

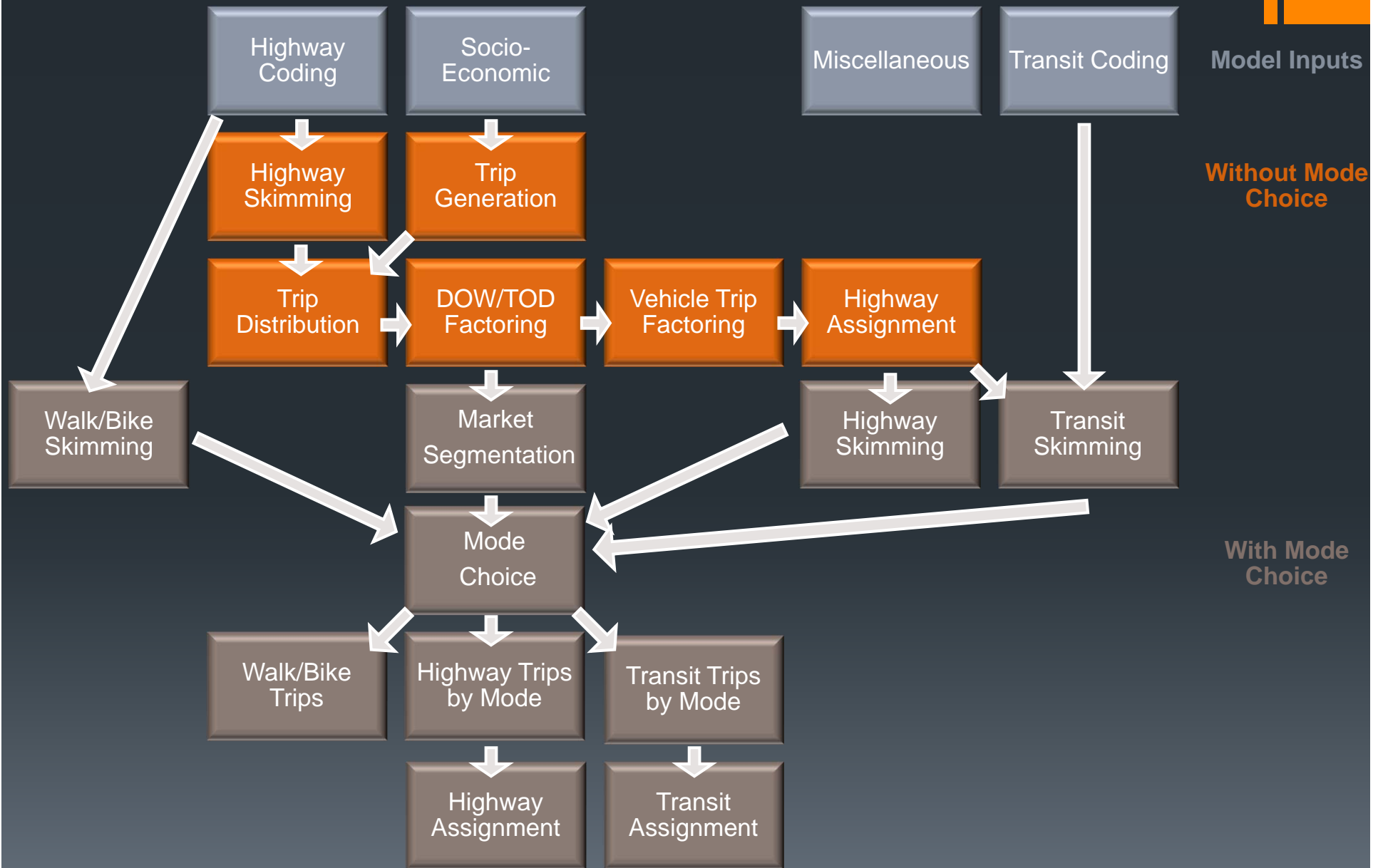


Des Moines Transit Modeling

Midwest Traffic (*and Transit*) Model Users Group

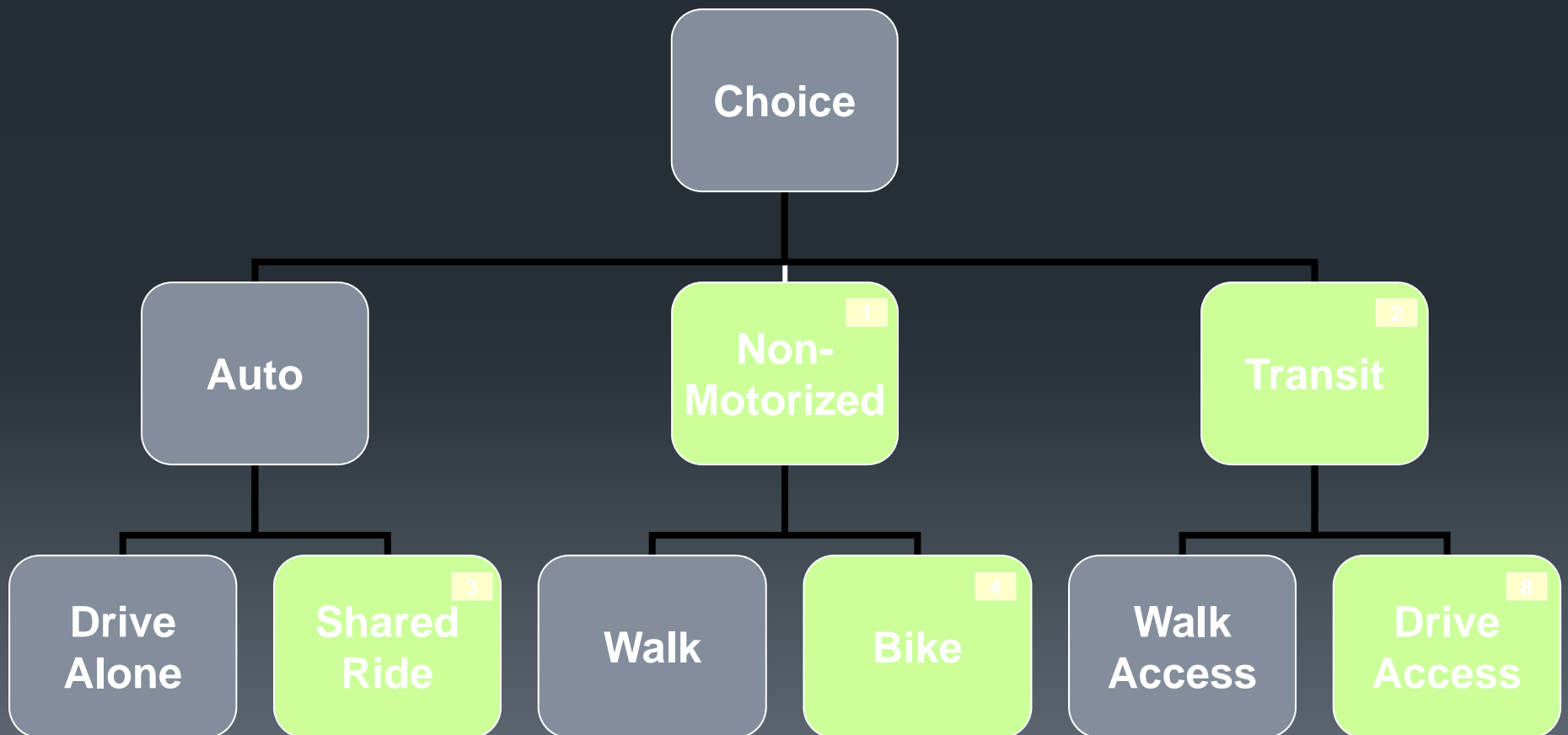
April 9th, 2014

DMAMPO Modeling Process

