5 FREIGHT NEEDS

The Freight Access Project (FAP) is tasked with identifying locations that hamper freight mobility. It determines infrastructure and operational issues and develops solutions that address these needs.

Based on the conditions assessment presented in Chapters 3 and 4, this chapter evaluates truck freight needs. It introduces and applies a 'toolbox' of strategies designed to address these needs, setting the stage for the development of a prioritized list of potential investments to maintain and improve freight mobility between today and the planning horizon year of 2035.

In addition to the analytical process outlined below, the Freight Access Project considered:

- National, state and regional policies related to freight to ensure that its needs assessment and project list are consistent with criteria and goals that are used to make funding decisions at the regional, state, and federal level
- Input from local freight stakeholders and the Seattle Freight Advisory Board

Chapter 5: Freight Needs		Chapter 6: System Improvements	
EVALUATE freight needs	**APPLY toolbox treatments**	**DEVELOP project list**	**PRIORITIZE projects**
• Define performance measures • Score and Index Needs	• Identify gaps • Consider possible solutions	• Refine descriptions • Develop cost estimates and timeframes	• Consider implementation issues • Prioritize

5.1 Policy Context

To ensure that Seattle's freight mobility projects can compete effectively for regional, state, and federal funding, it is important to understand and address the goals and related performance criteria related to programs that provide funding for freight projects. Generally, these policies establish a hierarchy of facilities important for freight to use, define criteria for evaluating freight routes such as safety and preservation, define management oversight and operations of freight routes and identify needed investments to move freight. Aligning with national, state and regional policies regarding freight not only promotes improved coordination between agencies but also supports coordinated investments in shared priorities. A summary of national, state, regional, and local freight policies follows.

5.1.1 National Policy Guiding Investments in Freight Infrastructure

Review of national policies ensures that the FAP provides the information necessary to help the City and the Port align with regional, state and national interests and identify potential opportunities for partnering.

National Freight Strategic Plan (MAP-21) [1]

Moving Ahead for Progress in the 21st Century (MAP-21), signed in July 2012 and effective for fiscal years 2013 and 2014, includes numerous provisions intended to improve the condition and performance of the national freight network and support investment in freight-related surface transportation projects. As a natural deep water port that, together with the Port of Tacoma, comprises the 3rd largest container port complex in North America, which in turn supports the fourth largest warehousing and distribution center in the U.S., the City of Seattle has a critical role in the national freight network. It is therefore important to ensure that the projects identified through the Freight Access Project support MAP-21 goals and meet its funding criteria.

MAP-21 directed USDOT to designate a national freight network to assist the state DOT in strategically directing freight related resources. MAP-21 directed USDOT to develop or improve data and tools to support an outcome-oriented, performance-based approach to evaluating proposed transportation projects. The legislation also changed funding eligibility and prioritization for freight-related projects.

MAP-21 directed that a national freight strategic plan be developed and updated every five years. Among other things, the plan would:

- assess the condition and performance of the national freight network,
- identify highway bottlenecks,
- forecast freight volumes,
- identify major trade gateways and national freight corridors,
- identify best practices for improving the performance of the national freight network and mitigating the impacts of freight movement on communities, and
- provide a process for addressing multistate projects and strategies to improve freight intermodal connectivity.

The analytical and project development approach outlined in this report addresses the goals and criteria for MAP-21's strategic plan at the local level.

1 U.S. Department of Transportation. www.fhwa.dot.gov/map21/factsheets/freight.cfm

National Freight Network[2]

MAP 21 also called for establishing a two-part National Freight Network – one network being "primary," the other "rural." The Primary Freight Network would feature the 27,000 centerline miles of existing roadways that are most essential to freight movement. It is within USDOT's discretion to designate a further 3,000 miles of existing and future un-built roadways under the Primary Freight Network. The National Freight Network would serve as a target for state investment. However, the Network did not include freight rail, which carries about 42 percent of the nation's ton-miles (a unit that measures a ton of freight moving one mile). Within the City of Seattle I-90, SR 519, and I-5 are designated as part of the National Freight network.

National Highway System

The National Highways System (NHS)[3] is an interconnected network of strategic highways within the United States, including the Interstate Highway System and other roads serving major airports, ports, rail or truck terminals, railway stations, pipeline terminals and other strategic transport facilities. The NHS was developed by USDOT in 1995 in cooperation with the states, local officials, and metropolitan planning organizations (MPOs). MAP-21 resulted in the addition of 1,200 miles of Washington roads to the NHS.

The NHS also includes Intermodal Facilities and intermodal connector routes, where required for travel from the NHS routes to the Intermodal Facilities. Routes designated as Strategic Highway Network (STRAHNET) by the Department of Defense also form part of the NHS. In Washington, NHS routes are maintained in Washington's Highway Performance Monitoring System (HPMS) and represented in Washington's HPMS spatial network (GIS).

Within the FAP study area, I-5, I-90, SR 519, SR 99, Fourth Avenue S, 1st Avenue and Leary Way are designated on the National Highway System as strategic connections, with the last three as Principal Arterials in MAP 21. A full current (as of 2014) listing of NHS roadways in the City of Seattle is provided in Appendix C.

5.1.2 State and Region

State Freight Mobility Plan [4]

At the state level, the most recent and major undertaking to define freight needs was development of the Washington Statewide Freight Mobility Plan by the Washington State Department of Transportation (WSDOT). It was tasked with

2 Federal Highway Administration. ops.fhwa.dot.gov/freight/infrastructure/nfn/index.htm

3 www.fhwa.dot.gov/planning/national_highway_system/

4 Washington State Freight Mobility Plan, WSDOT 2014.

developing and prioritizing freight transportation system improvement strategies that support and enhance trade, sustainable economic growth, safety, the environment, and goods delivery needs in the state. Development of a State Freight Plan was encouraged by MAP-21, and is required by Washington according to Revised Code of Washington (RCW) 47.06.045.

The Statewide Freight Mobility Plan contains several key new deliverables, including the identification of Washington State Freight Economic Corridors, first- and last-mile truck connector routes, and the identification and prioritization of truck freight highway bottlenecks, as guided by MAP-21. The Freight Access Project (and Freight Master Plan) will assess last mile connectors that are included into the state network.

WSDOT also analyzed nine categories of truck bottlenecks on highways, including safety, pavement and bridge conditions, load restrictions, clearance restrictions, resiliency bottlenecks, truck slow-speed locations in urban areas and on signalized highways, and capacity needs. The Seattle region is a significant area for truck bottlenecks. Preliminary data show poor pavement and bridge conditions along several highways in Seattle, including several height and weight restriction issues. Finally, the portion of I-5 going through Seattle is a truck slow speed location. The Freight Access Project's criteria for scoring of prospective projects are compatible with the state's criteria. The modeling analysis also accounts for the impacts of congestion on the state highway network.

Washington State Rail Plan [5]
This state rail plan identifies policy changes and provides a list of proposed improvements for a 20-year design horizon. The projects listed in the plan cover the entire State. Within the MICs, the plan lists the need for a new-east west grade separation over the BNSF mainline between Spokane and Dearborn Streets as well as the need for the Lander Street grade separation. Both of these are in the later part of the plan horizon due to funding uncertainty.

FMSIB Strategic Freight Corridors [6]
Freight Economic Corridors were identified using volume, resiliency and first-/last-mile connectivity factors. Routes with the highest annual gross tonnage, T-1 and T-2 routes are identified as Strategic Freight Corridors. In the Seattle region, state highways, 15th Avenue in the BINMIC, 4th Avenue S and E Marginal Way S in the Greater Duwamish MIC, and several other arterials are designated as T-1 truck economic corridors (i.e. routes carrying more than 10 million tons of freight per year). Maps of the strategic freight

5 Washington State Rail Plan Integrated Freight and Passenger Rail Plan: 2013-2035, WSDOT March 2014.
6 StatewideMapofFMSIBStrategicFreightCorridors, WSDOT 2013.

corridors are included in Chapter 2 – Freight Context and the MICs.

