Geodatabase for Analysis of Public Transportation Usage

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Background

- A city's transit system works constantly to optimize their transit systems to accommodate localized changes in demand.
- These changes can drastically impact how, where, and when transit riders need service.
- Utlilizing GIS technology, we can model changing demographics and project how to adjust transit service.

Potential Applications

- Explore demographic and socioeconomic data related to transportation ridership.
- Evaluate public transportation service available to different populations and locations.
- Evaluate potential demand at Trimet transit stops.

Objective

- Bring together transit ridership data, demographic data, combined with a multi-modal transit network to support data exploration and analysis.
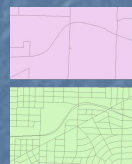
Data Sources

RLIS Transit and Trimet Internal Usage Data
- Bus stops 2002 and 2008 (RLIS point)
- Bus routes 2002 and 2008 (RLIS polyline)
- TriMet service area 2002 and 2008 (RLIS polygon)
- Passenger census – daily boarding and deboarding data (table)
- Streets (RLIS polyline)
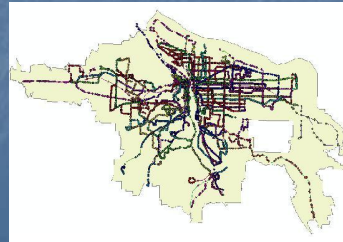
Data Sources - continued

U.S. Census Data
- Geometry – with topology implemented to ensure polygons do not overlap
  - Census blocks – (polygon – SF1)
  - Census block groups – (polygon – SF3)
  - Census tracts (polygon)
- Demographic data
  - Population (table – SF1)
  - Income (table – SF3)
  - Transportation usage (table – SF3)
  - Housing (table – SF3)

Data Sources - continued

- Addional RLIS Data
  - Taxlots (polygon)
  - Boundaries (polygon)
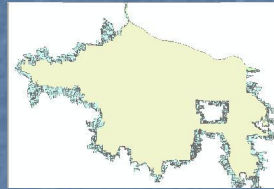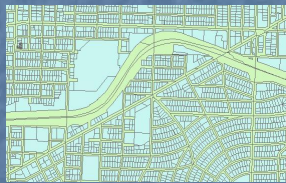
Geodatabase Structure

| Boundary	Census Geometry	Taxlots	Transit	Tabular Data
City	Block	Taxlots 2000	Park Ride	SF1 – Census 2000
County	Block Group	Taxlots 2002	Streets	SF3 – Census 2000
Metro Region	Tract	Taxlots 2008	Transit Lines	Transit Ridership 2002
Neighborhood			Transit Stops	Transit Ridership 2008
TriMet Service Area				Taxlot Summary
Urban Growth Boundary				

Census Data

- Objective: Provide easy access to relevant demographic and transportation data from Census 2000.
- Steps:
  - Normalize
  - Simplify

	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT
1	P012003	P012004	P012005	P012006	P012007	P012008	P012009	P012010	P012011	P012012	P012013	P012014	P012015	P012016	P012017	P012018	P012019	P012020	P012021	P012022
2	3	2	1	2	1					1		5	2	3	3		3	1	1	5
3																				
4																				
5													1							
6	2	4	1								1	2	2							
7			1										1							
8																				
9			1	1									1		2					
10	1										1									
11			3	2									1	1						
12	3	3	2								2	2	1			1				
13																				
14													1		1				1	
15	2	1	1	1	1						2	2	4		3					
16		1											1	1						
17	1	2	2	2	1		4			1	2	6	4	4	1			2	1	

Features

- Objective: Trim features to study area without altering feature geometry
  - Select by Location
  - Export
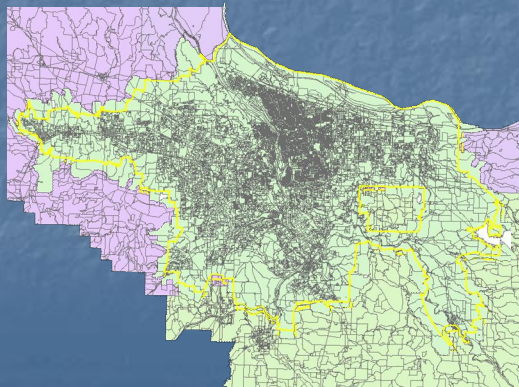
Multimodal Transit Network