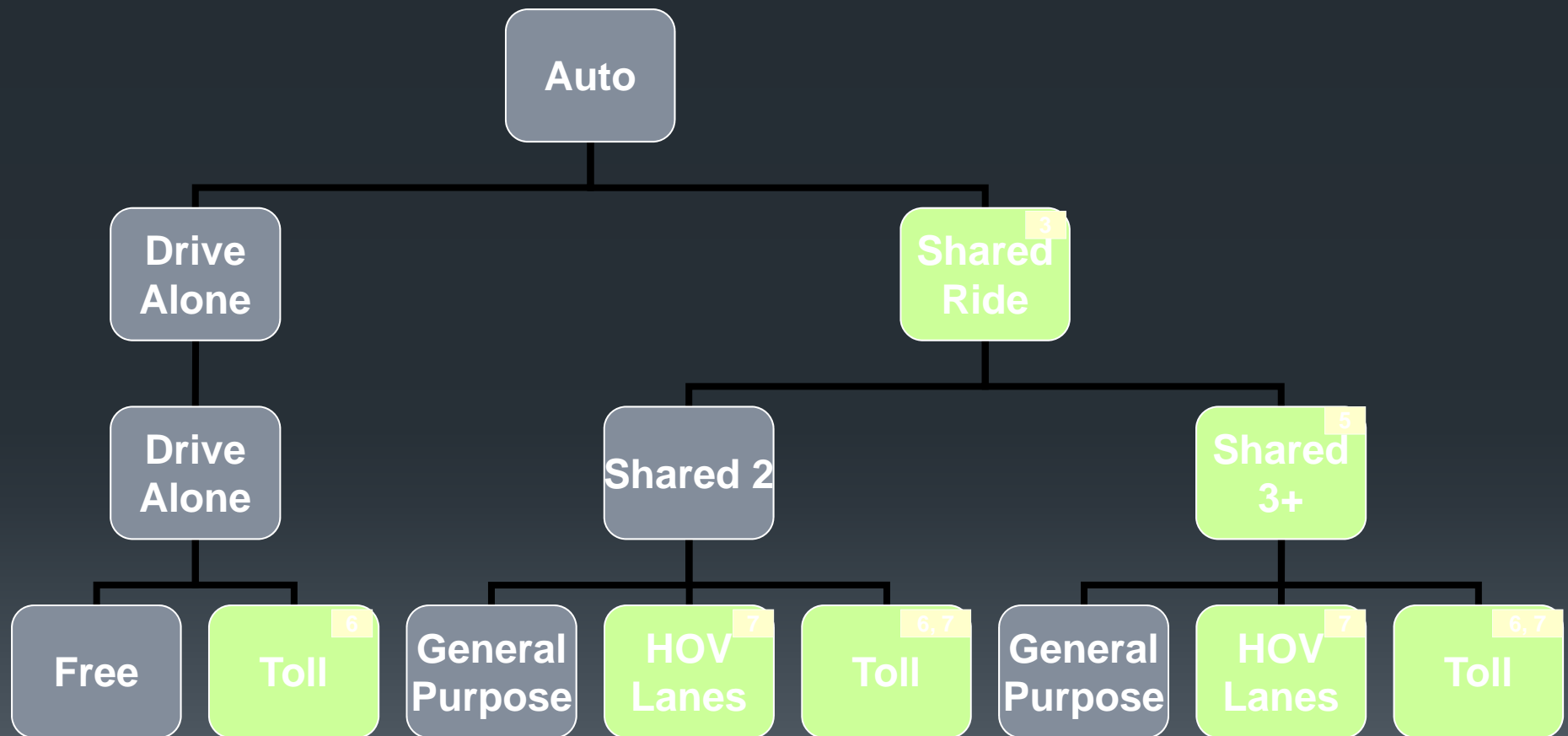


Mode Choice Function

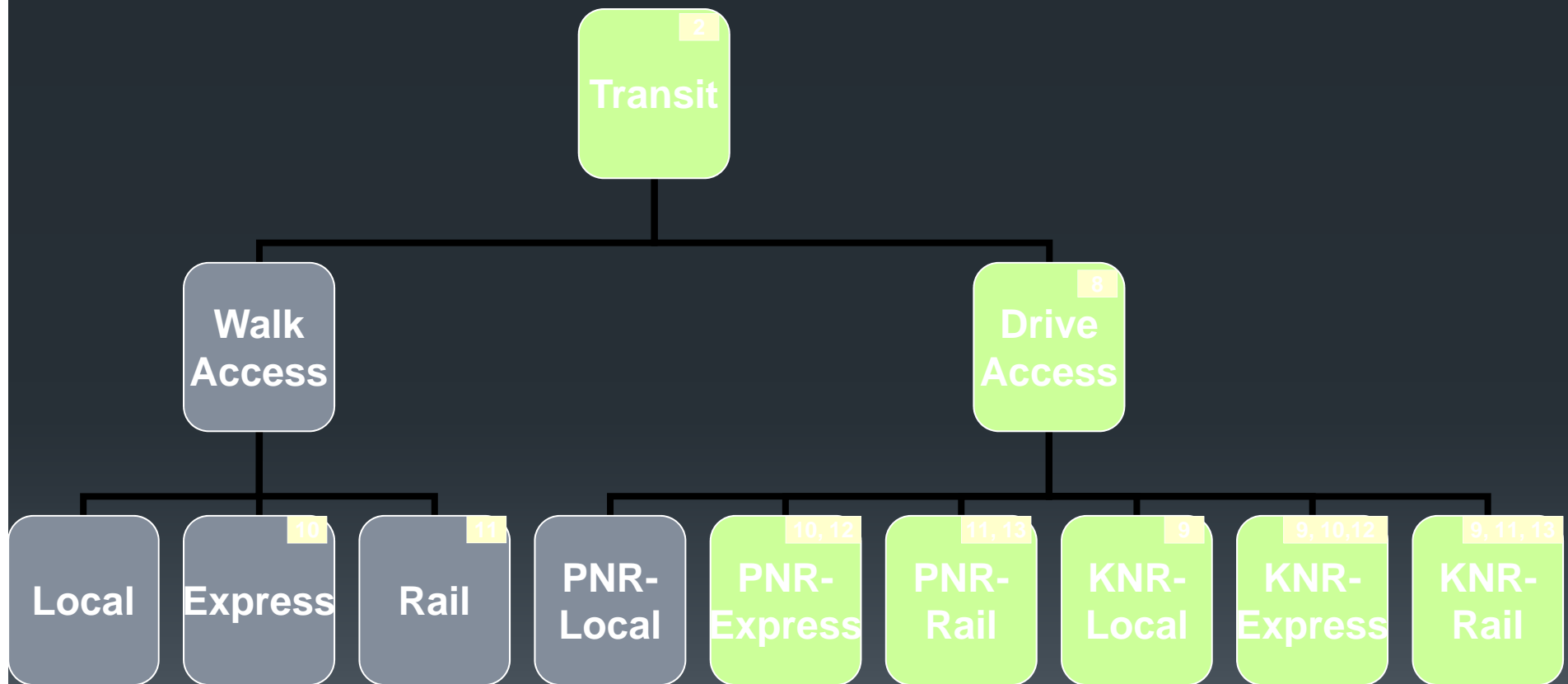
- Allocate person trips to modes based on utility of each mode and trip-maker and trip characteristics



