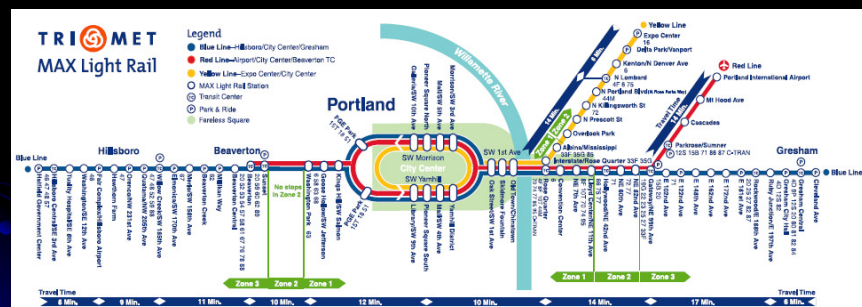# Determining the Best Route for a SE Portland Light Rail Line

Seth Bergeson

Chris Rowlette

Existing MAX Lines

Proposed New Lines

- I-205
  - 6.5 Miles between Gateway TC and Clackamas Town Center
  - September 2009
- Milwaukie – South Corridor
  - 6.5 Miles
  - PSU to Lake Rd
  - 2014??

Goal: Find the best route for a new SE Portland line connecting I-205 green line and proposed Milwaukie Line
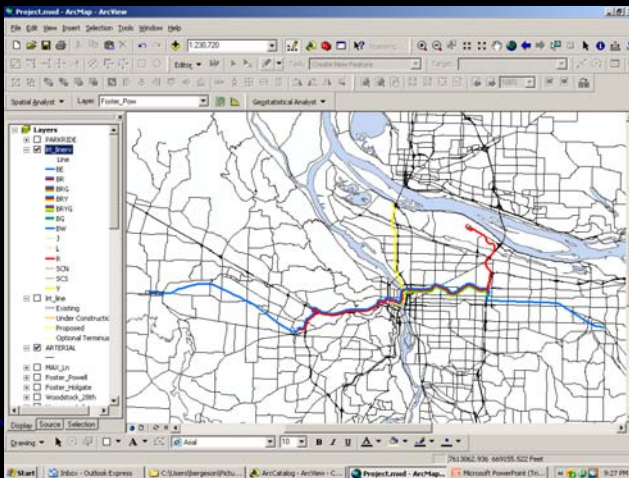
GIS Multi-Criteria Evaluation

- Use GIS to determine best new SE Portland route
- Data
  - RLIS Data
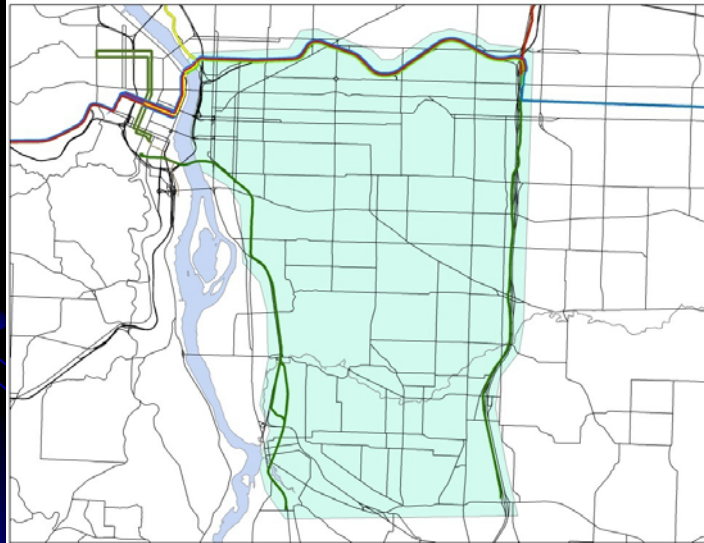 - USGS National Elevation Data
  - 2000 US Census Data

