Connecting Policy and Performance: Bellingham's Approach to Integrated Multimodal Transportation and Land Use Planning

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Paper Abstract

Bellingham, WA, the southern terminus of the Alaska Marine Highway system, has been on the forefront of transportation planning with its efforts to integrate multimodal transportation planning with urban infill land use plans. Bellingham has been recognized for implementing one of the nation's first multimodal transportation concurrency programs to encourage new development in mixed-use Urban Villages where adequate pedestrian, bicycle, and public transit infrastructure already exists (2009 APA/PAW Transportation Planning Award; 2010 ITE Transportation Planning Council Runner-Up for Best Program Award).

Bellingham is looking to expand on these successes by exploring innovative methodologies and metrics to directly measure multimodal connectivity. These methods would allow Bellingham to measure plan implementation over time (i.e. performance metrics), as well as prioritize capital improvements due to limited funding.

Bellingham performed a pilot study to evaluate the use of parcel-level point-to-point GIS connectivity metrics in several city planning areas. These metrics measure route quality at the parcel level leveraging existing GIS data sets, allowing detailed analysis of transportation facilities. These methods looked at the quality of connections between residential parcels to schools, transit stops, and trailheads, including scenarios with and without a new arterial link. The GIS metrics use the route directness index (RDI) and route distance in route quality assessments.

The pilot study showed that these tools can effectively be used to graphically show areas of good and poor connectivity. It also showed how the impacts of key new connections can be quantified for later project prioritization and performance metrics.

Paper Text

The City of Bellingham, Washington, has been recognized[1] for implementing one of the nation's first multimodal transportation concurrency programs to encourage new development in mixed-use Urban Villages where adequate pedestrian, bicycle, and public transit infrastructure is provided. Bellingham is looking to expand on these successes by exploring innovative methodologies and metrics to directly measure multimodal connectivity.

This paper provides an overview of the current Bellingham concurrency program and new parcel-level point-to-point GIS connectivity metrics. Possible methods of how to incorporate these connectivity metrics are discussed. Results from a pilot study are provided, which looked at the quality of connections between residential parcels to schools, transit stops, and trailheads, including scenarios with and without a new arterial link.

Bellingham's Current Multimodal Concurrency Program

Bellingham's approach to integrated transportation-land use planning evolved from auto-centric and roadway-based transportation planning to inclusive, flexible, and integrated multimodal transportation planning and concurrency standards. Bellingham transportation planners and consultant (Transpo Group) created an innovative new LOS methodology specifically designed to help achieve the infill and multimodal goals and policies of their Comprehensive Plan.

Bellingham's new systematic plan-based Multimodal Transportation Concurrency program integrates land use and transportation goals, policies, development regulations, and funding mechanisms to ensure that adequate facilities are available for pedestrians, bicyclists, transit riders, and vehicle users. The new multimodal transportation concurrency program also incorporates the long list of multimodal transportation projects needed to accommodate projected population growth in the Comprehensive Plan. Taken as a whole, this new concurrency approach is aimed toward achieving Bellingham's long-term mode shift goals to reduce the percentage of trips made by single occupant vehicles while increasing the percentage of trips made by pedestrians, bicyclists, and transit riders.

Bellingham's adopted LOS standard is "*Person Trips Available by Concurrency Service Area*" based on arterial and transit capacity for motorized modes and on the degree of network completeness for pedestrian and bicycle modes. Any new development that requires more person trips than are available must fund or construct an appropriate amount of additional transportation infrastructure, or institute measurable transportation demand management strategies, to ensure that there are enough person trips available on the multimodal transportation network to serve the new development. Consistent with State law for concurrency, if the developer cannot ensure that enough person trips will be available, then the City cannot accept the application for the proposed development.

Transportation planners divided the city into fifteen small mobility sheds called "Concurrency Service Areas" (CSA), each of which has unique land use patterns and transportation facilities and services available, which influence travel behavior and the transportation choices that people make. Each CSA is classified into typologies as listed below and weighted with policy dials to reflect the relative importance of different transportation modes in the three different CSA Types. Exhibit 1 shows the CSA locations and types.

- **Type 1 CSA** ***(Green)*** are Urban Villages with adopted Master Plans. Type 1 CSAs are characterized by a high percentage of pedestrian and bicycle facilities, high frequency transit service, and higher density land uses with a good mix of services. Western Washington University is an exception and is classified as Type 1A CSA #10 ***(Blue)*** due to the extremely high transit service and ridership, campus parking limitations, and the adopted WWU Institutional Master Plan. St. Joseph's Hospital and Whatcom Community College are both future candidates for Type 1A CSA's.