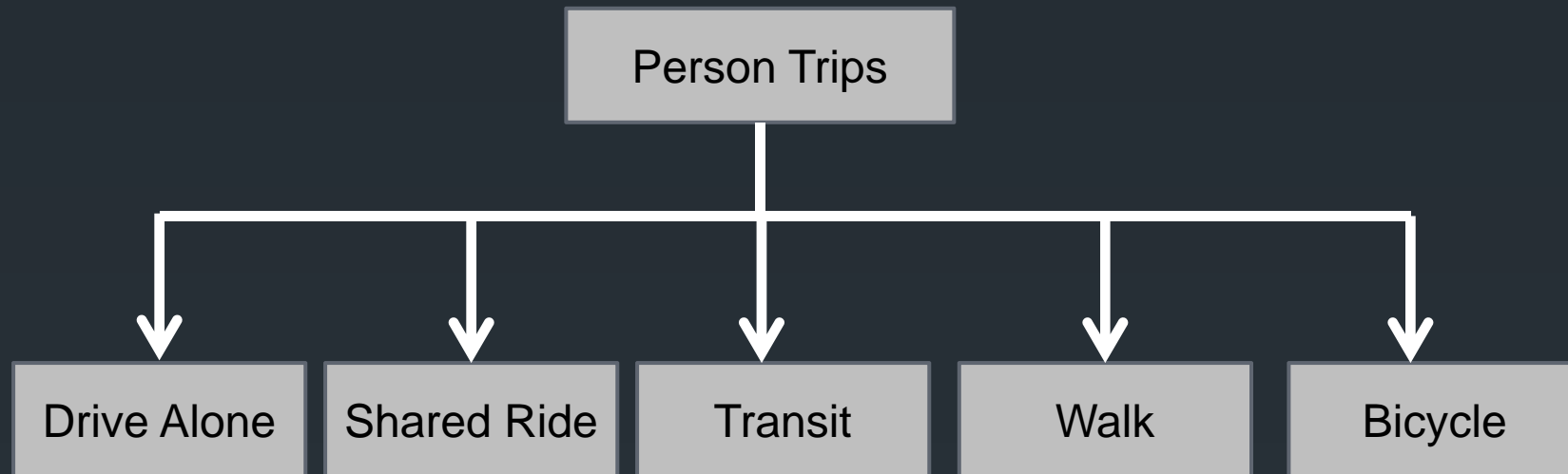
Mode Choice Function



Mode Choice Function



Des Moines Mode Choice Structure



Reasons for Mode Choice Modeling

- Evaluating the feasibility of a major transit investment (new mode?)
- Providing performance measures for choosing corridors, station locations, and alignments for transit improvements
- Evaluating the effectiveness of transit oriented development strategies and other methods of reducing auto travel
- Determining the traffic volume reductions of transit improvements
- Getting federal funding for transit projects (FTA New Starts)
- Determining toll road and HOV lane usage
- Driving transportation modelers insane



Assumptions





- Trip makers know the times and costs of each mode and choose modes accordingly
- Modes have “unincluded” attributes that can’t be quantified but influence mode use
- Unincluded attributes are reflected through the use of mode constants that vary by trip purpose and market segment

Google Auto Directions

Get directions

My places





A

university & 42nd, des moines

B

8th & walnut, des moines

Add Destination


Show options

GET DIRECTIONS

Suggested routes


I-235 E

4.3 mi, 7 mins

 In current traffic: 8 mins


I-235 E

3.9 mi, 8 mins

 In current traffic: 9 mins

University Ave

3.3 mi, 8 mins

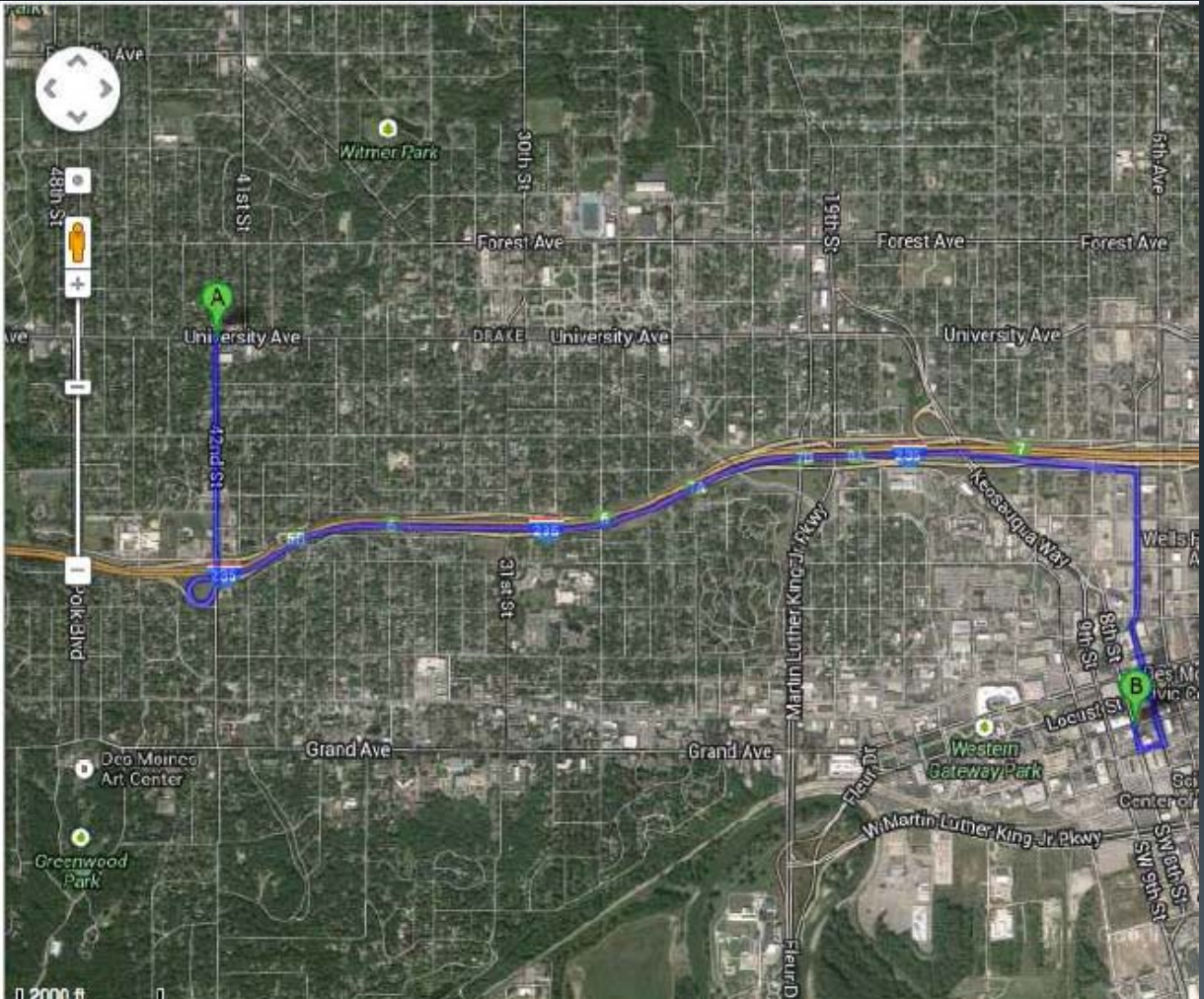
 In current traffic: 9 mins

Driving directions to 8th St & Walnut St, Des Moines, IA

University Ave & 42nd St

Des Moines, IA 50311

1. Head south on 42nd St toward Cottage Grove Ave



Google Transit Directions

The screenshot displays the Google Transit Directions interface. On the left, the input fields show the starting point 'A' as 'university & 42nd, des moines' and the destination 'B' as '8th & walnut, des moines'. The departure time is set to 'Leave now' on '04/06/14' at '12:17pm'. A 'GET DIRECTIONS' button is visible. Below the input fields, 'Suggested routes' are listed:

- Route 1: 19 mins, 12:17pm - 12:36pm, route icon: 60
- Route 2: 18 mins, 12:32pm - 12:50pm, route icon: 3
- Route 3: 19 mins, 12:57pm - 1:16pm, route icon: 60


Below the suggested routes, the starting point is detailed: 'University Ave & 42nd St, Des Moines, IA 50311'. A walking instruction is provided: 'Walk to University Ave / 41ST St, DSM About 2 mins (436 ft)'.

