Congestion Management Process

2015 Monitoring Report

RTC

Southwest Washington Regional Transportation Council

Congestion Management Process
2015 Monitoring Report

Clark County
Skamania County
Klickitat County
City of Vancouver
City of Camas
City of Washougal
City of Battle Ground
City of Ridgefield
City of La Center
Town of Yacolt
City of Stevenson
City of North Bonneville
City of White Salmon
City of Bingen
City of Goldendale
C-TRAN
Washington DOT
Port of Vancouver
Port of Camas-Washougal
Port of Ridgefield
Port of Skamania County
Port of Klickitat
Metro
Oregon DOT
14th Legislative District
17th Legislative District
18th Legislative District
20th Legislative District
49th Legislative District

Clark County, Washington

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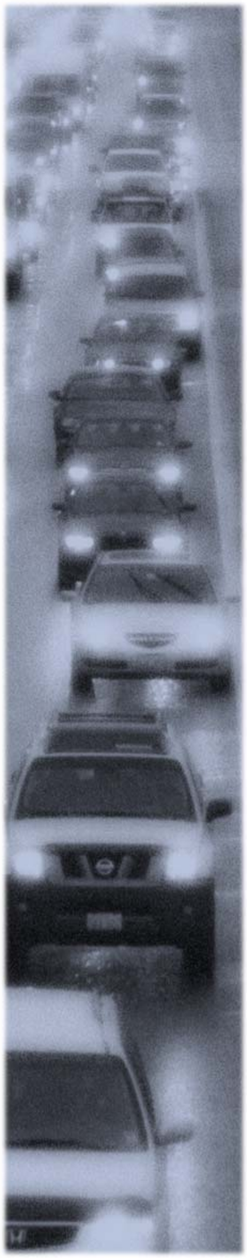
Chapter 1: Introduction



Traffic congestion can be defined as a condition where the volume of users on a transportation facility exceeds or approaches the capacity of that facility. Congestion can be characterized by heavy volumes, increased travel time, delay, travel time uncertainty, reduced travel speed, increase of traffic crashes, or other characteristics. It is important to note that high traffic volumes that may result in congestion can also be a sign of growth and economic vitality. While it may be impossible to totally remove all congestion, congestion needs to be managed in order to provide a reliable transportation system for users.

The ability to increase highway capacity as a means to relieve congestion is limited by constrained financial resources as well as by physical and natural environmental factors. Therefore, the prime consideration should be improvement to the operation and management of the existing and future transportation system.

The *Congestion Management Process: Monitoring Report* offers information to Southwest Washington Regional Transportation Council[1] (RTC) for implementing a Congestion Management Process (CMP). The CMP is a way to:

- Monitor, measure and diagnose the causes of congestion on the regional transportation system;
- Evaluate and recommend strategies to manage regional congestion; and
- Evaluate the performance of strategies put in practice to manage or improve congestion.

Background

The CMP is required to be developed and implemented as an integral part of the regional planning process in Transportation Management Areas, regions with more than 200,000 people.

Federal regulation 23 CFR 450.320(c)[2] identifies the required components for a CMP:

[1] *http://www.rtc.wa.gov/*
[2] *http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&rgn=div5&view=text&node=23:1.0.1.5.11&idno=23*

High traffic volumes that may result in congestion can also be a sign of growth and economic vitality.

1. Methods to monitor and evaluate the performance of the multimodal transportation system, identify the causes of recurring and non-recurring congestion, identify and evaluate alternative strategies, provide information supporting the implementation of actions, and evaluate the effectiveness of implemented actions.

2. Definition of congestion management objectives and appropriate performance measures to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods. Since levels of acceptable system performance may vary among local communities, performance measures should be tailored to the specific needs of the area and established cooperatively by the State(s), affect MPO(s), and local officials in consultation with the operators of major modes of transportation in the coverage area.

3. Establishment of a coordinated program for data collection and system performance monitoring to define the extent and duration of congestion, to contribute in determining the causes of congestion, and evaluate the efficiency and effectiveness of implemented actions. To the extent possible, this data collection program should be coordinated with existing data sources (including archived operational/ITS data) and coordinated with operations managers in the metropolitan area.

4. Identification and evaluation of the anticipated performance and expected benefits of appropriate congestion management strategies that will contribute to the more effective use and improved safety of existing and future transportation systems based on the established performance measures. The following categories of strategies, or combination of strategies, are some examples of what should be appropriately considered for each area:

    a. Demand management measures, including growth management and congestion pricing

    b. Traffic operational improvements

    c. Public transportation improvements

    d. ITS technologies as related to the regional ITS architecture, and

    e. Where necessary, additional system capacity

5. Identification of an implementation schedule, implementation responsibilities, and possible funding sources for each strategy (or combination of strategies) proposed for implementation.

6. Implementation of a process for periodic assessment of the effectiveness of implemented strategies, in terms of the area’s established performance measures. The results of this evaluation shall be provided to decision makers and the public to provide guidance on selection of effective strategies for future implementation.

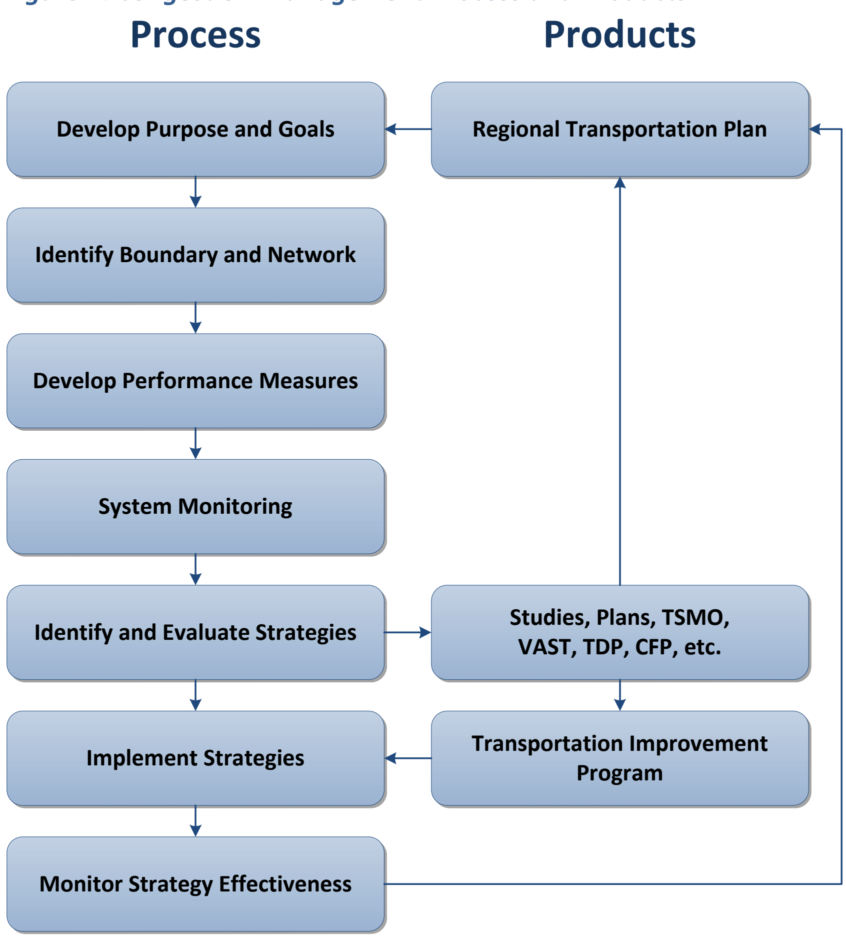
Overall Process

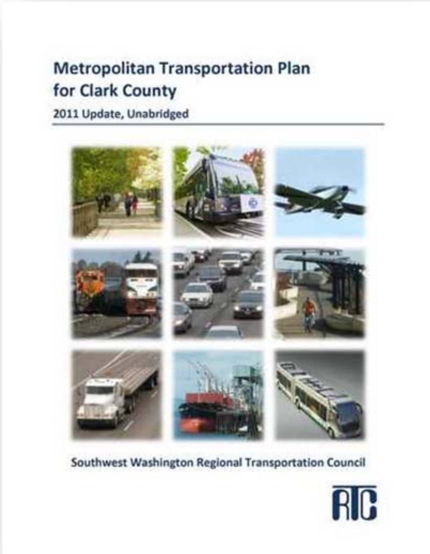
The overall Congestion Management Process used by Southwest Washington Regional Transportation Council incorporates the following steps:

- Develop purpose, goals and objectives
- Identify boundary and network
- Develop performance measures
- Monitor system performance
- Identify and evaluate strategies
- Implement strategies
- Monitor strategy effectiveness

The integration of the Congestion Management Process into the overall MPO planning process is displayed in the following figure.

Figure 1: Congestion Management Process and Products

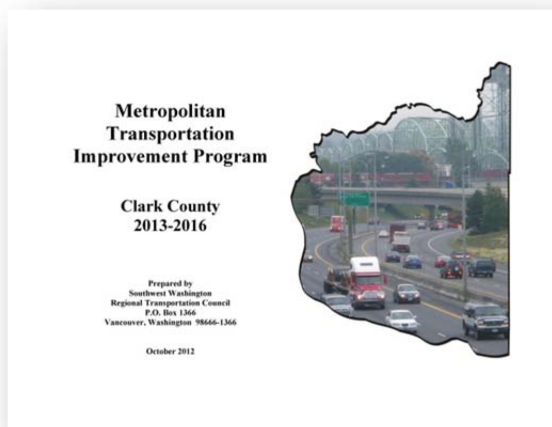




The process begins with the development of purpose, goals, and objectives that will be used to guide the overall Congestion Management Process. These purpose, goals, and objectives support those contained in the Regional Transportation Plan[3]. The boundary and network are identified to focus efforts on the regionally significant corridors. Performance measures are developed to help ensure that the program is achieving the desired goals. System Monitoring is performed to measure system performance. System monitoring is then used to identify system deficiencies. Identified system deficiencies are utilized to identify potential strategies.

Strategies are further analyzed through regional and local studies, plans, and programs. Strategies are then incorporated into the Regional Transportation Plan. Project and strategies identified through the Congestion Management Process and contained in the Regional Transportation Plan are then programmed and implemented through the Transportation Improvement Program[4] based on selection criteria and funding allowances. The overall Transportation Improvement Program selection criteria prioritize projects and programs identified through the Congestion Management Process. As part of the annual Congestion Management Process, the congestion trends and effectiveness of implemented projects are analyzed based on performance measures.

Purpose, Goals and Objectives



The purpose of the CMP is to establish a process that provides for effective management and operation of the transportation system in congestion management corridors to provide travel reliability.

Transportation projects and strategies identified in the CMP should meet the goals for the region’s long-range transportation planning process as listed in the Regional Transportation Plan (RTP) for Clark County. These RTP goals include:

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[3] *http://www.rtc.wa.gov/programs/rtp/clark*
[4] *http://www.rtc.wa.gov/programs/tip/*

Economy

Support economic development and community vitality.

Safety and Security

Ensure safety and security of the Transportation System.

Accessibility and Mobility

Provide reliable mobility for personal travel and freight movement as well as access to locations throughout the region and integrity of neighborhoods accomplished through development of an efficient balanced, multi-modal regional transportation system.

Management and Operations

Maximize efficient management and operation of the transportation system through transportation demand management and transportation system management strategies.

Environmental

Protect environmental quality and natural resources and promote energy efficiency.

Vision and Values

Ensure the RTP reflects community values to help build and sustain a healthy, livable, and prosperous community.

Finance

Provide a financially-viable and sustainable transportation system.

Preservation

Maintain and preserve the regional transportation system to ensure system investments are protected.

The following objectives were used to guide the development of RTC's Congestion Management Process:

- Focus upon congestion,
- Emphasize regional travel perspective,
- Support the local and regional transportation decision-making process,
- Increase public awareness of congestion issues and tradeoffs.

Congestion Management Boundary and Network

Development type, density, and location influence regional travel patterns and transportation access influences land use and development.

Congestion Management Network

The boundary of the Vancouver/Clark County Congestion Management System includes the major inter-regional corridors and major arterial corridors connecting cities to the base congestion management network, (I-5, SR-14, SR-501, SR-502, SR-503, and La Center Road). Congestion management corridors connect Battle Ground, Ridgefield, and La Center to Vancouver and the CMP's base network.

The first step in defining the congestion management network was to identify a set of candidate facilities and corridors. Only regionally-significant corridors were considered as candidates for the network. Regionally significant corridors were defined as facilities that are part of the Regional Transportation System as identified in the Regional Transportation Plan (RTP).

The initial congestion management network was refined from the list of candidate corridors. Using federal guidelines to include facilities with "existing or potential recurring congestion," professional judgment was used to identify corridors with existing congestion and those likely to become congested.

The scope of the congestion management network includes 31 regionally-significant transportation corridors within the Clark County, Washington region as listed in Table 2 (Page 12) and illustrated on Map 1 (Page 13).

Corridor Concept

An important step in defining the congestion management network is to define the basic unit for describing the network and performing analyses. For the Vancouver/Clark County congestion management network, transportation corridors were selected as the congestion management unit.

Individual corridors, where appropriate, are made up of more than one facility.

The congestion management corridors can be made up of more than one transportation facility. A single corridor can include multiple roadways where there are parallel facilities that serve the same travel shed. Data is reported for individual roadways even if they are grouped into one congestion management corridor. The endpoints for each corridor represent locations where the characteristics of the corridor change significantly.

Each roadway within a corridor is further divided into a series of segments. A segment is the portion of roadway between major intersections or interchanges. To allow for consistent operational analysis, corridor segments were developed such that the capacity and number of lanes remain the same within each segment.

Land Use

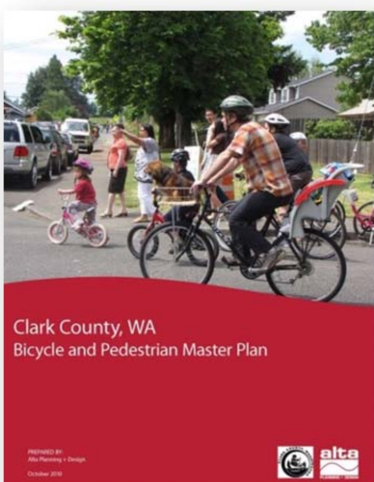
Land use and transportation are interrelated, in that land use and travel interact with each other. The type of development, the density, and its location in the urban landscape influence travel patterns. On the other hand the level of access to and from the transportation facility to the adjacent land use can affect the development patterns.

In order to better understand RTC's regional Congestion Management Network, it is important to have some understanding of the land use surrounding the congestion management corridors. Map 2 (Page 14) illustrates the Congestion Management Corridors and a generalized map of the comprehensive land use within the region.

For the purpose of travel demand modeling, future forecasts of population and employment resulting from the comprehensive land use plan have been developed. Table 1 illustrates the 2010 population and employment for Clark County along with the 2035 forecast that has been adopted for use in the long-range Regional Transportation Plan.

Table 1: Population and Employment

	2010	2035
Population	425,363	562,207
Employment	133,000	232,500



Multimodal

In addition to the road network it is important not to overlook modes such as walking, bicycling, and transit and to the degree that they can be improved to help mitigate congestion.

The Clark County Bicycle and Pedestrian Master Plan[5] provides a 20-year vision and implementation strategy for active modes. The C-TRAN website[6] provides information on the existing and 20-year future plan[7] for the regional transit system.

The CMP supports bicycle, pedestrian, and transit systems along the CMP network.

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[5] *http://www.clark.wa.gov/planning/bikeandped/docs.html*
[6] *http://www.c-tran.com/*
[7] *http://www.c-tran.com/about-c-tran/reports/c-tran-2030*

The regional travel model estimates approximately 47% of households and 68% of employment are within ¼ mile of PM peak period fixed route transit service.

Transit Service

The region's Public Transportation Benefit Authority (C-TRAN) provides transit services within Clark County and to Portland, Oregon. C-TRAN also provides connections with neighboring transit service providers in Portland, Oregon, Skamania County, and Cowlitz County. Map 3 (Page 15) illustrates fixed bus routes within Clark County and their frequency of service. In addition to fixed route service, C-TRAN provides connector service to their fixed route system from the cities of Camas, La Center, and Ridgefield. The regional travel model estimates approximately 48% of the households and 72% of employment are currently within walking distance of transit. By 2035, those within walking distance to transit will decline to 41% of the households and 56% of employment.

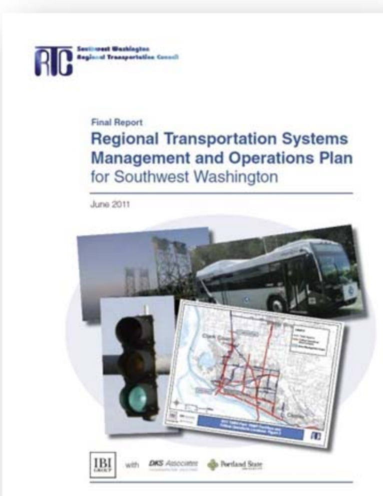
C-TRAN also provides paratransit service for those unable to ride C-TRAN's fixed bus service, through their C-VAN service.

Relationship to Regional Plans

The CMP is one of the federally required components of the regional transportation planning process. It is integrated with the Regional Transportation Plan (RTP) and the Transportation Improvement Program (TIP), and other regional plans and processes. For example, a TIP selection criterion rewards projects for consistency with the CMP.

Preservation and Maintenance

One of the region's goals is to ensure that sufficient money is available to preserve and maintain the transportation system that the region has already built. Agencies and jurisdictions have set standards for preserving and maintaining their existing transportation system. As the transportation system ages, preservation and maintenance costs are likely to take up a greater percentage of available transportation revenues.



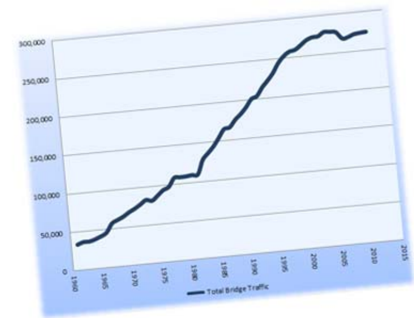
Transportation Demand Management (TDM)

Transportation Demand Management (TDM) programs focus on reducing travel demand, particularly at peak commute hours. TDM strategies can make more efficient use of the current roadway system and can reduce vehicle trips. It is important for the region to support Transportation Demand Management strategies that help the region make the best use of the existing road system.

Transportation Systems Management and Operations (TSMO)

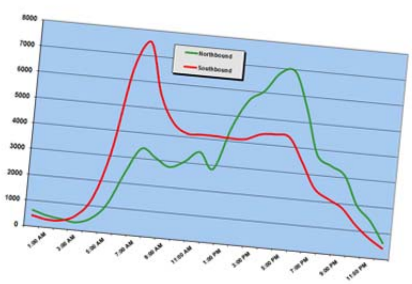
The focus of RTC's Transportation Systems Management and Operations program is on low-cost, quickly implemented transportation improvements that aim to optimize the existing transportation network. Examples include low-cost technology-based strategies and physical improvements that improve operation of the transportation system. It is important for the region to support Transportation Systems Management and Operations that enhance the existing transportation system. RTC has an adopted Regional Transportation Systems Management and Operations Plan.

Performance Measures



Performance measures are used to determine the degree of success that a project or program has had in achieving its stated goals. In other words, performance measures are a way to track progress. Performance measures are used to track the region's progress in reducing and managing congestion. For the purpose of this report, both system wide and peak period performance measures are utilized.

There are a number of performance measures that the region would like to use or expand but there are limitations due to current availability of data. The following section identifies the data elements that are collected and analyzed. Chapter II includes the measurement of these performance measures.



Data Elements

Data is collected on the following elements: traffic counts, travel time, automobile occupancy, and transit. In addition, RTC compiles and collects other measures of system performance such as highest volume intersections, Columbia River bridge volumes, and park and ride usage.

We use performance measures to track the region's progress in reducing and managing congestion.

The collected data serves as the basis for developing performance measures. Performance measures in the Congestion Management Process are categorized according to the region's overall transportation goals. It is also important to note that performance measures are collected and analyzed under the Regional Transportation Plan, Transportation Improvement Program, and other regional programs.

Performance Measures

Economy

- Truck Percentage
- Vehicle Volumes
- Columbia River Traffic Volumes

Safety and Security

- High Accident Locations

Accessibility and Mobility

- Population Compared to Transit
- Employment and Population within 1/3 mile of Transit
- Transit Seat Capacity Used

Management and Operations

- Volume to Capacity Ratio
- Average Speed
- Speed vs. Posted Speed
- Intersection Delay
- Park and Ride Capacity
- Vehicle Occupancy Rates
- On-time Transit Performance
- Busiest Intersections

Environmental

- Vanpool Usage
- Transit Ridership
- Park & Ride Usage

Vision and Values

- Comprehensive Land Use
- County Bicycle and Pedestrian Plan

Finance

- None. Covered in RTP and TIP

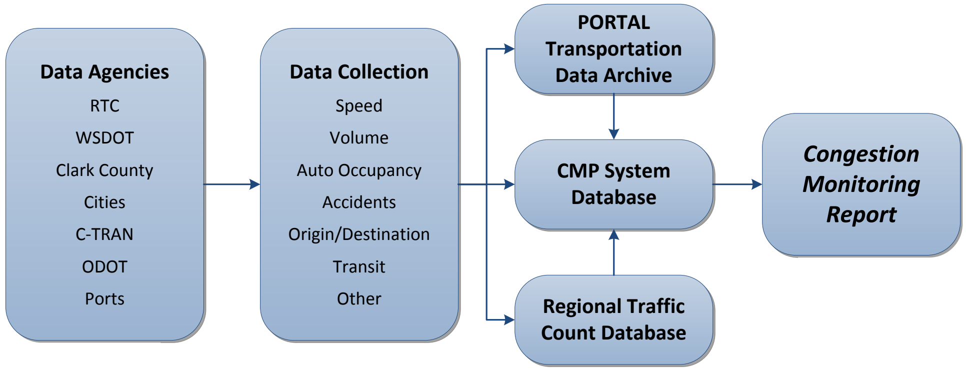
Preservation

- None. CMP Supports Preservation as a Primary Strategy

Data Collection

RTC is the lead agency for the collection of traffic congestion data. Some of the data is regularly collected by other transportation agencies within the Clark County region. RTC organizes a process for collecting all of the data. The flow for the collection of transportation data is illustrated in Figure 2.

Figure 2: Transportation Data Flow



Intelligent Transportation Systems (ITS) technology is automating the collection of data. In addition, the region has initiated a transportation data archive system called PORTAL to enhance data availability, ease its retrieval, and assist with the analysis of transportation data to support performance monitoring. RTC anticipates that many of the performance measures will begin to use the automated PORTAL data collection process.

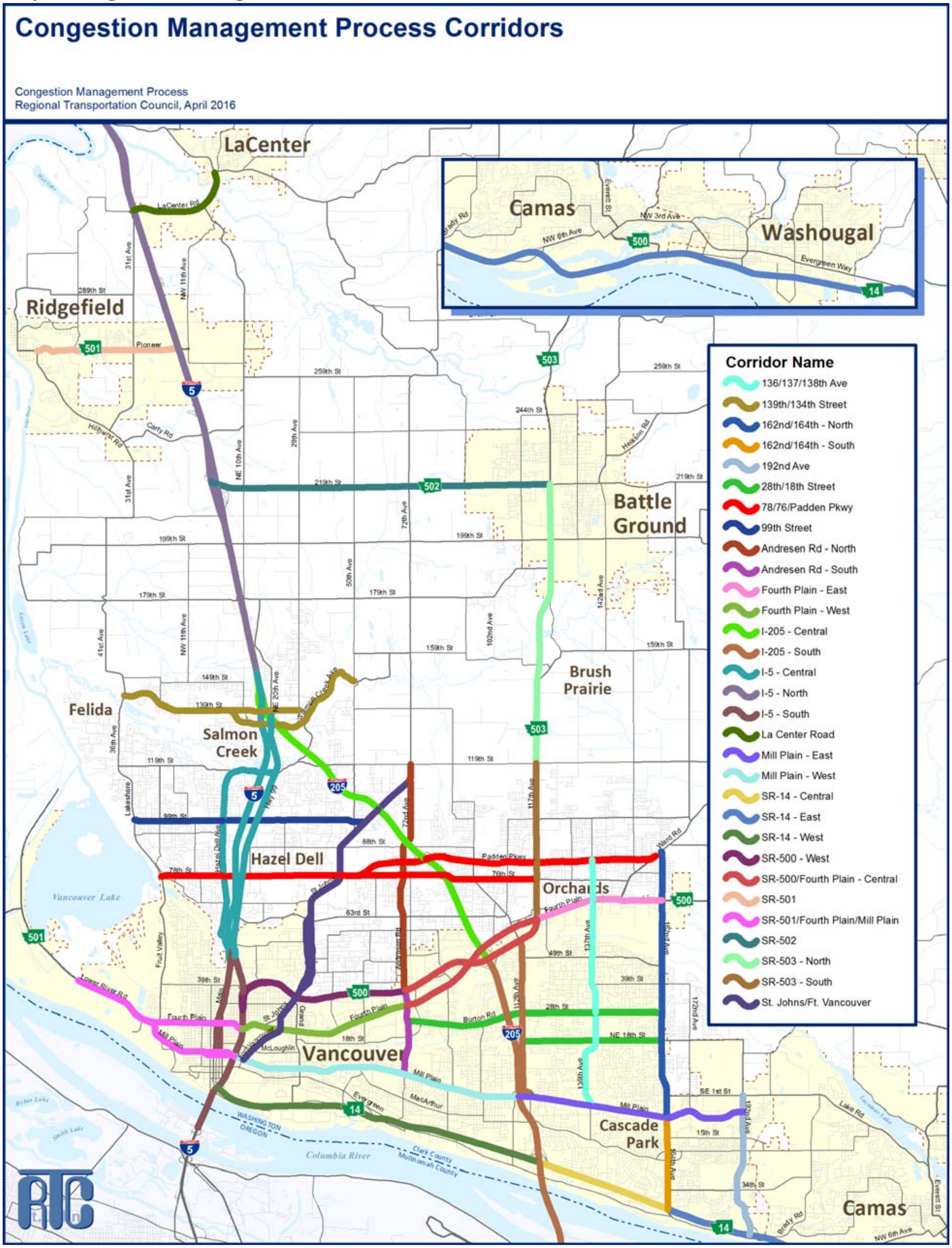
Data Analysis and System Performance

Transportation data is analyzed and validated for use in the Congestion Management Process. The collected data is then applied to develop system performance measures for the transportation corridors. System performance data is then illustrated through text, tables, and maps. The system performance data and maps are then used to identify system deficiencies and needs.