- **Type 2 CSA** ***(Yellow)*** are transition areas between Urban Villages and outlying areas. Type 2 CSAs are characterized by a moderate percentage of pedestrian and bicycle facilities, high frequency transit service, and moderate density land uses that are primarily residential with a small degree of mixed uses.

- **Type 3 CSAs** ***(Red)*** are primarily east of Interstate 5 and at the edges of the City. Type 3 CSA are characterized by a low percentage of pedestrian and bicycle facilities, moderate to low transit service availability, moderate to low density land use with a small degree of mixed uses, and a high degree of automobile dependency.

Existing Non-motorized Mode Component

The existing non-motorized mode component is facility-based and measures the relative completion of the planned system, as identified in the Comprehensive Plan. Person trip credits are calculated for both the pedestrian and bicycle modes based on the percent complete of the planned system in each CSA. If less than 50-percent of the planned system is complete, then no person trip credit is given for the non-motorized mode.

The pedestrian mode measures the percent complete of the planned pedestrian system. A person trip credit is calculated and person trips are added to the respective CSA. The bicycle mode also measures the percent complete of the planned bicycle system. Similar to the pedestrian mode, a person trip credit is calculated and person trips are added to the respective CSA. The multi-use trail component includes bicycle-friendly trails and adds person trip credits to each CSA based on the relative completeness of the planned bicycle system. The pedestrian and bicycle and multi-use trail person trip credits are added together for a total non-motorized person trips available for each CSA.