- Objective: Build a network that accurately models pedestrian and public transit travel.
- Steps:
  - Attribute features
  - Connect streets & transit
  - Build network: connectivity, restrictions & costs

Multimodal Transit Network

Weekday Time Point Level Run Time Report - Spring 2008

Route: 9-Powell - Inbound To Portland

SE Powell & 82nd to SE Powell & 39th

| Begin Time	Trip Number	Block	Scheduled Run Time	Median	Median Less Idle	20th %tile	80th %tile	Avg. Ons	Avg. Offs	Avg. Max Load	Avg. Speed	Avg. Stops	Percent On Time	Percent Early	Percent Late	Avg. Min. Late
4:04 PM	1530	2069	11:00	10:24	10:05	9:10	11:14	16	11	21	30	9	82%	0%	18%	2.9
4:20 PM	1540	934	11:00	10:50	10:12	9:58	11:34	16	9	18	27	9	95%	2%	3%	0.9
4:32 PM	1550	967	10:00	10:02	9:58	8:32	11:28	17	12	17	27	9	69%	2%	29%	3.2
4:42 PM	1560	1204	10:00	9:22	9:01	8:10	10:22	9	5	10	29	6	95%	2%	4%	2.1
4:57 PM	1580	952	10:00	10:04	9:48	9:24	11:20	14	7	15	27	8	98%	2%	0%	1.0
5:08 PM	1570	940	10:00	9:36	9:28	8:34	10:18	12	9	21	28	8	67%	21%	11%	1.3
5:23 PM	1590	947	10:00	9:46	9:40	8:48	10:42	15	9	15	31	8	89%	2%	10%	2.2
5:39 PM	1600	442	10:00	9:54	9:52	8:48	11:02	16	12	20	30	9	46%	0%	54%	5.0
5:58 PM	1610	1202	10:00	9:50	9:14	8:54	10:46	12	7	13	27	7	85%	15%	0%	0.2
6:07 PM	1620	939	10:00	9:06	9:02	7:58	10:20	10	7	14	29	7	88%	2%	10%	2.7
6:28 PM	1630	967	10:00	9:16	9:16	8:28	10:08	15	8	16	27	8	83%	6%	11%	1.9
6:45 PM	1640	1243	10:00	9:30	8:47	8:26	10:06	12	12	18	29	8	86%	0%	14%	2.5
7:01 PM	1650	937	9:00	8:37	8:00	7:54	9:06	11	6	12	31	6	100%	0%	0%	0.9
7:16 PM	1660	955	9:00	9:03	8:59	8:04	10:10	11	8	17	28	7	82%	0%	18%	3.2
7:33 PM	1670	934	8:00	8:02	8:00	7:32	9:04	8	4	10	28	6	100%	0%	0%	0.9
7:48 PM	1680	8435	8:00	7:54	7:54	7:20	8:22	8	6	11	30	6	93%	0%	7%	1.2
8:03 PM	1690	952	8:00	8:30	8:28	7:30	9:22	8	4	9	27	5	97%	2%	2%	1.4
8:18 PM	1700	2068	8:00	8:06	8:00	7:22	8:52	8	6	12	30	6	76%	5%	19%	2.1
8:33 PM	1710	947	8:00	7:58	7:56	6:58	8:38	7	4	7	32	5	97%	2%	2%	0.8
8:48 PM	1720	939	8:00	8:16	8:12	7:16	9:04	7	3	8	28	4	93%	0%	7%	1.6

Multimodal Transit Network

- Connect streets & transit network
    - Add XY Coordinates
    - Near
    - Add XY Line Data (Hawth's Tools)
    - Merge
    - Planarize
    - Integrate