FAST Program [7]

The Freight Action Strategy for the Everett-Seattle-Tacoma Corridor (FAST Corridor) is a partnership of 26 local cities, counties, ports, federal, state and regional transportation agencies, railroads and trucking interests, intent on solving freight mobility problems with coordinated solutions.

These partners have shared information and funding resources—sometimes shifting funds from projects that were delayed to those that were ready to begin—to benefit the program as a whole. Because of this team approach, projects were built which otherwise might never have been completed in the recommended timeframe. This partnership has identified 25 projects. Since 1998, the partners have identified and assembled $568 million of public and private funding and completed 19 of these priority projects.

In Seattle, the partnership has funded major improvements in the Greater Duwamish MIC, improving freight mobility and reducing the impact of freight traffic on the traveling public. Completed projects include WSDOT's SR-519 project, the City's Spokane Street Viaduct Widening and Duwamish ITS projects, and the Port of Seattle's East Marginal Way Grade Separation. The remaining project is a grade separation of the mainline rail corridor at Lander (which is included in the recommended projects listed below.)

7 FAST Corridors, PSRC.

PSRC 2040

As the local Metropolitan Planning Organization, Puget Sound Regional Council provides coordination of land use and other planning functions and prepares regional long range land use and transportation plans. PSRC's long range transportation plan, Transportation 2040, includes Appendix J the Regional Freight Strategy[8]. This strategy addresses Last Mile needs and recommends system preservation within the MICs.

5.1.3 City of Seattle

City planning includes an overall long range Comprehensive Plan, a Transportation Strategic Plan, and modal plans for pedestrians, bikes and transit, The City also has adopted a Complete Streets ordinance and annually updates its Capital Improvement Program. The influence of these plans on freight needs is described below for each plan.

Comprehensive Plan Building Connections 2035

The City Comprehensive Plan update, Building Connections 2035, will be completed in 2016 to meet the requirements of the Growth Management Act. The plan addresses land use and anticipated population and employment expected by the year 2035. The plan will address land use in the MICs which is expected to continue to grow and in-fill with manufacturing and industrial uses.

When complete, this plan will include goals and policies of a multi-modal transportation element. The plan will be informed by *Move Seattle*, a major strategic initiative bringing together the

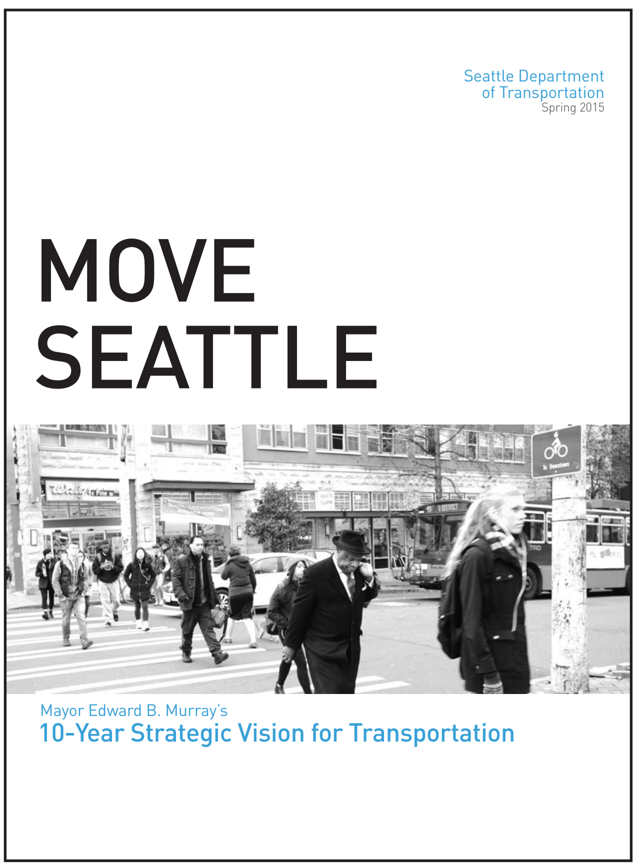
8 Transportation 2040 UPDATE: Appendix J Regional Freight Strategy, PSRC May 2014.

modal plans to develop a 10 year investment commitment.

Container Port Element

The Comprehensive Plan also contains a Container Port Element. The element is based on RCW 36.70A.085, which is a component of the Growth Management Act, The law required the Port and the City to work together to develop a Container Port Element that:

- establishes policies and programs to define and protect core areas for Port uses,
- provides efficient access to core areas through freight corridors,
- resolves key land use conflicts and mitigates incompatible uses,
- ensures consistency with Comp Plan (economic, land use, transportation elements) and the Port's Comprehensive Scheme.



Transportation Strategic Plan[9]—Move Seattle[10]

The 2005 Transportation Strategic Plan (TSP) outlines specific strategies, projects and programs that implement broader citywide goals and policies for Seattle and guide decision making. The TSP was updated with the 2012 Action Agenda. The next Transportation Strategic Plan, known as *Move Seattle,* was released in March 2015 and identified major SDOT investments to be implemented over the next decade. *Move Seattle* lists the development of the Freight Master Plan as a priority and identifies several projects and programs that also appear in FAP.

Complete Streets [11]

The City adopted a Complete Streets ordinance, along with a checklist, in 2007 requiring SDOT wherever possible to design streets to accommodate pedestrians, bicyclists, transit riders, prioritize freight on Major Truck Streets; and accommodate persons of all abilities while promoting safe operations for all modes.

Modal Plans

The City has adopted a Bicycle Master Plan[12] , Transit Master Plan[13] and Pedestrian Master Plan[14]. The Transit Master Plan and Bicycle Master Plan include lists of prioritized projects, while the Pedestrian Master Plan identified priority areas. Some streets within the City may have overlapping projects from more than one modal plan. The Complete Streets ordinance indicates that these investments should, wherever

9 www.seattle.gov/transportation/tsp_2005.htm
10 Move Seattle: Mayor Edward B Murray's 10 Year Strategic Vision for Transportation, SDOT, 2015.
11 www.seattle.gov/transportation/completestreets.htm
12 www.seattle.gov/transportation/bikemaster.htm
13 www.seattle.gov/transportation/transitmasterplan.htm
14 www.seattle.gov/transportation/completestreets.htm

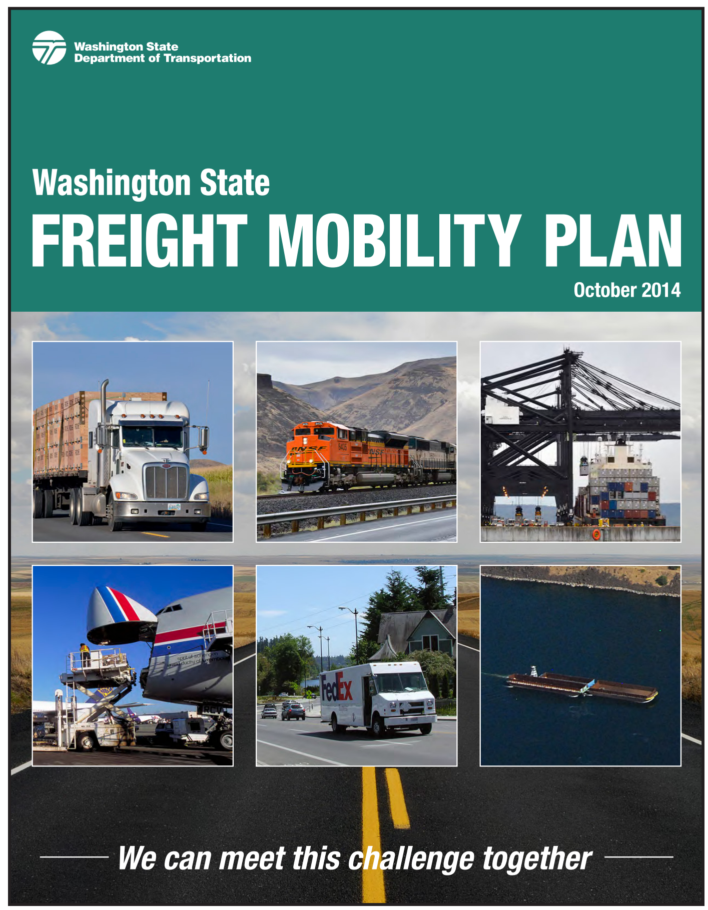
feasible, include accommodations for all modes (with freight as the priority mode on Major Truck Streets). The list of FAP projects may occur on streets where other modal investments are being considered. Where this occurs, safety must be a first priority. As noted above these "modal" plans, including the FAP and Freight Master Plan will be included in a cohesive plan, *Move Seattle*, which identifies a prioritized list of investments.

