FDOT Florida Department of Transportation | District 4



Districtwide Urban Model Development

SE Regional Planning Model

Acknowledgments

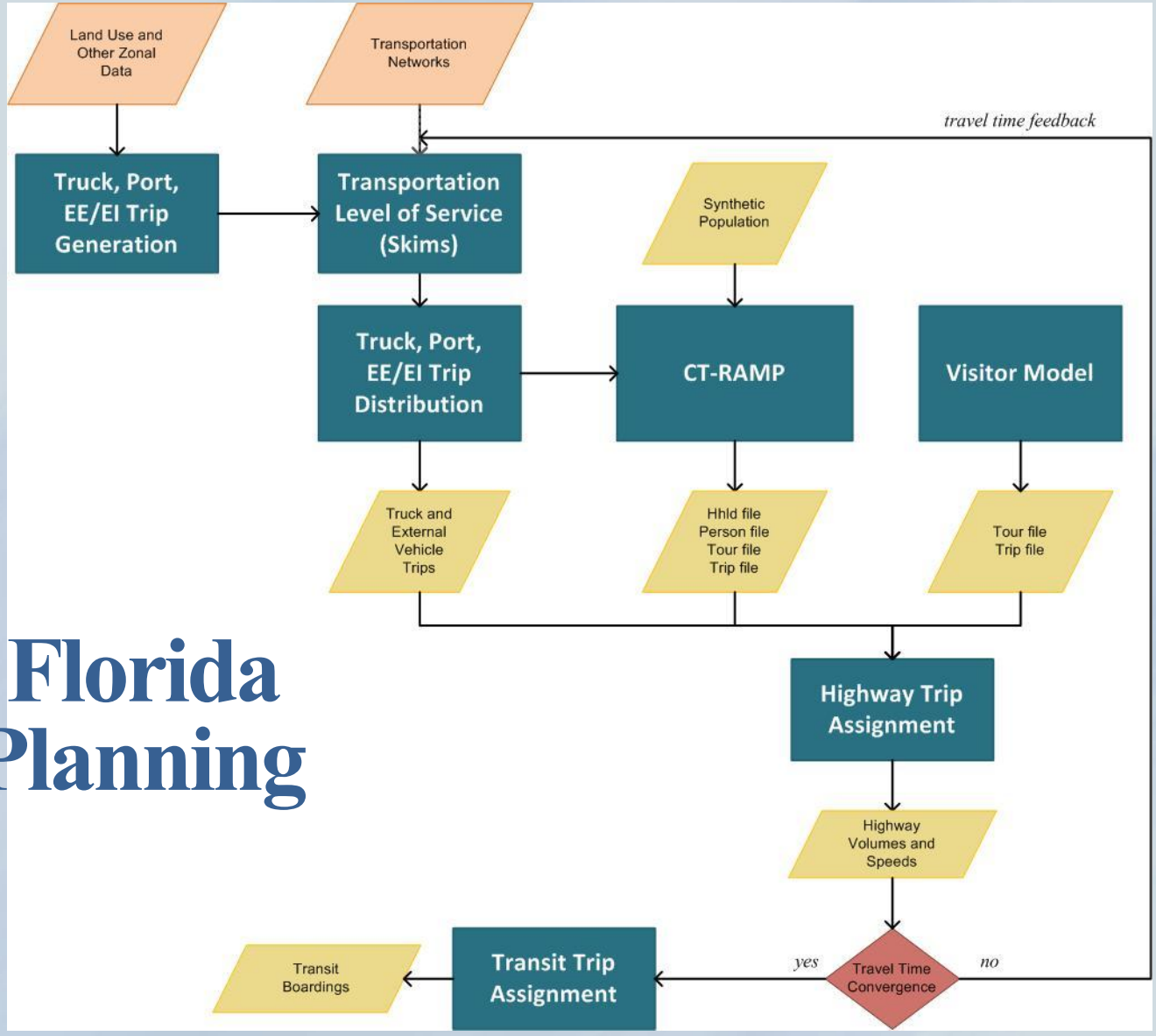
Project Advisory Committee

Shi-Chiang Li, Project Manager
Neil Lyn
Scott Seeburger,
Ming-Tan Li
Hui Zhao
Paul Larsen
Nellie Fernandez,
Vinod Sandanasamy
Wilson Fernandez
Larry Foutz
Paul Flavien
Andrew Velazquez

Consulting Team

Rosella Picado
Ken Kaltenbach
Srin Varanasi
Sung-Ryong Han
Bill Davidson
Ben Stabler,
Yegor Malinovskyi
Jinghua Xu

Southeast Florida Regional Planning Model v.7

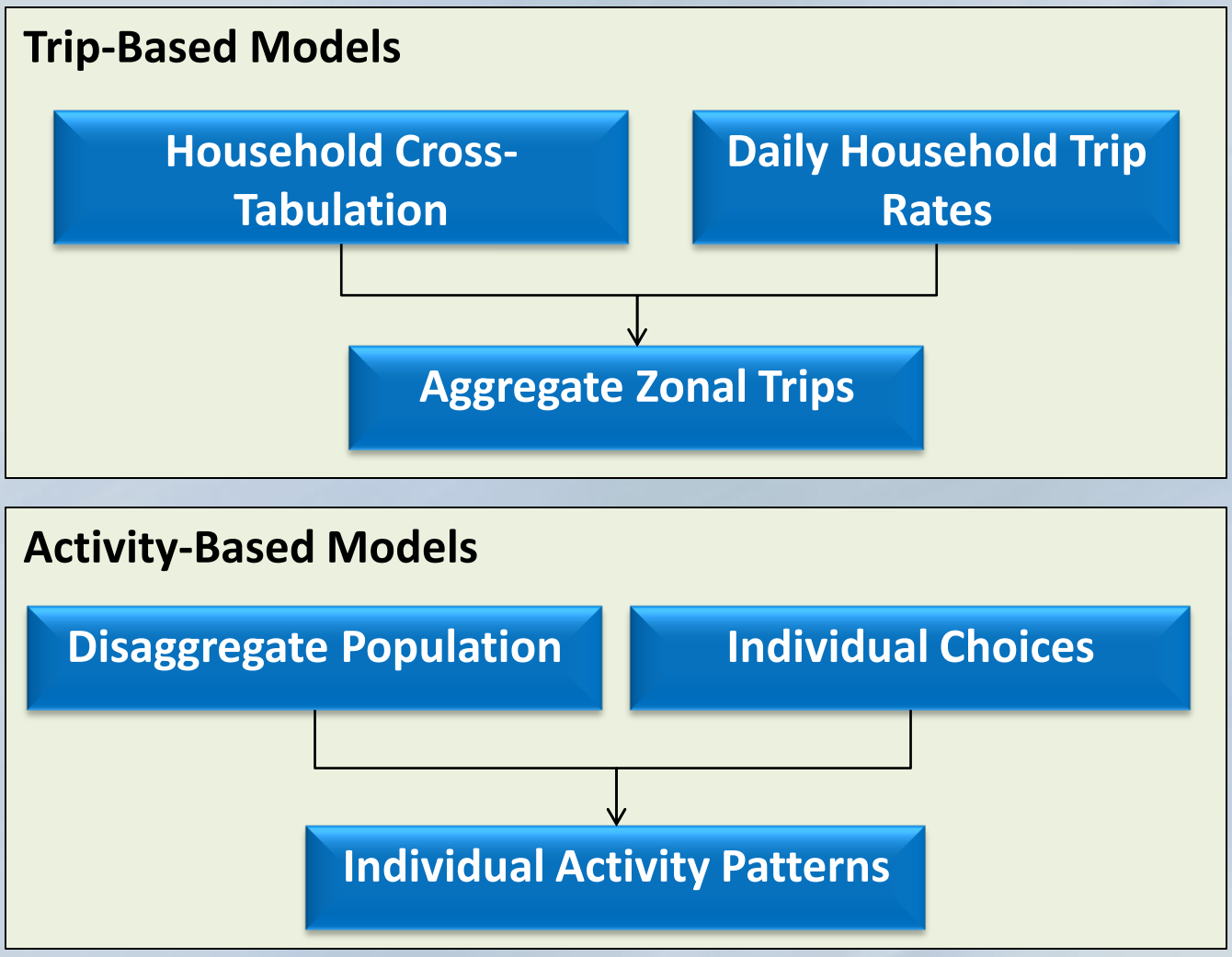


Model Design Concepts

What is an Activity-Based Model?

- An activity-based travel model differs from a trip-based model by modeling decisions to participate in activities
- The focus is whether, when and where to participate in activities, and for how long
- Travel is a derived demand. Trips are a means of traveling between out-of-home activity locations.
- Decisions related to mode and departure times are made to accommodate desired activity arrival and departure times
- Activity-based models represent each household and person individually, using simulation methods

Aggregate vs. Disaggregate Travel Representation



Prediction: Allocation vs. Simulation

- Classical Trip-Based Model – Mode Choice
  - For each market segment, defined by trip purpose and household demographic group, predict the probability of each mode for each O-D pair.
  - Allocate the number of trips for each segment and O-D pair to modes in proportion to their predicted probabilities.
  - Sum over market segments to form trip tables.
- Activity/Tour-Based/Simulation—Mode Choice
  - Predict probability of each simulated chooser selecting each mode for a specific O-D pair and purpose.
  - Use Monte Carlo random draws to predict mode choice.
  - Sum over choosers and purposes, grouped by O-D pair, to form trip tables for network assignment.

Decision-Making Units

- Travel is generated by ***persons*** as they participate in out-of-home activities.
- Persons belong to ***households*** and make joint activity participation decisions. Household members share certain characteristics (e.g., income, auto availability)
- Some travel decisions are modeled at the household level, e.g.,
  - Auto availability
  - Coordinated activity pattern
  - Joint tour mode
- Most travel decisions apply to individual persons, e.g.,
  - Usual workplace location
  - Individual tour mode

Person Types

No.	PERSON-TYPE	AGE	WORK STATUS	SCHOOL STATUS
1	Full-time worker	18+	Full-time	None
2	Part-time worker	18+	Part-time	None
3	College student	18+	Part-time or None	College
4	Non-working adult	18 – 64	None	None
5	Non-working senior	65+	None	None
6	Driving age student	16 - 17	Part-time or None	Pre-college
7	Non-driving student	6 – 16	None	Pre-college
8	Pre-school	0 - 5	None	None

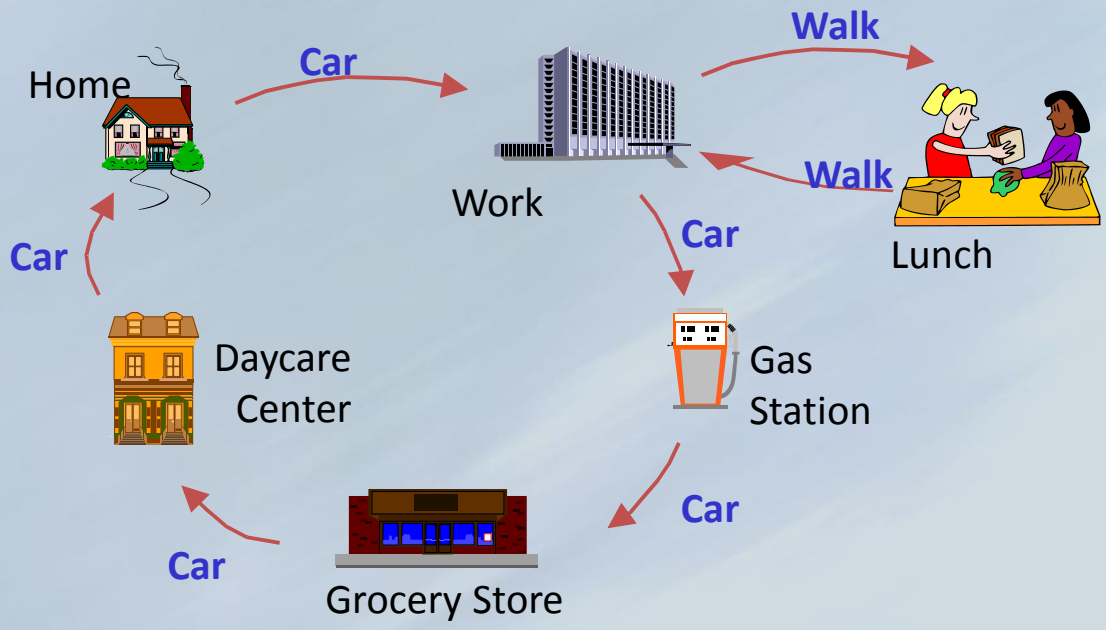
- Model segmentation
- Constraints on available alternatives
- Explanatory variables in models
- Comparative analysis

Household Types

- Household attributes are used primarily as explanatory variables in models
  - Auto availability
  - Household size
  - Number of employed persons
  - Number of students
  - Household income
  - Type of dwelling unit
- No explicit household types predefined in SERPM7

Modeling Trips as part of Tours

- **Tour**: a series of trips beginning and ending at home or work
  - No more modeling for journey home from work separate from journey to work
- Primary destination and intermediate stops
- Sub-tours
  - No more non-home-based trips



Activity Types

TYPE	PURPOSE	DESCRIPTION	CLASSIFICATION	ELIGIBILITY
1	Work	Working at regular workplace or work-related activities outside the home.	Mandatory	Workers and students
2	University	College +	Mandatory	Age 18+
3	High School	Grades 9-12	Mandatory	Age 14-17
4	Grade School	Grades K-8	Mandatory	Age 5-13
5	Escorting	Pick-up/drop-off passengers (auto trips only).	Maintenance	Age 16+
6	Shopping	Shopping away from home.	Maintenance	5+ (if joint travel, all persons)
7	Other Maintenance	Personal business/services, and medical appointments.	Maintenance	5+ (if joint travel, all persons)
8	Social/Recreational	Recreation, visiting friends/family.	Discretionary	5+ (if joint travel, all persons)
9	Eat Out	Eating outside of home.	Discretionary	5+ (if joint travel, all persons)
10	Other Discretionary	Volunteer work, religious activities.	Discretionary	5+ (if joint travel, all persons)

Activity Types

- Each tour involves traveling to one or more out-of-home activities
- The purpose of the tour is taken from the activity at the primary destination of the tour

Activity Types

Joint Activities

*Activities undertaken by **all** household members at the same time, traveling **together** as a single party.*

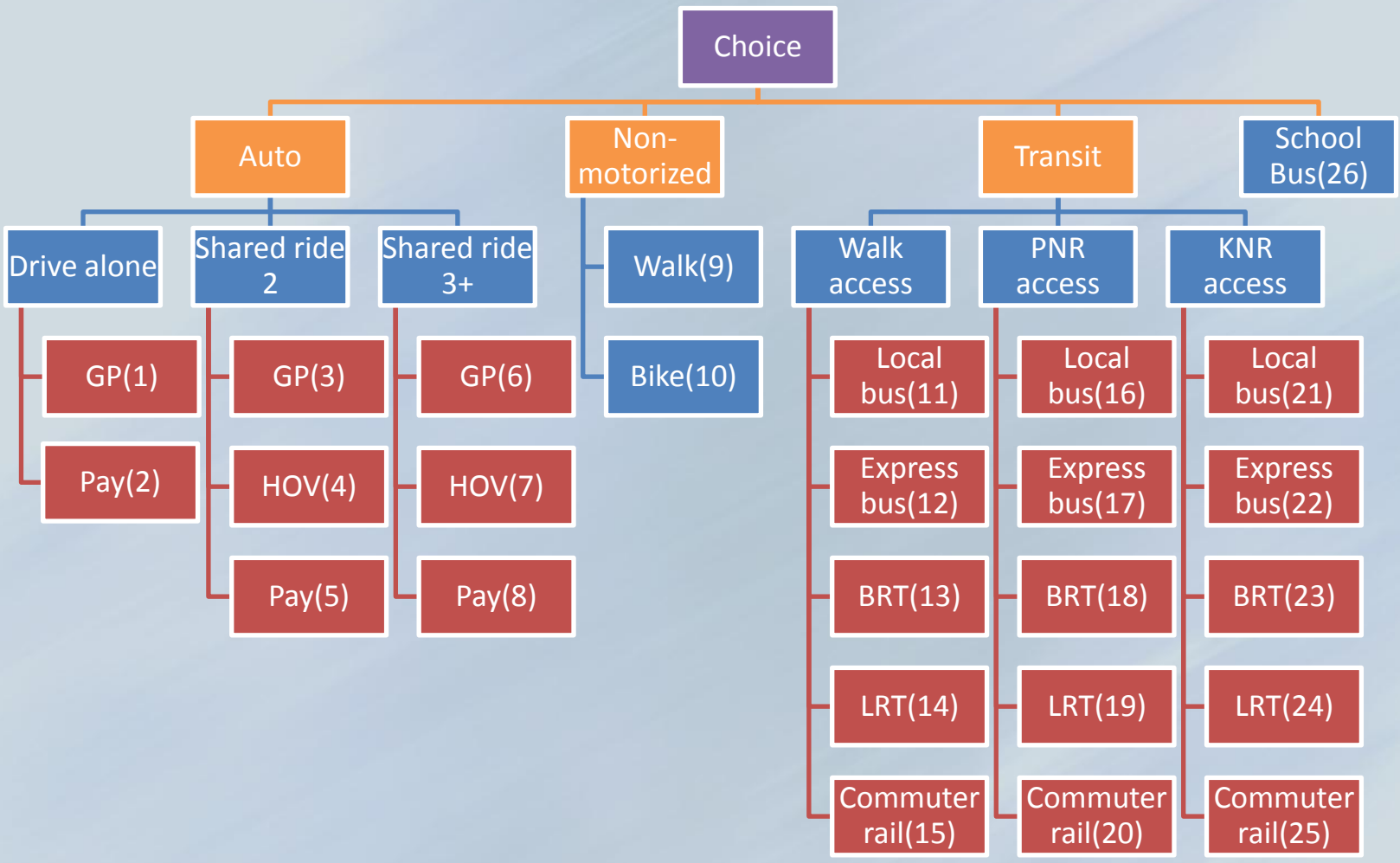
Individual Activities

Activities undertaken by one person independently of the activities performed by other household members.

What about partially joined activities and activities with non-household members?