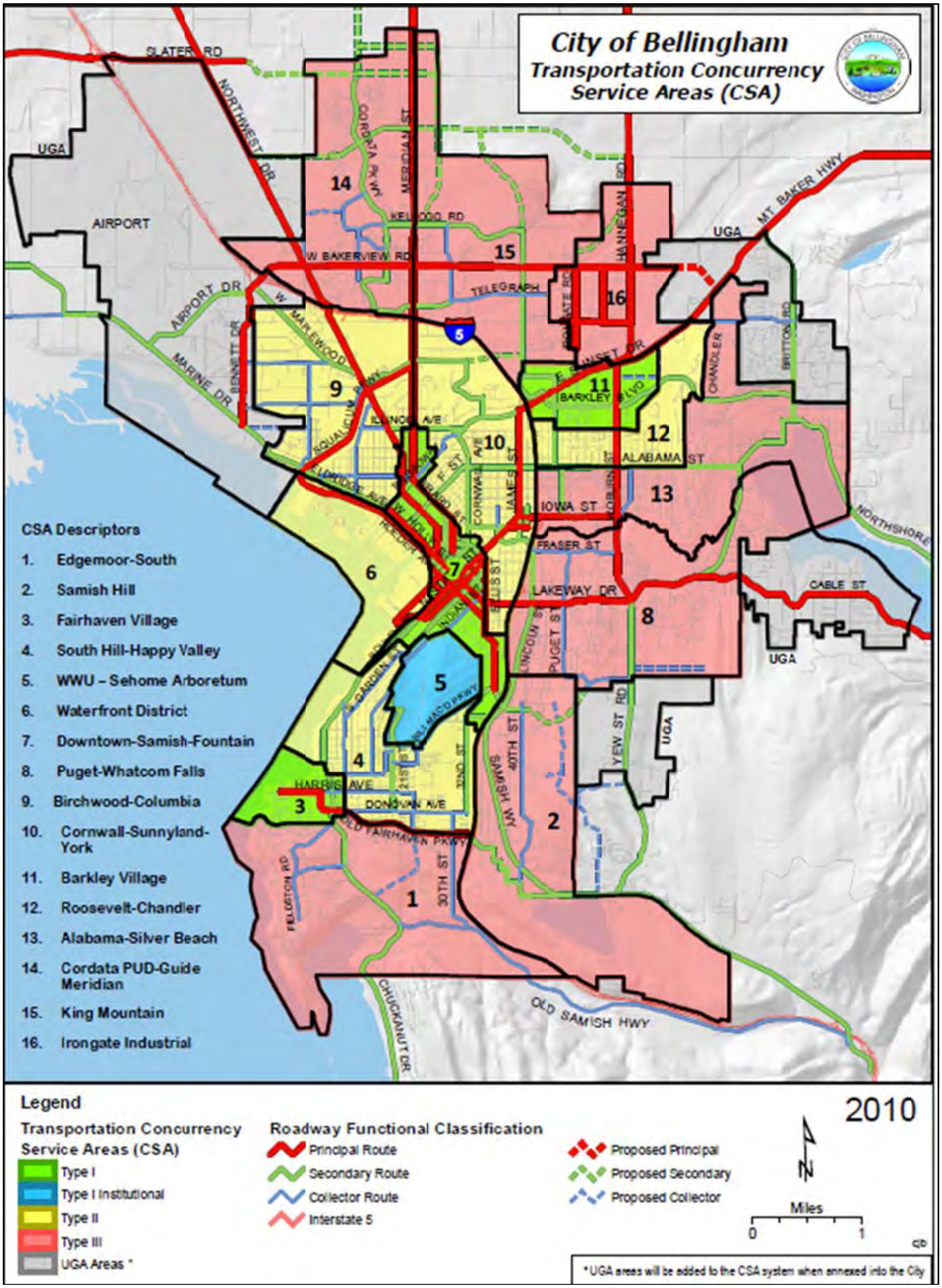


Exhibit 1 – Bellingham's Concurrency Service Areas

Point-to-point Connectivity Metrics Now Available

While the current non-motorized measures of completeness of planned facilities provide a glimpse of how far along the City is in completing plans for pedestrian and bicycle networks, these measures do not provide a good assessment of the quality of the facilities nor the connectivity benefits provided from either a user or neighborhood perspective. At the time of adoption, the City found limited use with existing technical tools and quantitative analyses to assess alternatives to improve the non-motorized system connectivity and accessibility, particularly with walk and bike connections to transit and schools.

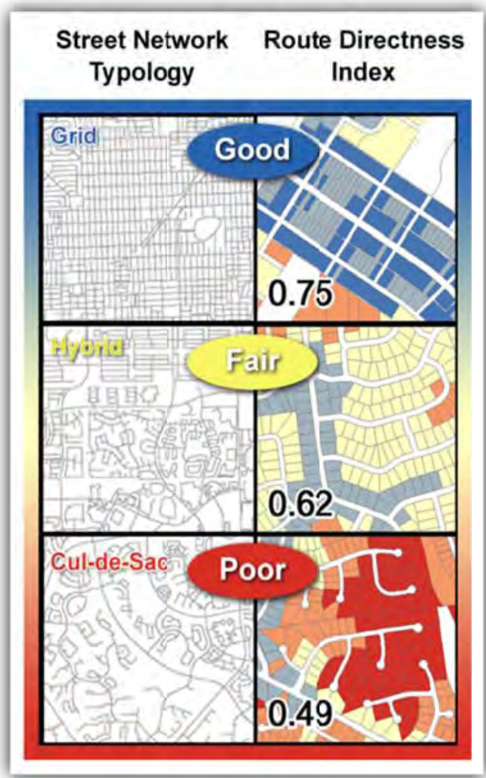


Exhibit 2 - Network Typology and RDI

Since adoption of the plan, new point-to-point GIS tools have been developed. These GIS tools directly measure the route between two points using street centerline (or similar) spatial databases. The score of each route origin can be stored in GIS parcel data sets, allowing a consistent comparison between connection alternatives or for thematic mapping. In addition, GIS analyses allow a large number of parcels to be quickly evaluated.

There are two main types of point-to-point connectivity metrics. First is the basic route distance (measured in distance or time) between two points. Second is the ratio of the straight-line distance and the route distance, which is called the Route Directness Index (RDI). A composite of these two metrics is called the Viacity Score. Exhibit 2 shows how RDI scores relate to different network typologies.

How Connectivity Metrics Could be added to the Concurrency Program

The City Bellingham is looking to enhance or expand upon the existing non-motorized component methodology measures by exploring innovative methodologies and metrics to directly measure multi-modal connectivity. As the City's planning priorities and policies are focused on developing more livable, walkable, and bikeable neighborhoods, more emphasis is placed on creating and improving costs, benefits, and prioritization of capital improvements to create the accessibility and connectivity for a truly multi-modal transportation network.

In Bellingham, rail lines, freeways, streams and terrain pose significant barriers to network connectivity. Land use and neighborhood street design patterns can also form barriers to pedestrian and bicycle travel. The quality of connectivity and presence of major walking and bicycling barriers are not considered with the existing “percent complete” non-motorized component methodology.

