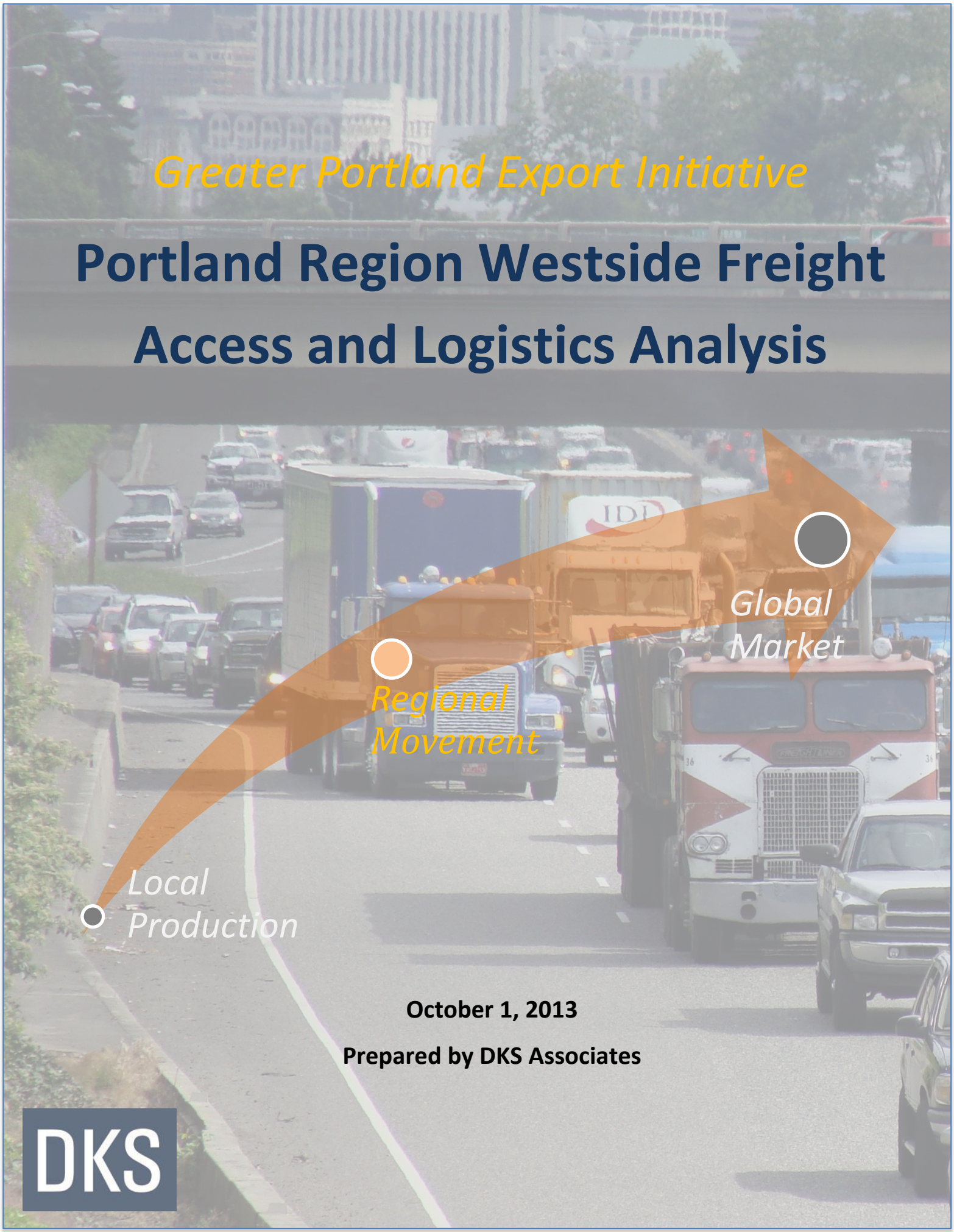
Greater Portland Export Initiative

Portland Region Westside Freight Access and Logistics Analysis



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General Disclaimer

The findings expressed in this document reflect analysis conducted for specific needs related to freight movement in the Portland metropolitan region. The findings do not necessarily represent the plans or policies of individuals, agencies, or groups listed in this document.

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1.SUMMARY

This chapter provides a high-level summary of the content of this report, including context for the analysis, perspective of the findings, and recommended outcomes.

Portland's Dependence on High-Tech Exports

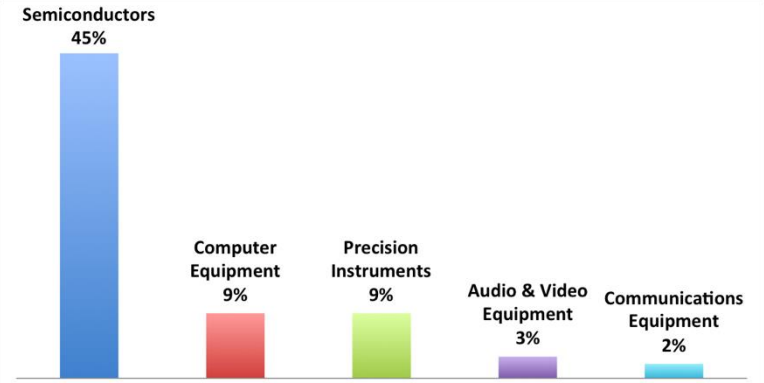
Portland's economy has long relied on export industries, serving broad domestic and international markets and bringing outside dollars into the region. Increasingly, Portland's export economy relies on the computer and electronics (C&E) industry, which accounts for over half the total value of the region's exports (Figure 1). This industry is primarily located in the region's Westside (sometimes called the "Silicon Forest") and depends on a tightly managed supply chain to efficiently bring products to markets that are mostly outside of the Portland Metropolitan area. This study provides recommendations on how to improve goods movement from the Westside C&E industry to Portland International Airport (PDX) freight consolidation locations.

Portland's export economy relies on the computer and electronics (C&E) industry, which accounts for over half the total value of the region's exports (Figure 1).

While this study focuses on a single sector of the region's export economy, it is important to recognize that the policies and investments that support the C&E industry may support other key export industries such as footwear, apparel, and agricultural products.

Continued growth in these other industries will tend to have ancillary benefits to the C&E industry, such as improving the frequency of PDX air cargo service or increasing the range of freight movement options.

Figure 1: Industries Representing Two Percent or More of the Portland Region's Exported Goods



Source: Brookings Instituion Export Nation 2013
(http://www.brookings.edu/research/interactives/export-nation)

Haven't We Studied This Before?

The movement of goods throughout the region is a key consideration in regional transportation planning. Metro, which leads these planning efforts, has adopted a Regional Freight Plan that focuses on the transportation improvements needed to support freight movement. The region has also produced a *Cost of Congestion* study that looks at how roadway congestion impacts freight movement and the economy.[1] This

[1]Economic Development Research Group. *The Cost of Congestion to the Economy of the Portland Region*. 2005.

study recognized the importance of the Westside C&E cluster and documented some of its unique constraints and challenges, but no study has ever focused exclusively on these manufacturers and their unique logistical challenges.

With the industry's transition to short-lifecycle mobile devices, a fast, efficient supply chain is more important than ever.

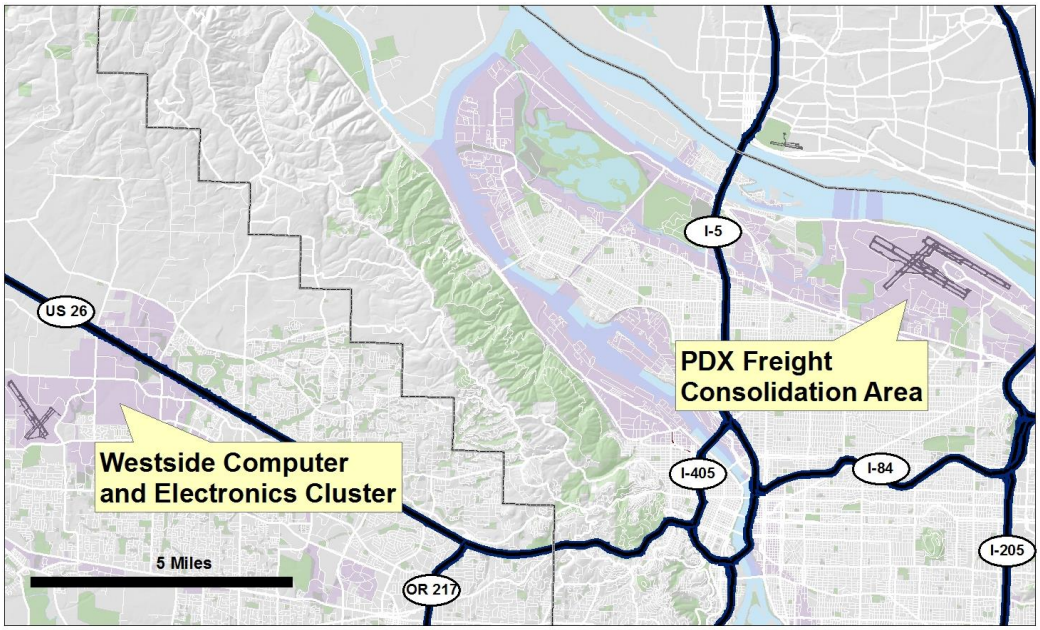
Many changes have taken place in the region since the *Cost of Congestion* study, which was completed in 2005, including the following:

- **Traffic is a bigger problem.** Where the previous study noted that 3:00 p.m. was a general cutoff time after which reasonable freight movement could not be expected, this time has now been pushed back to 2:00 p.m.
- **Fast and efficient supply chains are even more important.** The C&E industry has seen a shift away from personal computers, which typically have a four-year lifecycle, and moved toward smartphones and tablets, which have a one-year lifecycle.

Study Focus

This study focuses on the outbound movement of goods from Westside C&E manufacturers to the freight consolidation area at Portland International Airport (PDX), as shown in Figure 2. While not all C&E goods fly out of PDX, the freight consolidation area, generally located north of Columbia Boulevard and south of the terminal, is home to several firms that support international and domestic service by handling and combining C&E goods before trucking them north or south of the Portland region for consolidation at other airports. For the purposes of this study, Westside C&E firms are assumed to be clustered south of US 26 in the vicinity of Brookwood Parkway.

Figure 2: Study Area



Freight movement between the Westside C&E cluster and the PDX freight consolidation area depends on two routes: (1) US 26 to I-405 north to I-5 north, and (2) Cornelius Pass Road to US 30 then eastbound across the St. Johns Bridge to Columbia Boulevard. These key routes are the focus of this study. The study does not consider other corridors, such as OR 217 and I-5 south, that are important to regional freight movement but are not regular routes for transporting freight from the Westside to PDX.

Freight movement between the Westside C&E cluster and the PDX freight consolidation area depends on two routes: (1) US 26 to I-405 north to I-5 north, and (2) Cornelius Pass Road to US 30 then eastbound across the St. Johns Bridge to Columbia Boulevard.

As directed by the project's advisory committee, this study looked at projects that can have a significant impact on speed, efficiency, and reliability and that can be pursued in the near term. Other projects may have significant benefits to the Westside C&E industry but are outside of the study's scope because their expense and complexity makes them infeasible to implement in the near term. These include the Columbia River Crossing, capacity improvements at the Vista Ridge Tunnel and US 26/I-405 interchange, and a potential new Willamette River bridge north[2] of the St. Johns Bridge.

Five industry manufacturers were interviewed along with seven of their freight forwarder or integrators and carriers (trucking). These twelve stakeholders were interviewed to determine the factors that influenced their supply chain/ logistics decisions. The interviews highlighted that the span of control over the movement of products does not reside with any single entity, institution, or supply chain node from end to end. This results in the forwarders and integrators as primarily having the high level routing decisions; determining gateways and mode of travel. The factors driving logistics decisions are:

1) Fastest routing
2) Carrier equipment
3) Carrier qualification
4) Cost

Key Findings

Several important findings emerged from this study's industry interviews and technical analysis:

- **PDX is a crucial location along the supply chain, but most C&E freight moves out of PDX on a truck.** Firms involved in freight movement and logistics currently use PDX as a freight consolidation hub, but they generally find it is most efficient to truck, rather than fly, goods to airports that have better links to overseas destinations.

[2] A preliminary sensitivity analysis was conducted for a potential new Willamette River bridge to determine if it provided substantial benefit to travel times on the Cornelius Pass/US-30/Columbia Boulevard corridor. The analysis did not find that the corridor travel time reduction benefit appeared to match the potential cost and project impacts associated with this type of major improvement project. Therefore, this project was not further explored and considered as part of this study for improvements that would be feasible in the short term.

- **Supporting a strong Westside C&E cluster can help leverage freight movement options for other industries.** While the Silicon Forest is dominant in the region's export economy, other regional export industries such as footwear, apparel, and agriculture can benefit from the short-term strategies identified in this report. All export industries in the region benefit from air cargo services out of PDX, and these services can be maintained and/or increased by increased export activity.
- **Reliability of the roadway system is key to C&E goods movement.** Interviews indicated that after 2:00 p.m. "all bets are off" regarding the reliability of the US 26/I-405/I-5 corridor and that Cornelius Pass Road/US 30 becomes the de facto route in the afternoon. Analysis of travel time data confirms that Cornelius Pass Road/US 30 is significantly more reliable in the midday and p.m. hours.
- **The Westside C&E industry is heavily dependent on a rural road with known deficiencies.** Cornelius Pass Road from the Washington County line to US 30 was designed and built for rural use, but it is increasingly used for urban-to-urban trips. Because it is a winding and steep road through a narrow pass, it is susceptible to incident-induced congestion (such as truck rollovers, Figure 3) and a lack of viable alternative routes.

Figure 3: Tanker Rollover on Cornelius Pass Road in July 2013

Source: KPTV-KPDX Broadcasting Corporation

Recommendations

Three strategies emerged from this study that show clear benefit to Westside C&E freight movement and can potentially be implemented in a short timeframe. These strategies are shown in Table 1.

Table 1: Recommended Priority Projects

Project Name	Description	Benefits
Enhanced Traveler Information	Provides predictive traveler information at key points on routes approaching US 26, alerting drivers to congestion on US 26, through the central city loop, or on Cornelius Pass Road northbound.	Provides more reliable travel time by alerting drivers of incidents, reducing non-recurring delay.
US 26 Truck Ramp Meter Bypass	Modify select US 26 on-ramps to allow freight to bypass ramp meter queues.	Potential to reduce queue-related delay by 10 to 20 minutes.
Enhanced Freeway Incident Response	Increase incident response and clearing capacity on key US 26/I-405/I-5 freight route to reduce non-recurring congestion impacts.	Reduces delays due to incidents.

Frequently Asked Questions

If congestion is such a problem, then why don't manufacturers on the Westside simply ship all of their goods at uncongested times, like midnight? Shippers, consolidators, and carriers are staffed up to handle C&E goods during the afternoon and evening hours. This allows them to efficiently truck, sort, and consolidate goods so they can meet delivery specifications, which typically depend on cut-off times for early-morning international shipments. Moving goods within the Portland region late at night would require that cutoff times at all stages of the logistics process would have to shift, which would have an effect all around the world. Additionally, later cutoff periods would require a change in shifts for the local work force, which would not be beneficial for attracting and retaining workers that prefer typical daytime working hours.

If connecting to air service is so important to the Westside C&E industry, why not fly everything out of the Hillsboro Airport (HIO)? This report reveals that most C&E shipments bound for PDX do not go on a plane, but are consolidated with other goods and trucked to other gateways like Seattle and San Francisco. Freight consolidation firms are clustered at PDX because they depend on the scale created by region-wide export needs, and not just goods from the Westside. Significant capital investment would be required to justify service from HIO, especially given the relatively small physical volume of freight from the C&E Industry.

Why were only two routes considered for this analysis? Can't freight move directly out of the Westside to other gateways (e.g., Seattle and San Francisco)? Interviews revealed that the US 26/I-405/I-5 route is generally preferred for off-peak movements to PDX, while the Cornelius Pass Road/US 30 route is the alternative in the afternoon and evening peak. Westside C&E manufacturers currently depend on freight logistics firms based at PDX to consolidate and provide economy of scale for their export activities. To this point, the market has not supported freight logistics services directly out of the Westside (north on US 30 to I-5 north at Longview/Kelso or south through Washington County to I-5 south).

2. BACKGROUND AND CONTEXT

This chapter provides relevant background information on past planning efforts and freight needs in the Portland metropolitan region.

Export Industries and Goods Movement in the Portland Region

The Portland metropolitan region is an international gateway for trade and a domestic freight hub. Portland's role in international commerce and a variety of key industries help drive the economy and growth potential of the region. Recent studies (such as the *Cost of Congestion* study cited in the previous section) report that the metropolitan region has a higher than average dependency on traded sector industries. These industries include computer/electronic products, wholesale distribution services, and other business sectors that serve broader national and international markets and infuse the region's economy with outside dollars.

These studies found that Portland's traded sector industries depend on a well-integrated and well-functioning international, regional, and local transportation system to stay competitive in a global economy. Economic growth forecasts for the Portland region are based on the implicit assumption that the Portland region will remain competitive with other regions in such factors as business cost and operating conditions, which includes access and reliability. This study focuses on access, reliability, and logistics for the Portland area's computer and electronics (C&E) industry, concentrated in the west side of the region.

Regional Planning Background

Previous regional studies have identified issues that impact the movement of goods between the Westside area and PDX.

Cost of Congestion Study (2006)

One aspect of this study was to obtain the business perspective on regional transportation issues through interviews with stakeholder, including representatives from the Westside C&E industry. Stakeholders identified these issues:

- **Cross-Region Movement.** Most interviewees cited major problems with east-west movements that involve Highway 26 and/or Highway 217. The I-5/I-84 interchange was also frequently identified as a major choke point on the system.
- **P.M. Congestion.** Several interviewees had already restricted their operations after 3:00 p.m. to avoid evening congestion.
- **Interchange and Ramp Congestion.** Inadequate capacity was most apparent to interviewees on arterials leading to the freeway system and on- and off-ramps.

Regional Freight Plan 2035 (2010)

This Metro-led effort acknowledged that the Portland regional economy is heavily trade-dependent and that a regional plan for freight and goods movement is a key part of keeping Portland economically vibrant. Transportation and logistics issues identified in this process include:

- **Congestion and Hotspots:** Chronic bottlenecks that impede regional freight/goods movement
- **Reliability:** Unpredictable travel time due to crashes, construction, special events, and weather
- **Capacity Constraints:** Physical and operational issues as well as lack of capacity in critical corridors
- **Network barriers:** Safety concerns and out-of-direction travel resulting from weight-limited bridges, low bridge clearances, steep grades, at-grade rail crossings, and poorly designed turns or intersections

A Regional Freight and Goods Movement Task Force identified specific bottlenecks. Two of these are particularly significant routes from the Westside to PDX: the I-5/I-84 interchange and the I-5/I-405/US 26 loop.

Current Export Planning and the Westside C&E Industry

Through a competitive process, Portland was selected as one of four metropolitan regions in the nation to partner with the Brookings Institution on a Metro Export Initiative (MEI).[3] The purpose of the MEI is to convene and focus the regional trade community in order to establish shared export objectives across different agencies, levels of government, and public and private entities.

Greater Portland Export Plan

As part of the MEI, an Export Plan was drafted that included a market assessment to help establish the foundation for future strategies. This assessment found that the computer and electronic industry is by far the dominant export industry in the Portland metropolitan area, accounting for about 57 percent of the value of the region's total exports as of 2010. More recent data from the Brookings Institution (cited in the first section of this report) suggests that the region's economy has become even more dependent on exports, with the C&E industry continuing to lead the export economy.

According to the Greater Portland Export Plan, in 2010 nearly one-fifth of the Portland economy was generated by exports. The computer and electronics industry accounted for 57 percent of the value of these exports.

The Export Plan provided guidance to Greater Portland Inc, the region's public-private economic development organization, on next steps, which involve implementing MEI's four key strategies:

1. Leverage primary exporters in computer and electronics
2. Catalyze under-exporters in manufacturing
3. Improve the export pipeline for small business
4. "We Build Green Cities" – brand and market Greater Portland's global edge

[3] Brookings Institution. *Greater Portland Export Plan: Metro Export Initiative*. 2012.

The first strategy in particular relates to the region's transportation system:

Support and Leverage Primary Exporters – This strategy calls for increasing the local share of the computer and electronic manufacturing supply chain and addressing regional policy issues to enhance the long-term competitiveness of the industry.

Export Initiative Business Plan

Greater Portland Inc developed an Export Initiative Business Plan (EIBP) to help advance the four strategies.[4] The EIBP established the actions needed, including those that specifically support and leverage primary exporters, and defined the roles and responsibilities of regional partner agencies in each action. One action was a Freight Access and Logistics Analysis. The Port of Portland was named the lead agency and several other public and private entities identified as partners on a work group. The EIBP defines this action as follows:

Freight Access and Logistics Analysis – Determine critical freight movement from the Westside computer and electronics (C&E) companies to PDX and other transfer points and recommend improvements to the system, travel patterns, and/or other options and recommendations on leakage.

The C&E sector depends on timely deliveries to national and international destinations, and the freight and logistics process can be complex. It requires coordination of several entities, with specific timing and modal connections varying by manufacturer. Manufacturers specify destinations, handling requirements, timing constraints, and general cost parameters to forwarders and integrators. The forwarders and integrators determine high-level routing and select domestic and international gateways that meet the manufacturer specifications, and they assign the various segments of the movement to carriers. Carriers select local routing to meet the specifications given by the forwarders and integrators, which must be dynamically optimized as conditions and changes occur.

If Intel experiences delays or missed shipments, it can shut down a production line as far away as Costa Rica or Malaysia, creating a worldwide ripple effect on production and testing operations.

The EIBP defines several supporting elements for the Freight Access and Logistics Analysis. These include:

- Identify export/import destinations and services used to access markets
- Evaluate logistics patterns, volume, and time of day for target industries
- Identify export/import destinations and services used to access markets

[4] Greater Portland Inc. *Export Initiative Business Plan*. October 2012.

- Evaluate logistics patterns, volume, and time of day for target industries
- Examine current travel patterns
- Examine projected traffic growth by time of day and determine implications for Westside C&E companies
- Define problems and consider options for improving flow and efficient access to PDX and other transfer points
- Define possible projects and evaluate their feasibility for implementation

Based on these elements, a work program for the Freight Access and Logistics Analysis was developed, which included the following tasks:

- **Data Collection and Assessment**. This task focused on analyzing existing conditions on corridors connecting Westside C&E firms to PDX.
- **Stakeholder Interviews**. This step in the process was aimed at identifying stakeholders in the Westside C&E industry and asking about how they use the corridor, key routes and locations, time-of-day issues, and other information to help define the key issues.
- **Needs Analysis and Recommendations.** This task assembled a list of potential projects and strategies, analyzes their effectiveness in addressing the issues identified in the previous two steps, and recommended priority projects for the Westside C&E industry.

Freight and Logistics Terms

Carrier: Airline, ocean line, railroad, or trucking company that carries cargo

Clearance: Moving imports through U.S. Customs inspection

Consolidator: Company that takes smaller loads going to the same destination and combines them into larger loads to take advantage of cost savings

Drayage: The movement of goods to and from transportation facilities (airports, marine terminals, rail ramps, etc.)

Forwarder: A third-party company that arranges for the transportation of freight based on its customers' needs (timing, cost, etc.), choosing the carriers, modes, and routes on its customers' behalf; the company prepares all import and export documentation for international shipments. Forwarders do not handle or move the cargo themselves.