Capital Improvement Program[15]

The latest Capital Improvement Plan (CIP, 2014-2019) provides a list of budgeted investments programmed for a six-year period. In relation to freight, the CIP includes large and smaller spot investments and improvements along multi modal corridors as well as preservation and maintenance of arterial streets heavily used by trucks.

Other Plans

As described in the previous section, the FAP included a review of past neighborhood plans and related studies prepared for the two MICs. The project team reviewed past input from the North Seattle Industrial Association, the Seattle Manufacturing/Industrial Council, and many other stakeholders throughout the project. The project team also reviewed technical report prepared for the SoDo, Greater Duwamish and BINMIC areas by stakeholder groups and Seattle Office of Economic Development. The team also reviewed the project lists for the SDOT Truck Spot Improvement Program.



15 www.seattle.gov/financedepartment/1419proposedcip/documents/Transportation.pdf

5.2 Stakeholder Input

The FAP conducted stakeholder interviews[16] with representative members from the manufacturing and trucking industry operating in the Greater Duwamish MIC and BINMIC to identify specific issues, needs, and ideas regarding improving freight mobility in the study area. The six stakeholder interviews were conducted between January 13 and 22, 2014. The stakeholder interviews had the following objectives:

- Identify problem locations and challenges for trucks operating:
  - within the Greater Duwamish MIC and BINMIC,
  - on freeway connections to Greater Duwamish MIC and BINMIC,
  - between Greater Duwamish MIC and BINMIC,
  - throughout the regional transportation system.
- Identify potential solutions and options to improve freight operations.

5.2.1 Freight Advisory Board

The Seattle Freight Advisory Board[17] served as the primary sounding board throughout the project. The Freight Advisory Board suggested stakeholders to interview, and reviewed stakeholder interview results. The board also provided additional observations and suggestions on:

- freight related mobility and access problems.
- possible solutions within the Freight Access Project study area.

During two FAB workshops, one on freight mobility problems, and the second on solutions, the project team gained feedback on current and future freight needs.

5.2.2 Stakeholder Interviews

Several key themes emerged during stakeholder interviews, including specific periods of the day with unexpected travel times and locations that pose challenges for freight movements. The following is a summary of stakeholder suggestions for freight mobility improvements:

- longer signal green times on established trucking routes and important truck streets
- minimize daytime construction impacts
- complete SR 99 project
- physically separate major bicycle and truck facilities and corridors
- enforce loading zone restrictions
- extend port terminal hours (recognizing this has policy and other implications)

Signal timing. Many freight operators complained about short signal timing that only allows one or two trucks to get through a signal. This was most notable for east-west routes in the SoDo.

Construction and design vehicles. Access along the waterfront along Alaskan Way is a growing challenge due to construction. The design of roadways, especially during construction is governed by several criteria – one being size of the vehicles. When it is assumed the facility will be used by larger vehicles, the radius for turning and the widths of lanes are more generous. Construction traffic control appears to be using

16 Interviews conducted by PRR
17 www.seattle.gov/sfab

a WB 62[18] design vehicle but should consider a larger WB 67 design vehicle. Design vehicles are described in the latest edition of AASHTO's Policy on Geometric Design of Highways and Streets[19].

Modal competition. Many expressed concern about the loss of space or lane miles for freight, specifically lanes assigned to other uses including parking, transit, bike lanes and roadway narrowing. Truck drivers would prefer that bikes and trucks operated in separate right of ways.

Port of Seattle terminal congestion. Port of Seattle terminals are limited by daytime operating hours. Trucks sometimes queue at terminal access points. Stakeholders expressed frustration about congestion on the Spokane Street Bridge (West Seattle Freeway) and related openings of the Lower Swing Bridge.

Loading zone inaccessibility. One challenge identified as a rising and worsening issue is loading zone availability throughout downtown Seattle and its neighborhood business areas. Interviewees expressed a desire for more or better managed commercial parking procedures.

Location and time of day challenges. Most interviewees expressed frustration regarding truck operations and delay to reach the Port's terminals. Peak travel times, particularly during morning commute hours, were the most challenging times for freight movement through these already congested areas.

5.2.3 Project Team

The joint SDOT/Port project team itself was a collaborative team that guided the development of the FAP. The project team shared findings with SDOT technical experts and City departments, the Port of Seattle, and an Interagency Management Team throughout the FAP work program to obtain input. SDOT staff and consultant team members also undertook field observations of the three project subareas and documented observations from those field reviews.

5.3 Performance Measures and Criteria

In recent years, the use of performance measures in the public sector has matured and expanded significantly, yet nationally the use of freight-specific performance measures remains limited and the performance measures used vary significantly between states and regions. This is due in part to the shared public - and private-sector roles in the freight system and the data available to develop measures. A principle for development of freight system performance

18 Wheelbase, the distance from the front axle under the cab to the last rear axle.
19 AASHTO, 2011.

measures is to not just "implement measures," but to implement measures that are accurate, consistent, and meaningful, and can lead to improved decision making.

For the FAP, the team used historical information from past plans and input from stakeholders on what project needs exist for freight. From this the project team developed quantifiable performance measures based on analysis conducted in Chapters 3 and 4. The performance measures were specifically designed to be compatible with existing performance criteria used (or expected to be used) by the City, PSRC, the state, and the federal government.

The performance measures that were applied to the transportation network in the MICs for the FAP are linked to the overall project goals and objectives. A summary of the performance measures is shown in Table 5.1.

Table 5.1 Project goals and link to performance measures

Goal	Objective	Performance Measures and Data
Safety	Increase safety for all modes	• Truck collision history
Truck Mobility, Reliability, & Throughput	Maintain and improve freight-truck mobility and access	• Volumes & vehicle classifications • Speed (from Chapter 3 & 4) • Buffer index*
Connectivity	Ensure network connectivity, especially for major freight inter-modal facilities	• Mobility constraints (e.g. railroad crossings, geometric constraints, intersection operations, over-legal limitations)
Environment*	Reduce environmental impacts	• Congestion/delay- from speed & travel time • Stormwater management

* Buffer Index and Environment performance measures used for prioritizing projects as described in Chapter 6.

The development and application of performance measures enables the FAP to gauge system condition and use, evaluate transportation programs and projects, and help decision makers allocate limited resources more effectively than would otherwise be possible. There are also several additional reasons to apply performance measures, including:

- **Linking Actions to Goals.** Performance measures can be developed and applied to help link plans and actions to goals and objectives.
- **Prioritizing Projects.** Performance measures can provide information needed to invest in projects and programs that provide the greatest benefits.
- **Managing Performance.** Applying performance measures can improve the management and delivery of programs, projects, and services. The right performance measures can highlight the technical, administrative, and financial issues critical to governing the fundamentals of any program or project.
- **Communicating Results.** Performance measures can help communicate the value of public investments in transportation. They can provide a concrete way for stakeholders to see SDOT and the Port's commitments to improving the transportation system and help build support for transportation investments.
- **Strengthening Accountability.** Performance measures can promote accountability with respect to the use of taxpayer resources. They reveal whether transportation investments are providing the expected performance or demonstrated need for the improvement.

