Neumann
Digital Terrain Analysis Final Project

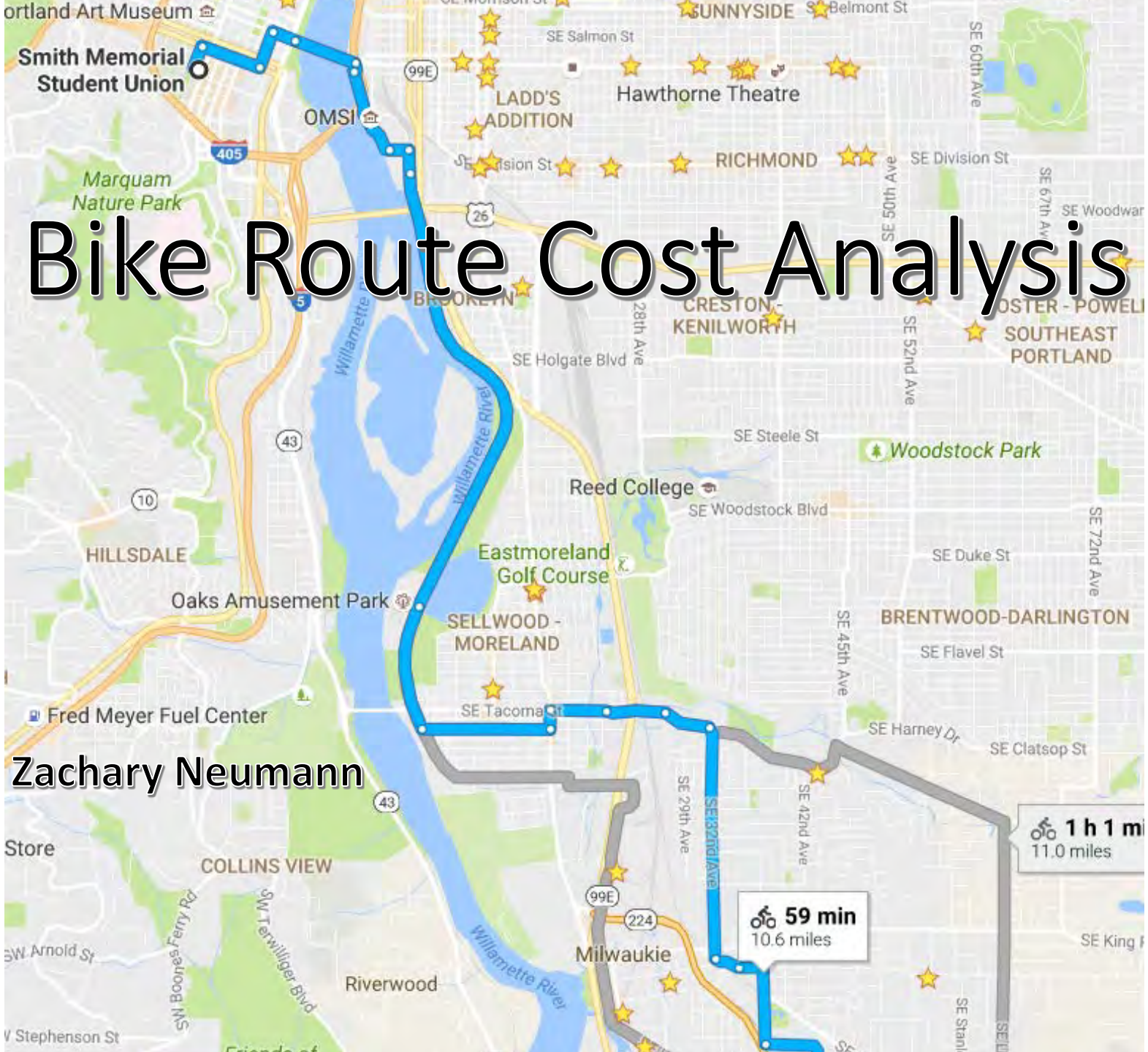
Bike Route Cost Analysis

Abstract

Network analysis is a powerful aspect of GIS that allows one to find the least costly path from point A to point B. Google maps uses network analysis to route a driver in the quickest and most efficient manner by analyzing time, distance, and the amount of traffic. I wanted to know what the best route from my place of residence to school was based on the least slope and the best biking roads or paths. I combined RLIS bike routes with Oregon Spatial Data Library 10m DEM to get bike routes by type with average slope attributes attached. I classified the bike routes by type and weighed them based on personal preference (from lowest cost to highest cost: bike paths (1), bike boulevards (2), bike lanes (3), and roads (5)). I classified average slope using a slope classification from theclimbingcyclist.com (from lowest cost to highest cot: 0 – 1% (1), 1 – 3% (2), 3 – 6% (3), 6 – 9% (4), > 9% (5)). I then converted the data to raster and used the raster calculator to add the reclassified data together to find the highest cost (bike slope + route type; bike slope * 0.4 + route type * 0.6, and bike slope * 0.6 + route type * 0.4). This method was able to provide a route to school that was different than my usual route and that was satisfactory and seemed like a logical alternative to what I normally do.