Point-to-point GIS connectivity metric can be used within each CSA to measure elements directly related to policy objectives. For example, connectivity metrics could account for these Quality of Service indices:

- **Smart Growth** – City-wide, nearest neighbor connectivity scores of walking and bicycling routes between individual tax parcels
- **Safety** – Neighborhood route analyses as safe-routes-to-schools
- **Access** – Neighborhood access to primary transit station walk destinations
- **Active Living** – Access to parks and important recreational pathways
- **Land Use Benefit** – Measurement of parcel-to-parcel land use connectivity improvements
- **Emergency Access** – Access to parcels from fire or emergency response stations

The indices can be weighted to better reflect the connectivity objectives of a CSA Type. For instance, the composite RDI score for Type 1 CSAs may emphasize “Access” and “Smart Growth”, while Type 3 may emphasize “Active Living” and “Safety”.

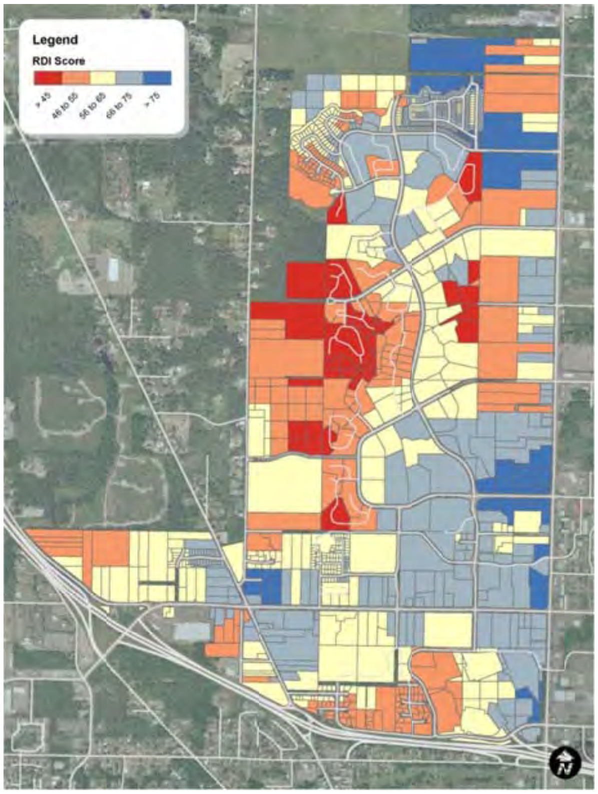
The indices can also be a means to establish connectivity benefits related to project costs, and related long-range plan implementation priorities. These indices are also a consistent measure to quantify how infrastructure is updated

Pilot Study Shows Potential Use

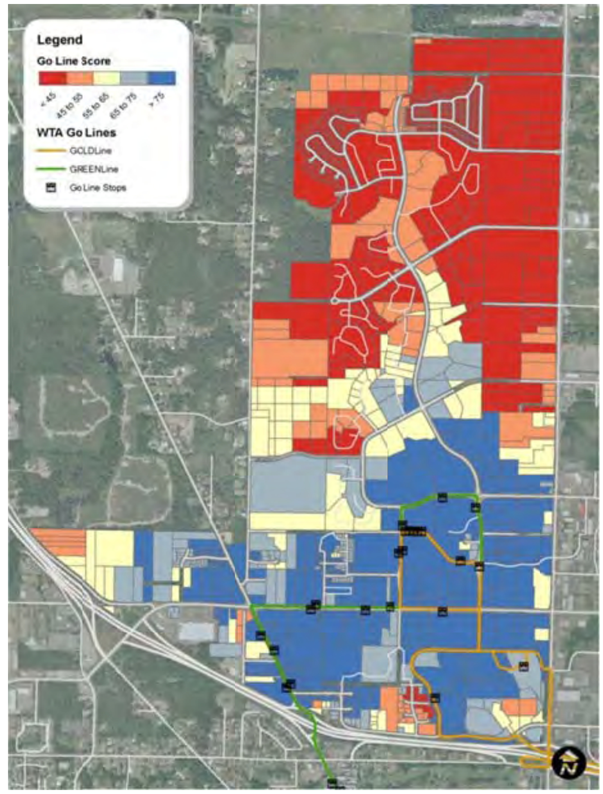
To understand how connectivity characteristics would be measured within a CSA and for a particular project, two point-to-point GIS analyses were conducted. First, CSA #14 (see Exhibit 1) was evaluated. This CSA is a Type 3 CSA representing suburban growth areas. Second, the Birchwood Connector project was evaluated, which provides both a motorized and non-motorized connection across Interstate 5 away from existing interchanges.