The performance measures are evaluated through a number of components that are individually scored as described in the next section.

5.4 Scoring Methodology for Needs

The evaluation methodology included an assessment of a series of performance data sets that were assigned a maximum point value so that the most points a roadway segment could achieve was 100 points. The scoring components of safety, mobility, and connectivity were selected because they are linked to overall FAP goals. Each component was based on measurable data or analysis conducted during the project process. Table 5.2 shows the breakdown point values assigned for each category.

Table 5.2 Performance measure scoring[20]

	Component	Points	Max Points
Safety	**Truck-Bike Collision**	15	40
	Truck-Pedestrian Collision	15	
	Other truck-involved collisions Fatality Injury Only PDO Only	15 10 5	
Mobility	**Travel Speed**	1 to 25	35
	Daily Truck Volumes	1 to 5	
	Truck Percentage	1 to 5	
Connectivity	**Railroad Crossings** Mainline Tail Track Spur	15 10 5	25
	Geometric Constraints	10	
	Intersection Operations	10	
	Infrastructure Limitations *(weight & height rest.)*	5	
		Total Possible Points	**100**

Because these performance measures align with National, State, and regional objectives for freight, these criteria also align with criteria from transportation grant funding programs. The following sections describe the components of the evaluation methodology in more detail.

5.4.1 Safety (40 points)

The safety score is based on collision records from the five most recent years of complete data. The collisions involving trucks with other vehicles, pedestrians, and bicyclists were the focus for the safety evaluation. Collisions were organized based on collision severity (fatality, injury, or property damage only).

Any roadway segment where a truck collision resulted in a fatality was assigned 15 points. Roadway segments that had truck collisions resulting in injury were assigned 10 points per injury collision. Property damage only (PDO) truck related collisions were assigned 5 points per PDO collision. Thus a roadway segment with a fatality, two injuries, and a PDO collision recorded in the last five years would be assigned 40 points. Appendix D shows the results of the safety evaluation.

Segments with the highest safety score include locations with the most severe collisions. A roadway segment on Fourth Avenue just south of the bridge over the Argo Intermodal Yard received the maximum safety score of 15 points. Other locations in the Greater Duwamish MIC that received high safety scores include E Marginal Way S, 1st Avenue S, Spokane Street, and Diagonal Avenue S. Short segments in the BINMIC on Leary Way and 15th Avenue also received high safety point totals.

20 A segment could score higher than the max, but only receive max points.

5.4.2 Mobility (35 points)

The mobility score was based on three elements:

- Morning and evening congestion levels,
- Percentage of trucks in the daily traffic stream, and
- Total truck volumes on the roadways.

Mobility data was not available for all roadway segments, including some of the last mile connectors that access the intermodal yards in the Greater Duwamish MIC. The average travel speed as a percentage of posted speed represents the congestion level for a roadway. Congestion levels for the weekday AM peak (7–9am) and the PM peak (4–6pm) were used in the mobility score. Congestion levels for existing and forecast conditions were presented in Chapters 3 and 4, respectively. Congestion levels were used to assign a value of 2 to 25 points based on the criteria shown in Table 5.3.

Table 5.3 Congestion level scoring breakdown

Description	Points
Severely Congested Flow (less than 60% of posted speed) during AM and PM in both directions.	25
Severely Congested Flow (less than 60% of posted speed) during AM and PM in one direction.	20
Congested Flow (60 – 70% of posted speed) during AM and PM in both directions.	15
Congested Flow (60 – 70% of posted speed) during AM and PM in one direction.	10
Congested Flow (60 – 70% of posted speed) during AM or PM in both directions.	5
Delayed Flow (70 – 85% of posted speed) during AM or PM in one direction.	2

The second mobility scoring metric is daily truck volume. A score from 1 to 5 points was assigned based on the criteria shown in Table 5.4.

Table 5.4 Daily truck volume scoring breakdown

Description	Points
More than 2,000 daily trucks	5
1,000 to 2,000 daily trucks	3
Less than 1,000 daily trucks	1

The last mobility scoring metric was daily truck percentage. This was calculated by dividing the average daily truck volume by the average daily total volume. Based on the daily truck percentage the following scores were assigned (with a maximum of 5 points) as shown in Table 5.5.

Table 5.5 Daily truck percentage scoring breakdown

Description	Points
More than 8% of trucks in the daily traffic stream	5
4 to 8% of trucks in the daily traffic stream	3
Less than 4% of trucks in the daily traffic stream	1

The total mobility score is based on a maximum of 35 points. The roadway segment with the highest mobility point total is the Atlantic Street/ Edgar Martinez Drive (SR 519) due to peak period congestion and high truck volumes accessing regional routes. Other east-west corridors with high mobility scores include S Holgate Street and roadways accessing state highways (SR 99 and I-5) such as Mercer Street, Denny Way, and S Spokane Street. North-south roadways that experience recurring congestion and thus high mobility scores include Fremont Avenue N, E Marginal Way S, and 1st Avenue S. Appendix D shows maps depicting the results of the mobility evaluation.

5.4.3 Connectivity (25 points)

Connectivity is based on four categories of physical constraints: railroad crossings, geometric constraints, poor intersection operations, and other infrastructure limitations, such as size and weight restrictions.

- Railroad crossings were divided into three categories with point values for each category. Roadways with mainline at-grade crossings were assigned 15 points, while roadways with tail-track crossings were assigned 10 points. Roadways crossing spur lines were assigned 2 points.
- Geometric constraints were taken from an inventory of intersections on freight routes that have known geometric constraints for truck access (such as turning radii issues). All roadway segments approaching an intersection with a geometric constraint were assigned 10 points.
- Intersection operational issues were based on findings from the Seattle Arena EIS where intersections with poor levels of service, under both existing and future conditions, were documented. All roadway segments approaching the intersection with poor signal operations were assigned 10 points.
- Other infrastructure limitations consist of locations with weight or height restrictions and limitations. Bridge openings were also included in the scoring here. All roadways with other infrastructure limitations were assigned 5 points.

Most locations include one or two of the physical constraints for the connectivity evaluation have little overlap with multiple constraints. The maximum connectivity score assigned was 25 points. Mainline rail crossings were some of the highest scoring locations in the Greater Duwamish MIC. In the BINMIC the over-legal limitations on 15th Avenue W are some of the highest scoring locations, including bridges at W Emerson Street and W Dravus Street. Appendix D shows the results of the connectivity evaluation.

5.4.4 Composite Score (Maximum 100 points)

Each category was assigned a maximum point value combining each of the criteria above (safety, mobility and connectivity) which could amount to a total of 100 possible points for each roadway segment. Combining the Safety, Mobility and Connectivity scores reveals locations with high need scores for locations in the MICs. Figures 5.1 to 5.3 show the existing conditions composite score results, and Figures 5.4 to 5.6 show the forecast conditions. Table 5.6 summarizes the high scoring locations (shown in red on the maps) for both existing and future conditions.

