MEASURES OF EFFECTIVENESS REPORT

Bellevue Transit Master Plan

CITY OF BELLEVUE

December 2013

Transportation Department

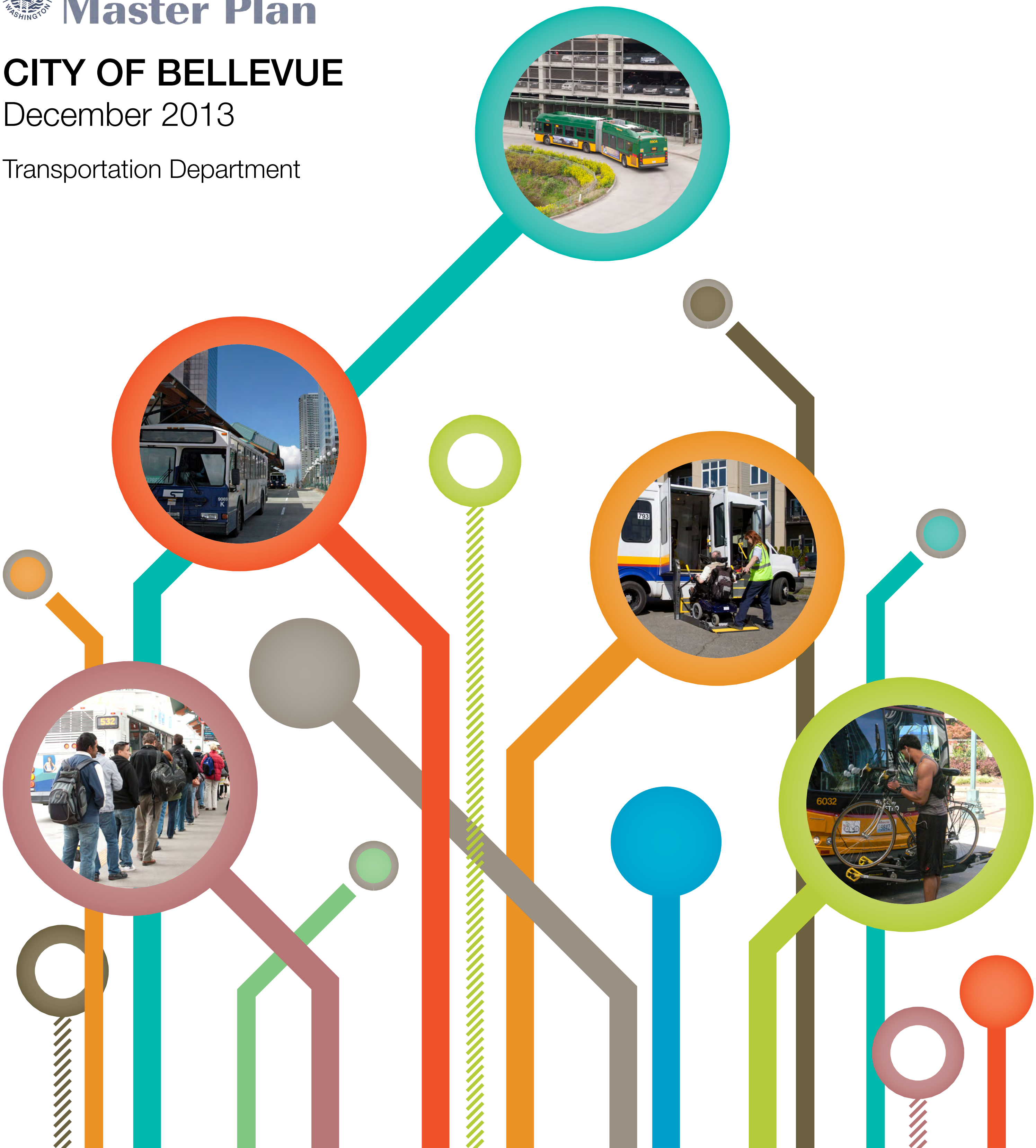


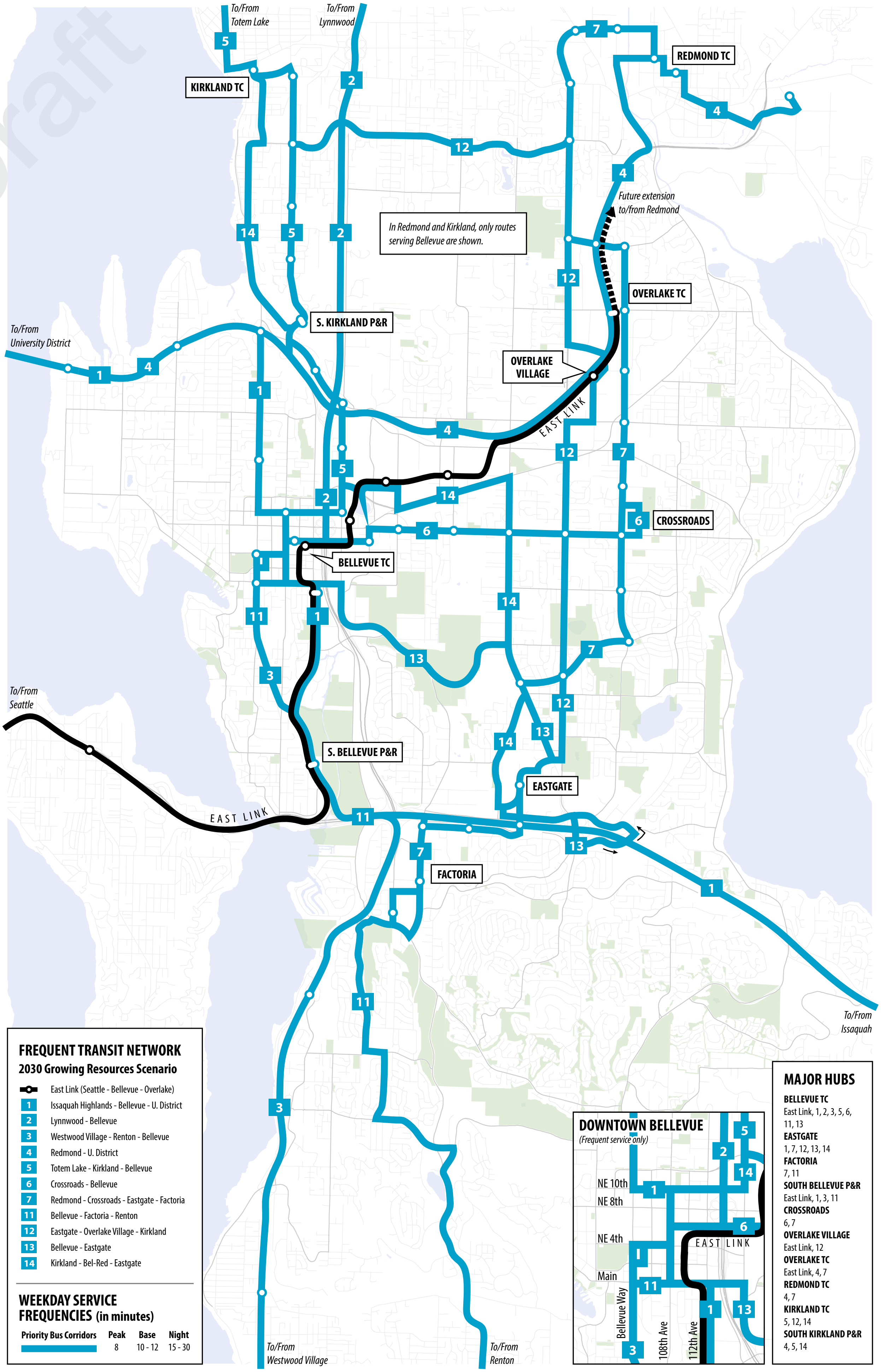
PHOTO BY John Tiscornia

INTRODUCTION

Measures of Effectiveness (MOEs) help track the impacts of transportation system investments and gauge the quality of services delivered by an agency. Some of the useful benefits provided by MOEs include:

- Greater accountability to policy-makers, the agency's customers, and other stakeholders;
- Improved communication of information about the transportation system to customers, political leaders, the public, and other stakeholders;
- Increased organizational efficiency in keeping agency staff focused on priorities and enabling managers to make decisions and adjustments in programs with greater confidence that their actions will have the desired effect;
- Greater effectiveness in achieving meaningful objectives that have been identified through long-range planning and policy formulation; and
- Ongoing improvement of business processes and associated information through feedback.