Figure 2: This is the route that was generated when bike slope and bike route type were evenly weighted. This route was the same as multiplying bike slope by 60% and bike route type by 40%, weighing bike slope greater than bike route type.

Figure 1: This is the route that was generated when bike slope was multiplied by 40% and bike route type was multiplied by 60% to give route type a greater weight than bike slope.



Bike Route Cost Analysis

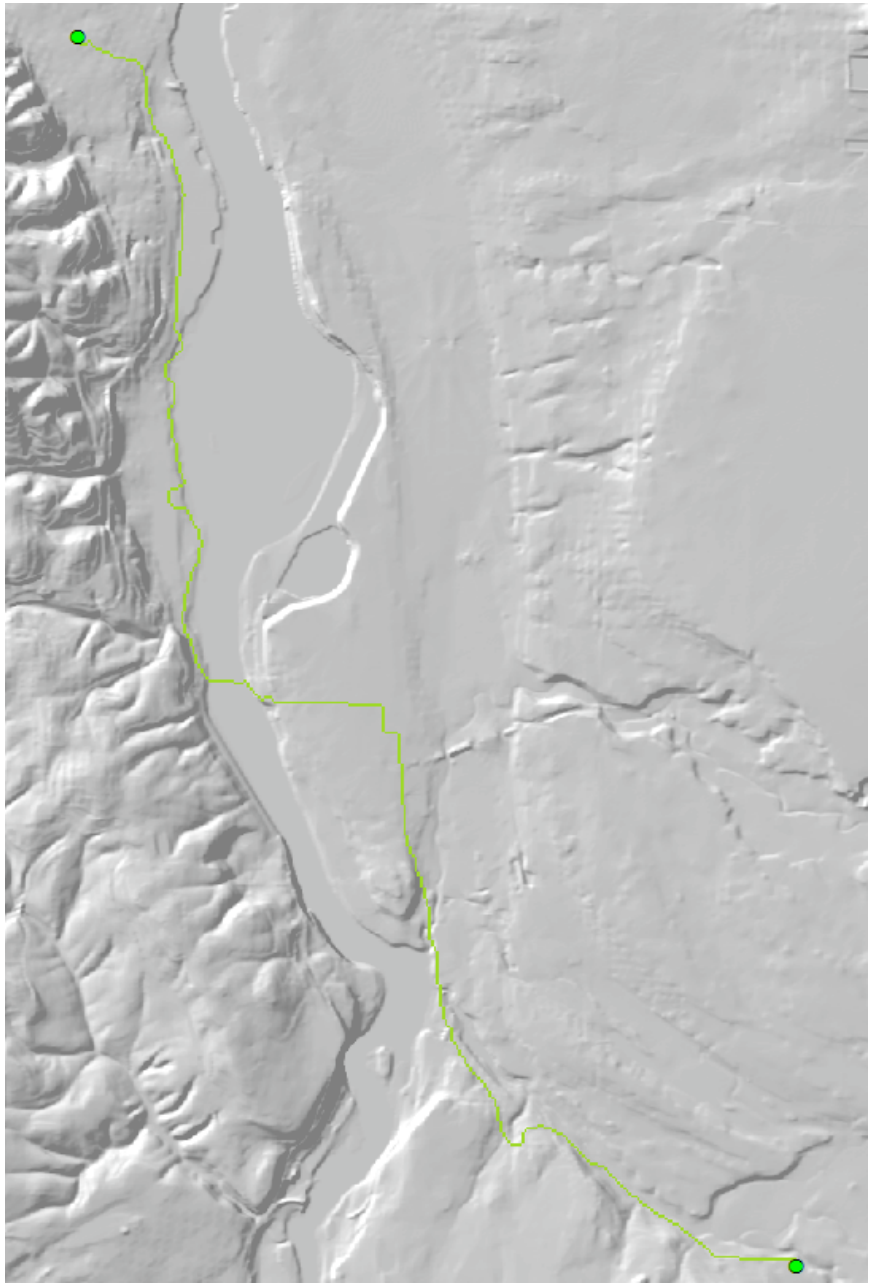
Zachary Neumann

Question

- What is the most effective/least cost path to take to get to campus from my house on a bike?