Integrator: Company that provides door-to-door delivery, carrying the freight for its entire trip (such as UPS or FedEx)

3. INDUSTRY INTERVIEWS

Interviews and working groups that involved private sector representatives from a variety of industries were a key part of earlier, related efforts such as the *Cost of Congestion* study and the *Regional Freight Plan*. In order to more precisely define the transportation and logistics issues facing Westside C&E firms, this study also interviewed stakeholders involved in manufacturing and transporting high technology goods to and from the Beaverton-Hillsboro area. The results of these interviews can be found in the appendix.[5]

Interview Process

The stakeholder interviews consisted of two sample sets of participants: manufacturers and firms that specialize in freight movement of C&E goods from the Westside. In the first set of interviews, the manufacturers were asked who their key freight logistics providers were. This helped in identifying the second set of stakeholders: forwarders, integrators, and carriers. Interviews were conducted with representatives of these sample firms:

C&E Industry Manufacturers

- FEI Company
- Intel
- Lattice Semiconductor
- Oracle
- TriQuint Semiconductor

Forwarders, Integrators, and Carriers

- Expeditors
- Javelin Logistics
- Kintetsu Worldwide Express
- OIA Global Logistics
- United Van Lines
- Jet Delivery
- FedEx

Interview Findings

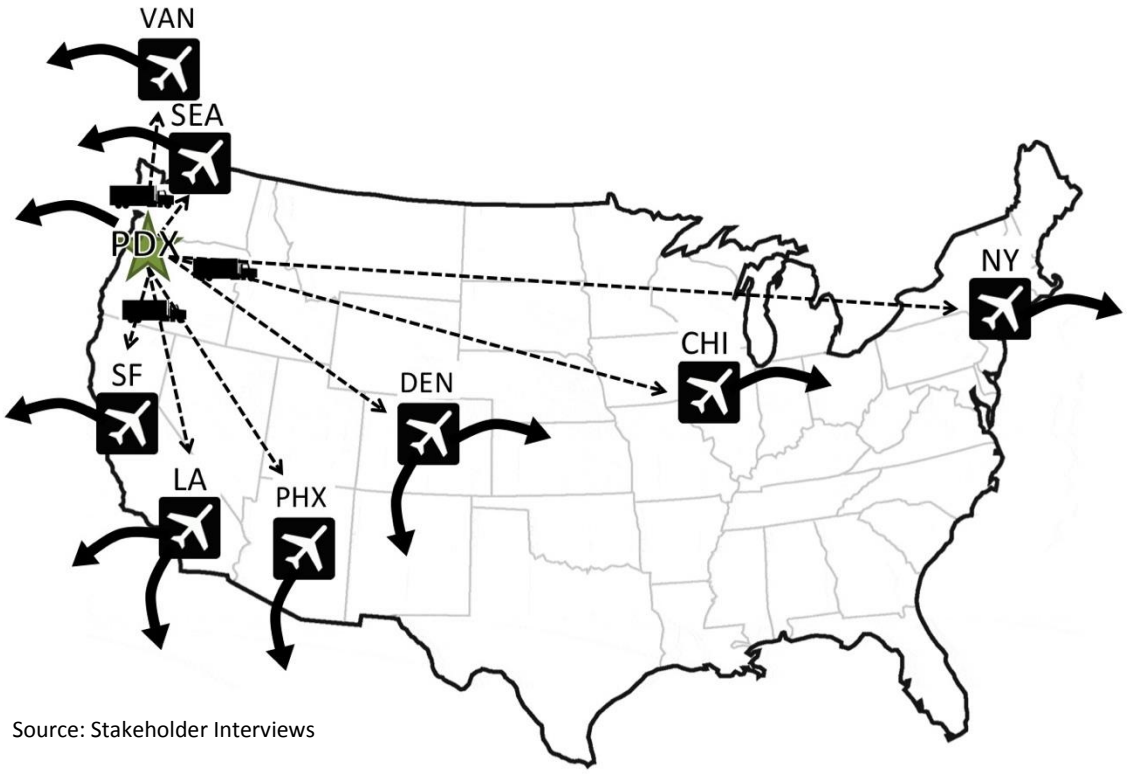
The interviews provided valuable insight into the preferences and observations of the participants, including ultimate destination of goods, how participants use the transportation system, and key issues and observations of the transportation system.

Key Destinations

The freight consolidation area at PDX is the key destination for movement of C&E goods from the Westside, not only for air freight directly out of Portland but for ground movement to other gateways as well. The PDX freight consolidation area facilitates connections to other international transfer points such as Seattle and San Francisco. A sample of mainland destinations identified as key hubs for regional exports is shown in Figure 4. Ultimate destinations for C&E goods from the region are listed in Table 2.

[5] One Northwest Consulting, LLC. *Westside Freight Access and Logistics Study Stakeholder Interviews (2013)*. August 2013.

Figure 4: Goods Flow to Overseas Gateways



Source: Stakeholder Interviews

Table 2: Sample Destinations of Regional Goods Based on Interviews

Asia		Northern Europe	Other Destinations
Bangkok	Manila	Amsterdam	Mexico
Beijing	Saigon	Dublin	Israel
Chengdu	Shanghai	Frankfurt	
Hong Kong	Singapore	Prague	
Incheon	Taipei		
Kuala Lumpur	Tokyo		

Source: Stakeholder Interviews

Needs and Issues

The interviews revealed key information about how decisions are made regarding supply chains, routing, and logistics. The following factors were identified as important in optimizing performance:

- Fastest routing, including directness and proximity, minimal touches and interchanges, and efficient movement through customs
- Carrier equipment compatibility and availability
- Carrier qualification as measured by damage-free handling and on-time performance
- Cost

Firms' level of concern over these issues varied depending on their role in the supply chain. Manufacturers were most interested in speed and damage-free handling; freight integrators emphasized that speed of delivery did not necessarily correlate with directness of routing; freight forwarders and carriers had the most interest in minimizing their costs. These differences in emphasis drove key interview findings that helped shape this study.

Industry interviews revealed that due to fluctuations in travel time, most carriers avoided the freeway system after 2 o'clock in the afternoon.

Role of PDX Freight Consolidation Area. The airport is a hub for C&E goods movement not only for goods being flown out of the Portland metropolitan region, but it is also home to consolidator facilities and integrator facilities (where goods are sorted and combined for the next phase of movement). In these facilities shipments are assembled and then transported overland to other gateways such as San Francisco and Seattle, where they may be consolidated further for a flight. Consolidation at PDX and other mainland gateways is especially important for C&E goods such as semiconductors, which are high-value but not a large volume so need to be combined with other goods in order to justify an air cargo flight.

Use of Feeder Flights. Because manufacturers showed a strong willingness to pay for speed in delivery, they expressed significant support for the possibility of short flights (Hillsboro Airport [HIO] to PDX, for example) to replace truck trips. However, forwarders, integrators, and carriers were skeptical that this type of service would be competitive with current ground services. From their perspective, a feeder flight from HIO to PDX would not yield a significant velocity gain, if any, due to added logistical complexities. These firms also indicated that manufacturers are unlikely to pay the higher cost for an additional air cargo trip in the supply chain. Additional research may be needed to quantify the tradeoff between cost and velocity.

Highway 26 Congestion and Alternative Routes. Interviewees stated that, during the p.m., recurring congestion on US 26 eastbound (perceived as originating at the Vista Ridge Tunnel) renders the facility unusable for efficient goods movement. Variability was also cited as a problem, as eastbound movements may take 30 minutes one day and 90 minutes the next. The only viable alternative route identified in interviews for freight destined to PDX is Cornelius Pass Road to US 30 to either Marine Drive or Columbia Boulevard. Interviews suggested that this is generally the de facto route after 2:00 p.m. This alternative route presents its own set of issues, however, as Cornelius Pass Road is a narrow, winding two-lane rural road that has been targeted for several safety-related investments, most of which are unfunded.

Bottlenecks. Participants noted several pinch points on the regional system. Problem areas specifically related to the Westside-to-PDX route are:

- US 26 at the Vista Ridge Tunnel
- I-5 from the Terwilliger curves to I-405
- I-5 from I-405 to the Interstate Bridge over the Columbia River
- The I-5/I-405 loop (including the I-5/I-84 interchange)
- The St. Johns Bridge, particularly conflicts in the St. Johns neighborhood as freight movements connect to Marine Drive and Columbia Boulevard

Other identified pinch points affecting the overall regional system include:

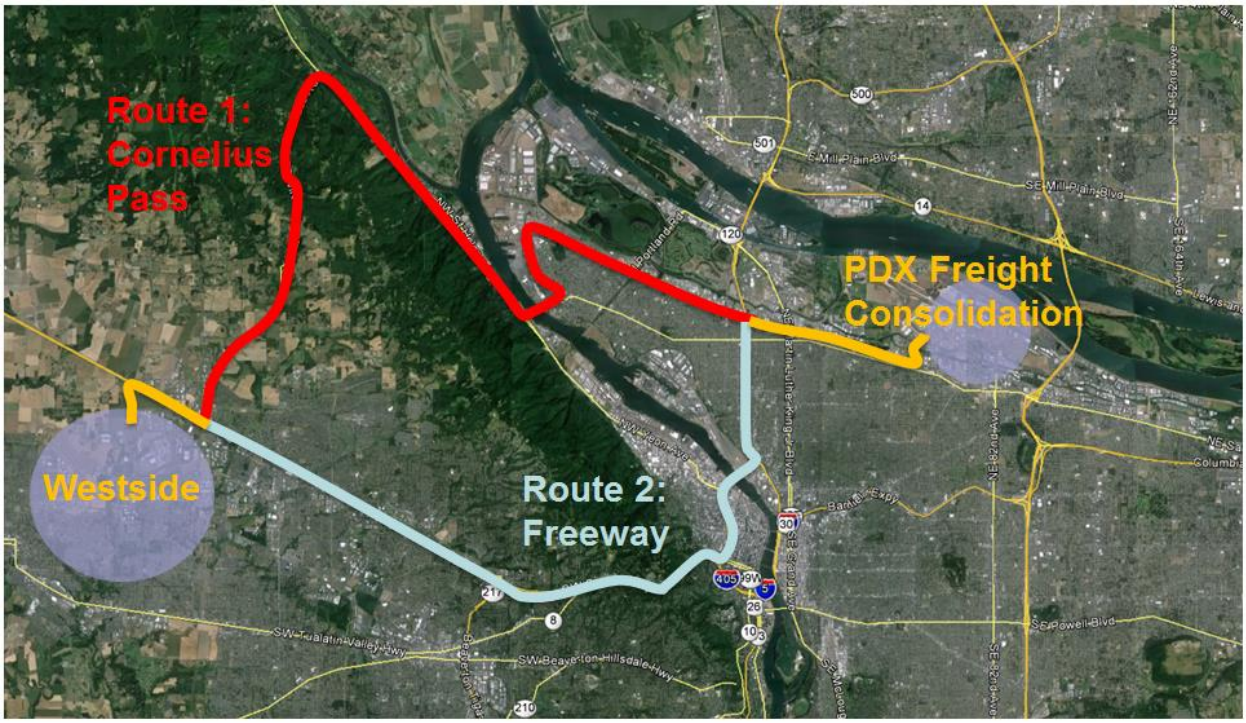
- The I-205/I-84 interchange
- The Airport Way/I-205 interchange, particularly for traffic headed north of I-205
- I-84 east of I-205

Defining the Scope of the Analysis

The interview process helped define the scope of the Westside Freight and Logistics Analysis, which focuses on Hillsboro as the beginning point for Westside C&E freight movement and the PDX freight consolidation area as the end-point because of its role in consolidation, integration, and transfer of goods. By considering connections to the freight consolidation area, the analysis accounts for both short-term needs (existing conditions and goods consolidation for regional aggregation) and long-term opportunities for air cargo growth at PDX.

Because the interviews did not identify transportation issues in the morning period, the analysis focuses on p.m. conditions. Two routes were analyzed as part of this study. These routes consisted of (1) a direct freeway connection between Hillsboro (at Brookwood Parkway) to PDX freight consolidation, and (2) a parallel arterial route via Cornelius Pass to St. Johns Bridge, as shown in Figure 5.

Figure 5: Routes included in Traffic Analysis



What about Other Options for Goods Movement?

Other options for moving C&E goods were explored[6] in order to identify the potential for improved service and obstacles to implementation. Two modes were explored: MAX light rail (LRT) from Hillsboro to PDX, and flights out of HIO, either to PDX or to other domestic gateways in the western U.S. The following challenges were identified, and are described in more detail in the appendix to this report.

- LRT issues:
  - System capacity
  - Train capacity
  - Efficient connections to PDX freight consolidation areas
  - Increased handling and associated damage risk
- HIO issues
  - Runway and other design limitations
  - Lack of cargo loading infrastructure and equipment
  - No integrator or consolidator presence
  - Capital cost of aircraft for new service

Evaluation of Potential Strategies

The interview process suggested several ways to measure the success of different freight and logistics strategies. The project team selected evaluation criteria to align with these issues and that was applied in the assessment of transportation projects to address freight movement between Hillsboro and PDX. Table 3 lists the issues and evaluation criteria.

Table 3: Evaluation Criteria Considered

General Goal or Issue Identified	Evaluation Criteria
Fastest Routing	Average travel time (minutes)
Most Direct/Optimal Proximity	Travel distance (miles) Number of travel segments / corridors used
Minimize System Performance Variability	Travel time reliability (Buffer Index)
Improve System Redundancy (Connectivity)	Qualitative assessment (Would improvement add a new physical connection or provide a new opportunity to use an existing route?)

[6] Port of Portland. *Alternate Mode Consideration Working Paper*. June 2013.

4. TRANSPORTATION SYSTEM CONDITIONS

Transportation system infrastructure and operating conditions play an integral role in daily movement of goods. System conditions and connectivity can impact both when and how goods are moved. This chapter reviews two related items: existing use of the system and performance of the system.

System Use

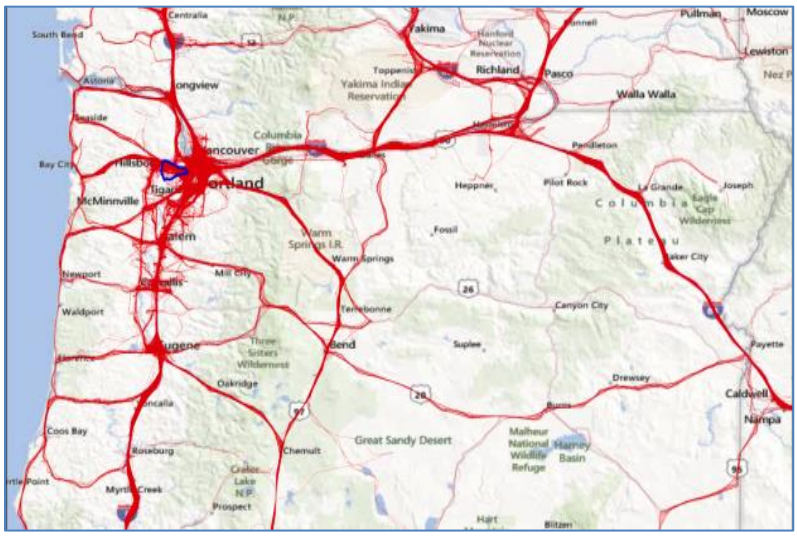
Various datasets are collected on a daily, weekly, or annual basis by local agencies and the freight industry. These datasets provide indicators of the routes, frequency, and volumes of freight traffic.

Regional Freight Movements for All Firm Types (Not Limited to C&E Firms)

The American Transportation Research Institute (ATRI) provided data that summarized truck movements into and out of the greater Westside area (inclusive of east Hillsboro and North Beaverton).[7] This area is broader than the C&E focus, giving a more complete understanding of freight use of the Westside area.

ATRI collects data from devices in trucks to record data[8] on the routes, times of day, and speeds of freight traveling into and out of the area. Freight passing through the area without an actual origin or destination was not included in this specific dataset. The data does not include pick-up/delivery/courier trucks that are typically used by firms such as FedEx and UPS. However, deliveries made by the smaller vehicles would use similar routes and could still benefit from the findings of this dataset. Interstate movements and key regional gateways for freight movements to this area are shown in Figure 6. Primary routes into and out of the Portland Metro Region are located along the state highway and interstate system: US 30, I-5 (north and south), I-84, US 26 (east and west), OR 99W, OR 99E, OR 219, and OR 8.

Figure 6: Westside Freight Movements – Intrastate and Interstate Routes



Source: ATRI (2013)

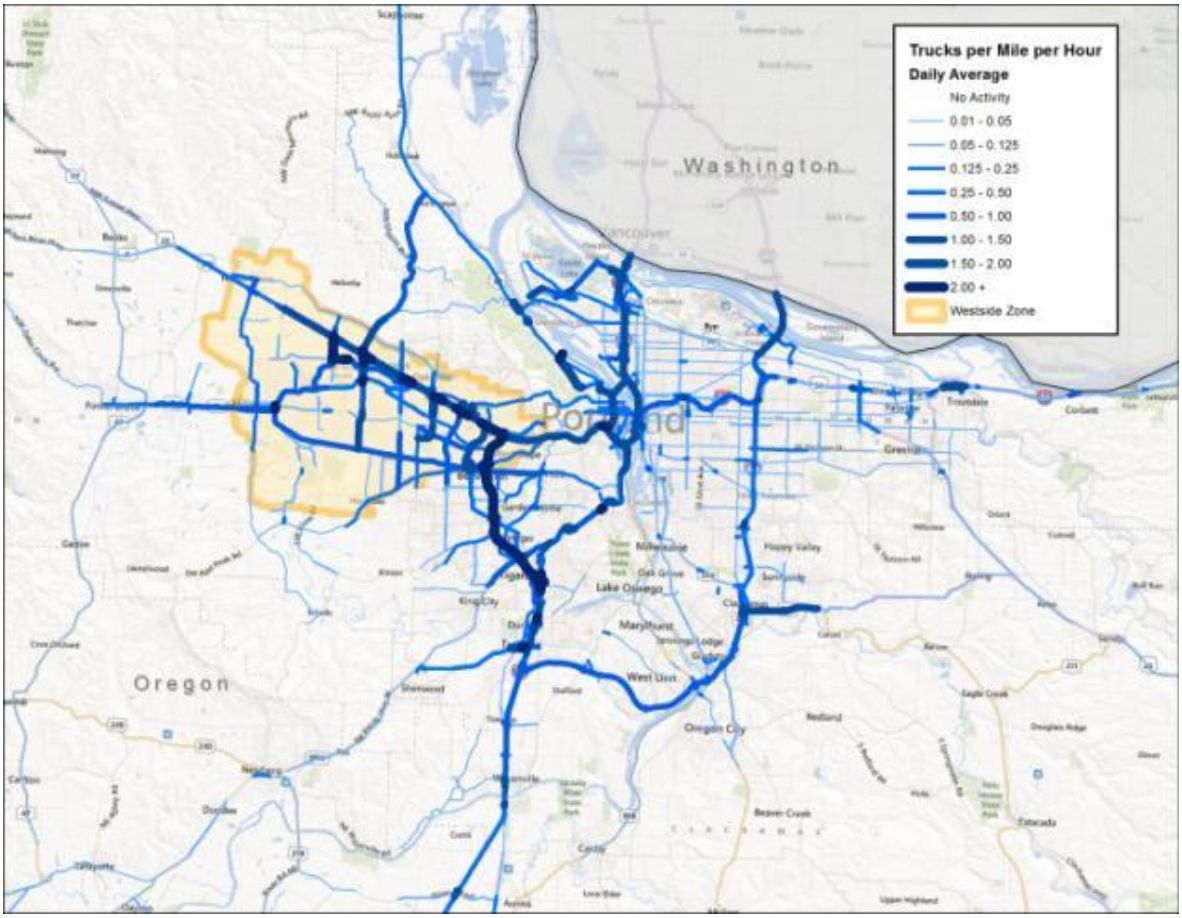
[7] American Transportation Research Institute (ATRI). *Portland, Oregon Westside/High-tech Freight Analysis*. July 2013.

[8] ATRI processed the data to maintain the anonymity of specific vehicles.

A closer look at the data shows how freight traffic uses the regional network. Trucks use four primary routes—US 26, Cornelius Pass Road, OR 217, and OR 8—to move in and out of the Westside area (Figure 7). In some cases these routes also serve as regional gateways (US 26 or OR 8), but in other cases the routes provide intermediate connections to regional gateways (OR 217 connecting to I-5 and Cornelius Pass Road connecting to US 30).

Data from American Transportation Research Institute (ATRI) reveals that US 26, Cornelius Pass and OR 217 carry major shares of Westside freight traffic.

Figure 7: Westside Freight Movements – Daily Trucks per Mile per Hour



Source: ATRI (2013)

Corridor Demand

Overall route choice for shipments out of the Westside area varies by time of day, as indicated in the industry interviews. Analysis of the ATRI data confirms this behavior. Several of the primary transportation corridors providing access into and out of the greater Westside area were analyzed to determine when they are typically used for freight movement. While a variety of factors are considered for route selection, one of those factors is the speed or performance of the corridor. To account for this, the relative speed of each

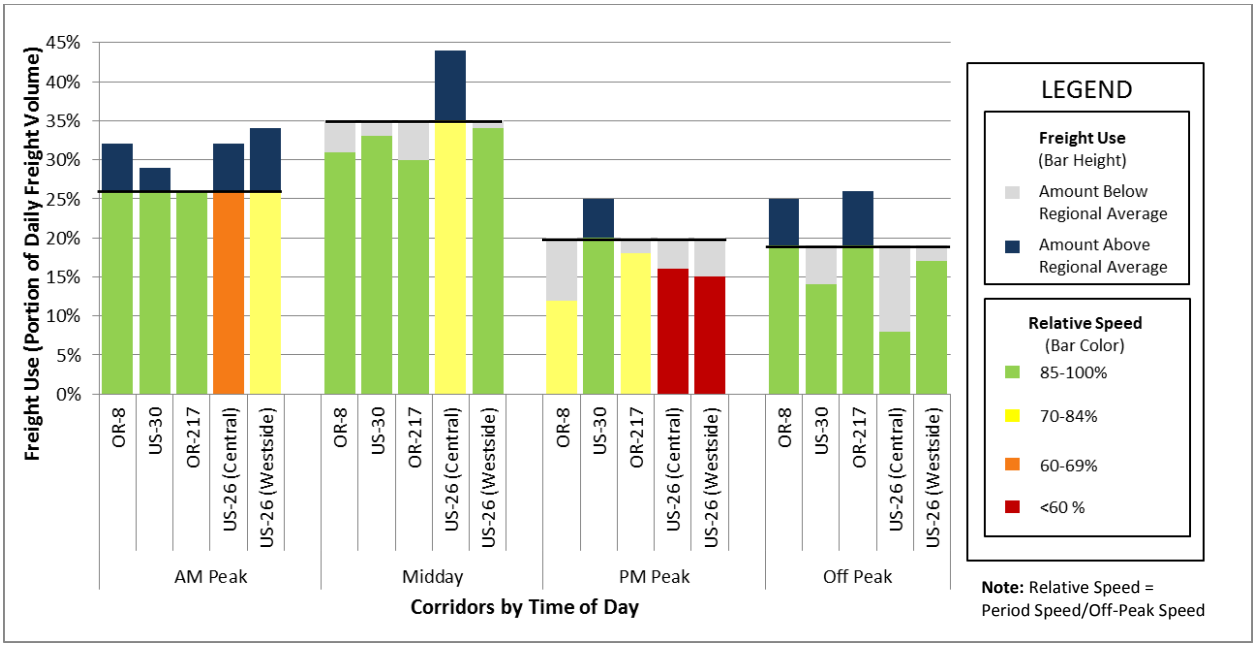
corridor (compared to the free-flow or uncongested speed) during each time period was considered to determine if congestion was a likely factor in corridor use.