The right side of the interface shows a map of Des Moines, IA, with a blue line indicating the transit route. The route starts at 'University Ave & 42nd St' (marked with a green 'A') and ends at '8th St & Walnut St' (marked with a green 'B'). The route follows University Ave, then Grand Ave, then W Martin Luther King Jr Pkwy, and finally 8th St. The map includes labels for various streets, parks (Witmer Park, Greenwood Park), and landmarks (Des Moines Art Center, Wells Fargo Arena, Science Center of Iowa). A scale bar at the bottom left indicates 2000 ft and 500 m. The bottom of the map shows copyright information: 'Imagery ©2014 DigitalGlobe, Landsat, USDA Farm Service Agency, Map data ©2014 Google' and links to 'Edit in Google Map Maker' and 'Report a problem'.





Google Transit Directions

Get directions

My places



GO



university & 42nd, des moines

8th & walnut, des moines

Add Destination · Show options



Leave now

04/06/14


12:17pm

GET DIRECTIONS

Suggested routes





60




12:17pm - 12:36pm

19 mins





3




12:32pm - 12:50pm

18 mins



60




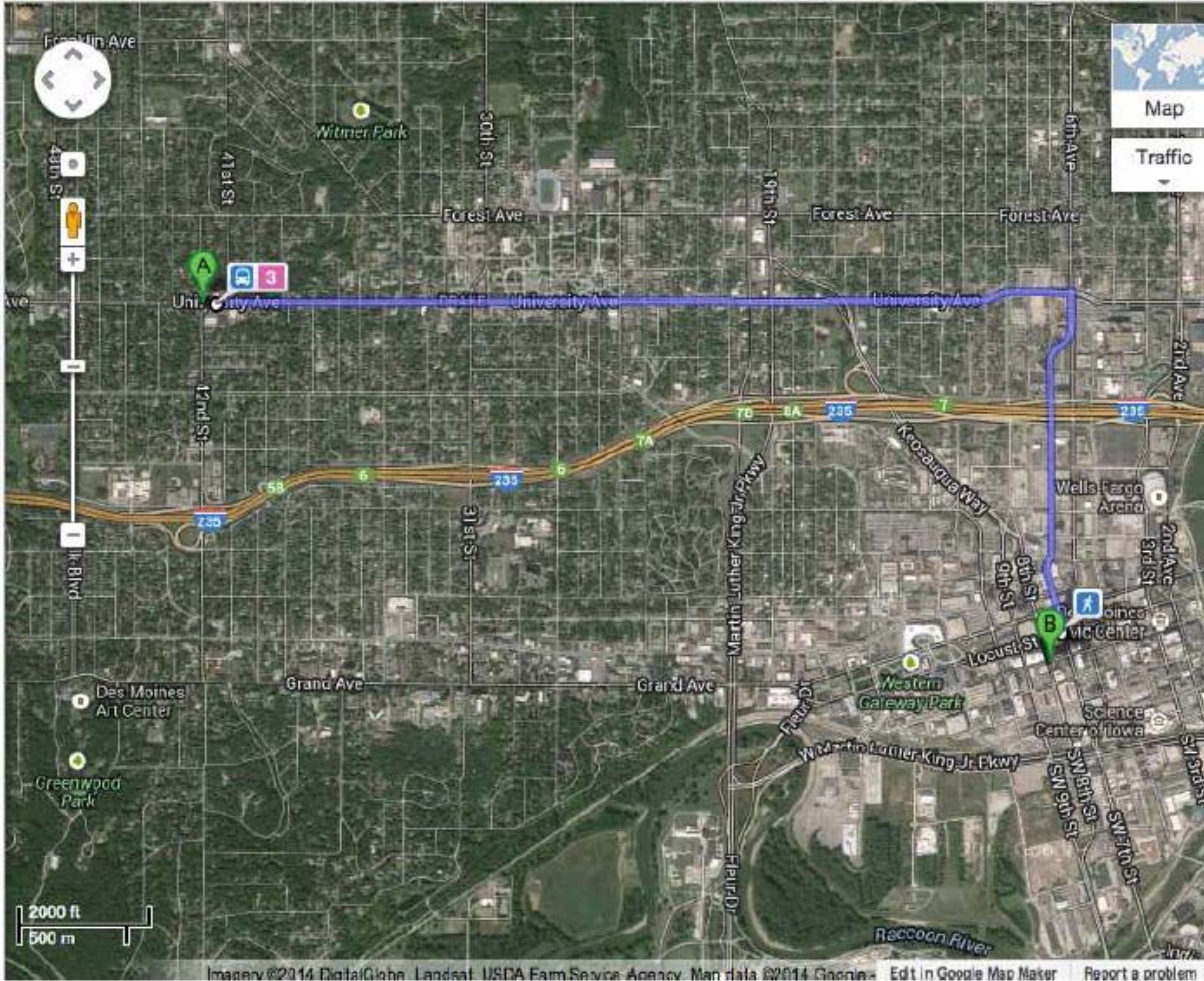
12:57pm - 1:16pm

19 mins

Transit directions to 8th St & Walnut St,
Des Moines, IA

University Ave & 42nd St
Des Moines, IA 50311

 Walk to University Ave / 42ND St (Far-Side),
DSM



Map

Traffic

2000 ft
500 m

Imagery ©2014 DigitalGlobe, Landsat, USDA Farm Service Agency, Map data ©2014 Google, Edit in Google Map Maker, Report a problem

Market Segments

- Des Moines model allocates trips to zero auto households, one auto households, and household with 2 or more autos
- Other schemes include using household income and a combination of factors like auto ownership and workers per household
- Non-home based and school trips are often not segmented

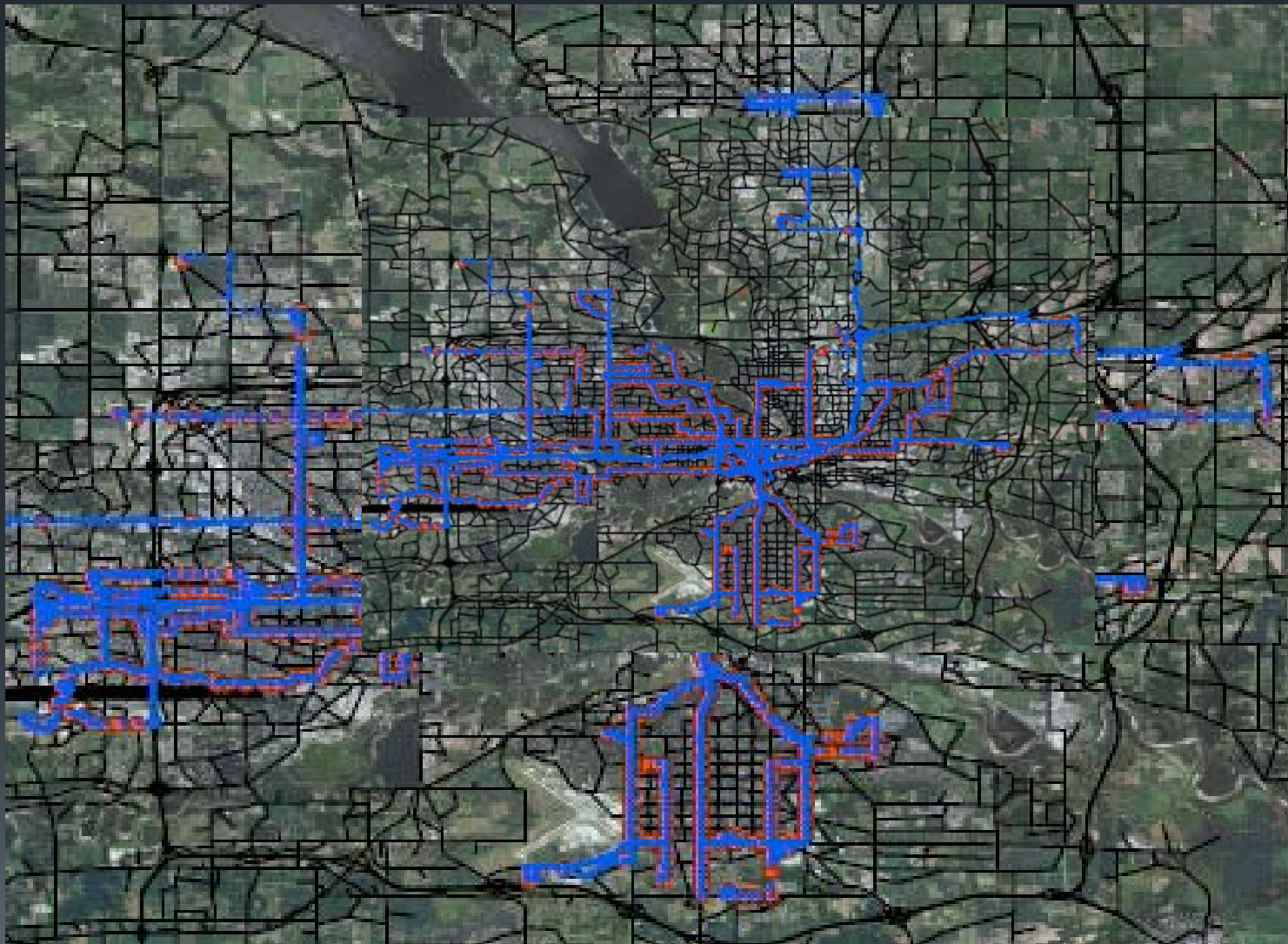
2010 DMAMPO Average Weekday Trips by Mode