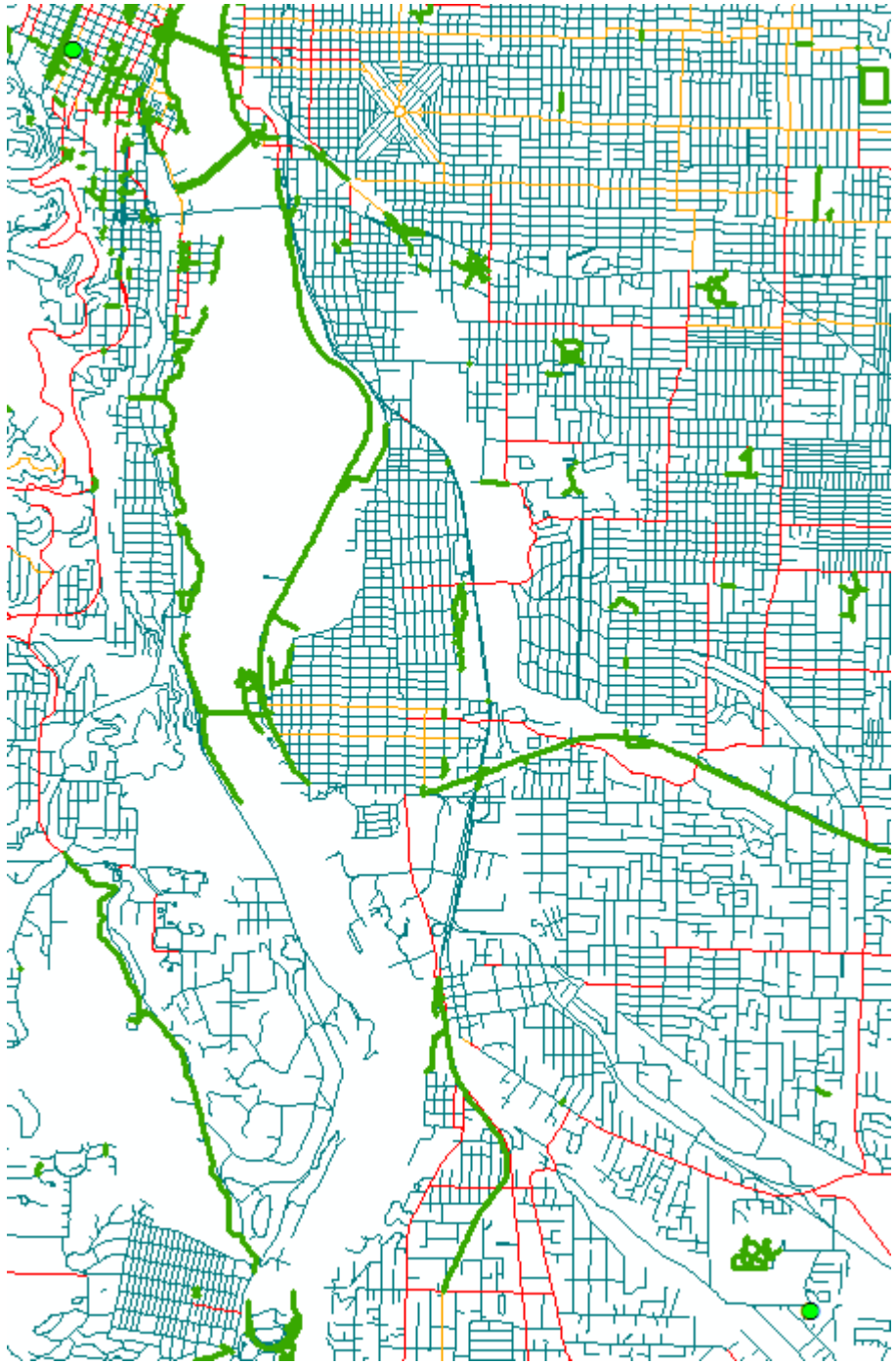
Data Sources

- RLIS Bike Routes
- Oregon 10m DEM (Oregon Spatial Library)



Methods

- Separated bike paths, boulevards, and lanes frm roads that are not bike friendly.
- Gave roads a weight of 5, lanes a weight of 3, boulevards a weight of 2, and paths a weight of 1 (1 being the least costly and 5 being the most) using the **Field Calculator Tool**.
- Used the **Merge tool** to merge them back together.
- Used the **Add Surface Information tool** to add slope percentage to road data previously mentioned from Oregon DEM.