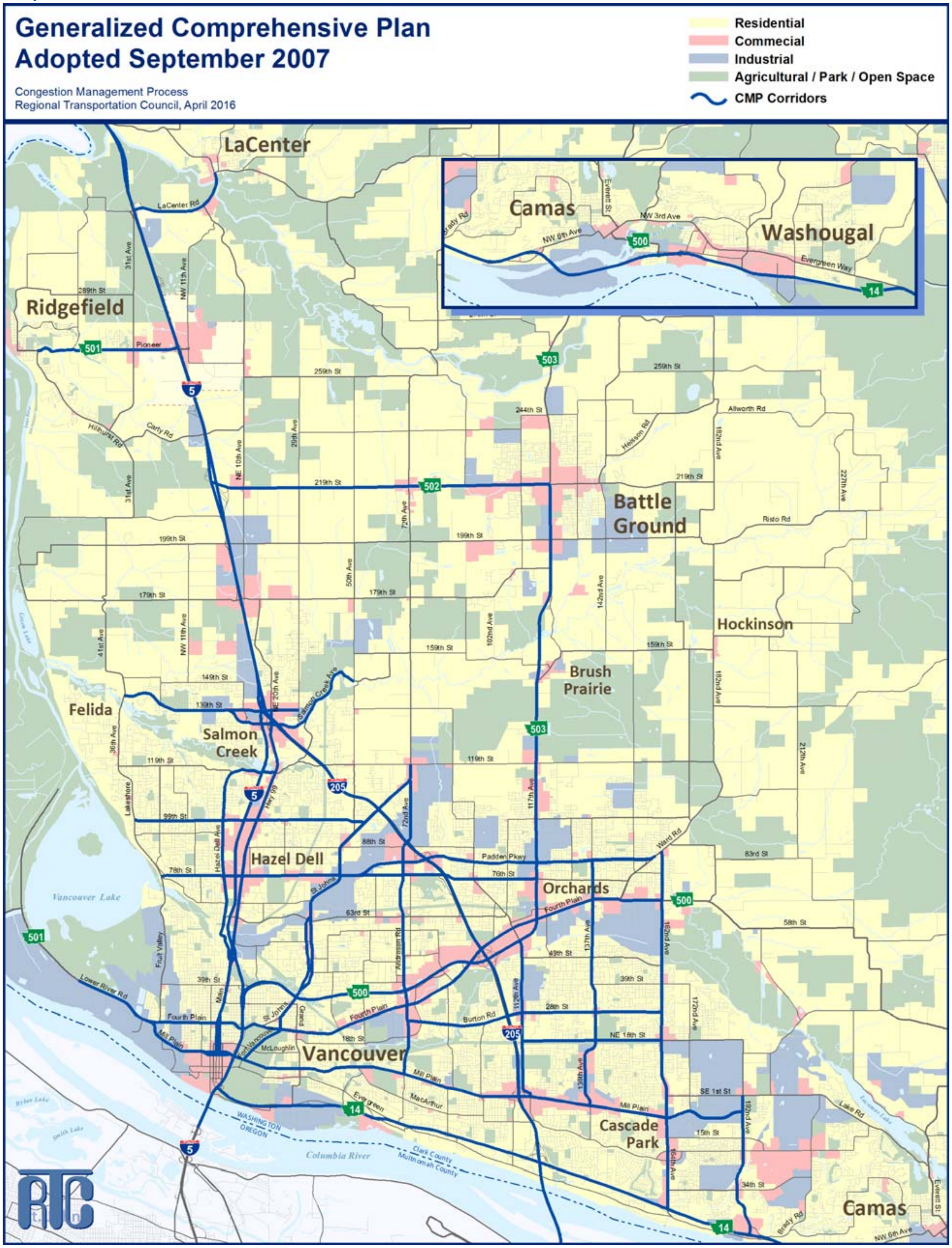
Table 2: Corridors in the Congestion Management Network

Corridor Name	Facilities	Endpoints	
I-5 North	I-5	County Line	I-205 Junction
I-5 Central	I-5, Highway 99, Hazel Dell Avenue	I-205 Junction	Main Street
I-5 South	I-5, Main Street	Main Street Interchange	Jantzen Beach
I-205 Central	I-205	I-5 Junction	SR-500
I-205 South	I-205, 112th Avenue	SR-500	Airport Way
Saint Johns	Saint Johns Road, Saint James Road, Fort Vancouver Way	NE 72nd Avenue	Mill Plain Boulevard
Andresen North	Andresen Road / NE 72nd Avenue.	119th Street	SR-500
Andresen South	Andresen Road	SR-500	Mill Plain Boulevard
SR-503 North	SR 503	SR-502	119th Street
SR 503 South	SR 503	119th Street	Fourth Plain, SR-500
137th Avenue	136th, 137th, 138th Aves.	Padden Parkway	Mill Plain Boulevard
162nd Avenue North	162nd, 164th Avenues	Ward Road	Mill Plain Boulevard
164th Avenue South	164th Avenue	Mill Plain Boulevard	SR-14
192nd Avenue	192nd Avenue	SE 1st Street	SR-14
SR-14 West	SR-14	I-5	I-205
SR-14 Central	SR-14	I-205	164th Avenue
SR-14 East	SR-14	164th Avenue	Evergreen Highway
SR-501, Fourth Plain	SR-501, Mill Plain, Fourth Plain	I-5	NW 26th Street
Mill Plain West	Mill Plain Boulevard	I-5	I-205
Mill Plain East	Mill Plain Boulevard	I-205	192nd Avenue
Fourth Plain West	Fourth Plain	I-5	Andresen Road
SR-500 West	SR-500	I-5	Andresen Road
Fourth Plain, SR-500 Central	SR-500, Fourth Plain	Andresen Road	SR 503
Fourth Plain East	Fourth Plain	SR-503	162nd Avenue
78th Street, Padden Parkway	78th Street, 76th Street, Padden Parkway	Lakeshore Avenue	Ward Road
99th Street	99th Street	Lakeshore Avenue	Saint Johns Boulevard
28th Street, 18th Street	28th Street, Burton Road, 18th Street	Andresen Road	164th Avenue
134thStreet, 139th Street	134th Street, 139th Street, Salmon Creek Avenue	NW 36th Avenue	WSU Entrance
SR-502	SR-502	I-5	SR-503
SR-501	SR-501	I-5	9th Street *(Ridgefield)*
La Center Road	La Center Road	I-5	East Fork Lewis River

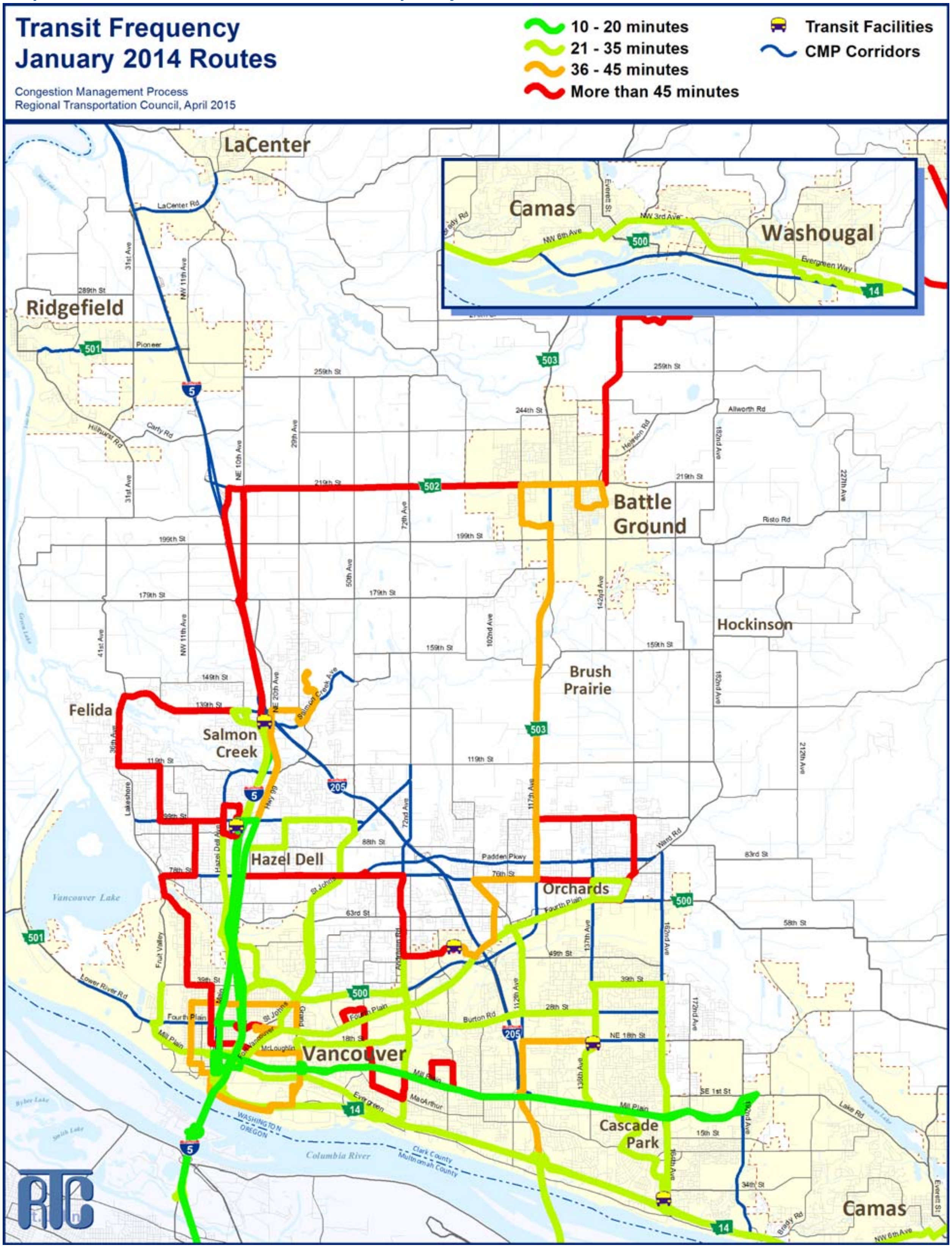
Map 1: Congestion Management Network



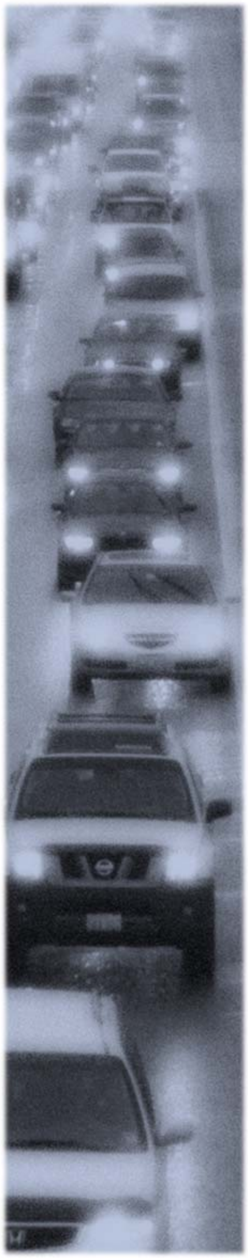
Map 2: Land Use



Map 3: Fixed Route Transit Service and Frequency



Chapter 2: System Monitoring



Chapter 2 contains a narrative and visual display of the system performance measures contained in the Congestion Management Process.

System monitoring is described in two sections. The first, **System Performance Measures**, consists of data compiled for measuring system performance at the corridor level. It is comprised of data that supports the analysis of the Congestion Management System. The second, **Areas of Concern**, uses shorter segment transportation data, with supporting data[8] provided online, to identify specific segments with congestion concerns related to volume-to-capacity ratio and speed.

There are many causes of traffic congestion including bottlenecks, traffic incidents, bad weather, construction, poor signal timing, and other events. The source of congestion can vary from one corridor to another, such that the strategies to improve capacity must be tailored to each corridor.

This report measures and quantifies average weekday morning and evening peak period "congestion" consistently across the congestion management corridors, through the use of performance measures.

System Performance Measures

Volumes: Vehicle Volumes

AM and PM peak hour vehicle volumes were compiled from the regional traffic count database[9]. Volumes represent traffic counts within each corridor and provide a good comparison of the relative difference in travel demand among the congestion management corridors.

Peak hour traffic volumes for the congestion management corridors are delineated by four volume range categories. These categories are intended to provide a regional picture of travel flows for the Clark County region.

PM peak hour trends are similar to AM peak hour; although, most congestion management corridors carry higher volumes during the PM Peak.

Map 4 (Page 29): During the PM peak, I-5 and I-205 and of SR-14 west of 164th Avenue display volumes greater than 3,000 vehicles per hour. Within the region,

[8] *http://www.rtc.wa.gov/programss/cmp/*
[9] *http://www.rtc.wa.gov/data/traffic/*

AM and PM peak hour vehicle volumes were compiled from the regional traffic count database.

facilities carrying more than 1,500 vehicles in the PM peak hour include segments of SR-14, SR-500, SR-503, Mill Plain, Fourth Plain, Padden Parkway, Andresen Road, 112th Avenue, 164th Avenue, and 192nd Avenue.

Volumes: Highest Volume Intersections

Table 3 displays the highest volume intersections in 2015 based on the total number of vehicles entering an intersection on an average weekday. At-grade intersections along SR-500, Mill Plain, SR-503, and Padden Parkway dominate the list.

Table 3: Highest Volume Intersections

Rank	East/West	North/South	Volume
1	Mill Plain	Chkalov Drive	79,000
2	Fourth Plain	SR-500	72,000
3	SR-500	54th Avenue	62,000
4	Mill Plain	136th Avenue	61,000
5	SR-500	42nd Avenue	58,000
6	Fourth Plain	Andresen Road	58,000
7	Padden Parkway	SR-503	57,000
8	78th Street	Highway 99	54,000
9	Padden Parkway	Andresen Road	53,000
10	Mill Plain	120th Avenue	51,000
11	Mill Plain	164th Avenue	51,000
12	Mill Plain	NE 117th Avenue	51,000
13	134th Street	20th Avenue / Hwy 99	51,000
14	SR-502	SR-503	50,000
15	McGillivray Blvd.	SE 164th Avenue	49,000

The Interstate Bridge reached capacity during peak hours in the early 1990s.

Volumes: Columbia River Bridge Volumes

The Interstate Bridge (I-5) carried approximately 33,500 vehicles a day in 1961. Volumes had increased to over 108,000 vehicles a day by 1980. With the opening of the Glenn Jackson Bridge (I-205) in late-1982, total Columbia River crossings had increased to 144,000 vehicles a day by 1985. Glenn Jackson Bridge traffic volumes began to exceed Interstate Bridge traffic volumes on a daily basis in 1999. Total bridge crossings have declined twice since 1961, in 1974 (oil embargo) and 2006-2008 (recession). The Glenn Jackson Bridge had its first vehicle volume decline ever in 2008. Currently total Columbia River crossing are nearing 300,000 vehicles a day. Table 4 shows the historical growth in Columbia River bridge crossings since 1980.

Both Columbia River bridges are suffering daily congestion during morning and evening peak periods. The Interstate Bridge had reached capacity during peak hours in the early-1990s, and the Glenn Jackson Bridge in the mid-2000s. With both Columbia River bridges at capacity in the peak periods, peak spreading has occurred. Peak spreading leads to a flattening and longer peak period as trips shift to times immediately before and after the peak demand. The impact of this type of congestion means that the peak hour becomes a peak period that can last three or more hours.

Table 4: Average Weekday Traffic across the Columbia River

Year	I-5	I-205	Total
1980	108,600	N/A	108,600
1985	91,400	52,600	144,000
1990	95,400	87,100	182,500
1995	116,600	106,100	222,700
2000	126,900	132,100	259,000
2005	132,600	145,900	278,500
2010	126,700	145,500	272,200
2015	135,696	158,409	294,105

Capacity: Corridor Capacity Ratio

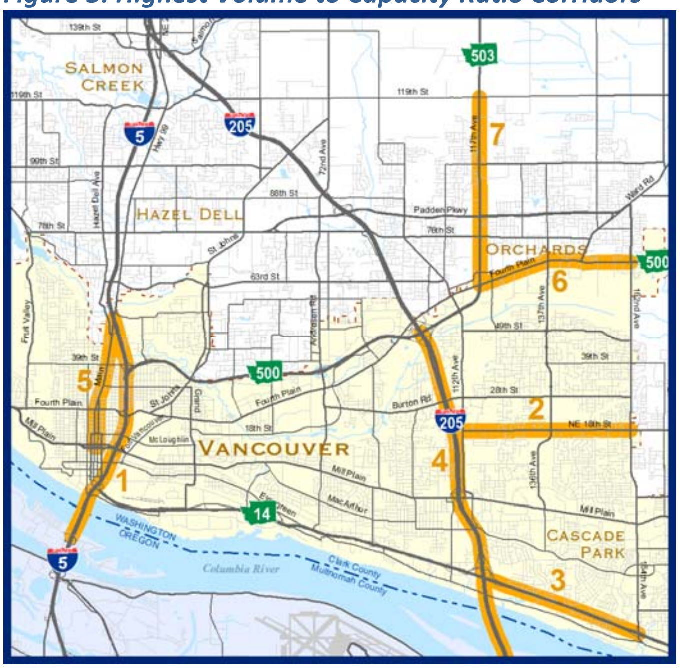
The corridor capacity ratio is an aggregation of the volume/capacity ratios for the individual general-purpose segments that make up a facility within a corridor. The corridor capacity ratio is calculated for both the AM and PM peak hours and for the peak directions of travel within a corridor. For each segment in a corridor, the volume/capacity ratio, vehicle miles traveled, and vehicle miles traveled weighted by volume/capacity ratio (the product of the volume/capacity ratio and vehicle miles traveled) for the peak hour are calculated. The corridor capacity ratio is the sum of the weighted link ratios.

The corridor capacity ratio is an indicator of congestion. The higher the ratio, the more traffic congestion a driver is likely to experience. A facility with a corridor capacity ratio above 0.90 will feel congested. An exception is where a bottleneck causes the demand to exceed capacity. At the bottleneck traffic will slow down and a backup will occur. The result is that fewer vehicles are able to get through the bottleneck, while the corridor capacity ratio appears to improve. This occurs on the I-5 Columbia River Bridge most weekday mornings, where the demand significantly exceeds the capacity.

Corridors with a capacity ratio above 0.90 include the following:

1. I-5: Jantzen Beach to Main Street (AM) – >1.00
2. 18th Street: 112th to 162nd Avenue (PM) – >1.00
3. SR-14: I-205 to 164th Avenue (AM/PM) – >0.90
4. I-205: Airport Way to SR-500 (AM) – >0.90
5. Main Street: Ross Street to Mill Plain (AM) - >0.90
6. Fourth Plain: 117th Avenue to 162nd Avenue (PM) – >0.90
7. SR-500/SR-503: NE 119th Street to Fourth Plain (PM) - >0.90

Figure 3: Highest Volume to Capacity Ratio Corridors



Map 5 (Page 30): The AM periods show congestion along major facilities such as I-5 South, Main Street, I-205 South, and SR-14 Central. Much of the AM period congestion can be attributed to the demand for crossing the two Interstate bridges into Oregon. Generally, the PM period displays higher corridor congestion than that experienced in the AM period.

Map 6 (Page 31): In the PM period, congestion is shown along I-205 South, SR-503 South, SR-14 Central, Fourth Plain East, and 18th Street. In the PM period the interstate bridge limits vehicle flow from Oregon, resulting in low congestion on the Washington side of the Columbia River.

Map 7 (Page 32): In addition to existing corridor capacity ratio, the 2035 PM corridor capacity ratio was calculated using the regional travel forecasting model (2014 RTP forecast model version). The 2035 model shows that the full funding of planned transportation improvements positively impact future corridor capacity.

Slow corridor travel time is an indicator or congestion.

Speed: Auto Travel Speed

Travel time data is collected annually. The data is collected using global positioning system (GPS) units and by driving corridors as many times as possible during peak periods (6:30-8:30 AM and 4:00-6:00 PM). Travel speed is computed from the travel time data. It consists of utilizing the travel time and distance to calculate the average travel speed in the peak period for through movements.

Slow corridor travel speed can be an indicator of delay and congestion. Better progression and coordination between signals will improve overall travel time, reliability, and safety. The lowest speed corridors include:

1. I-5: Main Street to Jantzen Beach (AM) – 9 mph
2. Andresen Road, Mill Plain to SR-500 (PM) – 14 mph
3. *Mill Plain, Fourth Plain to I-5 (PM) – 15 mph
4. Main Street, I-5 to Mill Plain (AM) – 17 mph
5. NE 112th Avenue, Mill Plain to SR-500 (PM) – 18 mph
6. Fourth Plain: Andresen to NE 117th Avenue (PM) – 18 mph

   **Construction in corridor*

Figure 4: Lowest Speed Corridors

Map 8 & 9 (Pages 33-34): Corridor travel speeds continues to decline. One concern is regional facilities that have a travel speed below 20 mph, which may encourage trips to divert to alternate routes. During the AM period, I-5 South displays an average speed below 20 mph, and is resulting in neighborhood cut-through traffic.

Travel time along arterials is directly connected to delay at signalized intersections.

In the PM period, corridors with travel speed below 20 mph include Andresen, 112th Avenue, Mill Plain, and Fourth Plain. However, the majority of the principle arterials operate only slightly above 20 mph.

Speed: Speed as Percent of Speed Limit

Travel speed was converted to a percent of posted speed limit for each of the congestion management corridors. This was intended to provide another measure of the delay along the corridor.

As development occurs along the corridors, travel speed often decreases because of congestion, multiple driveways, and additional traffic signals. One of the difficulties is in balancing access to land uses and maintaining the throughput travel speed.

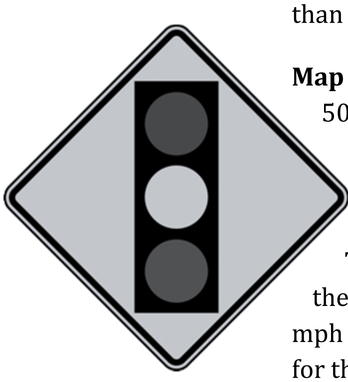
The speed percentages for the freeway facilities are generally close to 100% of the posted speed limit. While facilities with multiple signalized intersections and driveways are generally between 60% and 80% of the posted speed limit. The lowest speed percentage or worst performing corridors compared to posted speed limit include:

1. I-5, Main St. to Jantzen Beach (AM) – 15%
2. Andresen, Mill Plain to SR-500 (PM) – 40%
3. SR-14, 164th Av. to I-205 (AM) – 44%
4. Fourth Plain, SR-503 to 162nd Avenue (PM) – 48%
5. *Mill Plain, I-5 to Fourth Plain (PM) – 50%
6. SR-500, I-5 to Andresen Rd. (PM) – 50%
7. 164th Avenue, SR-14 to Mill Plain (PM) – 50%

*Construction in corridor

Figure 5: Lowest Speed Percentage Corridors

Map 10 (Page 35): In the AM period, I-5 South and SR-14 Central operate at less than 50% of the posted speed.



Map 11 (Page 36): In the PM period, Andresen South, Fourth Plain East, SR-501/Mill Plain, and SR-500 West all operate at less than 50% of the posted speed.

Speed: Intersection Delay

The delay at an intersection, for the through movement, was recorded as part of the PM travel time. Delay time represents the period of time travel speed below 5 mph due to the intersection control. The delay time at an intersection was averaged for the multiple travel time runs. Intersections with an average delay time of greater than 45, 60, and 90 seconds were identified as a location of delay along a corridor. This delay is only calculated for through movement on the congestion management corridor and does not include delay associated with left turns or cross street traffic.

The goal of signal coordination is to get the greatest number of vehicles through a corridor with the fewest stops in the safest and most efficient manner. The higher volume movement is generally favored over lower volume movements. In this situation, the benefit gained by traffic on the higher volume approach exceeds the degradation in operations experienced by the lower volume approach and the overall intersection operations are improved.

Map 12 (Page 37): Generally, intersections that displayed a 45 second or greater delay, for the average through movement on a CMP corridor, were located where two major arterials intersect. Map 12 displays the location of the 45 intersections that demonstrated this characteristic. Of these intersections, 21 had at least one direction with an average delay between 60-89 seconds and 9 had at least one direction with an average delay greater than 90 seconds. Delay at these intersections adds to the overall travel time and increases congestion at these locations.

The longest delays are at the following intersections:

1. Fourth Plain/Andresen Rd. (Northbound) – 182 seconds
2. *Mill Plain/Columbia St. (Eastbound) – 157 seconds
3. Fourth Plain/SR-500 (Eastbound) – 154 seconds
4. SR-500/42nd Av./Falk Rd. (Eastbound) – 122 seconds
5. *Padden Parkway/NE 94th Av. (Westbound) – 103 seconds
   **Construction near intersection*

In addition to intersection delay, delay can also occur at freeway off-ramps, where high volumes of traffic are loaded onto the arterial system. This can create a significant problem when traffic backs onto the freeway. Locations known to experience this characteristic in the PM peak include northbound I-205 off-ramp to SR-14, Mill Plain, and SR-500. In the AM peak, backups can occur on SR-500 and SR-14 ramps to I-5 South, and Padden Parkway, SR-500, and SR-14 ramps to I-205 South.