This report proposes four measures of effectiveness that will be used by the City of Bellevue Transportation Department to track the progress of implementation of the Transit Master Plan.


To/From Totem Lake
To/From Lynnwood
KIRKLAND TC
REDMOND TC
In Redmond and Kirkland, only routes serving Bellevue are shown.
Future extension to/from Redmond
To/From University District
S. KIRKLAND P&R
OVERLAKE TC
OVERLAKE VILLAGE
EAST LINK
CROSSROADS
BELLEVUE TC
To/From Seattle
S. BELLEVUE P&R
EASTGATE
EAST LINK
FACTORIA
To/From Issaquah
To/From Westwood Village
To/From Renton
FREQUENT TRANSIT NETWORK
2030 Growing Resources Scenario
East Link (Seattle - Bellevue - Overlake)
1 Issaquah Highlands - Bellevue - U. District
2 Lynnwood - Bellevue
3 Westwood Village - Renton - Bellevue
4 Redmond - U. District
5 Totem Lake - Kirkland - Bellevue
6 Crossroads - Bellevue
7 Redmond - Crossroads - Eastgate - Factoria
11 Bellevue - Factoria - Renton
12 Eastgate - Overlake Village - Kirkland
13 Bellevue - Eastgate
14 Kirkland - Bel-Red - Eastgate
WEEKDAY SERVICE FREQUENCIES (in minutes)
Priority Bus Corridors | Peak 8 | Base 10 - 12 | Night 15 - 30
DOWNTOWN BELLEVUE
(Frequent service only)
NE 10th
NE 8th
NE 4th
Main
EAST LINK
Bellevue Way
108th Ave
112th Ave
MAJOR HUBS
BELLEVUE TC
East Link, 1, 2, 3, 5, 6, 11, 13
EASTGATE
1, 7, 12, 13, 14
FACTORIA
7, 11
SOUTH BELLEVUE P&R
East Link, 1, 3, 11
CROSSROADS
6, 7
OVERLAKE VILLAGE
East Link, 12
OVERLAKE TC
East Link, 4, 7
REDMOND TC
4, 7
KIRKLAND TC
5, 12, 14
SOUTH KIRKLAND P&R
4, 5, 14

BACKGROUND

One of the Bellevue City Council's *project principles* for the Transit Master Plan (TMP) is that staff should: "Develop measures of effectiveness to evaluate transit investments and to track plan progress." In response to this direction, the Transportation Commission (October 17, 2013) prepared the following four measures of effectiveness (MOE) for monitoring progress in achieving Bellevue's Transit Service Vision.

1. Measure service availability on Bellevue's Frequent Transit Network corridors.
2. Measure transit usage in Bellevue's Mobility Management Areas.
3. Measure person throughput by mode on Bellevue's Frequent Transit Network corridors.
4. Measure travel time savings resulting from speed and reliability improvements on Bellevue's Frequent Transit Network corridors.

This report outlines the Transportation Department's proposed approach to monitoring these MOEs, which build on both Bellevue's existing framework for transportation assessment and national best practices.

- **Bellevue Framework:** One of the MOEs considers Bellevue's Mobility Management Areas (MMAs), an analysis framework used by Bellevue for concurrency assessment. Three of the MOEs reference Bellevue's Frequent Transit Network (FTN), which is detailed in the *Bellevue TMP Transit Service Vision Report* (see Figure 1).
- **Best Practices:** Consideration was given to identifying MOE protocols that are consistent with guidance found in the *Transit Capacity and Quality of Service Manual Third Edition*

Figure 1 (opposite) The Frequent Transit Network (FTN) is where transit service and capital investments need to be focused to serve the most riders and provide the highest quality of service. The FTN supports Downtown growth, Bel-Red corridor redevelopment, and Bellevue's other activity centers with well-connected bus routes that seamlessly interface with East Link light rail. People traveling along FTN corridors can expect convenient, reliable, easy-to-use services that are frequent enough that they never need to refer to a schedule. The core characteristic of the FTN is that it provides all-day, frequent service, wherein the headway (the time between successive buses) of individual constituent routes is 8 minutes or better in peak hours, 10-12 minutes mid-day, and 15-30 minutes at night.

(TCQSM). The TCQSM, published by the Transportation Research Board in September 2013, provides the latest research results on estimating and assessing the capacity, speed, reliability, and quality of transit services, facilities, and systems (see Figure 2).

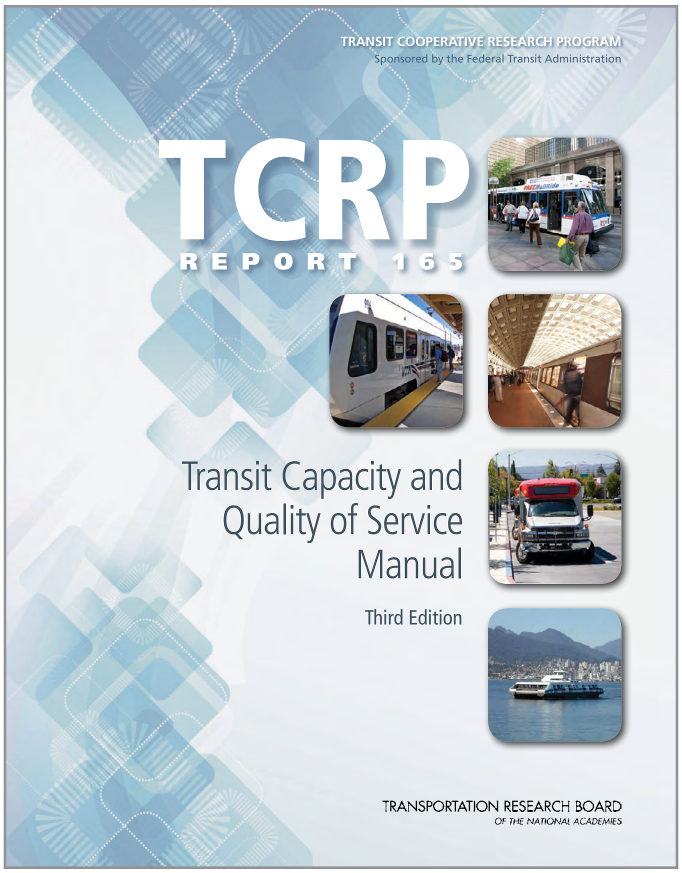


Figure 2 The Transit Capacity and Quality of Service Manual, Third Edition provides guidance on transit capacity and quality of service issues and the factors influencing both. The manual contains background, statistics, and graphics on the various types of public transportation, and it provides a framework for measuring transit availability, comfort, and convenience from the passenger and transit provider points of view. In addition, the manual includes quantitative techniques for calculating the capacity and other operational characteristics of bus, rail, demand-responsive, and ferry transit services, as well as transit stops, stations, and terminals.