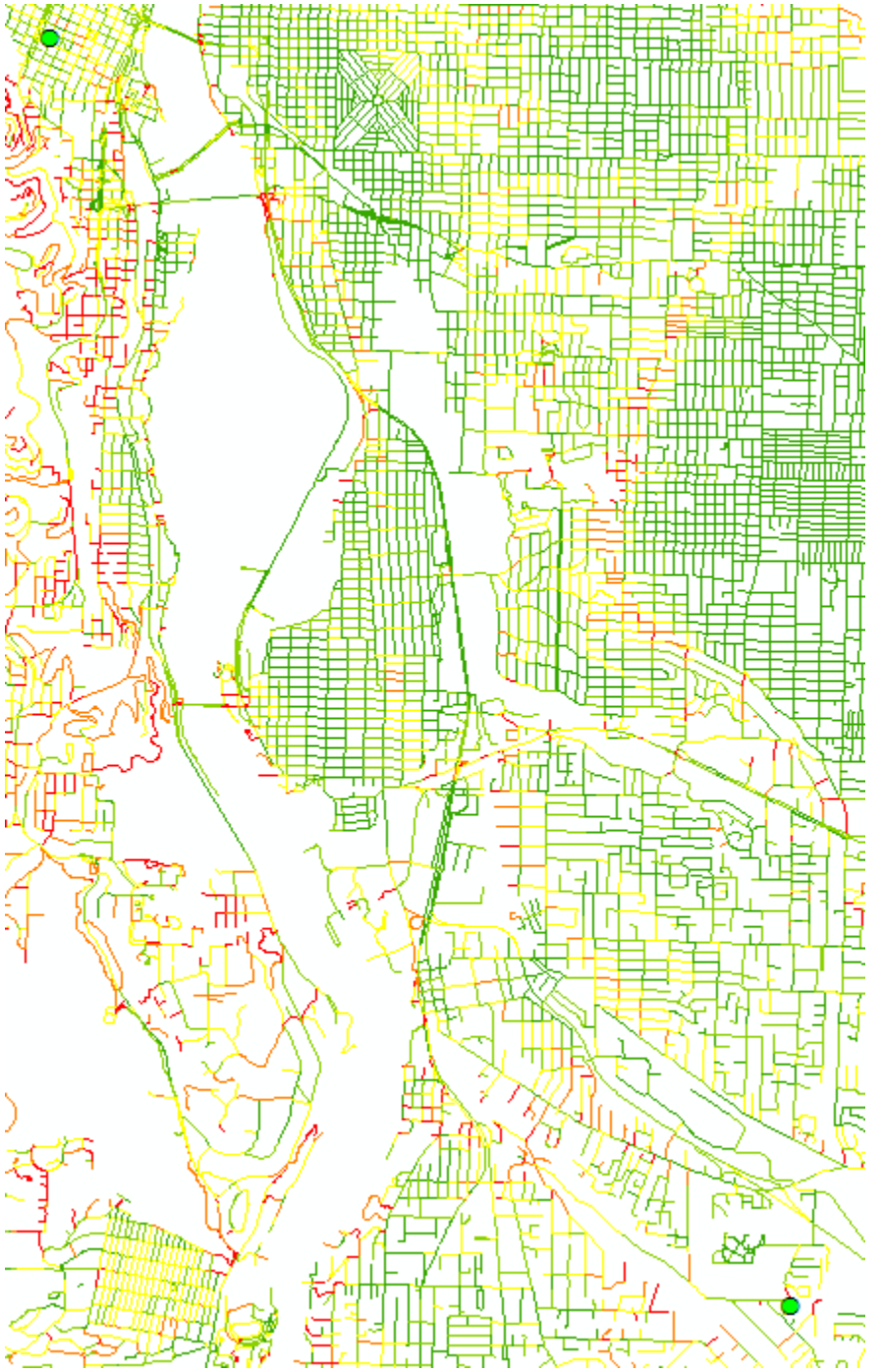


LEFT: Route weight by route type and classification

Roads = 5
Lanes = 3 (red)
Boulevards = 2 (orange)
Paths = 1 (green)