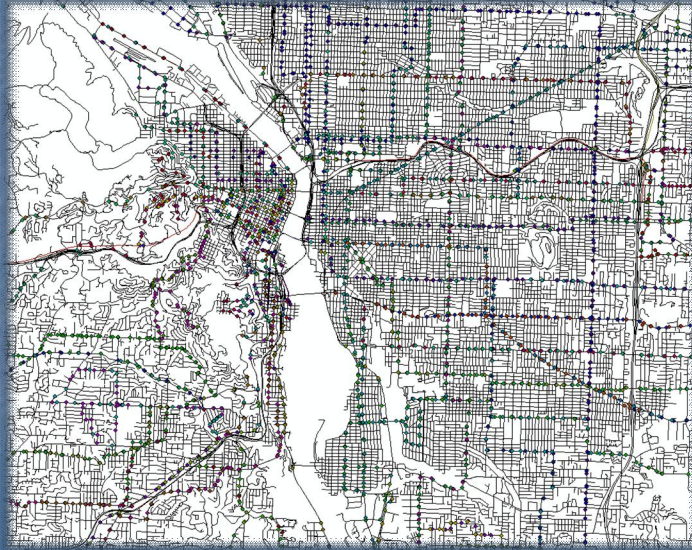

Multimodal Transit Network

- Build network: connectivity, restrictions & costs
    - Connectivity
    - Restrictions
    - Costs
        - Walk = 3.3/2.6 mph
        - Bus = 14.1 mph
        - MAX = 18.4 mph
        - Streetcar = 7.5 mph
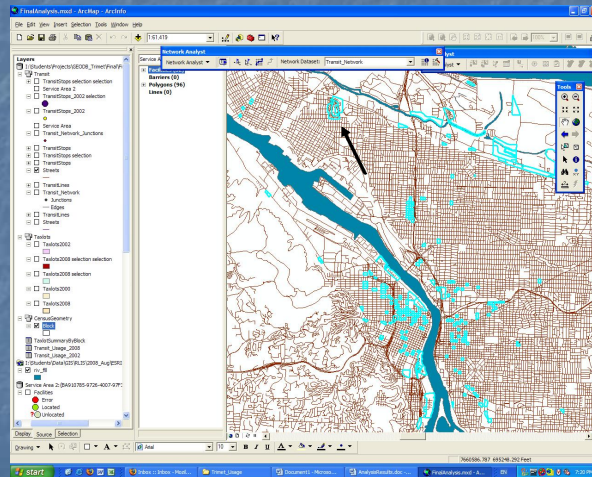   - Tram = 22 mph
        - Wait time = 7.5 min
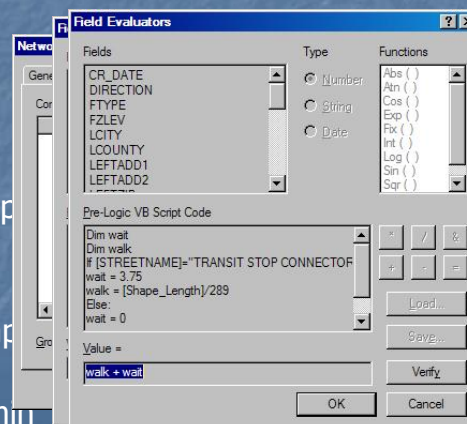
Multimodal Transit Network

Analysis

- Determine area of large residential growth (from 2000 – 2008)
- Estimate population of area
- Evaluate change in Trimet ridership for the area
- Evaluate level of service to the area
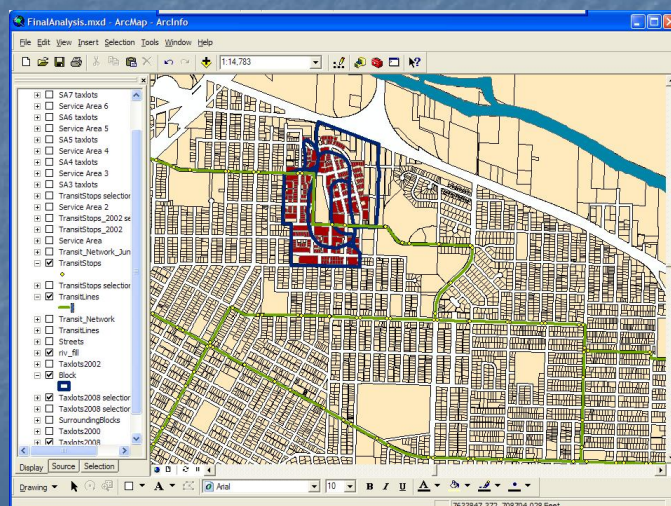
Determining Area of Growth