Figure 8 shows the percent share of overall daily freight use along corridors split into individual periods of the day. A regional average (not limited to the corridors listed) is provided for comparison. The subset of corridors (and regional average of all corridors) serves the most freight during the a.m. peak and midday periods. The five corridors shown all have as high, or higher, use than the regional average during the a.m. peak period, when conditions on these corridors are generally favorable. The exception to this may be US 26, which is typically uncongested in the westbound direction for inbound freight movements (the speed shown was aggregated for both directions of travel).

Echoing industry interviews, ATRI data reveals that freight use of US 26 is lower during the p.m. peak when average speeds are lower. Similarly, freight use of US 30 increases to avoid poor travel conditions on US 26 during the p.m. peak.

The use of these corridors for freight movement during the p.m. peak is typically lower than the regional average, except for US 30. US 30 is served by Cornelius Pass Road, which was identified during the interviews as being used in the p.m. peak when conditions generally degrade on US 26. In addition, the data indicates that speeds on US 26 drop much lower during the p.m. peak period.

Figure 8: Daily Freight Traffic Distribution during Peak Periods by Corridor



Source: ATRI (2013)

System Performance

Transportation system performance can be assessed using a number of measures and criteria, such as average travel time and travel time reliability.

Average Travel Time

Travel time is important for route selection, whether a trip is being made once or on a recurring basis. Travel time can vary for a variety of issues, but travel time during a given period for a given route generally fluctuates based on the level of use or congestion. Any given route has a practical minimum travel time that can be realized under low traffic volume conditions, known as a "free flow" travel time. However, the actual travel time is generally greater due to congestion, which typically varies by time of day. Drivers can obtain travel time data in a variety of ways, ranging from word-of-mouth to smartphones and global positioning system (GPS) devices (Figure 9).

Figure 9: Congestion Levels May Increase Travel Time above Free Flow Conditions

Source: Google

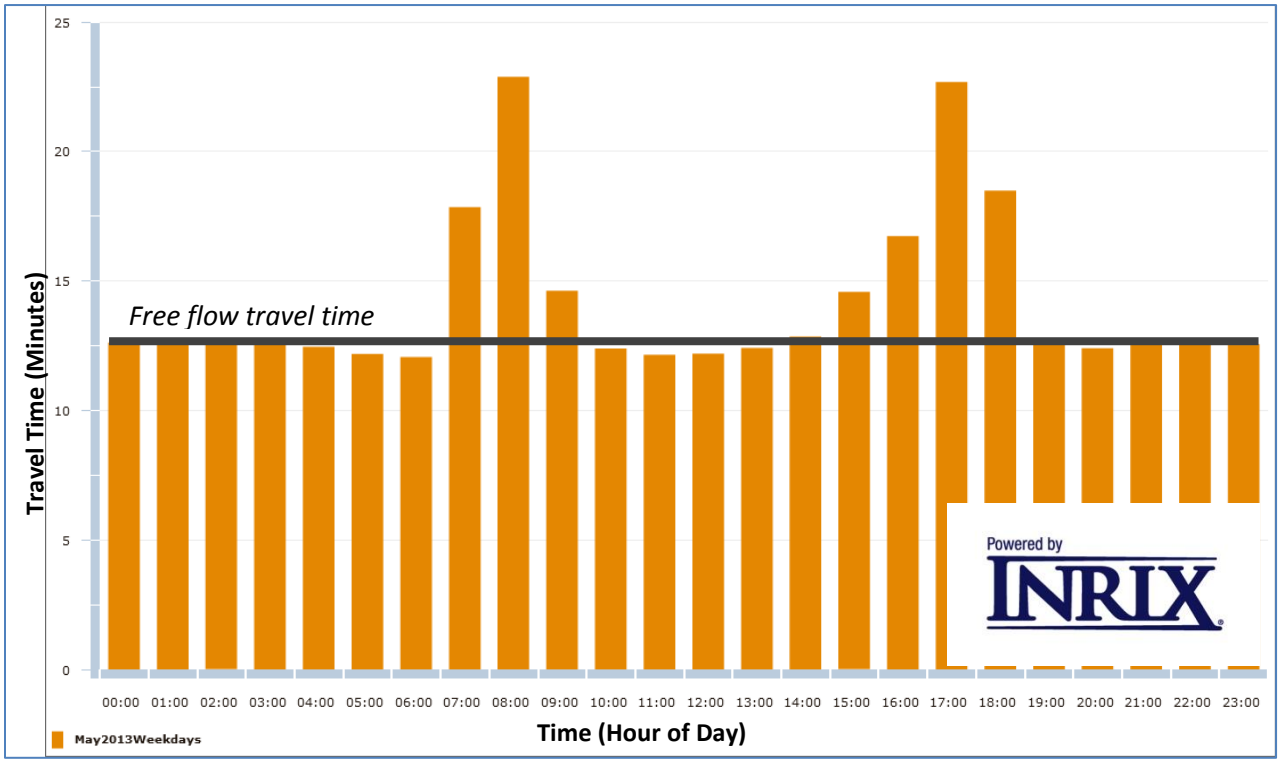
Travel time data for the corridors was examined using the INRIX dataset. The dataset is composed of aggregated travel time data collected through GPS units, fleet systems, and other means that is provided for segments of the transportation network by time of day. The data provide measures such as average speed by time of day and reliability of speed during those periods.

A survey of 400 California truck drivers found that CB Radio and AM/FM Radio were each used by 45 percent of drivers to obtain traveler information. However, other means of information such as dynamic message signs, smart phone apps, or in-vehicle GPS systems were each used by fewer than 25 percent of drivers.[9]

[9] Cambridge Systematics, Inc. *Gateway Cities Council of Governments ITS Implementation Plan for Goods Movements, Public Surveys Parts 1 and 2 Final Report.* May 2012.

Figure 10 is a sample travel time profile for eastbound US 26 (from Cornelius Pass Road to Canyon Road) that shows the average travel time along the segment by hour of day. As seen in the figure, the average travel time during the morning and evening commute periods (approximately 23 minutes) is approximately twice the free flow travel time (12 minutes) experienced in early morning, midday, and late night periods.

Figure 10: Eastbound US 26 Average Travel Time (Minutes) by Hour of Day

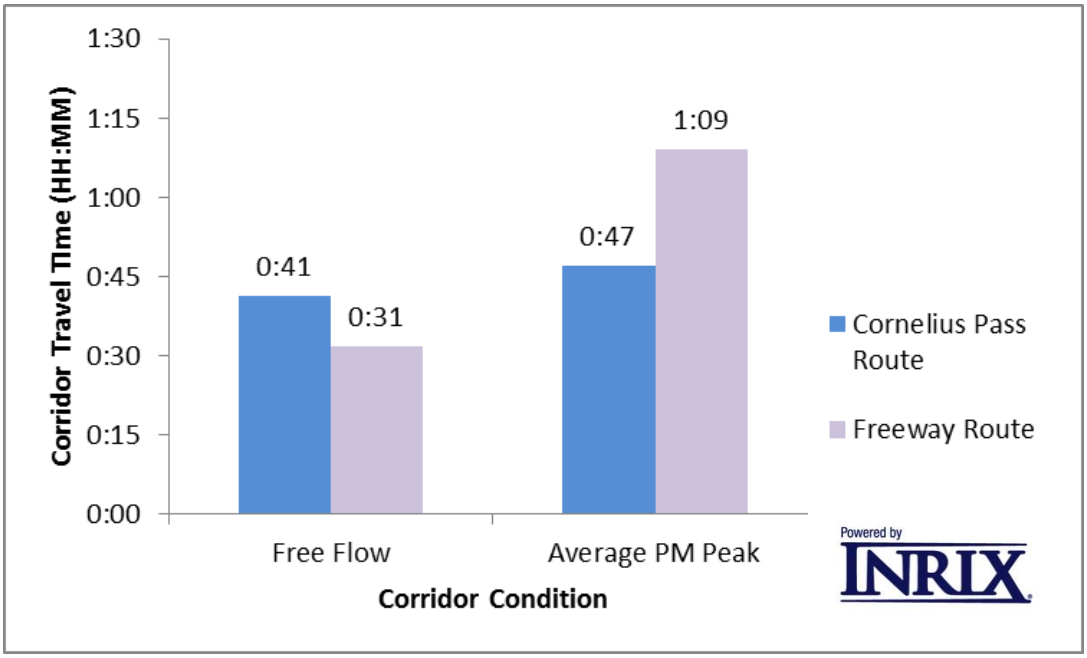


Source: INRIX

Travel times along the two primary routes were compared to assess differences between free flow and average travel times. Travel times along the US 26 to I-5 route are faster during low-volume "free flow" conditions due to higher posted speed limits and directness of route. However, the average p.m. peak hour travel time doubles along the freeway route, and a trip on this route takes longer than the Cornelius Pass Route, which degrades comparatively little (and is more similar to the free flow travel time). Figure 11 compares the travel time for the two routes during both free flow and average p.m. peak hour conditions.

INRIX vehicle speed data indicates that average travel times on US 26 take twice as long during commute periods as free flow conditions.

Figure 11: Travel Time from Hillsboro to PDX Freight Consolidation Areas



Source: INRIX

Travel Time Reliability

In addition to average travel time, it is important to consider its reliability—how likely the time is to fluctuate and to what degree. For instance, some routes may provide travel times that are generally consistent on a day-to-day basis for a given time period, whether the traffic volumes are relatively low and free-flow conditions exist or reoccurring congestion causes traffic to slow to a crawl on a daily basis. Both conditions may be generally reliable and not fluctuate greatly from one day to another. However, some locations may be generally unreliable and have extreme changes in travel time because varying individual events can create "non-recurring" congestion that is difficult to predict and can greatly impact the actual travel time for a given day. These conditions make routes unreliable and make route planning difficult for freight carriers.

Impacts of incidents or other events lead to non-recurring congestion that is difficult to predict and creates unreliable travel times that can vary greatly from day to day.

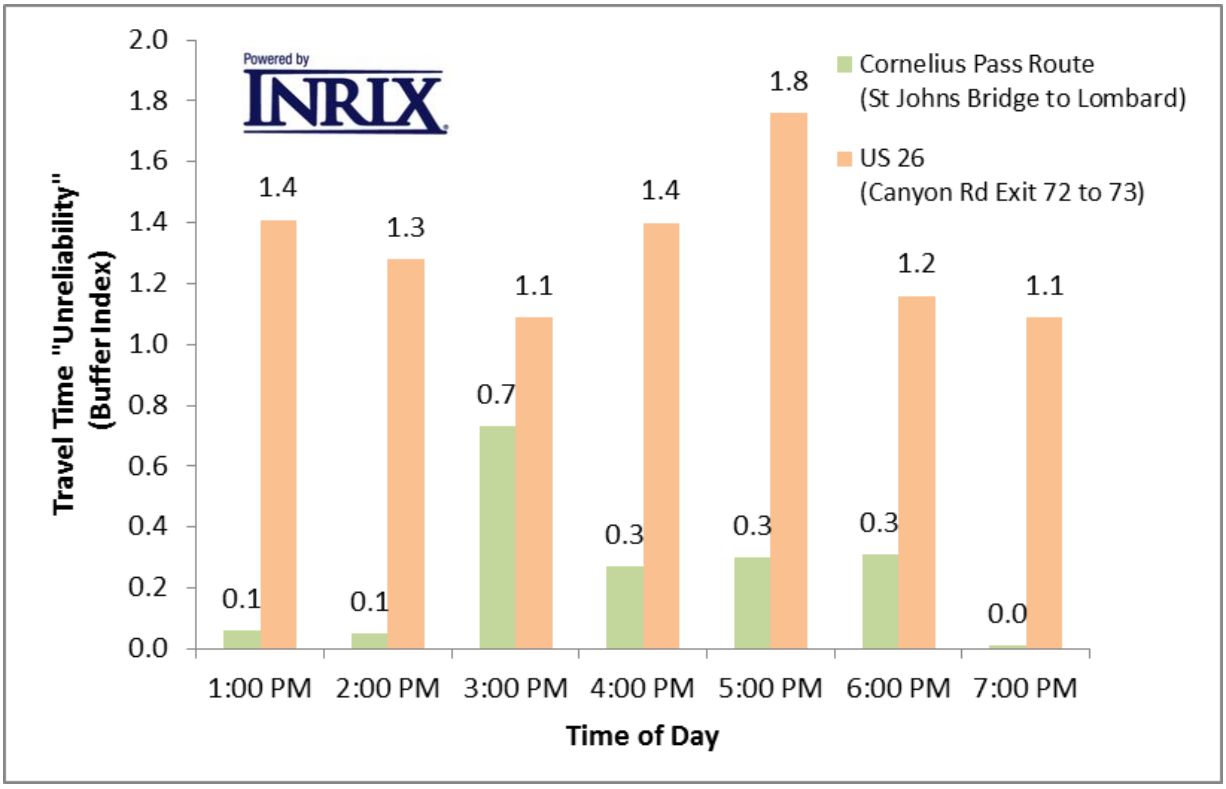
There are a number of measures to assess reliability.[10] Two of these—planning time index and buffer index—use the 95th-percentile travel time as a reference for reliability. The 95th-percentile travel time represents the duration that is exceeded only by five percent of the total vehicles travelling during a given period, for example, 5 p.m. to 6 p.m. on weekdays over the course of a year. Typically, this would identify highly

[10] FHWA. *Travel Time Reliability: Making It There on Time, All The Time*. November 2009. http://ops.fhwa.dot.gov/publications/tt_reliability/TTR_Report.htm

congested conditions that will occur in one day out of 20. If a driver considers the 95th-percentile travel time, the risk of experiencing a longer travel time has only a five percent chance of occurring.

Figure 12 shows the degree of travel time unreliability (higher values in the buffer index represent less reliability) along key segments of the two routes of interest: eastbound US 26 west of the Vista Ridge Tunnel and eastbound US 30 over the St. Johns Bridge. While travel times in the off-peak periods are generally reliable, the morning and evening commute periods can have generally unreliable travel times on US 26. For reference, the buffer index value of approximately 1.8 in the evening peak represents a 95th percentile travel time, which is a factor of 2.8 times the average (congested) travel time for that hour of the day.

Figure 12: Comparison of Segment Travel Time "Unreliability" (Buffer Index) by Time of Day



Source: INRIX

The segment shown for the Cornelius Pass corridor has generally good reliability with even the worst (95th percentile travel time) conditions varying little from average conditions. The poor reliability of the US 26 corridor, on the other hand, can add significant travel time on days when congestion is at its worst. For example, the average travel time for eastbound US 26 between the Cornelius Pass Road and Canyon Road interchanges is approximately 23 minutes while the 95th-percentile travel time is 70 minutes. The possibility of significant fluctuations in travel time makes it difficult to plan routes along US 26. According to information gathered during the interviews, the Cornelius Pass Road route is generally used over US 26 after 2 p.m. due to travel time reliability issues.

Incidents and Delay

While average travel time is impacted by recurring congestion, travel time reliability can be impacted by the frequency, type, and duration of vehicle collisions and other incidents on the road system. When an incident occurs, capacity of the roadway system can be reduced, regardless of lane blockage or closure. Drivers may react to an incident in several ways, such as stopping, slowing, changing lanes, or yielding to maneuvers made by adjacent drivers. All of these reactions can interrupt traffic flow, reduce capacity, and increase travel time. The degree of these impacts depends on a variety of criteria, including traffic volume, roadway capacity, number of lanes impacted, and duration of blockage.

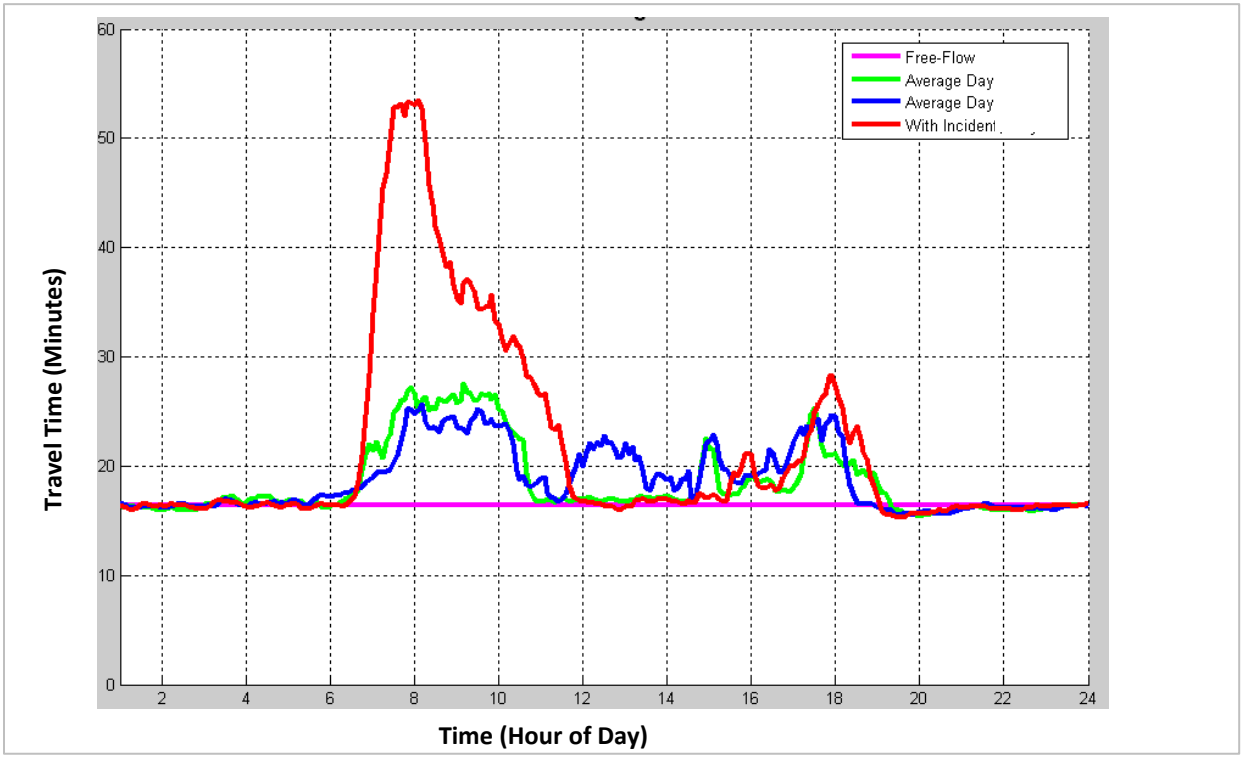
The Federal Highway Administration (FHWA) states in its *2010 Traffic Incident Management Handbook Update*:[11]

> "Traffic incidents have been identified as a major contributor to increased congestion. The National Traffic Incident Management Coalition (NTIMC) estimates that traffic incidents are the cause of about one-quarter of the congestion on U.S. roadways, and that for every minute a freeway lane is blocked due to a incident, this results in 4 minutes of travel delay time. Improving traffic incident management is one key to reducing congestion. In the 2009 Urban Mobility study, TTI calculated that in 2007, where improved incident management procedures were implemented in 272 of the 439 urban areas, the resulting reduction in incident-related congestion saved 143.3 million hours and $3.06 million."

Figure 13 demonstrates the impacts of recurrent vehicle delay (due to daily congestion) and the additional impacts of an unexpected event such as lane blockage due to a collision or other incident. The blue and green lines each represent the daily travel times for a sample corridor, which vary slightly from day to day. These lines both indicate recurring delay, which for this corridor begins around 6 a.m. and continues until approximately 7 p.m. During the reoccurring congestion of the morning and evening peak, travel time would take approximately 25 to 30 minutes. Outside of these hours, the travel time is generally similar to the free flow conditions (shown as a pink line for reference). In a condition where an incident occurs at approximately 6:30 a.m., the travel time for vehicles along the corridor increases significantly (up to approximately 55 minutes). The peak impact of the incident is felt until it is cleared at approximately 8 a.m., at which time the travel time begins to slowly improve. However, even after the incident has been cleared, it takes the system longer to return to typical conditions and additional vehicles are slowed until flow returns to normal, around 11:30 a.m. in this example. If the incident were cleared sooner with improved incident response system (IRS), overall delay would be reduced.

[11] Source: http://www.ops.fhwa.dot.gov/eto_tim_pse/publications/timhandbook/tim_handbook.pdf

Figure 13: Sample Travel Time Impact Due to Incident



Incident data was provided by the Oregon Department of Transportation (ODOT) and reviewed along the freeway corridor (composed of US 26 eastbound, I-405 northbound, and I-5 northbound). Between 2 p.m. and 7 p.m., approximately 250 weekday incidents occur each year[12] with an average duration of 35 minutes. This duration accounts for several primary components (which were not available individually):

- Time to report incident
- Time for incident response to arrive
- Time to clear the incident

Lane closure incidents on US 26 close a lane for 23 minutes on average but can add additional delay to vehicles beyond the actual closure duration.

As demonstrated in Figure 13, travel time for vehicles along the corridor is impacted even after the vehicle has been cleared. Reducing the duration of any of these components could reduce the overall amount of delay experienced by other vehicles.

Ramp Meter Impacts

The Portland metropolitan region uses ramp meters to manage the flow of traffic onto the freeway system. Traffic flows best and most efficiently in a uniform manner without interruption. Once turbulence has been introduced, the flow becomes disrupted and less efficient. The ramp meter system in Portland is a

[12] Approximately half of these incidents occurred along US 26 with the remaining occurring along I-405 or I-5.

coordinated network of detectors and meters that adapts to levels of congestion. For example, congestion on US 26 approaching the Vista Ridge Tunnel triggers a reduction in meter rates at Cornelius Pass Road and Brookwood Parkway, where freight from C&E firms may be trying to access the freeway.

Ramp meters on US 26 manage traffic flow on the freeway system and can introduce delay for vehicles waiting at on-ramps.

While ramp meters may provide an overall benefit to movement of vehicles within the larger system, they can introduce delay for vehicles waiting to enter onto a metered facility. In some cases, this leads to traffic queues along the on-ramps that can spill back as far as the arterial street system.