Occupancy: Vehicle Occupancy

Average automobile occupancy is calculated by observing passenger cars at a given location and the number of people in each vehicle. The number of people divided by the number of passenger cars is the average automobile occupancy for that location. Trucks, buses, and other commercial vehicles are excluded from average automobile occupancy. Data is collected for the AM and PM time periods.

Table 5: Average Automobile Occupancy by Time of Day

Facility Type	AM	PM
Freeway *	1.11	1.17
Arterial	1.12	1.25

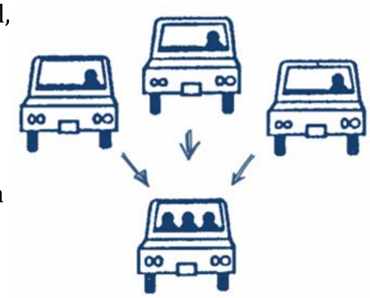
* *Freeway includes I-5, I-205, SR-14, and SR-500*

The AM time period displays a lower average automobile occupancy, with the AM average automobile occupancy at 1.11 persons per vehicle. The PM average automobile occupancy rate is approximately 1.21 persons per vehicle.

It may be that the AM peak period is more of a traditional commute time, while the PM peak period likely has a greater percentage of discretionary trips such as shopping where drive-alone trips are less prominent.

Occupancy: Carpool and Vanpool

Carpools and vanpools are modes that mitigate congestion and increase vehicle occupancy in the peak periods. Carpools and vanpools form when a group of people commute together. Carpools are generally informal, including 2 or more people, while vanpool arrangements are generally more formal and include 5 or more people. C-TRAN owns, maintains, manages, insures, and licenses a fleet of vans which are available to commuter groups. In 2015, C-TRAN had thirty-one vanpools in service.



Safety: Collisions

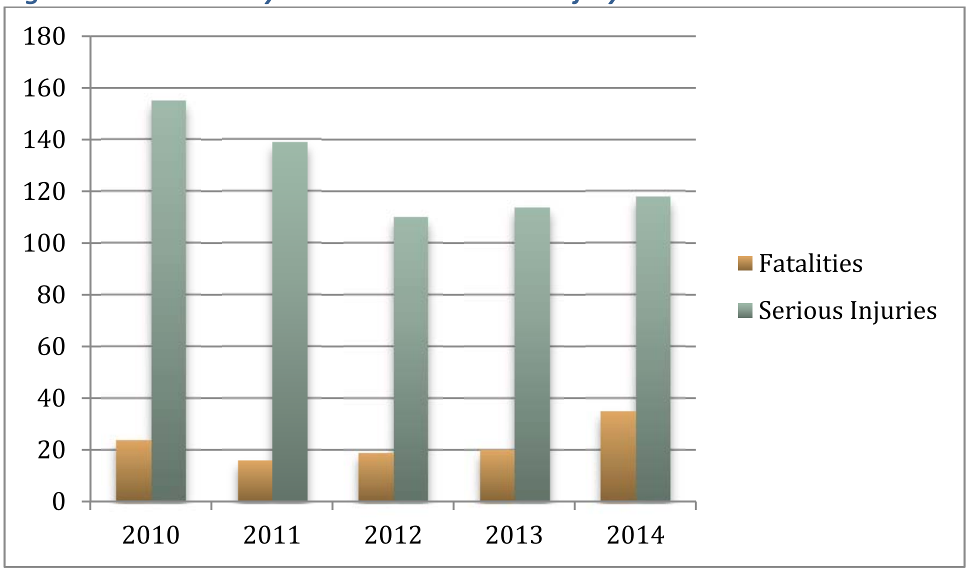
Safety for all modes of travel is an important component of the regional transportation planning process. Congestion often occurs as a result of collisions or other incidents that temporarily reduce a road's capacity. As such, the region completed a *2014 Safety Management Assessment for Clark County*[10]. The 2014 Safety Management Assessment for Clark County includes a number of recommendations to help the region meet safety goals.

Over the past several decades, national, statewide, and local safety trends have shown significant reduction in fatalities and serious injuries resulting from traffic collisions. With the recovery of the economy in the last few years the local, state,

[10] *http://rtc.wa.gov/reports/safety/SafetyMgmt2014.pdf*

and national trend appears to have reversed, with both fatalities and serious injuries remaining flat or increasing. Year 2014 was a particular bad year for fatalities in Clark County. Figure 7 shows Clark County trend for both fatalities and serious injuries, between years 2010-2014 (most recent available years).

Figure 6: Clark County Fatalities and Serious Injury Totals



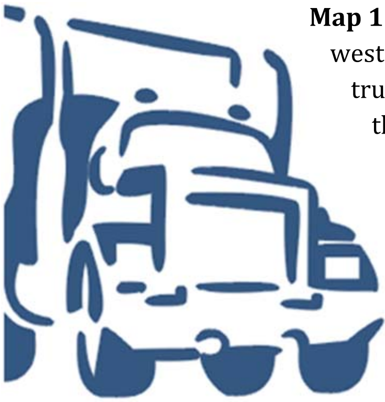
Clark County traffic safety priorities are set based upon the most frequently cited contributing factors. Table 6 lists the priority factors for Clark County:

Table 6: Clark County Priority Collision Factors

Collission Factors	Total Fatalities	Percent	Total Serious Injuries	Percent
Impaired Driver	57	50.0%	143	22.5%
Speeding	47	41.2%	167	26.3%
Run Off the Road	41	36.0%	153	24.1%
Young Driver 16-25	41	36.0%	295	46.4%
Distracted Driver	28	24.6%	132	20.8%
Intersection Related	28	24.6%	251	39.5%

Trucks: Truck Percentage

Traffic counts are collected at several locations where vehicles are classified according to the number of axles. This provides a measure of trucks as a percentage of all vehicles traveling on the roadway. Trucks are defined as vehicles with more than two axles, such as typical tractor/trailer rigs, traveling on the roadway during the peak period. It is important to note that trucks often travel outside of peak periods to avoid congestion.



Map 13 (Page 38): Overall, I-5 North, I-205 North, Fourth Plain and Mill Plain west of I-5, and Pioneer Street in Ridgefield display the highest percentage of truck volumes during the PM peak period with truck percentages greater than 7 percent. In the AM period, the percentage of trucks is generally higher, with both Mill Plain and Fourth Plain west of I-5 averaging over 15% trucks during the morning commute.

The State Freight and Goods Transportation System classify roadways according to the annual gross freight tonnage they carry. This system designates I-5, I-205, SR-14, and Mill Plain west of I-5 as the highest tonnage facilities.

Transit: Transit System Ridership

Table 7 provides 2015 annual C-TRAN patronage by type of service. C-TRAN moved to automated passenger count system in 2013, which resulted in decline in the passengers counted. For purpose of this report 2013 to present passenger counts will be considered. Between 2013 and 2015 minor transit service revisions were made and fare increases were implemented. Between 2013 and 2015 total ridership decreased by 4.8%.

Approximately 82% of C-TRAN system ridership was made up of urban fixed route patrons, followed by commuter service that carried 12% of the total riders and C-VAN that carried almost 4% of the total riders. Vanpool usage has increased to over 1% of the total ridership.

Table 7: 2015 C-TRAN Ridership by Type of Service

Service Type	Annual Riders	Percent
Urban/Local	5,083,118	82.3%
Commuter	729,796	11.8%
C-VAN	249,801	4.0%
Events/Other	29,451	0.5%
Connector	18,460	0.3%
Vanpool	68,961	1.1%
Total	**6,179,587**	**100.0%**

Transit: Transit Seat Capacity Used

Transit seat capacity used includes transit riders divided by the transit capacity at a defined location. Transit seat capacity represents the percentage of seats that are occupied during the two-hour peak period. C-TRAN uses an automated ridership collection system on their vehicles. RTC compiled this data at a specific location in each corridor to calculate bus capacity based on the vehicle type and frequency of service. This process has allowed for the estimation of transit patronage and capacity for congestion management corridors.

Map 14 (Page 40): Generally, in the PM Peak period, the number of available seats is higher to accommodate the greater transit demand. In the PM period, 27 corridors utilize more than 50% of the available seat capacity.

Transit: Park and Ride Capacity

Park and Ride capacity and daily average usage include lots owned or leased by C-TRAN. In addition to the capacity shown in Table 8, there are WSDOT maintained or informal park and ride and park and pool facilities located throughout the County. Clark County park and ride capacity and usage for C-TRAN served facilities are shown in Table 8.

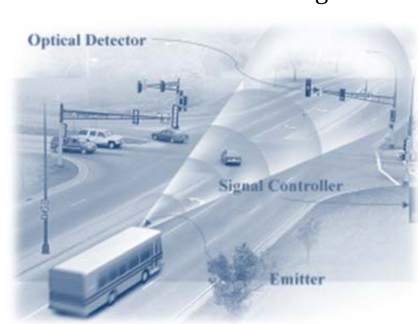
Table 8: Clark County Park and Ride Capacity and Usage in 2013

Facility	Lot Capacity	Lot Usage	Occupancy
99th Street	610	409	67%
Evergreen	279	37	13%
Salmon Creek	467	260	56%
BPA Ross	N/A	Closed	N/A
Andresen/Living Hope	60	97	162%
Fisher's Landing	560	511	91%
Total	**1,976**	**1,314**	**66%**

Transit: Transit On-Time Performance

Traffic congestion, station dwell time, wheel chair boardings, and other factors can impact transit vehicles' ability to maintain a schedule.

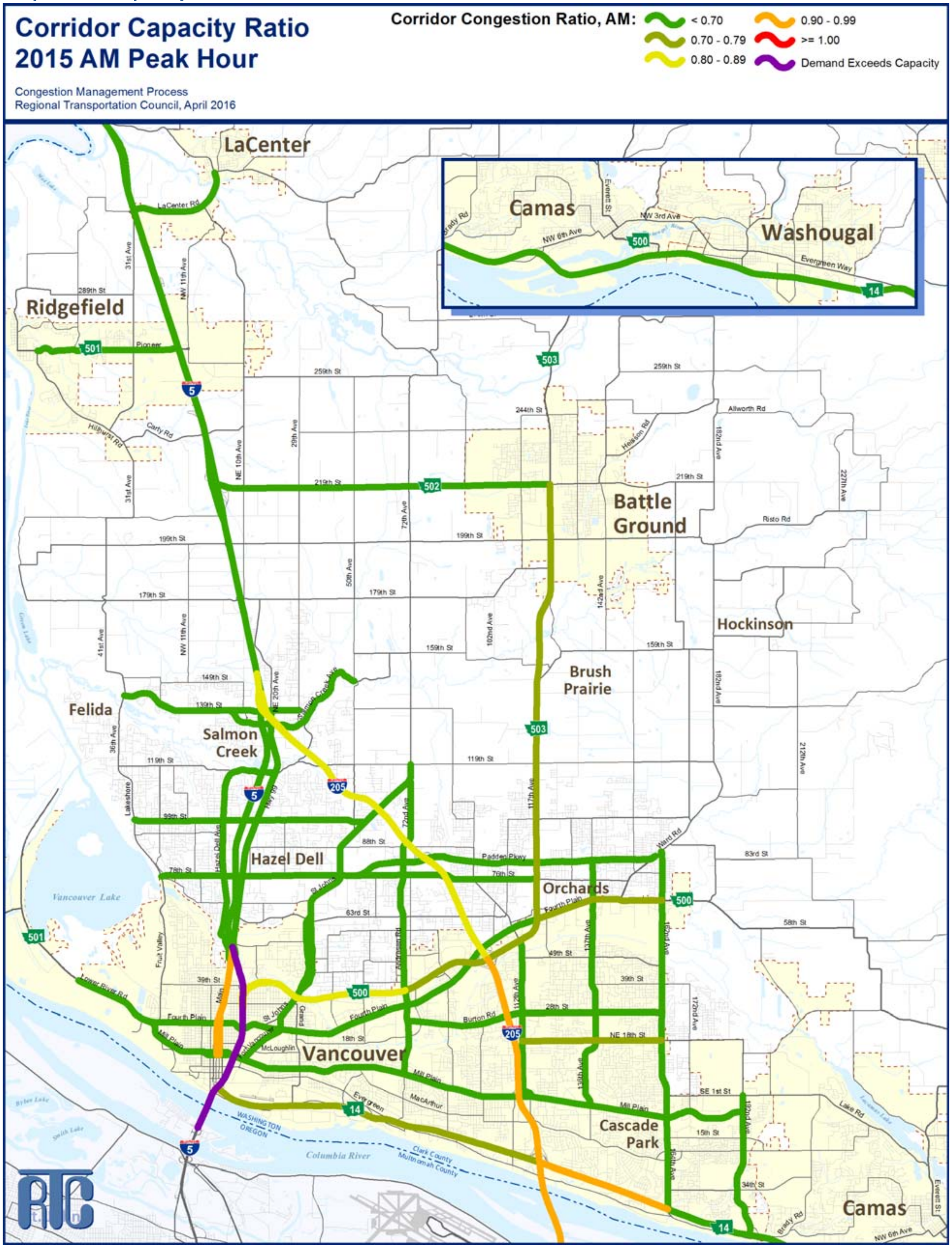
To improve on-time performance, C-TRAN tested a pilot project in 2013 to implement Transit Signal Priority along 22 signals in the Mill Plain corridor. This Transit Signal Priority project allowed buses to communicate with traffic signals and allow additional green time where needed. C-TRAN evaluated its performance and found that this technology showed improvements to corridor travel time and on-time performance without negatively impacting roadway traffic. C-TRAN is moving forward to implement a similar technology in the Highway 99 corridor.



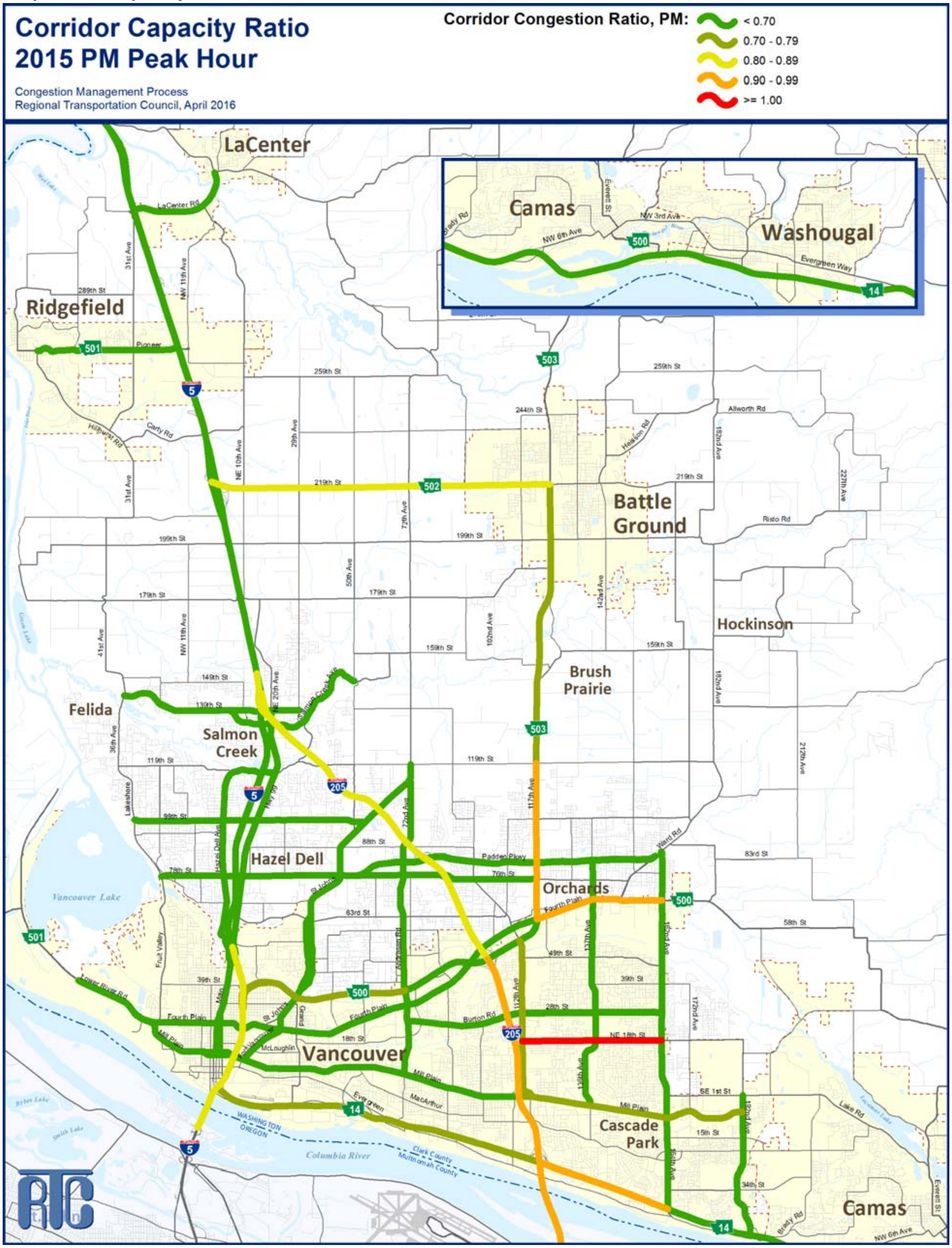
C-TRAN's 2015 On-Time Performance Report shows that routes that cross the Columbia River into Oregon had the lowest on-time performance due to congestion. This includes all Express Routes, Route 44 (Fourth Plain Limited), and Route 47 (Battle Ground Limited).

Map 4: PM Vehicle Volumes

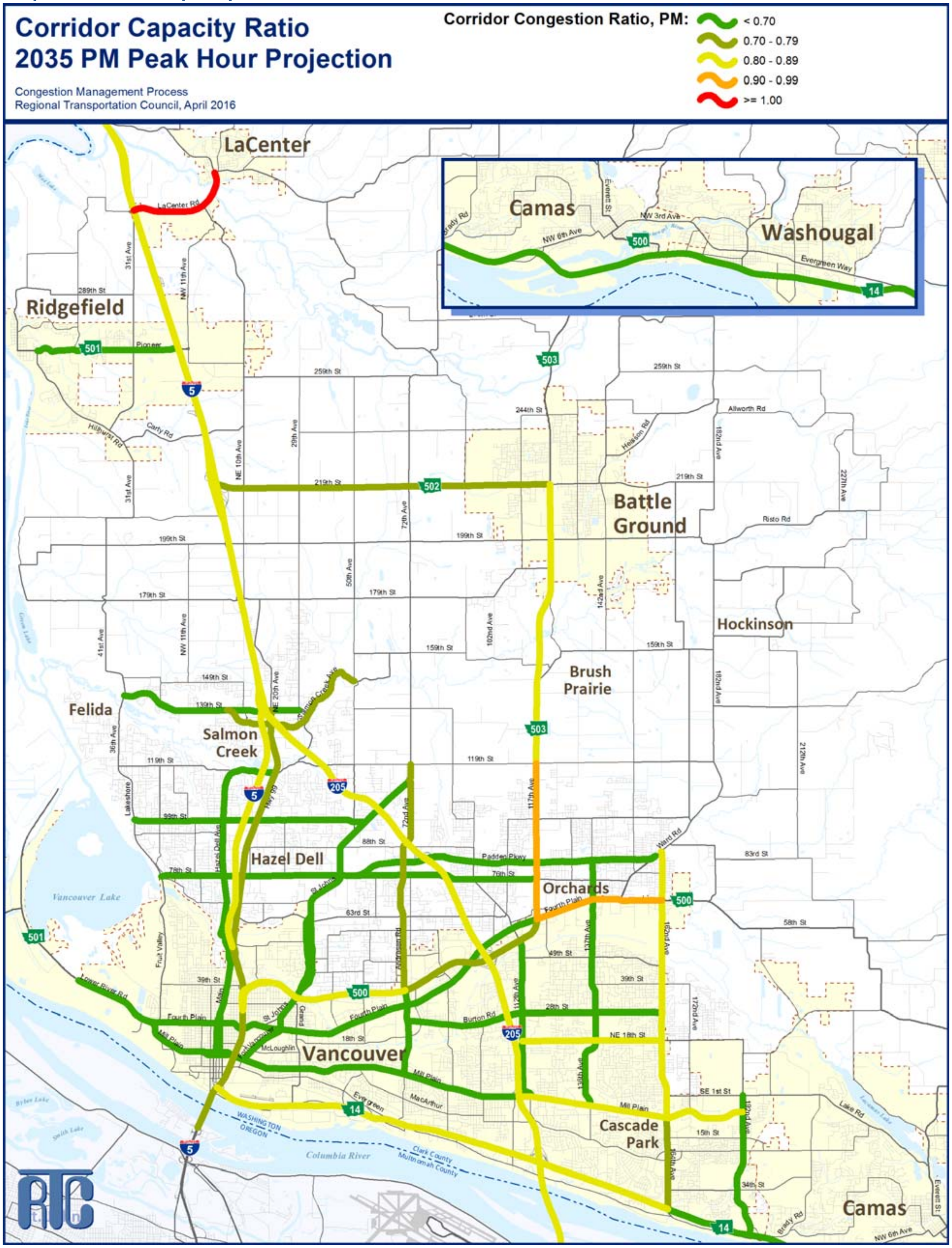
Map 5: AM Capacity Ratio



Map 6: PM Capacity Ratio



Map 7: 2035 PM Capacity Ratio



Map 8: AM Corridor Travel Speed

Map 9: PM Corridor Travel Speed

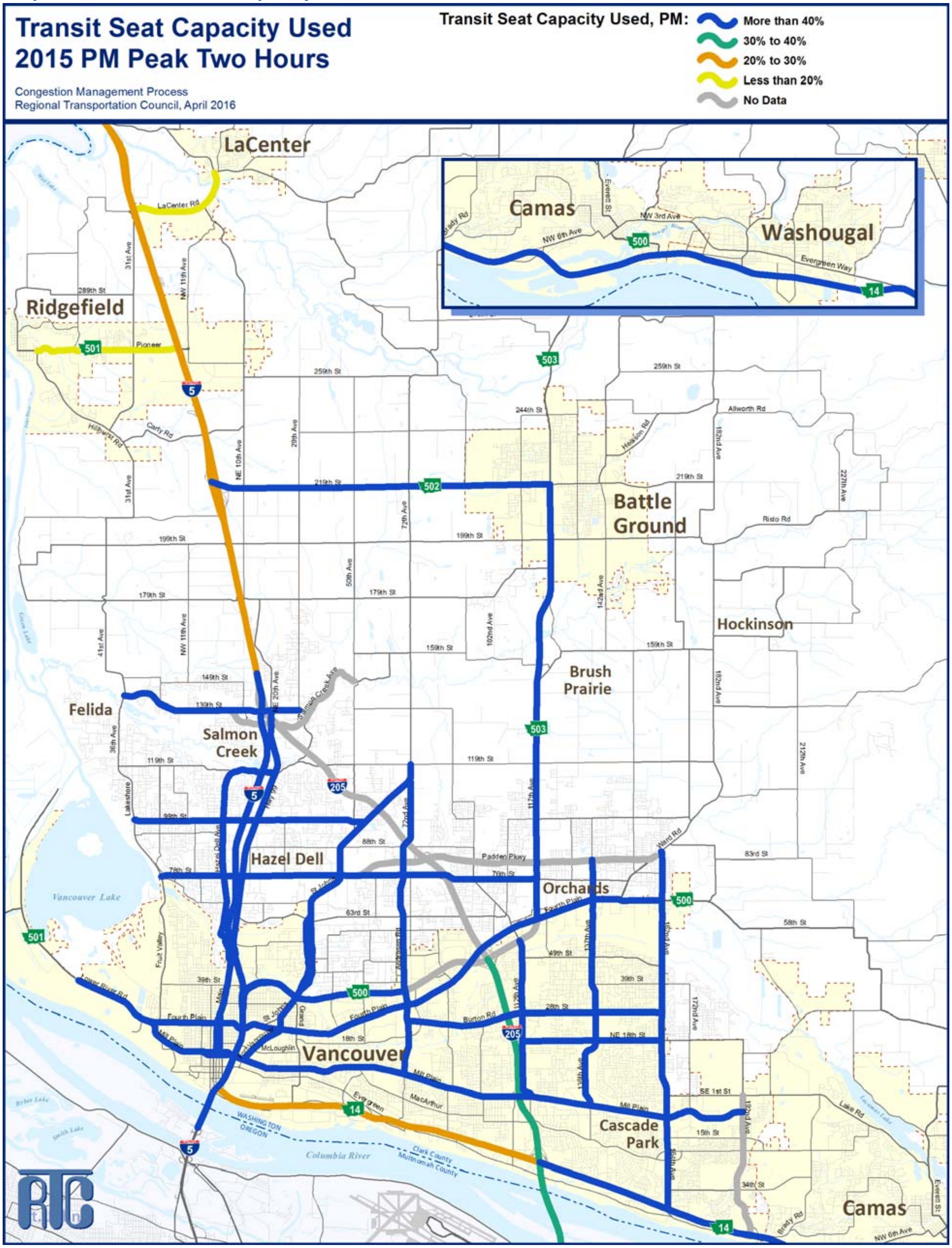
Map 10: AM Speed as a Percent of Speed Limit

Map 11: PM Speed as a Percent of Speed Limit

Map 12: PM Intersection Delay

Map 13: PM Truck Percentage

Map 14: PM Transit Seat Capacity Used



Areas of Concern

Using the individual CMS corridor segment data, areas of concerns were identified. Areas of concern are defined as segments within an individual corridor with a volume-to-capacity (V/C) ratio greater that 0.9 or a travel speed 60% or less of the posted speed limit.