Area of Interest
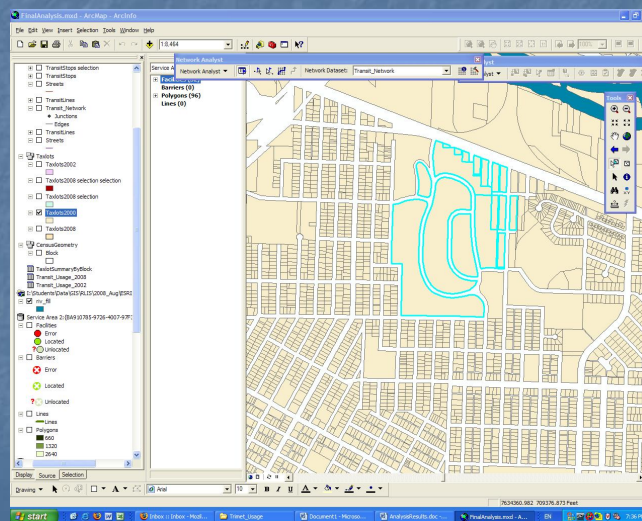
Area of Interest with Transit Lines (2002)
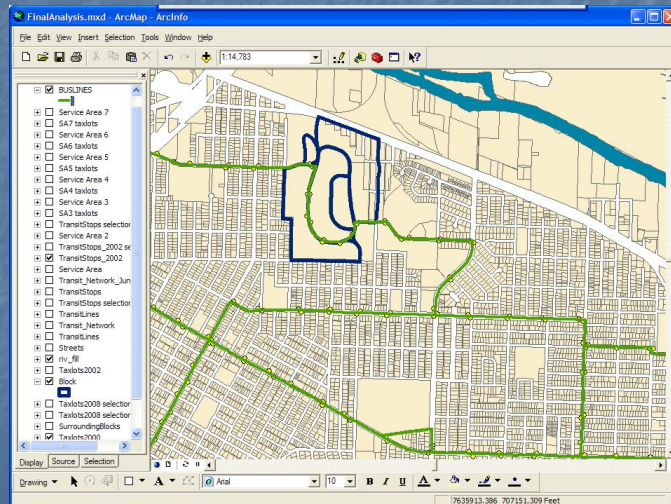
2008 Tax Lots with Transit Lines

Estimating the Population Density

Weekday Daily Usage for the 13 stops in the area in 2002

Bus Route	Stop ID	Location	Daily ONs	Daily OFFs
4	5862	Trenton & Dana	35	34
4	6430	Woolsey & Woolsey Ct	34	85
4	6431	9010 Woolsey Ct	23	45
4	6434	9126 Woolsey Ct	5	21
4	6436	9226 Woolsey Ct	29	34
4	1724	Fessenden & Woolsey	66	73
4	1725	Fessenden & Woolsey Ct	91	70
4	6435	9226 Woolsey Ct	26	25
4	10702	9135 Woolsey Ct	31	12
4	6432	9037 Woolsey Ct	42	26
4	6437	Woolsey Ct & Woolsey	16	12
4	6429	Woolsey & Trenton	82	26
4	40	Alaska & Dana	52	29

## Weekday Daily Usage for the 6 stops in the New Columbia Housing Project (2008, 232 tax lots, 852 units)

Bus Route	Stop ID	Location	Daily ONs	Daily OFFs
4	5862	N Trenton & Dana	35	106
4	40	N Trenton & Dana	102	24
4	12750	N Trenton & Dwight	296	91
4	12725	N Fessenden & Haven	78	148
4	12726	N Fessenden & Haven	162	74
4	12727	N Trenton & Newman	87	262