SEGMENT	MODE	HBW	HBSH	HBO	MODE	HBSCH	NHBW	NHBO
0 AUTO	DA	-	-	-	DA	23,059	164,206	160,249
0 AUTO	SR	1,450	4,240	439	SR	52,030	49,270	257,877
0 AUTO	TR	1,748	1,410	1,300	TR	851	1,027	606
0 AUTO	WK	3,561	10,412	1,078	WK	19,969	23,206	7,913
0 AUTO	BK	-	-	-	BK	2,098	578	-
1 AUTO	DA	72,714	55,840	14,258	TOTAL	98,007	238,288	426,646
1 AUTO	SR	25,928	70,591	29,708				
1 AUTO	TR	1,772	253	649				
1 AUTO	WK	5,928	2,714	10,503				
1 AUTO	BK	60	607	1,548				
2+ AUTO	DA	440,330	219,091	80,650				
2+ AUTO	SR	42,520	236,595	150,161				
2+ AUTO	TR	1,855	483	331				
2+ AUTO	WK	5,707	9,388	32,688				
2+ AUTO	BK	279	2,201	7,776				
TOTAL		603,851	613,826	331,089				

Transit Model Inputs

- TransCAD transit network describing the path of each route variation, transit link times, service frequencies, stop locations, fares and walk and drive access links
- Walk access fractions by TAZ, purpose, and production/attraction
- Weekday person trips by purpose and time period (AM peak, PM peak, off-peak)
- Market segment fractions by TAZ and purpose
- Congested highway times and distances by time period at link level and TAZ-TAZ
- Parking costs and auto terminal times by TAZ
- TAZ-TAZ Walk and bike times

Google Transit Feed Data



Route 1



WESTBOUND-Inbound

Monday-Friday

Street	Hubbell Ave & E 42nd St	Easton Blvd & E 37th Ct WB/OB	Sherry Lynn & E University	NE 56th St & E University	Grand Ave & E 30th St	Grand Ave & E 14th St	DART Central Station
36	5:42	5:50	---	---	5:56	6:05	6:15
49	5:55	6:03	---	---	6:11	6:20	6:30
	---	---	6:15	6:18	6:26	6:35	6:45
19	6:25	6:33	---	---	6:41	6:50	7:00
	---	---	6:45	6:48	6:56	7:05	7:15
50	6:56	7:04	---	---	7:11	7:20	7:30
	---	---	7:15	7:18	7:26	7:35	7:45

EASTBOUND-Outbound

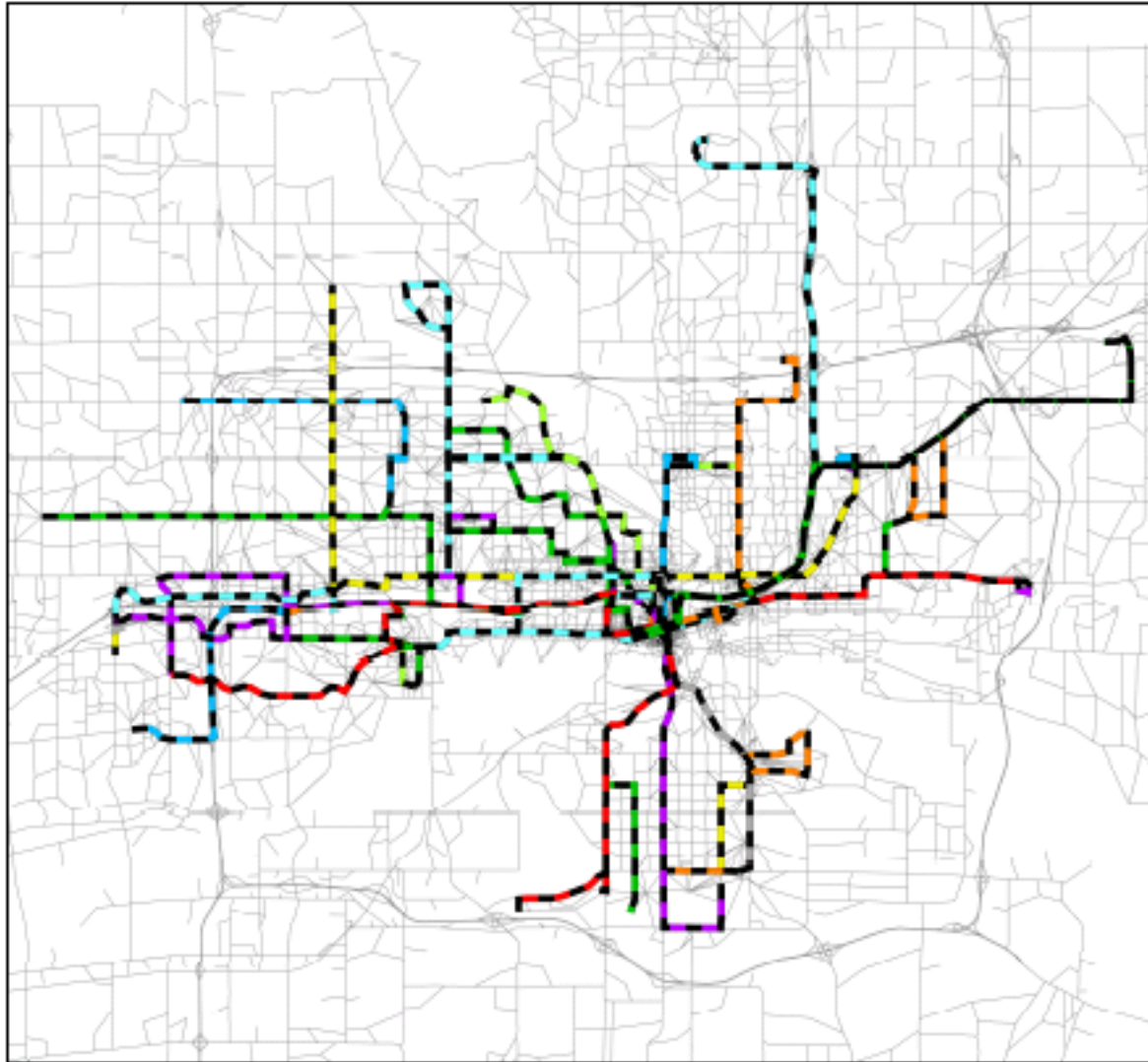
Monday-Friday

Street	DART Central Station	Grand Ave & E 14th St	Grand Ave & E 30th St	Sherry Lynn & E University	NE 56th St & E University	Easton Blvd & E 37th Ct EB/OB	Hubbell Ave & E 42nd St	Hoyt Middle School	Easton Blvd & E 37th Ct EB/OB
AM	6:05	6:13	6:20	6:26	---	---	---	---	---
	6:20	6:28	6:35	---	---	6:41	---	---	---
	6:35	6:43	6:50	6:56	---	---	---	---	---
	6:50	6:58	7:05	---	---	7:11	---	7:15	7:21
	7:05	7:13	7:20	---	---	7:26	---	---	---
	7:20	7:29	7:36	---	---	7:42	---	---	---
	7:50	7:59	8:05	---	---	8:11	---	---	---