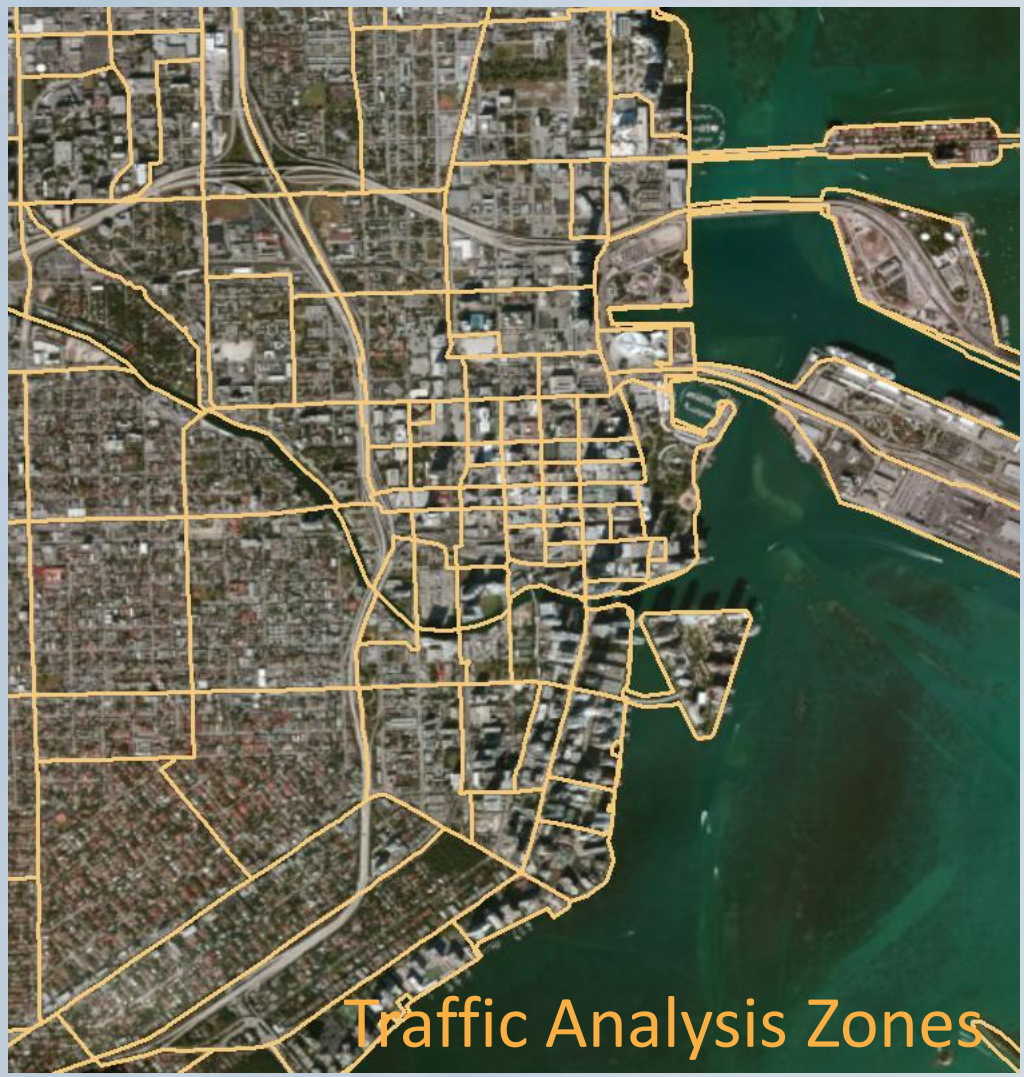
They are modeled as individual activities, with appropriate modes

Modes


Choice
Auto
Non-motorized
Transit
School Bus(26)
Drive alone
Shared ride 2
Shared ride 3+
Walk(9)
Bike(10)
Walk access
PNR access
KNR access
GP(1)
Pay(2)
GP(3)
HOV(4)
Pay(5)
GP(6)
HOV(7)
Pay(8)
Local bus(11)
Express bus(12)
BRT(13)
LRT(14)
Commuter rail(15)
Local bus(16)
Express bus(17)
BRT(18)
LRT(19)
Commuter rail(20)
Local bus(21)
Express bus(22)
BRT(23)
LRT(24)
Commuter rail(25)

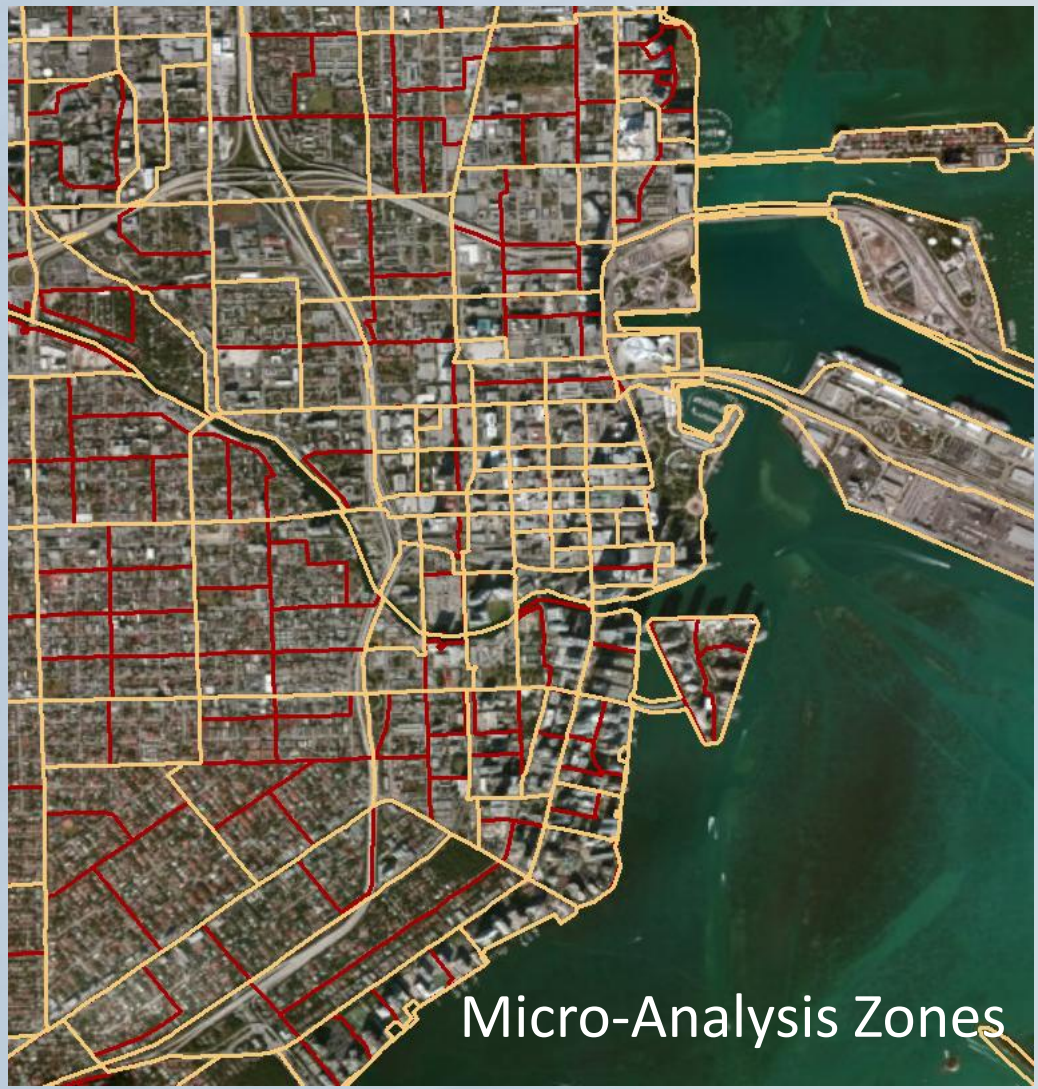
Representation of Space

- Traffic Analysis Zones
  - ~4,200 TAZs
  - Used to represent highway level of service and for assigning highway trips
  - Spatial resolution of input population characteristics (aka, the SE data)



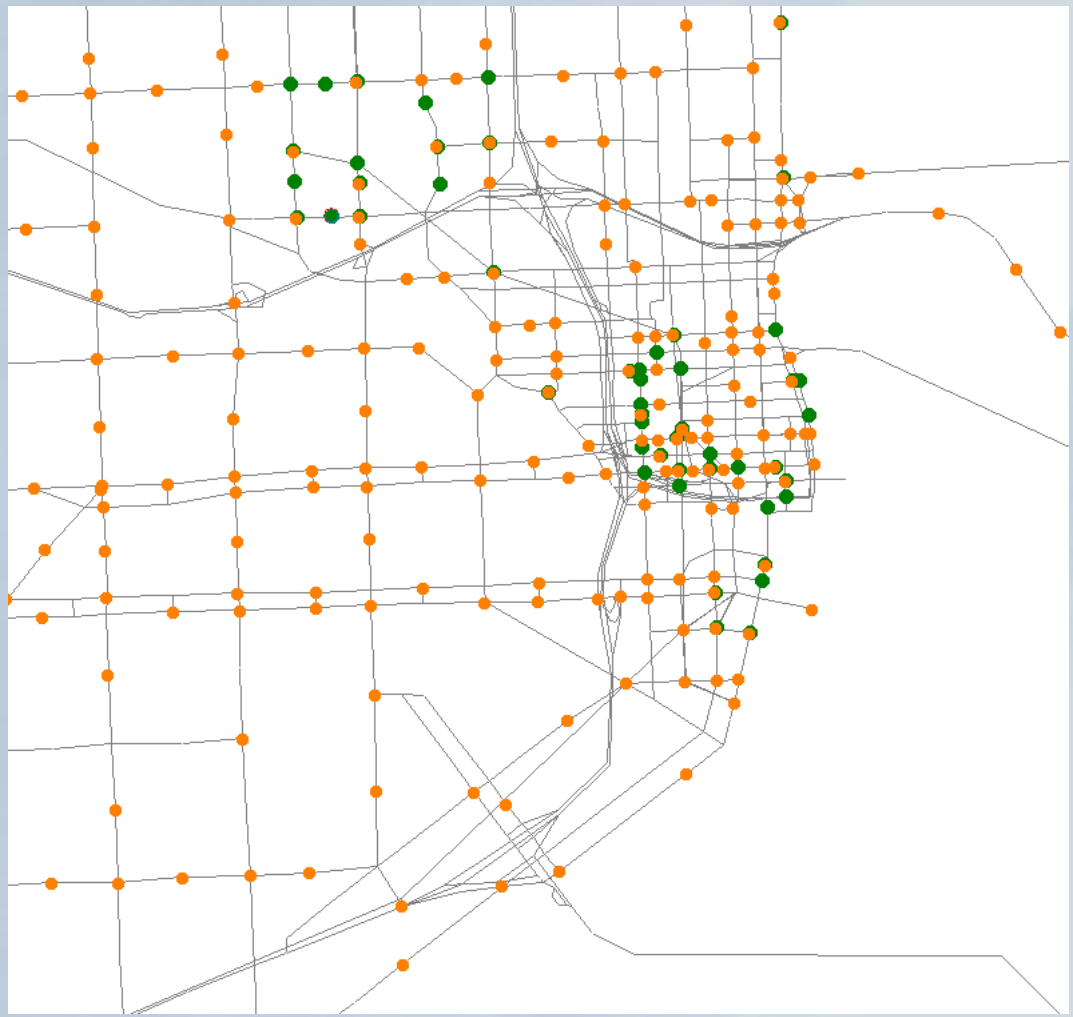
Representation of Space

- Micro-Area Zones
  - ~12,000 MAZs
  - Spatial resolution of land use data
    - Employment
    - School Enrollment
    - Hotels and Motels
    - Parking Costs
  - Spatial resolution of all activity locations and trip ends



Representation of Space

- Transit Access Points
  - ~3,200 in 2010
  - Represent transit boarding and alighting locations
  - Used to represent transit level of service matrices
  - Each rail station and premium bus stops are TAPs
  - Proximate local bus stops share the same TAP

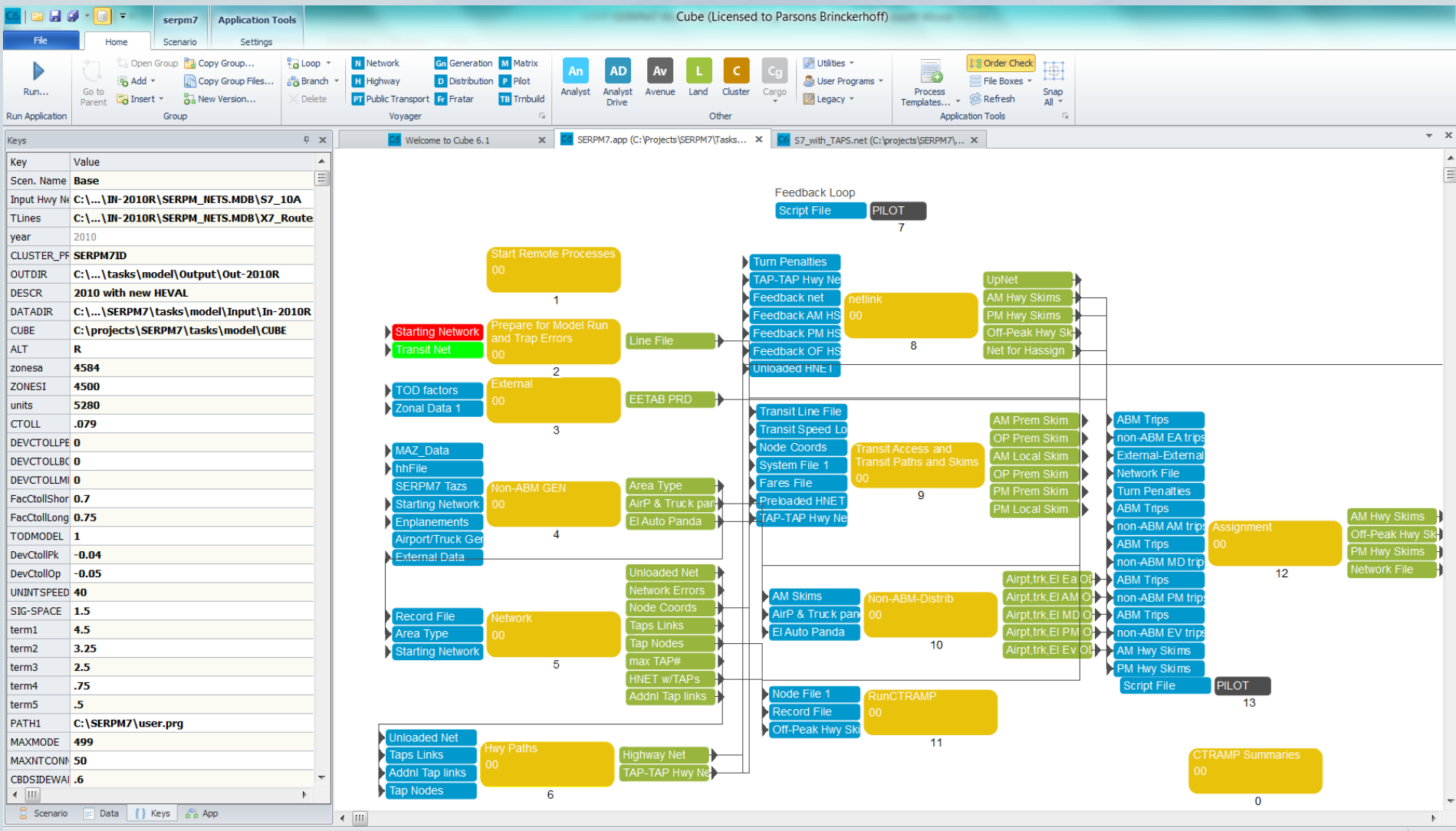


Representation of Time

Aggregate Time Periods (5 total)	**Half-hour intervals (40 total)**
Used for representing level of service matrices (skims) and for trip assignment	Used for scheduling tours and trips
AM Peak – 6:00 AM to 8:59 AM	6:00 – 6:29; 6:30 – 6:59; 7:00 – 7:29; 7:30 – 7:59, 8:00 – 8:29; 8:30 – 8:59
Midday – 9:00 AM to 2:59 PM	…
PM Peak – 3:00 PM to 6:59 PM	…
Evening – 7:00 PM to 9:59 PM	…
Early – 10:00 PM to 5:59 AM	10:00 – 10:29, 10:30 – 10:59; 11:00 – 11:29; 10:30 – 12:00; ***12:00 – 4:30***; 4:30 – 5:00; 5:00 – 5:29; 5:30 – 5:59

System Framework

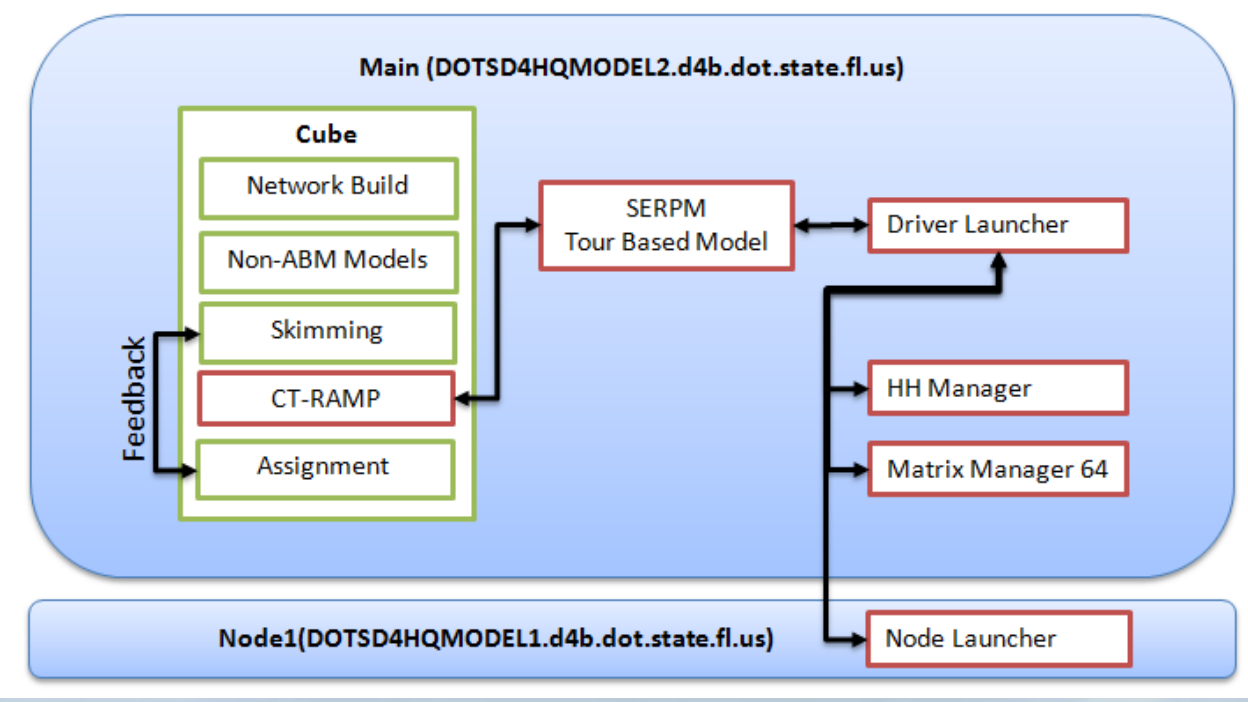
Cube User Interface / Modeling Platform



System Setup

- Hardware (FDOT)
  - Microsoft Windows Server 2008 R2 Enterprise, 64-bit Operating System
  - Two Intel Xeon X5690 @ 3.47 GHz 6 core
  - 144 GB RAM (minimum 96 GB required)
  - 2-3 TB Hard drive recommended
    - One run consumes ~20GB hard drive
- Installed on 3 FDOT Servers
- Each server runs the model independently of the other two
  - Slower, but multiple users can access the model concurrently
- Each run takes approximately 24hrs (per feedback loop)
- Eventually the model will be distributed to 2 or 3 servers