By providing a sense of the quality of transit service in Bellevue, these metrics can serve as a tool for communicating the City's need for transit service delivery and capital improvements to the public, King County Metro, Sound Transit, and other elected leaders. These measures can be organized into the following performance categories:

- **Service Availability:** ease of use for various kinds of transit trips;
- **Transit Usage:** passenger satisfaction with the quality of transit service provided;
- **Person Throughput:** transit's role in increasing roadway capacity and improving operations; and,
- **Travel Time:** how long it takes to make a trip by transit in comparison with another mode.

With the exception of the transit usage MOE, which will be reported twice annually, the other metrics will be produced on a five-year reporting cycle. More frequent tracking is not warranted as we are not likely to see significant variations in performance without changes in the level of transit service and capital investment. In the intervening years, Bellevue staff will monitor King County Metro's *Strategic Plan and Service Guidelines*, which has established a network evaluation and operations performance standards system based on measures of productivity, social equity, and geographic value.

SERVICE AVAILABILITY

The first MOE—"measure service availability on Bellevue's Frequent Transit Network corridors"—will help the Transportation Department determine whether or not transit service is a viable option for a given trip in Bellevue. Where, how often, and when transit service is provided are all important factors in one's decision to use transit. In transit planning terms, these qualities are known as accessibility (or service coverage), service frequency, and service span, respectively. From the user's perspective, service frequency determines how many times per hour a user has access to transit at a given location, assuming that location is within an acceptable walking distance (measured by service coverage) and service is provided at the times the user wishes to travel (measured by service span). The following spatial and temporal attributes—when considered together—provide an actionable assessment of transit service availability.

Route Frequency

Transit frequency is the number of transit vehicles scheduled to serve a given stop during one hour. Frequency was reported as the top factor influencing overall trip satisfaction in the *Bellevue Transit Improvement Survey*. The more frequent the transit service, the shorter the wait time when a bus is missed or when the exact schedule is not known before arriving at a bus stop, and the greater the flexibility that customers have in selecting travel times. The longer the service headway (the time between successive buses), the more inconvenient transit becomes, both because passengers have to plan their trip around bus schedules and because they incur more unproductive time during their trip.

Research suggests that 30-minute service frequency is considered to be unattractive to

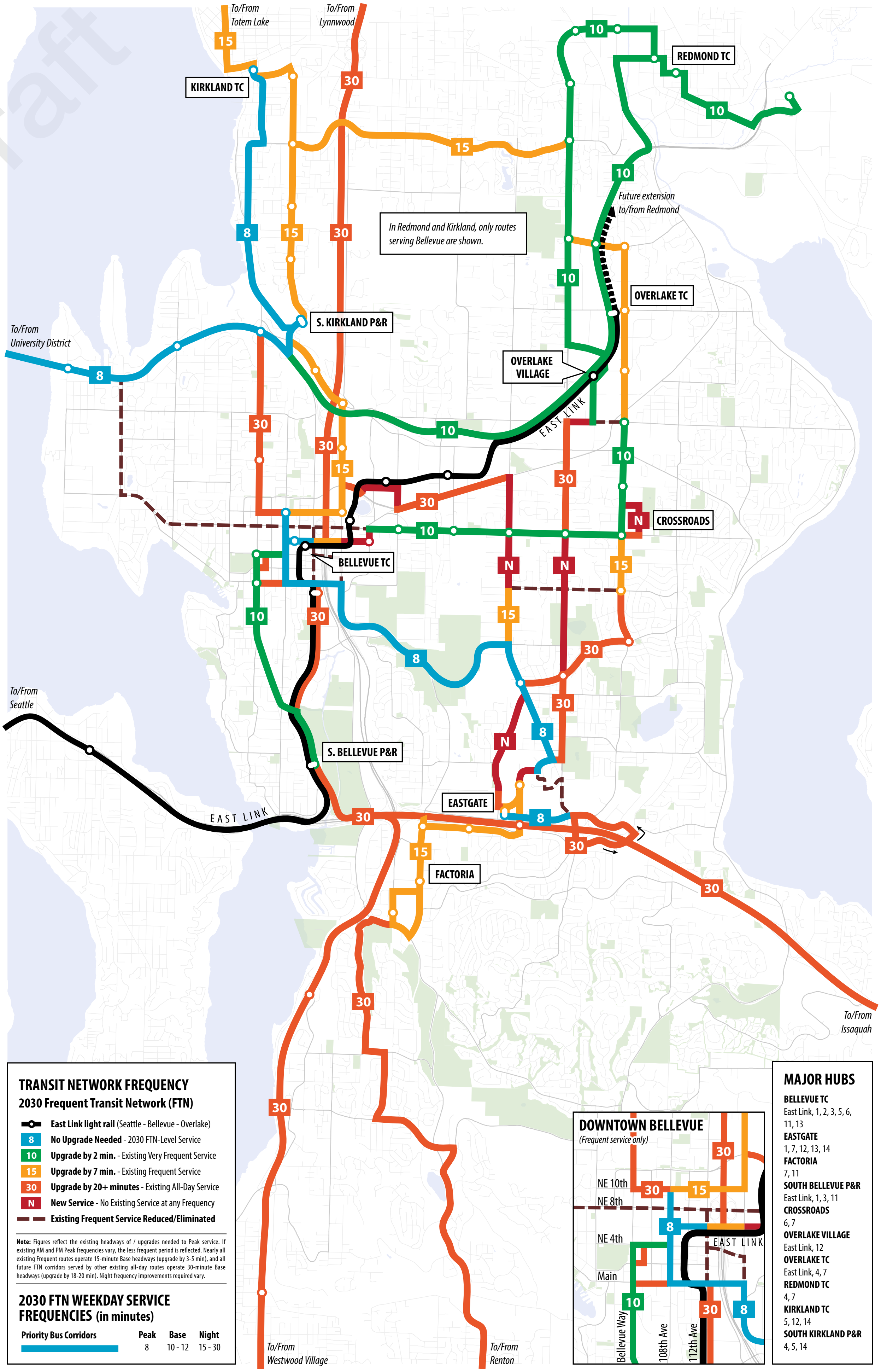
"[I]f your frequency decreases, timed connections become more important. What really matters is the time I have to wait. [I]f I have a well-timed connection but have to wait 30 minutes because my late bus just missed it, it's not much help. In order to encourage transfers you need frequency."

-Christian, All-Around Transit Rider
Resident of Seattle[1]

"Speed and frequency of service goes a long way to make up for schedule reliablility and connection timing."