Table 5.6 Existing and Future Freight Needs and Deficiencies

Corridor Segment or Intersection Location	Existing Need	Future Need
15th Avenue / Emerson Street	✓	✓
Westlake Avenue *Mercer Street to Fremont Bridge*		✓
Mercer Street *SR 99 to I-5*		✓
Denny Way *Western Avenue to I-5*		✓
Alaskan Way / Broad Street	✓	✓
Alaskan Way *Yesler Way to Atlantic Street (SR 519)*		✓
E Marginal Way S		
Atlantic Street (SR 519) to S Spokane Street	✓	✓
S Spokane Street to 1st Avenue Bridge	✓	✓
1st Avenue S		
Yesler Way to Atlantic Street (SR 519)		✓
Atlantic Street (SR 519) to S Spokane Street	✓	✓
4th Avenue S		
Yesler Way to Atlantic Street (SR 519)		✓
Atlantic Street (SR 519) to S Spokane Street		✓
S Spokane Street to S Michigan Street		✓
Atlantic Street (SR 519) *Alaskan Way to I-90*	✓	✓
Holgate Street		
1st Avenue S to 4th Avenue S	✓	✓
4th Avenue S to Airport Way S		✓
S Lander Street *1st Avenue to 4th Avenue S*	✓	✓
S Spokane Street		
Chelan Street to E Marginal Way	✓	✓
E Marginal Way to Airport Way S	✓	✓
S Spokane Street Viaduct		
Chelan Street to E Marginal Way		✓
E Marginal Way to Airport Way S	✓	✓
S Michigan Street *1st Avenue S to Corson Avenue*		✓
16th Avenue S *E Marginal Way to S Park Bridge*		✓