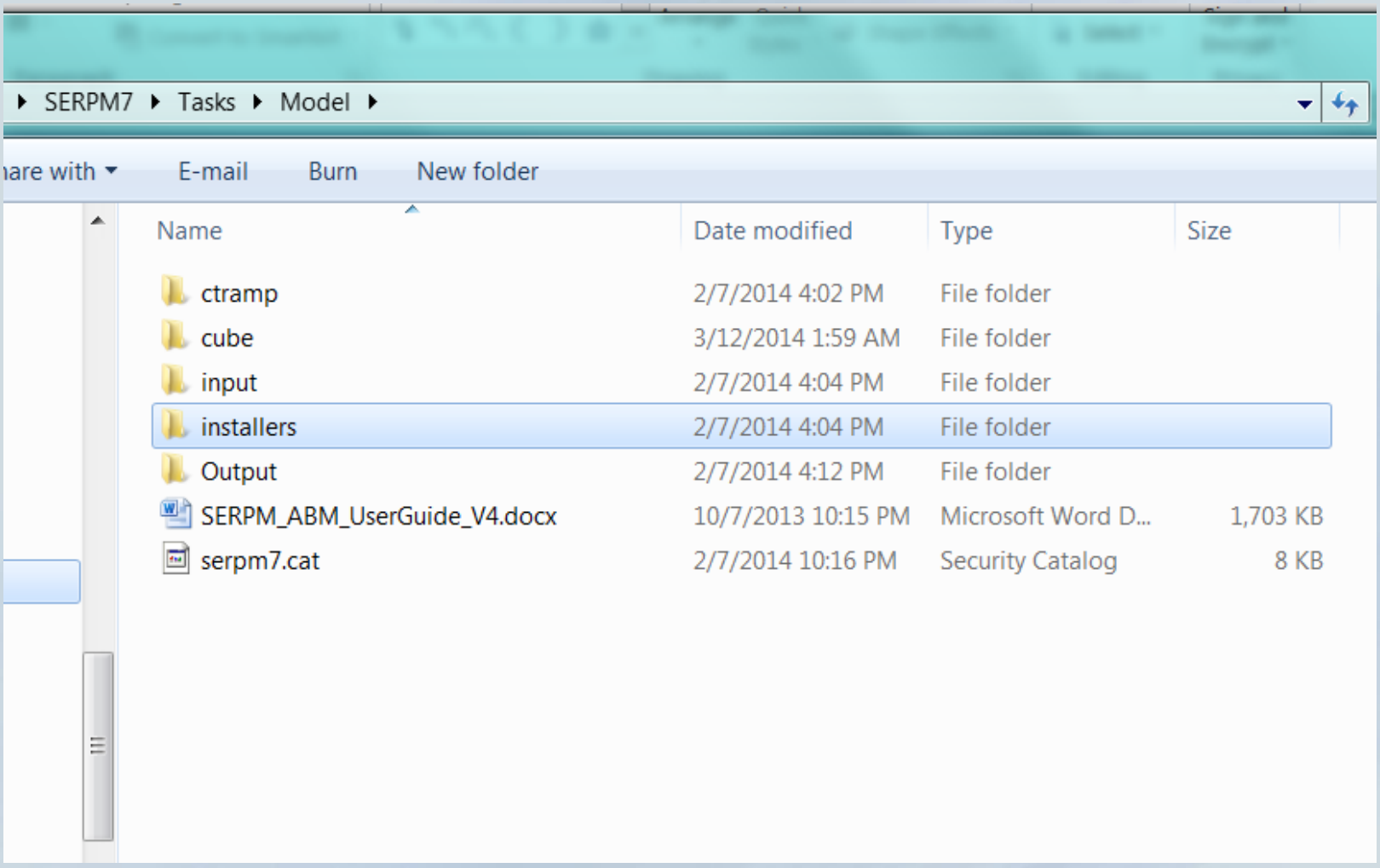
System Setup



System Setup

- Software:
  - Cube 6.1
  - Java and CT-RAMP
  - Microsoft Excel (helpful but not required)
  - SQL (PopSyn and ABM reports)

System Setup



Inputs Subfolder

- **Inputs**
  - **IN-2010R** -- working input folder; user-defined inputs go here
  - **IN-2040R** -- another working input folder for the 2040 scenario
  - **MAZShape** – MAZ shapefile
  - **TAZShape** – TAZ shapefile
  - **Seed_Net_Skim** – initial “seed” highway skims
  - **TA_Analyst** – truck matrix
  - **ABMTemp** – temporary working folder

Input Folder Structure

- **Inputs**
  - IN-2010R
  - IN-2040R
  - MAZShape
  - TAZShape
  - Seed_Net_Skim
  - TA_Analyst
  - ABMTemp

- **Inputs**
  - IN-2010R
    - ctramp
      - Visitor
    - transit
    - capcalctabs
  - IN-2040R
  - MAZShape
  - TAZShape
  - Seed_Net_Skim
  - TA_Analyst
  - ABMTemp

Input Data

- Population and Household SE Data (Controls)
- Land Use Data
  - Employment
  - School Enrollment
  - Hotel and Motel Rooms
  - Parking Supply and Costs
  - Special Generators
- Highway Network
- Transit Network
- External Station Volumes
- Airport Enplanements
- Seed Skims, Traffic Counts, other inputs

Model Parameters

- Non-ABM model parameters are stored in the input data folders and in Cube keys
- Examples
  - Truck diurnal factors
  - Capacity calculation tables
  - Airport and truck trip generation rates
  - External traffic volumes
  - …
- ABM model parameters are stored in the **ctramp system** folder
  - Utility Expression Calculators (Excel format files)
  - Properties files (text files)

Running CT-RAMP

```
*rmdir {OUTDIR}\..\ABMTEMP /S /Q
*rmdir {DATADIR}\..\ABMTEMP /S /Q
*xcopy {OUTDIR}\* {OUTDIR}\..\ABMTEMP /E /I /Y
*xcopy {DATADIR}\* {DATADIR}\..\ABMTEMP /E /I /Y

if(fbi=1) ; need to run only the first time through - kdk
*{CUBE}\..\ctramp\runCreateAccessFiles.cmd
endif

*mkdir logFiles
*taskkill /im "java.exe" /F
*start {CUBE}\..\ctramp\runHhMgr.cmd {JDK64} {HOST_IP}
*start {CUBE}\..\ctramp\runMtxMgr.cmd {HOST_IP} {JDK64}
*rem start {CUBE}\..\ctramp\config\runDriver.cmd
*copy {CUBE}\..\ctramp\serpm_abm.properties serpm_abm.properties /Y
*ping -n 11 127.0.0.1 > nul
*{CUBE}\..\ctramp\runSERPMAbm.cmd {SAMPLERATE} {VSAMPLERATE} {JDK64}
*{CUBE}\..\ctramp\runCreateDemandMatrices.cmd {SAMPLERATE} {VSAMPLERATE} {JDK64}
*taskkill /im "java.exe" /F

*rmdir {OUTDIR}\ctramp /S /Q
*rmdir {DATADIR}\ctramp /S /Q
*xcopy {OUTDIR}\..\ABMTEMP\ctramp\* {OUTDIR}\ctramp /E /I /Y
*xcopy {DATADIR}\..\ABMTEMP\ctramp\* {DATADIR}\ctramp /E /I /Y
```

Running CT-RAMP

1. Set the values of scenario-specific keys in Cube:
    i. Input highway and transit network
    ii. Input MAZ data and TAZ data files
    iii. Scenario name, year
    iv. Scenario input and output folder paths
    v. HEVAL settings
    vi. Sampling Rate
        i. Resident model {samplerate}
        ii. Visitor model {vsamplerate}

Running CT-RAMP

- A simulation of the entire population is not required for every single application
- For example, CT-RAMP could simulate 1 out of every 10th household in the population
  - Aggregate region and county-wide statistics are nearly identical when comparing a 10% sample to a 100% sample
  - E.g., network validation statistics or model calibration statistics
- We can do this because household behave independently of each other in the demand model
- They are not independent of each other in assignment; we need all trips to obtain reasonable loads on the network. To assign the vehicle and transit trips, each trip record is weighted by 1/samplingRate
- It is prudent to verify that the simulated population sample is not biased in some unexpected way

Running CT-RAMP

2. Set up the Inputs folder
3. Verify the CT-RAMP properties (come back for the April workshop!)
4. Run the Cube application
5. Cube runs ok but when it gets to CT-RAMP, nothing seems to be happening. Is it working?
6. Check the log file periodically
   - serpm7\cube\logFiles\event.log

Outputs Subfolder

- **Outputs**
  - **OUT-2010R** -- working output folder
  - **OUT-2040R** -- another working output folder (for a different scenario)
  - **ABMTemp** – temporary output folder

Output Data

- Person files
- Household files
- Resident tour files
- Resident trip files
- Visitor tour file
- Visitor trip file

comma-separated text files

hh_id	person_id	person_num	person_type	tour_id	tour_category	tour_purpose	orig_mgra
1651791	4061801	1	1	0	MANDATORY	Work	1
1651791	4061802	2	1	0	MANDATORY	Work	1
1651791	4061802	2	1	1	AT_WORK	Work-Based	6558
1651791	4061802	2	1	2	AT_WORK	Work-Based	6558
1651791	4061803	3	7	0	MANDATORY	School	1
283893	708040	1	1	0	MANDATORY	Work	1
283893	708040	1	1	1	AT_WORK	Work-Based	399
283893	708041	2	7	0	MANDATORY	School	1
283893	708041	2	7	0	INDIVIDUAL_NON_MANDATORY	Shop	1
1651786	4061781	1	1	0	MANDATORY	Work	1
1651786	4061782	2	1	0	INDIVIDUAL_NON_MANDATORY	Eating Out	1
1651786	4061783	3	7	0	MANDATORY	School	1
1651786	4061783	3	7	0	INDIVIDUAL_NON_MANDATORY	Visiting	1
1651797	4061825	1	1	0	INDIVIDUAL_NON_MANDATORY	Escort	1
1651797	4061825	1	1	1	INDIVIDUAL_NON_MANDATORY	Visiting	1
1651797	4061827	3	7	0	MANDATORY	School	1
604671	1492240	2	1	0	MANDATORY	Work	1
604671	1492241	3	4	0	INDIVIDUAL_NON_MANDATORY	Escort	1
604671	1492241	3	4	1	INDIVIDUAL_NON_MANDATORY	Maintenance	1
1908365	4706108	1	1	0	MANDATORY	Work	3
1908365	4706108	1	1	1	MANDATORY	Work	3
1908365	4706108	1	1	0	INDIVIDUAL_NON_MANDATORY	Escort	3

Value labels documented in User Guide and in Utility Expression Calculators (UECs)

Output Data

- Highway (TAZ) LOS Matrices
- Transit (TAP) LOS Matrices
- Truck, airport, IE, EE trip tables
- Vehicle trip tables
- Loaded highway networks
- Loaded transit network
- Reports

- Where are the person trip tables and the mode split matrices?

- Not built as part of a standard model run
- All information required to build them is in the trip list file

Output Data

- ABM Reports
  - Summary tabulations
  - Generated from merged ABM output data
  - Optional; not created as part of standard model run

System Folders

- **ctramp – CT-RAMP code, scripts, and configuration files**
  - application – Java code and Cube scripts for CT-RAMP
  - config – JPPF and CT-RAMP logging settings
  - logFiles – CT-RAMP log files
  - popsyn – helper files to run PopSyn to create the HH and Person input files
  - reports_sql – SQL scripts for the reporting module
  - uec – UEC model specification files
- **cube – Cube application manager programs and scripts**
  - logFiles – CT-RAMP log files
- **installers – Program installers for setting up in a new machine**

Population Synthesis

What is Population Synthesis?

- Population Synthesis is a procedure for creating a simulated population for the model region
- Conceptually equivalent to a full census of the Southeast Florida population
- Does not attempt to exactly reproduce each and every household; instead it attempts to reproduce aggregate characteristics, such as
  - Household income
  - Labor force participation and composition
  - Household size
  - Age
  - …
- The synthetic population includes only permanent Southeast Florida residents.

Role of Population Synthesis

- Households and persons are represented individually in the activity-based model through micro-simulation
- Population synthesis "creates" these households and persons for use in the activity-based model
  - Synthetic households and persons should possess all of the demographic attributes needed for model inputs
  - Variables that will be used to explain variation in …
    - Daily activity patterns and tour generation
    - Levels of participation in various activities
    - Preferences for time of day, mode and destination attributes
    - Value of time (willingness to pay)
    - Coordination between household members

How does the SERPM7 Synthetic Population look like?

Control group levels -- (uncontrolled) continuous values for income also available

Household records

MAZ	HHID	Age of Household Head	Number of Persons	Income Group	Presence of Children	Autos Owned	Number of Workers
1433	16670	1	2	1	1	0	1
1937	17392	1	2	2	1	0	1
77	232	1	3	3	1	1	2
18	5042	1	3	2	1	3	2

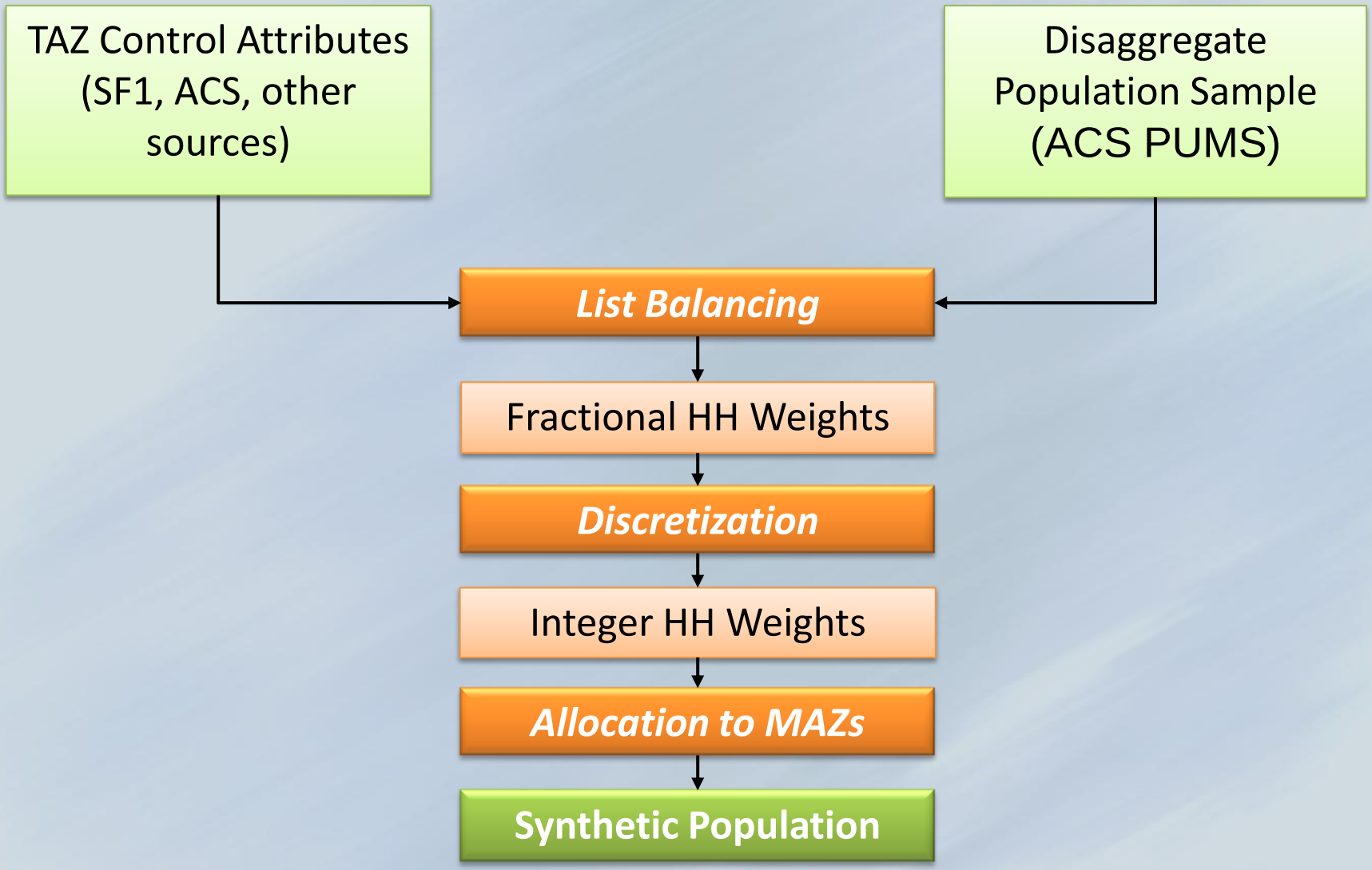
Each household is allocated to a MAZ

Attribute values to be updated by Long-Term models

Use to ID full-time vs. part-time workers

MAZ	Household ID	Person ID	Age	Works From Home	Employ-ment Status	Gender	Is Student	Hours Worked per Week
77	232	1	22	1	1	2	0	9
77	232	2	24	1	1	1	0	45
77	232	3	1	0	0	2	0	0

SERPM7 PopSynII Overview



List Balancing

HH ID	HH size				Person age				HH initial weight
	1	2	3	4+	0-15	16-35	36-64	65+	
	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$	$i=7$	$i=8$	ω_n
$n=1$	1							1	20
$n=2$		1			1	1			20
$n=3$			1			1	2		20
$n=4$				1		2	2		20
$n=5$				1	1	3	2		20
….									…
Control	100	200	250	300	400	400	650	250	

SERPM7 Controlled Attributes

- Household-Level Controls
  - Total households (1)
  - HH Size (4)
  - HH Income (5)
  - Presence of Children (2)
  - HH Workers (4)
  - Type of Dwelling Unit (3)

- Person-Level
  - Age (7)
  - Gender (2)
  - Race/Ethnicity (3)
  - Total Group Quarters (1)
  - Group Quarters Type (3)

SERPM7 Uncontrolled Attributes

- The synthetic population can be attributed with all the information available in the “seed” (ACS PUMS) population
- Uncontrolled attributes are directly transferred to the synthetic population when the initial list for each TAZ is created
- Examples of uncontrolled attributes in SERPM7:
  - Worker industry
  - Number of hours worked per week
  - Student grade level
  - Disaggregate household income
- These and other uncontrolled variables are used as explanatory variables or segmentation variables in SERPM7

Creating a Synthetic Population with PopSynII

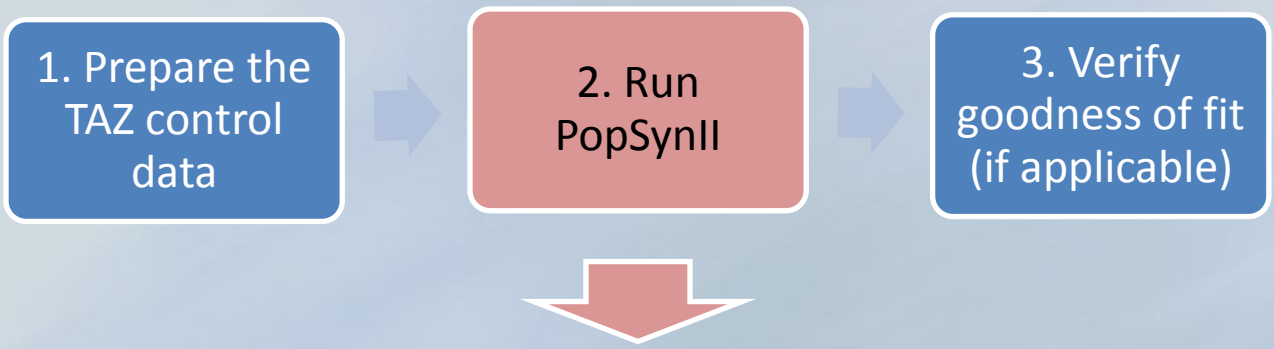
1. Prepare the TAZ control data
2. Run PopSynII
3. Verify goodness of fit (if applicable)

Creating a SERPM7 Synthetic Population

1. Prepare the TAZ control data → 2. Run PopSynII → 3. Verify goodness of fit (if applicable)

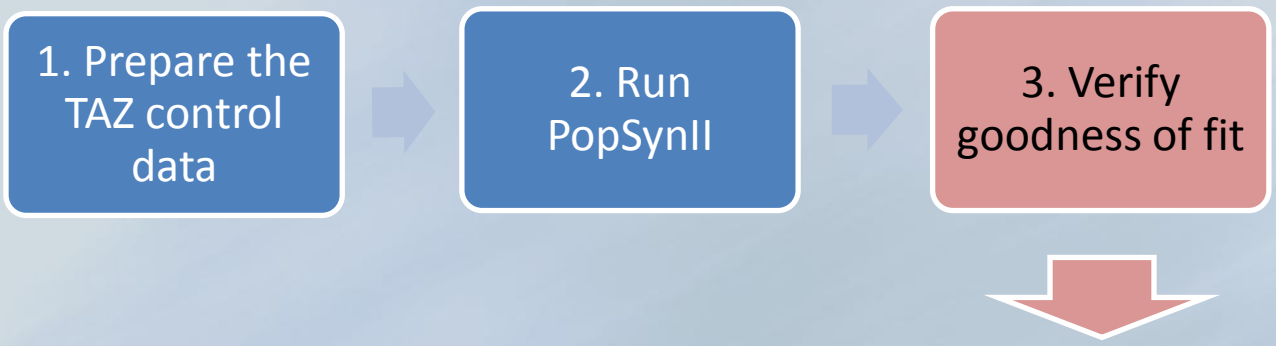
TAZ_REG	TAZ_MPO	HHSIZE_1	HHSIZE_2	HHSIZE_3	HHSIZE_4PLUS	INCOME_25K	INCOME_50K	INCOME_75K	….
1	1	226	344	69	76	101	114	107	
2	2	256	391	78	86	117	129	123	
3	3	236	350	133	159	185	164	195	
4	4	222	329	125	150	175	155	183	
5	5	318	471	179	213	249	220	262	
6	6	86	97	16	13	28	54	50	
7	7	186	208	35	30	61	118	108	
8	8	103	115	19	16	33	65	59	
9	9	25	28	5	4	8	15	15	
10	10	153	171	29	25	50	97	88	
11	11	67	75	13	11	23	41	39	
12	12	3	4	1	0	0	1	3	

