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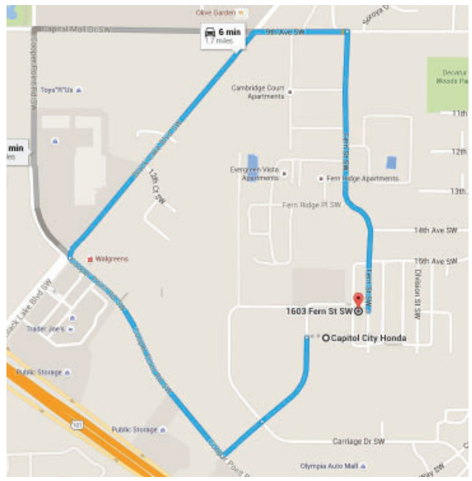
WORKING TOGETHER TO SUPPORT TRANSPORTATION EFFICIENT COMMUNITIES

Washington State Department of Commerce | Washington State Department of Ecology | Washington State Department of Health | Washington State Department of Transportation

WHAT IS A TRANSPORTATION EFFICIENT COMMUNITY?

Transportation efficient communities support health, prosperous economies, energy conservation and a sustainable environment by requiring less driving to meet daily needs.

How can cities and counties plan for street network connectivity?



Starting at1603 Fern Street SW and ending at 2346 Carriage Loop SW in Olympia, WA. Less than 500 feet away, but requires 1.8 miles of driving due to a lack of street network connectivity.

What is street network connectivity?

Street connectivity results when a network of streets forms a grid pattern and provides multiple routes and connections to get to origin and destination points. In well-designed transportation networks, adequate street connectivity results from a mixture of different sized streets such as arterials, collectors, and locals.

Connectivity refers to both the number of connections in a given area as well as the directness of the routes. A well-connected network has many short links, numerous intersections, and minimal dead-ends. Where a road connection may not make sense, a pedestrian or bicycle connection may still be considered. As connectivity increases, travel distances decrease and route options increase. The result is more direct travel between destinations and a more accessible system.

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What are the benefits of street network connectivity?

The major benefit of street connectivity is that it redistributes traffic across an entire street network. If local streets are poorly connected, local trips are forced to use the arterial system, which is designed to handle longer trips. The combination of short and long trips using the same streets creates congestion problems.

Connected local streets help keep local trips off arterial streets and reduce the need for widening and construction improvements on collector or arterial streets. Highly connected grids are cheaper to build and maintain making them more economical by:

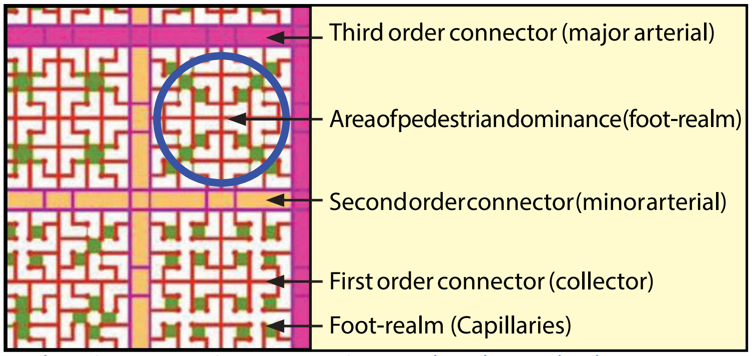
- Getting better value out of every street.
- Not having to build for high-speed traffic.
- Not creating congested choke points.

Increased connectivity provides for different modes of travel besides automobiles. By linking sidewalks, paths, bicycle lanes, and streets, destination distances become shorter, thereby potentially increasing trips by walking, bicycling, or transit.

KEY TAKEAWAYS

- Street network connectivity helps reduce the volume of traffic and traffic delays on major streets (arterials and major collectors), and ultimately improves livability in communities.
- There is enhanced bicycle and pedestrian travel when the number of street connections or local intersections in communities is increased.
- A well-connected street network is the traditional grid pattern.
- Street network connectivity is achieved by providing connections within individual developments, between developments, and by having a well planned collector road network to compliment the arterial highway network.
- Characteristics of street network connectivity is short block lengths, numerous three and four-way intersections, and minimal dead-ends (cul-de-sacs).

A network of streets, sidewalks, bicycle lanes, and paths that connect to each other also reduce the distance children have to travel from home to school. It also allows for the use of more local streets rather than major roadways and provides a greater choice of routes to travel to and from school safely.



Roadway Connectivity, Creating More Connected Roadway and Pathway Networks, TDM Encyclopedia, Victoria Transport Policy Institute

How does street network connectivity make a more livable, sustainable, and overall better quality of life community?