Volume-to-capacity Ratio

The volume-to-capacity ratio identifies road segments where current volumes are approaching road capacity. This limitation on road capacity leads to congestion.

Map 15 (Page 41): Prominent volume-to-capacity ratio areas of concern in the AM peak period are the bottlenecks at the two interstate bridges. The AM period shows a high volume-to-capacity ratio with related poor system performance on portions of I-5, Main Street, I-205, SR-14, and SR-500.

Map 16 (Page 42): In the PM period, additional volume-to-capacity ratio areas of concern showed up. The PM period shows congestion on portions of I-5, I-205, SR-14, SR-500, SR-502, SR-503, Mill Plain, Fourth Plain, 112th Avenue, and 18th Street.

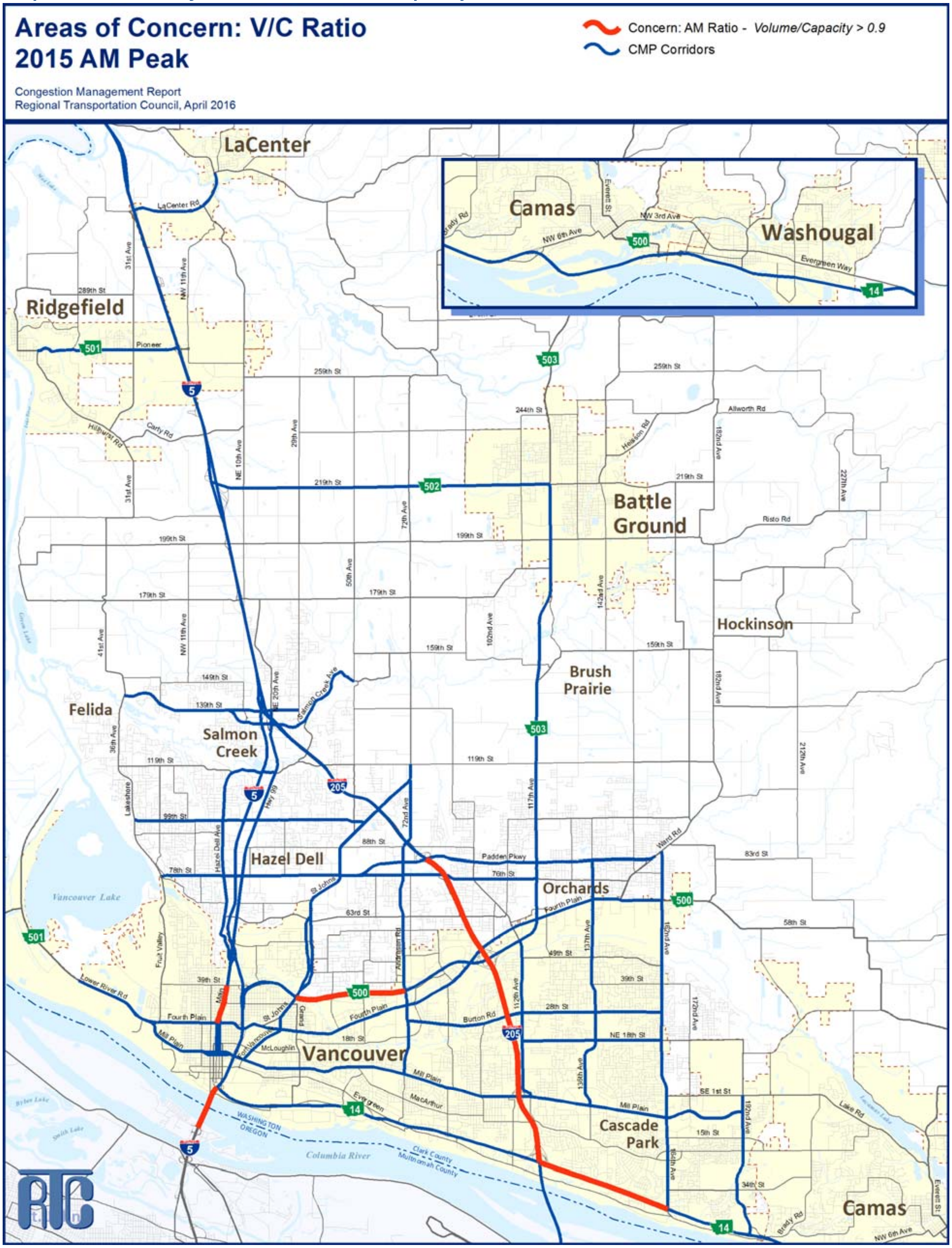
Speed

A travel speed lower than 60% of the posted speed limit is an indicator of delay, which can result in congestion. Often these speed areas of concern occur at locations with multiple traffic signals in close proximity or with a high volume intersection.

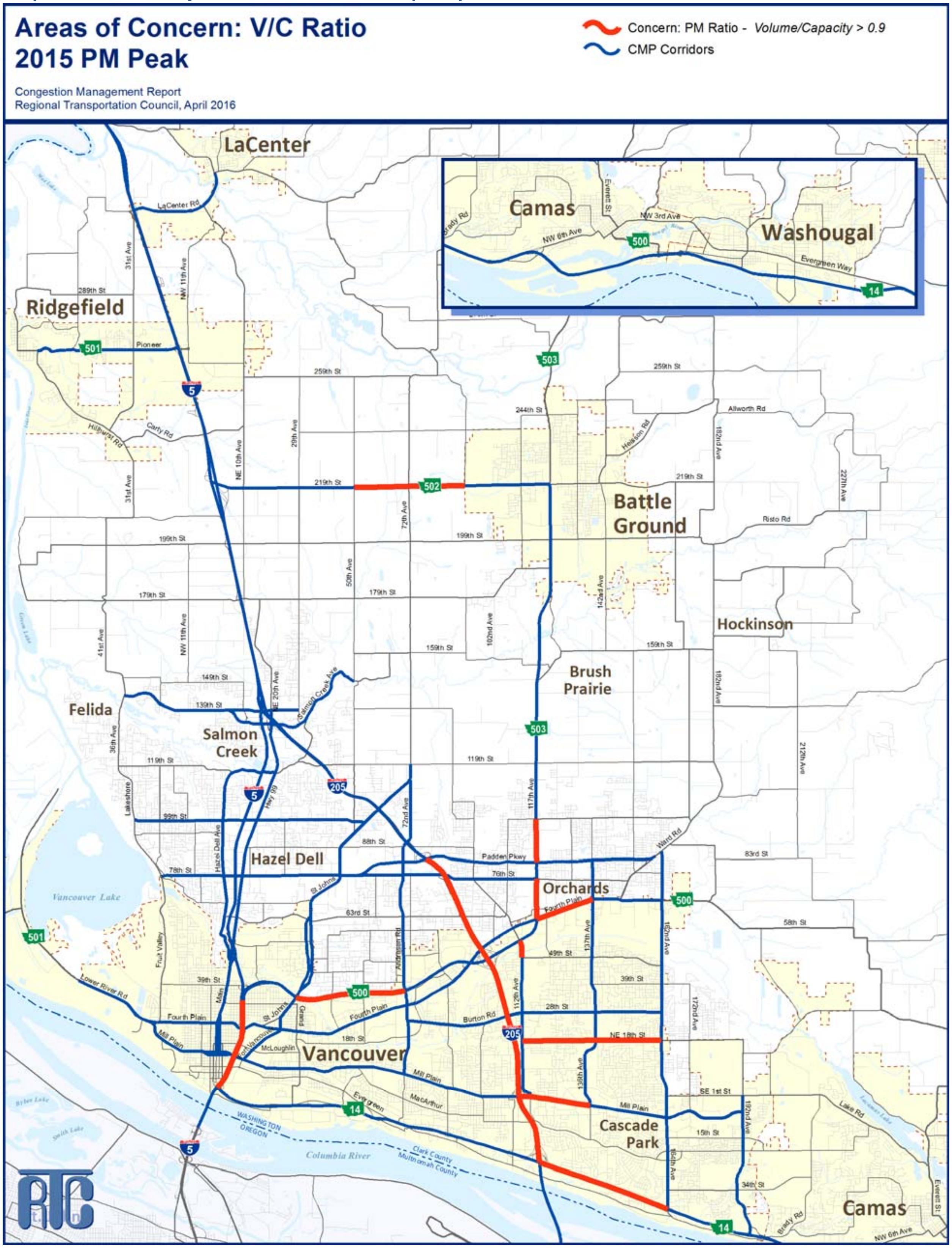
Map 17 (Page 43): In the AM period, speed areas of concern occur along portions of I-5, Main Street, Hazel Dell Avenue, Highway 99, Ft. Vancouver, St. Johns, Andresen, SR-503, 112th Avenue, 137th Avenue, 162nd Avenue, 192nd Avenue, SR-14, Mill Plain, Fourth Plain, 78th Street, and Padden Parkway.

Map 18 (Page 44): In the PM period, speed areas of concern occur along portions of most of the congestion management corridors in the Vancouver Urban Area, with the exception of grade-separated facilities (I-5, I-205, and SR-14).

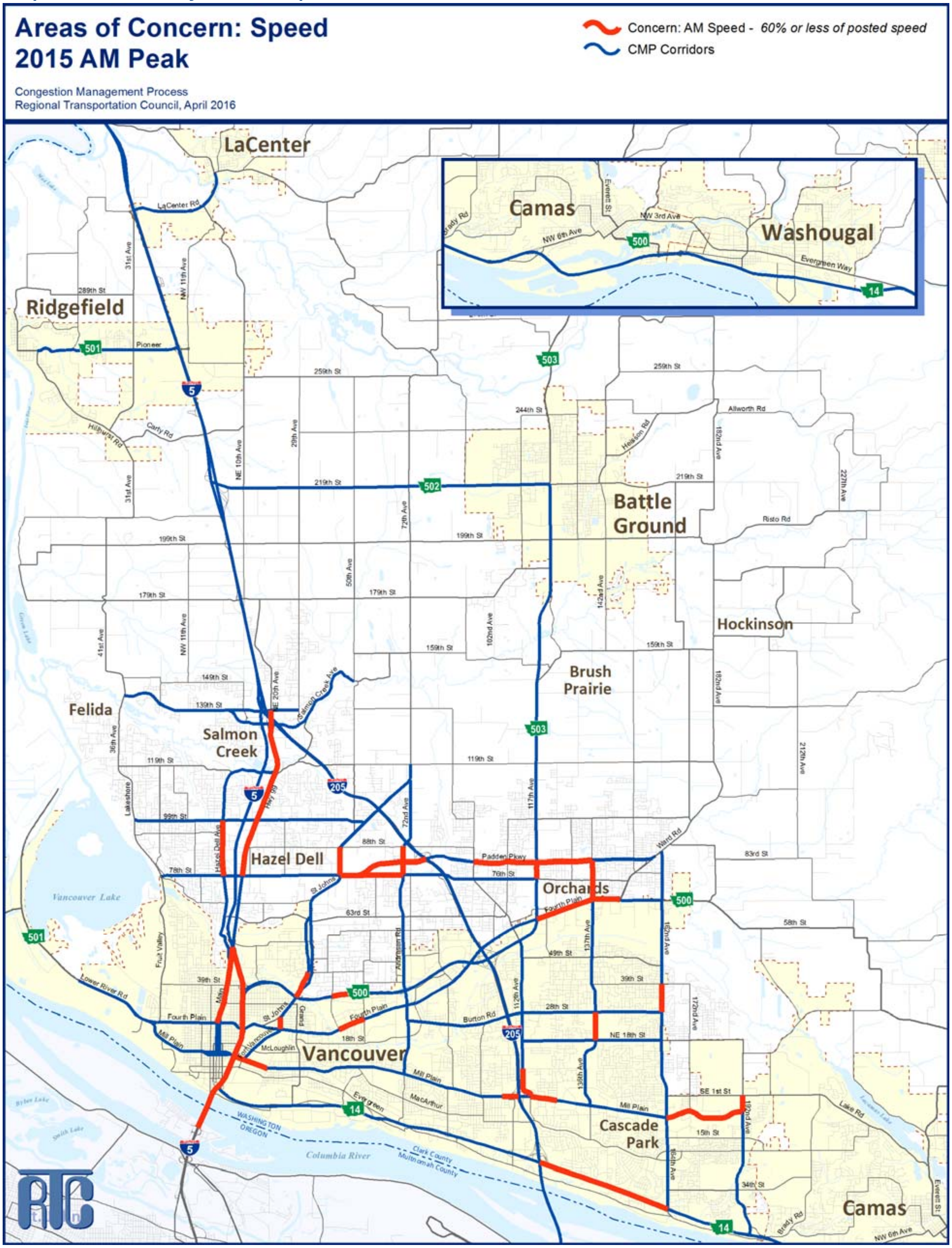
Map 15: AM Areas of Concern: Volume-to-capacity Ratio



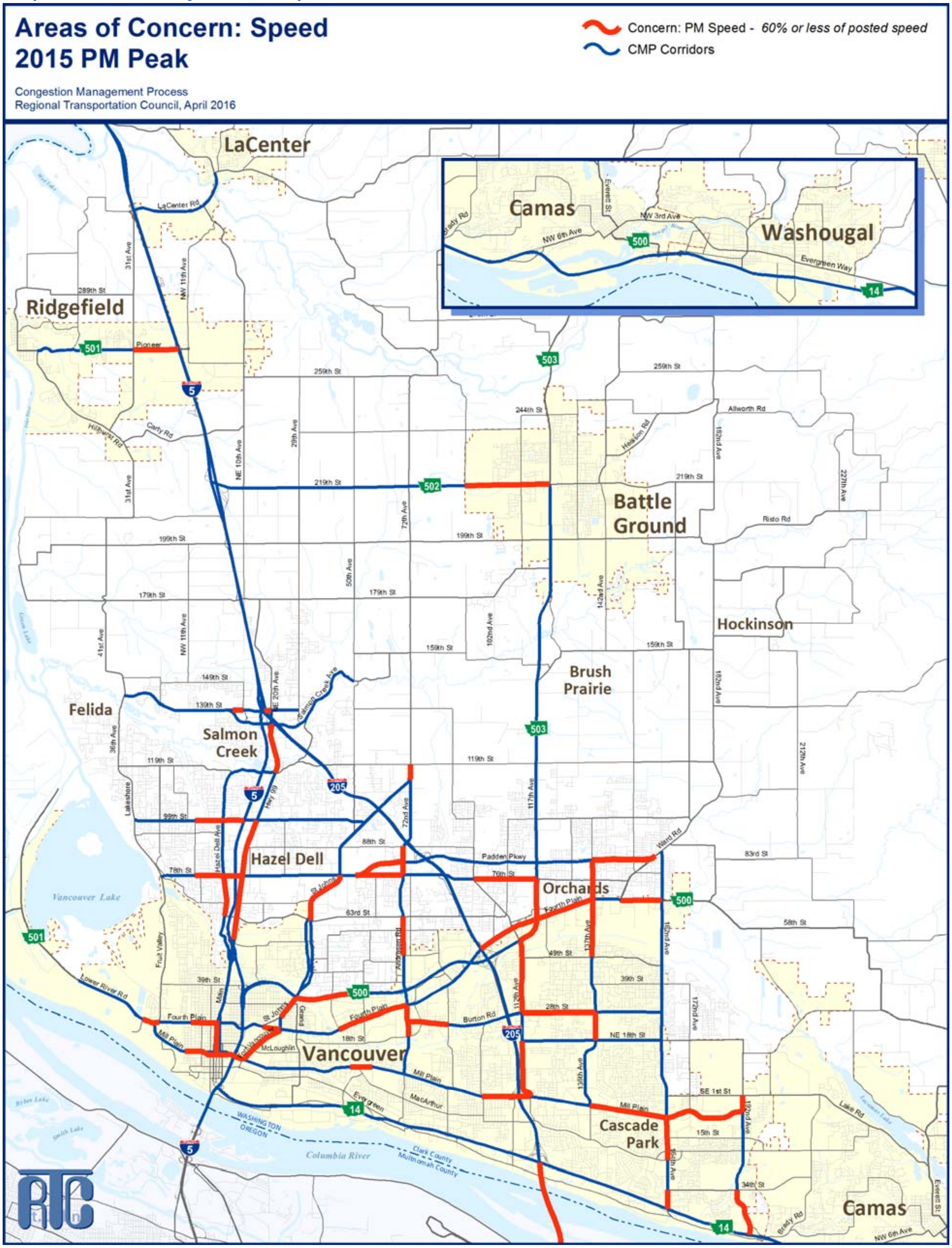
Map 16: PM Areas of Concern: Volume-to-capacity Ratio



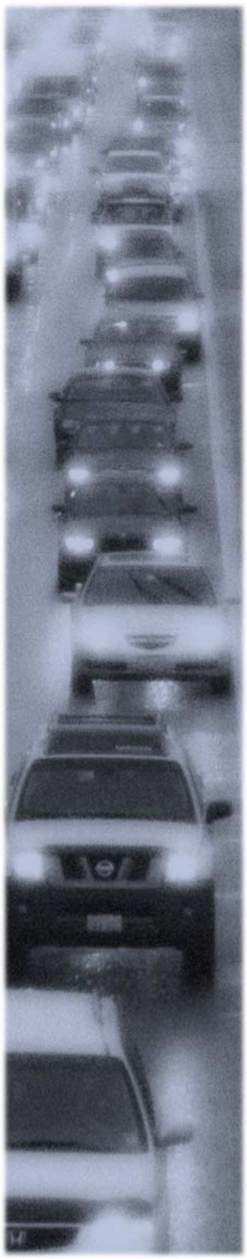
Map 17: AM Areas of Concern: Speed



Map 18: PM Areas of Concern: Speed



Chapter 3: Strategies



Because each roadway corridor has its own characteristics, congestion management efforts must be tailored to meet the needs of a roadway. Transportation professionals must employ a variety of strategies to effectively manage congestion.

Transportation Planning Efforts

RTC is involved in a number of transportation planning efforts intended to address the impacts of traffic congestion. The following is a list of current transportation planning efforts:

The Regional Transportation Plan[11] for Clark County (RTP) is the most prominent planning document. The plan is designed to be a guide for the effective investment of public funds for regional transportation needs over a twenty-year period. The region uses a wide range of data to develop a regional travel demand forecasting model. The model simulates both current travel demand and also forecasts travel demand twenty years into the future based on planned land use growth. Using the model, the region can identify where future congestion is most likely to occur.

The Transportation System Management and Operations Plan[12] (TSMO) was adopted in June 2011. TSMO focuses on low-cost, quickly implemented transportation improvements that aim to utilize existing transportation facilities more efficiently. TSMO combines advanced technologies, operational policies and procedures, and existing resources to improve coordination and operation of the multimodal transportation network. TSMO project examples include traffic signal integration, ramp metering, access management, traveler information, smart transit management, and coordinated incident response to make the transportation system work better.

The C-TRAN 20-year Transit Development Plan[13] was adopted in 2010. This planning process is designed to build upon existing service and develop future operating scenarios for public transit. The plan incorporates the recommendations of the High Capacity Transit System Plan.

[11] *http://rtc.wa.gov/programs/rtp/clark/*
[12] *http://rtc.wa.gov/programs/vast/docs/tsmoReport2011.pdf*
[13] *http://www.c-tran.com/about-c-tran/reports/c-tran-2030*

The CTR program is intended to improve transportation system efficiency, conserve energy, and improve air quality by decreasing the number of commute trips made by people driving alone. RTC approved a Regional Commute Trip Reduction Plan and endorsed CTR plans for unincorporated Clark County, Vancouver, Camas, and Washougal. The City of Vancouver is implementing their CTR plan through Destination Downtown[14].

The Clark County Freight Mobility Study[15] (RTC, 2010) provides useful information and analysis designed to inform regional transportation planning, local comprehensive planning, and project design. Study efforts included an evaluation of freight traffic movement, identification of freight system deficiencies, identified future infrastructure needs, and identified policy issues to support freight mobility in Clark County.

The 2014 Human Services Transportation Plan for Clark, Skamania, and Klickitat Counties[16] summarizes the transportation needs for people who, because of disability, low income, or age, face transportation challenges. It also identifies the transportation activities to respond to these challenges.

The 2014 Safety Management Assessment for Clark County[17] is intended to be an organized approach to transportation safety. Safety for all modes of travel is an important component of the regional transportation planning process. The purpose of the plan is to consider ways to increase the safety of the transportation system.

Identify and Evaluate Transportation Strategies

The information and data contained in the System Monitoring chapter is used to identify appropriate congestion management strategies for the region. The identification and selection of strategies for a particular segment or corridor should be tied to the specific congestion issue. RTC will work collaboratively with member agencies to identify and advance appropriate strategies for managing congestion.

Strategies are detailed in the CMP Toolbox. The intent of the CMP Toolbox is to provide a reference for the development of alternative strategies for consideration in corridor development in relationship to the Regional Transportation Plan.

Objectives of Strategies

Reducing congestion in the region will require accomplishing the following objectives:

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[14] *http://www.cityofvancouver.us/ced/page/destination-downtown*
[15] *http://rtc.wa.gov/studies/freight/*
[16] *http://rtc.wa.gov/programs/hstp/*
[17] *http:// http://rtc.wa.gov/reports/safety/SafetyMgmt2014.pdf*

- Preservation and maintenance of the existing system
- Improving system performance through operation and management strategies
- Where possible, shifting trips to other modes
- Addition of auto capacity at key bottlenecks

CMP Toolbox

One of the components of RTC's Congestion Management Process is a toolbox of congestion reduction and mobility strategies. The intent of this toolbox is to encourage ways to deal with congestion and mobility issues prior to traditional roadway widening projects. Prior to adding single occupant vehicle (SOV) capacity, agencies and jurisdictions should give consideration to the various strategies identified in this section. Usually, multiple strategies are applicable within a corridor, while other strategies are intended to be applied region-wide.

The CMP toolbox strategies were assembled to provide a wide range of strategies that could be used to manage congestion. They are arranged so that the strategies are considered in order from first to last. Even with the addition of capacity, many of the strategies can be implemented with the project to ensure the long-term management of a capacity project.

Preservation and maintenance of existing systems is essential to mobility.

System Preservation and Maintenance

Essential for continued transportation mobility is the preservation and maintenance of the existing roadway, bridge, ports, rail, transit, bicycle, pedestrian, and other systems.

Safety Improvements

It is vital that the region builds and maintains a transportation system that provides a safe and secure means of travel by all modes. The type of safety improvement is dependent on the need at each location.

Transportation Demand Management

Transportation Demand Management: Options such as alternative work hours, telecommuting, ridesharing, and other options can remove, shift, or combine trips to reduce overall demand during peak periods. Many of these strategies can be successfully implemented through a Commute Trip Reduction (CTR) program and Transportation Management Associations.

Transit Improvements

Bus Route Coverage

Provides better transit accessibility to a greater share of the population.

Bus Frequencies and Transit Amenities

Makes transit more attractive to use.

Park-and-Ride Lot

In conjunction with express bus service, can encourage the use of transit for longer distance commute trips.

High Capacity Transit

Provides a higher transit service to maximize transit usage in dense urban corridors.

Bicycle and Pedestrian Improvements

New Sidewalks and Bicycle Lanes, Separated Pathways, and Trails

Provides better pedestrian and bicycle accessibility to a greater share of the population. Also increases the perception of pedestrian and bicycle safety.

Bicycle Amenities

Bicycle racks, lockers, and other bicycle amenities at transit stations and other trip destinations increases security and provides incentives for using bicycles.

Pedestrian-Oriented Development

Building setback restrictions, streetscape, and other pedestrian oriented development can be codified in zoning ordinances to encourage pedestrian activity.

Bicycle and Pedestrian Safety

Maintaining lighting, signage, striping, traffic control, and other safety improvements can increase bicycle and pedestrian usage.

Transportation System Management and Operations

Traffic Signal Coordination

This improves traffic flow and minimizes stops on arterial streets.

Incident Management System

Is an effective way to alleviate non-recurring congestion. Primarily applicable on freeways.

Ramp Metering

This allows freeway to maintain flow rates, resulting in improved operations and reducing congestion on freeways.

Highway Information Systems

These systems provide travelers with real-time information that can be used to make trip and route decisions.

Advanced Traveler Information Systems

This provides data to travelers in advanced by computer or to other devices.

Access Management

Left Turn Restrictions

Turning vehicles can impede traffic flow and are more likely to be involved in collisions.

Consolidation or Relocation of Driveways

In some situations, increasing or improving access to property can improve traffic flow and reduce collisions.

Interchange Modification

Modification of interchanges can reduce weaving and improve traffic flow.

Minimum Intersection/Interchange Spacing

Appropriate spacing of intersection/interchanges can reduce number of conflict points and merge areas, resulting in fewer incidents and better traffic flow.

Collector-Distributor Roads

Collector-distributor roads are used to separate interchange traffic from through traffic at closely spaced interchanges, resulting in fewer incidents and better traffic flow.

Land Use

Mixed-Use Development
This can allow many trips to be made in an area by walking rather than use of a vehicle.

Infill and Densification
This takes advantage of existing infrastructure, rather than requiring new infrastructure to be built.

Transit Oriented Development
Allows improved pedestrian access from transit to housing and businesses.

Parking Enforcement
Enforcement of existing regulations can improve traffic flow in urban areas.

Location Specific Parking Ordinances
Parking requirements can be adjusted for factors such as availability of transit, mix of land use, and pedestrian oriented development that reduces the need for on-site parking.

Carpool/Vanpool Parking
Preferential, reduced, or free parking for carpool/vanpool can provide an incentive and reduce parking demand.

Roadway Improvements

Geometric Design Improvements
Addition of turn lanes at intersections, roundabouts, improved sight distance, auxiliary lanes, and other geometric improvements can reduce congestion by removing bottlenecks.

Upgrade Roads to Urban Standards
Upgrading from rural roads to urban standards with improved geometry, bicycle lanes, sidewalks, and transit amenities can improve traffic flow for all modes.