Creating a SERPM7 Synthetic Population




```
C:\serpm7\popsyn>  runAll_popsyn.bat
```

Creating a SERPM7 Synthetic Population



- Check how well the synthesized population matches the control totals
- Review PopSynII outputs:
  - balanceDetails.csv
  - validationStats.csv
  - validationStatsByPUMA.csv

Improving Goodness of Fit

- The most common problem that results in poor fit are inconsistent control totals
  - Sum of households in each income group is different from total households
  - Sum of age controls is different from the sum of gender controls
  - Population implied by household size distribution is different from the sum of age controls

HHSIZE_1	HHSIZE_2	HHSIZE_3	HHSIZE_4PLUS
250	350	50	100

Implied Population
250x1 + 350x2 + 50x3 + 100x5.2 = 1620

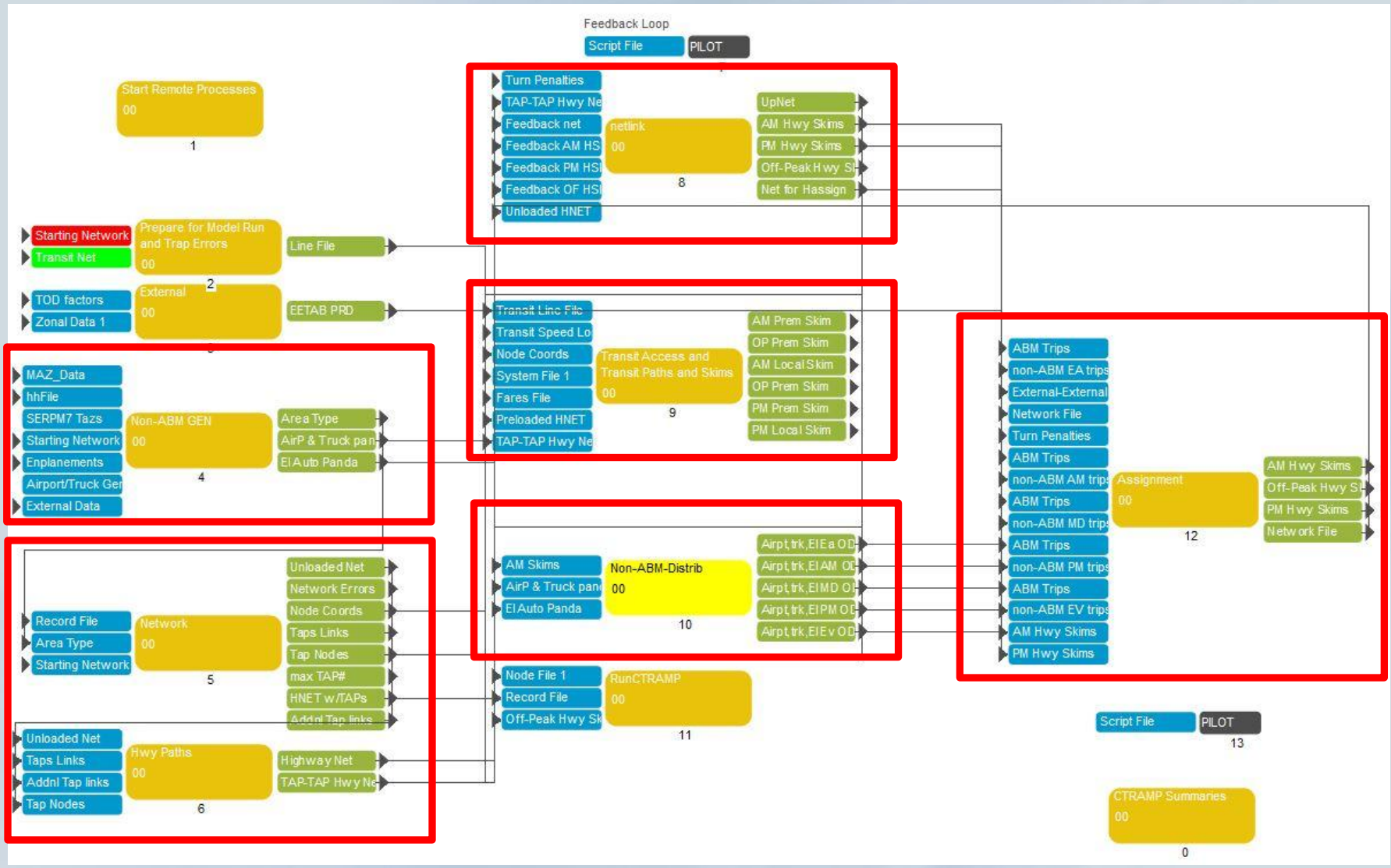
MALE	FEMALE
743	748

Control Population
743 + 748 = 1491

  - Age distribution is inconsistent with child presence controls
- Not all controls can be matched exactly in all TAZs
- Highest ranked controls are matched better than lower ranked controls

Network Coding

SERPM7 Flowchart



3/14/2014

Highway Coding - Link

Parameter	Description
A	A- Node
B	B-Node
DISTANCE	Distance (miles)
TIME_	Time
SCREENLINE	Screenline, Cutlines and Corridor ID
NUM_LANES	Number of lanes per direction
COUNT10	Directional year 2010 Traffic Counts
TOLL	Toll ID
TWOWAY	Two-way Indicator (1= Yes, 0= No)
DIRCODE	Direction codes (1=1-way, 0=2-way)
LOCATION	Geographical Location codes (1=PB, 2 = BO, 3=MD)
SEGID	Segment ID. To add a new set of coordinated signals
POSTSPD	Posted speed (MPH)
TOLLTYPE	Toll Type (1= coin, 3= AVI)
PLAZADESC	Toll Plaza Description
CARTOLL	Car Toll Price ($) same as SUNPASSTOLL
SVCMINUTES	Service Time (min)
SVCSECONDS	Service Time (sec)

Highway Coding -- Link

Parameter	Description
AVILANES	Number of Dedicated AVI Lanes
PCTTRUCKS	Ratio of Heavy Trucks on Toll links
NONTPKTOLL	An Indicator for Non- Turnpike Toll Booth Facility (1= Miami, 2= Broward - Sawgrass)
STCARD	Speed-Time Card
ROADNAME	Roadway Name
RDNAME	Roadway Name
CONUM	County number (1=PB, 2=BO, 3= MD)
FTC2	Facility-type codes
OVERIDE	Override Capacity Indicator (0= No, 1 = Yes)
DIVIDED	Divided Aterials and Uninterrupted roadways (1=Yes, 0=No)
LEFTTURN	Presence of a left turn bay (1 = Yes, 0=No)
LFWYMRG	Left-side ramp and freeway merge (1 = Yes, 0=No)
TDSECID	Travel Time & Delay Section ID
GC_RATIO	User coded Green/ Cycle Length Ratio
HOT	HOT lane Flag (0=Non- HOT facility - Default, 1= HOT Lane Facility, 99 = Dummy Facility)
REVERSIBLE	Reversible lanes (1= East bound, 2=West bound)
EARLY	Ealry Morning Factor
AM	AM Factor
MID	MID Day Factor
PM	PM Factor
EVE	Evening Factor
TCG_ID	Corradino Project ID for E+C
TCG_ID_N	Corradino Project ID for Needs Plan

Highway Coding - Link

Parameter	Description
AVILANES	Number of Dedicated AVI Lanes
PCTTRUCKS	Ratio of Heavy Trucks on Toll links
NONTPKTOLL	An Indicator for Non- Turnpike Toll Booth Facility (1= Miami, 2= Broward - Sawgrass)
STCARD	Speed-Time Card
ROADNAME	Roadway Name
RDNAME	Roadway Name
CONUM	County number (1=PB, 2=BO, 3= MD)
FTC2	Facility-type codes
OVERIDE	Override Capacity Indicator (0= No, 1 = Yes)
DIVIDED	Divided Aterials and Uninterrupted roadways (1=Yes, 0=No)
LEFTTURN	Presence of a left turn bay (1 = Yes, 0=No)
LFWYMRG	Left-side ramp and freeway merge (1 = Yes, 0=No)
TDSECID	Travel Time & Delay Section ID
GC_RATIO	User coded Green/ Cycle Length Ratio
HOT	HOT lane Flag (0=Non- HOT facility - Default, 1= HOT Lane Facility, 99 = Dummy Facility)
REVERSIBLE	Reversible lanes (1= East bound, 2=West bound)
TCG_ID	Corradino Project ID for E+C
TCG_ID_N	Corradino Project ID for Needs Plan

Highway Coding - Node

Parameter	Description
N	Node number
X	X Coordinate
Y	Y Coordinate
STATIONNUMBER	Station Number.
STATIONZONE	Nearest centroid to station. This field is filled during model execution.
SERVICEMILES	Maximum roadway distance allowed for auto-access connector (miles)
PARKINGSPACES	Number of parking spaces
PARKINGCOSTAM	Parking cost in peak period in cents
PARKINGCOSTMD	Parking cost in off-peak period in cents
TERMTIMEPNR	Terminal time for park-and-ride trips (in minutes)
TERMTIMEKNR	Terminal time for kiss-and-ride trips (in minutes)
ACTIVEFLAG	Determines which nodes have park-and-ride access. Used in model execution if greater than zero.
STATIONDESC	Station name & description
FAREZONE	Fare zone (zone-based fares only). Example- Tri-rail
SIGLOC	Signal location. Should either have a value of 1 or 0
NODETYPE	Node Type (1= Centroid, 2 = External, 3 = Int Dummy, 4= Ext Dummy)
CONUM	County / Location number
CYC_LEN	If signalized and data is available, cycle length in seconds

Facility Type Codes

FTC1: MAJOR Classification	FTC2: MINOR Classification	Capacity Lookup Table	Capacity Calculation Attributes							Capacity Adjustment Attributes		
			FREEWAY (FRWY)	UNINTERRUPTED (UNINTRP)	HOV	KTOLL	LOWSPEED (LOWSPD)	SIGNAL SPACING (SIG_SPACE)	POSTED SPEED (POSTSPD)	TWOWAY	DIVIDED	LEFTTURN
10 FREEWAYS	11 Freeway Segments	FRWYPCE.DAT	1									
	12 Freeway Segments (I 595 - Broward)	FRWYPCE.DAT	1									
20 UNINTERRUPTED ROADWAYS	21 Uninterrupted Segments	HWYPCE.DAT		1				> 1.5	>40	X	X	X
40 Higher Speed Interrupted Facility	41 Higher Speed Interrupted Facility	ARTPCE.DAT						<= 1.5	>=35	X	X	X
50 CENTROID CONNECTORS	51 Internal	n/a										
	52 External	n/a										
60 Lower Speed Facility & Collector	61 Lower Speed Facility & Collector	LOWPCE.DAT					1		< 35	X	X	X
70 RAMPS	71 On	ONPCE.DAT										
	72 Loop On	LONPCE.DAT										
	73 Off	OFFPCE.DAT										
	74 Loop Off	LOFFPCE.DAT										
	75 Freeway-to-Freeway (included in FRWY)	FRWYPCE.DAT	1									
80 HOV	81 2+ Persons HOV Segments	FRWYPCE.DAT	1		1							
	82 3+ Persons HOV Segments	FRWYPCE.DAT	1		1							
	83 AM and PM Peak Only Ramps	n/a			1							
	84 AM Peak Only Ramps	n/a			1							
	85 PM Peak Only Ramps	n/a			1							
	86 All Day Ramp	n/a			1							
90 TOLL	91 Freeway Segments	FRWYPCE.DAT	1			1						
	92 Uninterrupted Segments	HWYPCE.DAT	1			1						
	93 On	TONPCE.DAT				1						
	94 Off	TOFFPCE.DAT				1						
	95 Toll Plaza	n/a				1						

NOTES:

1. Posted Speed and Signal Spacing determine the "Uninterrupted" designation for Non-Toll and Non-HOV facilities.

Toll and HOV facilities are considered to be freeway segments. CDs, Expressways, and Parkways are considered Uninterrupted regardless of posted speed.

2. All possible variables/adjustments are shown here; some may not be triggered for a given link depending on whether the roadway is divided, is oneway and/or has a left-turn bay.

Transit Line Coding

Parameters	Description
MODE	Mode (Mode Table)
OPERATOR	Transit Service operator for the Route
NAME	Route Name - MxLyyyzz. MPO where x= Mode number, yyy= line number, zz= Inbound/outbound code
ONEWAY	Operating Direction (1= Operates in coded direction, 0= Operates in both directions)
LONGNAME	Route Description
USERA4	User defined code – specific to mode and operator. Based on this, the default dwell time (DWELL_C) gets updated.
HEADWAY1	AM Peak headway
HEADWAY2	Off Peak headway
HEADWAY3	PM Peak headway
NAME	Node String: Stops are positive, non-stops are Negative
DWELL_C	Default Value of Dwell time at stops (0.5 Min)

Transit Coding

Mode Name	Description	Mode Name	S7 Mode	Operator & Name	UserA4
Tri-Rail	Tri-Rail	Commuter	111	11	15
Metrorail	Metrorail	Urban Rail	121	25	14
Regional LRT	Regional LRT	LRT	131		14
Inter-County Express Bus	I-95 Inter-County Express	Express	151	33	16
Exclusive ROW Cir-Reg	Exclusive ROW Cir-Reg	Mover	181	13	12
Trolleys/Shuttles-Reg	Tri-Rail Shuttles	Local	191	12	11
Trolleys/Shuttles-Reg	Tri-Rail Shuttles	Local	192	12	33
LRT- MDT	MDT LRT	LRT	231	25	14
Buses (local/express) - MDT	MDT Busway Flyers	BRT	241	27	27
Buses (local/express) - MDT	MDT MAX/KAT/Busway Local	BRT	242	27	27
BRT - MDT	MDT BRT/LRT	BRT	243	28	28
Buses (local/express) - MDT	MDT Express	Express	251	22	24
Buses (local/express) - MDT	MDT I-95 Exp	Express	252	24	26
Inter-County Express Bus	I-95 Inter-County Express	Express	253	24	16
Exclusive ROW Cir-MDT	Metromover	Mover	281	26	22
Trolleys/Shuttles-MDT	MDT Trolleys/Shuttles	Local	291	21	21
Buses (local/express) - MDT	MDT Local	Local	292	21	23
Buses (local/express) - MDT	MDT Shuttle	Local	293	23	25
LRT - BCT	BCT LRT	LRT	331	35	37
BCT Rapid Bus BRT	BCT Rapid Bus	BRT	341	34	36
BCT Fixed-guideway BRT	BCT BRT	BRT	342	35	37
Buses (local/express) - BCT	BCT Breeze	Express	351	32	34
Buses (local/express) - BCT	BCT Express	Express	352	33	35
Exclusive ROW Cir-BCT	BCT Exclusive ROW Cir	Mover	381	31	32
Trolleys/Shuttles-BCT	BCT Trolleys/Shuttles	Local	393	31	31
Buses (local/express) - BCT	BCT Local	Local	391	31	27
Buses (local/express) - BCT	BCT Local	Local	392	31	33
LRT - Palm Tran	Palm Tran LRT	LRT	431	43	44
BRT - Palm Tran	Palm Tran BRT	BRT	441	43	44
Buses (local/express) - Ptran	Palm Tran Exp	Express	451	42	44
Exclusive ROW Cir-PTran	Palm Tran Exclusive ROW Cir	Mover	481	41	42
Trolleys/Shuttles-Ptran	Palm Tran Trolleys/Shuttles	Local	491	41	41
Buses (local/express) - Ptran	Palm Tran Local	Local	492	41	43