By shaping street layout, that influences urban design, communities:
- Develop character.
- Have narrower, safer, attractive streets.
- Have a good pedestrian environment for all ages.
- Have a collector/connector network that is the backbone of good transit service.
- Have improved emergency access, evacuation, and reduced response time.
- Encourage active, healthy living.

When and how can cities and towns implement street network connectivity?

The following are a number of suggestions on how cities and towns may implement street network connectivity:
- During street and non-motorized pathway planning and project development.
- When designing subdivisions.
- By adopting street connectivity standards or goals.
- By requiring alleyways and mid-block pedestrian shortcuts.
- By constructing new roads and paths connecting destinations.
- By using shorter streets and smaller blocks.
- By applying traffic calming rather than closing off streets to control excessive vehicle traffic.

Why have street connectivity standards?

The purpose of connectivity standards is to achieve an open street network that provides multiple routes to and from destinations. Such a network is key to supporting walking and bicycling as a convenient, safe, and healthy form of transportation. It also discourages the proliferation of limited access street designs where residential subdivisions have but one or two points of entry and exit, and where commercial developments have access only onto arterial streets with no connections to adjacent properties.
The growing trend in cities enacting street network connectivity is reflective of several larger trends shaping planning and land development. This includes:
- The possibility that bicycling and walking could be routinely, accommodated as transportation modes in regional and local transportation plans, models, and funding formula.
- The possibility that the traditional street hierarchy of arterial, collector, and local streets has reinforced the problems caused by conventional single-use zoning, including neighborhood isolation and inaccessibility (by all modes, but in particular walking) between origins and destinations.
- The possibility of the relationship between neighborhood design and residents' level of physical activity and the rates of obesity and other health issues.

In general, connectivity requirements have the purpose of creating multiple, alternative routes for cars and creating more route options for people on foot and on bicycles. Additional ordinances can establish pedestrian routes and passageways between land uses that can link isolated subdivisions to each other and create the shortest, safest routes possible between origins and destinations.

Connectivity ordinances generally use one of two methods to evaluate proposed developments. The first and most common method is to establish a maximum block length. The appropriate block length for any community can be determined by examining and measuring the dimensions of blocks in residential areas of the city that reflect the desired scale, character, and connectivity the municipality is hoping to achieve within new developments.

What are some of the policies for implementing improved street connectivity networks?

Local policies and statutes help ensure the implementation of street and non-motorized connectivity measures. Following are areas of policy or program recommendations that help implement improved street connectivity networks.
- Complete Streets policy
  - Establishes a vision for an integrated, multimodal transportation system with a well-connected roadway network that accommodates all modes and enhances community livability.
  - Provides the community an opportunity to enhance the quality of life of its residents by providing and improving pedestrian and bicycle access and connectivity.
  - Ensures streets and roads work for drivers, transit users, pedestrians, and bicyclists, as well as for older people, children, and people with disabilities.
- Mapping connections
  - Many cities map new (future) arterial and collector street connections as a guide for new development to complete important street connections. These maps are often part of a long-range transportation or comprehensive plan.
  - There is development of a conceptual local street plan that identifies the most important local streets and exclusive non-motorized path connections that improve local access and preserve the integrity of the street functional classification system.
  - There are also pedestrian and bicycle system plans. These local street plans are for use in the development review and permitting process to ensure the construction of those local street connections to adjacent areas promote a logical, direct, and connected local street system.

- Local street connectivity policies
  - Local agency policies could have a local street circulation pattern that provides access to property and connections to collector and arterial streets, neighborhood activity centers, and emergency access.
- Revisions to development codes or statutes
  - Local development codes for residential and mixed-use areas could have grid-based standards.
  - When full street connections are not possible, the developer could provide bicycle and pedestrian access on public easements or right of way in lieu of streets.
  - Developments could limit the use of cul-de-sacs in a situation where barriers prevent a connected street network.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- Connectivity measurement tools for plan evaluation
  - An established metric for revised baselines (motorized and non-motorized plan elements).
  - The measurement of intersection density (percent of four-way intersections) as the primary connectivity index as it is a consistent transportation metric that reflects variation in both (a) mode-share and (b) traffic safety.
  - The use of a connected node ratio (the number of street intersections divided by the number of the intersections plus cul-de-sacs). The maximum value is 1.0. Higher numbers (0.7 and above) indicate that there are relatively few cul-de-sacs and theoretically, a higher level of connectivity. It is not recommended to have a network with a value less than 0.5.
  - The use of a link-node index of connectivity (it equals the number of links divided by the number of nodes within a study area). Links are defined as roadway or pathway segments between two nodes. Nodes are intersections or the end of a cul-de-sac. A perfect grid has a ratio of 2.5.
  - A measure of the percent missing or incomplete in a comprehensive plan's bicycle and pedestrian network.