RLIS Data

- Existing MAX Line routes
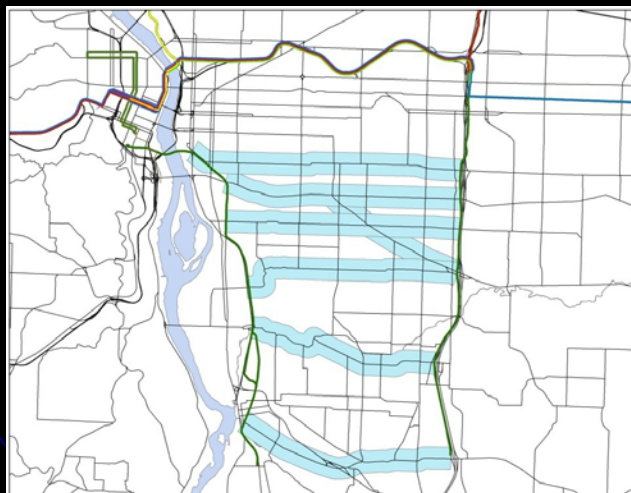- Arterial Streets
- Taxlots

Study Area

Used to clip all vector and raster data layers
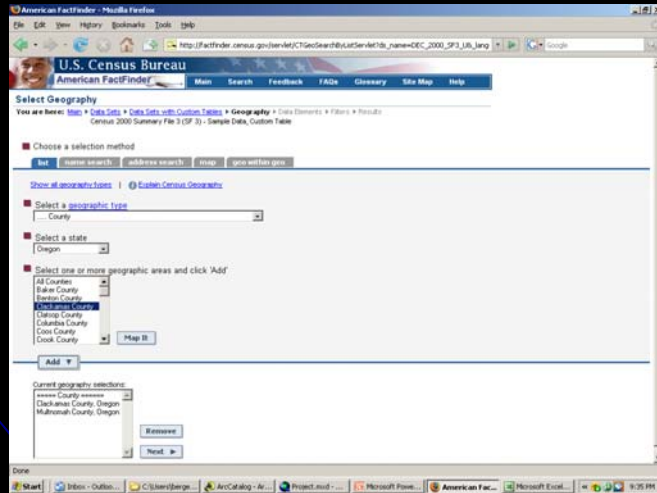

Proposed Route Selection

- Division
- Powell
- Powell – Foster
- Holgate
- Holgate – Foster
- Woodstock – 28th
- Johnson Creek
- Harmony – Lake

Interested in qualities 1000' on each side of routes

 - 1000' buffers

US 2000 Census Data

- Census 2000 Summary File 3 Sample Data (SF-3)
- Median Household Income
- Number of people over the age of 16
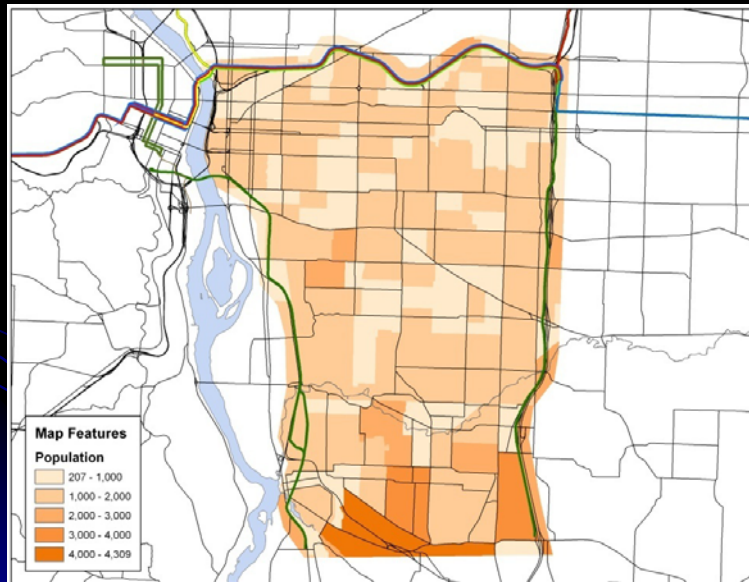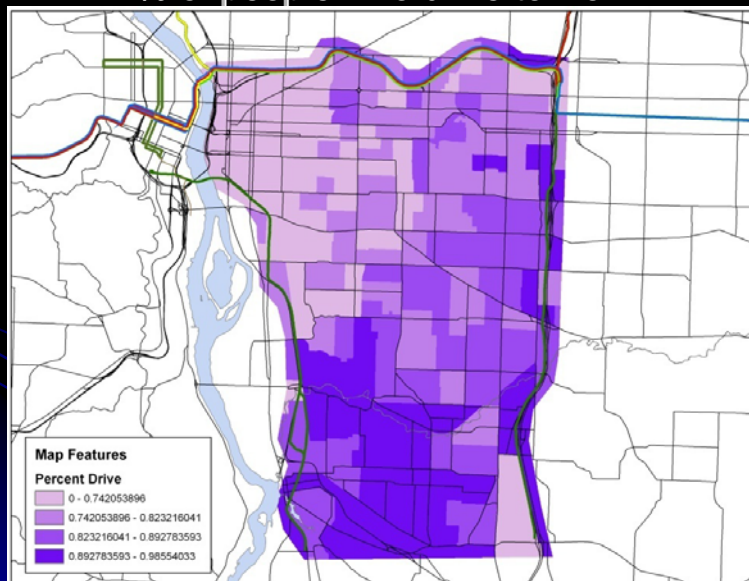- Number of people who drive to work