Highway and Transit Networks and Skims

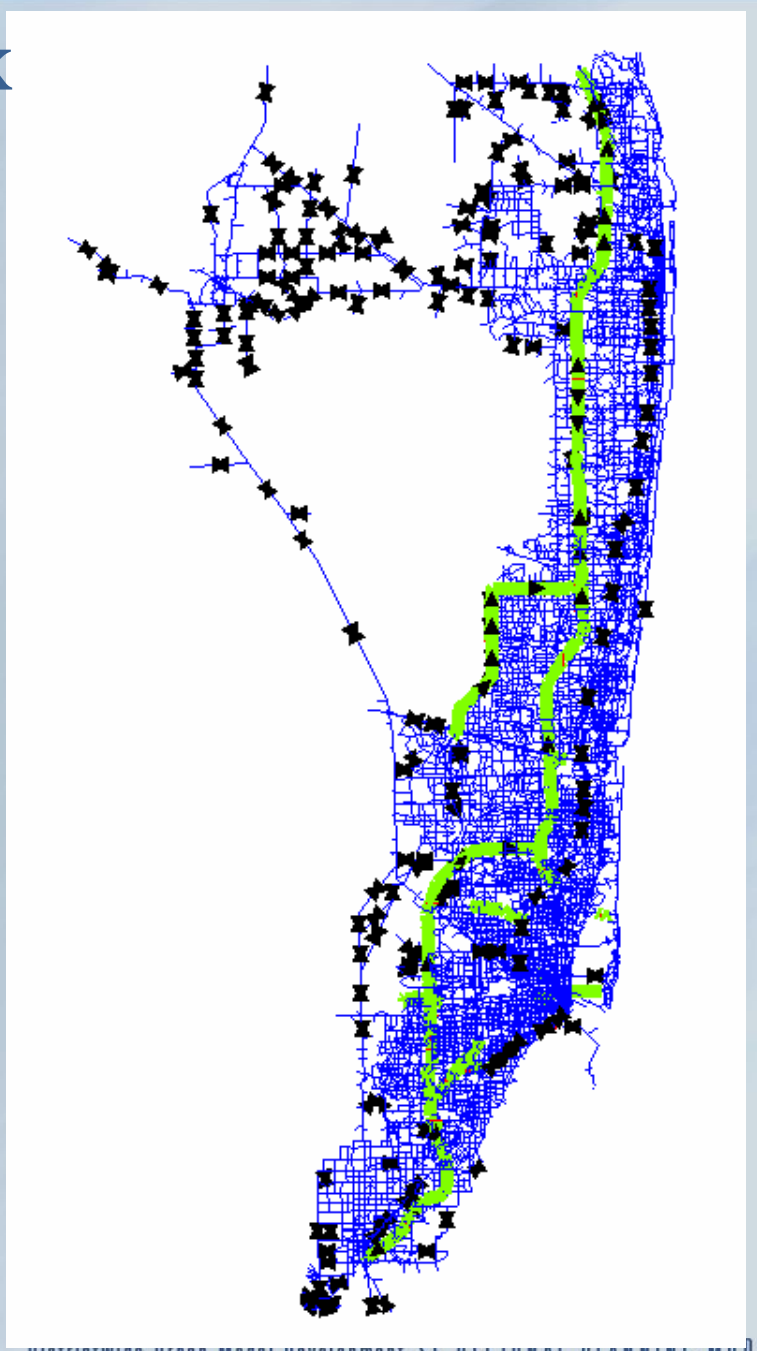
3/14/2014

Highway and Transit Skims

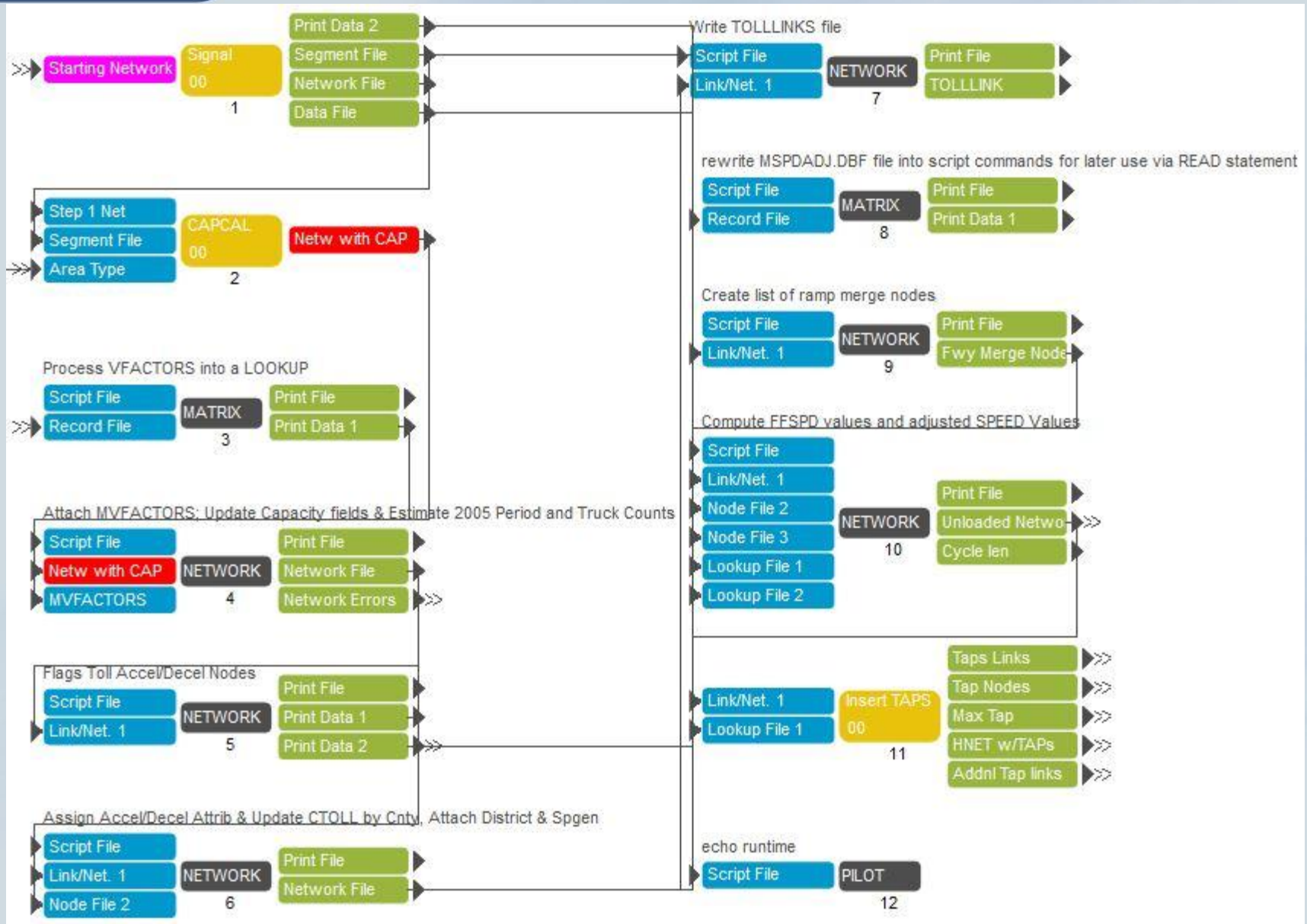
- Highway and Transit Networks maintained in a geodatabase.
- Highway Skims are TAZ-TAZ.
- Initial congested skims by time-period are gotten from a set of “seed” skims. Skims are updated during the feedback process.
- Transit skims are TAP-TAP (transit access point).
- Complete MAZ-MAZ highway and transit skims are calculated on the fly by CT-RAMP.

Highway Network

- ArcGIS, but
- Imported from Cube.



Highway Network



Speed/Cap Inputs

- FRWYPCE.DAT - Freeway capacity data
- HWYPCE.DAT - Uninterrupted flow highway capacity data
- ARTPCE.DAT - Arterial/high speed capacity data
- LOWPCE.DAT - Low speed road capacity data
- ONPCE.DAT - On-ramp capacity data
- OFFPCE.DAT - Off-ramp capacity data
- LOFFPCE.DAT - Off-loop-ramp capacity data
- LONPCE.DAT - On-loop-ramp capacity data
- TONPCE.DAT - On-toll-ramp capacity data
- DEFAULT_SEGMENT.CSV - Default signal segment data
- SPEC_SEGDATA.csv - Signal segment data

Network Speeds and Times

- Adapted from SERPM 6.5
- Initial free-flow speed:
  - Posted speed
  - Relationship between posted speed and actual speed (NCHRP 3-55(2))
  - Delays from traffic control devices
  - Adjustment factors all = 1.0.
- Output: Network with speeds and capacities: S7SPDCAP.NET

Highway Skims (initial seed and feedback)

18 skims per time period (AM peak, PM peak, Off-peak)

All paths on generalized cost (intrazonal values added)

- Non-toll, Drive-alone
  - Congested Time
  - Freeflow Time
  - Distance
- Toll, Drive-alone
  - Congested Time
  - Freeflow Time
  - Distance
  - Toll
  - Distance on Toll Roads
- Non-toll HOV, SR2+
  - Congested Time
  - Freeflow Time
  - Distance
  - Distance on HOV facilities
- Toll, HOV, SR2+
  - Congested Time
  - Freeflow Time
  - Distance
  - Toll
  - Distance on Toll Roads
  - Distance on HOV facilities

Highway Skims

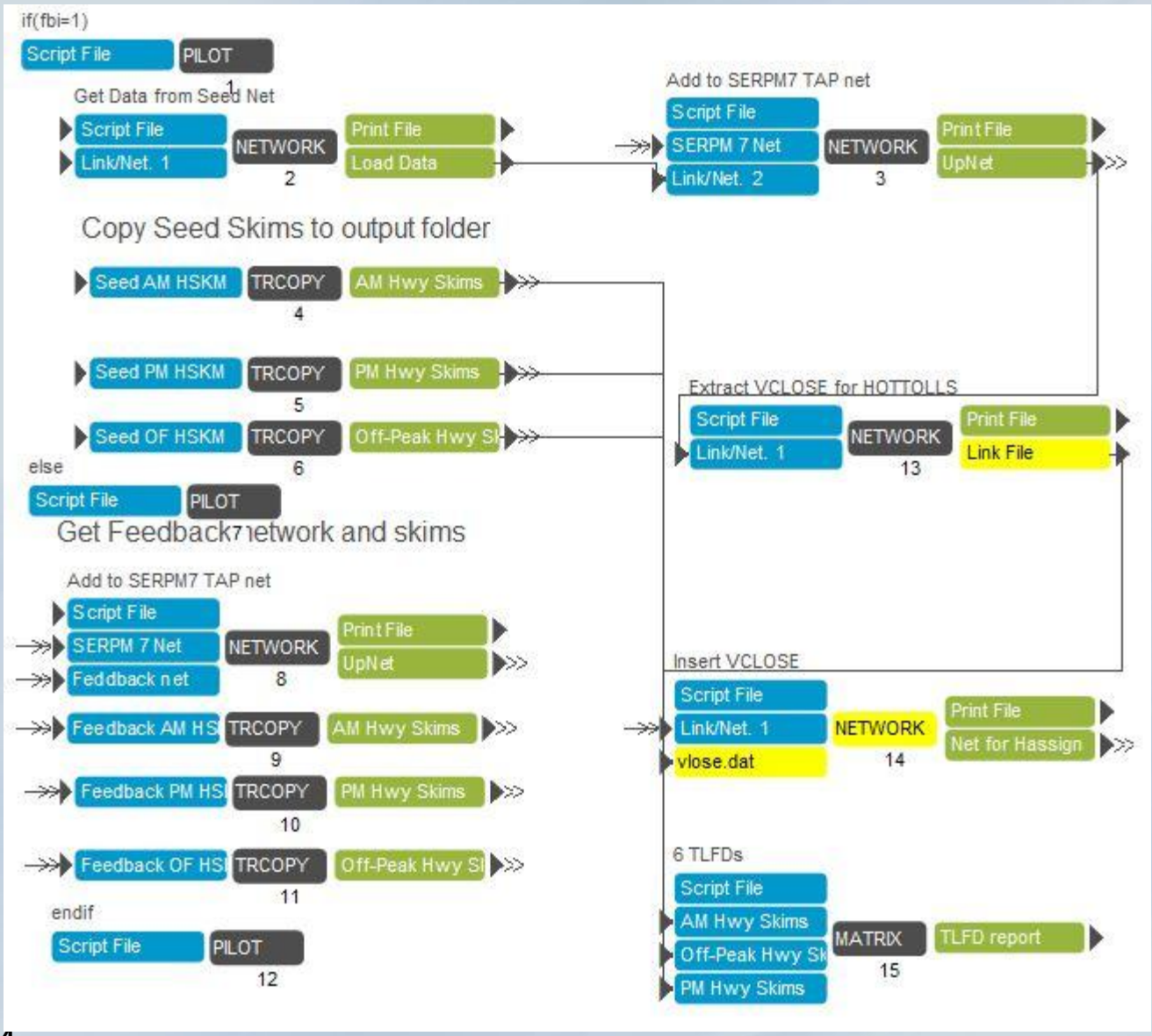
Parameters

- Generalized cost: times + toll*ctoll
- Ctoll by time-period (ctoll is a key)
- HOT = 1 network attribute
- Toll in CarToll
- Toll road indicators: IsToll & HOT

Link Groups

- Drive-alone No-Toll: Exclude toll lanes, express lanes, HOV ramps
- Drive-alone Toll: Exclude AM HOV ramps
- SR2+ HOV No-Toll : Exclude toll lanes, express lanes
- Reversible lane links (REVERSIBLE=1, 2 or 3), dummy HOT lane ramps (HOT=99), and non-highway transit links (ISREQTLINKSKIM).

Highway Skims



Highway Network Inputs

- SERPM_NETS.mdb - Network geodatabase (Highway & Transit)
- TURNS.PEN – turn penalties
- Hottoll.dbf- HOT Toll rates by V/C
- ML.CTL- Freeway merge delay control file
- MSPDADJ_2010.DBF - Highway speed adjustments (all 1.0)
- MVFACTORS.2010R - FSUTMS VFACTORS

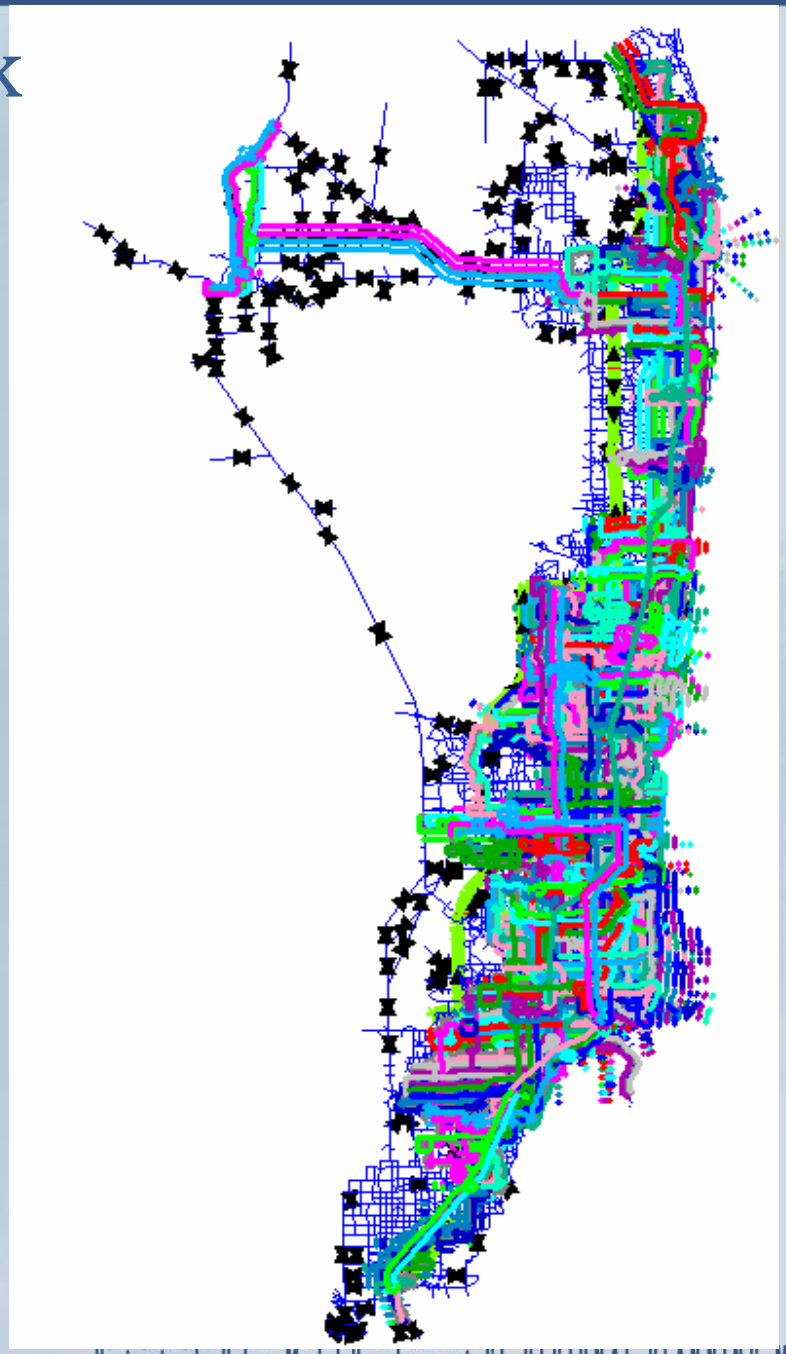
Highway Skim Outputs

- AM highway skims: AMHSKIMS.mat
- Off-peak highway skims: OFHSKIMS.mat
- PM highway skims: PMHSKIMS.mat

- Unloaded highway net for assignment: unloaded_with_vclose.net

Transit Network

- Maintained in the geodatabase
- Geodatabase records processed for TAP calculations
- Line records written from the geodatabase
- Network and skimming process adapted from SERPM 6.7



Transit Modes

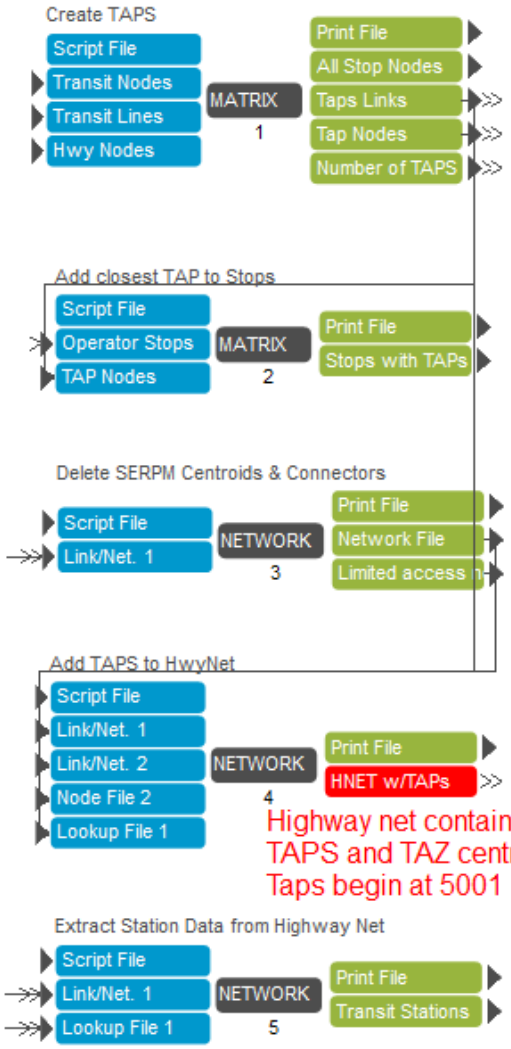
S67 Mode	Mode Name	Operator	& Name	UserA4	Mode Name	Local (L) Prem (P)	S7 MODE
15	Tri-Rail	11	Tri-Rail	15	Commuter	P	111
14	Metrorail	25	Metrorail	14	Urban Rail	P	121
X	Regional LRT		Regional LRT	14	LRT	P	131
16	Inter-County Express Bus	33	I-95 Inter-County Express	16	Express	P	151
12	Exclusive ROW Cir-Reg	13	Exclusive ROW Cir-Reg	12	Mover	L	181
11	Trolleys/Shuttles-Reg	12	Tri-Rail Shuttles	11	Local	L	191
11	Trolleys/Shuttles-Reg	12	Tri-Rail Shuttles	33	Local	L	192
X	LRT- MDT	25	MDT LRT	14	LRT	P	231
16	Buses (local/express) - MDT	27	MDT Busway Flyers	27	BRT	P	241
23	Buses (local/express) - MDT	27	MDT MAX/KAT/Busway Local	27	BRT	P	242
24	BRT - MDT	28	MDT BRT/LRT	28	BRT	P	243
23	Buses (local/express) - MDT	22	MDT Express	24	Express	P	251
16	Buses (local/express) - MDT	24	MDT I-95 Exp	26	Express	P	252
16	Inter-County Express Bus	24	I-95 Inter-County Express	16	Express	P	253
22	Exclusive ROW Cir-MDT	26	Metromover	22	Mover	L	281
21	Trolleys/Shuttles-MDT	21	MDT Trolleys/Shuttles	21	Local	L	291
23	Buses (local/express) - MDT	21	MDT Local	23	Local	L	292
23	Buses (local/express) - MDT	23	MDT Shuttle	25	Local	L	293
X	LRT - BCT	35	BCT LRT	37	LRT	P	331
34	BCT Rapid Bus BRT	34	BCT Rapid Bus	36	BRT	P	341
34	BCT Fixed-guideway BRT	35	BCT BRT	37	BRT	P	342
33	Buses (local/express) - BCT	32	BCT Breeze	34	Express	P	351
33	Buses (local/express) - BCT	33	BCT Express	35	Express	P	352
32	Exclusive ROW Cir-BCT	31	BCT Exclusive ROW Cir	32	Mover	L	381
31	Trolleys/Shuttles-BCT	31	BCT Trolleys/Shuttles	31	Local	L	393
33	Buses (local/express) - BCT	31	BCT Local	27	Local	L	391
33	Buses (local/express) - BCT	31	BCT Local	33	Local	L	392
X	LRT - Palm Tran	43	Palm Tran LRT	44	LRT	P	431
44	BRT - Palm Tran	43	Palm Tran BRT	44	BRT	P	441
43	Buses (local/express) - Ptran	42	Palm Tran Exp	44	Express	P	451
42	Exclusive ROW Cir-PTran	41	Palm Tran Exclusive ROW Cir	42	Mover	L	481
41	Trolleys/Shuttles-Ptran	41	Palm Tran Trolleys/Shuttles	41	Local	L	491
43	Buses (local/express) - Ptran	41	Palm Tran Local	43	Local	L	492

Modes Not in the 2010 Network

Mode Hierarchy		UEC M
Commuter	x10	CR
Urban	x20	LR
LRT	x30	LR
BRT	x40	BRT
Express	x50	EXP
Mover	x80	LB
Local	x90	LB

Highway Network & TAPS

Create Transit Access Points and add them to the Highway Network



TAPS in these files begin at 1.

Highway net containing both TAPS and TAZ centroids
Taps begin at 5001

TAP Modes based on MODE values

1) 191,192,291,292,293,391,392,393,491,492 - local
2) 151,251,252,253,351,352,451 - express bus
3) 241,242,243,341,342,441 - BRT
4) 111 - Commuter Rail
5) 181,281,381,481 - People Mover/Circulator
6) 121 - Heavy Rail
7) 231,331,431 - LRT

NOTE ON TAP Attributes: Info extracted from highway node data
- Station description
- Parking Spaces
- Parking Cost AM (all-day) in cents
- Parking Cost MD (3-hr) in cents
- TTIMEPnR (assummed time in minutes from PnR lot to platform)
- TTIMEKnR (assummed time in minutes from KnR area to platform)
- Time from bus stop to platform not here -- appears in the mode 7 walks.