What types of barriers may need to be addressed to achieve street connectivity networks?

Several barriers to street network connectivity may prevent or discourage development of desirable and complete street networks.

- Street service life
  - Auto-oriented design standards, may take years to establish bicycle, transit, and some pedestrian features as part of a major reconstruction project.
  - There may be constrained right of way by patterns of existing development that has a life cycle of its own.
  - When developing local capital projects designers may look to adopted standards as the sole source for guidance. This works well if the street design standards are "complete" with emphasis on multimodal access and mobility, but it may not work well when street standards are auto-dominant. The result may be projects that do not upgrade facilities with better sidewalks, bicycle lanes, or transit features.
- Limited funding
  - There may be funding constraints that come in several forms including insufficient resources at the federal, state, and local levels.
  - Funding processes may allocate by project rather than by network.

Tools and Resources:

General

- Your Community's Transportation System, Accessibility and Connectivity, Page 45
- Increased Street Connectivity Improves Public Health Outcomes
- Land Use Impacts on Transport
- Street Connectivity vs. Street Widening: Impacts of Enhanced Street Connectivity on Traffic Operations in Transit Supportive Environments
- Roadway Connectivity, Creating More Connected Roadway and Pathway Networks
- Analysis of the Effects of Local Street Connectivity on Arterial Traffic
- WSDOT Model Street Connectivity Standards Ordinance
- Smart Growth Streets and Emergency Response
- Connectivity
- Measuring Network Connectivity for Bicycling and Walking
- Associations between Street Connectivity and Active Transportation
- Street Connectivity and Neighborhood Development
- Improving Connectivity and System Function through Local Planning, Publication 731

Performance Measures

- Measuring Network Connectivity for Bicycling and Walking
- Measures of Street Connectivity: Spatialist Lines (MoSC)
- Successful Streets: Performance Measures, Community Engagement, and Urban Street Design
- Using GIS to Measure Connectivity: An Exploration of Issues
- Traffic Analysis Tools - Sketch Planning

Maps and Data

- FHWA's Connectivity Evaluation Resources
- Green Tools
- Smart Location Mapping (EPA)
- WalkScore (Walk Score)

Identifying and Analyzing Strategies

- Smart Growth Streets and Emergency Response

Rural Areas

- Smart Growth in Small Towns and Rural Communities (EPA)
- Complete Streets Work in Rural Communities

- Projects may not be eligible for funding due to restrictions to functional classification or by mode.

- Land use and transportation
  - There may be a land use and transportation disconnect, e.g., no mixed use, no active transportation access, site design that is oriented toward automobiles.
  - There may be environmental analyses by project rather than cumulatively over networks.
- The value of street networks and connectivity
  - There may be a predominant, negative perception of networks as fostering increased traffic and declining safety.
  - There may be outdated codes and ordinances that proliferate possible ineffective planning and implementation.
  - There may be existing development patterns that make it difficult to have network connections between new developments and existing developments that are "closed."
- Superblock and large footprint developments
  - Developers may prefer closing existing blocks of streets and subtracting from existing networks.
  - Large new developments may not include network components.
  - The perception that limiting network and access will control traffic problems.
- Natural features
  - Rivers and man-made features, (highways and freeways) may serve as or create barriers to direct local travel, particularly for bicycle and pedestrian travel.
- Gated communities
  - Limited access may increase motor vehicle travel and non-motorized accessibility.
- Cul-de-sac popularity
  - It may be difficult to overcome the preference for cul-de-sacs because they have a perceived sense of limiting traffic volumes and speeds.
  - It may be perceived that cul-de-sacs take less right of way and are also more secure.

www.pedbikeimages.org/Barbara Gossett

It is important to identify barriers to street network connectivity so transportation connections within individual developments, between developments, and by having a well planned collector road network to compliment the arterial highway network may be studied for consideration.

Tools and Resources:

Freight and Intermodal Connections

- Washington State Freight Economic Corridors (WSDOT)
- USDOT Connectivity

Examples:

- Seattle, Washington, Yesler Terrace
- Portland, Oregon, Street Connectivity: An Evaluation of Case Studies in the Portland Region
- Charlotte North Carolina, Street Connectivity Program Status Update
- Cary, North Carolina, Street Connectivity
- Albany, New York, Street Connectivity
- Allentown, Pennsylvania, Guidance Document, Street Connectivity
- Richmond, Virginia, Virginia's New Street Connectivity Regulations: the Specifics

For More Information:

Please contact Transportation Efficient Communities Coordinator:

Teri Chang
WSDOT Community Collaboration & Network Planning
360.705.7918
changt@wsdot.wa.gov