<u>CSA #14 Analysis</u>

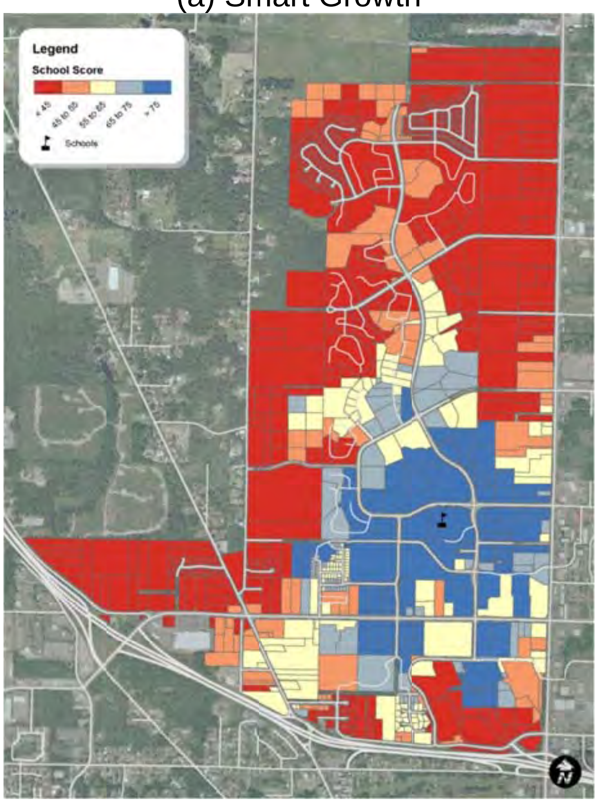
In the northern section of the City, CSA #14 represents a mix of suburban development bordering on rural areas. The RDI and Viacity connectivity metrics were used to evaluate for four different Quality of Service indices.