Network Analysis of Transit Stops in and around New Columbia (2008): .125 miles and .25 miles
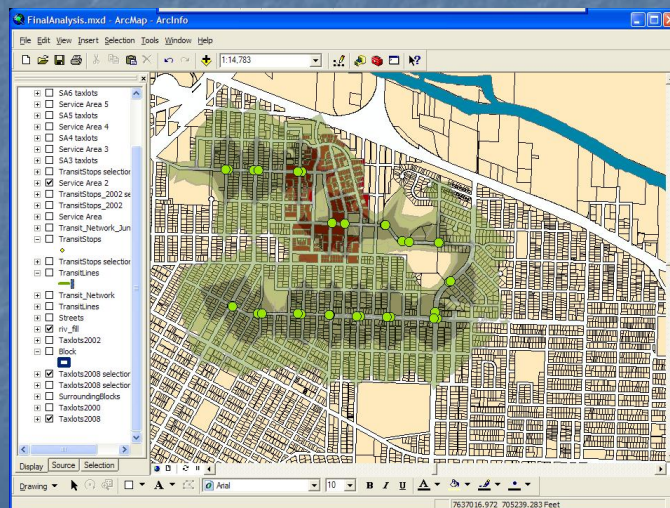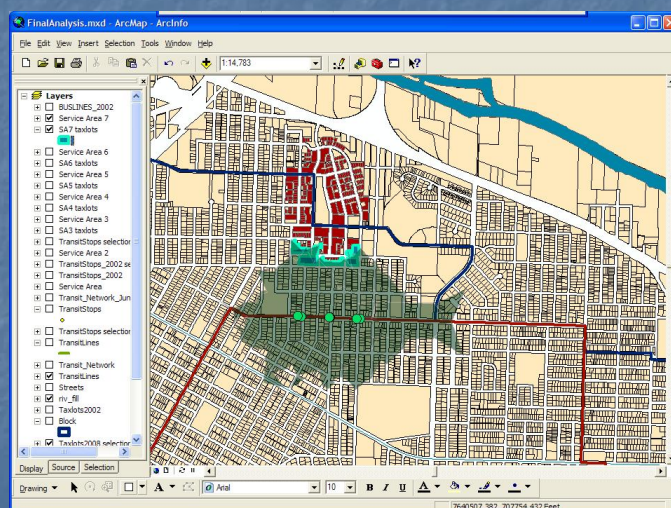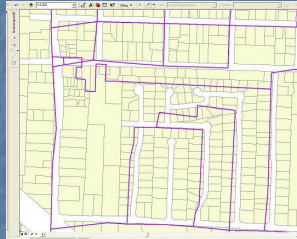
Number 4 and 35 Bus Lines
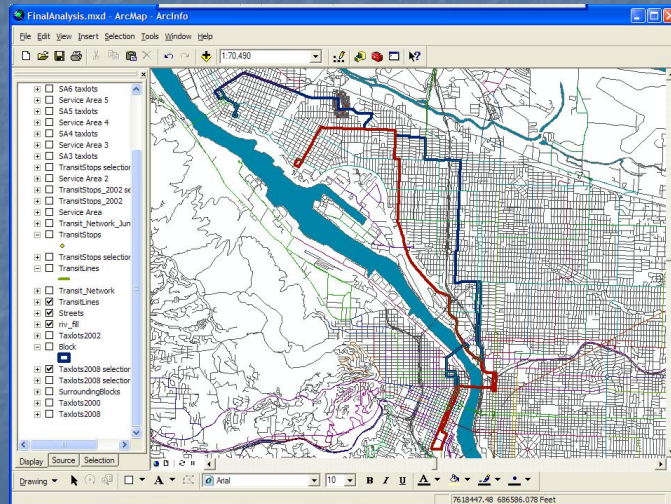
Tax Lots Serviced by Both Bus Lines

Limitations and Problems

- Network imperfections
  - Trimet route speeds
  - Elevation evaluations
- Inaccuracy of census geometry

- Age of census data
- Size of study area

References

- Maantay, Juliana Astrud; Maroko, Andrew R.; Herrmann, Christopher. "Mapping population distribution in the urban environment: the Cadastral-based Expert Dasymetric System (CEDS)" *Cartography and Geographic Information Science*

- Willis, A.; Gjersoe, C.; Havard, J.; Kerridge, Kukla R. Human movement behaviour in urban spaces: implications for the design and modelling of effective pedestrian environments. Environment and Planning B: Planning and Design. 2004,31, 805 – 828

- http://www.hapdx.org/newcolumbia/

- Special thanks to TriMet's Joseph Recker for generously providing ridership data.