Ramp meters are present at the US 26 on-ramps from Brookwood Parkway and Cornelius Pass Road. Under lower traffic conditions, the ramp meters are typically not used and traffic can flow freely onto US 26. However, during peak periods, the entry of traffic is metered and two queues form along each ramp (Figure 14). From anecdotal information, these queues frequently spill back onto the arterial streets and delays can range 10 to 20 minutes. Brookwood Parkway and Cornelius Pass Road are reported to regularly spill back for distances of nearly one mile (including back to the Intel Ronler campus)

Figure 14: Ramp Meters Manage the Flow of Traffic onto Freeways

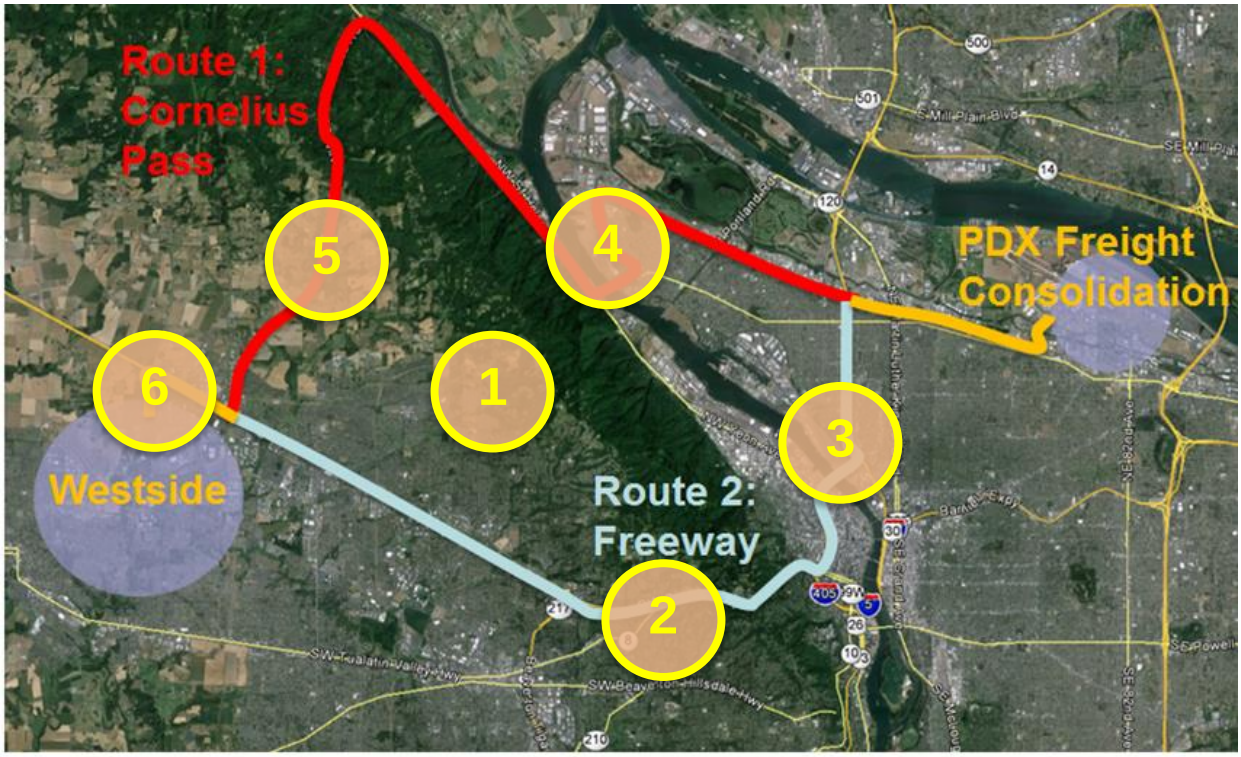
Issues and Considerations

The following summarizes key issues (mapped in Figure 15) identified through the assessment of how the transportation system is used and how well it performs to move goods from the Westside C&E area.

1) **Limited route choice.** Route choice for vehicles travelling from the Westside to consolidation facilities near PDX is constrained by topography and limited system redundancy. Once east of Cornelius Pass Road, vehicles are typically past the "point of no return" and must generally remain committed to their route.
2) **US 26 travel time reliability.** Average peak period travel time is significantly slower than free flow conditions on US 26. In addition, incidents and other issues can further degrade the performance and cause travel times to be unreliable. Downstream bottlenecks at I-405 cause queues to spill back to US 26 in both the inside and outside lanes as eastbound traffic approaches downtown Portland.
3) **I-5 travel time reliability.** Similar to US 26, I-5 has poor travel time reliability. The variation of travel time is due to downstream bottlenecks such as the Interstate Bridge over the Columbia River.
4) **US 30 to Columbia Boulevard connection.** Traffic using the Cornelius Pass route headed for eastbound Columbia Boulevard must travel a route that is significantly out of direction, both to cross the St. Johns Bridge and to maneuver through the existing street network in and around the St. Johns neighborhood.
5) **Cornelius Pass Road condition.** Due to limited right of way and terrain, this important connection between US 26 and US 30 involves both horizontal and vertical curves that are not optimal for freight mobility.
6) **Freeway Access and Ramp Meters.** From anecdotal information, these queues can frequently spill back onto the arterial streets, and delays can range 10 to 20 minutes.

Route choice for vehicles travelling from Westside Portland Metro to consolidation facilities near PDX is constrained by topography and limited system redundancy. Once east of Cornelius Pass, vehicles are typically past the "point of no return" and must generally remain committed to their route.

Figure 15: Key Transportation Issues for Westside Freight Movements



5.STRATEGIES AND PROJECTS

Previous plans and studies in the Portland metropolitan region have identified various projects and strategies that address the needs for Westside freight movement. This chapter summarizes these previous efforts, identified project lists, and describes the project team's analysis and screening of the projects using the evaluation criteria.

Previously Identified Solutions

Numerous plans and applications for funding opportunities have identified transportation strategies and projects that are relevant to Westside freight movement. The project team reviewed these plans and constructed an inventory of potential projects for consideration. These projects are:

Metro Regional Transportation Plan (RTP)[13] – The RTP lists projects that address identified transportation needs throughout the region. Metro coordinates with regional partner agencies, refining the regional project list to maintain consistency with the needs and plans of local jurisdictions. The RTP project lists describe infrastructure improvements and strategies ranging from system management to multimodal capacity enhancements to right of way acquisition for major capital projects. The project list differentiates between projects that are considered "financially constrained" (reasonably likely—not guaranteed—to be funded based on existing revenue streams) as well as additional projects that may be pursued if additional funds or opportunities are available.

Transportation System Management and Operations (TSMO) Fund Programming – Metro sets aside dedicated funding from its Regional Flexible Funds program to support implementation of the Regional TSMO Plan. The list for TSMO funding includes regional and corridor projects like traffic signal system enhancements, traveler information systems, and performance monitoring. Projects on the list for TSMO set-aside funding are often refined versions of projects that are also in the RTP.

Regional Flexible Funds Allocation (RFFA) – Metro allocates regional funding on a two-year cycle through this program that is funded by two federal grant programs (the Surface Transportation Program and Congestion Mitigation/Air Quality Program). Projects from two categories (Freight and Green Economy and Regional Economic Opportunity Fund) were considered.

Planned projects in the region may provide numerous benefits to address various needs. For the purposes of this study, these projects were assessed from the perspective of potential benefits to Westside freight movements as identified in the interview process.

General Screening Criteria

The strategies and improvements identified in past plans were screened by their general potential to address the needs identified in the industry interviews. Projects identified in prior planning efforts serve a multitude

[13] Metro. 2035 Regional Transportation Plan, Final 2035 RTP Project List. October 2010

of needs and produce various potential benefits. Those that were identified in the plans and met the following general criteria were considered for analysis:

- Project location – Does the project exist on a corridor, an extension of a corridor, or a parallel facility that would address the freight movements along the two identified routes (US 26 and Cornelius Pass Road)?
- Project type – Does the project address freight movement, or could it provide a benefit to freight movement? Modal improvements not relevant to freight were excluded.
- Project scope – Does the project have a reasonable chance of being implemented in the short term? Can it be funded within the next five years or so, and does it avoid a lengthy environmental process?

Since this analysis focused on short-term implementation, some projects were screened out because they were outside the scope of this analysis. These major capital projects address regional issues and bottlenecks:

- Vista Ridge Tunnel capacity improvement
- The Columbia River Crossing
- New Willamette River Crossing north of the St. Johns Bridge, connecting US 30 to the Rivergate area in North Portland.

Identified Projects

After reviewing the past plans using the general screening criteria (project location, type, and scope), the project team created a list of potential projects for analysis. Additional projects not contained in the regional lists were identified during discussion with the project review team and were considered as well. Table 4 is a comprehensive list of these projects.

Table 4: List of Identified Projects

Project ID*	Source	Location	Description
1	RFFA	Silicon Forest Green Signals	Adaptive signal control on major arterials in the Hillsboro area
2*	RFFA	US 26/Brookwood Interchange - Industrial Access Project	Construct new roads in the interchange area to serve employment uses
3	New	Enhanced Traveler Information	Provide at key points northbound from Hillsboro approaching US 26 and at eastbound US 26 approaching Cornelius Pass Road. Information also available at freight shippers and area employers.
4*	RTP 11178	US 26 at Brookwood Parkway / Helvetia Road	Interchange capacity improvements
5*	RTP 10600	US 26/Brookwood Interchange Improvements (US 26/Brookwood Parkway/Helvetia Road)	Additional interchange capacity improvements
6	New	US 26 Truck Ramp Meter Bypass	Modifies US 26 eastbound on-ramps to allow freight to bypass queues at meters
7	RTP	Helvetia Road (Schaaf Road to West Union	Improve to a multimodal three-lane

Project ID*	Source	Location	Description
	11149	Road)	roadway
8	RTP 11341	West Union Road (Helvetia Road to Cornelius Pass)	Improve to a multimodal three-lane roadway
9	RTP 10873	US 26W: Widen highway to 6 lanes (185th Avenue to Cornelius Pass Road)	Widen highway segment
10	RTP 11289	Cornelius Pass Road Safety Improvements – ITS (US 30 to Washington County)	May include electronic message signs and photo radar/enforcement, etc.
11**	RTP 11298	Cornelius Pass Road Safety Improvements – TSM (US 30 to Washington County line [MP 4.9])	May include targeted shoulder widening and new guard rails
12**	RTP 11296	Cornelius Pass Road Reconstruction (south) (Skyline Road to Washington County line [MP 4.9])	Provide shoulder, possible passing lane, and intersection improvement at Skyline Boulevard
13**	RTP 10396	Reconstruct Cornelius Pass Road (MP 2.8 to MP 3.5)	Reconstruction including passing lane, safety, shoulder, and drainage
14**	RTP 11295	Cornelius Pass Road Reconstruction (north) (US 30 to MP 2.8)	Widen segments to provide shoulder and possible passing lanes
15*	STIP	St Johns Truck Strategy Phase II	Multimodal safety and freight route elements in the St. Johns neighborhood
16*	RTP 10214	Lombard, N (Rivergate - to T-6): Multimodal Improvements (Rivergate to T-6)	Create multimodal street with non-continuous center turn lane
17	RTP 10218	Burgard-Lombard, N: Street Improvements (Intersection of N. Burgard/Columbia to UPRR Bridge on N. Lombard)	Improve to a multimodal three-lane roadway
18*	RTP 10229	Columbia Boulevard/Portland Road, N: Intersection Improvements(Intersection of Columbia Blvd/Portland Road)	Redesign intersection
19	RTP 10332	Lombard, N/NE (MLK Jr - Philadelphia) (US 30): ITS (MLK Jr. Blvd to Philadelphia)	Remote monitoring and traffic control at key intersections.
20	RTP 10342	Columbia Blvd, N/NE (I-205 - Burgard): ITS	Remote monitoring and traffic control at key intersections.
21	RTP 11176	I-5 from I-405 to I-84 (Rose Quarter/Lloyd District) Construction (I-84 to Greeley Street)	Operational and safety improvements on I-5 with improved access to land uses
22*	RTP 10208	MLK O-Xing/Turn Lanes (Columbia-Lombard) (Intersections of MLK and NE Columbia Blvd/Lombard)	Intersection control and capacity improvements
23*	TSMO	N/NE Columbia Blvd Traffic and Transit Signal Upgrade	Improvements to detection, signal timing, and communications
24*	RTP 10210	47th, NE (Columbia - Cornfoot): Roadway & Intersection Improvements (NE 47th to NE Columbia Blvd)	Widen and reconfigure to facilitate truck movement
25	RTP 10340	Cornfoot, NE (NE 47th to NE Alderwood): Road Widening & Intersection Improvements	Widen to improve lighting, landscaping, turn lanes, and bike lanes
26	RTP 10366	Airtrans Way/ Cornfoot Road Intersection Improvements	Add signals and improve turn lanes

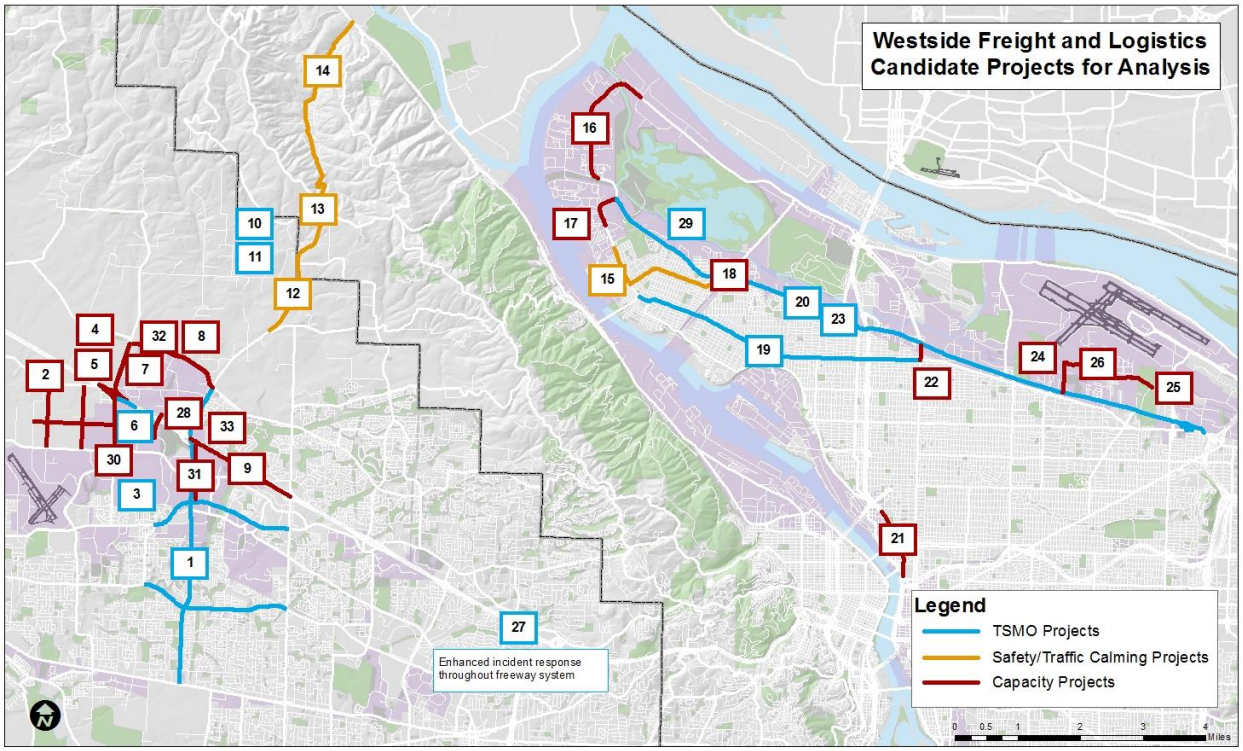
Project ID*	Source	Location	Description
27	New	Enhanced Freeway Incident Response	Increased incident response and clearing capacity on key US 26/I-405/I-5 route
28	RTP 10831	Century Boulevard (Bennett to West Union Road)	New US 26 overpass between Brookwood and Cornelius Pass Road
29	New	Columbia Boulevard	Rail crossing improvements and strategies
30*	RTP amend	Brookwood (Evergreen to US 26): Widen from 5 to 7 lanes	Improve to a multimodal 7-lane roadway
31*	RTP amend	Cornelius Pass Road (Cornell to US 26): Widen from 5 to 7 lanes	Improve to a multimodal 7-lane roadway
32	RTP 11147	Schaaf Road (Helvetia Road to West Union)	Construct new 3-lane multi-modal roadway to serve urban traffic away from rural edge
33*	Hillsboro CIP	Cornelius Pass second northbound to eastbound right turn lane at US 26 on-ramp	On-ramp widening to provide additional ramp meter storage for traffic entering US 26

Note:
*** Project identified as having committed funding source and was not advanced for analysis**
**** Project grouped with related project.**

The projects listed in Table 4 are shown in Figure 16, grouped by project type into three categories:

- **TSMO Projects** – Projects that improve the management and operations of the transportation system. Examples include improved traffic signal systems and driver information systems.
- **Safety/Traffic Calming Projects** – Projects that are directly focused on known safety issues or reducing traffic speed and/or volume along a roadway.
- **Capacity Projects** – Projects that include the construction of a new road or a wider cross-section and/or additional lanes on existing roads.

Figure 16: Previously Identified Projects



In order to focus on projects that are subject to future decisions, projects that already have secured funding were not included in the benefits analysis.

Project Analysis and Screening

Projects without secured funding were analyzed to determine potential benefits to the Westside freight industry. Each project was assessed using the evaluation criteria identified during the industry interview process and incorporating a variety of tools and data:

- **Average Travel Time –** Would the project or strategy reduce the average travel time significantly? Average p.m. peak hour travel time for the two routes currently ranges from about 50 to 70 minutes. The regional travel demand model was used to estimate potential benefits and assumed average conditions without the presence of an incident.
- **Travel Time Reliability –** Would the project improve travel time reliability along a segment of the route(s) that has unreliable travel time? INRIX travel time data was used to identify locations along the corridors with unreliable travel times.
- **Distance Reduction –** Would the project significantly reduce the overall distance travelled? This measure accounted for connectivity improvements that would extend existing roads or add new roads while also reducing distance travelled. The overall distance for the freeway route is approximately 23 miles while the Cornelius Pass route is approximately 28 miles.

- **Segment Reduction –** Would the project reduce the overall number of corridor segments (minimizing turning movements) required to travel from the Westside area to the freight consolidation area?
- **Improved Connectivity –** Would the project add a parallel route or increase route redundancy?

The following section presents a summary of how each project performed based on these criteria.

Project Summaries

Each of the projects was analyzed to determine the potential benefits to the system.

Project 1 – Silicon Forest Green Signals

Improvements to the signal systems on arterial corridors that serve adjacent industrial areas would provide some benefit to average travel time. However, any potential travel time savings would likely be limited to a few minutes and not significantly reduce the overall travel duration. Other evaluation criteria would not be addressed by this project.

Project 3 – Enhanced Traveler Information

Additional project development would be needed to work out specific details to enhance existing traveler information. However, such a system could significantly reduce delay in the event of an incident (and during congested periods) by establishing "predictive" travel time capability and route selection information particularly useful to Westside freight. The limited number of route options requires a commitment to a given route beyond a certain point (for example, once an eastbound vehicle on US 26 reaches Canyon Road, it cannot revert back to the Cornelius Pass route). This project would provide benefits primarily to travel time reliability.

Providing enhanced traveler information services (such as predictive travel time information) could significantly reduce delay and improve travel time between the Westside and PDX freight consolidation areas.

Project 6 – US 26 Ramp Meter Bypass

Providing a separate ramp lane for trucks to bypass the existing ramp meters to enter US 26 could reduce average travel time by 10 to 20 minutes during the p.m. peak hour. This project would benefit both average travel time and travel time reliability. Since ramp meters typically cause the most ramp delay when mainline conditions are poorest, the presence of high traffic demand and other bottlenecks on US 26 may reduce the overall benefit for trucks entering US 26 and connecting to I-405. However, this project could also benefit trucks destined for OR 217.

Providing a ramp meter bypass for trucks onto US 26 could reduce average travel time for freight by 10 to 20 minutes during the peak periods.

Project 7 – Helvetia Road Widening
Widening Helvetia Road is intended to provide multi-modal capacity as an alternative route from Schaaf Road to West Union. While the project would have some freight benefits, it would not provide significant benefits to average travel time or travel time reliability.

Project 8 – West Union Road Widening
This project is intended to provide multi-modal capacity as an alternative route from Helvetia Road to Cornelius Pass Road. While there would be some freight benefits, it would not significantly benefit average travel time or travel time reliability.

Project 9 – US 26 Widening (185th to Cornelius Pass)
Over the last several years, several phases have widened US 26 from the Portland downtown area westward. The facility currently has three lanes in each direction out to the 185th interchange and the next planned widening would continue westward to the next interchange at Cornelius Pass Road. While the project would add capacity, benefits to travel time for routes to PDX would not be significant. As more growth occurs in Westside areas and traffic volumes increase on US 26, this project could provide additional benefit.

Project 10 – Cornelius Pass Safety Improvements
Several projects for Cornelius Pass Road were bundled to consider the potential benefit to freight movement. This rural corridor between US 26 and US 30 provides important connections for regional goods movement. Stakeholders, through the interview process, identified it as an important route when freeway conditions (primarily US 26) are congested. Two factors—Cornelius Pass Road's environmental constraints and the local perception that it is a rural facility—may limit any improvements that could benefit freight movement.

Project 17 – Burgard-Lombard Widening
This project is intended to improve vehicular safety along the designated freight route and out of the St. Johns neighborhood. However, widening Burgard Road and Lombard would not significantly improve average travel time or travel time reliability. Other evaluation criteria would not be addressed by this project.

Project 19 – Lombard Communications
Improved communications along the Lombard corridor could provide some travel time benefits. However, relative to the overall travel time, benefits would not be significant and data indicates that travel times along the corridor are very reliable. These operational benefits would have no effect on evaluation criteria related to connectivity and route.

Project 20 – Columbia Communications
Improved communications along the Columbia corridor could provide some travel time benefits. However, relative to the overall travel time, benefits would not be significant and data indicates that travel times along the corridor are very reliable. These operational benefits would have no effect on evaluation criteria related to connectivity and route.

Project 21 – I-5/Rose Quarter Improvements
Improvements in the I-5/Rose Quarter would include the ability to move disabled vehicles onto the I-5 shoulder to reduce lane blockage. While this project would provide benefits to overall freight and traffic

mobility in the region, it would not directly address movements from the Westside to the freight consolidation areas.

Project 27 – Enhanced Incident Response

Enhancing incident response could decrease event duration and overall system delay during an incident. Enhanced incident response could include methods for faster deployment and/or faster clearance of an incident. While existing ODOT operations funding is limited, third-party operation could offer a means for implementation. This project would improve travel time reliability. In addition, faster clearance of an incident reduces the potential for additional vehicle collisions related to disrupted traffic flow.

Enhanced incident response could decrease incident duration and overall system delay during an incident and thus improve travel time reliability.

Project 28 – Century Boulevard Extension

An extension of Century Boulevard across US 26 would provide an alternate connection between industrial areas south of US 26 and Cornelius Pass Road. However, the extension would not reduce the overall distance or the number of corridors travelled. Travel time benefits would be minimal. The primary benefit of this connection would be to add redundancy to the system by providing an alternate route when ramp meter spillbacks clog access to and over US 26 at Brookwood Parkway and Cornelius Pass Road.

Project 30 – Columbia Boulevard Rail Crossing Improvements

Several at-grade rail crossings along Columbia Boulevard between Burgard Road and 47th Avenue could impact freight travel along the corridor. Impacts of rail events could be reduced by a variety of strategies ranging from implementing traveler information systems, corridor communication (Project 20, Columbia Communications), and constructing grade-separated crossings. Travel time data indicated that travel along the corridor is generally reliable; however, these strategies could improvement travel time reliability.

Project 32 – Schaaf Road Improvements

This project would construct a new 3-lane multimodal roadway between Helvetia Road and West Union Road at or near Cornelius Pass Road. It would minimize travel on the rural edge. While there would be some freight benefits, it would not significantly benefit average travel time or travel time reliability.

Project Analysis Results

Projects were grouped into the following categories based on how well they met identified needs:

- **Group 1** – Projects that address specific needs of Westside C&E freight movements to freight consolidation areas
- **Group 2** – Projects that address general Westside freight movements (beyond C&E)
- **Group 3** – Other long-range projects that provide benefits to freight

A matrix with detailed qualitative and quantitative metrics is provided in the Appendix.