-Anonymous Former Rider
Resident of Kirkland[1]

[1] Write-in comment from the *Transit Improvement Survey Summary Report* (2012).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S. BELLEVUE P&R
EASTGATE
FACTORIA
To/From Issaquah
To/From Westwood Village
To/From Renton
TRANSIT NETWORK FREQUENCY
2030 Frequent Transit Network (FTN)
East Link light rail (Seattle - Bellevue - Overlake)
8 No Upgrade Needed - 2030 FTN-Level Service
10 Upgrade by 2 min. - Existing Very Frequent Service
15 Upgrade by 7 min. - Existing Frequent Service
30 Upgrade by 20+ minutes - Existing All-Day Service
N New Service - No Existing Service at any Frequency
Existing Frequent Service Reduced/Eliminated
Note: Figures reflect the existing headways of / upgrades needed to Peak service. If existing AM and PM Peak frequencies vary, the less frequent period is reflected. Nearly all existing Frequent routes operate 15-minute Base headways (upgrade by 3-5 min), and all future FTN corridors served by other existing all-day routes operate 30-minute Base headways (upgrade by 18-20 min). Night frequency improvements required vary.
2030 FTN WEEKDAY SERVICE FREQUENCIES (in minutes)
Priority Bus Corridors Peak Base Night
8 10 - 12 15 - 30
DOWNTOWN BELLEVUE
(Frequent service only)
NE 10th
NE 8th
NE 4th
Main
EAST LINK
Bellevue Way
108th Ave
112th Ave
MAJOR HUBS
BELLEVUE TC
East Link, 1, 2, 3, 5, 6, 11, 13
EASTGATE
1, 7, 12, 13, 14
FACTORIA
7, 11
SOUTH BELLEVUE P&R
East Link, 1, 3, 11
CROSSROADS
6, 7
OVERLAKE VILLAGE
East Link, 12
OVERLAKE TC
East Link, 4, 7
REDMOND TC
4, 7
KIRKLAND TC
5, 12, 14
SOUTH KIRKLAND P&R
4, 5, 14

discretionary riders—those with access to an automobile who choose to use transit—while 15-minute service in the peak periods is considered a significant threshold to making transit a competitive alternative to driving. This threshold mainly relates to the amount of time people are willing to wait if they just miss a bus. With a 30-minute wait until the next bus, most people with a car available will not risk having to wait that long and will thus not attempt to take the bus at all.

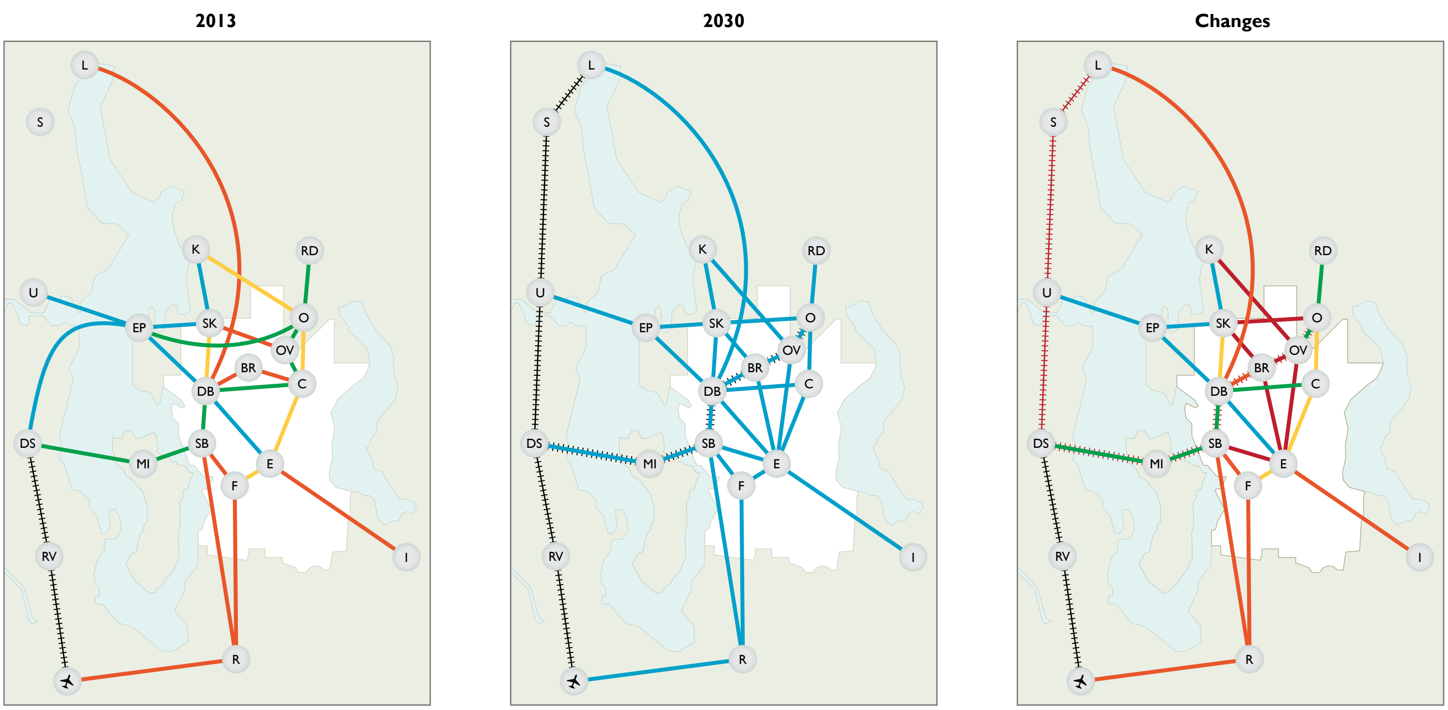
Assessing route frequency involves determining whether each portion of the FTN achieves the headway thresholds for frequent service defined in the *Transit Service Vision Report*. Staff will develop a table and map reflecting the percentage of FTN corridor segments operating at these target headways. Figure 3 reflects the route segments along 2030 FTN corridors and the upgrades in service headways required to achieve 2030 target frequencies. *Route segment* refers to a portion of an FTN route that is bounded by

"For the most part there is just not enough frequency to make it reliable and time management effective."

-Doug, Non-Commute Transit User
Resident of Bellevue[1]

[1] Write-in comment from the *Transit Improvement Survey Summary Report* (2012).

Figure 3 (opposite) Progress toward 2030 FTN by frequency of service on route segments.
Figure 4 (below) Progress toward 2030 FTN by frequency of service connections between major centers.



Legend

BELLEVUE	
BR	Bel-Red
C	Crossroads
DB	Downtown Bellevue
E	Eastgate
F	Factoria
SB	S. Bellevue Park & Ride

REGION			
DS	Downtown Seattle	R	Renton
EP	Evergreen Point	RD	Redmond Transit Center
I	Issaquah Transit Center	RV	Rainier Valley
K	Kirkland Transit Center	S	Shoreline
L	Lynnwood	SK	S. Kirkland Park & Ride
MI	Mercer Island	U	University District
O	Overlake Transit Center	✈	SeaTac
OV	Overlake Village		

	Peak	Midday	Night
Very Frequent (every train connection)	≤8	≤12	15-30
Infrequent	30	15-30	30-60
LRT			

Note: numbers reflect approximate peak/midday/night frequencies.

2013 - 2030 FTN Upgrades Required

8	**No Upgrade Needed** - 2030 FTN-Level Service
10	**Upgrade by 2 min.** - Existing Very Frequent Service
15	**Upgrade by 7 min.** - Existing Frequent Service
30	**Upgrade by 20+ minutes** - Existing All-Day Service
N	**New Service** - No Existing Service at any Frequency
— —	**Existing Frequent Service Reduced/Eliminated**

"I would like for my children to start using a bus to get home from school, but there is no bus stop close enough to home and no safe pedestrian connection from existing bus stops for them to be able to walk home alone."

-Lana, Non-Rider
Resident of Bellevue[1]

"Make bus routes more accessible during the late evening. Most Bellevue bus routes end at around 10pm or 11pm. [This] makes it difficult for people to go to social gatherings in the late evening. Also some people have graveyard shifts."