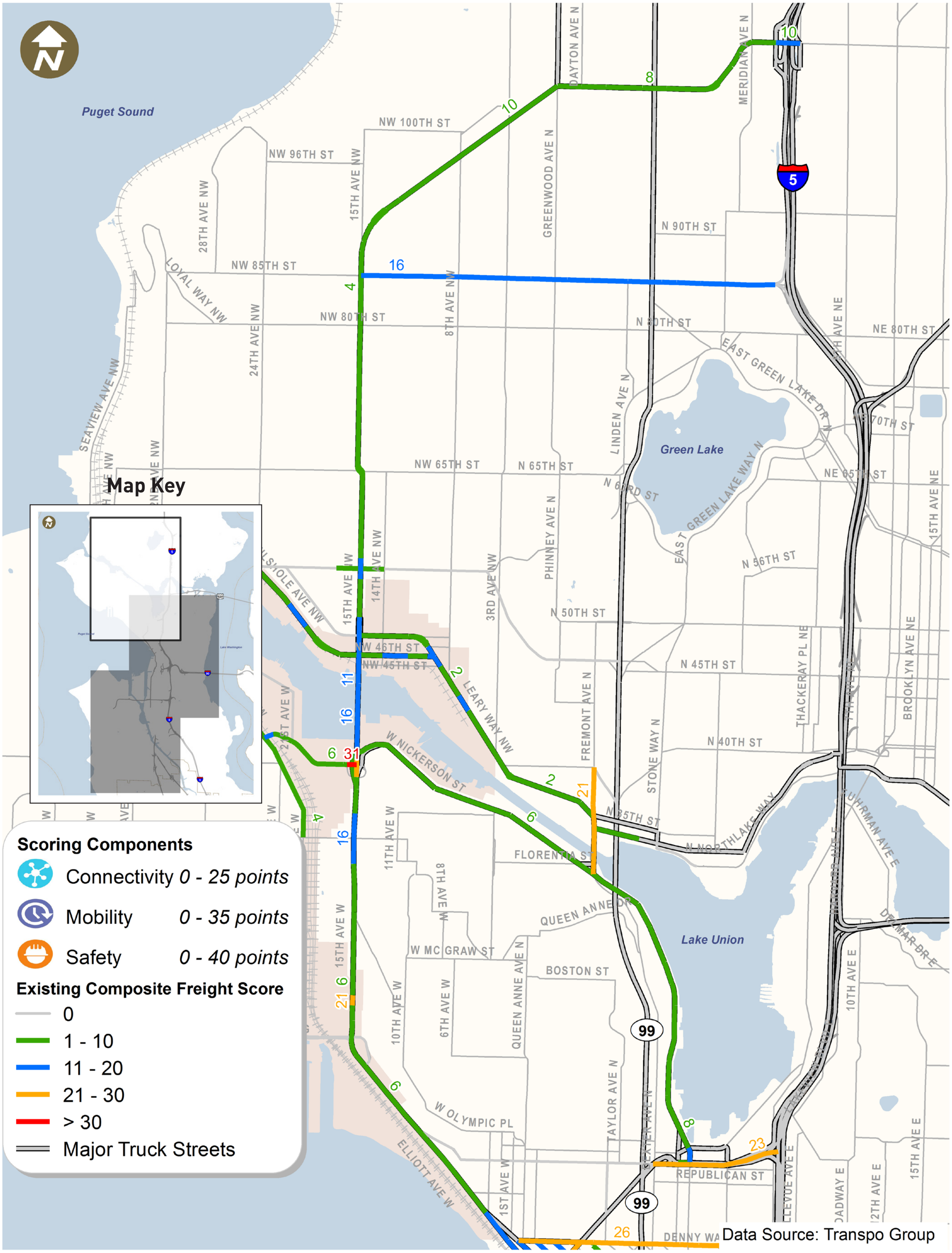


Figure 5.1 Existing Freight Needs and Deficiencies – North

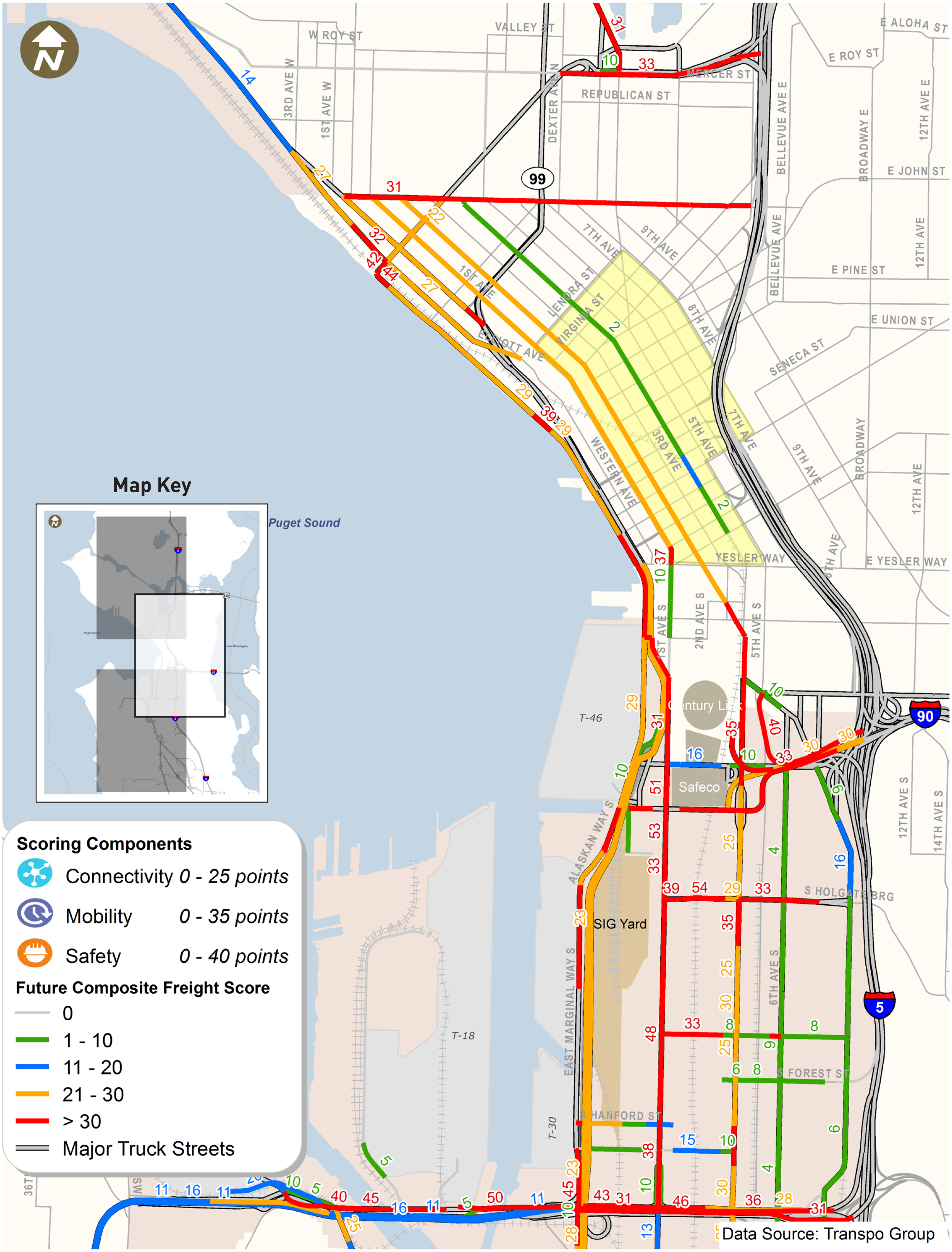


Figure 5.2 Existing Freight Needs and Deficiencies – Central

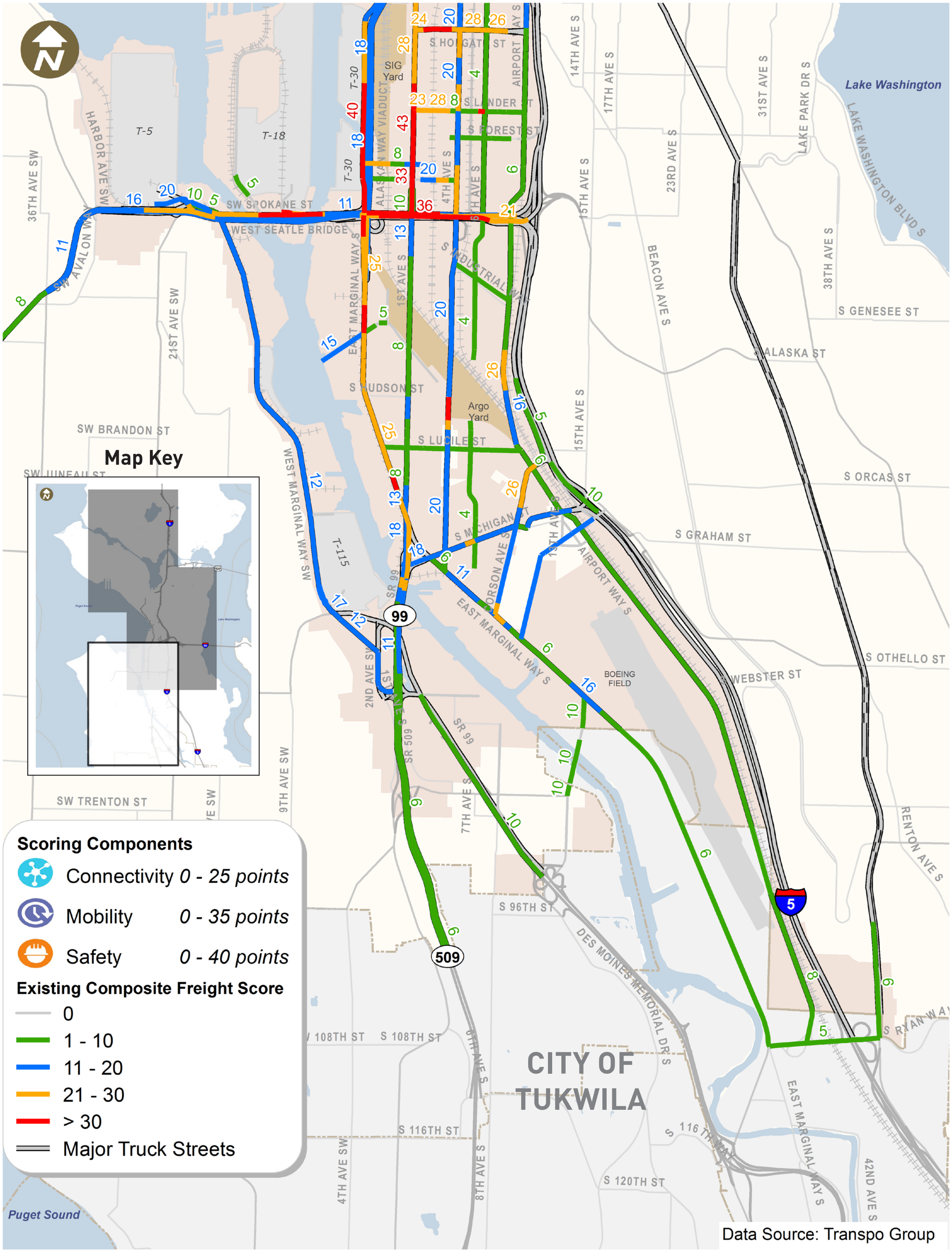


Figure 5.3 Existing Freight Needs and Deficiencies – South

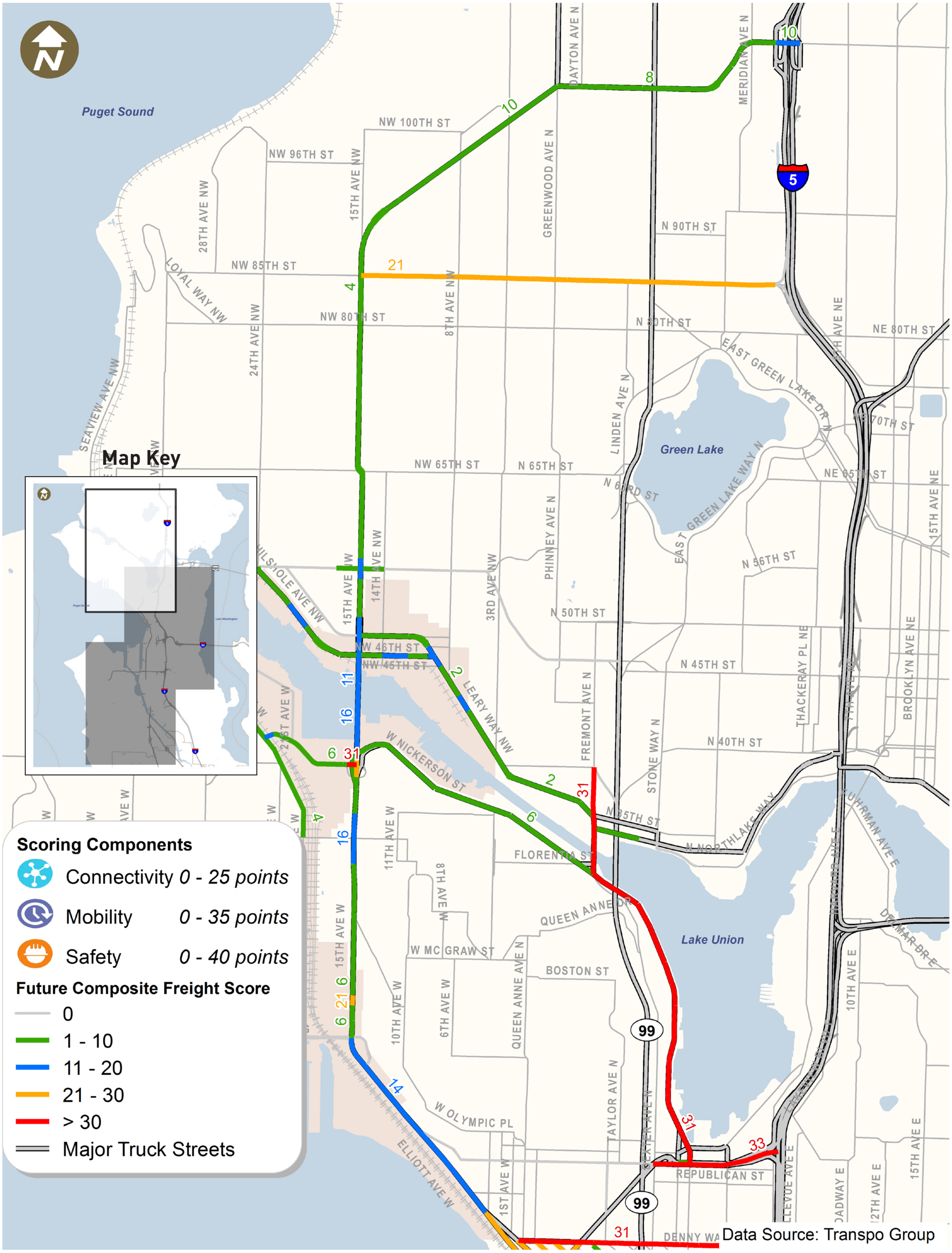


Figure 5.4 Forecast Freight Needs and Deficiencies – North

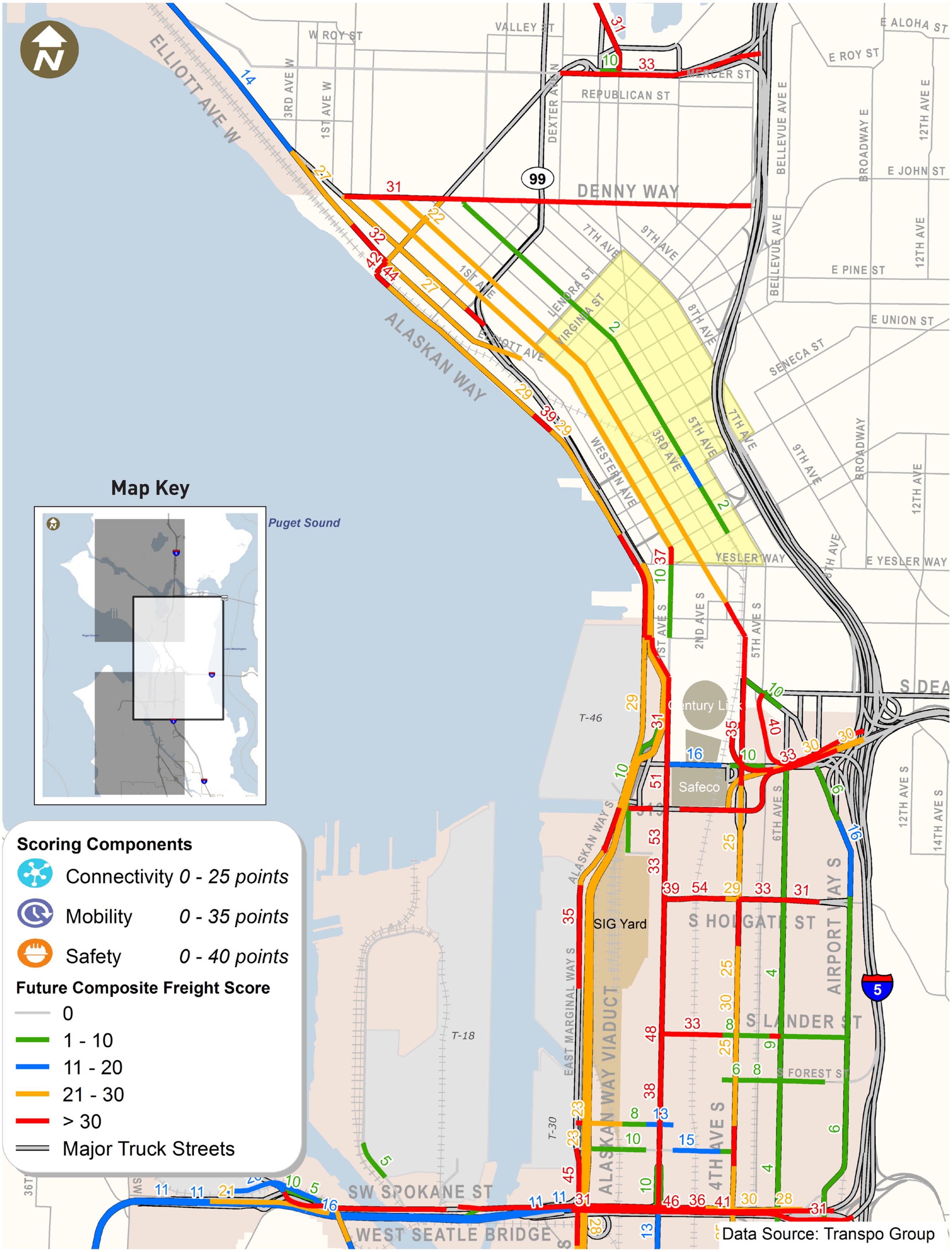


Figure 5.5 Forecast Freight Needs and Deficiencies – Central

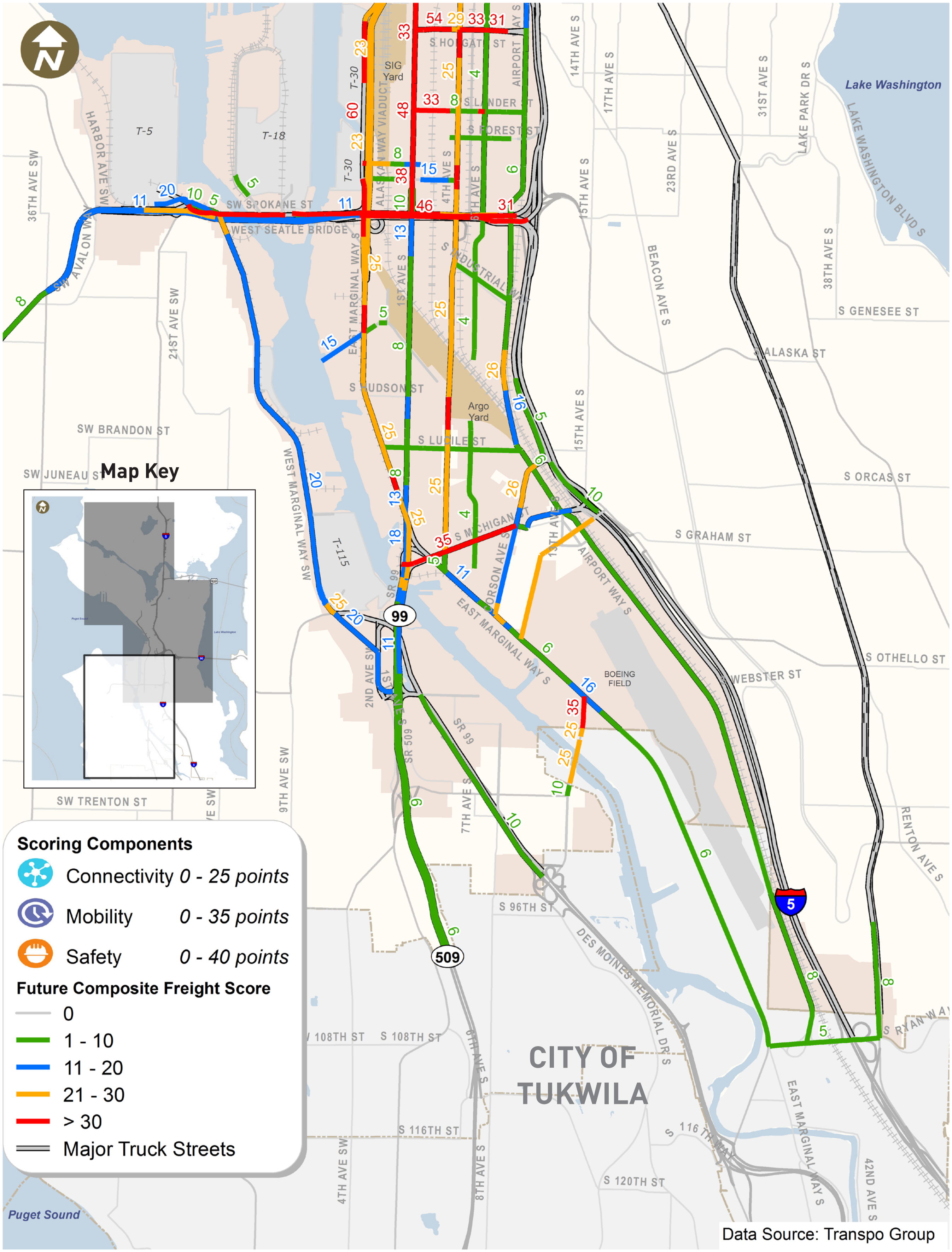


Figure 5.6 Forecast Freight Needs and Deficiencies – South

5.5 Freight Toolbox

With a list and maps of deficient locations, the project team developed a set of solutions to address these needs. This freight toolbox consists of a "menu" of improvement options that represent the types of projects that could enhance freight safety, mobility and connectivity. The toolbox includes various improvement strategies from wayfinding, operations, and technology solutions to geometric improvements and everything in between. The toolbox treatments are listed in Table 5.7 and address specific freight needs identified in the evaluation. For some problem locations, application of a single tool may be sufficient to solve the issues at hand, at other locations a combination of different tools may be needed to improve freight mobility.