Three projects demonstrate the greatest potential for benefits to Westside freight movement and are categorized as Group 1. Each would provide significant travel time benefits and address specific needs identified by the Westside C&E industry. In addition, each project could be implemented as short-term improvements that would immediately benefit freight movement.

The remaining projects, all but one of which falls into Group 2, still provide value to the wider region and/or have benefits to transportation system users other than those related to Westside C&E goods movement. However, when considering the specific travel needs of the freight routes considered in this analysis, these projects do not provide direct benefits to the same degree as the Group 1 projects.

One project, I-5 Rose Quarter, has been categorized as Group 3. While it does not directly address the two identified routes for Westside freight, it would provide benefits to other regional freight movement. Table 5 lists each project and the evaluation criteria that were applied.

Three "Group 1" projects have the most potential to provide significant benefit to Westside C&E freight travel based on the evaluation criteria. The remaining projects have value to the wider region even through the benefits may not directly address the needs of Westside freight movement identified in this analysis.

Table 5: Project Analysis Summary Matrix

Project Number	Project Name	Benefits by Evaluation Criteria					Project Group
		Travel Time (Average)	Travel Time (Reliability)	Overall Distance	Corridor Segment	Connection	
GROUP 1							
3	Traveler Information		■				1
6	Ramp Meter Bypass	■	■				1
27	Enhanced Incident Response		■				1
GROUP 2							
1	Green Signals	•	•				2
7	Helvetia Widening	•					2
8	West Union Widening	•					2
9	US 26 Widening	•	•				2
10	Cornelius Pass Safety		•				2
17	Burgard-Lombard Widening	•					2
19	Lombard Communications	•	•				2
20	Columbia Communications	•	•				2
25	Cornfoot Widening	•					2
26	Airtrans/Cornfoot Improvements	•					2
28	Century Extension	•				■	2
29	Columbia Rail Crossing Improvements		•				2
32	Schaaf Extension	•				■	2
GROUP 3							
21	I-5 Rose Quarter		•				3

Legend: (blank) = no benefit, • = potential for nominal benefit, ■ = potential for significant benefit

6. NEXT STEPS

In this planning effort, the project team focused on freight movement between Hillsboro and the PDX freight consolidation area, working with stakeholders to identify issues and prioritize solutions. Strategies important to the manufacturers and the firms they depend on for goods movement were evaluated, using criteria such as travel time, route reliability, and network redundancy. Three strategies were identified as the top tier (Group 1); all have significant potential benefit and can be implemented in the short term:

- Enhanced traveler information
- US 26 Truck Ramp Meter Bypass
- Enhanced Freeway Incident Response

Three strategies have significant potential benefit and can be implemented in the short term. These strategies are conceptual and need considerable refinement before they can be implemented.

These strategies are conceptual and need considerable refinement before they can be implemented. Questions need to be asked to determine appropriate technologies, infrastructure, operations and maintenance needs, cost estimates, and willing project partners. Issues specific to each strategy are outlined below.

Steps for Project Development

Enhanced Traveler Information

- Focus on providing predictive travel times that account for known as well as likely delays on the entire route from Hillsboro to PDX.
- Consider technologies for collecting speed, travel time, and incident information.
- Assess the trade-offs between capital improvements (detection and other infrastructure) and data subscriptions and where these two might complement one another.
- Focus on pre-trip planning as well as in-route information.
- Consider providing information on roads outbound from key locations (such as Ronler Acres) to direct trucks to optimal northbound routes.
- Consider providing information on wait times and lengths of queues at interchanges.

US 26 Truck Ramp Meter Bypass

- Consider signage and designs needed to reinforce the truck bypass function.
- Coordinate with ODOT so that meter bypass design incorporates truck volumes into the existing adaptive metering system. Analysis of impacts on existing metering may require simulation.
- Resolve design of ramp meter bypass and other issues relating excessive backups on the arterials approaching US 26 so that access to the bypass lane is not blocked. Besides widening ramps, consider also widening portions of the arterials leading to the ramps. Conduct detailed traffic analysis as needed.

- Conduct public outreach to address questions of equity (such as increased delay for non-freight motor vehicles).
- Refine definition of vehicles that are eligible to use the bypass; determine technology and nature/level of effort needed to enforce truck-only bypass.

Enhanced Freeway Incident Response

- Consider whether to use state-owned vehicles and agency staff or to contract out privately. An arrangement with tow companies near the corridor will likely result in better response times.
- Consider fee structures for contracted towing agreements (such as calls received versus number of actual tows) and options for program funding.
- Determine whether response type includes staged towing (with dedicated tow trucks docked in key locations) or dry-run towing (with tow trucks sent direct without previous reconnaissance). Dry-run is likely preferred for the US 26/I-405/I-5 corridor.
- Consider how to administer additional education and training for law enforcement and medical response providers in order to clear incidents sooner. Such action may require a directive to be effective.

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APPENDIX

A-1) Westside Freight Access and Logistics Study Stakeholder Interviews (2013)

A-2) Alternate Mode Considerations Working Paper

A-3) Project Summary Matrix

Westside Freight Access and Logistics Study Stakeholder Interviews (2013)

Prepared for:

PORTLAND BUSINESS ALLIANCE

Commerce • Community • Prosperity

September, 2013

One Northwest Consulting, LLC

Economics ~ Land Use ~ Transportation ~ Business ~ Finance

Executive Summary

With annual exports of more than $21 billion, Greater Portland was one of only four regions in the nation that doubled exports in the past decade. The Greater Portland region is poised to do the same again in half the time. The Greater Portland Export Initiative – developed in conjunction with the Brookings Institution – is a newly developed plan to help local companies access global markets and grow local jobs. The region's plan includes four strategies focused on supporting export expansion of Portland area businesses. The Westside Freight Access and Logistics Study was commissioned to determine critical freight movement from the Westside computer and electronics industry to Portland International Airport (PDX) and other transfer points to identify improvements to the surface transportation system, travel patterns, or other options to improve business fluidity. A consortium of interests asked the consultants to ascertain the transportation needs of a subset of the computer and electronics industry, while also considering the future of local market access given the geographic location of most of the computer and electronics industry firms and their points of transfer.

The stakeholder interviews consisted of two cohorts. First, a set of computer and electronics industry manufacturers were selected and interviewed. Selection criteria included geographic location (the purpose of the study was to focus on the computer and electronics sector cluster located in Washington County, Oregon), as well as specific line of business. Because of the significant economic impact of the computer and electronics sector to the economy of the State of Oregon, other sectors – though closely related – such as solar energy technology and biotechnology companies were ruled out. The Portland Business Alliance provided a list of major Washington County computer and electronics sector companies and relevant contacts to solicit for participation. As part of these first interviews, the manufacturers were asked who their key freight logistics providers were and to assist in establishing contact to develop a second cohort of stakeholders to interview comprised of the manufacturers' logistics services providers. The total sample size was limited to 12 firms, with the objective to have approximately half of the firms be representative manufacturers, while the remainder would be their logistics services providers.

The sample of computer and electronics industry manufacturers represented in the study represents a significant proportion of this sector in Washington County as represented by direct employment. The ability to extend the findings in this study to the computer and electronics sector throughout the region generally is limited primarily by the geographically-focused nature of this study. It is possible and likely that manufacturers in this sector located outside Washington County, Oregon would respond differently to the questions posed in the interviews to reflect local conditions and concerns. The reader should also bear in mind that the responses of stakeholders to interview questions represents the respective

stakeholder's perspective, perceptions, and opinions and may contain some factual inaccuracies.

Manufacturers Interviewed:	Commodities Produced:
FEI Company	Electron microscopes
Intel	Semiconductor test equipment
Lattice Semiconductor	Integrated circuits
Oracle	Capital fab tools
TriQuint Semiconductor	Automated tooling machines, raw materials
	Computer hardware and software
	Computer server, storage, and networking product
	Programmable logic products (semiconductor components)

Forwarders/3PLs Interviewed:	Services Provided:
Expeditors	Freight forwarding and logistics
Kuehne Nagel	Warehousing and storage
Kintetsu Worldwide	Local and long distance trucking
OIA Global Logistics	Customs brokerage, import and export documentation
	Integration/consolidation
Carriers/Integrators Interviewed:	Cross-docking
United Van Lines	In-bond
Jet Delivery	
FedEx	

The Portland region's status as an international freight gateway includes a wide variety of regional employment and industry sectors, economic clusters, regional access points and transportation infrastructure including a highway that runs from Baja to British Columbia, a river that runs from Idaho to the Pacific Ocean, rail lines that stretch to the Midwest and an international airport with direct service to Europe and Asia. These transcontinental and international connections through the region provide a way to ensure international market access for local industry. That being said, market size and business cost structure dependent upon least cost market access drive the decisions about carrier choice and gateway, not always directly found within Portland. As a result, trucking becomes a critical means of addressing market access needs for time sensitive, high value commodities.

Economies of scale, particularly as energy costs and prices of transportation fuels grow over time and become increasingly volatile, are important as carriers seek to consolidate volumes, routing through the highest volume gateways in order to hold the line on cost per unit of freight transported. Efforts to develop business in such a way that carriers are enticed to provide higher service levels – including increasing the capacity of direct

international service offered through local gateways such as Portland International Airport – confront the reality of carriers' drive to increase scale economies. Increasing the total volume of exports from the Portland market makes PDX a more attractive gateway for carrier service investments, contributing to additional competitiveness of Portland's export economy.

Sample of Stakeholder Interview Questions:

- Descriptive questions (products and services firm provides, employment levels, workforce commuting patterns)
- Materials movement (inbound and outbound, commodities, volumes, transportation modes, routing origins and destinations, trends and seasonality)
- Transportation gateways and proportional split
- Carrier and routing selection factors
- Use of Port of Portland facilities
- Strengths and weaknesses of the regional transportation system
- Airfreight shipping issues and anecdotal assessment of PDX air cargo facilities
- Other significant business sectors generating business volumes for carriers and forwarders
- Tactical responses to systemic roadway congestion
- Local routing considerations

Key findings from the stakeholder interviews include:

- Factors driving logistics decision-making
    - Fastest routing derived from most direct or optimal proximity, least number of handoffs or interchanges, and most efficient cargo clearing
    - Carrier equipment type and compatibility to cargo, and equipment availability
    - Carrier qualification as defined by damage-free handling and on-time performance reliability
    - Cost
- Desired air services routes include points in East Asia and Northern Europe
    - East Asia: Bangkok, Beijing, Chengdu, Hong Kong, Incheon, Kuala Lumpur, Manila, Narita, Saigon, Shanghai, Singapore, Taipei, Tokyo
    - Northern Europe: Amsterdam, Dublin, Frankfurt, Prague
- Air gateways utilized in addition to Portland International Airport (PDX) include
    - San Francisco (SFO)
    - Los Angeles (LAX)
    - Seattle-Tacoma (SEA)
    - Vancouver, British Columbia (YVR)
    - Chicago (ORD)
    - New York (JFK)
    - Denver (DEN)
    - Phoenix (PHX)

- Local routings and associated timing and use of roadway infrastructure
    - Volumes inbound to Washington County occur during the morning hours and typically use the freeway system (I-5, I-84, US 26, and OR 217) depending on the origin and whether cargo has been consolidated with other cargo
    - Volumes outbound from Washington County occur during the afternoon and evening hours and use the freeway system if the movement generally occurs prior to 2:00pm but otherwise use the Cornelius Pass Road route (Cornelius Pass Road to US 30, connecting to the freeway system, air cargo, and consolidation facilities via the St. Johns Bridge and Marine Drive or Columbia Blvd)
- Recurring roadway congestion, accident/incident frequency and clearing rate, and variability of system reliability were cited as the greatest problems with the regional ground transportation system with particular areas of recurring issues cited as:
    - I-5 Columbia River Crossing
    - US 26 Vista Ridge Tunnel area (and interchange with I-405)
    - I-205/I-84 interchange area
    - Airport Way/I-205 interchange
    - I-5/I-405/I-84 loop area

Introduction

The Portland Business Alliance retained One Northwest Consulting, LLC to conduct stakeholder interviews for the Westside Freight Access and Logistics Study. This study emerged as an area of research interest following the Brookings Institution work on the Metro Export Initiative developing the Greater Portland Export Plan (2012). This Plan recognized the importance of the computer and electronics industry contribution to the Portland Metro and Oregon state economies. This industry has a significant concentration in the Hillsboro, OR area (Washington County).

The Westside Freight Access and Logistics Study primarily concerns itself with the routing used and routing selection criteria with respect to the inbound and outbound freight transportation associated with the computer and electronics sector. Because of the locational concentration, of interest were transportation system constraints that may affect the performance of this key industrial cluster. DKS Associates was retained to conduct traffic modeling analysis on local routes identified as critical to the movement of goods for this sector.

The stakeholder interviews consisted of two cohorts. First, a set of computer and electronics industry manufacturers were interviewed. As part of these interviews, the manufacturers were asked who their key freight logistics providers were and to assist in establishing contact to develop a second cohort of stakeholders to interview. The manufacturers

who participated in this first cohort were: FEI Company, Intel, Lattice Semiconductor, Oracle, and TriQuint Semiconductor. Participating in the second cohort of forwarders, carriers, and integrators were: Expeditors, Javelin Logistics, Kintetsu Worldwide Express, OIA Global Logistics, United Van Lines, Jet Delivery, and FedEx.

The commodities transported by the manufacturing cohort include: electron microscopes, semiconductor test equipment, integrated circuits, capital fab tools, automated tooling machines, raw materials, computer hardware and software, computer server, computer storage, computer networking product, and programmable logic products (semiconductor components). Total worldwide employment for the companies represented in this cohort is 478,517 (range of 95 to 230,600). Total local employment is 23,299 (range of 12 to 20,000), which is significant both in terms of Washington County employment (roughly 10% of Washington County's workforce) and regional industry sector employment (about 40% of Portland MSA computer and electronics industry manufacturing employment, and about 31% of Portland MSA total manufacturing employment). The total annual freight volume was estimated to be approximately 248,936 shipments (range of 572 to 185,533), varying in weight and dimensional size from as small as parcels of important documents, small parts, and product samples, to as large as capital fab tools and large, complex scientific equipment.

Services provided by the cohort of forwarders, carriers, and integrators include: freight forwarding and logistics, warehousing and storage, local and long distance trucking, customs brokerage, import and export documentation, integration and consolidation, cross-docking, and in-bond shipment and warehousing. Air import and export gateways cited by this cohort as commonly utilized include: San Francisco-Oakland (SFO), Los Angeles (LAX), Seattle-Tacoma (SEA), Vancouver BC (YVR), Portland (PDX), Chicago (ORD), New York (JFK), Denver (DEN), and Phoenix (PHX). Primary international trading locations include points in East Asia (Bangkok, Beijing, Chengdu, Hong Kong, Incheon, Kuala Lumpur, Manila, Narita, Saigon, Shanghai, Singapore, Taipei, and Tokyo), Northern Europe (Amsterdam, Dublin, Frankfurt, and Prague), Mexico, and Tel Aviv Israel. Western gateways are typically utilized to connect to East Asian points, whereas Chicago and New York are gateways primarily used to connect to Northern Europe.

Appendices I and II contain consolidated responses of each cohort to the respective questionnaires developed and interviews held. The reader should bear in mind that the responses of stakeholders to interview questions represents the respective stakeholder's perspective, perceptions, and opinions and may contain some factual inaccuracies. Additionally, as this particular study was limited to the computer and electronics industry cluster located in Washington County, Oregon, the reader should consider that clusters also

exist in other areas of the Portland Metro area that were not examined in this analysis, including the computer and electronics sector cluster located in Clark County, Washington. The total computer and electronics industry volumes when taken in total (not simply limited to Washington County, Oregon) would bear a significant impact on air cargo services offered in the Portland Metro. The following discussion analyzes and summarizes the questionnaire and interview content.

Decision Factors

In the course of interviewing stakeholders in both cohorts, a decision-making/optimization algorithm emerged. The factors driving supply chain/logistics decisions are:

1. Fastest routing – most direct/optimal proximity, least handoffs/interchanges, most efficient clearing
2. Carrier equipment type (compatibility to cargo) and availability
3. Carrier qualification (defined by damage-free handling and on-time performance reliability
4. Cost

The span or degree of control exercised over the movement of goods varies and does not reside with a single entity, institution, or supply chain node from end to end. Manufacturers specify destinations, handling requirements, timing constraints, and general cost parameters to forwarders and integrators. The forwarders and integrators determine high-level routing and select gateways which meet the manufacturer specifications and tender the various segments of the movement to carriers. Carriers select local routing meeting the specifications given by the forwarders and integrators, and dynamically optimize based on conditions and changes as they occur in executing their responsibilities.

Concern over and responsibility for cost considerations drives asymmetric behavior in the supply chain. Manufacturers, who ultimately pay freight charges, indicated that velocity and damage-free handling were the most important factors in routing, ranking cost as one of the lowest – if not the lowest – consideration. Integrators pointed out that manufacturers seem to conflate direct routes with increased velocity, where this may not necessarily be the case. Integrators perceive that manufacturers may not understand that a direct air cargo routing to Asia and subsequent connecting flights to destination, for example, do not always result in greater velocity than what integrators can provide combining consolidated truck and air movements. Manufacturers, for their part, are concerned not only with velocity, but damage-free handling, and emphasize that each time cargo is handled, consolidated, or integrated, the

probability of damage increases. Forwarders expressed greater concern over cost factors than the manufacturers did. Carriers simply focused on their particular segment of the movement, minimizing cost to the extent possible.

One major point of discussion in the stakeholder interviews concerned the role of feeder flights. This concept was discussed from two different perspectives: (1) use of small aircraft to move cargo from small airports such as Hillsboro International Airport (HIO) to Portland International Airport (PDX), and (2) to move cargo using larger aircraft from PDX to larger West Coast gateways such as SEA, SFO, and LAX. While respondents in the first cohort indicated enthusiasm at the prospect of feeder flights, stakeholders in the second cohort indicated that there may not be a substantive velocity gain using this strategy and the cost would be substantially higher.

For instance, in the case of cargo shipping through SFO as a gateway, an expedited truck movement likely would be able to transport the cargo to SFO to make the cutoff for the same flight as the feeder aircraft would, but at substantially lower cost. And considering the regional role of small aircraft to perform feeder flights to PDX, respondents from the second cohort indicated that manufacturers were likely not willing to pay the higher cost for this, and PDX lacks air cargo lift capacity (i.e. variety of carriers and flights), so the need for this is minimal. Again, however, on this subject stakeholders from the manufacturing cohort responded with enthusiasm.

Clearly there is a variance between what manufacturers are expressing as their willingness to pay and what their forwarders, integrators, and carriers perceive they are actually willing to pay. There may be an opportunity for additional research in this area using choice experiments to examine the cost/velocity tradeoff: for an increase in unit cost, what would the corresponding velocity gain have to be to compel a change? Manufacturers indicated that velocity considerations rank very highly in their decision matrix. This, they stated, is driven largely by product life cycles: PCs have a 4-year life cycle, whereas phones and tablets have a life cycle of less than 1 year. The consumer preference away from PCs and more towards smartphones and tables as computing hardware means that velocity/time to market is an increasingly important consideration for sector manufacturers, including the cohort examined here.

Regional Transportation Network

Concerning the variety of air cargo carriers calling on PDX, respondents identified Asiana, FedEx (an integrator), Delta, NWA[1], and Alaska. All identified the lack of upper deck, center load airlift capacity associated with air freighter service as a constraint. Additionally, respondents noted that the volatile and declining economic conditions in Asia are making it increasingly difficult to rely on trans-Pacific reliability and consistency. One forwarder indicated that they had won a substantial amount of business from a customer only to find that the air carrier had cancelled the inbound flight due to lack of demand in the Asia to North America trade lane. The west-bound movement is considered to be a "backhaul": lower revenue movement to reposition equipment for a higher-paying "head haul".

Similar concerns about carrier selection and capacity were expressed by forwarders with respect to Portland's Marine Terminal 6. Carriers and forwarders also expressed concern regarding inefficiency in terminal operations with respect to the turnaround time on drayage trucks trips. Predictability of drayage trip times were noted as an important factor in selection of port facilities, and could constitute an area of competitive advantage for Terminal 6 if an efficiency differential could be established over competing gateways.

A key area of research involved discovering the primary local surface routing used in moving computer and electronics industry freight, and related issues such as patterns of congestion, bottlenecks, and other recurring systemic problems that influence routing decisions. Respondents indicated they are able to use the freeway systems in the Portland Metro Area during the morning hours when making deliveries in Washington County. In the afternoon hours, however, the recurring congestion on US 26, particularly associated with the Vista Ridge Tunnel and convergence of I-405 and US 26, renders this facility unusable for efficient goods movement. The alternative route of choice for freight destined to the PDX air cargo terminals, consolidator facilities, and integrator facilities on the East side of the Metro Area was identified as Cornelius Pass Road, US 30, and local connections to Marine Drive and Columbia Blvd.

Decisions at this level of routing are typically made by the carriers, as opposed to the non-asset based 3PLs and forwarders, although they also expressed familiarity with this routing. It was generally agreed that after 2:00pm it is best to use this alternative routing instead of US 26. There is some deviation in this generally-understood West to East routing pattern, primarily deriving from servicing other pickups and avoiding congestion by selected what is perceived at the time to be the optimally efficient route to the hub location. Though there are some direct shipments of cargo to Washington County computer and electronics industry manufacturers

[1] NWA became a part of Delta on January 1, 2010. It is notable that manufacturers may not be fully aware of PDX cargo providers as this detail is left to forwarders.

(primarily shipments of capital fab tools and larger, higher valued, goods which are sensitive to handling frequency), most freight movement goes through an East side integration or consolidation facility. From these facilities goods depart the region from the PDX air cargo terminals, or via I-205 either northbound or southbound if the export gateway is SEA, SFO, or LAX. Direct shipments have a greater likelihood of enduring the congestion on US 26 and I-5 North through the Columbia River Crossing for exports via SEA, or US 26 to OR 217 to I-5 South for goods moving through SFO and LAX.

Specific bottlenecks and problem areas identified by stakeholders during interviews include:

- US 26 with the identified pinch point or bottleneck being the Vista Ridge Tunnel/convergence of US 26 and I-405
- I-5 from the Terwilliger Curves to the Columbia River Crossing
- The “box”, identified as the I-5/I-405 loop encompassing the I-5/I-84 interchange
- The I-84/I-205 interchange
- Airport Way/I-205 interchange, particularly for northbound I-205 traffic
- St. Johns Bridge, particularly the West end bridgehead where traffic interchanges with US 30, and conflicts with the St. Johns neighborhood as freight movements connect to Marine Drive and Columbia Blvd
- I-84 east of I-205 often performs poorly due to the I-205 interchange, the lack of interchanges on I-84 east of I-205, and general issues of congestion (some stated the congestion issues are comparable to US 26 at certain times)

Congestion-related system performance variability was cited repeatedly as the driving factor behind missed cutoffs, consolidations, and other connections. Stakeholders indicated that this variability makes planning activities very difficult: eastbound US 26 movements may take 30 minutes one day and 1.5 hours the following day, and this deviation by a factor of two or greater is what renders planning ineffective.

When asked about other areas of poor function in the region’s roadway transportation system, several stakeholders indicated Tualatin-Sherwood Road as a major problem. This is described as the main connection between Highway 99W and I-5. Transportation of manufactured commodities originating in McMinnville, Newberg, Tualatin, and Sherwood use this route heavily. The problems with this facility described by stakeholders were pinch points where the road narrows from four lanes to two, as well as lack of traffic signal coordination to facilitate flows.

