The Paved Trail Networks of South Puget Sound: Finding the Gaps and Connecting the Dots

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With wildly fluctuating fuel prices, the onset of global warming, epidemic obesity, and the political problems accompanying dependence on foreign oil, many communities and regions are looking to bicycling as an important part of a comprehensive transportation solution. Local governments are investing in bicycling infrastructure. However, in the South Puget Sound region, these investments have lacked central coordination and a longer view of how the trails being built will fit into the larger bicycle transportation system. This has resulted in a patchwork of individual trail networks lacking interconnectivity. This lack of interconnectivity hampers the full potential of these trails as transportation infrastructure from being realized, and, in some cases, renders them useless (for the most part) for recreation only.

**Project Objectives**

The aim of this project is to create and implement a GIS methodology that can be used by urban planners, bicycling advocates, or any other interested party to identify “high value gaps” between the existing infrastructure across a region. Shortest distance gaps are found and weighted to identify “high value gaps”.

**Methods**

The methodology was the primary focus of this project. It is the author’s hope that this method can be honest and made into a portable model for bicycle advocacy everywhere.

The input used for this project was three polyline shapefiles representing the paved trails in King, Pierce, and Thurston County in the State of Washington. These shape files were imported into a feature dataset to rectify projections and then merged into a single feature class containing regional trails. This feature class was then buffered using a 50 ft. buffer and clipped resulting in a feature-class of single distinct geometric features for each “network” of interconnected trails. The Generate Near Table tool was then run in ArcGIS 9.3 using this resulting feature class as both “input feature” and “near feature”. This resulted in a large table containing information on the gaps between each trail network and every other trail network in the daseline network layer. The resulting table contained XY start points, length and angle indicating the presence of trail network A to trail network B.

In order to take in the information contained in the resulting “gaps” table and generate a new feature class of “gap polygons”, a new process was created using a python script. The script created a new polygon feature class. Two XY points were needed to create a line segment in this new feature class. The script, through the table, located matching pairs of entities— for instance:

- Input Object ID = 5, Near Object ID = 13 was matched to Input Object ID = 13, Near Object ID = 5

The XY point from each of these matched table rows were used as end points to create a new polygon in the gap polygons feature class with the following attributes:

- Shape Area of the input feature
- Shape Area of the near feature
- Distance of gap

The script accounted for and skipped any entries with zero length.

A “select by location” procedure was then run with a buffer of -10 feet (removing tangent end points from consideration) to locate the gap polylines which intersected trail networks. The inverse of this selection was taken and exported as a new feature class. The gaps that remained were then removed further by removing all fields were added to adjust the Shape Area fields to a number that more closely matched the total length of the trails represented. This was done using the following equation:

\[
\text{Shape Area of the input feature} - \text{Shape Area of the near feature} = \text{Distance of gap}
\]

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\[
\text{Distance of gap} = \text{Shape Area of the input feature} - \text{Shape Area of the near feature}
\]

The resulted table contained XY start points, length and angle indicating the nearness of trail network A to trail network B.

These shape files were imported into a feature dataset to rectify projections and then merged into a single feature class containing regional trails. This was done using the following equation:

\[
\text{Total Length of Trail Network A} + \text{Total Length of Trail Network B} = \text{Length of gap}
\]

This resulted in a large table containing information on the gaps between each trail network and every other trail network in the daseline network layer. The resulting table contained XY start points, length and angle indicating the presence of trail network A to trail network B.

The inverse of this selection was taken and exported as a new feature class. The gaps that remained were then removed further by removing all fields were added to adjust the Shape Area fields to a number that more closely matched the total length of the trails represented. This was done using the following equation:

\[
\text{Distance of gap} = \text{Shape Area of the input feature} - \text{Shape Area of the near feature}
\]

The primary barrier to bridging this gap is clearly the river. However, it may present a simpler option to simply bridge the gap directly by a highway corridor. No structure is provided.

The map above highlights multiple gaps. Two are of particular interest. The green lines indicate that a Sacrificial Trail has been identified and has been provided for safe bicycle travel. The gap between the Fortunato Trail and the LeMay Trail is a highly utilized and connected corridor that is key to the urban planning and funding stages.

**Acknowledgements**

Many thanks to my wife, Dr. Amy Young, for her support. Thank you to Dr. Matthew Kelley for his guidance and endless patience. Thank you to my classmates for candidly challenging me and encouraging me. Lastly, thank you to all of the many bicycling advocates here in the Pacific Northwest— especially the Friends of Trails to Trails Coalition. It was your hard work that inspired and informed this project.