Transit Access Points

Used for Stop-Stop Skims (TAP-TAP)

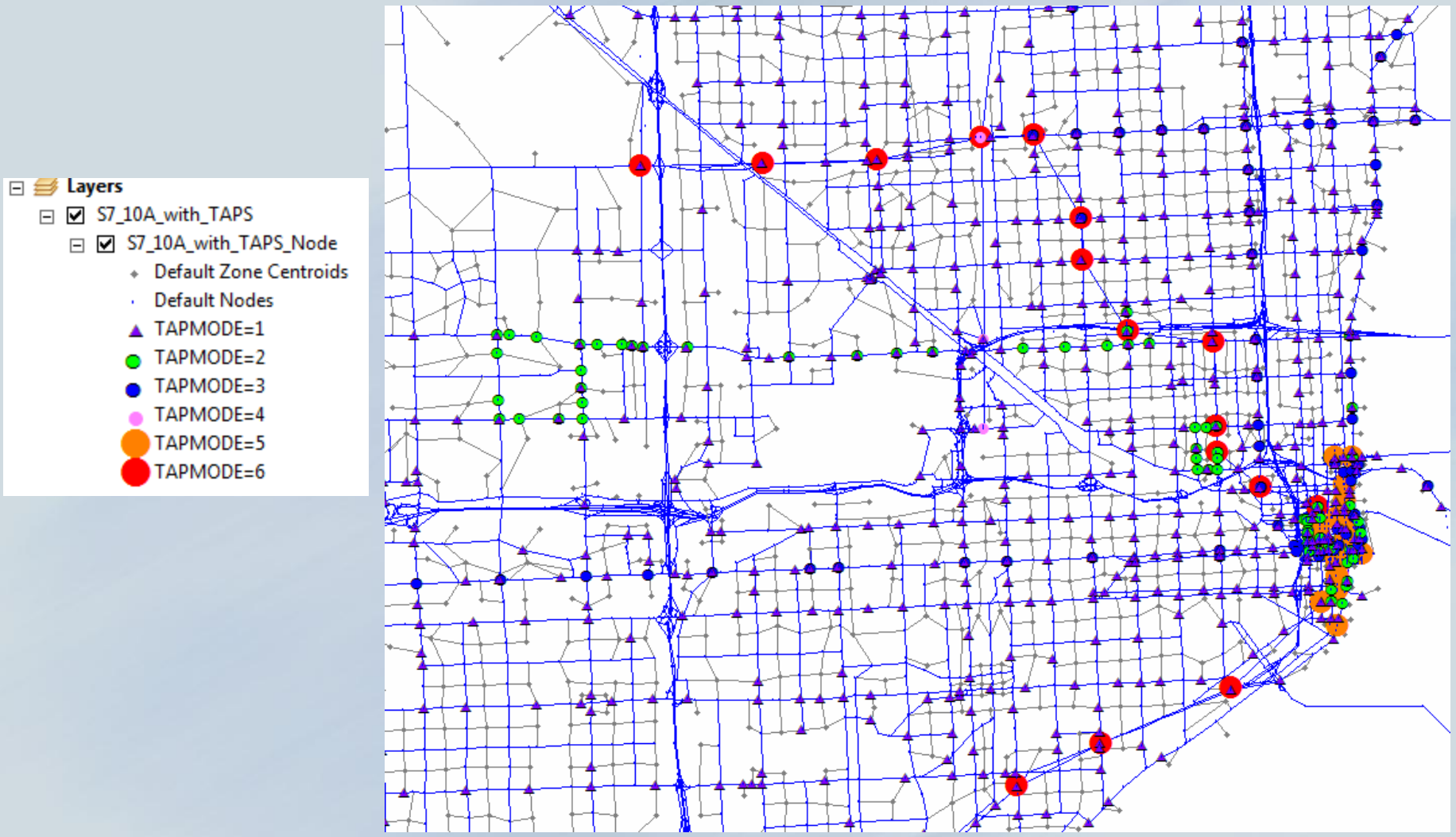
Bus stops are selected by rule to reduce the number.

All premium stations are TAPS.

Percent walk no longer needed.

- STOPS ON Local LINES ..... =5783
- STOPS ON Express LINES ..... = 217
- STOPS ON BRT LINES ..... = 211
- STOPS ON Commuter Rail LINES ... = 18
- STOPS ON PeopleMover LINES ..... = 27
- STOPS ON Heavy Rail LINES ..... = 22
- STOPS ON Light Rail LINES ..... = 0
- STOPS ON ALL LINES ..... = 6278
- HIGHEST TAP ..... =3241

TAP Example


Layers
S7_10A_with_TAPS
S7_10A_with_TAPS_Node
Default Zone Centroids
Default Nodes
TAPMODE=1
TAPMODE=2
TAPMODE=3
TAPMODE=4
TAPMODE=5
TAPMODE=6

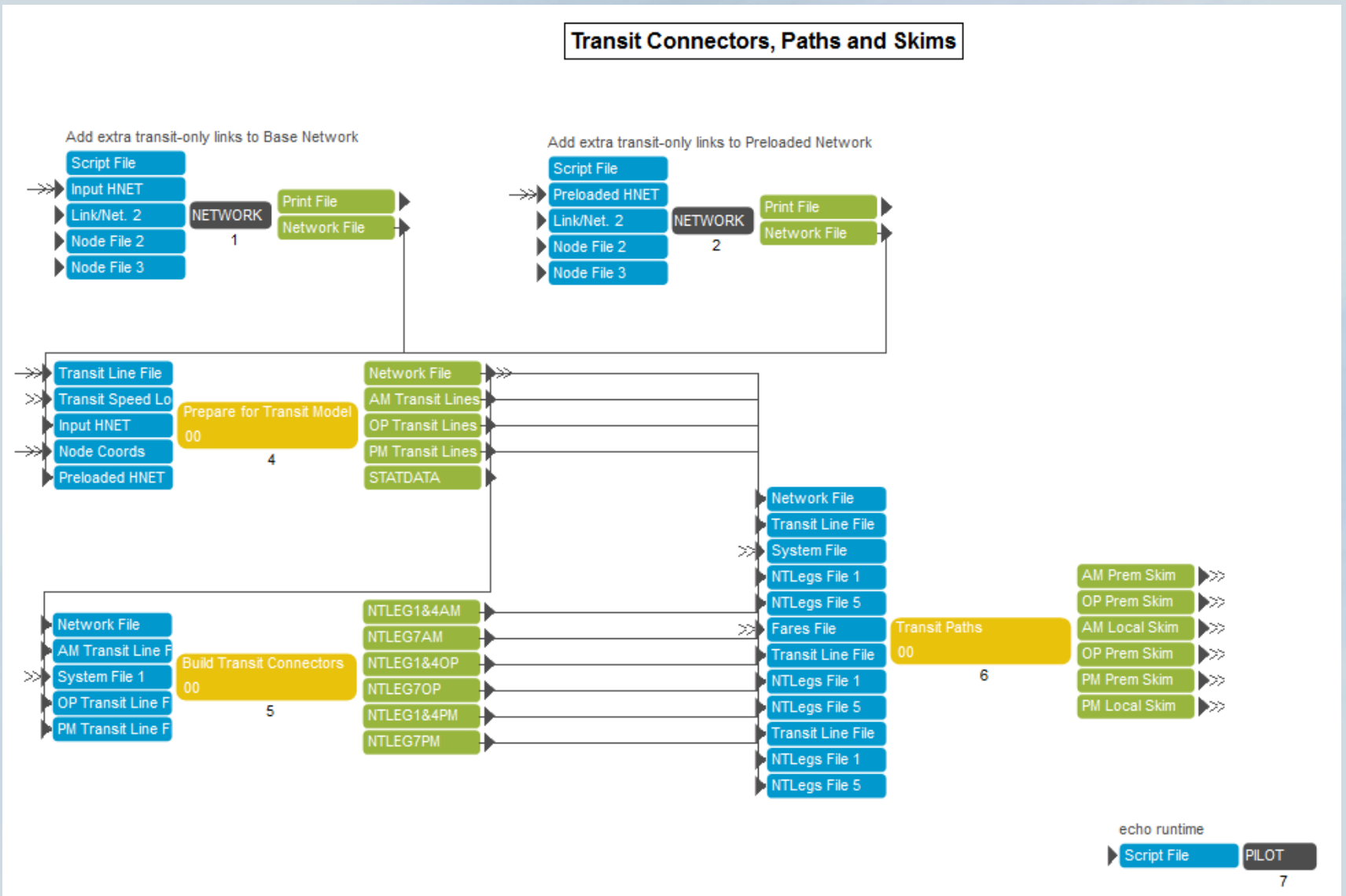
TAP Outputs

- List of TAPS: TAP_Nodes.DBF
- List of Stop-TAP connectors: TAP_LINKS.DBF
- Highway network with TAPS: S7_10A_with_TAPS (in geodatabase)

Transit Dwell Times determined from the USERA4 attribute (see the transit mode table)

USERA4	PK_DWELL	OP_DWELL	PK_TIMEFAC	OP_TIMEFAC	GRP_NAME
11	0.70	0.700	1.00	1.00	TRI-RAIL SHUTTLE
12	0.00	0.000	1.00	1.00	EXCLUSIVE ROW CIR - REGIONAL
13	0.00	0.000	1.00	1.00	REGIONAL LOCAL/EXPRESS BUSES
14	0.00	0.000	1.00	1.00	METRORAIL
15	0.00	0.000	1.00	1.00	TRI-RAIL
21	0.00	0.000	1.00	1.00	MDT TROLLEYS/SHUTTLES
22	0.00	0.000	1.00	1.00	EXCLUSIVE ROW CIR / METROMOVER
23	0.60	0.600	1.00	1.00	MDT LOCAL
24	0.75	0.750	1.00	1.00	MDT EXPRESS
25	0.60	0.600	1.00	1.00	MDT SHUTTLE
26	0.75	0.750	1.00	1.00	MDT I-95 EXPRESS
27	0.60	0.600	1.00	1.00	MDT MAX/KAT/BUSWAY
31	0.00	0.000	1.00	1.00	BCT TROLLEYS/SHUTTLES
32	0.00	0.000	1.00	1.00	BCT ROW CIR
33	0.70	0.670	1.00	1.00	BCT LOCAL
34	1.20	1.200	1.00	1.00	BCT BREEZE
35	0.75	0.750	1.00	1.00	BCT EXPRESS
41	0.00	0.000	1.00	1.00	PALM TRAN TROLLEYS/SHUTTLES
42	0.00	0.000	1.00	1.00	PALM TRAN ROW CIR
43	0.46	0.460	1.00	1.00	PALM TRAN LOCAL
44	0.46	0.460	1.00	1.00	PALM TRAN EXPRESS
16	0.75	0.750	1.00	1.00	INTER COUNTY EXPRESS
36	0.70	0.670	1.00	1.00	BCT RAPID BUS
37	0.00	0.000	1.00	1.00	BCT FIXED GUIDEWAY BRT

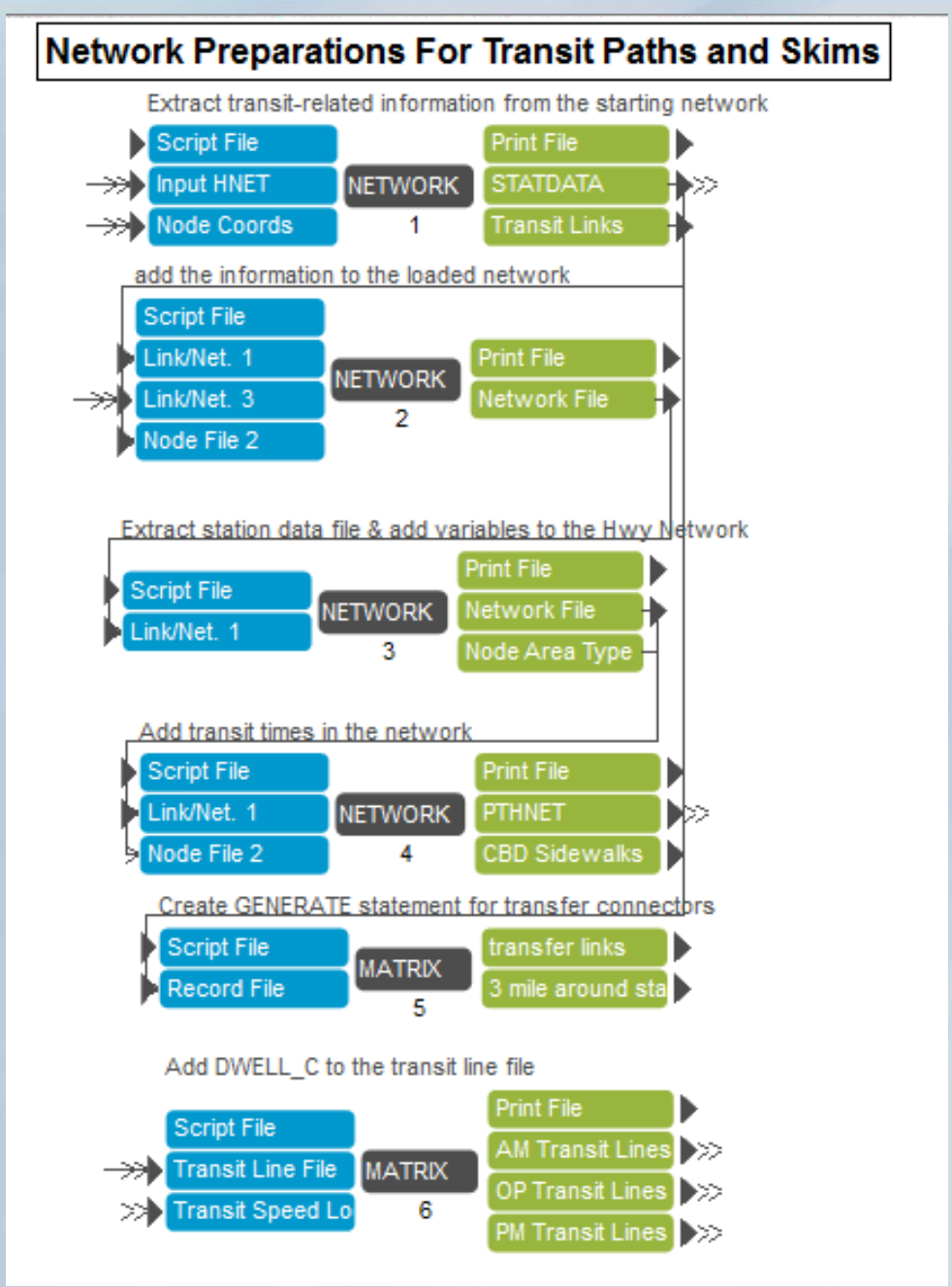
Transit Skims



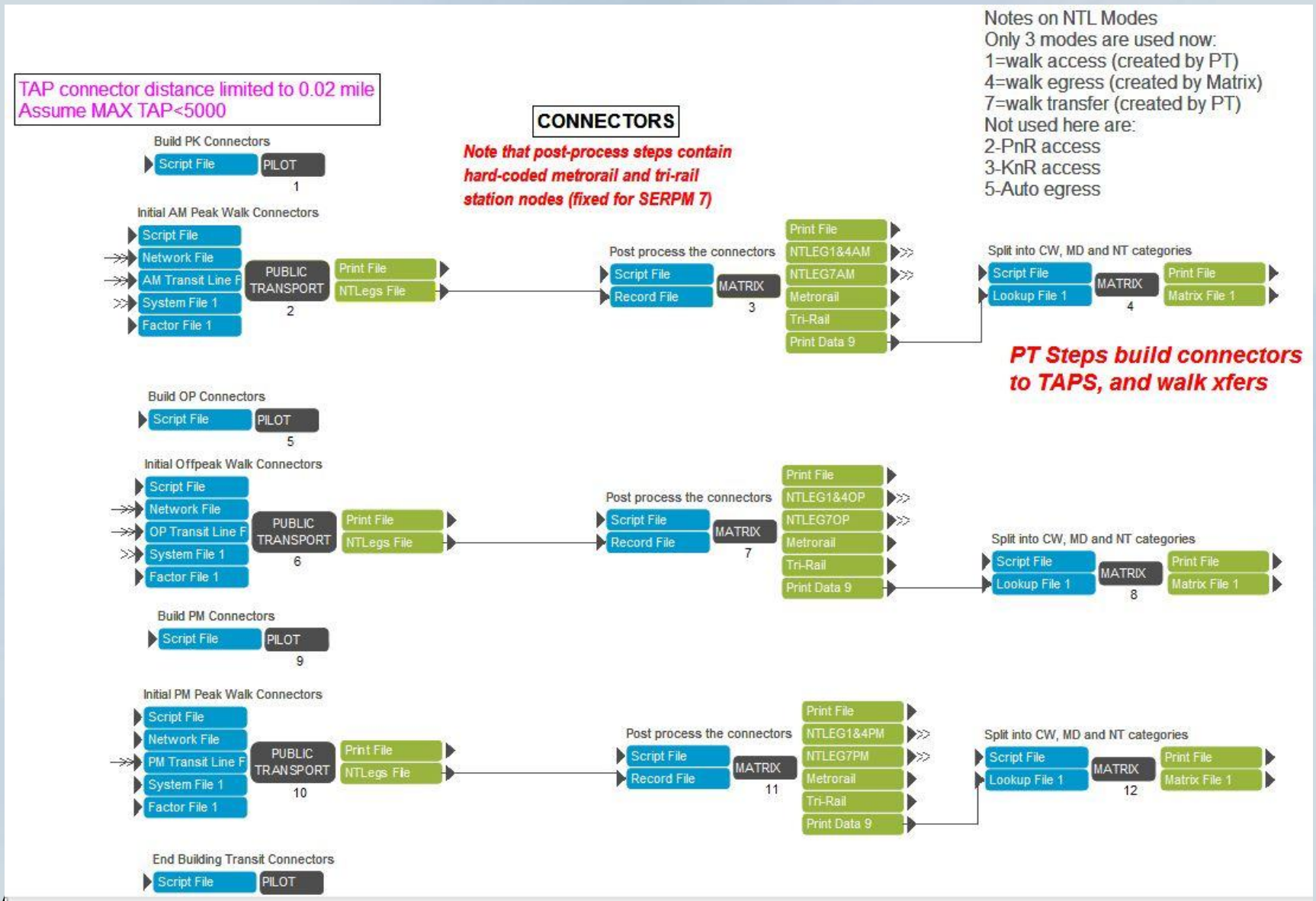
Transit Skims

- Transit times base on congested highway times.
- Times at transit stops added as a dwell time (SERPM 6.7 method).
- PT adds TAP-transit line stop node connectors. CT-RAMP adds MAZ-TAP connectors on the fly.
- Drive connectors not needed (added by CT-RAMP).
- REWALK not needed.
- Path-conditioning is done in the mode choice program, not in path-building.

Transit Network Preparation



Transit Connectors (TAPS & Transfers)



Transit Skims

- Skims developed for
  - Period
    - AM (6 – 9 am)
    - Off-Peak (9 am – 3 pm)
    - PM (3 - 7 pm)
  - Service Type
    - All routes
    - Local Routes only

Transit Paths and Skims

TAP Modes based on MODE values

1) 191,192,291,292,293,391,392,393,491,492 - local
2) 151,251,252,253,351,352,451 - express bus
3) 241,242,243,341,342,441 - BRT
4) 111 - Commuter Rail
5) 181,281,381,481 - People Mover/Circulator
6) 121 - Heavy Rail
7) 231,331,431 - LRT

Transit Path Elements

- BESTPATHONLY
- Congested highway time
- Dwell time
- Initial and transfer waits
- Transfer walk time
- Boarding and transfer penalties
- Fare

Transit Skims (TAP-TAP)

All Routes

1. Number of transfers
2. Commuter rail IVT
3. Light rail IVT
4. BRT IVT
5. Express bus IVT
6. Local bus IVT
7. Main Mode (hierarchical)
8. Fare
9. Initial wait time
10. Transfer wait time
11. Transfer time
12. Total time for all modes

Local Routes

1. Number of transfers
2. Total time for all modes
3. Fare
4. Initial wait time
5. Transfer wait time
6. Transfer time

IVT=In-vehicle time

Transit Network Inputs

- SERPM_NETS.mdb - Network geodatabase (Highway & Transit)
- MicroCodedData_{YEAR}{ALT}.DBF - Micro-coded station data
- Op_Stops.DBF - File of all transit stops from the operators
- TransitLinks_{YEAR}{ALT}.DBF - Transit-only links
- TSPEED.DBF - Transit dwell times by USERA4
- TFARES.FAR - Transit fare description
- TSYSD.PTS - Transit system file: wait definitions and system names
- WALK_WALK_LocOnly_FAC.FAC - local bus-only factors, penalties, fares system
- WALK_WALK_WithLoc_FAC.FAC - All transit factors, penalties, fares system

Transit Network Inputs

- PT Lines from the geodatabase – as always must match the highway network.
- TSYSD.PTS – defines modes, operators and wait time curves.
- TFARES.FAR – defines fare structure by operator
- Structure adapted from SERPM 6.7

Transit Network Inputs (cont.)