US 2000 Census Data

- Calculated % of people over the age of 16 who drive to work

US 2000 Census Data – Population

US 2000 Census Data – % of people who drive to work

USGS NED

- Downloaded from National Map Seamless Data Server
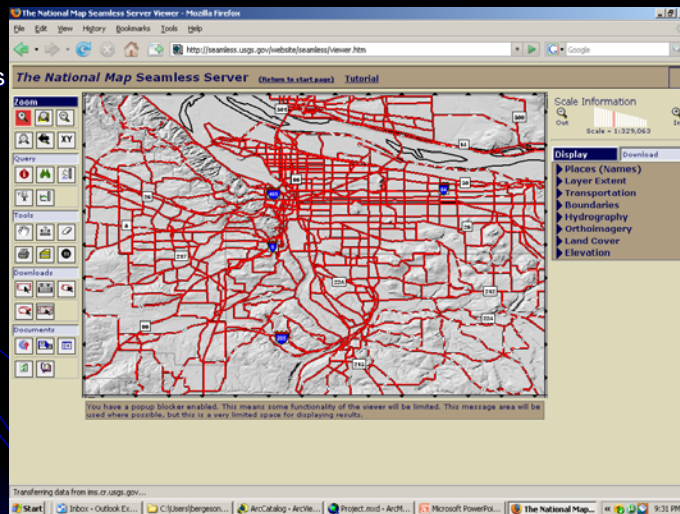
USGS NED - Elevation
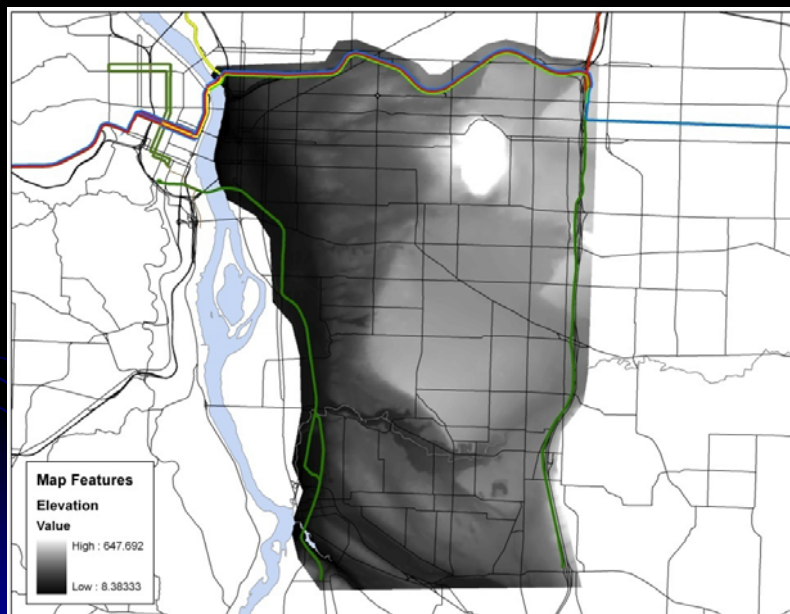
USGS NED - Slope
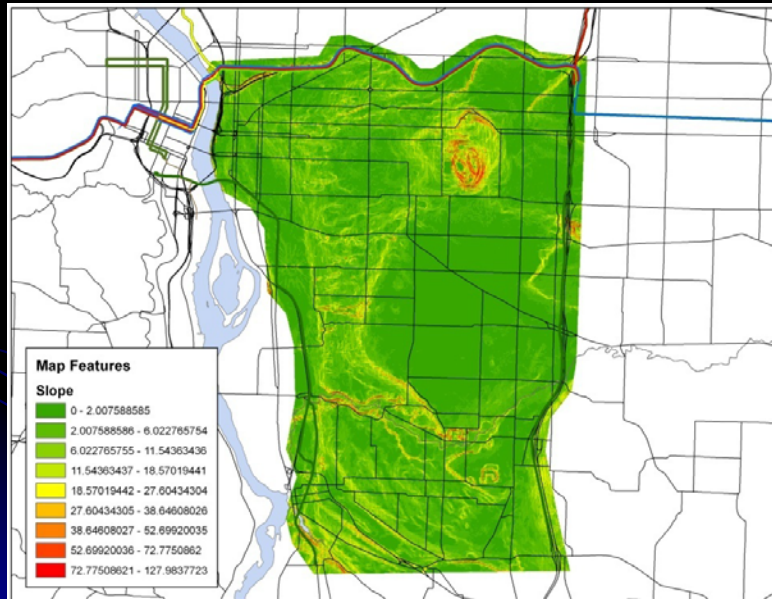
Slope anomalies
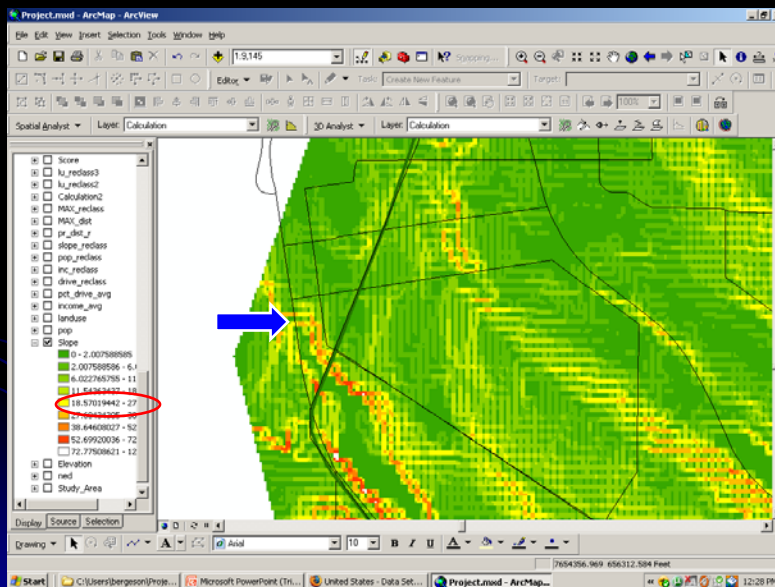
USGS NED - Slope