Ground routing alternatives were discussed with stakeholders including the use of feeder flights and the MAX transit system. Concerning feeder flights from HIO to PDX

using smaller aircraft, previously noted costs and derived benefits (particularly given the additional handling) were the main issue. Additional concerns about HIO neighbors and their likely objections to use of HIO for commercial cargo purposes, along with the potential for a protracted land use action process diminish the viability of this option. One forwarder asked about the potential of using Evergreen Airport in McMinnville as a cargo lift option. One respondent was "intrigued" by the idea of using a freight car attached to a MAX train, or running a freight only MAX train. All other respondents regarded this option as lacking credibility and demonstrating a lack of understanding of practical, tactical business operations and needs.

Diverging Viewpoints

The variances in perspectives between manufacturers and forwarders/carriers/integrators seems an important point to discuss. The manufacturers believe that the greatest leverage point is additional direct air cargo service from PDX, whether direct by air to international destinations or as a feeder flight to other export gateways. They believe that improving the local transportation system performance (through addressing bottlenecks, etc.) reduces transit time by 1 or 2 hours, while additional direct international air cargo service out of PDX (cited as the preferred method) or air feeder service to other export gateways has greater impact on reducing transit times. In the case of feeder movements by truck to SFO and LAX the expected transit time reduction is 8 to 20 (or greater) hours.

From the perspective of the forwarders, integrators, and carriers expedited truck feeder service from Portland to other gateways is more cost effective than air feeder service. Also, additional air cargo lift (though desirable) will be a challenge to draw into Portland because of high start-up costs and lack of scale. They also believe that manufacturers are not willing to pay more for the service they desire.

Economic Development Policy

Another issue to take note of involves the effects of aggregate economic activity. The body of work by the Brookings Institution and others (including this work) examines the computer and electronics sector. It is interesting to note, however, that this sector derives indirect and important benefits from growth in other sectors of the economy. For instance, over the course of the stakeholder interviews with forwarders, integrators, and carriers it was noted that Asiana's direct service to PDX materialized from a need to service exports of agricultural products. Other sectors that build scale in the local and regional economy include the apparel, footwear, and food and beverage industries. Computer and electronics industry stakeholders

noted that, while they would love to have additional direct air cargo service out of PDX, from a physical volume standpoint they may be able to fill the equivalent of a lavatory.

From a policy standpoint, this seems to indicate that focusing on overall business climate (as opposed to singling out sectors of significance) is a sensible approach. As sectors other than the computer and electronics industry benefit from policy changes and public investment, they add growth and scale to their industries, which potentially induces increased levels of air cargo service: an important benefit to the computer and electronics sector. Thus, indirect economic development policy effects may be more important and effective in terms of benefitting growth and competitiveness in the computer and electronics sector than direct policy approaches. Therefore, contemplating specific transportation system improvements on the basis of a single economic sector is likely a suboptimal approach.

For instance, a policy approach whose benefits do not adequately accrue to all sectors may actually end up harming the success of the computer and electronics industry. With this perspective of scale and growth in all traded sectors of the economy, one might reasonably describe computer and electronics industry cargo largely as the physically small, high value items catching a ride with Oregon's footwear and components, apparel, food and beverage, and agricultural products.

Aligning Viewpoints

With various perspectives within and between cohorts, there was universal agreement on five main points:

1. Portland needs more air cargo lift and marine carriers calling to support a competitive market, affording better pricing and more service options
2. Roadway congestion is a significant problem, and the failure to address it impairs regional competitiveness
3. The roadway transportation system lacks redundancy, contributing to the significant effects of congestion as the ability to recover from a disruptive accident or incident (or bridge lift in the case of I-5) is absent
4. The Port of Portland is seen as easy to do business with and a sincere economic development partner striving to attract new businesses and carriers to the region, encourage existing industries to expand, and supporting policies beneficial to the economy

Conclusion

The logistics planning and execution environment in the computer and electronics sector is complex, with planning for movements of this high-value cargo optimizing

on factors such as: timing and velocity, carrier experience and known ability to provide the required services with the necessary equipment, and cost. The manufacturers and the carriers/forwarders have different perspectives on the needs for various types of air cargo service at PDX. They also differ on the key drivers for selecting various services and gateways in terms of which factors are most important. Carriers/forwarders perceive manufacturers give greater weight to cost as a decision factor more heavily than the manufacturers themselves express: manufacturers largely indicated that velocity and handling quality are the most important factors. This apparent variance between manufacturers' expressed willingness to pay for higher levels of service and what carriers, forwarders, and integrators believe the manufacturers' willingness to pay actually is may warrant additional research. In particular, it would be helpful to understand the cost/service trade-off in greater detail.

Several other points were evident from the interviews with stakeholders:

- In logistics decision-making, a single point of control is lacking: a contact who has clear visibility into the routing of air cargo from the production site to the chosen airport. Manufacturers can describe what they are trying to achieve, but the decisions are substantially made by the forwarders. Specific routes used in the Portland metro area are the domain of trucking companies, which, if not done by an integrated carrier such as FedEx, introduces an additional actor with specific knowledge on the routing.
- Major arterial roadway function and resulting system capacity has been impaired by obsolescence, alternative modes gaining right of way capacity, and use changes such as traffic calming. The roadway transportation system lacks adequate redundancy and disaster recovery capability.
- The routes identified for moving cargo on the surface transportation system are consistent with both the use of PDX and other gateways. Getting goods to market, therefore, will mean the need for efficient and reliable access to PDX as well as for egress from the region to other air gateways.
- Outbound shipments from Washington County in or near the PM peak, given current conditions and system reliability, use a larger number of routes than inbound shipments to Washington County.
- Economic development policies should focus on building scale from which all sectors benefit. Leveraging volumes from other air cargo-using sectors can help retain and attract service.
- The manufacturing cohort directed us to their most significant carriers, forwarders, and integrators. These carriers, forwarders, and integrators indicated that the computer and electronics sector – though an important sector of their overall business – constitutes only a portion (sometimes minor) of overall business revenue and physical volumes.

- A more thorough identification of market opportunities and data inferences may be needed to attract greater marine and air cargo lift to the area. In other words, policy makers and other stakeholders may need to help make the case to air and marine carriers such that they recognize the current and potential business opportunities in a more compelling way.

The stakeholder interviews covered only a few firms, however the variety of final destinations and the gateways used to reach them was sizable. Based on the content of the interviews and the destinations and gateways identified, the tech sector relies on integrators as well as dedicated freighters such as Asiana, and belly space on passenger carriers (for example Alaska and Delta) to move their freight. The computer and electronics sector ships a variety of sizes and types of cargo and match that to the cargo service that best fills their need for a given shipment. Given the diversity of shipment types, service needs, and final destinations combined with the Portland region's overall smaller market size, PDX is not likely to meet all of the manufacturers' needs for cargo service, regardless of the lift available in the market: manufacturers will continue to need to use other gateways to compliment services offered at PDX. This being the case, an efficient regional system of roadways is critical to the movement of Greater Portland's high-value and economically-significant computer and electronics sector freight.

Appendix I: Questionnaire instrument used in interviews with cohort of high tech/electronics sector manufacturers and the consolidated responses of firms

1. **What products and/or services does your firm manufacture/provide? (Please provide relevant NAICS codes)**

334413 – Semiconductor and Related Device Manufacturing
334515 – Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals
541511 – Custom Computer Programming Services
541512 – Computer Systems Design Services

Specific commodity descriptions include: electron microscopes; semiconductor test equipment; integrated circuits; capital fab tools; automated tooling machines; computer hardware and software; computer server, storage, and networking product; programmable logic products (semiconductor components)

2. **Approximately how many full-time equivalent employees currently work for your organization (in total and locally)? Please describe general employment trends over the previous 5-year period at your firm for your local site.**

Total employment: 478,517; range 95 to 230,600
Total local employment: 23,299; range 12 to 20,000

3. **Do your local employees have access to mass-transit? Can you provide information regarding your local employees' use of transit versus other modes of transportation for commuting purposes?**

[Company] participates in the Metro TriMet "Passport Program" as part of our compliance with Oregon's Employee Commute Options regulations. Participation in this program is approximately 30%.

The large majority of [Company] employees drive their cars to work. Employees have access to mass transit and some participate in a program where the company reimburses employees for a portion of their monthly transit pass. There are employees who are registered carpool permit holders, and some employees ride bicycles and/or walk to work.

Our offices are located within easy walking distance of the MAX. We do not regularly track our employees' commuting patterns, but we average about 25 employees per month purchasing Tri-Met passes through us.

There is access to light rail and bus service. Approximately 5% of the workforce uses public transportation at least once per week.

Employees have access to the MAX line and access to bus service. Our employees commute using a variety of modes of transportation including public transit, personal automobile and biking.

4. **Considering workforce commuting, can you provide information on where employee commuting trips generally begin (origin points), typical routing, and peak hours when employee commuting trips are occurring?**

{Companies sampled do not have a good sense of employee commuting patterns}

Employees predominantly live in Beaverton/Hillsboro. [Company] operates single shift beginning 6:00am to 7:00am and ending at 3:00pm to 4:00pm.

The majority of employees commute within Washington County. Several hundred travel from Multnomah County to Washington County, as well. There are five primary shifts: There are three daytime shifts and two night shifts.

Commuting origins vary but the predominate population are throughout the West side of the Portland metro region. Employee peak commuting hours are between 7:30-9 AM and 4-6 PM.

Employees commute from all over the Portland metro area. About 35% are local to Hillsboro/Cornelius, 25% commute from Aloha/Beaverton/Tigard and another 20% commute from Portland. The remaining 20% commute from other parts of the metro area.
About 40% of our Hillsboro employees work a Compressed Work Week. These employees start and end shift at 6:30am/pm, meaning 5:30-7:30 am/pm are peak commuting hours. The remaining 60% work Monday – Friday, 8:00am-5:00pm schedule with commute hours on either end.

5. **Please describe raw materials, components, and other work-in-process materials received at your local manufacturing site for value-added processes for your most recently completed year (these may be identified by commodity and quantified**

by a combination of measures such as value, number of shipments and size such as TL/LTL/Parcel, and total weight). If possible, please specify the origin point of these commodities and the typical transportation mode(s) and route(s) utilized for movement of these goods. With respect to finished goods shipments for your most recently completed year from your local manufacturing site, please provide destination locations and associated volumes shipped by commodity and transport mode.

Total freight volume: approx. 248,936 annual shipments of varying weight and dimensional size; as small as parcels of important documents and small parts/samples, and as large as capital fab tools and scientific equipment (572 to 185,533)

6. **As concerning freight routing, what types of real-time traffic information (both for recurring congestion and/or incident related information) do you use (if any) to inform your day to day logistical route choice and anticipated travel times? What additional information or types of real-time system data would you like to see available in the future?**

Not applicable: route selection is left to the forwarders, carriers, expeditors, and integrators to determine.

7. **What trends are occurring with respect to volume changes (i.e. increasing or decreasing trends over time and projected growth or decline) in inbound raw materials and/or outbound finished goods shipments? Are there seasonal trends or other predictable periodicity with respect to shipment volumes?**

Volumes have been increasing over the last few years. In terms of seasonal changes in volume, at the end of fiscal quarter year periods uplift increases significantly, generally the last 10 days of a quarter.

Volume growth forecast is uncertain when looking ahead a year or more. [Company] experiences seasonal peaks in the high single-digit percentages in the 3rd and 4th calendar quarters due to back to school and holiday consumer demand.

When market demand shifted from domestic demand to Asia (due to a shift in where final consumer electronics were manufactured/assembled), supply chain nodes and functions shifted accordingly, with our local offices serving more of an R&D, engineering, and testing function than a production function. This shift of supply chain nodes away from the US to Asia, closer to customer markets, is regarded as customary in the electronics industry. That

is why it makes headlines and is considered highly unusual when Apple announces they will produce a MacBook in the US.

[Company] experiences seasonal trends with the highest freight months in March-May. The smallest shipment volumes occur June-August. Volumes are expected to increase as production is shifting from a foreign plant to our local plant. This will result in a one-time volume increase and then we expect volumes to remain relatively flat.

2012 was relatively flat with respect to changes in year-over-year shipment volumes. We predict the first 6 months of 2013 to be flat, but are predicting a 15-20% increase in production in the second half of 2013. Seasonality tends to affect shipment volumes such that the 3rd and 4th calendar quarters are heavier volume quarters than the 1st and 2nd quarters.

8. **Within the past 1-3 years, what changes or initiatives have been undertaken with respect to supply chain operations (scheduling, transportation modal change, capital investment, change in vendor/customer leading to significant route/gateway changes, etc)?**

A project was just started last month within [Company] to address supply chain operations issues. Generally, our supply chain has been stable the past 3-5 years. We recently hired a physical distribution manager and have been working to consolidate our carrier base. Cost savings initiatives in the supply chain arena must fall within time and quality parameters: we cannot afford service failures in terms of delays and/or damage.

[Company] made airfreight gateway shifts in 2011 and 2012, and anticipate further changes in 2013 in response to new airfreight options, which will result in shifting some volume from SFO to LAX.

In recognition of a shift in where most of our customers were located (from domestic US to now predominantly in Asia), final manufacturing and warehousing operations were moved to Asia to reduce cycle time, risk, and cost.

[Company] has shifted production from a foreign-based supplier to the local facility, with full implementation expected mid-year 2013.

[Company] made some scheduling changes and switched from integrator to forwarder where it made sense on some routes where bulk shipping volumes were occurring. Some new investments in IT capabilities and production capacity were also undertaken recently.

9. What are your primary regional import and export gateways?

Companies sampled indicated heavy use of roadway gateways and PDX, with little use of rail intermodal or containerized marine transportation.

Primary export and import gateways include: SFO, LAX, SEA, YVR (Vancouver, BC), PDX, ORD, NY, DEN, and PHX. Primary international trading locations include

- East Asia: Bangkok, Beijing, Chengdu, Hong Kong, Incheon, Kuala Lumpur, Manila, Narita, Saigon, Shanghai, Singapore, Taipei, Tokyo
- Northern Europe: Amsterdam, Dublin, Frankfurt, Prague
- Other: Mexico, Tel Aviv

10. Please describe your firm's use and frequency of use of the Port of Portland's facilities (marine terminals, passenger/business air travel, air cargo facilities). Were these facilities unavailable to your business, how would this impact your operation?

Marine Terminals – Never; Passenger/Business air travel - Multiple work travelers daily, particularly the PDX-AMS flight; Air cargo facilities - Used on occasion

Marine terminals not used (ex. use Seattle/Tacoma Ports, then truck down); Passenger/Business Travel at PDX used – Big impact if down; Air Cargo facilities usage limited

Our air cargo currently moves primarily through Seattle. We do use passenger/business air travel from PDX extensively. Our business would be impacted if PDX air passenger service were unavailable, but it is not possible to quantify or to determine how we would adapt.

This would not have a significant impact on our manufacturing operation as 60% of our shipments are shipped via an Integrator who each has their own sorting facility in PDX. Very few of our Import Export shipments actually enter the country in PDX. Most air cargo uses SFO. We do have frequent business travelers in and out of PDX. Not having the PDX passenger/business air travel would seriously impact many of our administration operations. In the recent year there have been 2,200 business travelers in and out of PDX.

11. How has your organization responded to systemic roadway congestion? (e.g. changes in shipping/receiving hours and production schedules, variability associated with labor force arrival times, any associated costs or internally quantified effects, etc.) How effective have these approaches proven to be? (rank them)

We have an internal car pool program but have not really addresses congestion from a cargo standpoint as we have not been adversely affected that we are aware of.

Adjusted factory and shipping cut-off time buffers. There is negligible impact to holding costs. Reducing the buffer would result in a one-time, rolling, convergent benefit to inventory velocity.

We have not made any changes due to systemic roadway congestion. We expect our employees to make any necessary adjustment to their commuting habits, and our integrated carriers/freight forwarders to adjust their schedules, if needed.

This is managed by our contract 3PL.

We have not changed any internal labor practices as a result of roadway congestion. The D1X pipefitters at Intel are off at 4:00pm, and alternative routes have become very congested.

12. Considering the region's multi-modal transportation system/network in its present form, what are its strengths and weaknesses? (rank strengths and weaknesses ordinally) In particular, what aspects of systemic function contribute to your organization's viability and what aspects negatively impact your operations (such as infrastructure bottlenecks)?

Good highway infrastructure that is hurt by a few horrible bottlenecks (26 Tunnel, I5 bridge). Cargo uplift at PDX is ok, but limited International lift is available which matters most to us. Ocean and rail are available, although we don't use these modes. PDX is an excellent, well run airport that is easy to navigate for employee travel. Air cargo connections are lacking, however.

Strengths and weaknesses ordered from high priority to low: Good highway access to other major markets (Seattle, Vancouver, SFO, LAX), although local congestion presents a problem and the negative impact is counted in hours; Outbound airfreight is available, though limited usage due to connection timings at airports in Asia; Inbound airfreight is limited due to lack of freighter access; Marine terminals are available, though not viable today due to limited service and labor issues.

Strengths: (1) Generally good mass transit, particularly for those who are located near a MAX station. (2) Generally easy access to highways. 3. Generally good air passenger service to U.S. West Coast cities. Weaknesses: (1) Limited direct, non-stop air passenger service to cities other than U.S. West Coast cities, and particularly to Asia. (2) Limited number of

highway routes and system redundancy, for example if an accident blocks US-26 there are few or no alternative routes. (3) A bridge connecting Highway 30 to Rivergate/Marine Drive to provide an alternative viable access route from the Westside to PDX would be great. (4) The extreme variability in travel time on US 26 makes travel and transit planning a challenge: occasionally it takes very little time to get from Hillsboro to Downtown, while other times it can take quite a while. Predicting this and planning for it is challenging. Water seems to constrain the regional transportation system: bridges over the Willamette. Water crossings seem to be the choke points. MAX is so slow getting through Portland! Not likely it would be viable for freight.

Our contract 3PL would be better able to speak to these issues, however one considerable issue is the lack of air freight from PDX. Most of our shipments exceed 66 inches in height and require upper deck, so these are primarily trucked to LAX for international shipments.

We have later pickups here than we do at any other site, so there must be something right about PDX. It's a challenge for us to talk about pros and cons simply because we don't directly deal with freight movement through PDX. Our forwarders handle flights and carriers.

13. What other improvements could be made from a physical/infrastructural, policy, or regulatory perspective to the regional transportation system? (rank these responses contextually with responses to questions 10 and 11 above)

Fix the tunnel bottleneck on US-26. The CRC should fix or help with I-5 congestion issues. Additional international flights especially to Europe. We would use additional air freighter lift from Europe 3-4 times per week.

Prioritized improvements: (1) Inbound airfreight capacity from Asia; (2) Outbound airfreight capacity to Asia with more effective connections; (3) Reduced road congestion to PDX, I-5 North, and I-5 South; (4) Investments to entice direct air cargo service.

More passenger air service between PDX and Asia.

Expanding US-26 to the Shute/Brookwood Exit and widening Shute Road would help eliminate congestion during peak commute hours.

14. Who are your primary freight carriers, forwarders, and expeditors by mode? Will you provide contact information so that we may follow up with them regarding this analysis project?

Expeditors, DHL, Nippon, Panalpina, FedEx, UPS, United Van Lines, Kintetsu Worldwide Express, OIA Global, JSI Shipping, Javelin Logistics

15. What factors influence carrier selection and routing in your supply chain? Please rank these in importance. (e.g. equipment availability, frequency and reliability of service levels, on-time performance, airport services, consistency of transit times, cost, trucking access, marine terminal efficiency, etc.)

By priority: (1) Ability to deliver on time undamaged; (2) Cost (Secondary concern).

In carrier selection time and quality requirements are critical, and cost is a secondary consideration. Factors in route and gateway selection are: (1) air services (carrier availability, flight frequencies, availability of nonstop service, etc.); (2) airport services (ease of doing business with Customs, airfreight forwarder location, etc.); (3) ground services (trucking access, quality of service, etc.); (4) transit time to destination; (5) price.

The primary factors influencing routing are cost and lift/availability of flights.

Requirements are cost, reliability of service (quality), transit time (schedules), and predictability (on-time delivery).

In order of importance: (1) on time performance, (2) consistency of transit time, (3) frequency and reliability of service levels, and (4) cost.

16. Describe key issues related to airfreight shipping (i.e. production cut-off times, consolidation days, etc.) that affect your operations.

In general most logistics issues we have are at other regional hubs, not in Portland.

Production cut-offs, carrier cut-offs, local service availability, transit time to destination (#1 critical), Asia connections and transit time, pricing, and handling (wide body to narrow body transfers, security, handling sensitive cargo). We can't bring anything in directly to PDX: have to use ground routing between Hillsboro and LAX or SFO. This is a waste of time in terms of throughput time and handling, and negatively impacts quality (damage to capital equipment).

HIO could be viable for air cargo, although whether there is sufficient volume to meet cost requirements remains an open question.

Flight schedule changes, cancellations, capacity constraints all have negative impact on predictable delivery to our end users.

There are not currently any key issues, but traffic congestion does require an earlier pickup for airfreight shipments than for ground shipments due to making cutoff times. A later pickup would help reduce some stress levels in our shipping department on busy days.

17. Does your firm use PDX flights when shipping air cargo between Asia and the Pacific Northwest? Why or why not?

Yes, though volume is very limited. We need a front-loaded 747 to move some of our largest cargo, which is not available at PDX.

No, because available flights do not meet transit time requirements.

No, air freight is typically routed through Seattle because it's cheaper.

Uncertain: would need to confirm with our contract 3PL.

Rarely: PDX to Asia flights are used when in expedite mode and the correct day for a PDX cargo flight lines up. The flight options are limited.

18. Does/would using PDX as an air cargo gateway help improve the efficiency of your business? If so, in what ways?

Yes, we already use it as a hub for our service organization.

Yes. PDX is physically close to [Company] facilities in Portland. If the right services were available in PDX, it would reduce [Company] transit times and costs.

At current volumes, there would be little difference.

Because we require upper-deck freighter space, shipments are primarily trucked to LAX for international connections. This is a significant cost and speed impact that could be alleviated were services available at PDX.

Yes, it would help improve efficiency. A PDX air cargo gateway would allow for later pickups and reduced transit time. This could be recognized inbound and outbound. This availability could also help to reduce the number of expedites (most of which are through SFO).

19. What are the positive characteristics of using PDX? What are the negative characteristics of using PDX? What would make PDX a more attractive cargo gateway for you or your customers? Do you see an opportunity to use PDX to serve other markets? What makes other airfreight gateways work well for you?

PDX has less uplift than LAX/SFO. More lift is needed to be competitive. Asia is our fastest growing market, so this will increasingly be a problem.

Positive characteristics of using PDX: physical location relative to [Company] facilities. Shorter distance equates to environmental and social governance/green advantages vs. ground routing to LAX/SFO/SEA exit gateways. There are few restrictions due to ground handling capabilities, wide body to narrow body transfers, etc. Predictable weather equates to positive wheels-up times. More direct air cargo service would result in timing and velocity improvements and fewer quality issues related to damage to equipment/cargo occurring during ground routing and handling. Negative characteristics of using PDX: lack of air cargo capacity, low variety of air carriers, and limited routings to key destinations, especially direct. What would make PDX a more attractive cargo gateway for us and our customers would be fast or direct air cargo capacity into and out of PDX including for large (often over-sized), sensitive, high-value cargo movements. Direct routes/transfers mean lower security risks. We could use PDX to serve other markets if the capacity was there. Positive attributes of other gateways include: air cargo capacity (both commercial and freighter) to major gateways into and from Asia; cargo handlers' experience (i.e. existing agreements with contracted airfreight forwarders for services [Company] utilizes) – with new service this would have to be monitored carefully; better on-forwarding to other U.S. airports due to range of connections. It is a disadvantage that PDX is a small market. Air partnerships help [Company] avoid issues (i.e. delays and errors) caused by cargo transfers between airlines without such agreements.

