham
Beaverton
Tigard
Milwaukie
Damascus
Oatfield
Oak Grove
Sandy
Lake Oswego
Tualatin
Sherwood
West Linn
Oregon City
Newberg
Wilsonville
Canby
McMinnville
Woodburn
Keizer
Hayesville
Dallas
Salem
Four Corners
Albany
Corvallis
Lebanon

PCC Cascade


Legend
County Lines
High
Low
Zip Code Daily
Origin & Destination
Tumwater
Centralia
Longview
Kelso
St. Helens
Battle Ground
Salmon Creek
Hazel Dell
Orchards
Vancouver
Camas
Washougal
Bethany
Oak Hills
Hillsboro
Cornelius
Forest Grove
Aloha
Portland
Gresham
Beaverton
Tigard
Milwaukie
Damascus
Oatfield
Oak Grove
Lake Oswego
Tualatin
Sherwood
West Linn
Oregon City
Sandy
Newberg
Wilsonville
Canby
McMinnville
Woodburn
Keizer
Hayesville
Salem
Four Corners
Dallas
Albany
Corvallis
Lebanon

PCC Rock Creek

Legend

County Lines

High
Low
Zip Code Daily Origin & Destination

Tumwater
Centralia
Longview
Kelso
St. Helens
Battle Ground
Salmon Creek
Hazel Dell
Orchards
Vancouver
Camas
Washougal
Bethany
Oak Hills
Hillsboro
Cornelius
Forest Grove
Aloha
Portland
Gresham
Beaverton
Tigard
Milwaukie
Damascus
Oatfield
Oak Grove
Sandy
Lake Oswego
Tualatin
Sherwood
West Linn
Oregon City
Newberg
Wilsonville
Canby
McMinnville
Woodburn
Keizer
Hayesville
Salem
Four Corners
Dallas
Albany
Corvallis
Lebanon

PCC Southeast

Legend

County Lines

High Zip Code Daily
Low Origin & Destination

Tumwater
Centralia
Longview
Kelso
St. Helens
Battle Ground
Salmon Creek
Hazel Dell
Orchards
Vancouver
Camas
Washougal
Bethany
Oak Hills
Hillsboro
Cornelius
Forest Grove
Aloha
Portland
Gresham
Beaverton
Tigard
Milwaukie
Damascus
Oatfield
Oak Grove
Sandy
Lake Oswego
Tualatin
Sherwood
West Linn
Oregon City
Newberg
Wilsonville
Canby
McMinnville
Woodburn
Keizer
Hayesville
Salem
Four Corners
Dallas
Albany
Corvallis
Lebanon

PCC Sylvania