Smoothed out slope raster with
Neighborhood Statistics Tool

● Mean of 5X5 cells
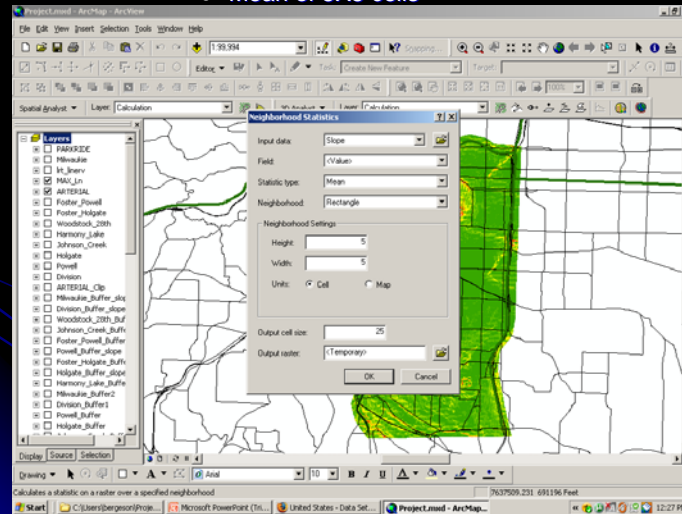
Slope Calculations

125' Buffer around routes to calculate slope

ROUTES	MAX SLOPE	AVG SLOPE
Harmony-Lake	33	6.83
Holgate	20.7	2.23
Holgate-Foster	17.6	1.9
Powell	20.6	2.24
Powell-Foster	20.6	2.24
Johnson Creek	16.9	1.83
Woodstock-28th	61.8	8.2
Division	12.3	2.3
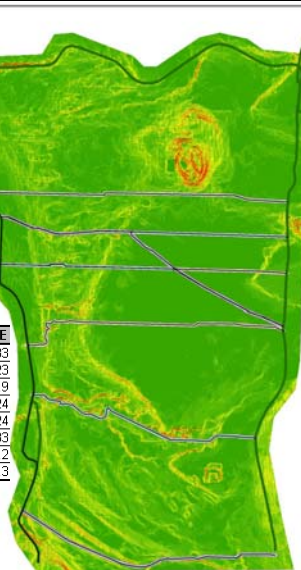
Elevation Profiles
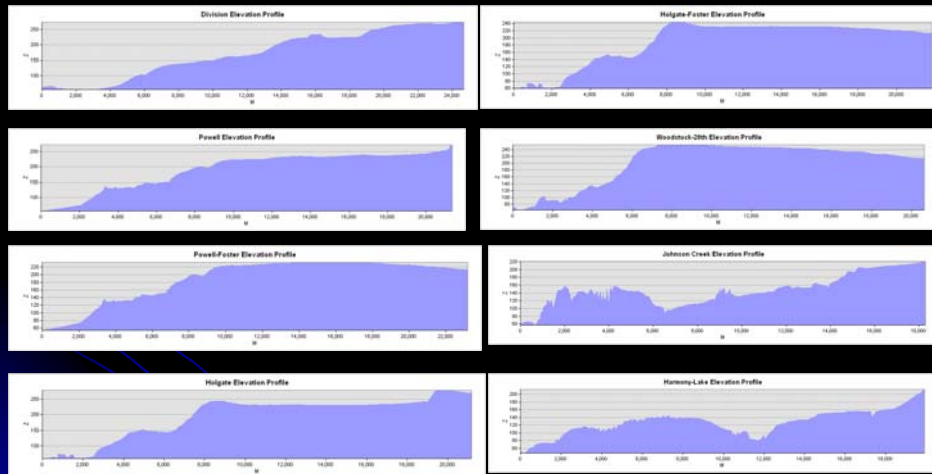
Slope

- Decided not to use slope calculations in AHP
- Instead use as a constraining factor