-Juan, Non-Commute Transit User
Resident of Bellevue[1]

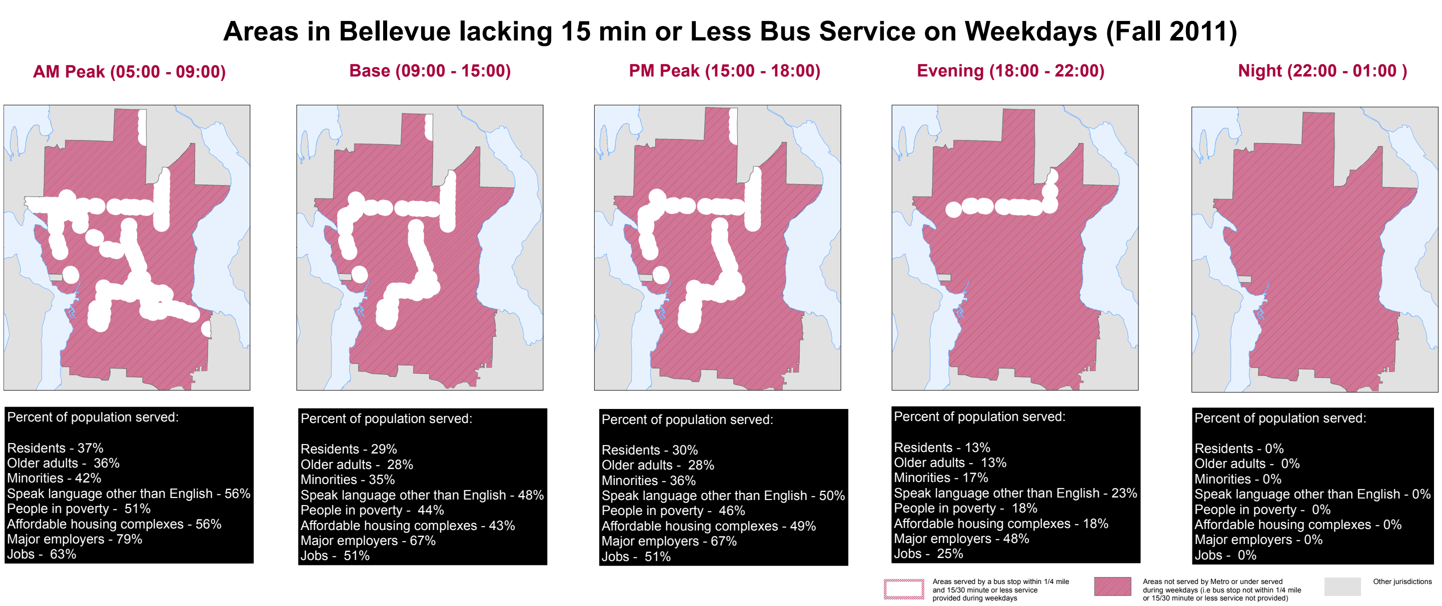
an intersection with another route on both sides. This method avoids consideration of the transit network in terms of the block-by-block approach promoted by the *Highway Capacity Manual*. Figure 4 on page 9 reflects the connections between major local and regional centers served by FTN routes and indicates which require upgrades to achieve 2030 FTN-level service. Both figures depict only those segments and connections operated by FTN routes—infrequent all-day services are not shown.

Route Coverage

The presence or absence of transit service near one's origin and destination is a key factor in one's choice to use transit. Route coverage is a measure of the area within a reasonable walking distance of transit service. When combined with service frequency and span data, route coverage helps identify the number of opportunities people have to access transit from different locations.

The calculation of the transit route coverage area is performed through the use of a geographic information system (GIS) using the following data: (i) bus stop locations from King County Metro's GIS database, and (ii) demographic data (population and jobs) from the U.S. Census Bureau. Bellevue's GIS software buffering feature is then used to outline on a

Figure 5 Weekday level of service coverage, Fall 2011.



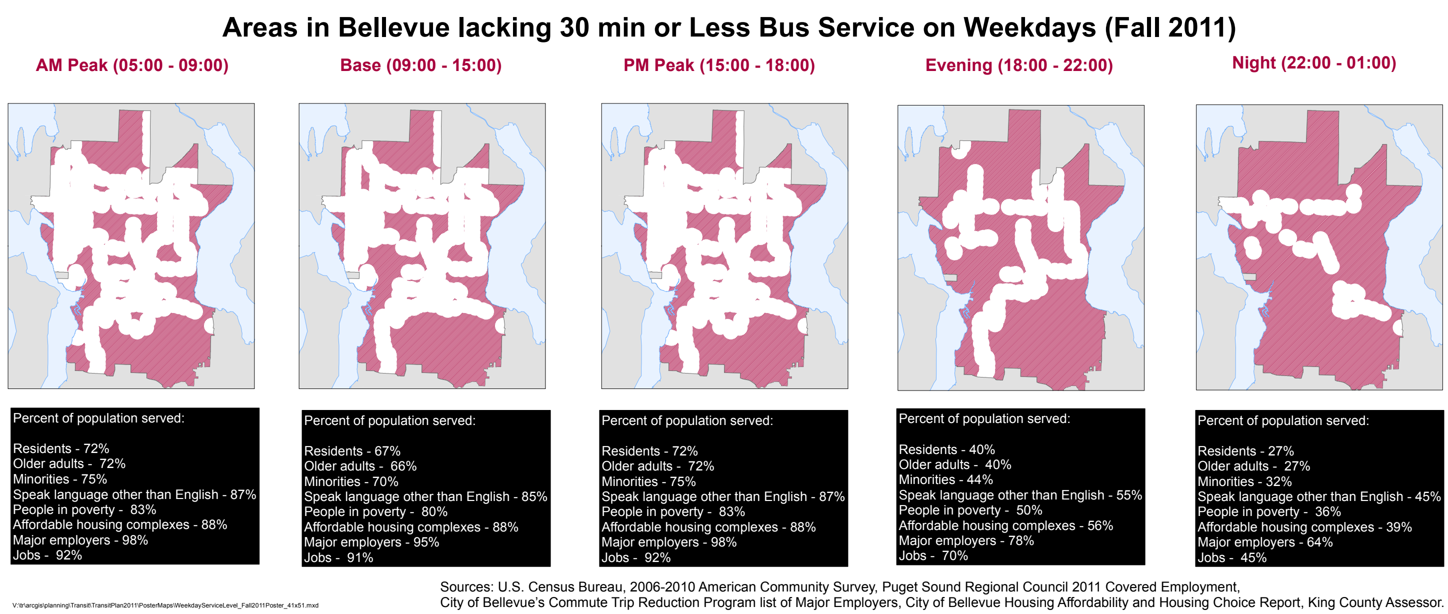
map all of the area within one-quarter mile of an FTN bus stop. The one-quarter mile buffer is consistent with industry literature that most passengers (75 to 80% on average) walk one-quarter mile or less to bus stops. At an average walking speed of 3 mph, this is equivalent to a maximum walking time of 5 minutes.

In conducting this analysis, Transportation Department staff will assess how many Bellevue residents and employees are provided frequent bus service by day of week (weekday and weekend) and time of day (AM peak, base, PM peak, evening, and night). Broadening the route coverage analysis to consider service span helps to refine this assessment of service availability to potential users. If transit service is not provided at the time of day a potential passenger needs to take a trip, it does not matter where (coverage) or how often (frequency) transit service is provided to the rest of the day. Some potential transit riders choose not to use transit services because particular services are unavailable for their anticipated return trips or because they cannot be certain about the time of their return trips and need to be certain that they do not get stranded. Figure 5 and 6 reflect areas in Bellevue lacking 15-minute bus service on weekdays and weekends, respectively, based on Fall 2011 data.