Grade Separation
Upgrade high volume intersection to an interchange or grade separated facility can significantly reduce traffic delay and reduce congestion.

Road Widening to Add Travel Lanes
Can increase capacity and remove congestion.

The CMP provides information to help guide the investment of transportation funding toward improving congestion.

Strategy Implementation

RTC's Congestion Management Process provides a tool for monitoring the region's traffic congestion. The CMP provides information to help guide the investment of transportation funding toward improving congestion. Information developed through the Congestion Management Process will be applied through the RTC regional transportation planning process.

In coordination with WSDOT, C-TRAN, and local agencies, RTC utilizes the Congestion Management Process to identify transportation system needs. This effort is supported by regional studies, local capital facility plans, regional transportation model, and other planning efforts which all feed into the development of the Regional Transportation Plan[18] (RTP). Needs are developed based on a planning level analysis that considers how various strategies can address congestion prior to adding capacity. Identified congestion needs are then incorporated into Regional Transportation Plan recommendations. Project sponsors then must give consideration to the various strategies from the CMP Toolbox as projects move forward to implementation.

Local project priorities are then submitted to RTC and prioritized through the regional Transportation Improvement Program[19] (TIP) which selects priority projects for implementation. For purpose of selecting projects to fund through the TIP process, additional points are awarded to a project that:

- Are Located on the CMP Network
- Addresses Congestion
- Incorporates Alternative Modes
- Incorporates Transportation System Management Alternatives

The Transportation Improvement Program and Annual List of Obligation will allow the region to track the implementation of congestion management strategies.

Monitor Strategy Effectiveness

This report contains data that allows for the continuing development and updating of information to track the performance of the regional transportation system and implemented strategies.

In assessing the degree to which the CMP strategies address congestion issues, projects are tracked through the project implementation process and results are reported back to regional technical committees.

[18] *http://www.rtc.wa.gov/programs/mtp/*
[19] *http://www.rtc.wa.gov/programs/tip/*

As part of the project implementation process, all regionally selected projects are required to complete a before and after analysis that identifies project goals and outcomes. This information is reported back to the Regional Transportation Advisory Committee. The region also tracks effectiveness through a 10 year corridor analysis.

Strategy Corridor Analysis

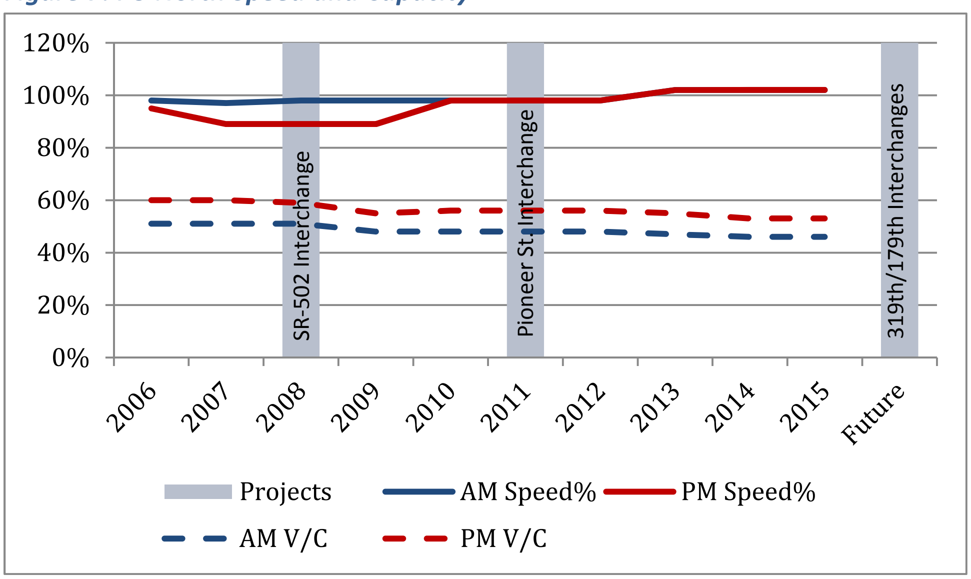
This section displays the linkages between transportation infrastructure improvements and corridor performance. System infrastructure improvements often impact the operation within a corridor. Sometimes a project removes a localized bottleneck, while other projects have corridor-wide impacts.

The following graphs show overall corridor travel speed compared to posted speed limit and volume to capacity ratio in comparison to implemented and future infrastructure improvements. This analysis is for each facility as a whole, and is not necessarily an indicator of individual bottlenecks. Roadways are likely to experience corridor-wide congestion when average travel speed falls under 60 percent of posted speed limit or when average volume to capacity ratio is greater than 90 percent.

I-5 North, County Line to I-205 Junction

Neither speed nor capacity indicates potential corridor-wide congestion. Recent and future corridor improvements are reflective of the need for improved access to the I-5 Corridor.

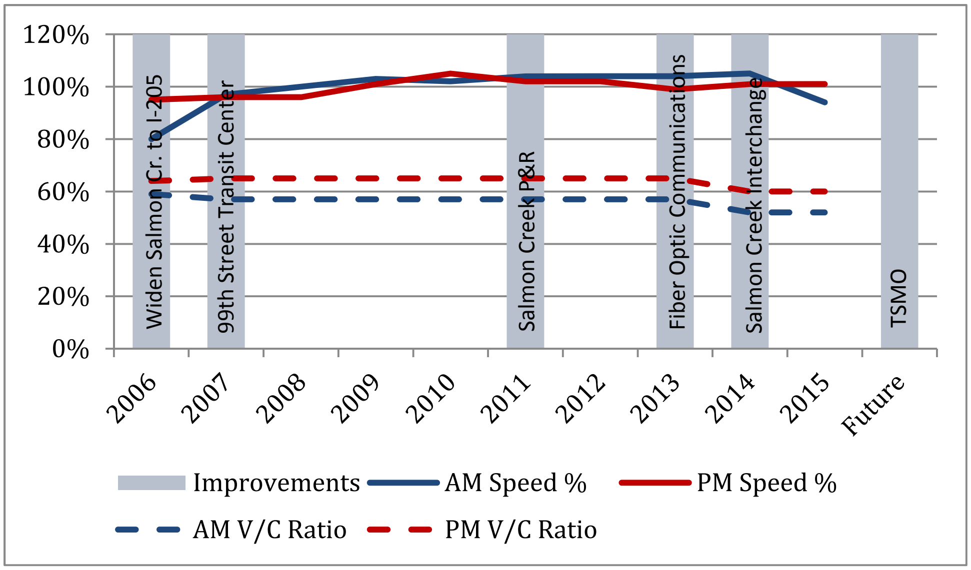
Figure 7: I-5 North Speed and Capacity



I-5 Central, I-205 Junction to Main Street

The 2006 widening project provided needed capacity in the corridor. Neither existing speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include Transportation System Management and Operational (TSMO) projects.

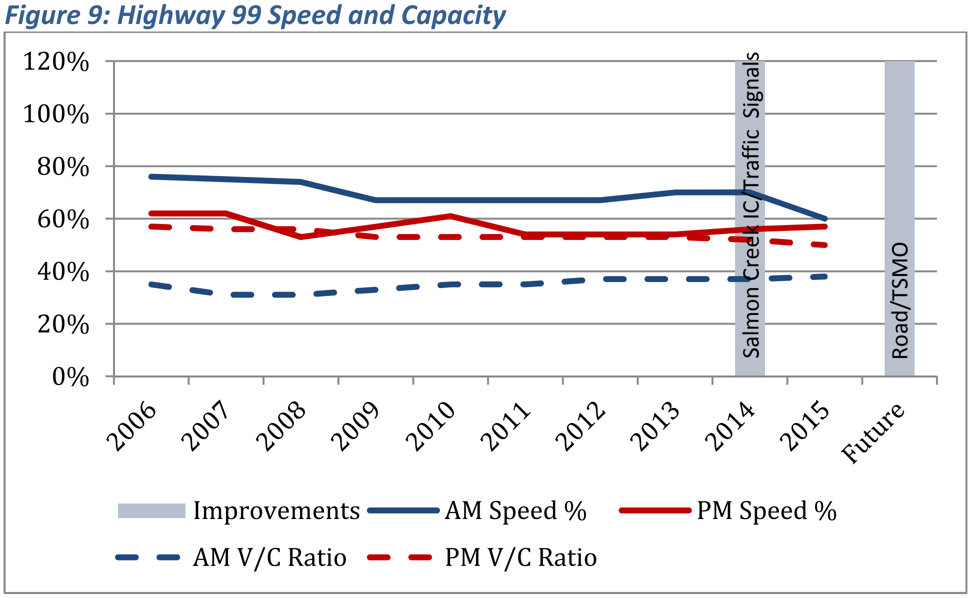
Figure 8: I-5 Central Speed and Capacity



Highway 99, 139th Street to I-5

The evening speed indicates potential corridor-wide congestion. Future corridor enhancements include select road improvements, TSMO, and transit projects.

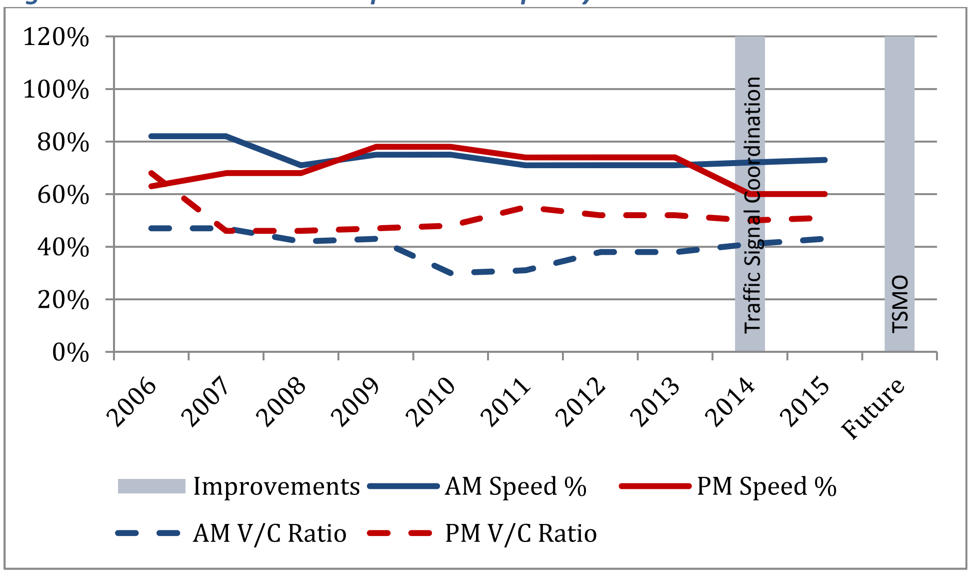
Figure 9: Highway 99 Speed and Capacity



Hazel Dell Avenue, Highway 99 to 63rd Street

Neither speed nor capacity indicates a pattern of potential corridor-wide congestion. Future corridor improvements include TSMO projects.

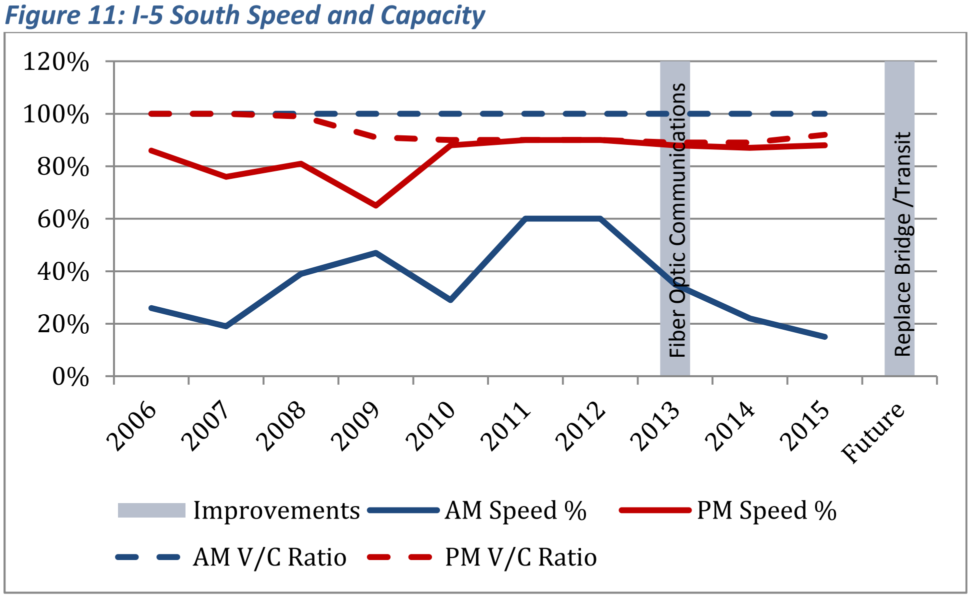
Figure 10: Hazel Dell Avenue Speed and Capacity



I-5 South, Main Street to Jantzen Beach

Morning speed and capacity indicate a pattern of corridor-wide congestion. Future corridor improvements include a new I-5 Bridge, interchange replacements, and added transit capacity. In the short-term the region needs to focus on Transportation Demand Management (TDM) and Transportation System Management (TSM) solutions to get the most out of the existing corridor.

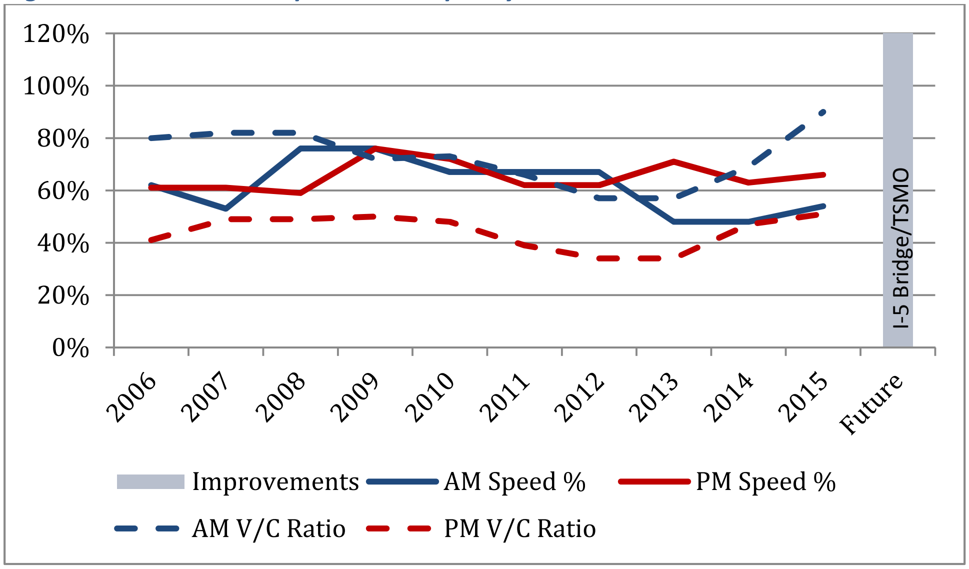
Figure 11: I-5 South Speed and Capacity



Main Street, I-5 to Mill Plain

Morning speed and capacity congestion indicates a pattern of corridor-wide congestion, as trips divert from the congested I-5 corridor. Future corridor improvements include I-5 Bridge replacement and TSMO projects.

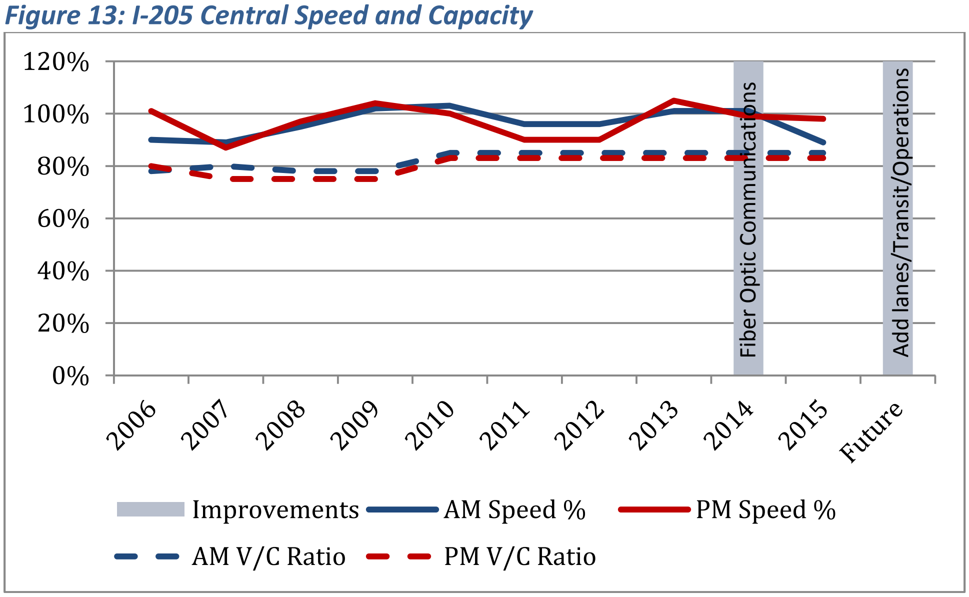
Figure 12: Main Street Speed and Capacity



I-205 Central, I-5 to SR-500

Corridor data indicates a very busy corridor that is near capacity. Future corridor improvements include addition of travel lanes, transit, operational, and interchange projects.

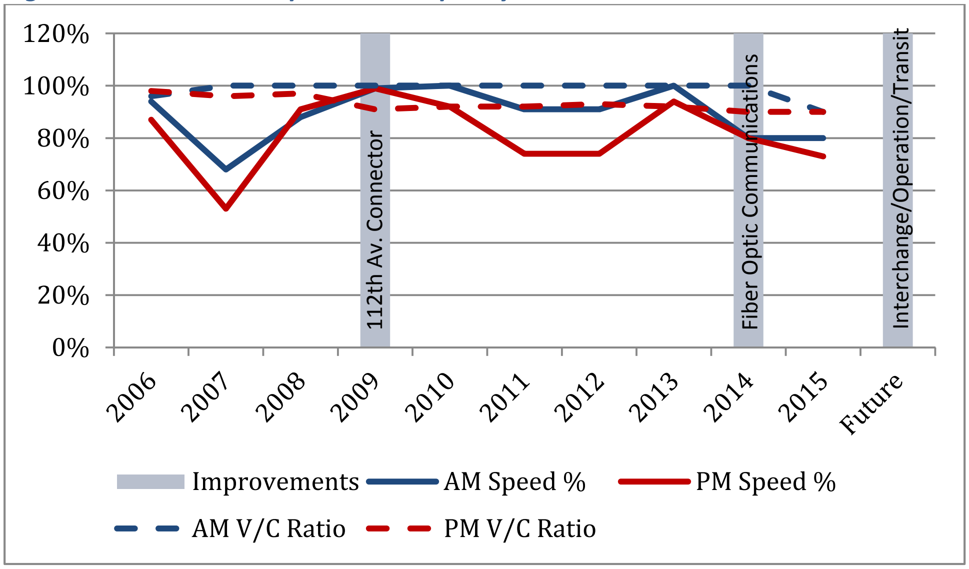
Figure 13: I-205 Central Speed and Capacity



I-205 South, SR-500 to Airport Way

Corridor data indicates capacity congestion and significant variation of speed. Future corridor improvements include a new interchange, travel lanes, transit, and TSMO projects. WSDOT will complete a new interchange at 18th Street in 2017.

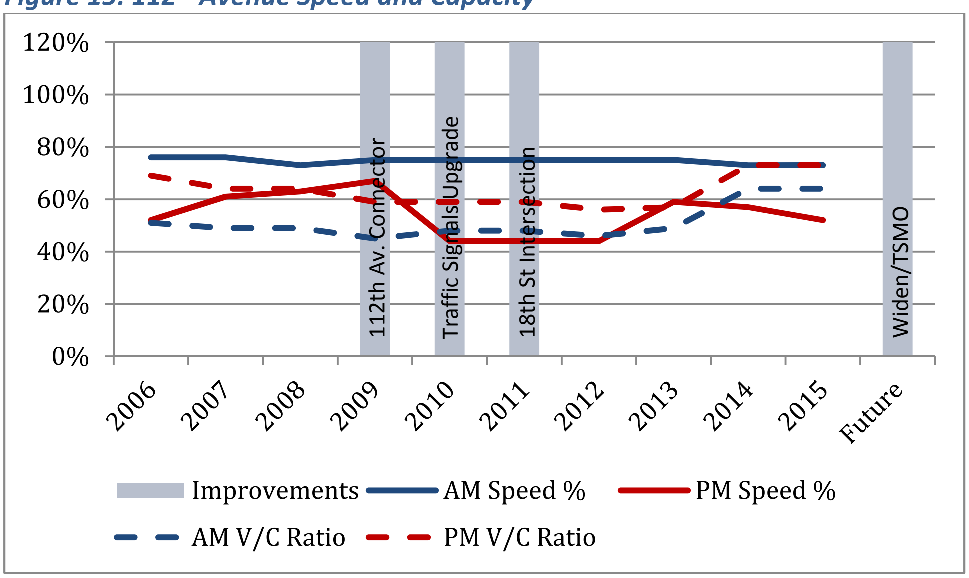
Figure 14: I-205 South Speed and Capacity



112th Avenue, SR-500 to Mill Plain

Evening speed indicates potential corridor-wide congestion. Future corridor improvements include widening of narrow travel lanes and TSMO projects.

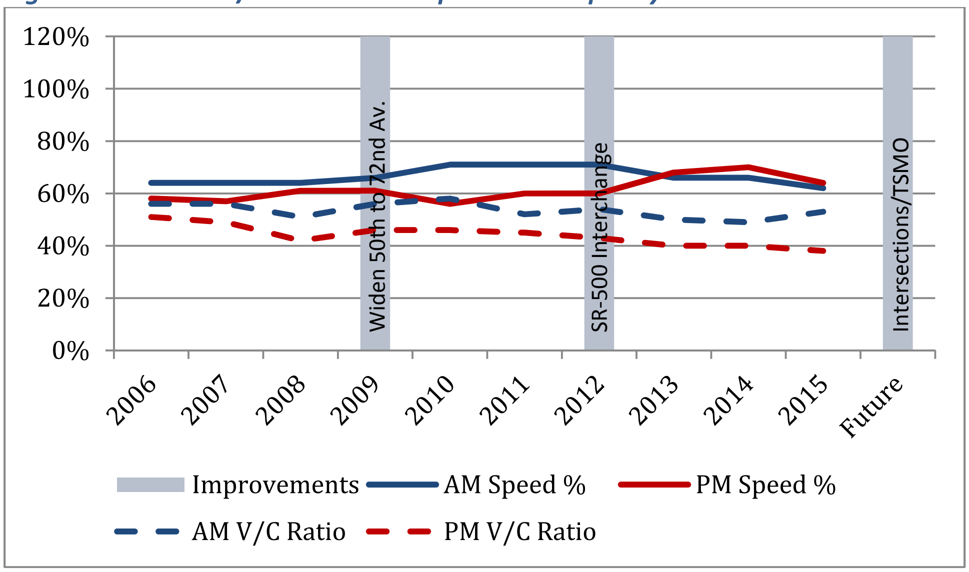
Figure 15: 112th Avenue Speed and Capacity



St. Johns/Ft. Vancouver, 72nd Avenue to Mill Plain

Both morning and evening speeds indicate some congestion in the corridor. Future corridor improvements include intersection and TSMO projects.

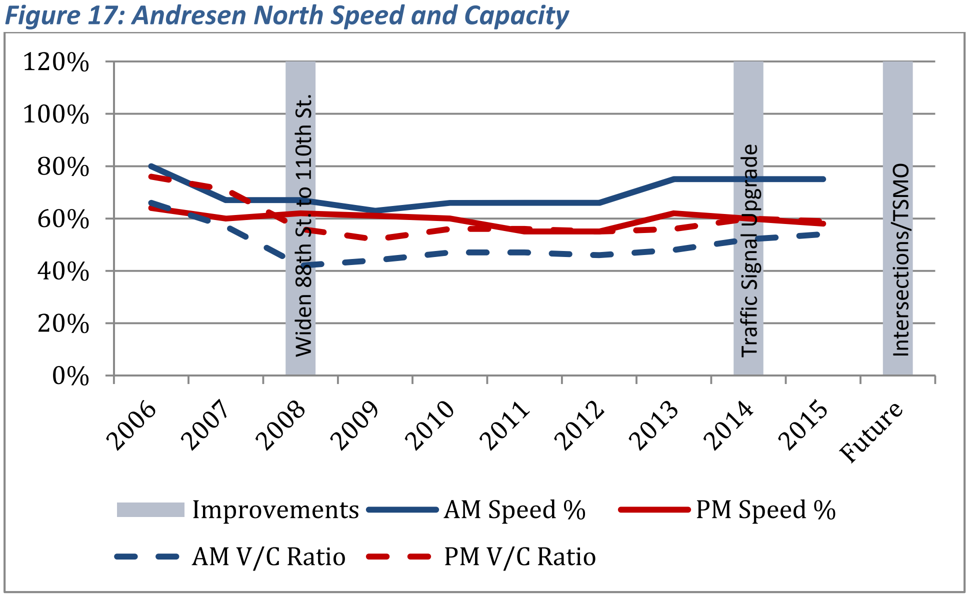
Figure 16: St. Johns/Ft. Vancouver Speed and Capacity



Andresen North, 119th Street to SR-500

Evening speed indicates potential corridor-wide congestion. Future corridor improvements include intersection and TSMO projects.