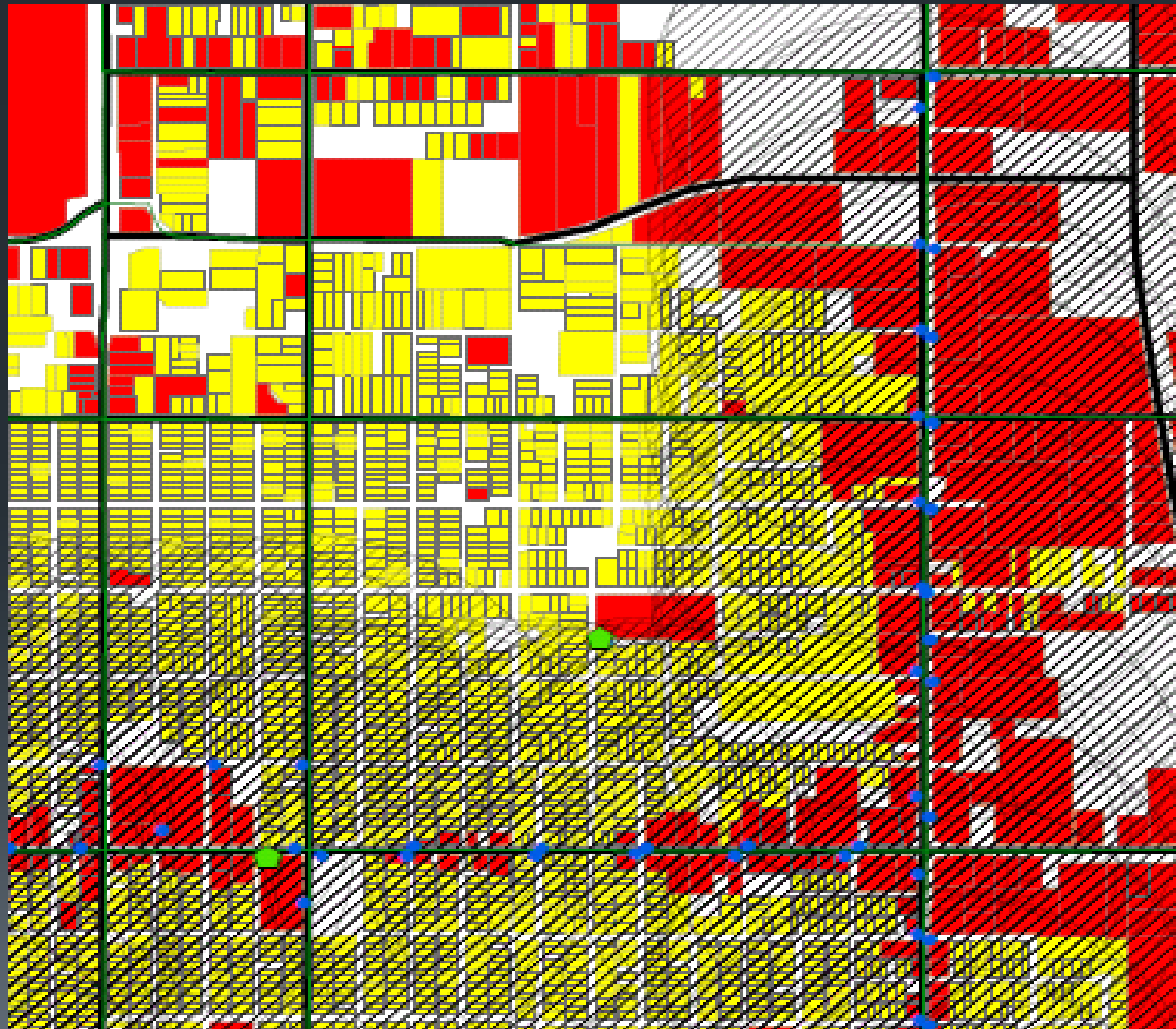
TransCAD Route Table

ROUTEID	MODE	ROUTENO	DIR	VARNO	AMHWY	OPHWY	PMHWY
1001	1	1	IB	1	30.0	40.0	30.0
1002	1	1	IB	2	90.0	120.0	60.0
1101	1	1	OB	1	22.5	36.0	30.0
1102	1	1	OB	2	90.0	180.0	90.0
3001	1	3	IB	1	20.0	30.0	20.0
3101	1	3	OB	1	20.0	30.0	22.5
...							
98001	2	98	IB	1	60.0	120.0	0.0
98002	2	98	IB	2	180.0	0.0	0.0
98101	2	98	OB	1	0.0	360.0	45.0
98102	2	98	OB	2	0.0	0.0	90.0
99001	2	99	IB	1	180.0	0.0	0.0
99002	2	99	IB	2	90.0	0.0	0.0
99101	2	99	OB	1	0.0	0.0	180.0
99102	2	99	OB	2	0.0	0.0	180.0

TransCAD Route System



Walk Access



Mode Utility Coefficients



In-vehicle travel time (drive alone, shared ride, transit) = -0.025

First wait time (transit) = -0.05

Terminal time (drive alone, shared ride) = -0.05

Transfer wait time (transit) = -0.075

Walk/bike time (transit, walk, bike) = -.05

Cost in dollars zero auto segment (drive alone, shared ride transit) = -0.12

Cost in dollars one auto segment (drive alone, shared ride transit) = -0.05

Cost in dollars 2+ auto segment (drive alone, shared ride transit) = -0.03

Cost = Transit fare or \$0.12 per mile plus parking cost for drive alone and shared ride

Mode Choice Constants

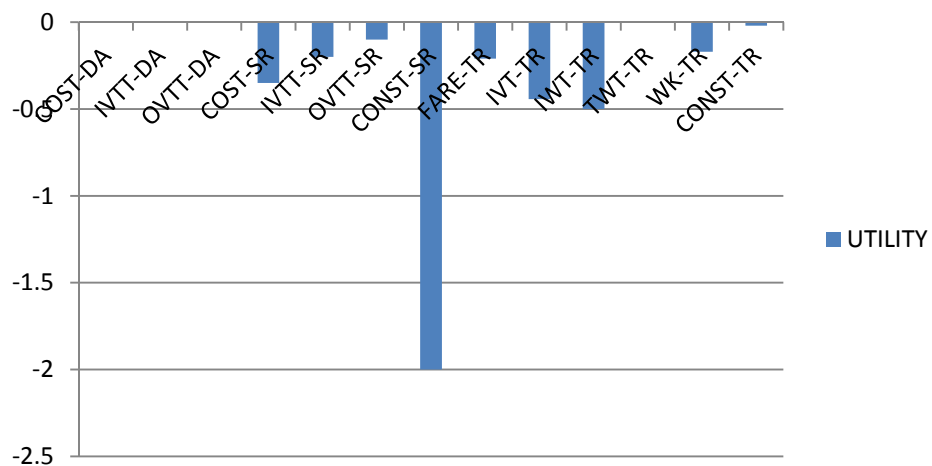
SEGMENT	MODE	HBW	HBSH	HBO	SEGMENT	HBSCH	NHBW	NHBO
0 AUTO	SR	-2.00	-2.00	-1.50	All	0.68	-0.86	0.97
0 AUTO	TR	-0.02	-0.39	3.00	All	0.06	-1.77	-1.79
0 AUTO	WK	3.00	3.00	3.00	All	1.87	0.22	-0.33
0 AUTO	BK	-5.00	-5.00	-5.00	All	-0.47	-2.50	-5.00
1 AUTO	SR	-0.80	0.80	0.61				
1 AUTO	TR	-1.63	-3.00	-0.43				
1 AUTO	WK	0.42	-0.24	3.00				
1 AUTO	BK	-5.00	-2.30	-0.36				
2+ AUTO	SR	-2.00	0.52	0.65				
2+ AUTO	TR	-3.00	-3.00	-3.00				
2+ AUTO	WK	-1.70	-0.33	1.70				
2+ AUTO	BK	-5.00	-3.00	-0.35				