"Proximity to my house is very important, or otherwise it's too easy to not take. Proximity to my destination is less important, especially for places I don't visit frequently."
-Anonymous All-Around Transit User
Residence Unknown[1]

[1] Write-in comment from the *Transit Improvement Survey Summary Report* (2012).

Figure 6 Weekend level of service coverage, Fall 2011.

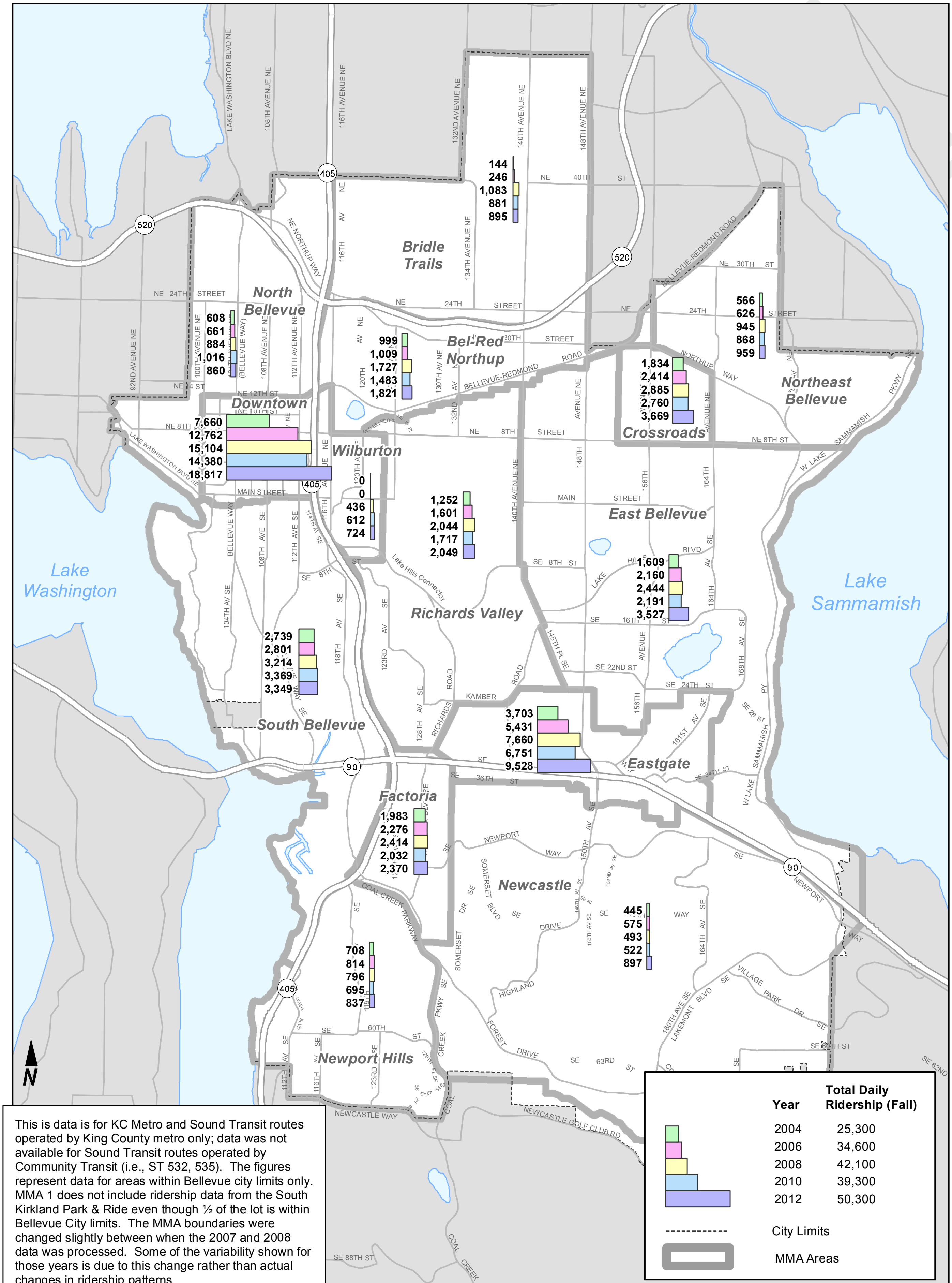


TRANSIT USAGE

The second MOE—“measure transit usage in Bellevue’s Mobility Management Areas”—will help the Transportation Department track passenger satisfaction with the quality of transit service provided in Bellevue. The transit usage calculation is performed with a geographic information system (GIS) using the following data: (i) average weekday stop-level usage data (ons/offs) on bus routes operating in Bellevue, and (ii) Bellevue’s GIS shapefile of the 14 Mobility Management Areas (MMA) of the city. Tracking transit usage occurs twice annually, reflecting average weekday stop-level on/off data from the Spring and Fall service changes.

Figure 7 reflects daily transit usage by Bellevue MMA for Fall 2004, 2006, 2008, 2010, and 2012. Increased usage of transit is correlated to the numerous service and capital investments that have been made over this period to improve travel options in Bellevue. Public transportation ridership in Bellevue has grown steadily since the adoption of the 2003 Transit Plan; average weekday transit ridership in Bellevue rose from 25,300 (in 2004) to 50,300 (in 2012)—a 99 percent increase.

Figure 7 (opposite) Total daily ridership by Mobility Management Area (MMA), 2004-2012.



This is data is for KC Metro and Sound Transit routes operated by King County metro only; data was not available for Sound Transit routes operated by Community Transit (i.e., ST 532, 535). The figures represent data for areas within Bellevue city limits only. MMA 1 does not include ridership data from the South Kirkland Park & Ride even though ½ of the lot is within Bellevue City limits. The MMA boundaries were changed slightly between when the 2007 and 2008 data was processed. Some of the variability shown for those years is due to this change rather than actual changes in ridership patterns.

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PERSON THROUGHPUT

The third MOE—"measure person throughput by mode on Bellevue's Frequent Transit Network corridors"—will assist the Transportation Department in tracking transit's contributions to improved mobility on Bellevue's street network. Historically, arterial street performance has been based mostly on outcomes for vehicles rather than people. In classical highway engineering, the goal is "vehicle throughput", expressed by letter grades that reflect an intersection's level of service (LOS). Vehicle throughput is based on the volume-to-capacity (V/C) ratio, which divides the total number of vehicles at a given intersection by the capacity of that intersection to handle cars. The V/C ratio regards each vehicle as equally important regardless of how many people it carries.

There is a *growing recognition* in the transportation industry that metrics that focus solely on vehicle throughput are unable to adequately capture the human and social costs of lost time and money. That is, vehicles do not lose time, but people do. In order to improve automobile LOS at a given intersection, for example, traffic engineers may inadvertently favor a reliance on vehicle-oriented solutions that unintentionally limit other investment choices. The result of these actions may be that the intersection can handle more vehicles but fewer people. In the long-term, as the city grows, managing the transportation system with an exclusive focus on auto congestion paradoxically results in more auto congestion than an approach that considers all modes.

The *Transit Capacity and Quality of Service Manual Third Edition* defines person capacity as: "The maximum number of people that can be carried past a given location during a given time period under specified operating conditions; without unreasonable delay, hazard, or restriction; and with reasonable certainty." Person throughput—a function of the mix of vehicles in the traffic stream, including the number

"If you advocate for ANYTHING, PLEASE make this city less accommodating to cars and MORE accommodating to PEOPLE!"
-Matthew, All-Around Transit User
Resident of Bellevue[1]

[1] Write-in comment from the *Transit Improvement Survey Summary Report* (2012).

and occupancy of each type of vehicle—recognizes the difference between a single bus containing 40 people and a pair of cars that occupy the same space but contain only 2 people.