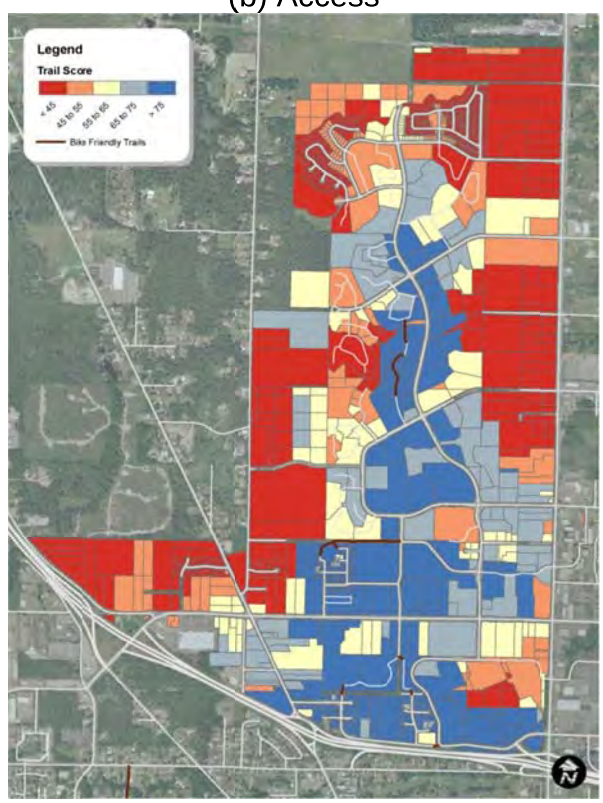
(a) Smart Growth



(b) Access



(c) Safety



(d) Active Living

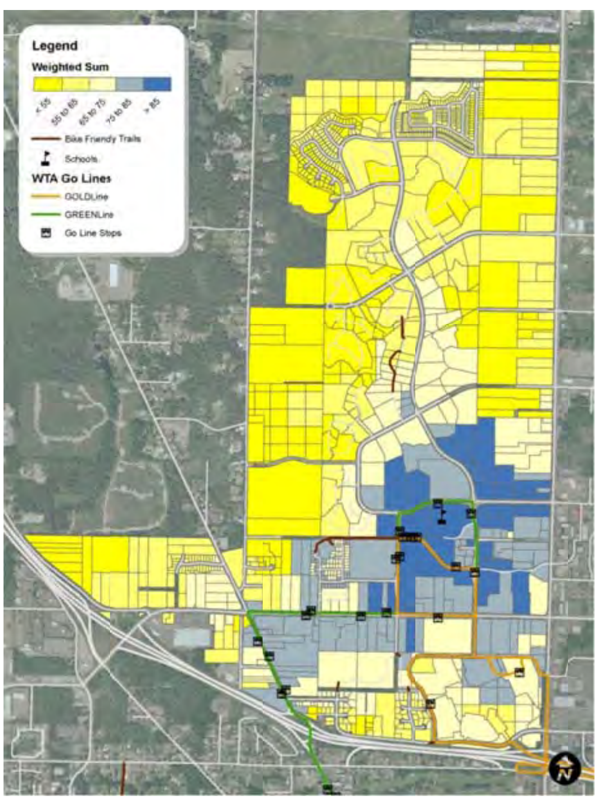
Exhibit 3 – Individual Quality of Service Indices

Exhibit 3(a) shows how **Smart Growth** could be evaluated, reflecting how well neighborhoods are generally connected to each other. For *each parcel* within the CSA, the RDI was measured to every other parcel within 0.25 mile (straight-line) and then averaged for a single score. Blue areas in Exhibit 3(a) show parcels more directly connected to neighboring parcels; red areas show poorer quality connections.

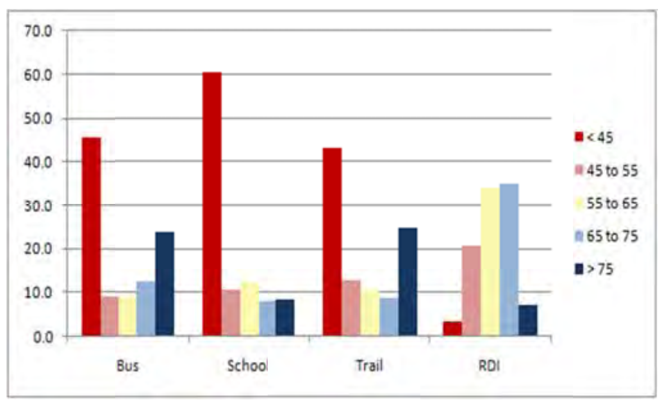
Exhibit 3(b) shows how **Access** to transit could be evaluated. For *each parcel* within the CSA, the Viacity Score was measured to the nearest transit stop for Bellingham's Go express transit service. Access is good in the southern area of the CSA, but poor in the northern area.

Exhibit 3(c) shows how **Safety** to neighborhood schools could be evaluated, reflecting less barriers and shorter connections. For *each parcel* within the CSA, the Viacity Score was measured to the school. Only parcels within close proximity of the schools showed higher scores.

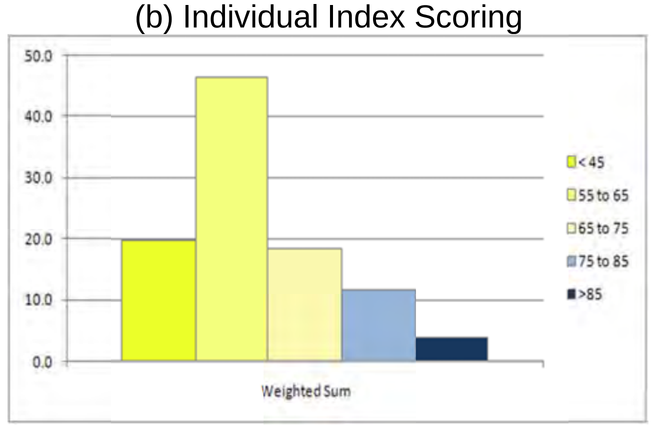
Exhibit 3(d) shows how **Active Living** connectivity characteristics could be evaluated, reflecting connections to parks and trailheads. For *each parcel* within the CSA, the Viacity Score was measured to the parks and trailheads. This shows parcels (red) that are not well connected to community recreational facilities.