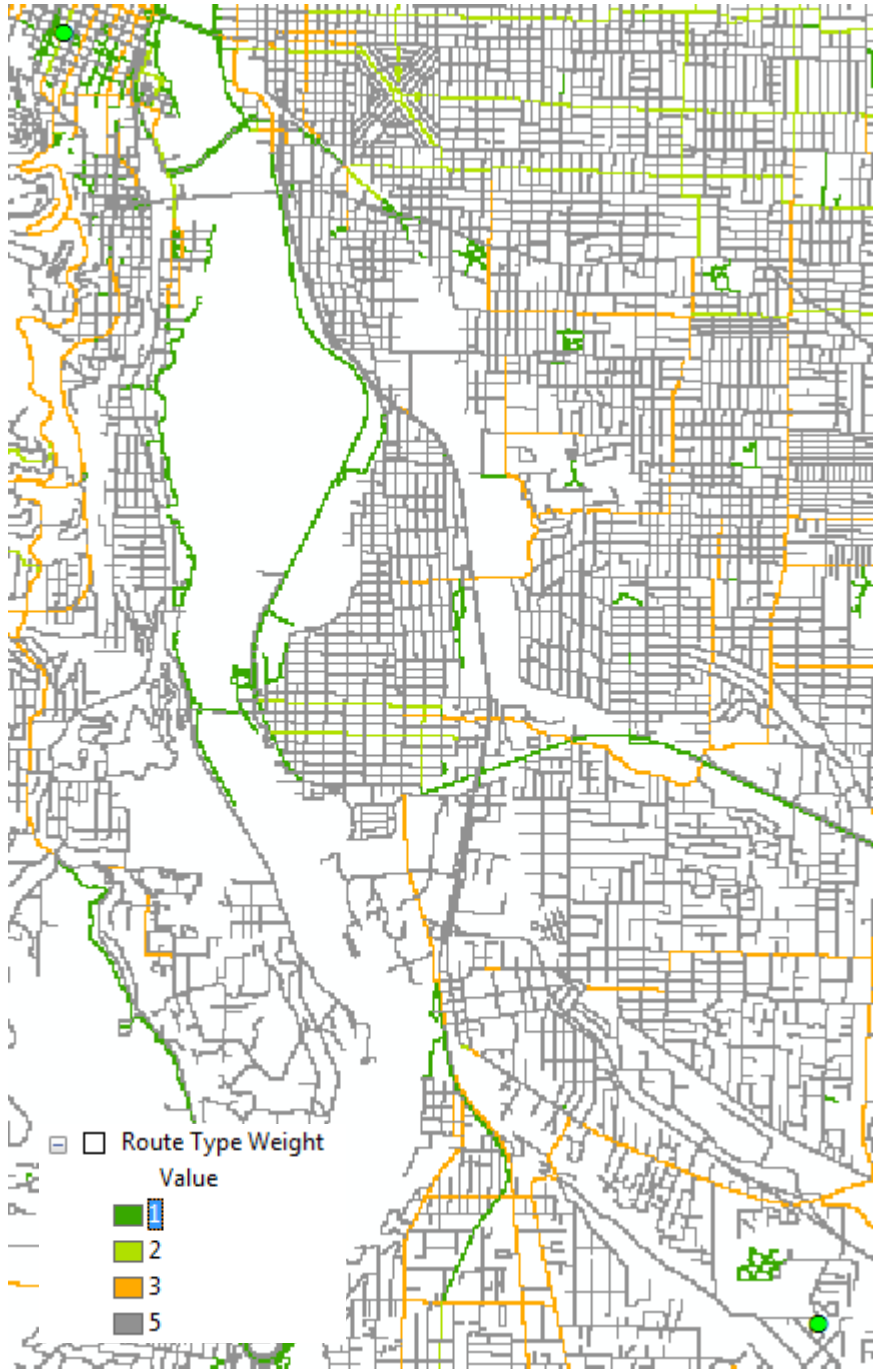
RIGHT: Route weight by route slope and classification

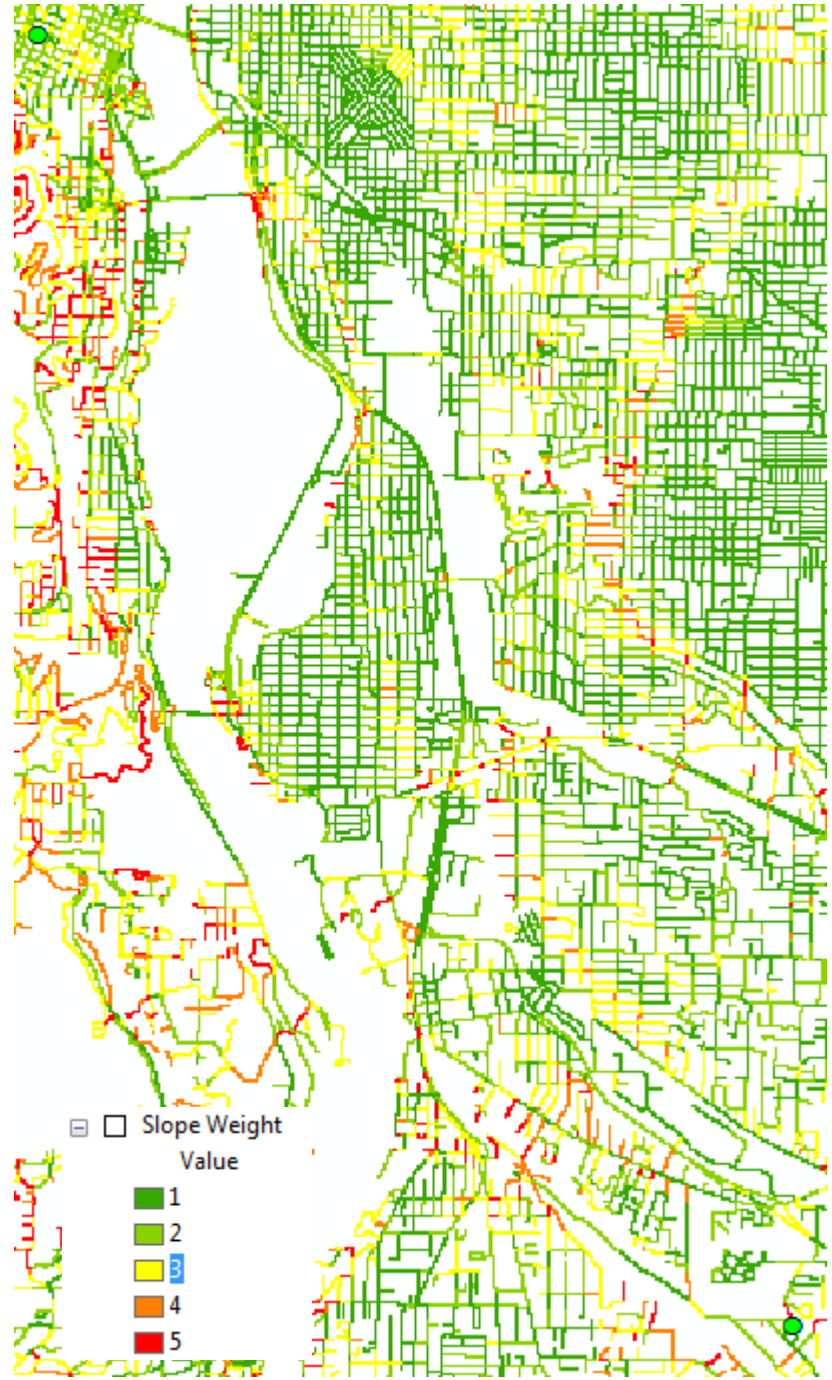
0 – 1 % = 1
1 – 3 % = 2
3 – 6 % = 3
6 - 9 % = 4
> 9 % = 5