As reflected in the following policy statements, a commitment to measure person throughput is found at every level of government in Washington State.

- *WSDOT HOV Policy* states: "The goals of this system are: (i) To maximize the people-carrying capacity of the freeway system by providing incentives to use buses, vanpools, and carpools; (ii) To provide capacity for future travel growth; and, (iii) To help reduce transportation-related pollution and dependency on fossil fuels. Through HOV programs and policies we strive to make the best use of existing facilities by increasing freeway efficiency and promoting programs to move more people in fewer vehicles." WSDOT's commitment to the person throughput metric is reflected in its annual monitoring of this indicator (see page 48 of the WSDOT *2012 Congestion Report*).
- *Vision 2040*, the Puget Sound Regional Council's adopted regional growth plan, policy MPP-DP-54 states: "Develop concurrency programs and methods that fully consider growth targets, service needs, and level-of-service standards. Focus level-of-service standards for transportation on the movement of people and goods instead of only on the movement of vehicles."
- The context-setting narrative of the Mobility Management section of the *Bellevue Comprehensive Plan* states: "The primary modes of transportation in the city include private vehicles, carpools and vanpools, transit, walking, and bicycling. The city must provide

services and facilities to support all modes, balancing resources to ensure that all are viable and provide reasonable travel choices. *This maximizes the people-carrying capacity of the system and encourages use of alternatives to the single-occupant vehicle.*" [Italics added for emphasis]

Bellevue's person throughput calculation is performed with the Bellevue-Kirkland-Redmond (BKR) travel demand model. Inputs to the four-step model used in travel demand forecasting are current land use, the current transportation system, forecast changes in households, employment, and transportation system improvements, and the fraction of trips made during the peak period. The travel demand model compares demand for travel to the supply of the roadway system within the project area. Travel demand is derived from population and employment, while the supply side of the equation is the roadway system on which travel occurs.

The BKR model produces Peak-Period Person Throughput (PPPT) by mode for the corridor segments that comprise the Frequent Transit Network (FTN) defined in the *Transit Service Vision Report*. The PPPT metric takes into account average vehicle occupancy of personal vehicles and public transportation. By measuring performance during peak periods, PPPT focuses attention on the time period when the transportation system is most stressed. The public easily understands peak-period performance, as it impacts many travelers through the daily commute, and improvements to system performance during peak periods are visible and appreciated.

As reflected in Figure 8, BKR model data facilitates a comparison of PPPT values for both transit and personal vehicles along FTN corridor segments. In the case of Bellevue Way SE between SE 8th Street and 113th Avenue SE, the 2030 projected PPPT on transit is 44 percent of all person trips. When considered from a vehicle throughput perspective, transit represents only 1.1 percent of all vehicle trips along this FTN corridor segment. Clearly, bus service is projected to make efficient use of the roadway capacity in this corridor.

Although the example provided is for projected 2030 conditions, BKR travel demand model outputs can also be generated for current conditions. Bellevue is able to aggregate prior year annual bus ridership data for each of the FTN corridors. This data is then compared to auto volume and person trips found in the base year model.

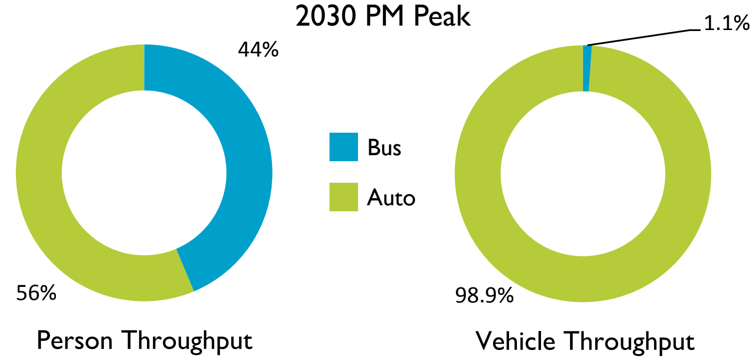
Figure 8 (opposite) Total daily ridership by Mobility Management Area (MMA), 2004-2012.

Bellevue Way SE

SE 8th St to 113th Ave SE

Buses[1]	36
Total Vehicles[1]	3,230
Percent Transit[1]	1.1%
Person Trips – Transit[1]	3,363
Person Trips – Total[1]	7,705
Percent Transit[1]	44%

Projected Travel Demand-
2030 PM Peak



TRAVEL TIME

The fourth MOE—"measure travel time savings resulting from speed and reliability improvements on Bellevue's Frequent Transit Network corridors"—will assist the Transportation Department in tracking the improvements realized by transit priority investments and help identify FTN service connections where ridership gains and operating cost savings might be realized from proposed transit priority measures. The *Transit Capacity and Quality of Service Manual Third Edition* notes that travel time is a useful metric for assessing transit performance because "travel time directly impacts the number of transit vehicles needed to operate on a route at a given headway and the impact of location-specific transit preferential treatments and operational strategies will typically be expressed as a travel time saved per location," and also because "ridership elasticity factors... exist for average speed, allowing the impact of speed improvements on ridership to be estimated."

According to respondents of the *Bellevue Transit Improvement Survey*, improving bus speed and reliability by investing in roadway and traffic signal infrastructure is the highest priority for municipal investment in transit. Attracting ridership is of course important to transit operators, but speed also impacts the cost of operating a route. The number of transit vehicles required to operate a service at a given frequency depends on the route's cycle time (the time required to make a round-trip on the route), plus driver layover time, and any additional schedule recovery time required beyond layover time. The cycle time (in minutes) divided by the headway (in minutes per vehicle) gives the required number of vehicles to serve the route. If a route's cycle time can be reduced sufficiently to reduce the required number of vehicles, cost savings result. Alternatively, the saved vehicle can be used to increase frequency on this or another route with no net change in operating costs.

"If there was a stop walking distance from my house and walking distance to work, and the time it took wasn't too much longer than driving, I would take the bus to save gas and money."

-Stacey, Non-Rider
Resident of Kenmore[1]

"If it takes me an hour to commute with my car, and 1.5 to 2.5 hours with public transporation, I will choose the most convenient mode of transportation that also provides the least amount of commuting time -- the car."

-Anonymous Non-Rider
Resident of Maple Valley[1]

[1] Write-in comment from the *Transit Improvement Survey Summary Report* (2012).

Bellevue's travel time MOE is considered in terms of two metrics: one assesses operating speeds in absolute terms and compares observed speeds to Service Vision targets, and the other expresses transit travel time in relative terms compared to automobile travel time. Together, these two measures provide a comprehensive understanding of the degree of mobility offered by transit service as it relates both to operations and users. The first metric calculates the average operating speed of all routes comprising each FTN service type—Frequent Express (FX), Frequent Rapid (FR), and Frequent Local (FL)—for each period of the day. These values are then compared to the target operating speeds established in the *Transit Service Vision Report* for 2022 and 2030 (see Table 1). Congestion on local roads is projected to worsen as time progresses, hence the estimated operating speeds for FR and FL services are expected to decline between 2022 and 2030. By contrast, the average speeds of Express services increase by 2030 because Route 550—currently the slowest of the Express services—will be discontinued after it is replaced by East Link light rail. Although the general trend is toward declining speeds over time, observed operating speeds in 2012 are not uniformly faster than the estimated speeds for future years. For example, Rapid service is estimated to be 10% faster than Local service in future years per guidance received from Metro, but Bellevue's only existing Rapid route (B Line) does not presently achieve such a speed premium over the average of all local all-day services. If observed speeds in 2022 and 2030 are ultimately found to be slower than the estimated targets, this may have implications for the amount of transit service operated in Bellevue.