- WALK_WALK_WithLoc_FAC.FAC
- WALK_WALK_LocOnly_FAC.FAC – delete all but local modes

- Global settings
- Assign fare structures to operators
- Define allowable access and egress modes
- Define wait curves and factors
- Define boarding and xfer penalties

Transit Skim Outputs

- Transit Networks with Dwell Times
- All mode skims
  - AM skims: SKIMAM_Walk_Walk_WithLOC.MAT
  - PM skims: SKIMPM_Walk_Walk_WithLOC.MAT
  - OP skims: SKIMOF_Walk_Walk_WithLOC.MAT
- Local-only skims
  - AM skims: SKIMAM_Walk_Walk_LocOnly.MAT
  - PM skims: SKIMPM_Walk_Walk_LocOnly.MAT
  - OP skims: SKIMOF_Walk_Walk_LocOnly.MAT

Non-Activity-Based Models

Non-Activity-Based Models

- Not part of the household activity pattern.
- Trip Purposes:
  - External-External
  - Internal-External
  - Airport
  - Trucks

Household Data

- Summarized from CT-RAMP hhFile.csv (one record/HH).
- Employment data from MAZ records.
- Dynamic area type from SERPM 7 TAZ's.

External-External Trips

- Relatively small number of trips.
- The EE seed trip table.
- Fratar model for future year growth.
- Allocate to time periods by observed counts.
- Allocate to autos and trucks by percentages at external stations.
  - Autos
  - Four-tire trucks
  - Single unit more than four tire trucks
  - Combinations
- Output file: EETAB-PRD.MAT

Internal-External Trips (new model)

- External auto and truck P's and A's from classification counts at external stations (input file).
- EI productions and attractions at internal TAZs as a function of households, employment, and distance to external stations (NCHRP 716 method).
- Distribution by an aggregate destination choice model.

External Control File Similar to ZDATA4

TAZ	TYPE	DESCRIP	ROAD	TERMT	PROD	PPCT4TIRE	PPCTSU	PPCTCOMB	ATTR	APCT4TIRE	APCTSU	APCTCOMB	TAZS65
4501	4	Collector	A1A/Beach Rd Martin County	0	2031	1	2	2	2031	1	2	2	4201
4502	3	Art/not near fwy	US-1 Martin County	0	12280	1	2	1	12280	1	2	1	4202
4503	1	Freeway	I-95 - Martin County	0	66420	1	2	6	66420	1	2	6	4203
4504	1	Freeway	FL TPK - Martin County	0	32329	1	2	5	32329	1	2	5	4204
4505	4	Collector	An Access to Martin County	0	1913	1	2	1	1913	1	2	1	4205
4506	4	Collector	Pratt-Whitney Rd Martin Co	0	2381	1	2	1	2381	1	2	1	4206
4507	4	Collector	BeeLine Hwy(SR710)-Martin	0	8101	1	4	9	8101	1	4	9	4207
4508	4	Collector	US 98/SR 15 North	0	2692	1	2	1	2692	1	2	1	4208
4509	3	Art/not near fwy	US 27/SR 80 North	0	10468	1	8	7	10468	1	8	7	4209
4539	1	Freeway	I75 North Collier County	0	16064	1	4	11	16064	1	4	11	4239
4582	3	Art/not near fwy	US41/SR90 Collier County	0	3558	2	8	3	3558	2	8	3	4282
4583	3	Art/not near fwy	US1/SR5-Monroe County	0	13685	2	8	3	13685	2	8	3	4283
4584	4	Collector	Card Sound Rd-Monroe Count	0	4750	2	8	3	4750	2	8	3	4284

EI Percentage (NCHRP 716)

$$E_j = AT_j D_j^B \qquad (4\text{-}11)$$

where:

E_j = EI trips generated in internal zone j;
T_j = Total internal trip attractions generated in internal zone j;
D_j = Distance from zone j to the nearest external station; and
A, B = Estimated parameters.

Non-ABM TOD and diurnal factors

IPRD	PNAM	EE	TRUCK	AIRPORT	EI
1	EA_Frac	0.0181	0.125	0.04718	0.0181
2	AM_Frac	0.10593	0.125	0.17514	0.10593
3	MD_Frac	0.40342	0.27083	0.4941	0.40342
4	PM_Frac	0.25658	0.14583	0.16697	0.25658
5	EV_Frac	0.21597	0.33333	0.11661	0.21597
6	EA_PA	0	0	0.31381	0.56812
7	AM_PA	0	0	0.2448	0.61413
8	MD_PA	0	0	0.49913	0.52245
9	PM_PA	0	0	0.50776	0.45356
10	EV_PA	0	0	0.66435	0.45841

Truck Trips

- Uses SERPM 6.52 QRS Freight II Method.
- Truck rates by Area Type and County from latest SERPM 6.52 work.
- Summarize new SERPM 7 ZDATA file:
  - Industrial Employment
  - Commercial Employment
  - Service Employment
  - Households
- Aggregate destination choice on time to match the current distribution.
- Add growth to Analyst-based truck trip table.

Airport Passengers

- Adapted from SERPM 6.5
- Passenger trips produced at the airports as a function of enplanements.
- Attracted to employment, households and Hotel/model units. Originally developed from an airport survey.
- Aggregate destination choice on time to match the current distribution.
- Allocate to time periods.

Non-ABM Gen Inputs

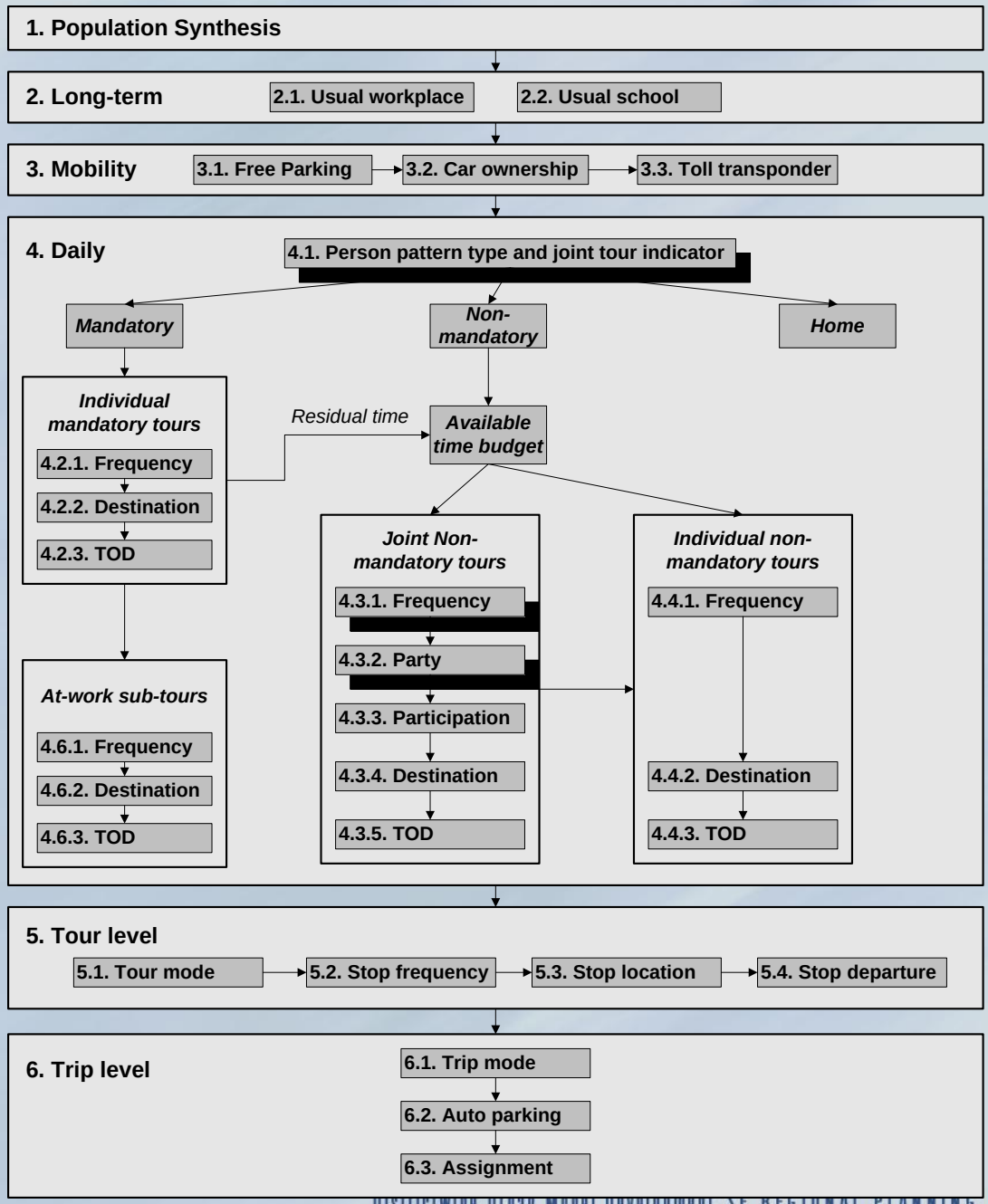
- airport_truck_rates.dbf - airport trip rates
- EIdata.dbf - External station data
- enplane.dbf - Airport enplanement data
- EETRIPS.MAT - Seed EE trip table
- hhFile.csv - CT-RAMP household file
- maz_data.csv - MAZ data

Non-ABM Outputs

- Airport and truck P's and A's: Air_truck_panda.dbf
- EI_Auto_Panda.dbf: EI P's and A's
- EI_trips.mat: External-internals trip table by TOD
- airport.mat: airport trip table by TOD
- truck.mat: truck trip table by TOD

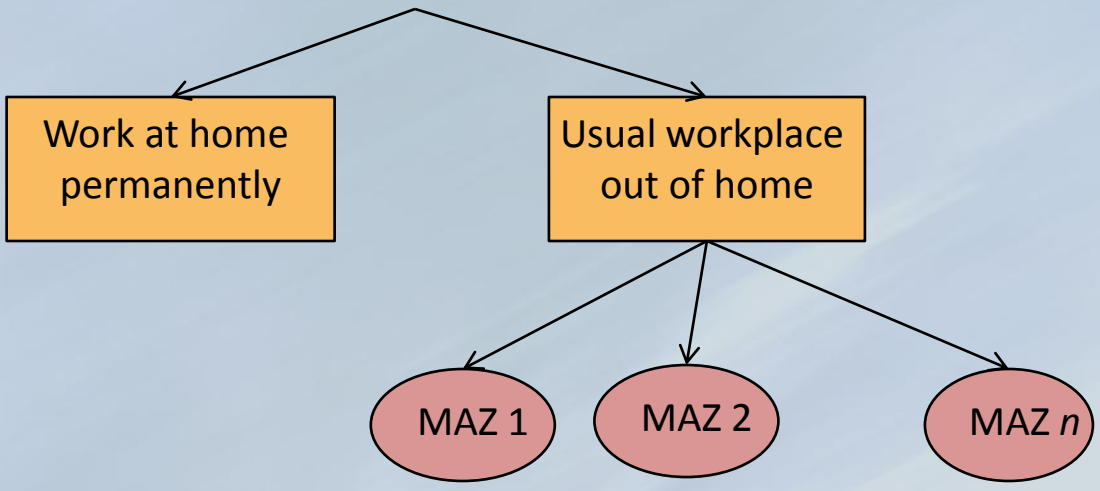
Long Term Choices

SERPM7 CT-RAMP Framework



Usual Workplace Location

- Determines workplace location for each worker in the synthetic population
- Workers choose later whether to go to work
- Model form: multinomial logit



Work at Home Choice

- Work at home is rapidly growing because of
  - Communications technology
  - Structural shifts in occupation and industries
- Will these trends continue?
  - Is there a saturation point? If so, what is it?
  - Can models forecast or back-cast the rise in this trend or are the factors changing?
- There are potentially significant impacts on congestion
  - Which makes this an effective policy lever
  - Sensitivity tests may help to evaluate these impacts

Out of Home Work Location Choice

Occupation

Person type

Residential zone

Workplace zone

$$U_{opij} = ln(JOBS_{oj})$$

/Zone size term (relevant jobs)

Mode

$$+\lambda \times ln\left[\sum_{j} exp(U_{mpij})\right] +$$

/Mode choice logsum

$$+\sum_{n}[\gamma_{pn} \times f_n(D_{ij})] +$$

/Distance decay function

Elemental functions

Work Location Utility Expression Calculator

TourDestinationChoice.xls / WorkLocation

Model	2	Destination_choice_work		Decision_making_unit	t	Alt	FILE	Segment	purpose=1
No	**Token**	**Description**	**Filter**	**Formula_for_variable**	**Index**	**Alt1**	**Re_use**	**Outcome**	
1	income	Household income (1 through 5)		@income					
2	fullTimeWorker	Full time worker (1 if true)		@fullTimeWorker					
3	femaleWorker	1 if Female, 0 otherwise		@femaleWorker					
4	distance	Peak MGRA to MGRA Distance		min(@@opSovDistanceAlt,72)					
5	distance_sqrt	Square root of OD distance		sqrt(distance)					
6	distance_squared	OD distance squared		distance^2					
7	distance_cubed	OD distance cubed		distance^3					
8		Sample of alternatives correction factor		min(@@dcSoaCorrectionsAlt,60)		1.000000			
9		Mode choice logsum		@@mcLogsumDestAlt		0.54680			
10		Distance		distance		0.265800			
11		Square root of distance		distance_sqrt		-1.604000			
12		Distance squared		distance_squared		-0.004362			
13		Distance cubed		distance_cubed		0.000024			
14		Distance - low income	income<=2	distance		0.194100			
15		Squared Root of Distance - low income	income<=2	distance_sqrt		-0.872100			
16		Distance squared - low income	income<=2	distance_squared		-0.002409			
17		Distance - high income	income>=4	distance		0.000000			
18		Distance squared - high income	income>=4	distance_squared		0.000192			
19		Distance - part-time worker	fullTimeWorker==0	distance		-0.116000			
20		Distance squared - part-time worker	fullTimeWorker==0	distance_squared		0.000393			
21		Distance - female	femaleWorker == 1	distance		-0.025150			
22		Size variable - total employment		@@lnDcSizeAlt		1.000000			
23		No attractions if no employment in zone		@@lnDcSizeAlt==0		-999			

Work Location Utility Expression Calculator

Accessibilities.xls / size term - work

Model	11	Constants		Decision-making-unit	m	Alt	6				
No	Token	Description	Filter	Formula for variable	Index	Alt1	Alt2	Alt3	Alt4	Alt5	Alt6
						White Collar	Services	Health	Retail and Food	Blue Collar	Military
1		Agriculture		emp_ag	z	0.2524	0.1060	0.0020	0.0171	0.6225	0.6225
2		Construction Production		emp_const_non_bldg_prod	z	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000
3		Construction Support		emp_const_non_bldg_office	z	0.9081	0.0370	0.0014	0.0535	0.0000	0.0000
4		Utilities Production		emp_utilities_prod	z	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000
5		Utilities Office		emp_utilities_office	z	0.9301	0.0478	0.0000	0.0221	0.0000	0.0000
8		Manufacturing Production		emp_mfg_prod	z	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000
9		Manufacturing Office		emp_mfg_office	z	0.8571	0.0506	0.0056	0.0868	0.0000	0.0000
10		Wholesale and Warehousing		emp_whsle_whs	z	0.3543	0.0235	0.0033	0.3691	0.2498	0.2498
11		Transportation Activity		emp_trans	z	0.2724	0.0735	0.0006	0.0295	0.6241	0.6241
12		Retail Activity		emp_retail	z	0.2302	0.0328	0.0178	0.5726	0.1466	0.1466
13		Professional and Business Services		emp_prof_bus_svcs	z	0.7975	0.0683	0.0120	0.1222	0.0000	0.0000
14		Professional and Business Building Maint		emp_prof_bus_svcs_bldg_maint	z	0.0000	0.5144	0.0259	0.0944	0.3653	0.3653
16		Private Education Post-Secondary		emp_pvt_ed_post_k12_oth	z	0.7981	0.1479	0.0127	0.0145	0.0268	0.0268
17		Health Services		emp_health	z	0.3146	0.0650	0.5716	0.0246	0.0242	0.0242
18		Personal Services Office-Based		emp_personal_svcs_office	z	0.8495	0.0843	0.0284	0.0000	0.0379	0.0379
19		Amusement Services		emp_amusement	z	0.2195	0.5124	0.0046	0.1920	0.0715	0.0715
20		Hotels and Motels		emp_hotel	z	0.3349	0.3279	0.0089	0.2586	0.0696	0.0696
21		Restaurants and Bars		emp_restaurant_bar	z	0.1245	0.0209	0.0000	0.8127	0.0420	0.0420
22		Personal Services Retail-Based		emp_personal_svcs_retail	z	0.0000	0.5026	0.0187	0.0914	0.3873	0.3873
23		Religious Activity		emp_religious	z	0.7830	0.1652	0.0000	0.0153	0.0364	0.0364
24		Private Households		emp_pvt_hh	z	0.0133	0.9313	0.0390	0.0097	0.0067	0.0067
25		State and Local Government		emp_state_local_gov_ent	z	0.5095	0.3935	0.0252	0.0085	0.0633	0.0633
26		Federal Non-Military		emp_fed_non_mil	z	0.8328	0.0592	0.0233	0.0104	0.0743	0.0743
28		State and Local Government Blue Collar		emp_state_local_gov_blue	z	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000
29		State and Local Government White Collar		emp_state_local_gov_white	z	0.7511	0.2046	0.0342	0.0101	0.0000	0.0000
30		Public Eduction (K-12)		emp_public_ed	z	0.8245	0.0797	0.0248	0.0375	0.0335	0.0335

Doubly-Constraining the Usual Work Location Choice Model

- A ***doubly-constrained*** model matches on trip productions and on trip attractions or destinations

$$Productions_i = \Sigma trips_{ij} \;\; and \;\; Attractions_j = \Sigma Trips_{ij}$$

- SERPM7 Usual Work Location can be doubly-constrained:

$$Workers_i = \Sigma WorkFlows_{ij} \;\; and \;\; Jobs_j = \Sigma WorkFlows_{ij}$$

- To constrain the model, a shadow price is added to the utility function
- Shadow prices are calculated iteratively

Computing Shadow Prices

- Specify the appropriate settings in the ***ABM properties file***

serpm7\ctramp\serpm_abm.properties

usualWorkLocationChoice.ShadowPrice.Input.File =
/../input/ABMTEMP/ctramp/ShadowPricingOutput_work_16.csv

uwsl.ShadowPricing.Work.MaximumIterations = 5

uwsl.ShadowPricing.OutputFile =
/../output/ABMTEMP/ctramp/ShadowPricingOutput.csv

- Run the model
- Verify the model has achieved the desired level of convergence

Usual School Location

Determines a Usual School Location for each student in the population

Number of Models:	4 (Pre-School, Grade School, High School, College)
Decision-Making Unit:	Persons younger than 5 (pre-school), Persons age 5-13 (for grade school), Persons age 14-17 (for high school), College Students (for college)
Model Form:	Multinomial logit
Alternatives:	MAZs