(a) Composite Score



(b) Individual Index Scoring



(c) Composite Index Scoring

Exhibit 4 – Composite Connectivity Scoring

Exhibit 4(a) shows the **Composite Score** for each parcel reflecting all four of the measures shown in Exhibit 3 (Smart Growth, Access, Safety, and Active Living). This composite score weights each component score according to CSA priorities. In this example, Smart Growth was weighted higher than Active Living scores.

Exhibit 4(b) and 4(c) show the types of statistics that can be used to characterize each area. As motorized, non-motorized, transit, and other facilities change over time, these connectivity analyses can be repeated to compare past facilities. This can allow Bellingham to evaluate plan progress over time.

<u>Birchwood Connector</u>

The Birchwood Connector provides a new undercrossing of Interstate 5 for motorized and non-motorized traffic. As shown on Exhibit 5, the new connection is approximately half-way between two existing Interstate 5 interchanges (Sunset Drive and Guide Meridian Road interchanges). Southwest of the new connection is St. Joseph Hospital, a major regional destination.

For *each parcel* in the study area, route distance was calculated between the parcel and St. Joseph Hospital. This process was done for two conditions, with and without the Birchwood Connector. Then the resulting difference in route distance was calculated and mapped as shown in Exhibit 5. Dark blue parcels reflect large differences, and light blue minor differences.

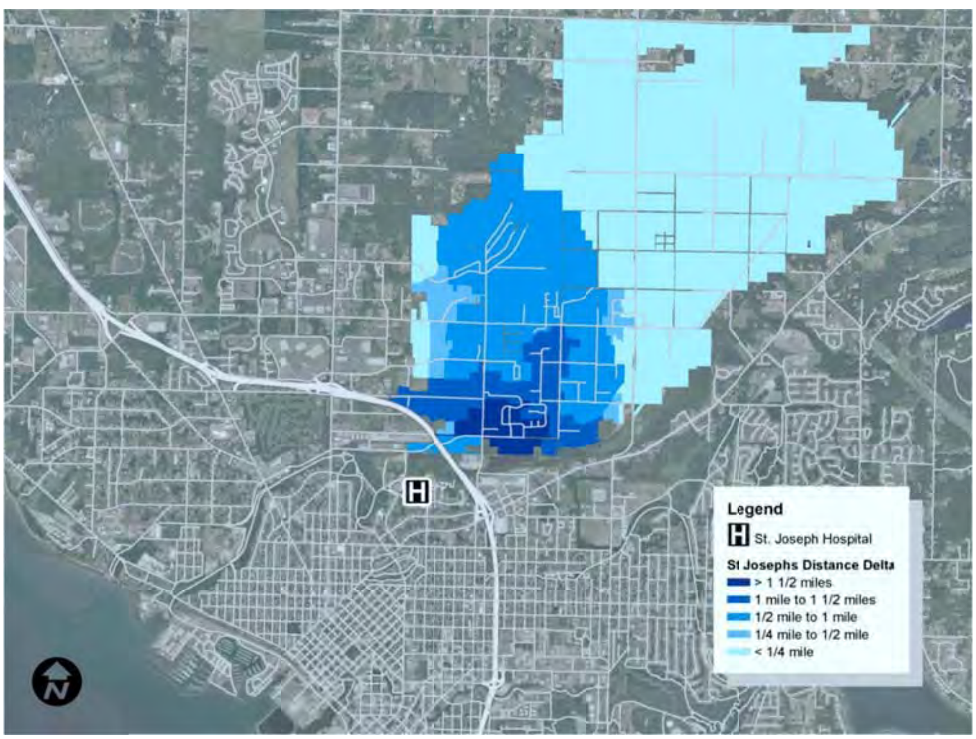


Exhibit 5 - Birchwood Connector Improves Access to Hospital

As shown in Exhibit 5, there are a substantial number of parcels that would benefit from the new connector. In addition to better hospital access by the general public, emergency response times to these parcels would also be positively impacted. The Birchwood Connector would also provide major bicycle commuter link across Interstate 5, connecting residential areas to Bellingham's downtown.

Conclusion

The pilot study showed that these new point-to-point connectivity metrics can effectively be used to graphically show areas of good and poor connectivity. It also showed how the impacts of key new connections can be quantified for later project prioritization and performance metrics. When Bellingham next updates the non-motorized portion of their concurrency program, connectivity tools such as these will likely be used to estimate project-related person trip credits.

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Endnotes

1. 2009 APA/PAW Transportation Planning Award; 2010 ITE Transportation Planning Council Runner-Up for Best Program Award