Stated simply: time is money. Slower service means less service unless Bellevue can secure additional resources (in terms of annual platform hours operated

Table 1 Estimated current, long- and mid-term operating speeds of FTN service by time of day.

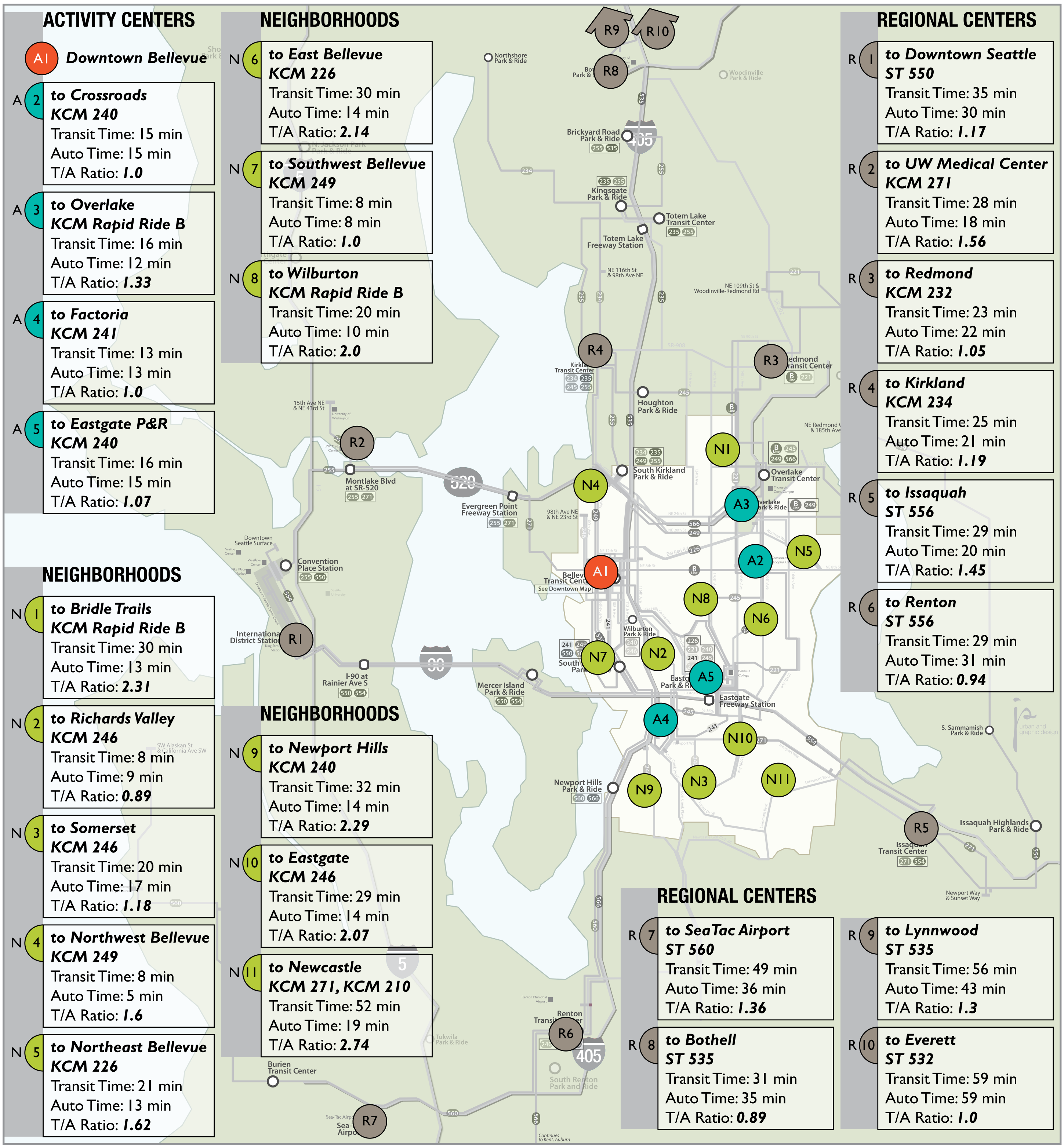
Year	Service	AAM	AM	MD	PM	EVE	NITE
2012	Express	24.81	23.14	23.07	20.62	24.15	25.85
	Rapid	18.14	15.63	13.74	13.03	16.72	19.03
	Local	20.52	16.34	15.76	14.48	16.95	18.71
	Local*	20.52	16.41	15.89	14.54	17.00	18.75
2022	Express	24.85	21.59	23.19	20.00	23.77	24.91
	Rapid	20.16	16.88	16.78	15.25	17.87	19.60
	Local	18.32	15.35	15.25	13.86	16.24	17.82
2030	Express	26.28	24.26	24.51	21.58	25.24	26.77
	Rapid	19.56	16.38	16.28	14.80	17.34	19.02
	Local	17.78	14.89	14.80	13.45	15.76	17.29

* Route 271 includes Local and Express segments. For the 2012 observed figures shown here, revenue miles and hours cannot be extracted for only a single segment. Two figures are therefore provided for Local speeds—the first without Route 271 factored in, and the second (*) with Route 271 included. Express speeds include only Sound Transit Express routes.

Note: Estimated speeds for 2022 and 2030 are calculated by dividing the distance between route timepoints by the scheduled travel time. Observed operating speeds for 2012 are calculated by dividing daily weekday revenue miles by revenue hours. All figures in miles per hour.

within the city) from local transit agencies. This is because slower operating speeds result in longer cycle times, which if sufficiently longer than planned will require additional vehicles to provide the same level of service. If additional resources cannot be secured to offset the difference, service frequency or span may need to be reduced to remain within the annual platform hour budget. The importance of achieving the targeted operating speeds therefore cannot be overstated, as these estimates play a central role in determining how much service can be operated given a particular budget.

Figure 9 Weekday level of service coverage, Fall 2011.



The second measure assessing travel time is a ratio obtained by dividing transit travel time by auto travel time. A Transit/Auto (T/A) ratio greater than 1.0 reflects transit travel times that exceed auto travel times. As a general rule of thumb, T/A ratios of 2.0 or above are considered not competitive to trips by auto and are therefore less likely to attract ridership. Figure 9 reflects PM peak transit travel times, auto times, and T/A ratios from Downtown Bellevue to various local and regional destinations. Additional details about this methodology—derived from manually tabulating travel times using Google Maps—are reflected in the *Bellevue Transit/Auto Travel Time Analysis Report*, in which transit travel times were compared to the time it would take to reach the same destination at the same time of day by car.

Travel times used to calculate the T/A ratio on Bellevue's FTN corridors can be obtained from a variety of sources, including:

- Field data, from auto travel time runs and transit automatic vehicle location (AVL) data;
- Estimates of auto and transit speeds from the Highway Capacity Manual or simulation;
- Online mapping tools like Google Maps, that can provide estimates of auto and transit travel times, including the effects of recurring traffic congestion; or
- BKR travel demand model, for origin-destination trips.

Whichever source is selected, it should be used as the basis for both transit and auto travel times. When travel times are estimated, rather than measured directly, a sample of estimates should be compared against existing conditions to verify the reasonableness of the estimates and, if necessary, develop correction factors for them.