Methods

- Converted bike route feature into two raster layers using **Feature to Raster tool**.
- **Reclassify tool** to reclassify route slope to match theclimbingcyclist.com slope classification:
  - **0%:** A flat road
  - **1-3%:** Slightly uphill but not particularly challenging. A bit like riding into the wind.
  - **4-6%:** A manageable gradient that can cause fatigue over long periods.
  - **7-9%:** Starting to become uncomfortable for seasoned riders, and very challenging for new climbers.
  - **10%-15%:** A painful gradient, especially if maintained for any length of time


Route Type Weight
Value
1
2
3
5

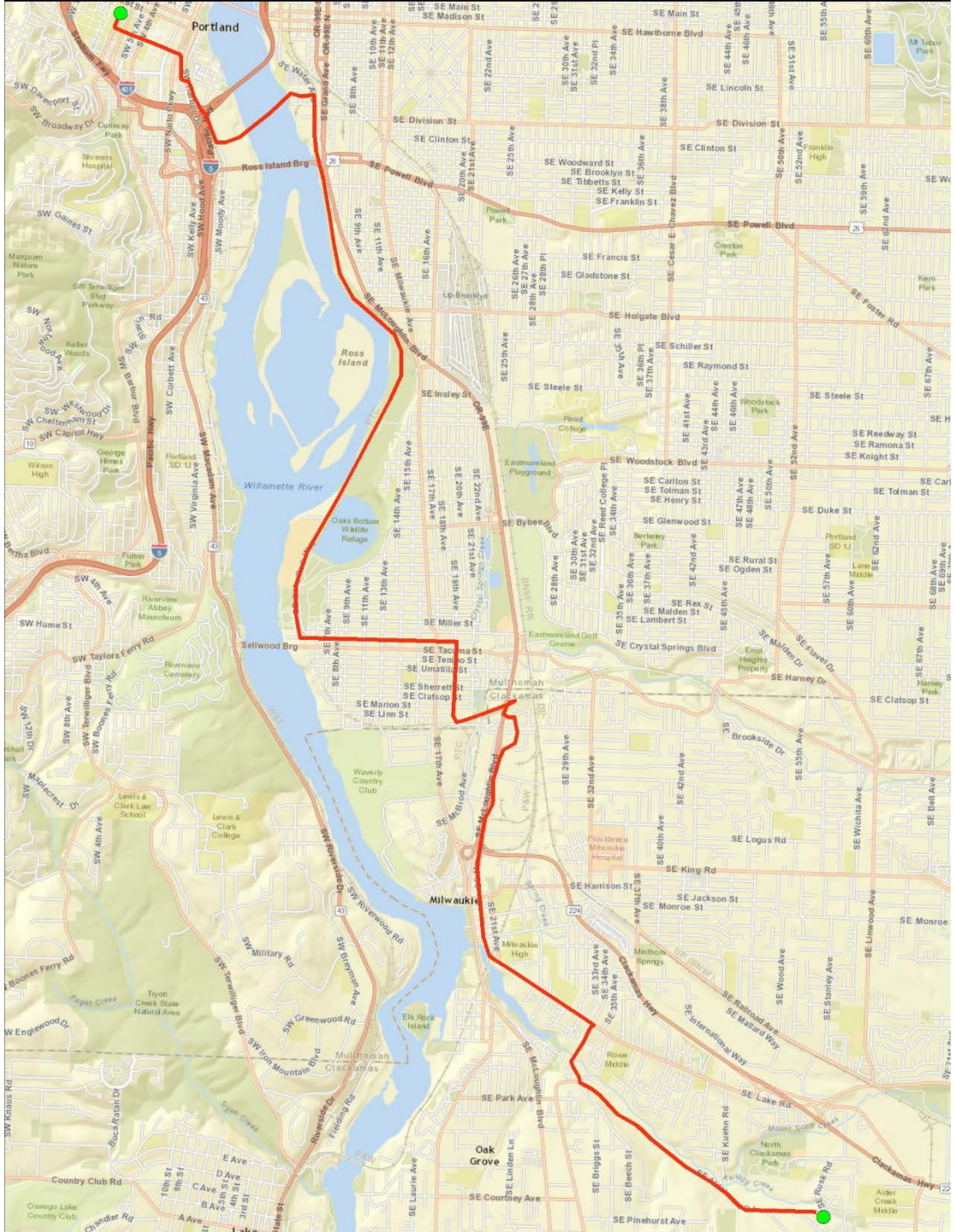

Slope Weight
Value
1
2
3
4
5

Methods

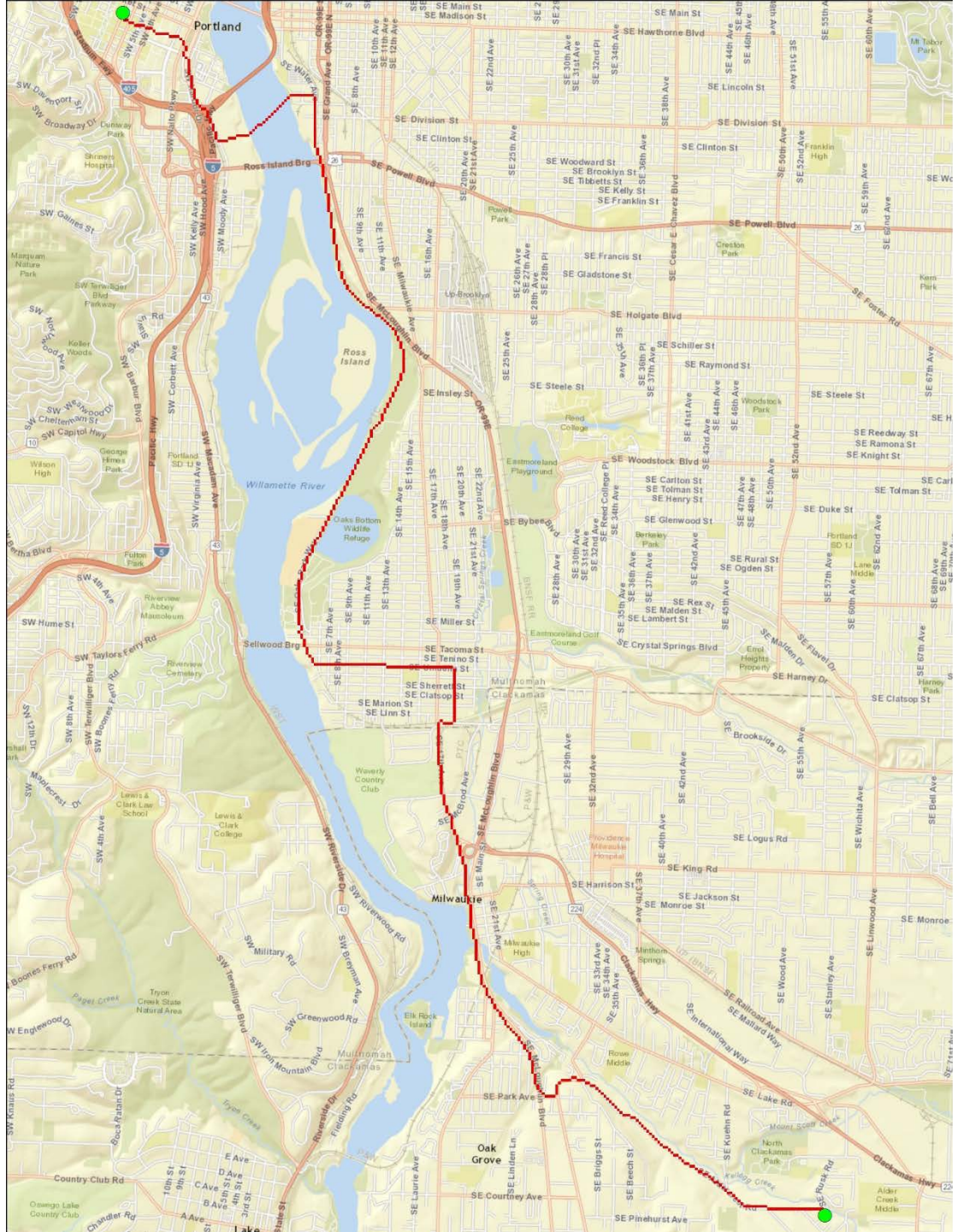
- **Raster Calculator tool** to create cost surface raster
  - Route Type Weight + Route Slope Weight
  - Route Type Weight * 0.6 + Route Slope Weight * 0.4