Land Use

- 10 classifications
  - Commercial (10)
  - Multi-Family Residential (9)
  - Single Family Residential (8)
  - Multi-Use (7)
  - Industrial (6)
  - Transportation (5)
    - NoData
  - Vacant (4)
  - Agriculture (3)
  - Rural (2)
  - Forest (1)
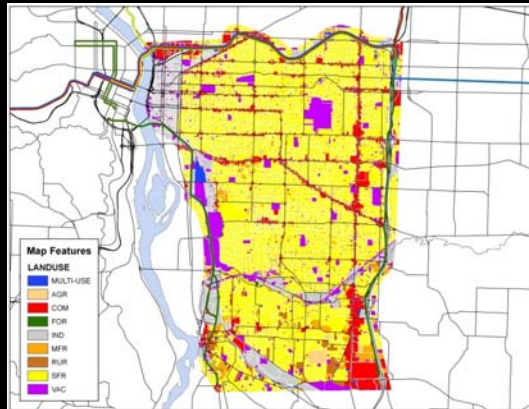
Median Household Income
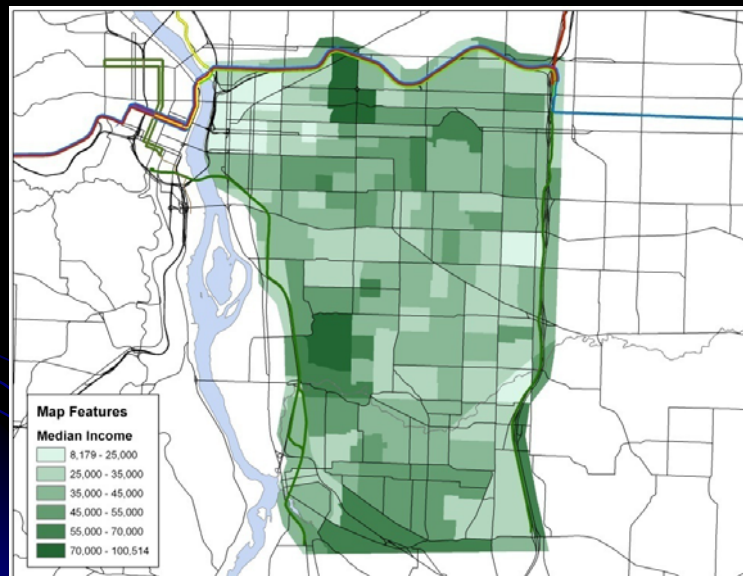