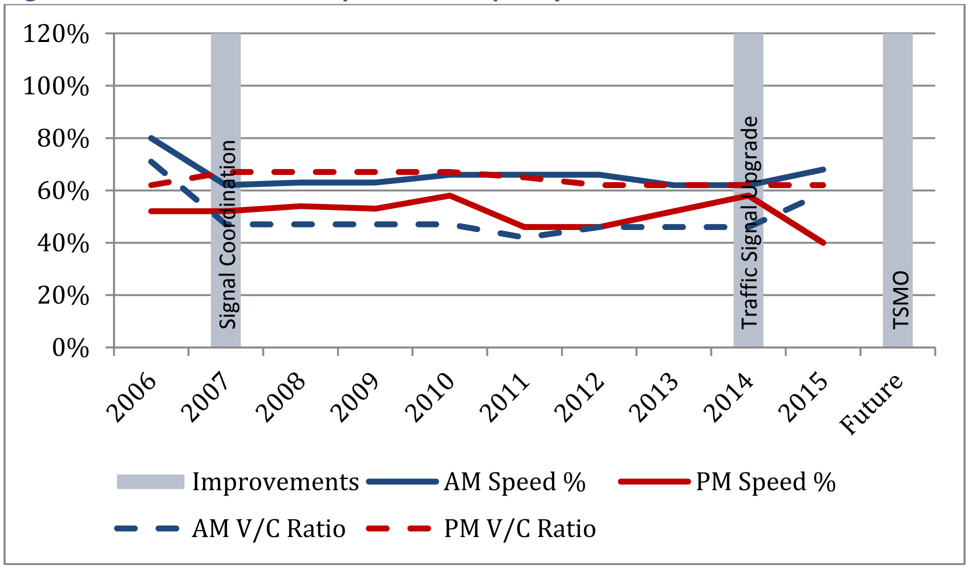
Figure 17: Andresen North Speed and Capacity



Andresen South, SR-500 to Mill Plain

Evening speed in 2015 indicates potential corridor-wide congestion. Future corridor improvements include TSMO projects.

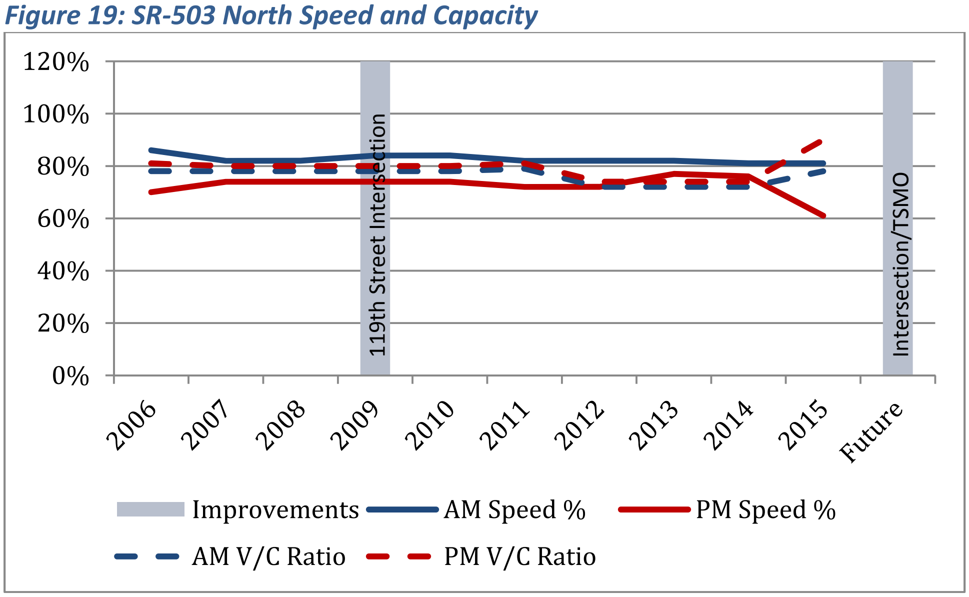
Figure 18: Andresen South Speed and Capacity



SR-503 North, SR-502 to 119th Street

In 2015, this corridor showed a significant increase in evening capacity congestion and decrease in speed. All of which demonstrate evening corridor wide congestion. Future corridor projects include SR-502/SR-503 Intersection improvement and TSMO projects.

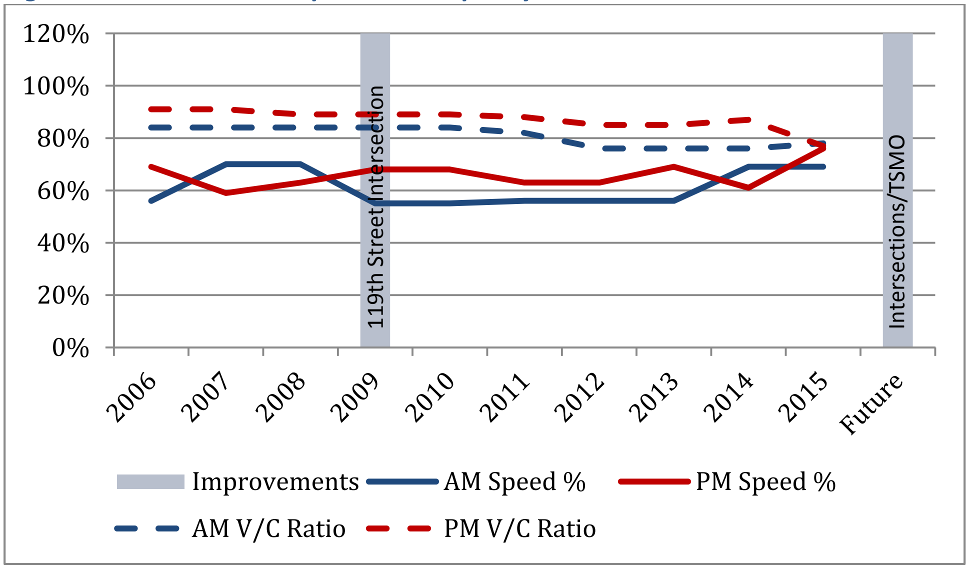
Figure 19: SR-503 North Speed and Capacity



SR-503 South, 119th Street to Fourth Plain

This is a very busy corridor that indicates corridor-wide congestion associated with capacity. Future corridor improvements include 99th Street & Fourth Plain intersections, access management, and TSMO projects.

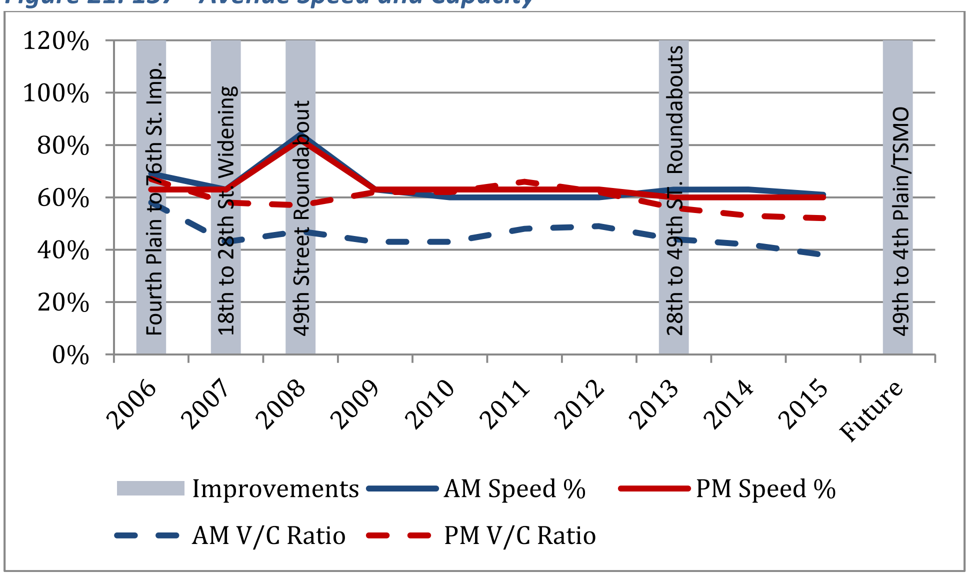
Figure 20: SR-503 South Speed and Capacity



137th Avenue, Padden Parkway to Mill Plain

Although, capacity does not indicate potential corridor-wide congestion, speeds are approaching a level that can lead to congestion. Future corridor projects include road improvements between 49th Street and Fourth Plain and TSMO improvements.

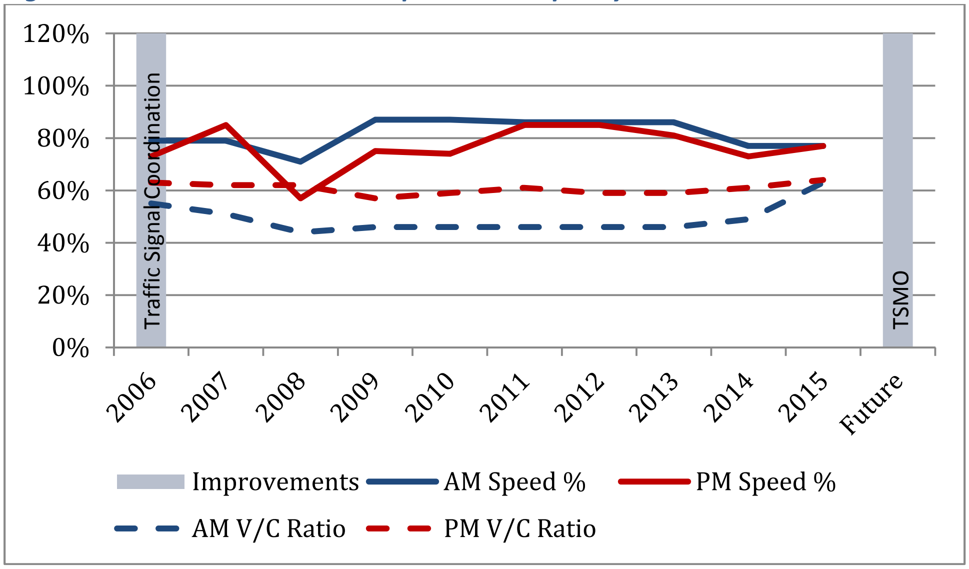
Figure 21: 137th Avenue Speed and Capacity



162nd Avenue North, Ward Road to Mill Plain

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include TSMO projects.

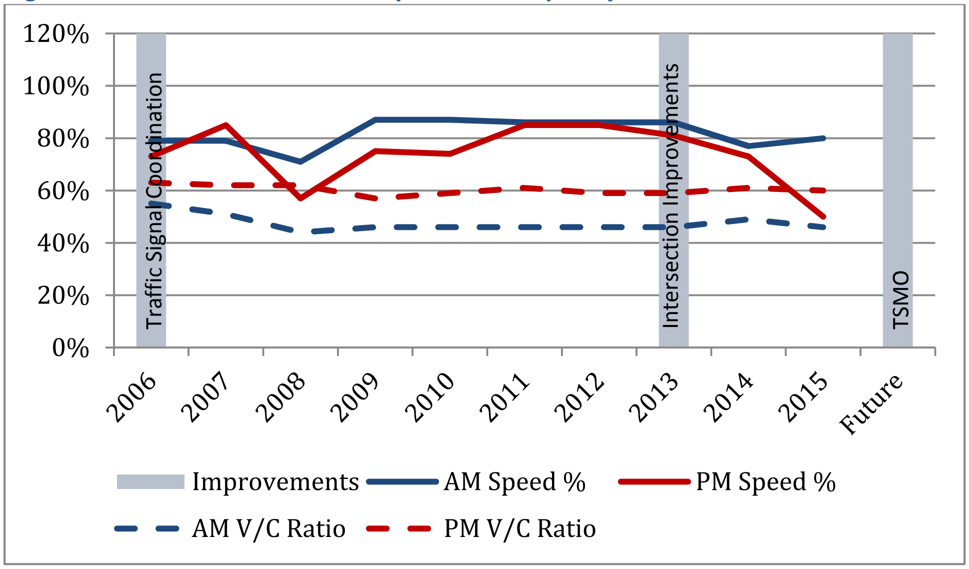
Figure 22: 162nd Avenue North Speed and Capacity



164th Avenue South, Mill Plain to SR-14

In 2015, evening speed showed a sharp decile to congested levels. Evening speeds should be monitored to see if this becomes a trend. Future corridor improvements include TSMO projects.

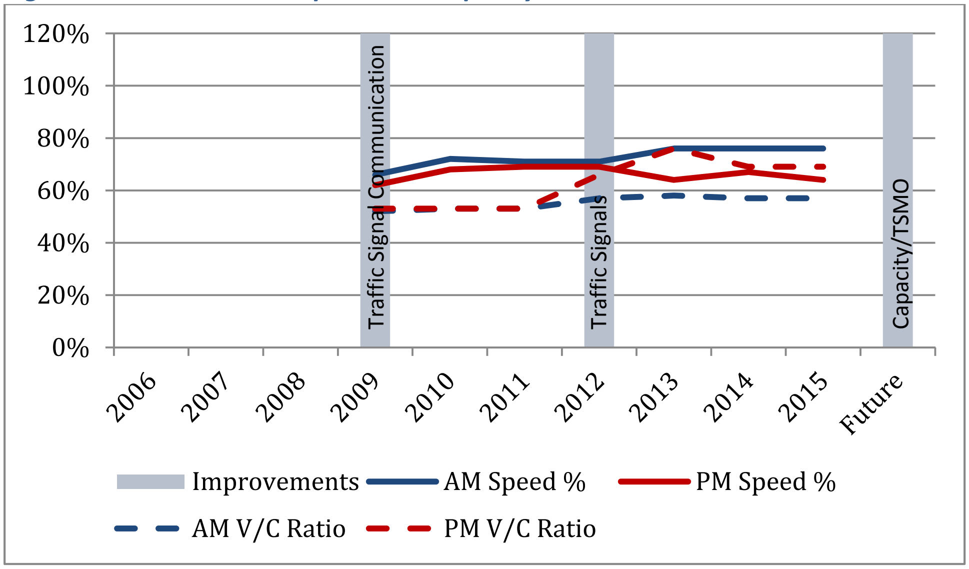
Figure 23: 164th Avenue South Speed and Capacity



192nd Avenue, Padden Parkway to Mill Plain

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include road widening between NE 1st Street and NE 18th Street and TSMO projects.

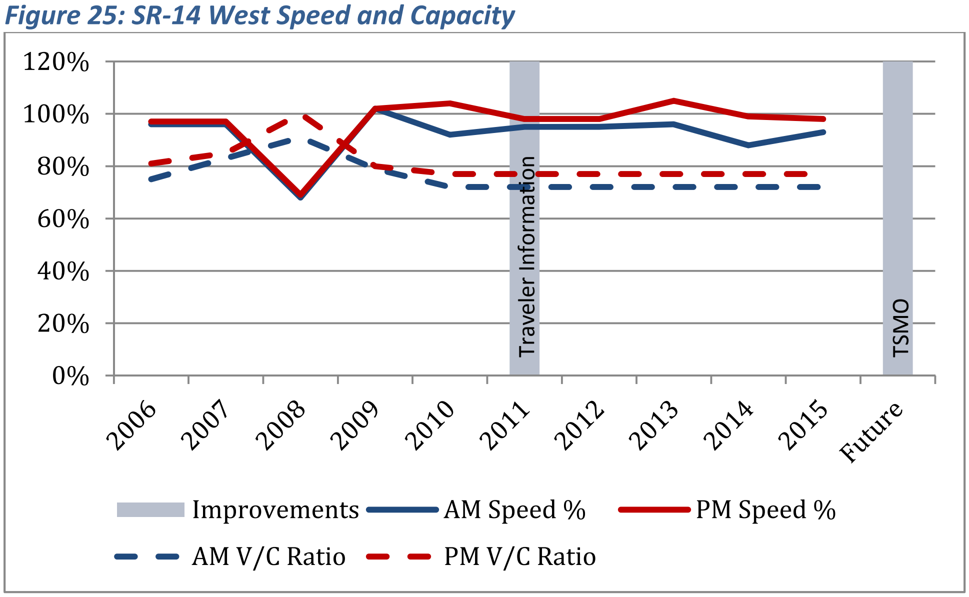
Figure 24: 192nd Avenue Speed and Capacity



SR-14 West, I-5 to I-205

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include TSMO projects.

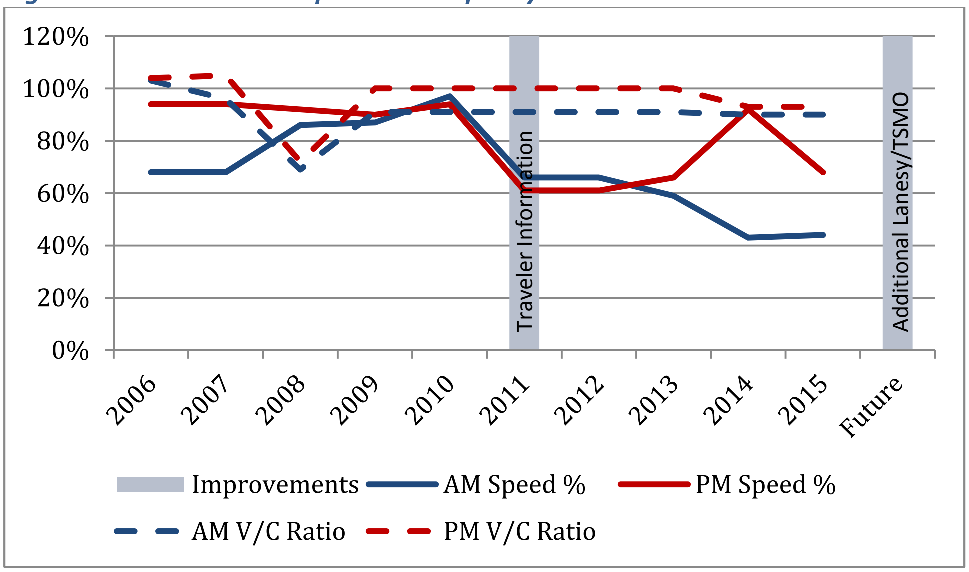
Figure 25: SR-14 West Speed and Capacity



SR-14 Central, I-205 to 164th Avenue

Both speed and capacity indicate corridor-wide congestion. Future corridor improvements include additional lanes, transit, and TSMO projects.

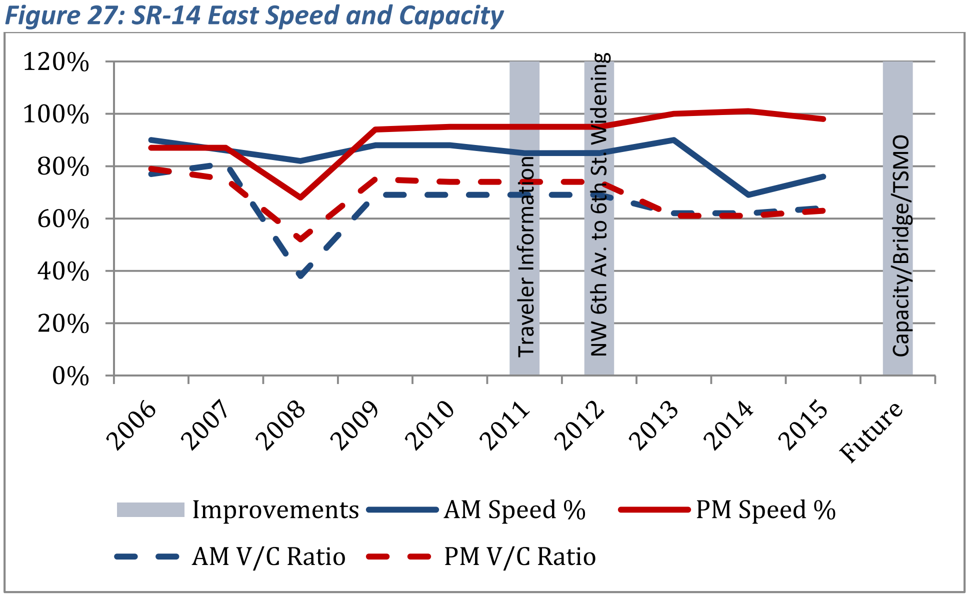
Figure 26: SR-14 Central Speed and Capacity



SR-14 East, 164th Avenue to County Line

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include added access and capacity east of 6th Street, replacement of West Camas Slough Bridge, and TSMO projects.

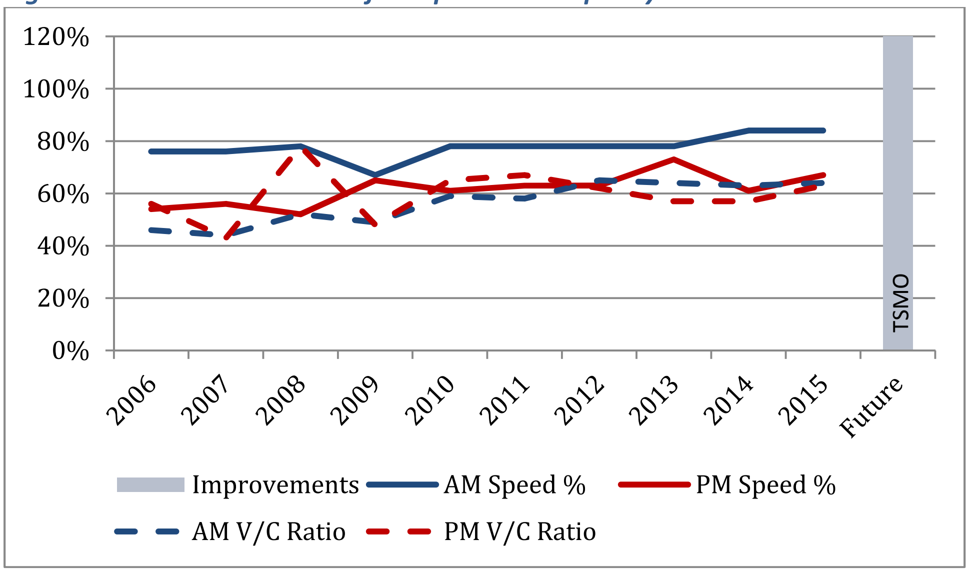
Figure 27: SR-14 East Speed and Capacity



Fourth Plain, I-5 to Port of Vancouver

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include TSMO projects.

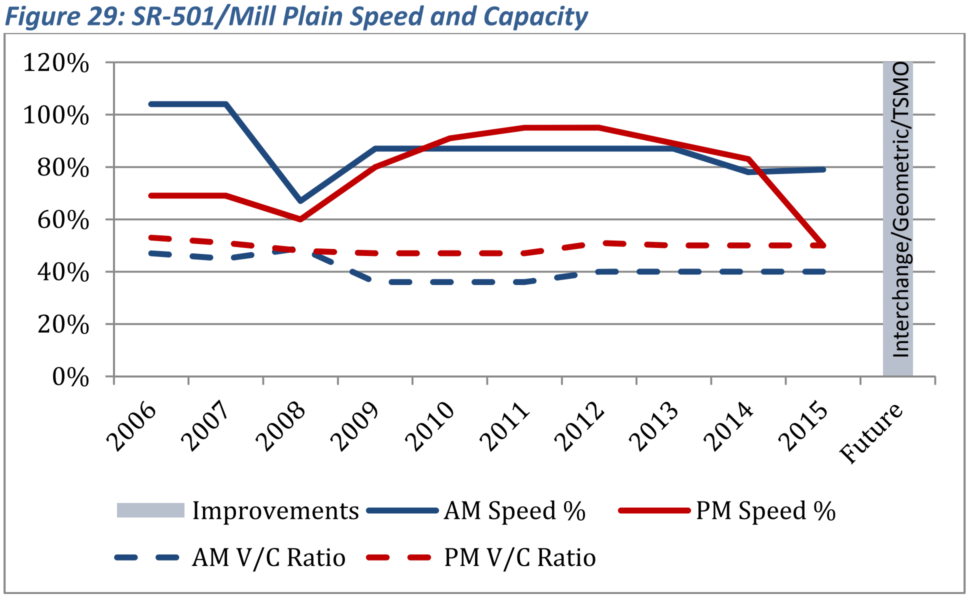
Figure 28: Fourth Plain west of I-5 Speed and Capacity



SR-501/Mill Plain, I-5 to Fourth Plain

In 2015, evening speed indicates congestion. Analysis of the corridor showed significant congestion near Columbia Street, where a new apartment complex was under construction. Future corridor improvements include both road and interchange modifications to improve freight movement.

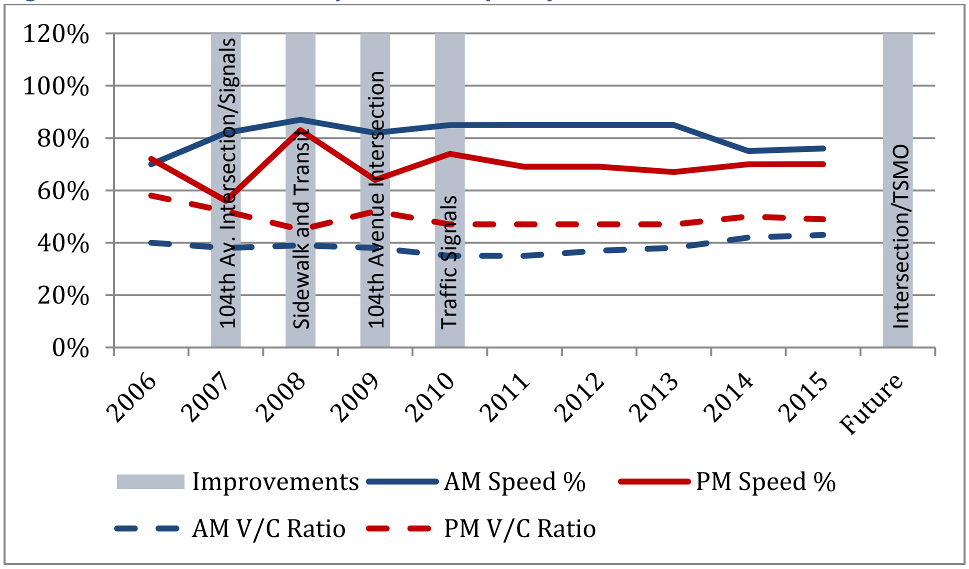
Figure 29: SR-501/Mill Plain Speed and Capacity



Mill Plain West, I-5 to I-205

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include 104/105th Intersection realignment and TSMO projects.