HBW Utility Calculations

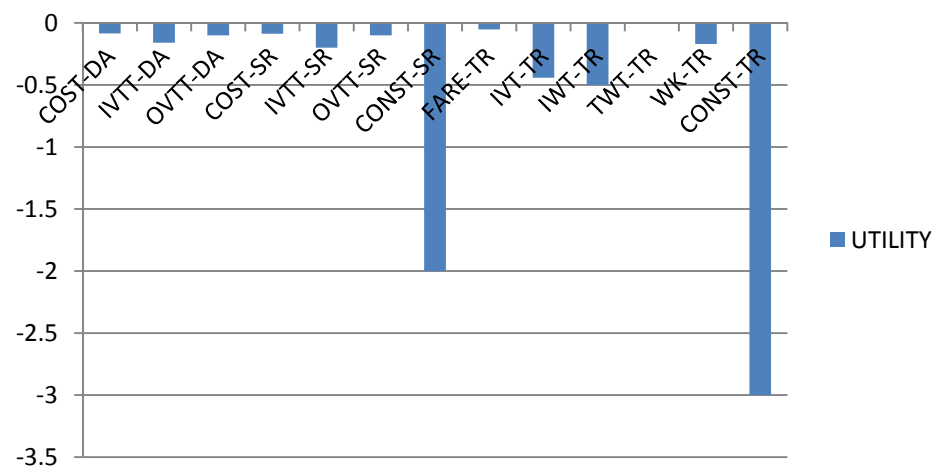
COMPONENT	VALUE	ZERO AUTO		ONE AUTO		2+ AUTO	
		COEFF	UTILITY	COEFF	UTILITY	COEFF	UTILITY
COST-DA	2.83			-0.050	-0.14	-0.030	-0.09
IVTT-DA	6.40			-0.025	-0.16	-0.025	-0.16
OVTT-DA	2.00			-0.050	-0.10	-0.050	-0.10
TOTAL-DA			0.00		-0.40		-0.35
COST-SR	2.92	-0.120	-0.35	-0.050	-0.15	-0.030	-0.09
IVTT-SR	8.00	-0.025	-0.20	-0.025	-0.20	-0.025	-0.20
OVTT-SR	2.00	-0.050	-0.10	-0.050	-0.10	-0.050	-0.10
CONST-SR			-2.00		-0.80		-2.00
TOTAL-SR			-2.65		-1.25		-2.39
FARE-TR	1.75	-0.120	-0.21	-0.050	-0.09	-0.030	-0.05
IVT-TR	17.70	-0.025	-0.44	-0.025	-0.44	-0.025	-0.44
IWT-TR	10.00	-0.050	-0.50	-0.050	-0.50	-0.050	-0.50
TWT-TR	0.00	-0.075	0.00	-0.075	0.00	-0.075	0.00
WK-TR	3.40	-0.050	-0.17	-0.050	-0.17	-0.050	-0.17
CONST-TR			-0.02		-1.63		-3.00
TOTAL-TR			-0.19		-1.80		-3.17
OVTT-BK	21.69	-0.050	-1.08	-0.050	-1.08	-0.050	-1.08
CONST-BK			-5.00		-5.00		-5.00
TOTAL-BK			-6.27		-7.88		-9.25

Utility Calculations

ZERO AUTOS



2+ AUTOS



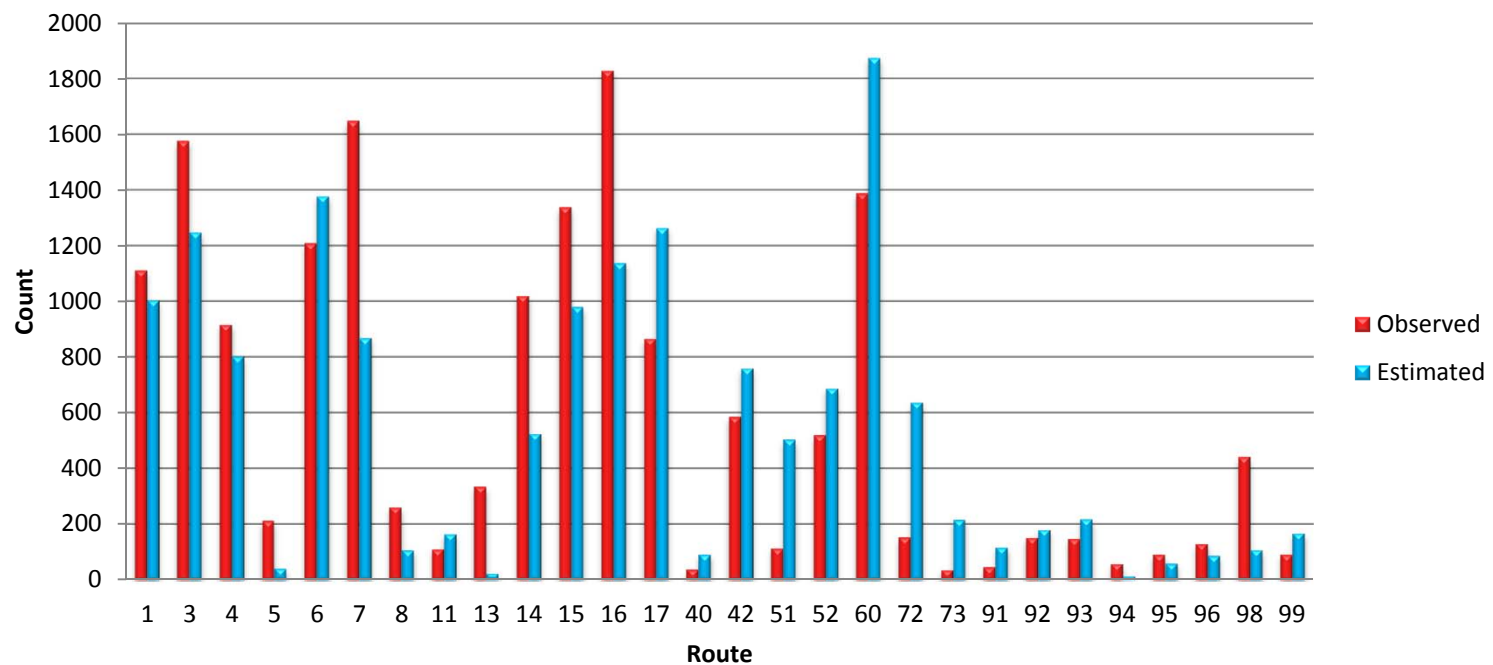
Mode Choice Logit Equation

$$P_n(i) = \text{prob}(Y_n = i) = \frac{e^{V_{ni}}}{\sum_{j \in C_n} e^{V_{nj}}}$$