Table 5.7 Freight toolbox overview

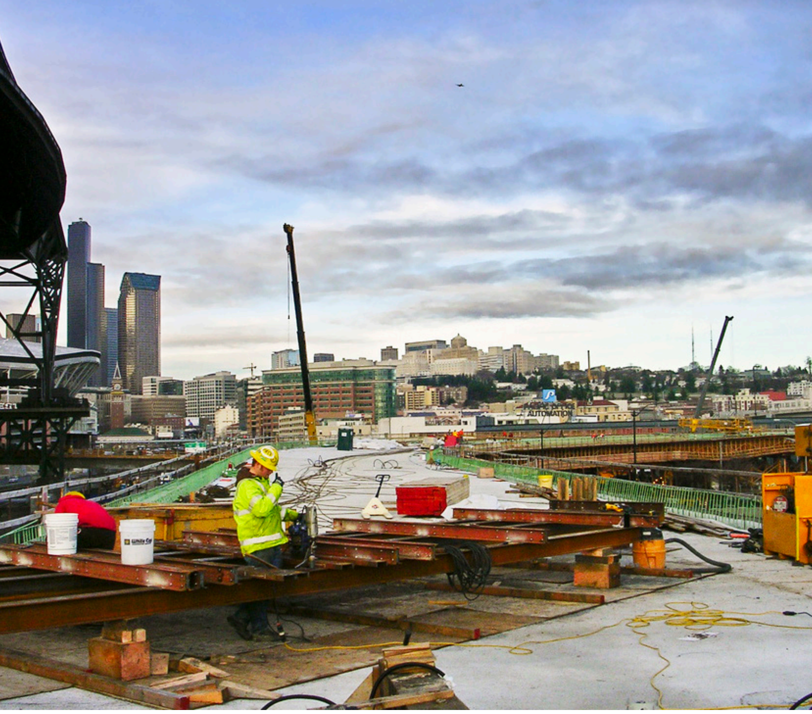
List of Tools	Deficiencies/Needs Addressed		
	Safety	Mobility	Connectivity
Maintenance and Preservation	✓	✓	
Capital Investments	✓	✓	✓
ITS	✓	✓	✓
Intersection Operations	✓	✓	✓
Wayfinding		✓	✓
Geometric Improve-ments	✓	✓	✓
Freight Operations Management	✓	✓	

The following sections provide examples and describe each of the toolbox items in detail.

CRACKED PAVEMENT WITHIN THE GREATER DUWAMISH MIC

5.5.1 Maintenance and Preservation

Maintenance and preservation projects include pavement and bridge investments. Routine maintenance and preservation can improve safety and mobility for freight routes. This report focuses maintenance and preservation recommendations on routes with heaviest truck traffic, using information from the City's pavement management database, which currently only includes arterial roadways. The projects recommended in Chapter 6 were selected through a systematic approach to prioritize projects based on objective analysis and long-term need. These projects help preserve infrastructure investments and improve conditions for all roadways users.



CONSTRUCTION WORKERS ON THE SR 519 PROJECT

DYNAMIC MESSAGE SIGN

5.5.2 Capital investments

Capital investments can address a range of mobility and connectivity needs and typically have a cost of $500,000 or more:

- new roadway connections
- direct freeway access ramps
- truck-only lanes
- grade-separation
- bridge replacement and renovation

The projects recommended in Chapter 6 are aimed at implementing large-scale truck mobility and access improvements that support investments in major truck and over-dimensional routes. Capital projects have significant costs, but can also consist of a package of smaller-scale projects which could be implemented in phases.

5.5.3 ITS Applications

ITS applications can address mobility needs by advising drivers of alternative routes during congested travel times. ITS improvements include traffic information systems, smartphone apps, dynamic message signs, port terminal advisories, and navigational applications. ITS also provides for communications with a central Traffic Management Center (TMC) and allows for that TMC to provide real time intervention to adapt to traffic conditions. This will provide improved traveler information on bottlenecks and current travel time to truck drivers and dispatchers. These are improvements to mobility and operations that can be used as decision making tools for both system users and managers. Implementation of ITS applications may require private and public collaboration to ensure tools are fully realized.


TRUCKS QUEUED ON S ATLANTIC STREET (SR 519)

EXAMPLES OF WAYFINDING SIGN IN BINMIC

5.5.4 Intersection Operations

Intersection operations include a range of signal timing improvements on truck corridors that include signal priority or adjusting signal timing to facilitate heavy truck movements. These signal improvement strategies can significantly improve truck mobility and access.

5.5.5 Wayfinding for Trucks

Wayfinding improves safety for all modes by indicating which streets are best for trucks. Wayfinding for trucks may include signs, striping, and roadway markings on city streets, Port gates, and state highways to:

- improve route decisions,
- reduce illegal movements, and
- alert truck drivers when there are disruptions.

These are quick, low cost strategies to help truck drivers identify truck routes, and avoid routes with height and weight restrictions. Signs and maps, such as the South Seattle Truck Routes[21] map, must be clear, intuitive, and standardized.

21 www.seattle.gov/transportation/docs/SpokaneCorridorTruckRoute-Map050707.pdf

TRUCK NEGOTIATING A TURN IN THE BINMIC

CURBSIDE DELIVERY IN THE CBD

5.5.6 Geometric Improvements

Geometric improvements should support goods movement and allow for harmonization with other modes. Geometric improvements include lane widening, adding left turn pockets, truck only lanes, repositioning utility poles, and turning radius corrections. These projects include small-scale spot improvements for better truck mobility and access.

5.5.7 Freight Management

Freight management includes a range of treatments such as changeable lanes, truck restrictions, time-of-day variations, idling control, and loading zone control. Options could include management of traffic to prioritize freight movements during certain times of the day or in certain areas or street segments (e.g. delivery windows, off-peak delivery). These projects can reduce traffic congestion and improve parking conditions on congested urban streets with limited additional physical capacity or infrastructure.

5.6 System Considerations

Implementation of any new investments to support freight mobility and meet identified needs must also be evaluated related to potential negative impacts or trade-offs on other modes, business, the community and the environment. These trade-offs include but are not limited to:

- Environmental impacts including increases in noise or worsening of air quality. In particular the City is committed to reducing Green House Gas (GHG) emissions. Some investments may reduce GHG by improving traffic flow and reducing idling.
- Impacts to low income, and limited English proficient (LEP) communities. Similar to the environmental justice provisions under the Environmental Protection Act[22] the City has adopted a Race and Social Justice Initiative to end institutionalized racism and race based in-equalities in Seattle. Improving the performance of the truck network supports the industrial sector and its provision of family-wage jobs. This outcome helps achieve wage equity and income equality.
- Modal integration and system resiliency investments in transportation infrastructure provides system-wide safety and mobility improvements for all modes and helps ensure overall system resiliency especially in response to catastrophic events.

All of the performance measures and other factors described throughout this chapter will be applied to establish a prioritized list of infrastructure and programmatic freight investments.

22 www.epa.gov/environmentaljustice/