- **Cost Distance tool** using destination point and cost surface raster to create cost distance raster and backlink raster
- **Cost Path tool** using starting point and cost distance raster + backlink raster to generate paths

My Regular Route
(Digitized)

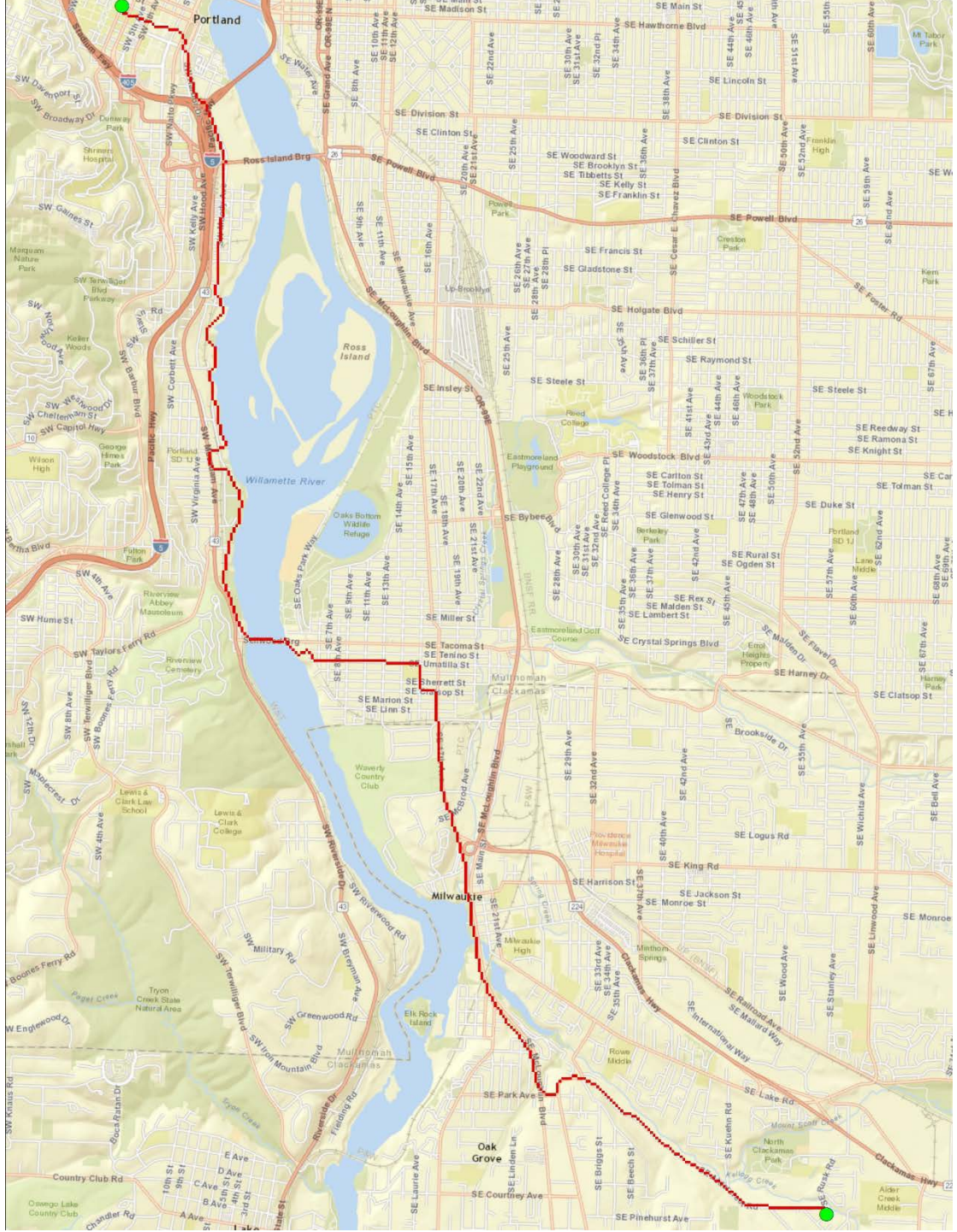


Route/Slope 60/40



Route/Slope Equal

(Same as
Route/Slope 40/60)



Discussion

- Successful, matches my current route pretty well, and gave me ideas of what I can do next time I ride to school.
- Limitations:
  - Hard to apply directional slope (if traveling downhill that would not be taken into consideration, but model probably just ignores hills).

Questions?