Certainly the closer location of PDX (vs. Seattle) would be attractive, but it is currently more expensive and doesn't offer enough flights. It is cheaper to truck to Seattle than to route through PDX.

Positives will exist if/when more options are introduced to PDX: reduced transit time, later

pickup times, more options for expedites, fewer touches (potential to reduce any sort of damage). Negatives currently exist due to limited options. Other gateways are currently working well due to reliability, frequency, and cost.

20. What level of service or rates would entice you to consider using or increasing your use of PDX as an air cargo gateway?

We have no problem paying a premium rate as long as our carrier delivers on time and in perfect condition.

It would need to be cheaper than Seattle, with similar lift availability.

The number of flights to Asia would have to increase and the rates would have to be competitive with SFO and SEA. [Company] was approached to charter a PDX to Asia flight, but this was cost prohibitive.

21. If Asiana Cargo Airlines offered more flights per week, would you be inclined to use these extra flights? If so, what percentage would be outbound? What percentage would be inbound?

Depends on the routing but it would more than likely be a small impact because [Company] ships heavier volumes in other lanes, although this may help in the future as [Company] grows business in Asia. [Company] supports more air cargo options out of PDX.

New services would have to meet or beat throughput times and quality requirements. Also, other gateways offer multiple flights/redundancy…a single flight out of PDX, while advantageous, induces risk with respect to loss of redundancy. If service offered the appropriate destination and connections with competitive pricing, [Company] would be inclined to ship nearly all inbound and outbound volumes on this service.

Not at current levels, unless it affected pricing.

Yes, we would be inclined due to the availability, and would commit a substantial proportion of inbound and outbound volumes. Time and transit requirements are specified to forwarders, who select routes and carriers, however.

22. Do you have any further comments or suggestions for the Port of Portland related to airfreight?

More European flights (cargo and passenger) are needed. The Port does a great job and provides great customer service, even though it's a tough sell because of West Coast competition. Direct international passenger flights save heavy-travelling employees many hours, which is a great benefit to [Company].

Very positive partnership with the Port of Portland. David and Rick are great to work with.

A major portion of [Company] spend is with an integrator. [Company] is subjected to constraints faced by forwarders. If [Company] pushes the pickup times out, the forwarders get nervous about making flight cutoff times.

[Company] fully supports the idea of air freight shipments in and out of Hillsboro Airport. [Company's] freight spend is relatively low: $0.006 per revenue dollar. Therefore attention to freight has been low. [Company] suggest the Port meet regularly with forwarders, integrators, and carriers. With respect to pricing and cost, fuel surcharges are significant and volatile, while base costs seem to be stable, which is likely where roadway congestion costs roll up. [Company] perceives a Westside bypass (Cornelius Pass Rd. to Highway 30) would be beneficial.

23. When thinking about the Port of Portland's marine and air cargo service offerings, in your experience and opinion, does the Port have the appropriate carriers available to serve the markets of interest to your organization?

Another even semi-weekly freighter from Europe would be nice.

Direct passenger service options to Asia are very limited. Delta is the only convenient option as other options require a greater number of layovers.

The Port of Portland has the necessary carriers servicing the Asia lanes, just not enough Frequency. Portland to Hong Kong daily service would be a game-changer, although [Company's] physical volume would be low. 50% to 60% of outbound volume is bound for Hong Kong.

Not at this time. Need viable inbound and outbound services, primarily to Asia. Larger markets also offer redundancy/more competition in the air cargo service offerings (SFO/SEA).

24. May a representative of the Port of Portland and/or one of the Trans-Pacific cargo airlines follow up with you or someone else in your company? If so, who should they contact?

All companies in cohort were willing to have follow-up contact from representatives of the Port of Portland and/or cargo airlines.

Appendix II: Questionnaire instrument used in interviews with cohort of freight forwarders, expeditors, integrators, and carriers and their consolidated responses

1. **Please describe the services your firm provides (carrier, forwarder, NVOCC, etc.). What are the relevant NAICS codes?**

481112 – Scheduled Freight Air Transportation
484110 – General Freight Trucking, Local
484121 – General Freight Trucking, Long-Distance, Truckload
484122 – General Freight Trucking, Long-Distance, Less Than Truckload
484220 – Specialized Freight (except Used Goods) Trucking, Local
484230 – Specialized Freight (except Used Goods) Trucking, Long-Distance
488510 – Freight Transportation Arrangement
492110 – Couriers and Express Delivery Services
493110 – General Warehousing and Storage
493120 – Refrigerated Warehousing and Storage
541614 – Process, Physical Distribution, and Logistics Consulting Services

Specific descriptions of services include: freight integrator, freight/cargo forwarding, logistics, import/export documentation, customs brokerage, 3PL (third-party logistics provider), non-asset based/asset-owning logistics provider

2. **Approximately how many full-time equivalent employees currently work for your organization (in total and locally)? Please describe general employment trends over the previous 5-year period at your firm for your local site. Is your business affected significantly by workforce demographic changes (aging workforce, driver shortages, etc.)?**

Total employment: 311,978; range: 95 to 290,000

Total local employment: 819; range: 0 to 540

When the economic downturn hit in 2008 all employees took a 15% pay reduction, although this has been totally restored.

In addition to our full time employees, we also hire contract labor (although these are not included in the employment figures submitted).

Employment levels have been steady since some layoffs in 2008-2009, with a slight increase in the last 6-12 months.

[Company] has been growing and has been hiring: no layoffs associated with the recent business cycle.

3. **Considering the computer and electronics sector in Washington County, Oregon, please describe the volumes for which your organization provides logistics services and associated trends over the previous 2 to 5 years. By revenue and by shipment volumes, what proportion of your organization's total business is constituted by logistics services for this sector?**

Approximately 20% of our business is in this sector.

60% to 70% of our business is computer and electronics industry related. In 2008 volumes hit bottom and began a steady recovery: volumes are now exceeding pre-2008 levels. Volume growth over the last 3 to 5 years has varied from as little as 3% to as much as 28% year-over-year.

40% of [Company's] business is concentrated in the computer and electronics sector.

For the Portland branch, the computer and electronics sector represents approximately 10% to 15% of the branch's business.

4. **What other sectors comprise significant proportions of your business revenues and volumes in Washington County, Oregon?**

[Company] handle all manner of freight, domestic and international. The Portland office manages business in Oregon and Southern Washington.

Some examples of commodities we provide services for include: apparel, sports apparel, footwear and footwear components, agricultural products, beverage industry goods (specialty yeast for beer production), frozen foods, seafood, mushrooms, and fresh herbs.

[Company] is involved in the movement of goods for the solar energy industry, aerospace industry, online retail, export agricultural products, medical/hospital equipment, and building materials.

Our company transports hazardous materials, agricultural products, machinery parts and related equipment, and aviation cargo (a substitute service moving cargo airlines used to transport between gateways on the West Coast).

Most of [Company's] business volume in terms of both revenue and weight/physical product is derived from apparel and footwear components.

We primarily transport high value electronics products and components.

5. **What overall trends are occurring with respect to volumes, revenues, and profitability? Can you comment on known causes of these current trends? Are there seasonal trends or other predictable periodicity with respect to these factors?**

Trends are driven by overall economic activity and winning or losing business either locally or nationally. For example, another branch office's win of significant business, say a Fortune 500 company, can greatly increase volumes handled by a branch office in another location (and conversely for lost business).

Shipment volumes double from September to December as part of seasonal shipping activity peak.

Markets are improving but becoming more competitive. Shippers have been belt-tightening, so we must become faster, leaner, smarter, and stronger. Our business does not seem to be substantively affected by seasonality.

Shipment sizes are declining even though our fixed cost burdens remain constant or are increasing over time. Volatility of market demand has increased substantially since the outset of the recession, reflected in variances between low and high shipment volumes (for example, a shipper may ship 10,000 lb today, but only 100 lb tomorrow, but carriers have the same level of fixed cost related to both movements). This has required more effort to maintain similar levels of revenue and profitability. There is greater uncertainty around hiring and capital expenditures. Finding qualified truck drivers is also difficult: unemployment compensation is generally equal to a driver's starting wages.

[Company] is experiencing a trend of revenue and volume growth, with modest growth in profitability, and this is expected to continue. Air carrier profits are down, so they are cancelling flights and consolidating routes: our people go out and win business only to find flights have been cancelled. 85% to 90% of freight we handle is Asia-bound, generally

backhauling aircraft. Business has slowed in the Asia to US trade lane, so there are fewer flights returning to Asia on which to ship cargo. We tend to experience heavier volumes in April through June (associated with the fall apparel season) as well as in September through November (associated with the spring apparel season).

Our volumes derive from our customers building new fabs, ramping new lines, and undertaking other capital expansion.

6. **As concerning freight routing, what types of real-time traffic information (both for recurring congestion and/or incident related information) do you use (if any) to inform your day to day logistical route choice and anticipated travel times? What additional information or types of real-time system data would you like to see available in the future?**

The local carriers we use determine specific routing and choose the information used to determine routing. Generally out of the Hillsboro area carriers are limited to either Cornelius Pass Road or US 26. With deliveries occurring in the morning timeframe and pickups occurring in the afternoon, typically vehicles will use US 26 to get into Washington County in the morning and use Cornelius Pass Road to get back into Portland in the afternoon. With our North Portland consolidation facility, Cornelius Pass is a viable alternative to the unpredictable, unreliable US 26 during the afternoon hours. From our consolidation facility shipments can make their way to PDX (if so destined), although Airport Way afternoon traffic is usually problematic. I-5 Northbound is consistently terrible in the afternoon. The unifying feature is this traffic congestion affects everyone: no one has a competitive advantage over another.

We have a fine dispatch organization that provides routing regularly updating and adjusting based on incident and condition reports. ODOT trip check is typically used. We gather as much information on upcoming projects, road and highway closures as possible in order to plan ahead of time (Portland Freight Committee, ODOT, and other project owners and champions). A consolidated portal of all construction and maintenance related roadway delays would be helpful.

We use cellular communications to keep in contact with hired carriers. Our carriers are familiar with conditions and times of congestion and lack of system reliability. Out of state line hauls trips occur at the same time every day. For these trips we use pass cams/trip check to assess weather-related conditions over mountain passes at relevant times of the year.

We use ODOT cameras, GPS, driver input, news radio, and what we know about normal conditions at given times of day (clarification: expected recurrent congestive conditions).

Since we are a 3PL, we are at the mercy of roadway conditions/congestion and our truck transportation carriers. Our trucking carriers access and use various data to determine local routing. We are concerned about the variability and inconsistency of travel times: it can take only 30 minutes from Washington County over US 26/I-84 eastbound, or it can take 1.5 hours. This results in missed cutoffs and consolidations. Some of our shipments go direct from the customer to SEA without consolidation.

[Company] uses ODOT Trip Check.

7. Within the past 1-3 years, what changes or initiatives have been undertaken with respect to providing service to the computer and electronics industry in Washington County (scheduling, modal changes, capital investment, significant route/gateway changes, etc)?

Addition of Asiana service made a significant impact. Adding other carriers to Europe (like KLM) and Asia would likewise make a significant impact on volume and changing gateway selection to PDX. [Company] ships volume through the following gateways: to Asia from SFO, LAX, PDX, SEA, and Vancouver BC; to Europe from PDX, SEA, and Chicago. [Company] has the liberty to choose the gateway based on transit time, service, and price parameters established by the customer. There is enough airfreight out of the Portland market to support use of multiple gateways. [Company] welcomes the Port of Portland's efforts to capture additional market share by attracting additional carriers to serve the market. The carriers, however, may only offer service at premium rates out of PDX, making it more viable to move product by ground to SFO, LAX, SEA, and Vancouver BC with only small differences in delivery timing. There is some use of feeder flights to the East Coast for shipments to Europe, but the economics don't seem to make sense when comparing West Coast feeder flights out of PDX (to LAX/SFO/SEA/Vancouver BC) as truck is more cost competitive with little (if any) difference in delivery timing.

Scanning systems have been updated, along with updates to truck dispatch and telematics systems. [Company] has also invested in new aircraft shifting from the 727 to the 757. [Company] has also made investments in fuel savings with new aircraft and electric/hybrid-electric trucks. Traffic congestion is driving some changes to scheduling and transportation modes, as well as necessitating the use of additional vehicles due to the resulting lower productivity rates. Periodically, use of feeder aircraft have been looked at.

We changed our operating system, although we're still going through integration and are not yet realizing the expected returns. On the marine side there have been international routing changes to avoid the Portland ILWU/ICTSI issues spilling over and affecting business. We've also heard that we should expect major disruptions next year when the ILWU contract is up: rumor is the ILWU has been advising their members to prepare for a prolonged port shutdown. We've also heard that ICTSI is not going to renew their contract with the Port of Portland.

We are using the Cornelius Pass Road/St. Johns Route more frequently to respond to daily repetitive congestive conditions on US 26: we use US26 westbound in the morning hours, and the Cornelius Pass route eastbound in the afternoon hours.

8. **What are your primary routes and gateways in servicing the needs of the computer and electronics sector?**
   OR 217/I-5 and points south
   US 26 through Downtown Portland to points north and east
   Cornelius Pass Road to Port facilities or other points north
   Railroads
   Marine
   PDX
   None of the above

[Company] uses all road gateways, marine Terminal 6, and intermodal rail gateways. Some computer and electronics industry freight moves by marine and rail intermodal, although not chips: generally plant equipment/capital equipment.

Our company uses all of the above gateways/modes.

We use OR 217/I-5 to points south although we avoid it certain times of the day because of congestion. We are constrained to use US 26 due to lack of alternative routes, making congested-related delays unavoidable at times. We don't use Cornelius Pass Road. We use the freight railroad system locally and marine terminals through other parties. Seldom use PDX due to lack of cargo airlines calling there: we primarily use SEA and SFO via road feeder service, but also ship through LAX and Houston.

All [Company] traffic into and out of the region goes through our terminal location near PDX for consolidation. We heavily use I-84/I-205 and experience significant congestion related delays at the interchange.

Post-consolidation, our freight routes over I-5, I-205, I-84, US 26, and OR 217. We also use rail intermodal and marine modes (Portland Terminal 6, as well as Seattle and Tacoma marine terminals). We are supporting the Asiana flight with as much cargo as possible and we also use Delta and Northwest on occasion. We also ship through LAX and SEA extensively, and only rarely use SFO.

9. **If you are a forwarder, will you provide contacts for the carriers you utilize for ground transportation movements for freight originating or destined to high tech sector companies on the Westside?**

Consolidated responses: Jet Delivery (included in cohort), Bridgetown, Summit NW, Courier Direct, United Van Lines (included in cohort), Landstar, and Becker.

10. **How has your organization responded to systemic roadway congestion? (e.g. changes in scheduling, routing, etc.) How effective have these approaches proven to be? (rank them) What specific alternative routing do you utilize (if any)?**

Cornelius Pass is slower but consistent, whereas US 26 is unpredictable. Generally traffic moves Westbound on US 26 in the morning hours when deliveries to Washington County are made, and Eastbound in the afternoon over Cornelius Pass Road following freight pickups in Washington County.

[Company] is using the Cornelius Pass route (when carrying hazmat they must use this route as US 26 is closed to hazmat traffic). We are also doing some regional feeder flights, and are using Marine Drive more extensively because of congestion.

Sometimes you have to simply sit in the traffic because of lack of alternative routes and system redundancy. Finding alternative routes and planning routing to avoid peak congestion times in various areas are the principal strategies used to respond to congestion.

Changing the routing has maintained a status quo position versus continuing to sit on US 26, but this advantage is expected to diminish over time.

What do we do about congestion? We cry a lot! There are not a lot of options or alternatives available: typically one issue on the system gridlocks the entire network as others find the few alternative routes available (which then become congested), so personnel and trucks sit in traffic and wait out the congestion. We checks information on the internet (trip check, Google) when determining the best routes. The trucking companies we use are

doing similarly, although this is only effective for major decisions such as whether to use I-5 or I-205 on a North-South movement, for example.

We have been using the Cornelius Pass to US30 route more.

11. Considering the region's multi-modal transportation system/network in its present form, what are its strengths and weaknesses? (rank strengths and weaknesses ordinally) In particular, what aspects of systemic function contribute to your organization's viability and what aspects negatively impact your operations (such as infrastructure bottlenecks)?

For being a smaller market we are fortunate to have international carriers (air) and steamship lines (although tenuous) calling on Portland. Our weakness is our freeway infrastructure.

Our region has a lot of transportation options though it is a small market. We haven't kept up with systemic congestion and bottlenecks. Also, downtown Portland parking is complicated.

The roadway system seems to function well during off peak hours. Local roadways, freeways, and arterials lack adequate capacity. Not enough of our signal system is equipped with intelligent systems/management as signal timing is very inefficient and contributes to traffic flow obstruction. The CRC would help I-5, although Vancouver doesn't seem to be supporting.

Portland benefits from both a good road network and regional shape: circular. Seattle is elongated, so it requires more time to get from one end of the area to another (i.e. Everett to Tacoma). San Francisco is separated by large bodies of water and Los Angeles is simply too large. Portland also sits at the confluence of major freeway, railway, and waterway connections, and has a major airport.

There are too many ill-timed traffic lights and the region would benefit from more ITS. For example, 122nd: a large street, but anytime a cross street is added a signal is added that is not in sync with the others.

The work from Alderwood to 82nd helped alleviate some traffic issues.

Tualatin-Sherwood Road should be 4 lanes all the way between I-5 and Highway 99. There is a lot of manufacturing in McMinnville, Newberg, Tualatin, Sherwood area that is obstructed here.

A bypass on the West side, from like Wilsonville to 185th, is needed.

The Boone Bridge is a significant regional bottleneck: there aren't enough river crossings and anytime there is a problem or accident around this bridge it shuts the region down due to lack of redundancy.

The I-84/I-5 interchange is a major bottleneck.

The Vista Ridge Tunnel's (US 26) poor design makes this a bottleneck because it is sight-limited: people cannot see around the corners and so slow down naturally whether there is traffic or not. I-84/I-5 has a similar problem at the intersection due to the sharp corners.

At Airport Way and 82nd as MAX passes, traffic for 82nd queues up. After the MAX passes, signals give priority to Airport Way traffic instead of clearing the 82nd Avenue queue immediately.

Why are there no on/off ramps at Marine Drive and I-205?

A Westside bypass is needed from Wilsonville to US 26.

[Company] has experience with Seattle's transportation system, and it is easier to get around Portland. Portland's weaknesses are its water constraints and limited crossings, and North-South mobility is more impaired than East-West. There are not enough on/off ramps for ingress/egress on I-84 between 122nd and 181st. If there were more ramps, traffic could divert to alternative routes when there are congestion issues.

The Portland area is known for its excellent mass transit system, but its freeway infrastructure is mediocre.

12. Please describe the typical locations and corresponding frequency, duration, and time of day you encounter roadway congestion.

I-84 and I-205 are unpredictable, with severe congestion at times. US 26 is predictably bad at the Vista Ridge Tunnel, especially for eastbound movements in the afternoon hours. I-5 North is predictably bad in the afternoon hours as well.

Typical locations of congestion encountered are on OR 217, I-5, Barnes Road, getting out of downtown Portland in the afternoon by any route, and system-wide daily congestion every afternoon.

The I-5 and I-84 systems from 7:00am to 9:00am and 3:00pm to 6:00pm are congested. Alternative routes are growing increasingly congested due to growth. On Tualatin-Sherwood Road from Sherwood to I-5 takes longer than I-5 to the PDX Airport: an intelligent signal system solution is definitely called for here. OR 217 and US 26 have predictable patterns of congestion, and 99W at times is very congested. The eastside seems to work a little better with westside congestion typically worse.

Areas of regular congestion include US 26 eastbound during afternoon hours, I-5 from the Terwilliger curves to the Columbia River Crossing from 2:00pm on, the I-5/205 interchange in Oregon, and Tualatin-Sherwood Road.

System-wide there is congestion after 3:00pm.

Congestion is encountered on I-5 South from 7:00am to 9:00am and on I-5 North and US 26 from 4:00pm to 6:00pm.

13. What other improvements could be made from a physical/infrastructural, policy, or regulatory perspective to the regional transportation system? (rank these responses contextually with responses to questions 9 and 10 above)

All else equal, a better route over Cornelius Pass to Rivergate would be a great improvement. Currently the routing over Cornelius Pass to Highway 30 destined for Rivergate takes traffic over the St. Johns Bridge and through the St. Johns neighborhood.

We are overinvesting in active transportation and transit, and not enough in freight mobility. Why are ongoing operations and maintenance an afterthought?

More lanes/roadway capacity and greater deployment of intelligent signal systems are needed. Eliminating cut-through trucks on Tualatin-Sherwood Road would improve the ability to serve customers in that area: trucks should either stay on I-5 or 99W, and the road should be made at least 4-lanes all the way from 99W to I-5.

Freight should have priority access to freeway infrastructure. How capital and operating funds are spent, particularly with respect to light rail versus priority bus movement, should be reviewed. The Broadway Bridge is now predominantly bike and transit use, reducing system redundancy. This bears similarity to the construction of the Interstate light rail system

displacing a major truck route, and eliminating an important North/South redundancy element. With regards to sharing the road, bikes should be subject to the same rules and levels of enforcement as motorized vehicles.

Cornfoot Road access is inefficient for trucks to get to air cargo terminal.

Portland airport's policies favor passenger movement over air cargo.

We need to add another major North/South artery that directs traffic away from the downtown area or eastern suburbs for traffic just passing through.

Replace the I-5 bridge over the Columbia River.

14. What factors influence routing in your business? Please rank these in importance. (e.g. consistency of transit times, cost, etc.)

Customer requirements for service, delivery, and cost drive routing selection.

Frequency of congestion and accidents influence how we route our trucks.

Most routing decisions are made on a cost basis, although for marine traffic some are willing to pay more to avoid the issues at the Port of Portland. We have heard that Fred Meyer is dropping Hanjin Portland because of the ILWU/ICTSI problems.

There is greater lift/more flights through gateways other than PDX. There is reliable expedited truck service from Portland to SEA and SFO that makes it difficult for PDX to compete with the scale of other gateways and attract wide body flights.

Direct routings are preferred. The type of equipment available at a given gateway drives selection because of specifications to accommodate some computer and electronics industry cargo (upper deck, center load). Carrier quality is also important for large cargo such as expensive capital equipment. Cost and transit time are secondary/tertiary issues.

Air carrier and available capacity drives gateway selection. Portland has Asiana while other gateways have multiple carriers. We truck to other gateways, but this results in longer transit times (by over 20 hours in the case of LAX shipments).

Factors affecting routing selection are (1) costs of fuel and labor, and (2) on-time pickup & deliveries.

15. Describe key issues related to airfreight shipping that affect your operations.

First, we must win the business, so competitive factors across markets. Fuel costs significantly impact airfreight shipping business. Lift is an especially crucial matter: out of Portland FedEx is the only option for domestic air cargo exceeding particular weights and dimensions.

Traffic, especially on I-5. The travel time to get to the airport has increased over the years.