Euclidian Distance
Distance to nearest
Park & Ride
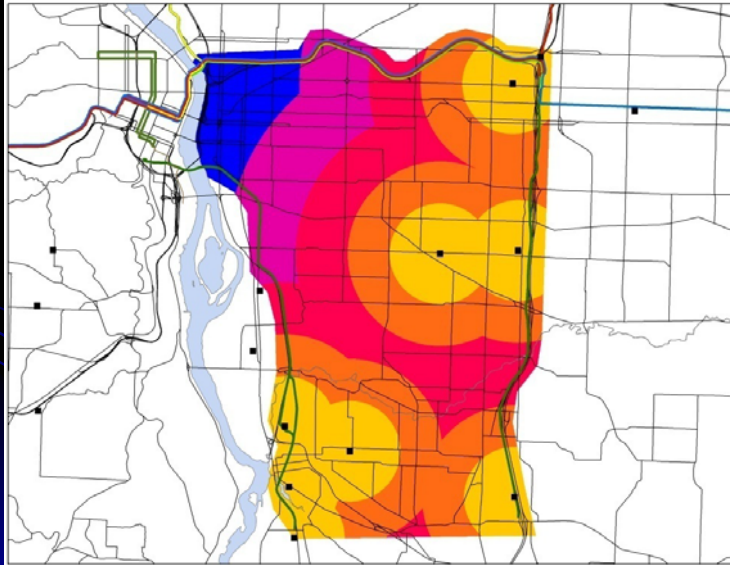
Euclidian Distance
Distance to Nearest MAX Line
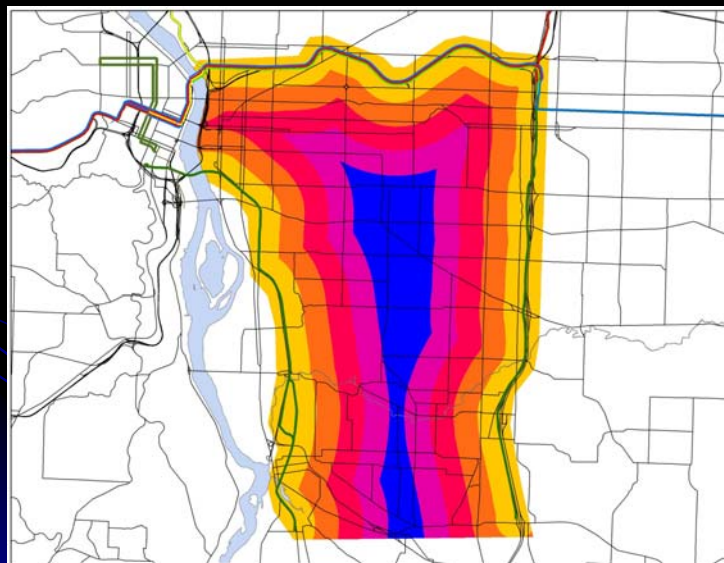
Reclassify

- 10 land use categories
- Reclassify all 6 factors to 10 equal interval classifications
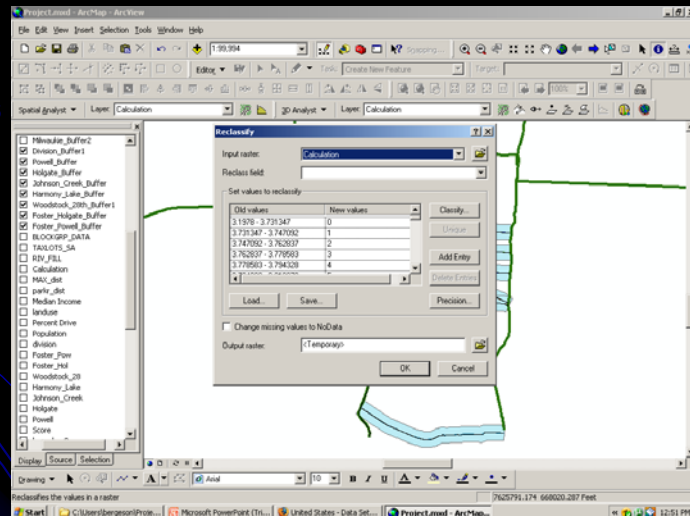
Factor Weights

