STAGE III: HIGH CAPACITY CANDIDATE CORRIDOR EVALUATION MEASURES

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This sheet serves as a companion to the corridor information sheets. Each of the evaluation measures reported on the corridor information sheets is described below, including the purpose or intent of the measure and a brief summary of the methods used in the analysis.

All costs are presented in 2011 dollars.

Metric	Purpose/Intent	Methodology
Weekday riders (2030)	• Ridership potential in 2030 based on service improvements and projected land use changes.	• Corridor 6, 8 and 11 ridership estimated based on existing corridor ridership (2009) which is adjusted to account for projected 2030 land use changes (including planned upzone proposals not reflected in 2030 forecasts), increased mode share due to change in density, change in headway and travel time, unmet travel demand, and pedestrian access investments. • In Stage III, travel time sensitivity and mode factors added to Stage II ridership analysis factors. • A peer based method was used to estimate ridership potential for Center City corridors (CC1 and CC2). Productivity and ridership (per mile) on comparable urban rail circulators was adjusted (up or down) based on land use density, major generators, level of tourist visitation, system connectivity, and design speed/priority. Portland, Seattle (SLU Streetcar), Tacoma, Memphis and San Francisco were used as relevant peers. It was assumed that BRT would attract 75% of the level of center city circulation ridership attracted by rail circulator and that enhanced bus would attract 50% (based on research of rail replacements of bus). • For Corridors 8 and 11 the potential for increased Center City circulation ridership (vs. current services) was assessed by mode and alignment, based on peer method described in previous bullet. • For Corridor 6 Washington State Ferry passenger (walk on) origin and destination and current mode of travel data were reviewed to identify potential for a BRT service to shift mode of travel between Colman Dock and points along the corridor.
Net new weekday riders (2030)	• Potential for ridership growth over time and due to service improvements.	• Net new weekday riders = current (2009) ridership assigned to the corridor in the ridership evaluation - 2030 estimate of potential ridership (see above). • This accounts for growth due to land use changes and improved quality, capacity, and level of corridor transit service.
Productivity (weekday riders per revenue hour)	• Efficiency with which provided transit capacity is utilized.	• Productivity = weekday ridership / weekday revenue hours. • Weekday ridership estimated based on methods described above. • Weekday hours of revenue service calculated through development of corridor specific operating plan.
Operating cost per boarding ride	• Cost to deliver a single boarding ride on this proposed line. NOTE: current Seattle electric trolley bus cost per boarding ride averages ~ $2.80.	• Operating cost per boarding ride = weekday operating cost / weekday boardings. • Weekday hours of revenue service calculated through development of corridor specific operating plans. • Weekday operating cost based on cost per hour of service for specific mode (King County Metro 2011 estimates): Cost Per Hour Bus: $134.71 Cost Per Hour Electric Trolley: $128.99 Cost Per Hour Rapid Streetcar: $220.00
Net Operating Cost per Boarding Ride	• Operating cost to deliver a boarding ride considering potential cost savings from route restructuring.	• Net operating cost per boarding ride = planned weekday operating cost - weekday operating cost savings (identified below), divided by the number of boarding rides projected for 2030 • Corridor 6: – Route 11 and 12 are folded into the new service. • Corridor 8: – The SLU Streetcar would be folded into the Rapid Streetcar concept. – Route 70 would be discontinued. – Routes 66/67 would operate every 15 minutes throughout the day between UW and Northgate and Route 66 trips would be converted into route 67 trips to better serve campus. • Corridor 11: – Route 17 would operate on Dexter between Nickerson and downtown Seattle, replacing Route 28 in that segment for the Streetcar and BRT options. – Route 28 would be truncated to only serve areas north of the 45th/Leary stop for the Streetcar, BRT and Enhanced Bus options. – Routes 17 would remain unchanged in the Enhanced Bus option. • Corridor CC1 and Corridor CC2: – No restructuring proposed. – CC2 reflects existing South Lake Union Streetcar costs.

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<table>
<thead>
<tr><th>Metric</th><th>Purpose/Intent</th><th>Methodology</th></tr>
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<tr>
<td>Total capital cost</td>
<td>Cost to construct the project including planning and engineering, vehicles, complementary infrastructure/roadway improvements, and contingency costs.</td>
<td>
Total capital cost for rail and BRT based on cross sectional designs developed for each ROW segment in corridor for relevant modes and a costing methodology developed by URS for rail and BRT projects. Total capital cost for enhanced bus based on a corridor survey for opportunities to implement transit priority measures (e.g., TSP, bus bulbs, queue jumps, etc.)
Cost estimate developed based on capital cost elements (including stations and vehicles), planning and engineering, and contracting fees and contingency. All corridor estimates include an allowance to expand or build a vehicle maintenance facility. Right-of-way acquisition not included
Rail mode would use a ‘rapid streetcar’ potentially larger than the South Lake Union or First Hill streetcar vehicles but similar in operation to LRT. BRT mode would use electric trolley buses. Enhanced bus assumes new vehicle fleet.
Major capital project elements given special consideration (e.g., bridges). University and Fremont bridges would be used in their existing configuration, subject to a retrofit for rail. All intersections with new rail construction subject to modifications to improve drainage and vertical profile. Some portion of rail alignments would share right of way with auto lanes.
Stations sited for rapid transit network (usually ¼ to 1 mile), not like local bus stops. 1st Avenue (Corridor CC1) stations more frequent to reflect waterfront circulation function.
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<td>Capital cost per mile</td>
<td>Total capital cost divided by the length of the corridor.</td>
<td>Capital cost per mile = total corridor capital cost by mode (as per above) divided by corridor length.</td>
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<td>Travel time savings (end to end)</td>
<td>In vehicle travel time savings (compared to current service) for a passenger riding between two terminus stations.</td>
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Travel time savings (end to end) = projected 2030 corridor travel time with current road design - estimated travel times under each mode, alignment and design.
Assumes most aggressive outcomes are achieved within a range of transit priority treatment and TSP optimization.
Off board payment is assumed for all BRT and rail options reducing station delay to 20 seconds.
Where transit operates in mixed traffic a 10% penalty is applied to the non-intersection corridor segments.
Signal penalties applied range from 0.25 minutes where aggressive TSP is provided to 0.50 where signal priority is more limited.
Data is reported for peak period.
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<td>Travel time savings (in and out of vehicle)</td>
<td>In vehicle travel time savings + out of vehicle time savings (reduced wait time resulting from improved frequency) at estimated average corridor trip length.