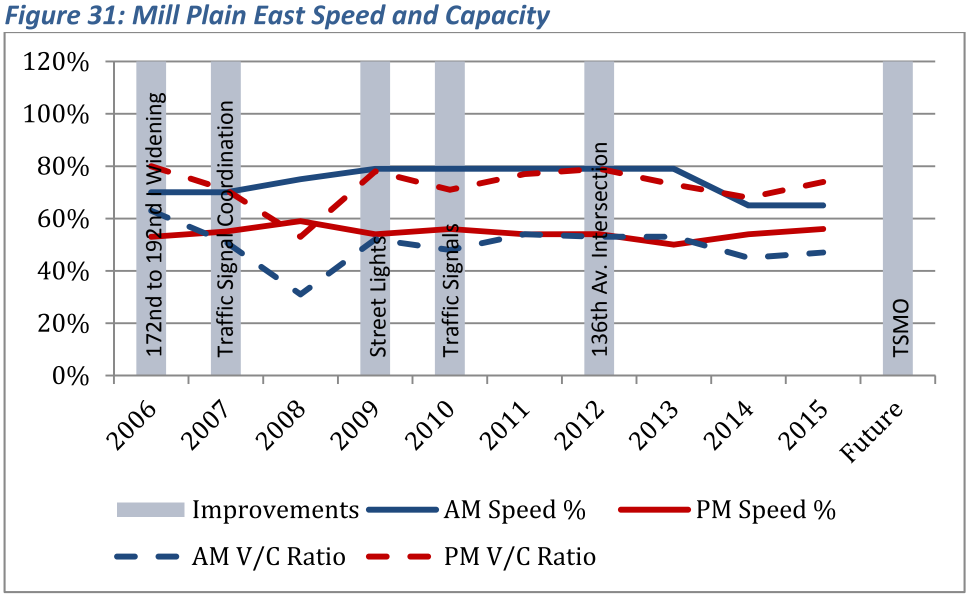
Figure 30: Mill Plain West Speed and Capacity



Mill Plain East, I-205 to 192nd Avenue

Evening speed indicates potential corridor-wide congestion. Future corridor improvements include TSMO projects.

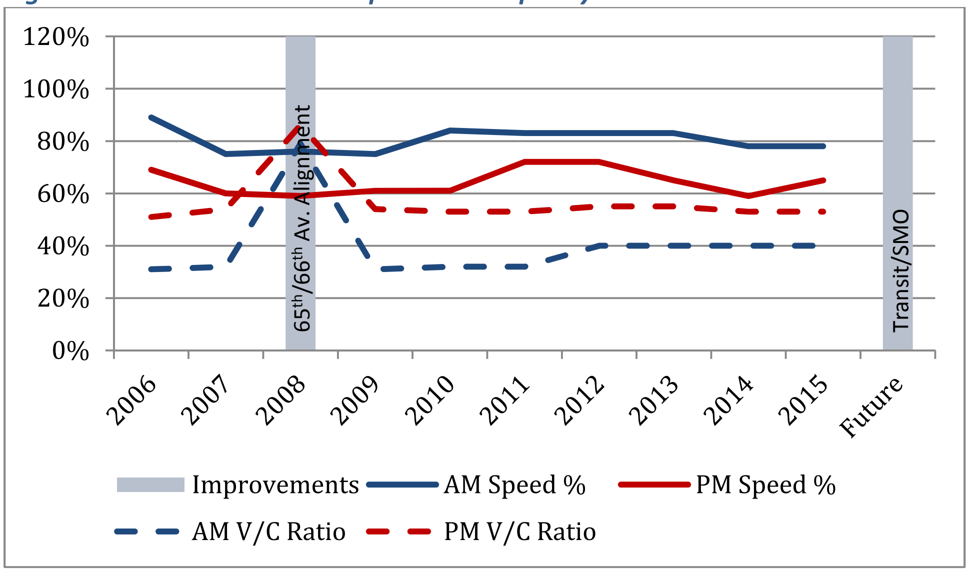
Figure 31: Mill Plain East Speed and Capacity



Fourth Plain West, I-5 to Andresen Road

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include transit and TSMO projects.

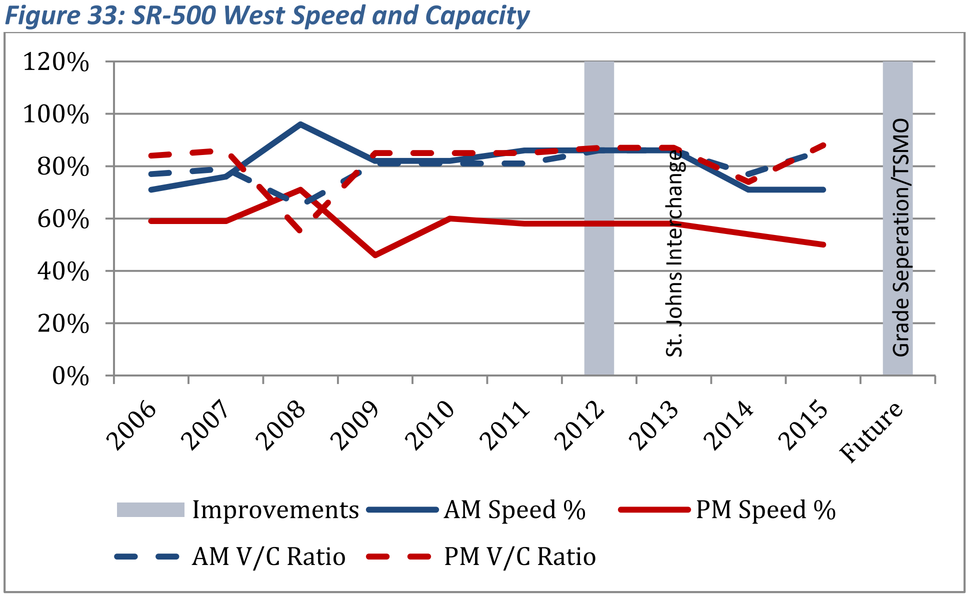
Figure 32: Fourth Plain West Speed and Capacity



SR-500 West, I-5 to Andresen Road

Evening speed and capacity congestion indicates corridor-wide congestion. Future corridor improvements include grade separation at 42nd and 54th Avenues, and TSMO projects.

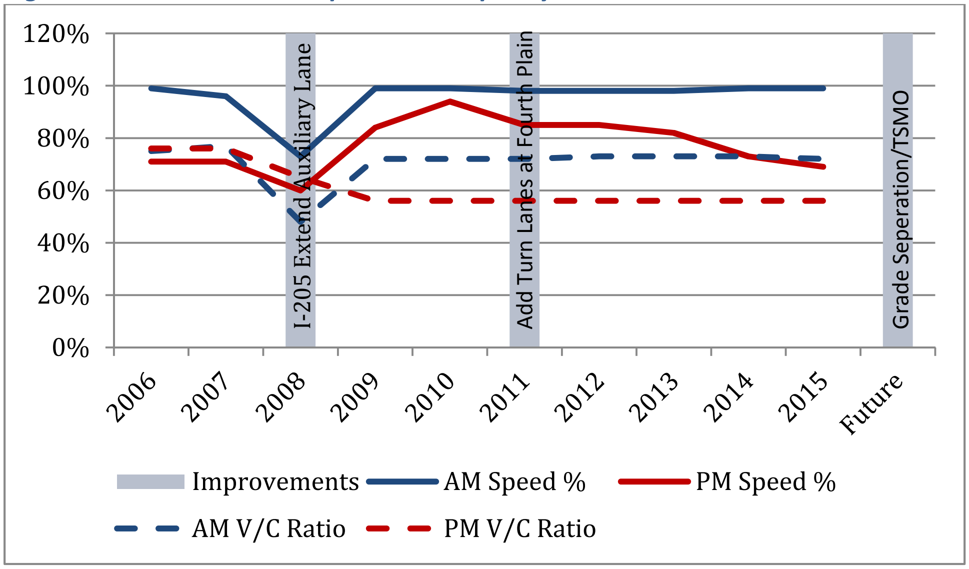
Figure 33: SR-500 West Speed and Capacity



SR-500 Central, Andresen Road to SR-503/Fourth Plain

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include grade separation at Fourth Plain, auxiliary lanes, and TSMO projects.

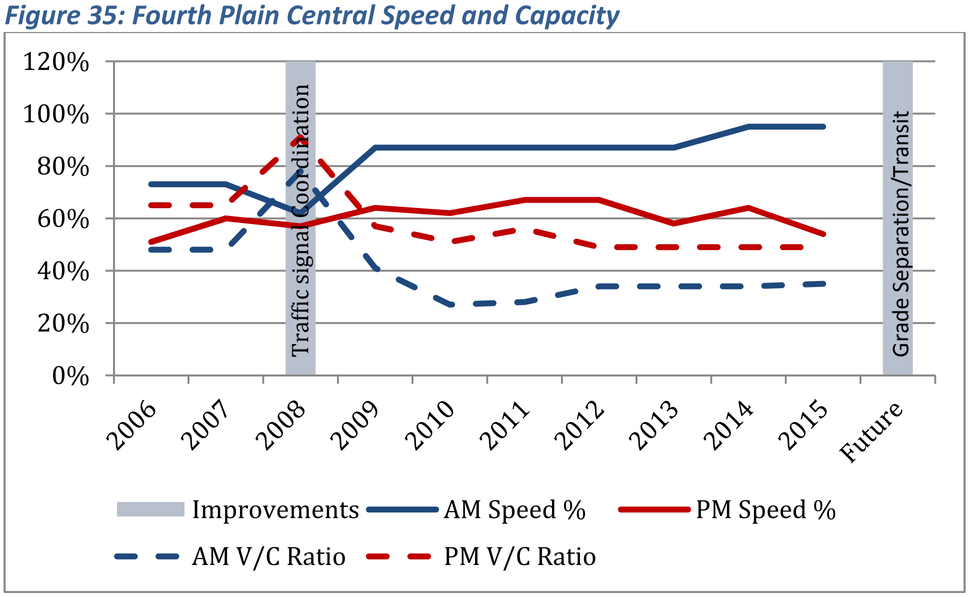
Figure 34: SR-500 Central Speed and Capacity



Fourth Plain Central, Andresen Road to SR-503

Evening speed indicates potential corridor-wide congestion. Future corridor improvements include grade separation at SR-500/Fourth Plain intersection, transit, and TSMO projects.

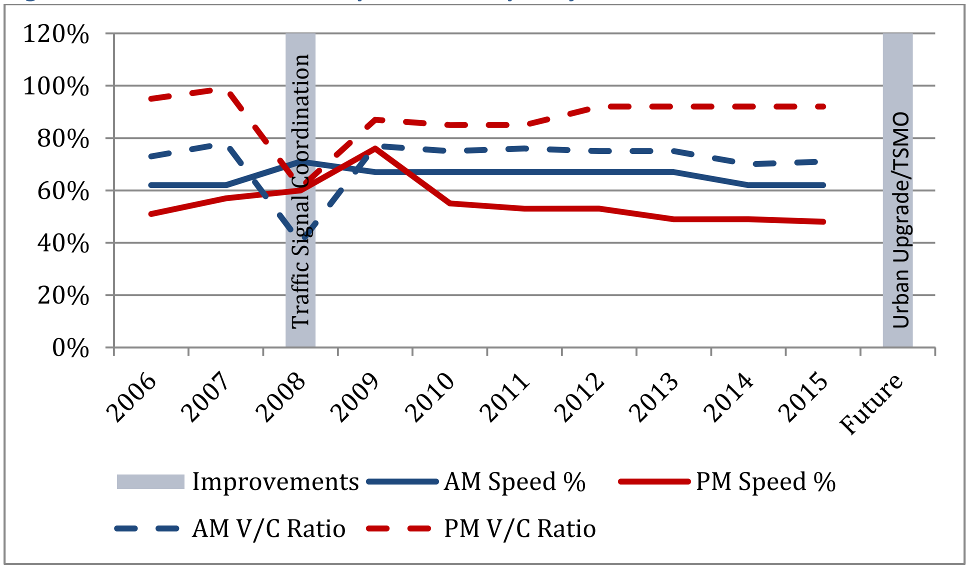
Figure 35: Fourth Plain Central Speed and Capacity



Fourth Plain East, SR-503 to 162nd Avenue

Both evening speed and capacity indicates potential corridor-wide congestion. Future corridor improvements include grade separation at Fourth Plain, Urban upgrade of full corridor, transit, and TSMO projects.

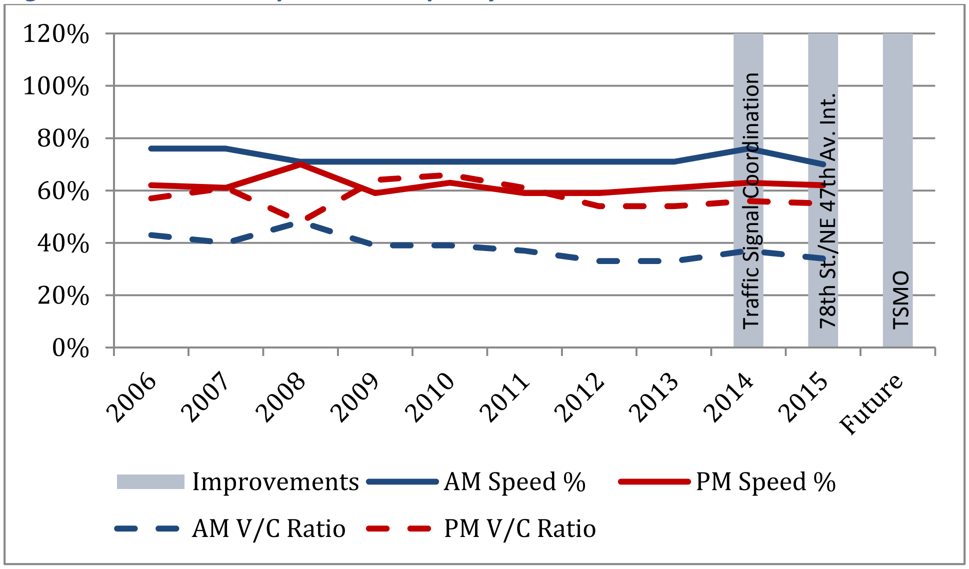
Figure 36: Fourth Plain East Speed and Capacity



78th Street, Lake Shore Avenue to SR-503

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include TSMO projects.

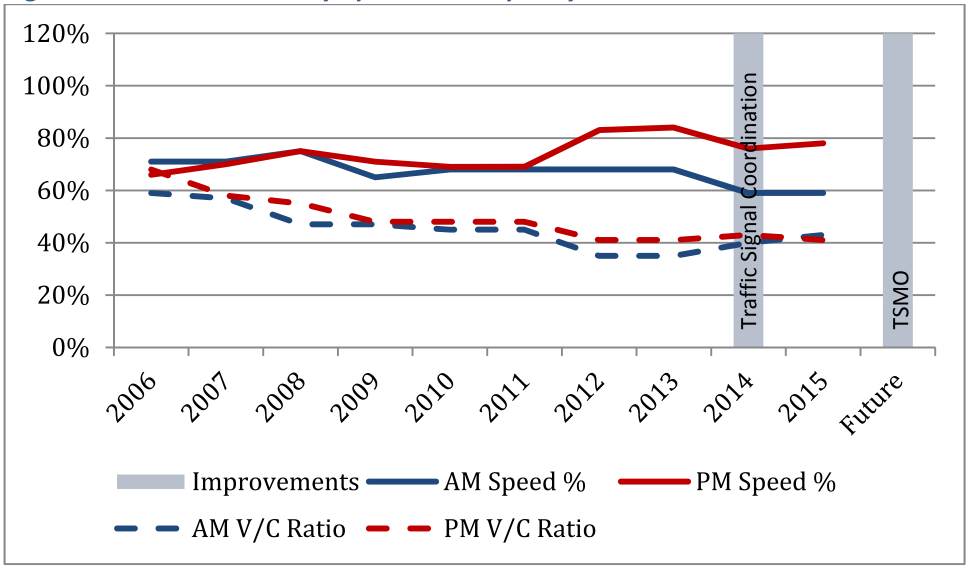
Figure 37: 78th Street Speed and Capacity



Padden Parkway, 78th Street to Ward Road

Evening speed indicates some congestion in the corridor. Future corridor improvements include TSMO projects.

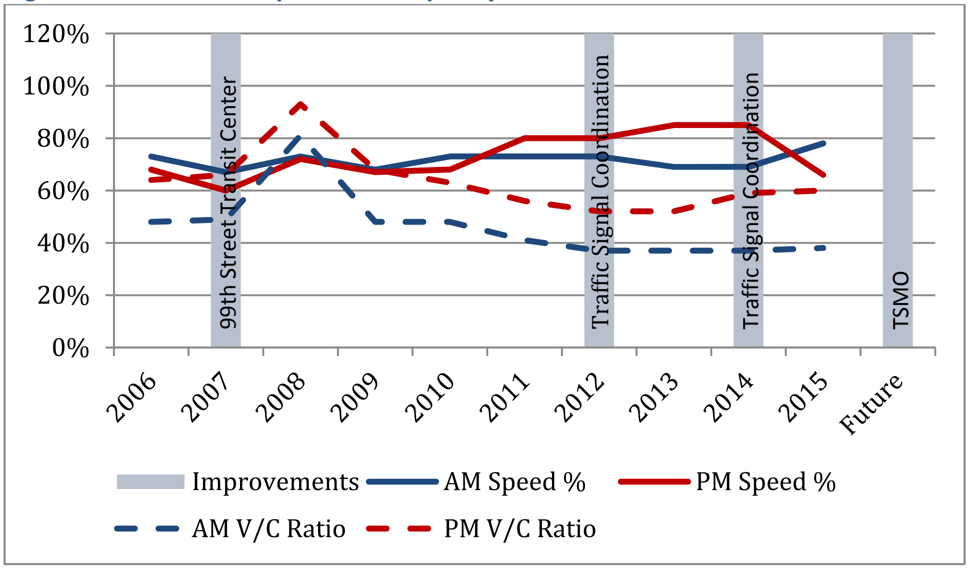
Figure 38: Padden Parkway Speed and Capacity



99th Street, Lake Shore Avenue to St. Johns Boulevard

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include TSMO projects.

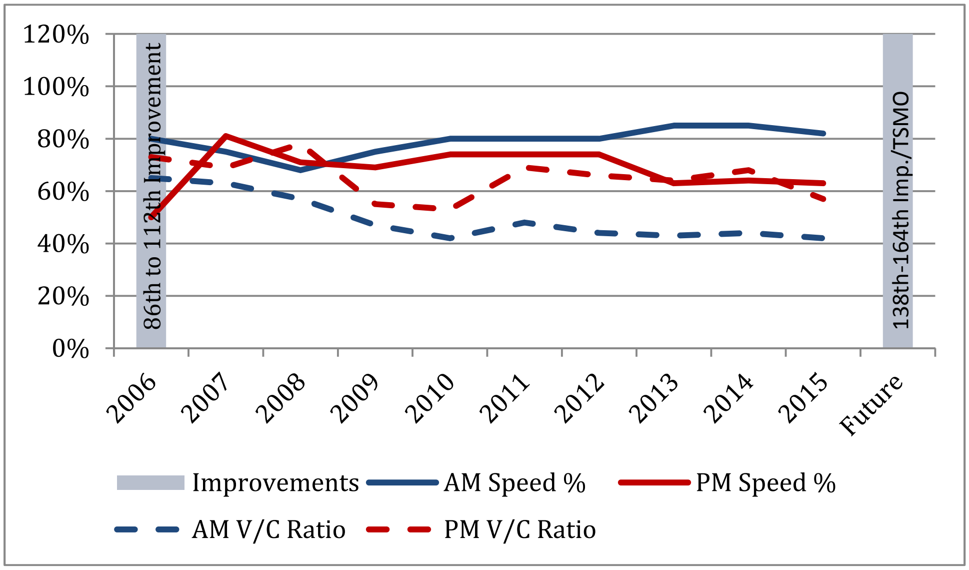
Figure 39: 99th Street Speed and Capacity



Burton Road, Andresen Road to 162nd Avenue

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements from 138th Av. to 164th Av. and TSMO projects.

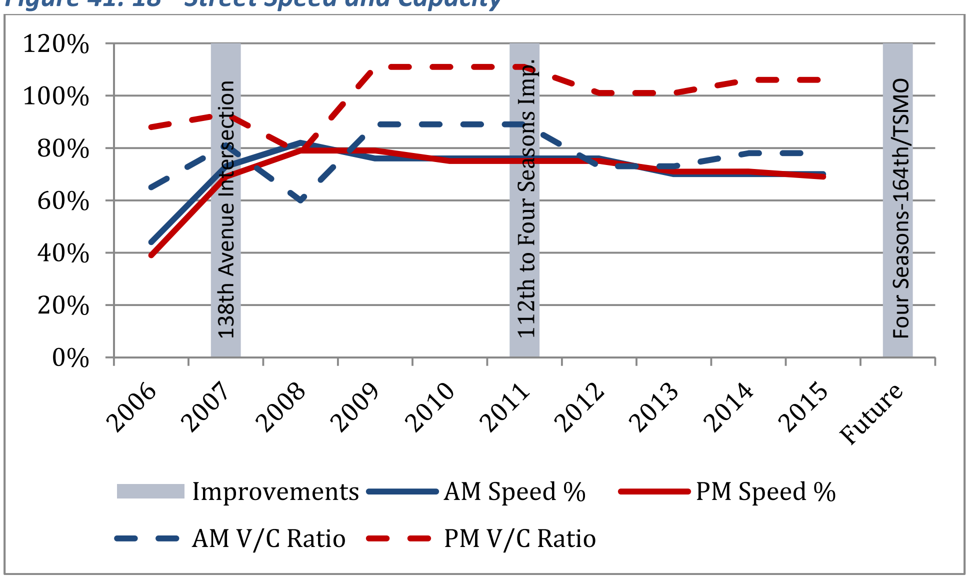
Figure 40: Burton Road Speed and Capacity



18th Street, 112th Avenue to 162nd Avenue

Evening capacity indicates potential corridor-wide congestion. With the completion of a new I-205 interchange at 18th Street in 2017, both speed and capacity are likely to worsen. Widening from Four Seasons to 136th Av. should begin in 2016. Future corridor improvements include improving 138th Avenue to 162nd Avenue, transit, and TSMO projects.

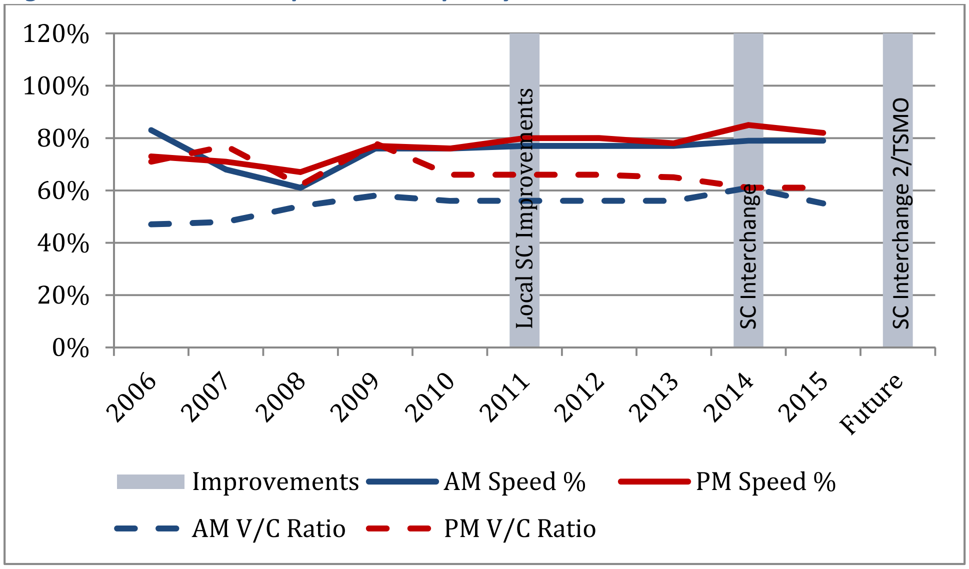
Figure 41: 18th Street Speed and Capacity



134th Street, 139th Street to 50th Avenue

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include Salmon Creek Interchange Phase 2, Salmon Creek Avenue improvements from WSU Entrance to NE 50th Avenue, and TSMO projects.

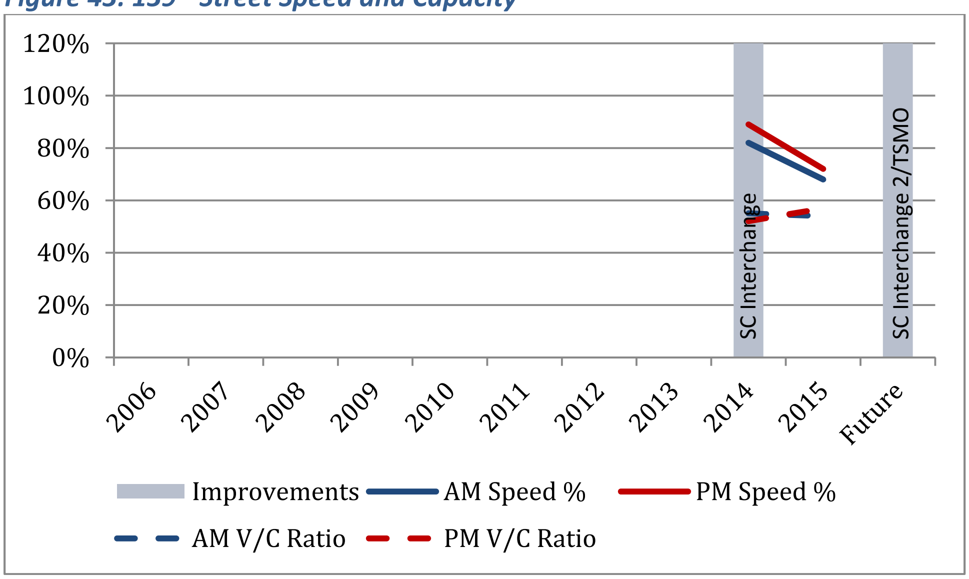
Figure 42: 134th Street Speed and Capacity



139th Street, NW 36th Avenue to NE 29th Avenue

Neither speed nor capacity indicates potential corridor-wide congestion. Future corridor improvements include Salmon Creek Interchange Phase 2 and TSMO projects.