- Analytical Hierarchy Process
- Pair wise Comparison of 6 factors

	POPULATION	DISTANCE TO MAX	% DRIVE	INCOME	LANDUSE	DISTANCE TO PARK & RIDE		FACTOR
POPULATION	1.00	3.00	5.00	7.00	9.00	11.00	4.671654851	0.467930459
DISTANCE TO MAX	0.33	1.00	3.00	5.00	7.00	9.00	2.608465471	0.261273678
% DRIVE	0.20	0.33	1.00	3.00	5.00	7.00	1.383087554	0.138535233
INCOME	0.14	0.20	0.33	1.00	3.00	5.00	0.723020026	0.072420396
LANDUSE	0.11	0.14	0.20	0.33	1.00	3.00	0.38336716	0.038399492
DISTANCE TO PARK & RIDE	0.09	0.11	0.14	0.20	0.33	1.00	0.21405691	0.021440742
							9.983651973	1

Population reclass x 0.4679 + Distance to Max reclass x 0.2613 + Percent drive reclass x .01385 + Income reclass x 0.0724 + Landuse reclass x 0.0384 + Distance to Park & Ride reclass x 0.0214

Raster Calculator
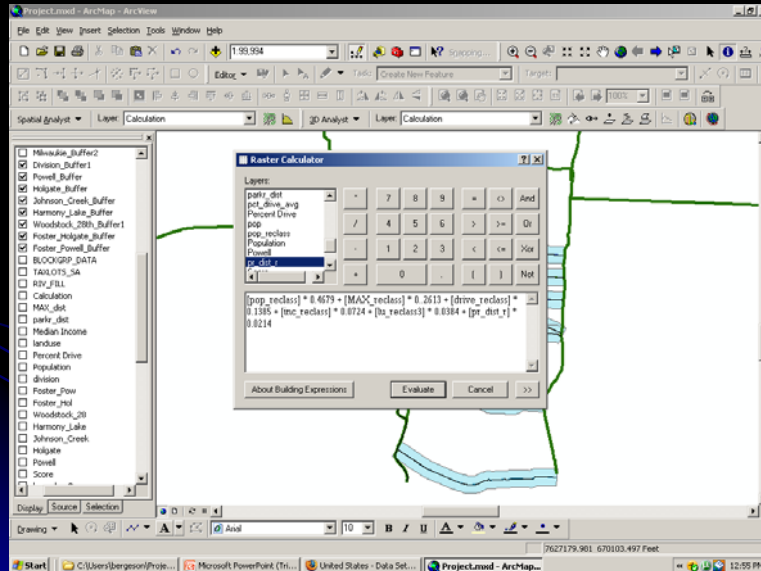
Score Calculation

- 1 = bad
- 10=good
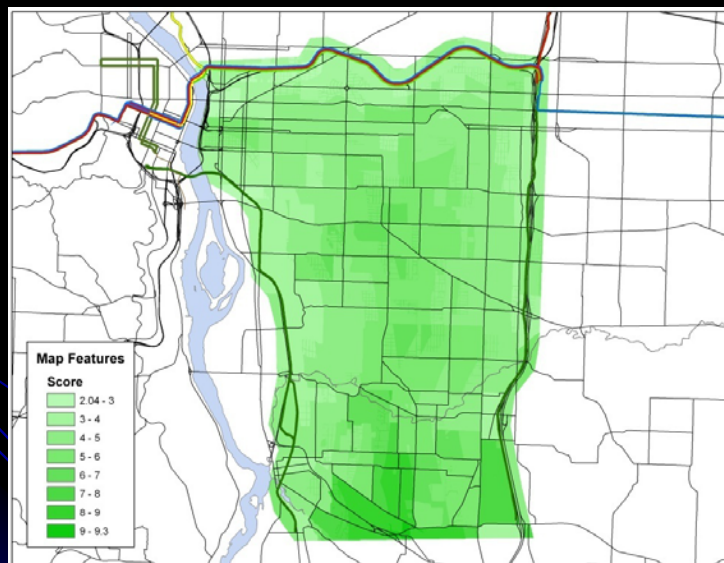
Route Scores

- Clipped score raster by 1000 route buffers
- Calculated mean score for each route