Note: This measurement is useful to compare modes, but not corridors.</td>
<td>
Travel time savings (in and out of vehicle) = in vehicle travel time savings * average estimated length of passenger ride + out of vehicle time savings (reduced wait time resulting from improved frequency).
End to end travel time savings as estimated above for peak, base, and evening.
Assumes average trip length is 65% of end-to-end trip (proxy based on ridership profiles).
Out-of-Vehicle Time: Difference between ½ of existing headway and ½ of planned headway.
Calculated based on hourly distribution of existing boardings.
Data is reported for peak period.
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<td>Annualized operating and capital cost per rider</td>
<td>Value of investment over time including cost of operation and annualized cost of capital investment, fleet replacement and maintenance.</td>
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Annualized operating and capital cost per rider = annual operating cost + annualized capital costs / annual boarding rides.
Weekday operating cost based on cost per hour of service for specific mode (King County Metro data reported to FTA) and service plan developed for corridor.
Capital cost as described above.
Assumes project life of 30 years.
Infrastructure life held constant.
Assumes vehicle replacement on the following schedule:
<table>
<tr><td>Diesel Bus</td><td>12 Years</td></tr>
<tr><td>Electric Trolley Bus</td><td>15 Years</td></tr>
<tr><td>Streetcar</td><td>30 Years</td></tr>
</table>
Assumes 3% inflation for operating costs.
2030 weekday ridership is assumed with a 325 annualization factor.
Analysis does not include roadway surface and trackage life in the calculation. However, since rail tracks have a significantly longer life and lower annualized maintenance costs, including this consideration would improve benefit of rail investments. Inclusion is challenging given mix of dedicated and shared ROW types.
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<td>GhG Reduction</td>
<td>Annual reduction in greenhouse gas emission equivalents from reduced vehicle miles traveled and net change in transit emissions

NOTE: Lifecycle analysis to be developed.</td>
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Emissions savings from reduced VMT:
Based on analysis of new transit riders and assumed replacement of light duty vehicles at a rate of 0.47 per new transit rider.
Average trip length calculated by corridor to estimate VMT reduction from each displaced light duty vehicle trip.
Average miles per gallon of fuel consumed for light duty vehicle fleet used to calculate total fuel savings and calculated GhG reduction in metric tons.
Emissions savings from net change in transit emissions
Net total emissions from transit vehicles = emissions from planned service (based on operating plan) – existing service (based on operating cost savings identified above)
Emissions factors applied based on mode (diesel bus, electric trolley bus, and streetcar), derived from the 2008 Seattle Greenhouse Gas Inventory (Seattle bus vehicle miles and total emissions; electricity emissions per kilowatt hour) and National Transit Database (total kilowatt hours):
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<tr><td>Diesel Bus</td><td>0.0023910 $MtCO_2e$ / Vehicle Mile</td></tr>
<tr><td>Electric Trolley Bus</td><td>0.0000999 $MtCO_2e$ / Vehicle Mile</td></tr>
<tr><td>Streetcar</td><td>0.0001722 $MtCO_2e$ / Vehicle Mile</td></tr>
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<td>Hourly capacity requirements (estimated bidirectional demand by mode) and Capacity by vehicle type and headway</td>
<td>Compares hourly demand for service in 2030 with hourly vehicle capacity (supply) provided by various vehicle types/sizes at operating plan headways.</td>
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Hourly ridership demand based on methods described above estimated for peak, base, and evening periods.
Hourly ridership demand compared to hourly vehicle capacity by type of vehicle and proposed headway (e.g., streetcar operating at 15 minute headways = 140*4 or a top capacity of 560 passengers per hour.
Resulting graphic shows relationship between bidirectional hourly demand and vehicle capacity at planned headways.
Vehicle capacity estimates are based on crush load capacity with standees (i.e., where demand and capacity lines meet, 2030 demand is met with standing load capacity full). Instances where the capacity line is 20% to 30% lower than the demand line is representative of a more comfortable load.
Ridership by time of day from King Metro APC data for routes serving the corridor. For CC1 and CC2, ridership by time of day is from Portland Streetcar (Winter 2009).
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