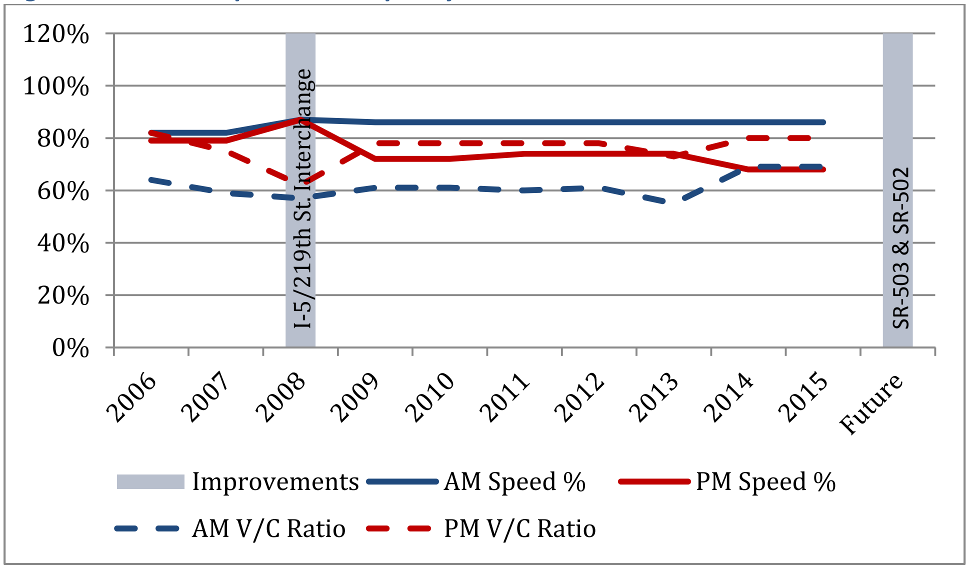
Figure 43: 139th Street Speed and Capacity



SR-502, I-5 to SR-503

Neither speed nor capacity indicates potential corridor-wide congestion. WSDOT is currently widening the corridor. Future corridor improvements include SR-502/SR-503 Intersection improvements.

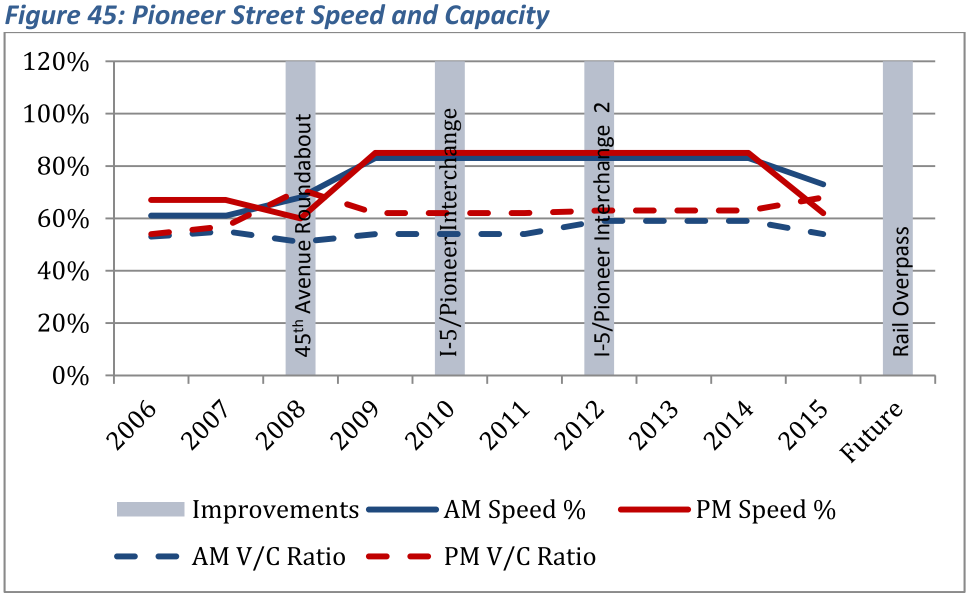
Figure 44: SR-502 Speed and Capacity



Pioneer Street (SR-501), I-5 to 9th Street

Neither speed nor capacity indicates potential corridor-wide congestion. In 2015 the corridor experienced a sharp decline in speed, because the road was narrowed to one lane due to a slide. Future corridor improvements include extension of Pioneer Street over the railroad tracks west of downtown Ridgefield.

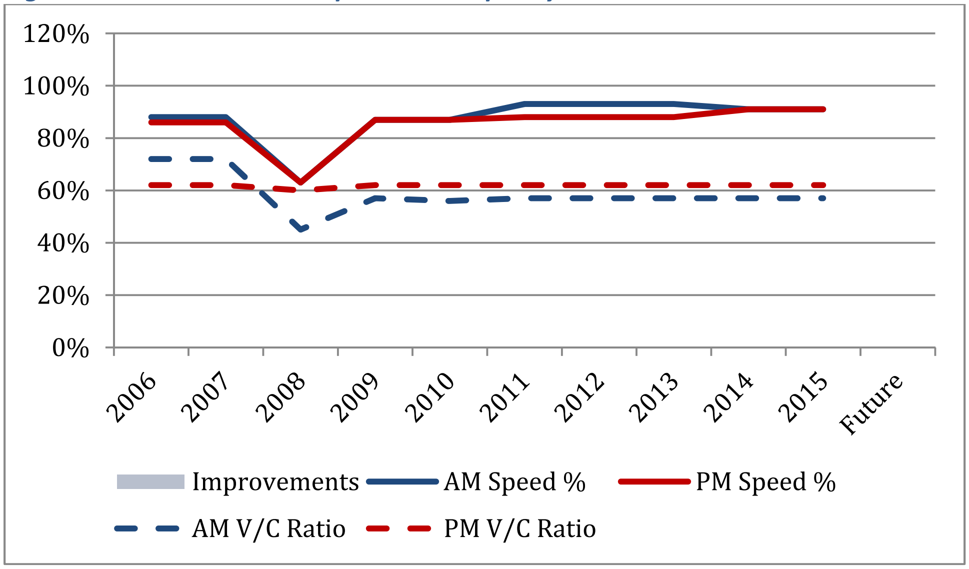
Figure 45: Pioneer Street Speed and Capacity

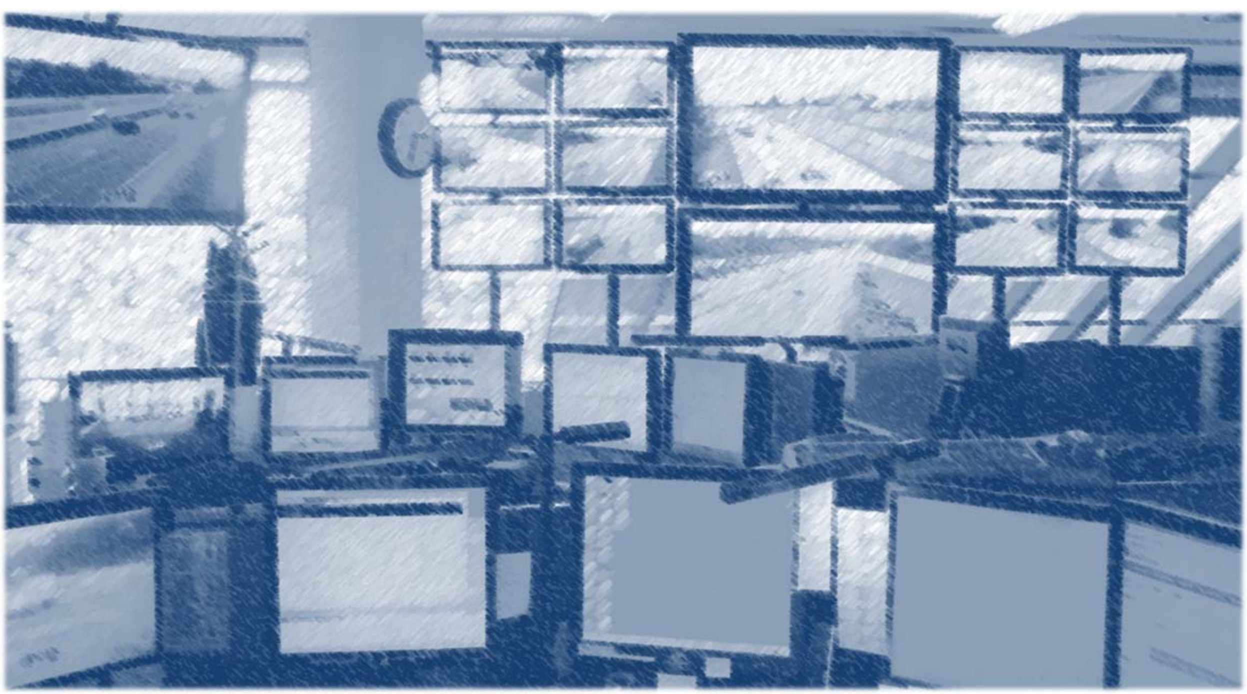


La Center Road, I-5 to East Fork of Lewis River

Neither speed nor capacity indicates potential corridor-wide congestion. No Future corridor improvements are planned.

Figure 46: La Center Road Speed and Capacity





Corridor Deficiencies

The corridor analysis shows that the region needs to continue to focus on operational improvements, and select capacity improvements, and address strong demand for bi-state travel. Table 9 identifies the corridors that should be the focus of capacity and speed reliability improvements:

Table 9: Corridors with Capacity and/or Speed Deficiencies

Corridor	Capacity	Speed	Need
Highway 99		X	Select road improvements, transit, and TSMO
I-5 South	X	X	I-5 Bridge Replacement, Interchanges, Transit, TSMO
Main Street	X	X	I-5 Bridge Replacement, Transit, and TSMO
I-205 South	X	X	Interchanges, lanes, Transit, and TSMO
112th Avenue		X	Widen Travel Lanes and TSMO
St. Johns		X	Intersection, capacity, and TSMO
Andresen North		X	Intersection Improvements and TSMO
Andresen South		X	TSMO
SR-503 North	X	X	SR-502/SR-503 Intersection and TSMO
SR-503 South	X		Intersections, Access Management, and TSMO
137th Avenue		X	Widen 49th St. to Fourth Plain and TSMO
SR-14 Central	X	X	Additional Travel Lanes and TSMO
Mill Plain East		X	TSMO
SR-500 West		X	Grade Separation at 42nd and 54th Avenues and TSMO
Fourth Plain Central		X	Transit and TSMO
Fourth Plain East	X	X	Fourth Plain/SR-500 Intersection, Urban Upgrade, TSMO
Padden Parkway		X	Intersection Improvements and TSMO
18th Street	X		Add Travel Lanes

Key Strategies

The Congestion Management Process shows that implementation of the 20-year Regional Transportation Plan (RTP) can address most of the corridor congestion needs over the next 20 years. The lack of transportation revenues and regional consensus for the I-5 Bridge replacement along with other key corridors, is contributing to worsening traffic conditions. Lack of progress on implementing select projects will result in delay in achieving the project benefits and add to future project costs.

The region should consider implementing low cost system operation and management strategies where long-term improvements have been delayed. There is an immediate need to implement additional low-cost strategies for the I-5 South Corridor as an interim response to increased bi-state travel demand.

The following are key solutions to address congestion needs within Clark County:

Table 10: Key Congestion Needs

Identified Needs	In RTP	Funded
I-5 Interstate Bridge and interchanges	✓	
I-5/Mill Plain Interchange (2026 Construction)	✓	✓
I-5/I-205/SR-500/SR-503 Corridor Operational Improvements	✓	
I-205, SR-500 to Padden Widening	✓	
I-205/SR-14 Interchange	×	
SR-14, I-205 to 164th Av. Widening	✓	
SR-500/42nd & 54th Av. Grade Separation	✓	
SR-502 Widening (Under Construction)	✓	✓
Fourth Plain, 117th to 164th Av. Operational Improvements	✓	
Mill Plain, I-205 to 192nd Av. Operational Improvements	✓	
NE 18th Street Widening, 112th to 164th Av (P) 18th St, Four Season to 136th Av (2017 Construction)	✓	(P) ✓
NE 112th Av., 49th St. to SR-500 Operational Improvements	✓	
Padden Parkway Intersection Improvements (P) Padden/94th Av. Intersection (Under Construction)	✓	(P) ✓
Bi-State Transit Expansion/Operational Improvements	✓	
Other Select Intersection Improvements	✓	
Other Select Operational/Capacity Improvements	✓	

Chapter 4: Bi-State

Clark County is situated in Southwest Washington State, across the Columbia River from Portland, Oregon. As a suburb of the Portland metropolitan area, significant population growth has occurred within Clark County, while substantial growth in employment has occurred throughout the Portland metropolitan area. This results in a large number of commuters traveling between Clark County and Portland. Approximately 31% of Clark County's workforce travels to the Portland metropolitan area for employment.

Bi-State Corridors

The demand between Clark County and Portland has placed significant pressure on the only two Columbia River Bridges (I-5 and I-205) between Clark County, Washington and Portland, Oregon.

The I-5 Interstate Bridge is a steel truss lift bridge that spans the Columbia River between downtown Vancouver and Portland. The northbound span was opened in 1917, and the southbound span was added in 1958, each span carries three lanes. This bridge is a bottleneck to both auto and river traffic. Bridge lifts occur approximately 15 times per month in off peak periods, with each lift lasting approximately 10 minutes and often results in over an hour of traffic congestion. Due to peak period congestion, bridge lifts, and other incidents the Interstate Bridge experiences auto congestion five to eight hours a day.

The Glenn L. Jackson Memorial Bridge, or I-205 Bridge, is a segmental concrete bridge that spans the Columbia River between eastern Vancouver and eastern Portland. It is a twin structure with four lanes in each direction and a 9-ft wide bicycle and pedestrian path in between. The I-205 Bridge opened for traffic in December 1982.

Bi-State Traffic Volumes

The demand for bi-state travel has increased each year over the last five years. In 2015, over 294,000 vehicles crossed the two bi-state bridges on an average day, up from 273,000 vehicles in year 2011.

Table 11: 2011-2015 Columbia River Crossings

Year	I-5	I-205	Total	Growth
2011	128,115	145,054	273,169	**0.4%**
2012	128,373,	145,440	273,813	**0.2%**
2013	130,511	148,152	278,663	**1.7%**
2014	132,592	151,735	284,327	**2.2%**
2015	135,696	158,409	294,105	**3.3%**

A review of key traffic data stations within the Portland metropolitan area shows that the I-205 Glenn Jackson Bridge has the highest total daily volume and the I-5 Interstate Bridge has the highest density of traffic per travel lane.

Table 12: 2015 Regional Traffic Volumes

Location	Total Volume	Volume Per Lane
I-5/Columbia River	136,321	**22,720**
I-205/Columbia River	**161,738**	20,217
I-205/Columbia Blvd	128,960	21,493
I-5/Terwilliger	117,913	19,652
I-84/Hollywood	133,891	22,315
Hwy 26/Tunnel	132,213	19,350

Bi-State Travel Speed

A review of ODOT and WSDOT data stations along both the I-5 and I-205 bi-state corridors shows a break in speed patterns near the Columbia River crossing. In the morning peak, the I-5 corridor experiences slow speeds from Vancouver to Portland, with the slowest speeds just north of the I-5 Interstate Bridge. During the evening peak slowest speeds in the I-5 corridor occurs south of the I-5 Interstate Bridge.

Table 13: 2015 I-5 Corridor Speeds

I- 5 Corridor	Southbound AM Peak	Northbound PM Peak
SR-500 to Columbia Rv.	14 mph	46 mph
Columbia Rv. to I-84	22 mph	15 mph

The I-205 corridor usually operates near capacity and at the posted speed limit during the morning commute. During the evening commute, regular slowing occurs on the Portland side of the Columbia River.

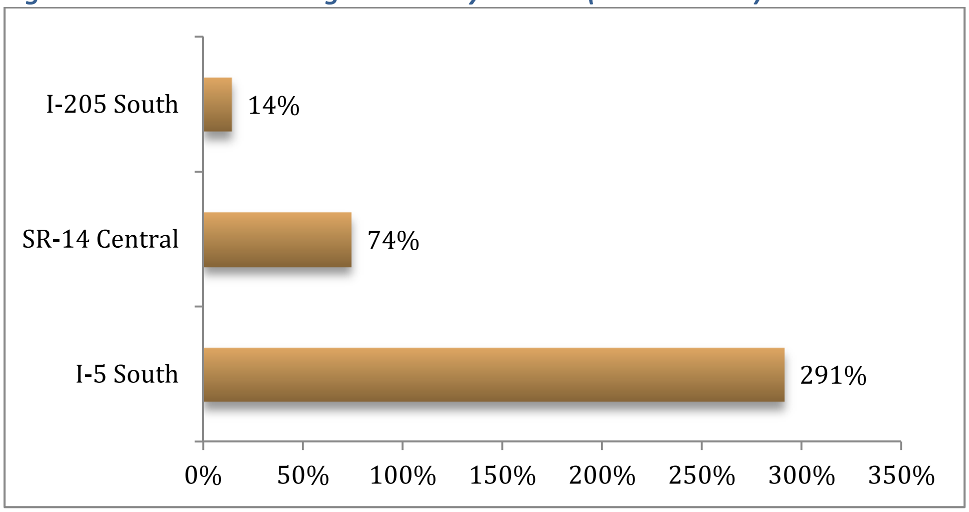
Table 14: 2015 I-205 Corridor Speeds

I- 205 Corridor	Southbound AM Peak	Northbound PM Peak
SR-500 to Columbia Rv.	47 mph	**46 mph**
Columbia Rv. to I-84	48 mph	**25 mph**

Bi-State Travel Delay

Delay represents the additional travel time experienced due to congestion. The region has experienced a significant increase in bi-state travel delay over the last five years. The greatest increase in delay within Clark County is experienced on I-5 South, SR-14 approaching I-205, and I-205 South.

Figure 47: Bi-State Morning Peak Delay Growth (2011 to 2015)



Significant delay also occurs in both the I-5 and I-205 corridors heading from Oregon into Washington during the evening commute, with the majority of the delay occurring in Oregon.

I-5 Corridor - Washington

I-5 is the main Interstate Highway on the West Coast of the United States. I-5 travels from Mexico to Canada, and serves many of the largest cities on the West Coast, including Portland/Vancouver metropolitan area. It is also one of the most congested corridors in the region.

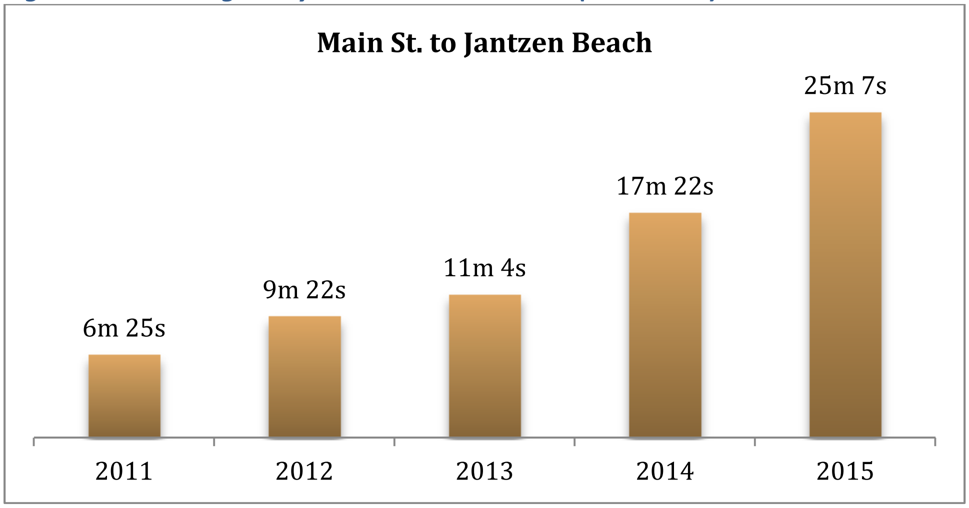
The I-5 corridor between Portland and Vancouver has been identified by INRIX[20] and TomTom[21] as one of the most highly congested corridors in the nation. RTC's

[20] *http://inrix.com/worst-corridors/*
[21] *https://www.tomtom.com/en_us/trafficindex/city/POL*

analysis of traffic data shows that over the past five years that morning congestion has significantly increased. The morning peak period continues to get longer as trips shift to periods immediately before and after the peak demand due to congestion impacts.

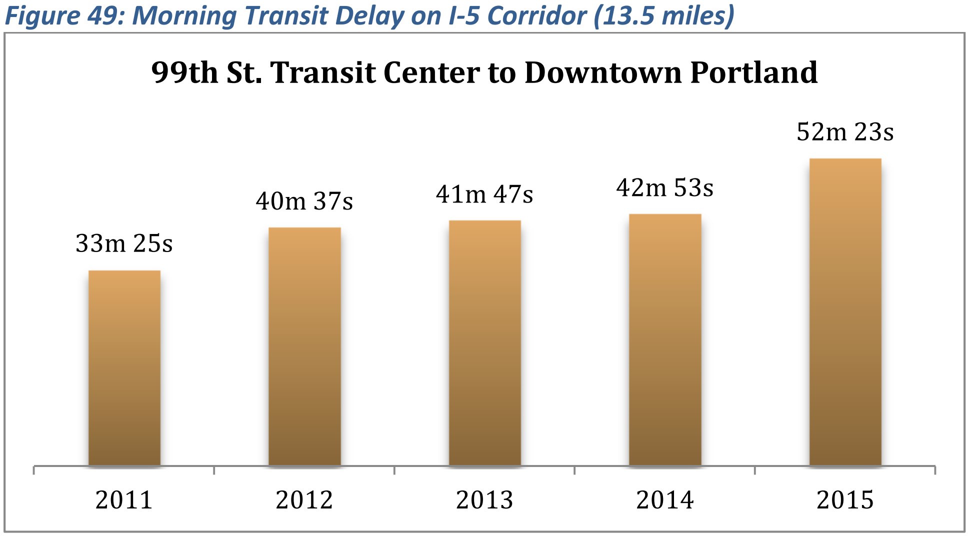
Travel time data is collected annually, by using global positioning system (GPS) units and by driving the corridor multiple times during the morning commute (6:30-8:30 AM) over several days. Between 2011 and 2015 the probe vehicle data showed a significant increase in travel time on I-5 between Main Street and Jantzen Beach exits. Between 2011 and 2015 the morning peak travel speed declined from 31 mph to 8 mph.

Figure 48: Morning Delay on I-5 South Corridor (3.63 miles)



C-TRAN also experienced a significant increase in travel time for morning commuter trips using the I-5 corridor between the 99th Street Transit Center and Downtown Portland.

Figure 49: Morning Transit Delay on I-5 Corridor (13.5 miles)



The southbound morning operations across the Interstate Bridge have significantly declined over the past five years. Corridor turbulence, associated with interchanges and the bridge geometry, is leading to lower speed and throughput during peak periods. Between 2011 and 2015, over 1,000 fewer trips are crossing the bridge in the morning peak two hour period (6:30-8:30 AM), with trips forced to the hours before and after the peak. Commuters are also leaving earlier to make their destination on time. In 2011, the morning southbound peak lasted three hours with speeds under 50 mph. By 2015, the morning southbound peak was five hours. Figure 50 and 51 demonstrate the relationship between speed and volumes for southbound travel on the Interstate Bridge

Figure 50: 2011 I-5 Southbound Speed and Volume

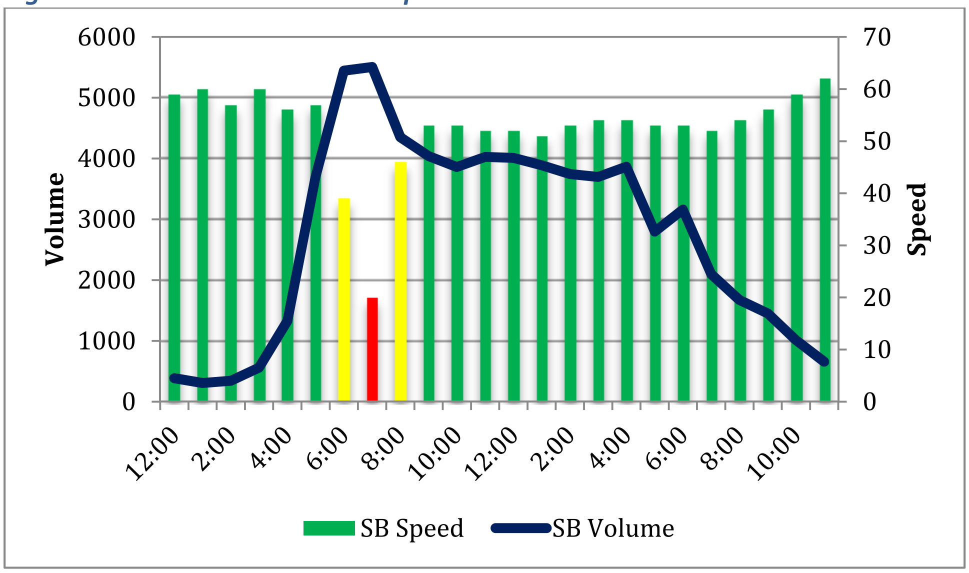


Figure 51: 2015 I-5 Southbound Speed and Volume