Routing, transit time, frequency, price, and lack of wide-body cargo service out of PDX. Road feeder service to other air gateways is good. We route most of our cargo through SEA.

TSA certification and training, security, and screening affect us. The process of clearing cargo has increased in scale over time with gateway consolidation, resulting in some delays. Some airlines are using a 3rd party provider to handle cargo and clearing.

Shipping by air is far more expensive than shipping by truck, rail, or marine modes, so when customers choose this mode it is driven by urgency. Velocity loss due to having to expedite truck to other gateways diminishes the value of the air segment.

Due to the size of the cargo, capital equipment moves thru either SEA or SFO, not PDX.

16. Does/would using PDX as an air cargo gateway help improve the efficiency of your business? If so, in what ways?

So long as the cost is not prohibitive, all else equal yes, this would help improve efficiency.

Yes, significantly. Direct routings would help. Why do direct carriers come to Portland and then pull out? It seems there are various sectors that could fill planes (computer and electronics, sportswear/footwear, etc.). Is the cost of operating in Portland making carriers pull out?

Yes – the greater volumes through PDX would result in improved cost effectiveness, but shippers need to support this.

If PDX offered more lift this would save shippers both time and money. Work has been done to entice Asiana to add more direct Portland/Asia service where the

volume currently goes through either SEA or SFO. The volumes associated with this move are fairly steady/consistent, although this was not enough to compel the service add this year, though it is under consideration for next year.

Yes, improved velocity.

If PDX could accommodate freighters like SFO or SEA, it would help to decrease transit time as well as promoting a "greener" solution.

17. What are the positive characteristics of using PDX? What are the negative characteristics of using PDX? What would make PDX a more attractive cargo gateway? Do you see an opportunity to use PDX to serve other markets? What makes other airfreight gateways work well for you?

All else equal, PDX is more accessible and the Port of Portland is very pro-business. PDX does not have the bureaucratic issues and delays associated with customs clearance as at other ports, particularly LAX. The customer requirements drive gateway selection: cost, transit time, and customs clearance delays (if import traffic).

We could and would use PDX for additional markets if the service were available (the right equipment, transit time, cost, direct routing, etc.). Are PDX's runways and capacity not sufficient for air cargo carriers to increase presence?

PDX is well-marketed to all West Coast gateways: forwarders, airlines, shippers, etc. It is tough to get a cargo airline into PDX. How can PDX build on what they have?

We're not aware of any issues or problems with PDX and would use it more if additional routings were available.

The most negative characteristic of PDX consists in insufficient cargo carrier choice (air). The Port works very hard to bring in additional lift and is supportive and responsive to the business community's needs.

PDX is an attractive gateway due to its close proximity to Hillsboro, but needs to have freighter service to adequately support the high tech community.

18. Do you have any further comments or suggestions for the Port of Portland related to airfreight?

Having other major carriers call on Portland daily with direct service to Asia and Europe would be ideal: our other branch offices would likely route traffic through Portland if this were the case.

The Port should host a regular forum and other events for the air cargo community. Some in the air cargo community conflate direct service with faster transit and less handling. This is not necessarily a correct assumption.

Many Northwest businesses would use any additional service capacity brought into PDX. PDX seems inefficient at handling the small amount of business it has relative to other major gateways.

Collaborate with other gateways. Focus on reliability. Build roads. Increase business.

19. When thinking about the Port of Portland's marine and air cargo service offerings, in your experience and opinion, does the Port have the appropriate carriers available to serve the markets of interest to your organization?

Yes, but some growth is needed. I'm admittedly naïve, but I don't think that PDX carrier selection is hurting Portland in terms of being able to land manufacturers, etc.

With regards to marine services, the port location creates inefficiencies and higher costs due to having to cross the bar, use bar pilots and river pilots a long distance to get into the harbor from the ocean, etc.

We refuse to deal with union-related delays at the Port's marine terminal, so instead of tying up our own equipment we hire this out.

Several years ago we used the Port of Portland's marine services, but now we use Seattle and/or Tacoma due to carrier routing and service offerings. This change was due to the steamship line's scheduling needs and changes in their offerings. If carrier service offerings were more robust, we would route through Port of Portland.

There are limited air cargo carrier options (Asiana, Delta, NWA). On the marine side the only option is Hanjin, which prices itself just below the tipping point to other ports when the higher drayage cost is accounted for.

To support the high tech industry, both the airport and marine terminal need to be able to accommodate larger aircraft/vessels. Until then, most of the shipments will move via Ports of Seattle/Tacoma (SEA for air) or SFO.

I think that's all they can do with the current size of the economy.

20. What are your thoughts regarding the current use and proximity of the Hillsboro Airport (HIO) to the high tech industrial cluster? In your opinion, does HIO have a future air cargo role?

We support the use of HIO.

Yes. With the limitations of US-26 and 217 that may be a viable alternative.

It would be beneficial to use HIO. We should also consider a dedicated MAX train for freight movement. A deep water port facility on the coast/at the mouth of the Columbia with high speed freight rail service to Portland would be better than Terminal 6.

Not for 20 years…the land use action would be widely opposed.

From KWE perspective, there is no difference between HIO and PDX.

Perhaps in the distant future. The near term solution is more lift out of PDX, and fixes to US 26 and I-84 so cutoffs and consolidations are missed less frequently and later pickups are possible (which manufacturers prefer). What about Evergreen in McMinnville?

Perhaps for small package/lower deck capacity, but HIO may need major revamping to accommodate freighters.

21. Were HIO to be used as a connection to a major air cargo terminal (feeder flights), what level of daily volume (by weight and space requirement) would you ship on average from the Westside high tech sector, and to what terminal locations (PDX, SFO, LAX, SEA, etc.)?

Using HIO for feeder flights will depend on the cost. SFO is a 9-hour trip by truck and is very cost-effective by filling the truck with additional cargo. It seems unlikely that feeder flights to these nearer gateways would make sense because of the additional cost and insignificant marginal gain from a timing standpoint. What would the unit cost of such service be?

It would have to be competitive with road feeder service in both timing and cost. They should look at advantages of bypassing screening requirements with an all-cargo aircraft.

Cost is the primary driver in shifting from truck to feeder flight as there may be no substantive gain from a timing standpoint but there would be significantly higher cost

The HIO to PDX feeder would not be effective because of the lack of lift out of PDX, and customers would not bear the additional cost (they're paying for air out of PDX already, and likely would not pay for HIO to PDX via air as well).

Road feeder service would be far more competitive than air feeder service in both cost and timing.

22. May a representative of the Port of Portland follow up with you or someone else in your company? If so, who should they contact?

Companies in the cohort are generally willing to accept follow up contact from Port representatives.

SUPPLEMENTAL QUESTIONS:

- **Can you provide a proportional split for use of export gateways (i.e. PDX, SFO, LAX, SEA, Vancouver BC, etc)? Are there variances in customs processing efficiency/ease regarding these gateways? To what extent does this affect gateway selection?**

With regard to customs variations, PDX is improving but used to have significant delays because of not pre-clearing cargo as in other ports. Expeditious handling is not a strength at Portland (perhaps due to lower scale/volume) but Customs tries to work with the Port and other stakeholders to make changes and improve processes.

Most volumes transported go through SFO and SEA.

For us the gateway split is fairly equal. Europe-bound traffic uses PDX and SEA (predominantly) whereas Asia traffic uses LAX and SFO. There is generally more Asia freight, so this likely drives the greater use of LAX and SFO by volume alone.

We use SEA, SFO, and LAX the most for both air and marine shipments.

We would need to pull data to speak to this better, but we operate large offices associated with LAX and SFO, and small offices attached to SEA and PDX (and we do not use Vancouver, BC). From our perspective there is no substantive difference in customs/clearing process between PDX and other gateways.

We have no clearing issues at PDX, however we experience significant delays associated with cargo clearing at SEA. We terminate cargo at Portland wherever possible to avoid this, including use of in-bond truck shipping so the cargo will clear in Portland. NWA and Delta outsourcing clearing, but the 3rd party provider lacks the experience and relationships so there are delays.

Our gateway split is: PDX – 0%, SFO – 70%, SEA – 27%, LAX – 3%, YVR – 0%.

- **Has the use of feeder flights between Portland and US gateways been considered? What about direct flights from Portland to foreign hubs with feeder flights/routing to destination from the foreign hub? What are the drivers (in order of importance) as concerns route selection (i.e. timing, cost, hubs and routing convenience, etc.)?**

Truck reliability and lower cost has margined away the use of feeder flights.

Carriers (air) could perhaps make stops at PDX, but then would have to pay landing fees, so the cargo would have to be profitable given all of the costs associated with the additional stops.

- **With respect to local ground transportation routing, do you use Cornelius Pass Road?**

Yes.

- **What routing do you use from there (i.e. US 30 to Longview to I-5 N, etc.)?**

US 30 to St. Johns/Rivergate and then Marine Drive to PDX.

Cornelius Pass to US 30 to Portland.

- **What conditions do you typically encounter on Brookwood Parkway?**

20-minute eastbound delays.

Traffic is OK on Brookwood but has increased.

We use Brookwood between 10:00am and 2:00pm, so generally there are no problems. After 3:00pm to 4:00pm mobility is very problematic.

We're not aware of specific problems on Brookwood Parkway, but amenities like freight only lanes or jump lanes such that cargo could bypass traffic and access US26 may be helpful.

When we call on customers in the area we have experienced 10 to 20 minute delays (depending on the time of day) at the eastbound US 26 ramp signal off Brookwood. It seems the eastbound bottlenecks are US 26 access (such as the ramp signals at Brookwood) and the Vista Ridge Tunnel.

- **What time of day are you typically using the system for your shipments in the Hillsboro area?**

We make morning deliveries and perform afternoon pickups.

We use the roadway system typically between 6:00am to 7:00am, and 4:00pm to 6:00pm.

Portland Region Westside Freight Access and Logistics Analysis

ALTERNATE MODE CONSIDERATION

WORKING PAPER

JUNE 2013

produced by the Port of Portland

Air Cargo Service on Light Rail

The following highlights issues associated with the potential use of light rail to transport air cargo from the west side to PDX to avoid regional roadway congestion. It should be noted that the Red Line currently operates between Beaverton Transit Station and PDX. To serve the high tech sector the Red Line would likely need to be extended to the west, probably somewhere between Elmonica and Fair Complex rail stations.

Light Rail System Capacity
Four TriMet light rail lines (Blue, Red, Yellow, and Green) cross the Willamette River on the Steel Bridge. During AM and PM peak hours the LRT capacity on the Steel Bridge is currently fully utilized. TriMet estimates that during the critical afternoon/evening hours an additional train could be added only after 8PM.

Independent of the Steel Bridge constraint any air cargo light rail train would have to operate within normal operation gaps for the Blue and Red line. There is no opportunity for an air cargo train to bypass the many passenger stations and trains along the route.

Light Rail Train Capacity
Current light rail trains are cars configured to maximize ridership for people, not the loading of boxed cargo. Any light rail cargo train would have to be specially configured for the loading, transport and unloading of cargo only.

Light rail train lengths are limited by the block length in downtown Portland (200 feet) meaning a maximum of only two cars can operate on a single train. This leaves two options for a light rail cargo car. It could either go as a stand-alone air cargo train with 1 or 2 cars, or 1 air cargo car could be attached to a single Red Line passenger car.

While a dedicated stand-alone air cargo train could operate independently of passenger trains, the light rail system capacity constraint at the Steel Bridge would mean that it could operate only if passenger service were reduced during peak travel times.

For a split passenger/air cargo train to operate would require a location where the air cargo train could be loaded/unloaded and a nearby location where the air cargo train could be attached/detached from the passenger train. Since existing intensive development at the Red Line terminus stations (Beaverton Transit Center or Hatfield Government Station and PDX Terminal) would preclude the processing of a cargo train at those locations, such an operation would need to occur elsewhere and would significantly delay passenger transit times and scheduled train headways.

Air Cargo Facility Requirements
An air cargo light rail handling facility at the airport would need to meet Port of Portland, FAA, and TSA requirements. Some of those requirements may include:

- Construction of a light rail spur to the PDX Cargo Center located south of Airport Way and west of 82nd Avenue requiring a minimum of one additional at-grade road crossing.
- An air cargo consolidated receiving facility at the PDX Cargo Center that can be shared by the cargo airlines such as FedEx, UPS, and Asiana. That includes reconfiguration of a portion of the site to allow a direct landside train unloading platform, an air cargo off load security inspection platform, and sufficient space to deconsolidate the cargo for pick-up and delivery to the various cargo airlines.
- Additional secure handling of cargo between the LRT receiving facility and AirTrans Center located on the south side of the airfield.

Air Cargo Handling Associated with Shifting Away from Trucks to PDX

Every time cargo is transferred from one transportation mode or location to another (loading dock to truck, or truck to airplane) the process requires time, staff, space and equipment. All of these elements add to the cost of shipping. According to experts in the air cargo industry, the cost is five cents per pound every time the shipment is handled. In general, freight forwarders are constantly seeking to balance cargo time sensitivity with handling costs. As a result there is a built-in incentive to "keep it simple" to minimize both variables. Currently the steps to get a package from the manufacturer's distribution site loaded onto a plane at PDX are as follows:

- Cargo is loaded onto air-freight forwarding truck at high-tech product distribution site
- Cargo is driven to the airport cargo receiving facility
- Cargo is off-loaded at cargo receiving facility for inspection
- Cargo is sent to airline sorting facility via conveyor or vehicle
- Cargo is sorted for flights
- Cargo is loaded on airplanes

Air Cargo Handling Associated with Trucks to HIO

At a high level, cargo handling needs for flights out of Hillsboro Airport are essentially the same as what currently occurs at PDX. Lower level differences would be associated with the costs. Because time and distances are less the cost transport between a west side product distribution site and the airport would likely be marginally less. However, because air cargo service does not currently exist at HIO, the costs of providing (redundant service to PDX) labor, buildings and machinery to off-load, inspect, sort, and load cargo would be higher.

Air Cargo Handling Associated with Light Rail to PDX

If air cargo were to be transported to PDX via light rail, the cargo would need to be handled many more times than currently exists. The result would be a significant increase in shipping costs. Below is an outline of the steps necessary to get a package from shipping dock to an airplane via LRT

- Cargo is loaded onto air-freight forwarding truck at west side product distribution site
- Cargo is driven to west side LRT cargo consolidation/shipment facility
- Cargo is off-loaded from trucks
- Cargo is loaded onto LRT car
- Cargo rides to PDX consolidated air cargo receiving facility
- Cargo is off-loaded at PDX consolidated air cargo receiving facility for inspection & airline sorting
- Cargo is loaded onto truck for airfield drive to AirTrans Center
- Cargo is driven to each airlines cargo receiving facility
- Cargo is off-loaded at airline sorting facility
- Cargo is sorted for flights
- Cargo is loaded on airplanes

Air Cargo Trends

The current trends in moving air cargo is to eliminate regional air cargo feeder flights from small communities to larger cargo hub airports and replace those shorter flights with truck trips directly to the hub cargo airport, because the cost of trucking is cheaper than the cost of flying AND it eliminates the costs to staff, store, and load/unload air cargo on airplanes. Even in the Portland region an increasing amount of air cargo that used to fly out of PDX is being trucked directly to Seattle and San Francisco.

Air Cargo Flights from Hillsboro Airport (HIO)

The following addresses the potential for direct air cargo service out of Hillsboro Airport both as intra-regional feeder service to PDX and direct service to larger commercial airport hubs in the western United States.

Hillsboro Airport Infrastructure

The current design of the airfield in terms pavement strength of the runway, taxiways and aircraft ramps does not support aircraft that weigh more than 100,000 lbs. Smaller commercial aircraft such as Boeing's 737 series or Airbus' 318/319/320 series exceed this weight threshold significantly. The smallest aircraft in the integrated air carrier fleet is the Boeing 757 which would not only be too heavy, but also require a much longer runway at HIO. The only commercial cargo aircraft that operate under the 100,000 pound weight limit are turbo-prop aircraft such as the Cessna Caravan or Jetstream 31. Bombardier and Embraer regional jets also meet this criterion, but are seldom configured for cargo service. The maximum range for these aircraft types range from 900 to 1400 miles. The Port estimates the cost of improvements to the airfield to accommodate larger cargo aircraft would be at least $100 million, probably significantly more.

To accommodate the handling and transfer of cargo to airplanes at HIO, associated airside space, aircraft ramp, buildings, and cargo loading equipment would be needed at a significant cost. In addition, there would be the additional cost of labor to perform all the functions to make an air cargo operation work.

Intra-Regional Cargo Feeder Service to PDX

From an airfield capacity and pavement structural perspective the existing airfield could accommodate turbo-prop feeder service to PDX. As noted earlier, significant issues would arise regarding new added costs associated with providing infrastructure, labor, extra handling, as well as the much higher transportation costs associated with airplanes replacing trucks. It is unclear how many cargo feeder flights would be necessary to transfer the volume and weight of west side air cargo to PDX.

Direct Cargo Hub Service

Due to airfield aircraft weight limitations, air cargo jet freighters cannot operate out of HIO. This limits the range of potential direct cargo flights to Seattle or the Bay Area. Denver or Los Angeles may be possible but are at the far limits of potential HIO operating aircraft range. Major national air cargo hubs such as Memphis (FedEx) and Louisville (UPS) are out of the question. As noted with the cargo feeder service, it is unclear how many flights would be needed to serve west side cargo needs, but it is also unclear what and how many air destinations are associated with that cargo. As is the same with cargo feeder service significant issues would arise regarding new added costs associated with providing infrastructure and labor to process air cargo.

The Port of Portland works very hard to provide air cargo freighter service for Oregon and SW Washington. Profitability of that service is marginal. While the potential actual effects of losing high value west side freight from cargo carriers serving PDX have not been studied, there is potential that the associated loss of revenue could result in losing some direct service from PDX. Loss of such service would negatively impact Oregon industries that rely on those flights to move everything from fresh seafood, to fresh fruit, to air soles to destinations around the world.

Westside Freight Access and Logistics Analysis - Project Analysis Matrix

							PM Peak Ave TT Reduction (min)			Distance Reduction (mi)		Segment Reduction (#)		Reliability			
Westside Freight Project No.	Project/Program Name	Project Start Location (Identify starting point of project)	Project End Location (Identify terminus of project)	Project Purpose	Description	Federal FC Project	CP	US 26	Source	CP	US 26	CP	US 26	BI	Existting Segment	System Connect	Comments
1	Silicon Forest Green Signals	varies	varies		The project will extend adaptive signal control along county-maintained arterial roadways (Cornelius Pass Road, Baseline Road, Cornell Road) in and alongside the City of Hillsboro.		0	0	model	0	0	0	0	NA	Not included in INRIX dataset	N	
3	Hillsboro Traveler Information				Provide traveler information at key points northbound approaching US26, alerting drivers of congestion either on US26 through the central city loop or on Cornelius Pass Road northbound.		NA	NA	no impact to average travel time, but reduces delay in event of incident	0	0	0	0	NA	system project does not focus on specific location	N	Provides more reliable travel time by alerting drivers of incident. Would not improve overall travel time, but would prevent/reduce delays related to incidents.
6	US26 Truck Ramp Meter Bypass				Modify select US26 on-ramps to allow freight to bypass ramp meter queues.		0	20	calculation, interviews	0	0	0	0	?	Not included in INRIX dataset	N	Existing travel time and reliability data does not include this location. Delay of 20 minutes is based on queue calculation and anectdotal data.
7	Helvetia Rd.	Schaaf Rd	West Union Rd.	Improve capacity and safety	Construct 3 lane roadwy with bike lanes and sidewalks	x	0.1	0	model	0	0	0	0	?	Not included in INRIX dataset	N	
8	West Union Rd.	Helvetia Rd.	Cornelius Pass	Improve capacity and safety	Construct 3 lane roadway with bike lanes and sidewalks		0	0	model	0	0	0	0	0.02	Jackson School to Corn Pass	N	
9	US 26W: Widen highway to 6 lanes	185th Ave.	Cornelius Pass Road	Increase capacity.	Widen highway to 6 lanes.	X	0.2	0.20	model	0	0	0	0	0.81	Corn Pass to 185th	N	
10	Cornelius Pass Road Safety Improvements - ITS	US 30	Washington County	Safety improvement	Implement ITS improvements recommended in FHWA Safety Audit; i.e., electronic messaging signs, photo radar/ticketing.		0	0	no impact to average travel time	0	0	0	0	0.65	Skyline to US 30	N	
17	Burgard-Lombard, N: Street Improvements	Intersection of N Burgard/Columbia	UPRR Bridge on N. Lombard	Improve freight mobility, safety and industrial site access.	From UPRR Bridge to N Columbia Blvd. Widen street to include 2 12-foot travel lanes, continuous left turn lane, bike lanes and sidewalk.	x	0.1	0	model	0	0	0	0	0.59	rail to Columbia Blvd	N	
19	Lombard, N/NE (MLK Jr - Philadelphia) (US 30): ITS	MLK Jr. Blvd	Philadelphia		Communications infrastructure including closed circuit TV camera, variable message signs for remote monitoring and control of traffic flow at the intersections with MLK Jr, Interstate, Greeley, Portsmouth, Philadelphia/Ivanhoe.		0	0	no impact to average travel time	0	0	0	0	0.05	Philadelphia to MLK	N	
20	Columbia Blvd, N/NE(I-205 - Burgard): ITS	I-205	N Burgard		Communications infrastructure including closed circuit TV cameras, variable message signs for remote monitoring and control of traffic flow for six signals.		0	0	no impact to average travel time	0	0	0	0	0.07 / 0.36	Burgard to I-5 / I-5 to 60th	N	
21	I-5 from I-405 to I-84 (Rose Quarter/Lloyd District) Construction	I-84	Greeley St.	Improve safety and operations on I-5, connection between I-84 and I-5, and access to the Lloyd District and Rose Quarter.	Construct improvements to enhance safety and operations on I-5, connection between I-84 and I-5, and access to the Lloyd District and Rose Quarter.	X	0	0.2		0	0	0	0	2.9	I-84 to I-405	N	Highly unreliable travel time segment that is not located directly on primary freeway route.
25	Cornfoot, NE (47th - Alderwood): Road Widening & Intersection Improvements	47th	Alderwood		Widen to improve lighting, landscaping, turn lanes, and bike lanes		0	0	model	0	0	0	0	?	Not included in INRIX dataset	N	
26	Airtrans Way and Cornfoot Road Intersection Improvements	intersection	intersection		Add signals and improve turn lanes at AirTrans Way/Cornfoot Rd.		0	0	model	0	0	0	0	?	Not included in INRIX dataset	N	
27	Enhanced Freeway Incident Response				Increase incident reponse and clearing capacity on key US26/I-405/I-5 freight route to reduce non-recuring congestion impacts.		NA	NA	no impact to average travel time	0	0	0	0	NA	system project does not focus on specific location	N	Woiuld not improve overall travel time, but would reduces delays related to incidents.
28	Century Blvd	Bennett	West Union Rd	Provide congestion relief.	Extend 2/3 lane with US 26 Overpass, connect existing segments.	x	0.1	0.1	model	0	0	0	0	NA	New segment	Y	Provides improved connectivity but does not reduce number of travelled segments nor provide significant reduction in travel time.
32	Schaaf Extension	Helvetia Rd.	West Union		Construct new 3-lane multi-modal roadway to serve urban traffic away from rural edge.		0.0	0.0	model	0	0	0	0	NA	New segment	Y	Provides improved connectivity but does not reduce number of travelled segments nor provide significant reduction in travel time.