ROUTES	SCORES
Harmony-Lake	6.681
Holgate	4.9866
Holgate-Foster	4.926
Powell	4.9201
Powell-Foster	4.8993
Johnson Creek	4.7925
Woodstock-28th	4.5623
Division	4.453
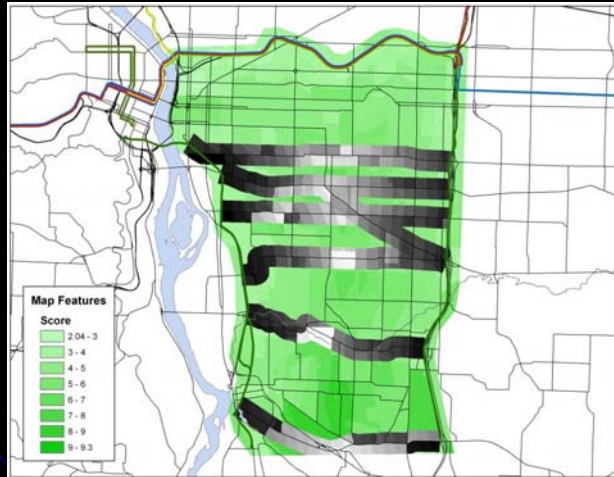
Model Validation

- See how well our AHP model works for proposed Milwaukie line
- Followed same steps as calculations for new routes
  - Recreated distance to MAX lines to exclude Milwaukie line

Milwaukie Route Score

ROUTES	SCORES
Harmony-Lake	6.681
Holgate	4.9866
Holgate-Foster	4.926
Powell	4.9201
Powell-Foster	4.8993
Johnson Creek	4.7925
Woodstock-28th	4.5623
Division	4.453
Milwaukie	5.731

Milwaukie Line Slope

Milwaukie Line Profile

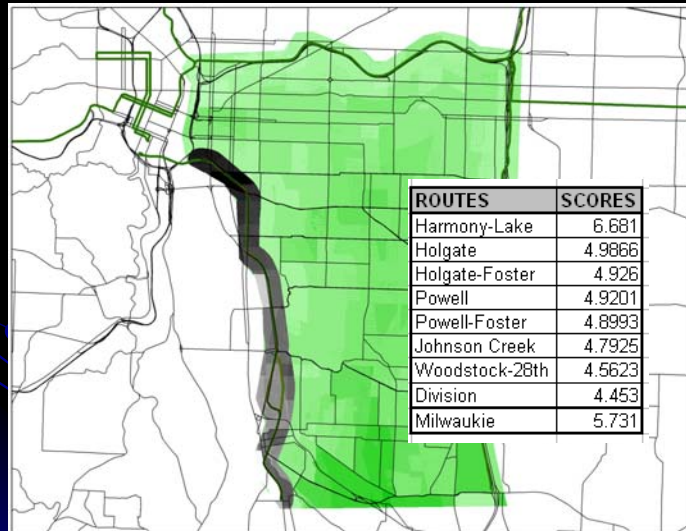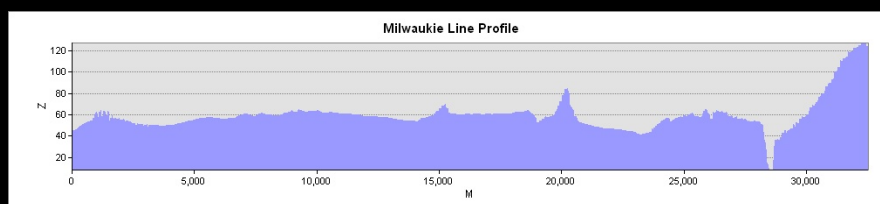| ROUTES	SCORES	MAX SLOPE	AVG SLOPE
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Powell-Foster	4.8993	20.6	2.24
Johnson Creek	4.7925	16.9	1.83
Woodstock-28th	4.5623	61.8	8.2
Division	4.453	12.3	2.3
Milwaukie	5.731	44.7	3.69

Further Considerations

- Other factors for MAX line possible route analysis
  - Current train rider levels
  - Cost
  - Public input
  - Neighborhood factors
  - Commuting patterns
  - Future planning/development
  - Environmental factors
  - Infrastructure/Structural factors
  - Train stop locating
  - Future Park & Ride locating
- Different AHP factors

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References

- RLIS February 2008
- US 2000 Census Data http://factfinder.census.gov/home/saff/main.html?_lang=en
- USGS National Elevation Dataset: http://ned.usgs.gov/
- Tri-Met: http://www.trimet.org/projects/index.htm
- City of Milwaukie: http://www.cityofmilwaukie.org/news/2008/webfactsheet/webfactsheet.pdf