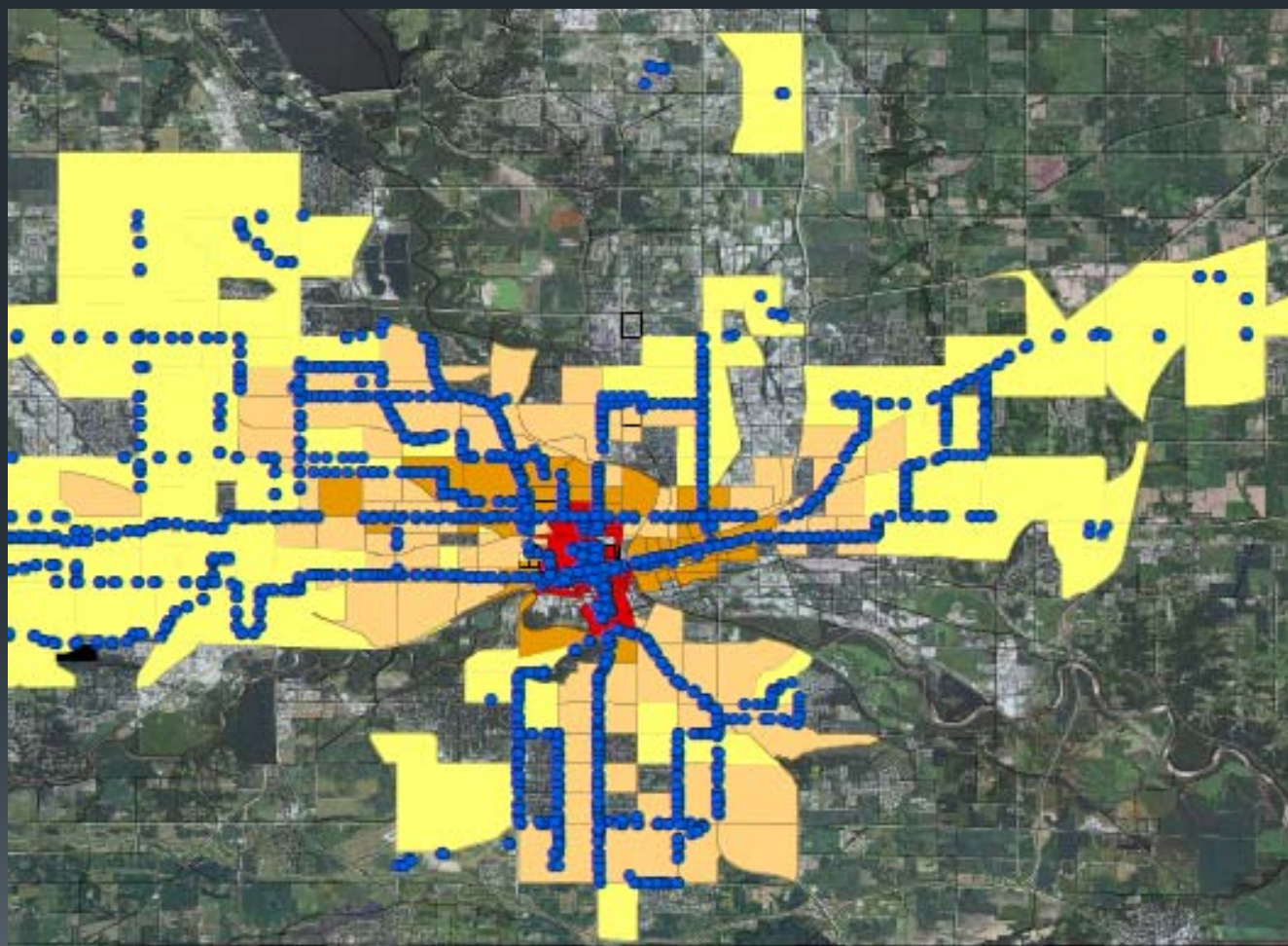
where:

- $P_n(i)$ – The probability with which person n will choose alternative i
- Y_n – The value of the response variable for individual n
- C_n – The set of alternatives in person n 's choice set
- V_{ni} – The measureable component of the utility of alternative i for individual n

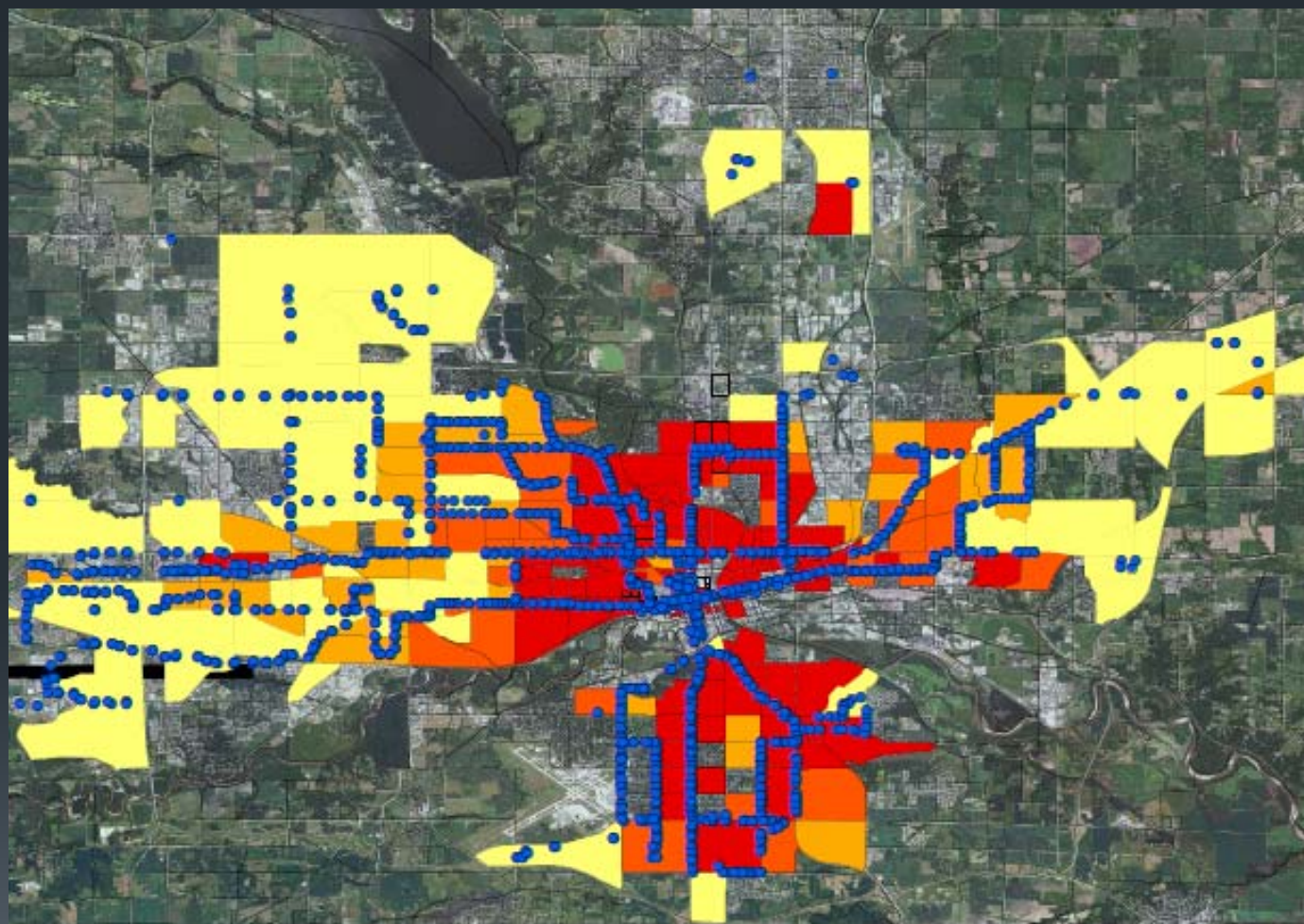
Transit Route Ridership



HBW Transit Share – Attractions



HBW Transit Share - Productions



Other Outputs



- Transit boardings by stop
- Transit link volumes
- Highway trip tables
- Walk and bike trips reports