Mobility Choices

Mobility Choices

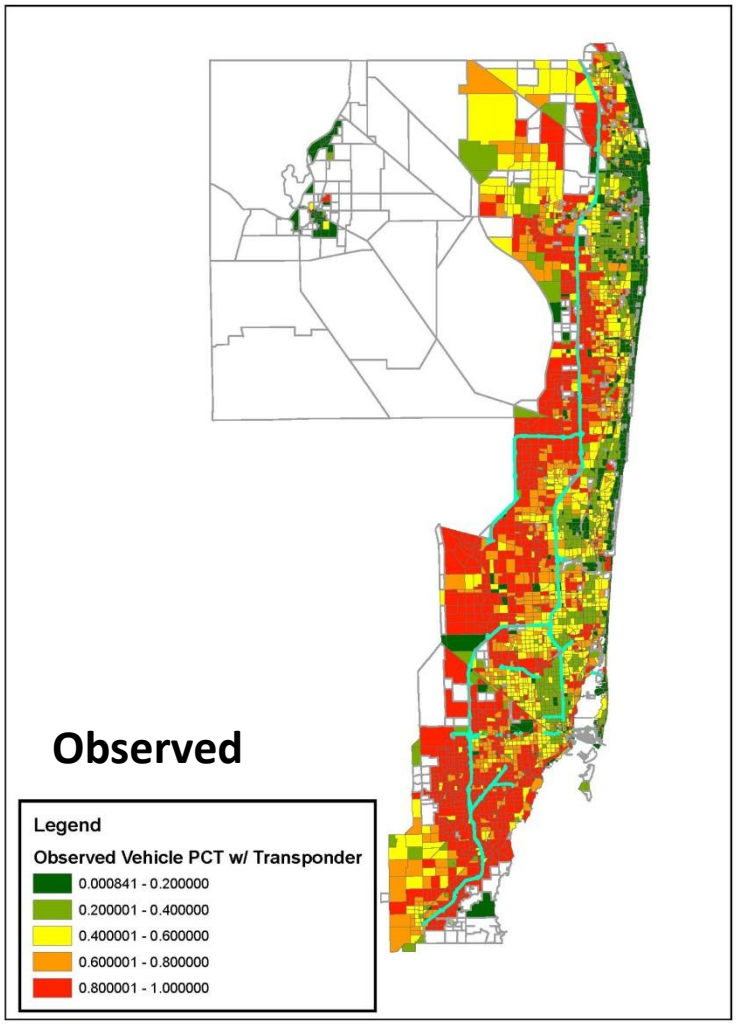
- SERPM7 accounts for three mobility choices:
  - Auto availability
  - Transponder ownership
  - Free parking eligibility
- Mobility choices help explain travel decisions
- Provide important policy-sensitivity … of interest in their own right
  - Often desirable to model these decisions rather than just accept static inputs
  - Scenario testing under varying assumptions
- Challenge: variables that identify mobility decisions were not available in the household survey

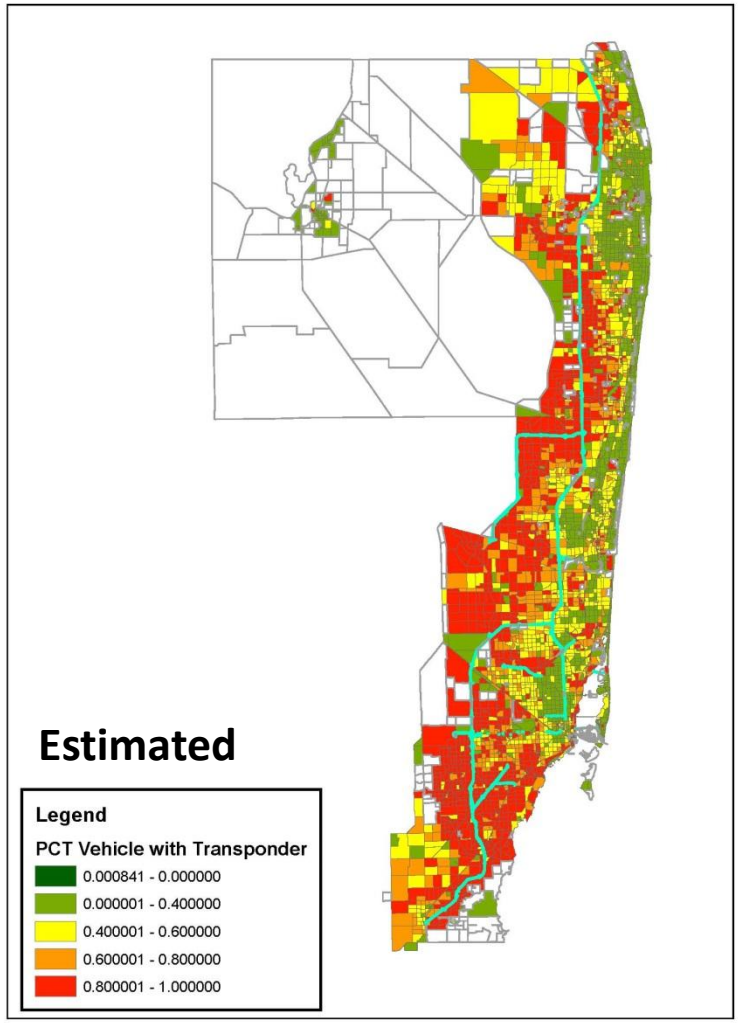
Transponder Ownership Model

- SUNPASS ownership likely influences use of toll facilities:
  - SUNPASS required to use I-95 express lanes, and possibly other facilities in future year scenarios
  - SUNPASS transactions enjoy a toll discount, compared to cash transactions
- No information on SUNPASS use/ownership available in the household survey data, but we have sales data provided by the Turnpike
- Transponder ownership modeled as a binary choice household decision, influenced by proximity to a toll facility and expected travel time savings

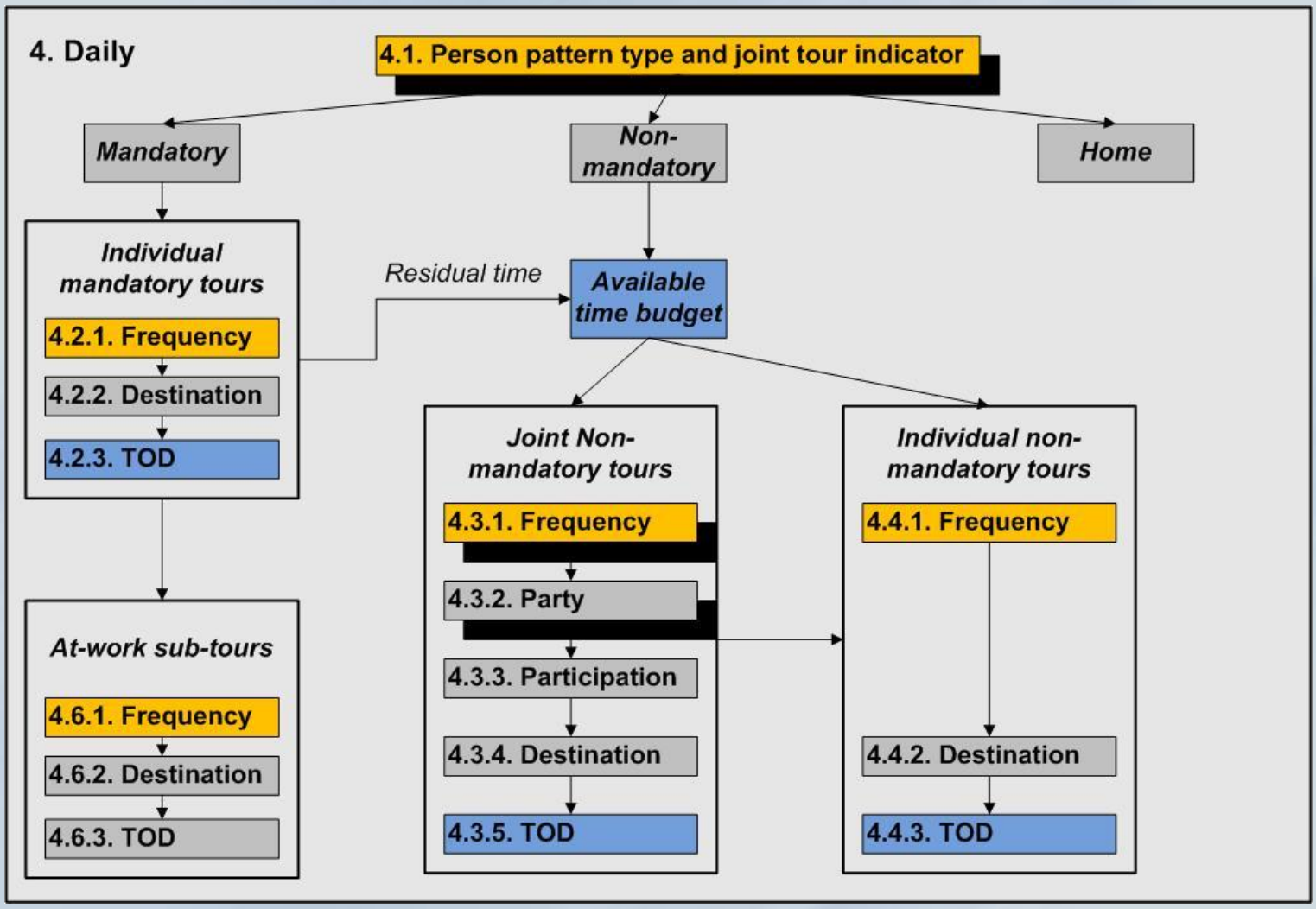
Transponder Ownership Model

Share of vehicles in a TAZ that are equipped with SUNPASS

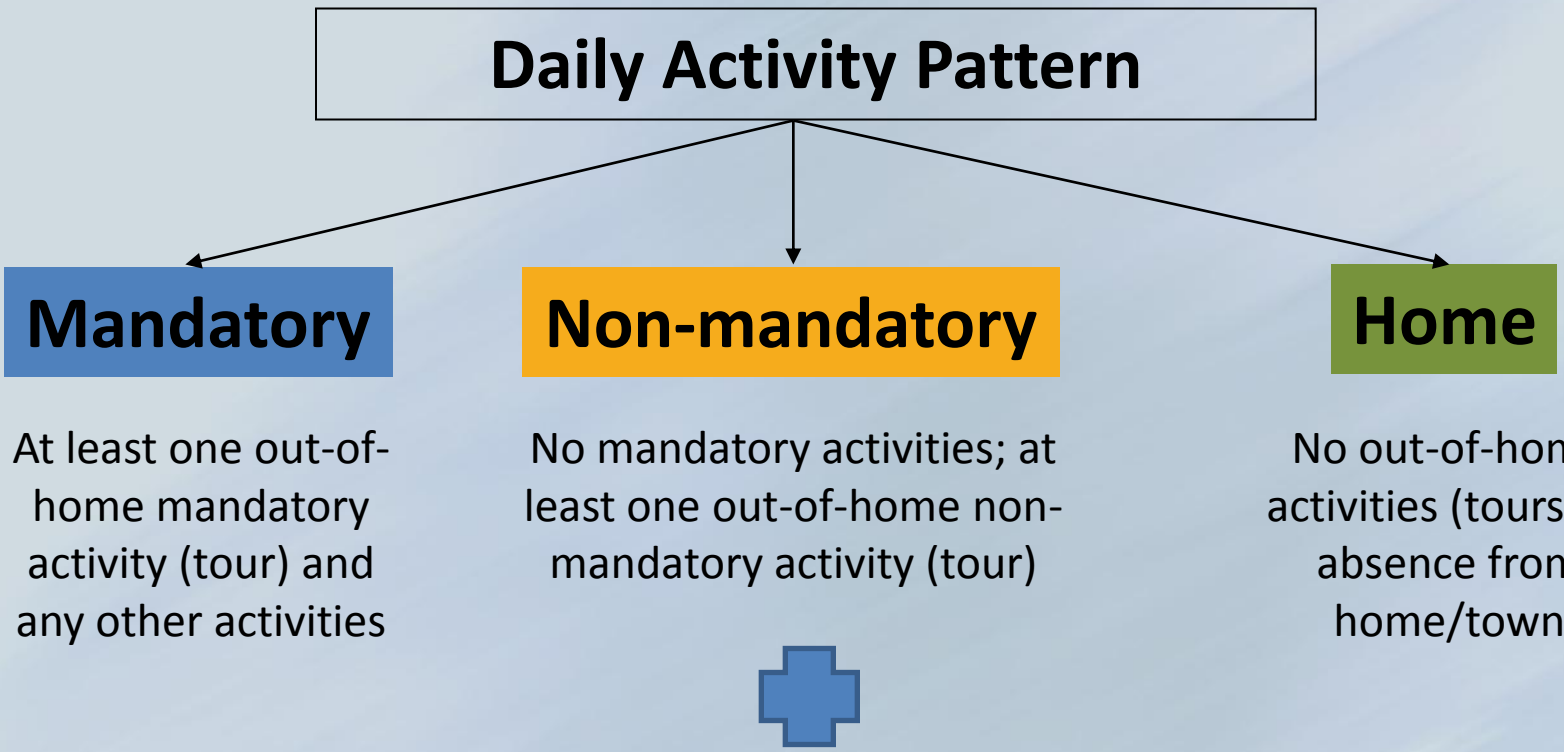




Tour and Trip Generation

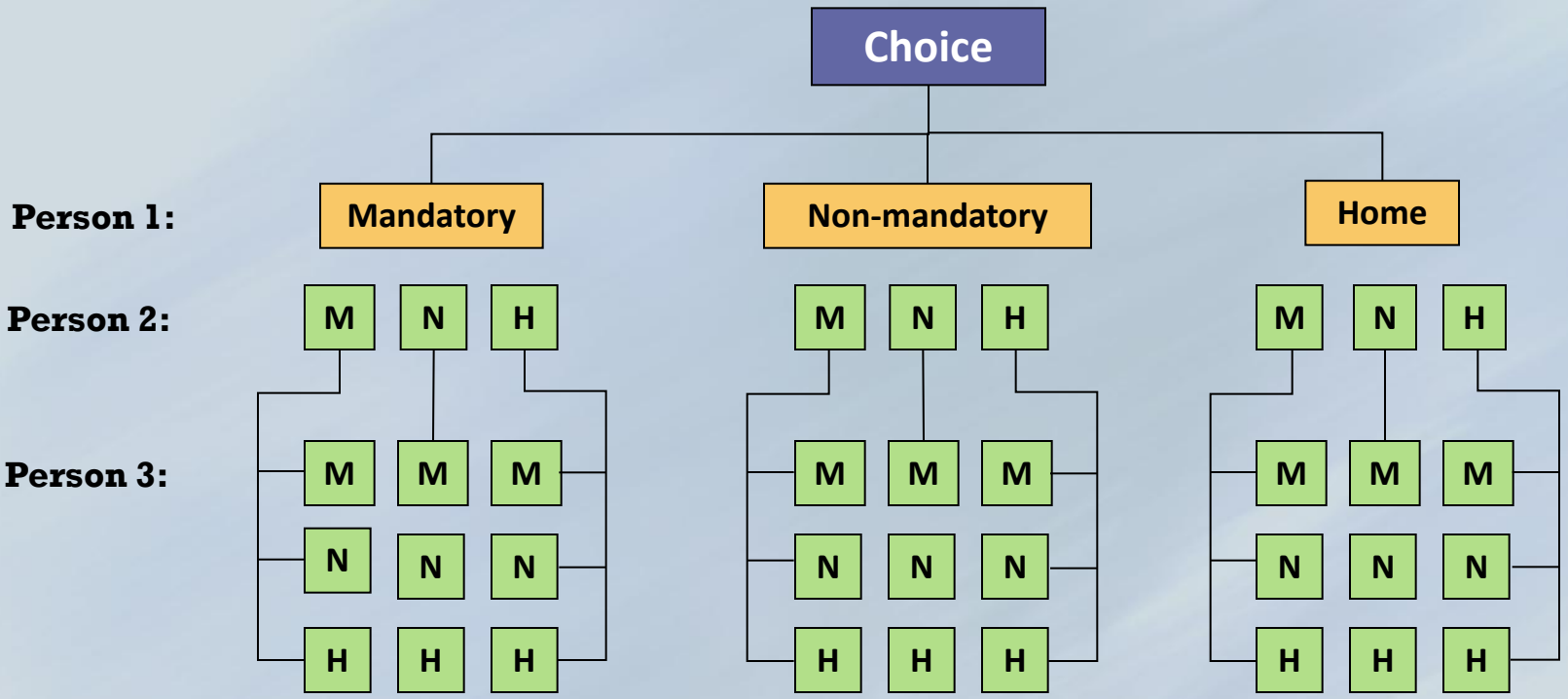


Coordinated Daily Activity Pattern

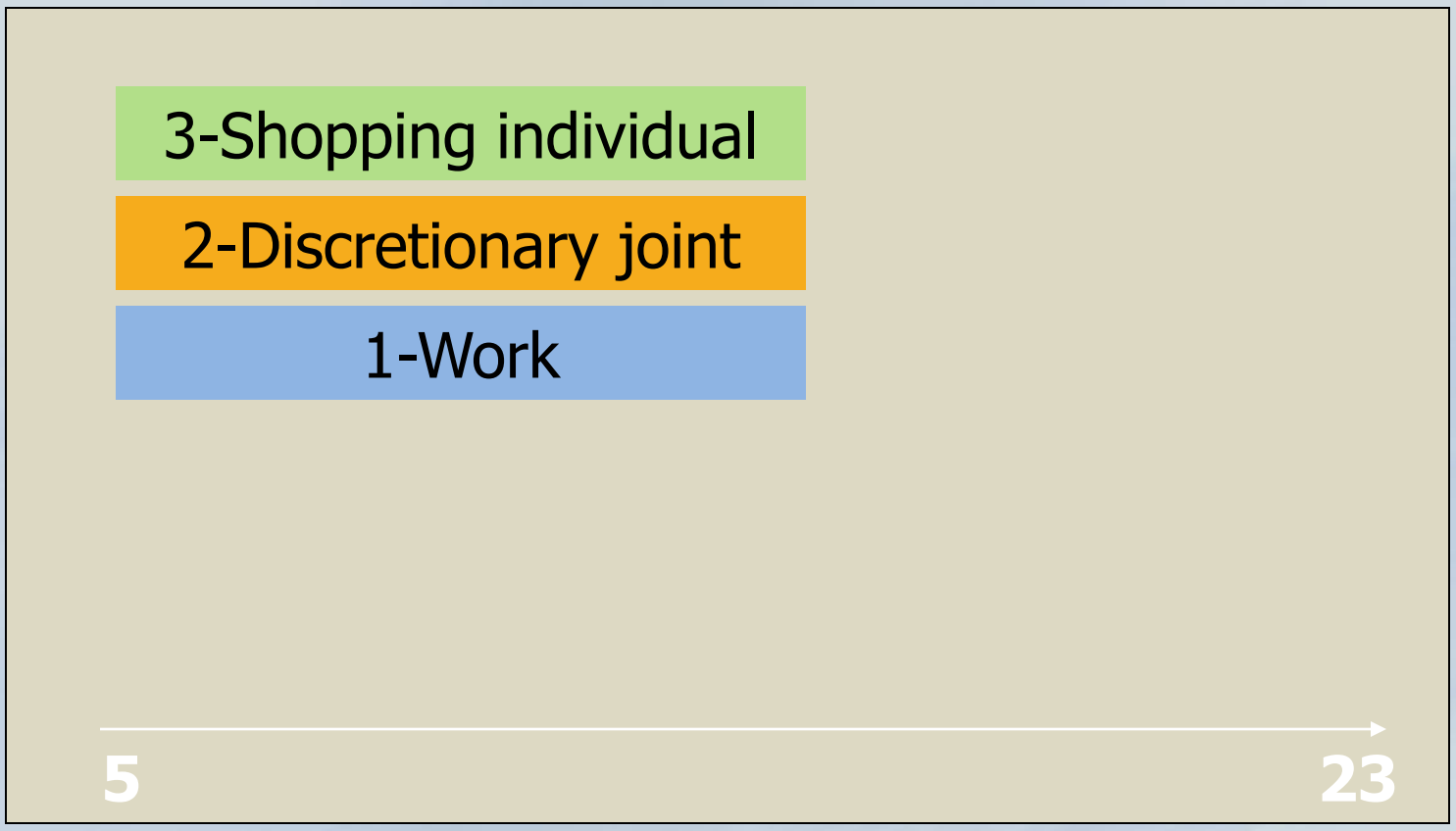


Coordinated Daily Activity Pattern

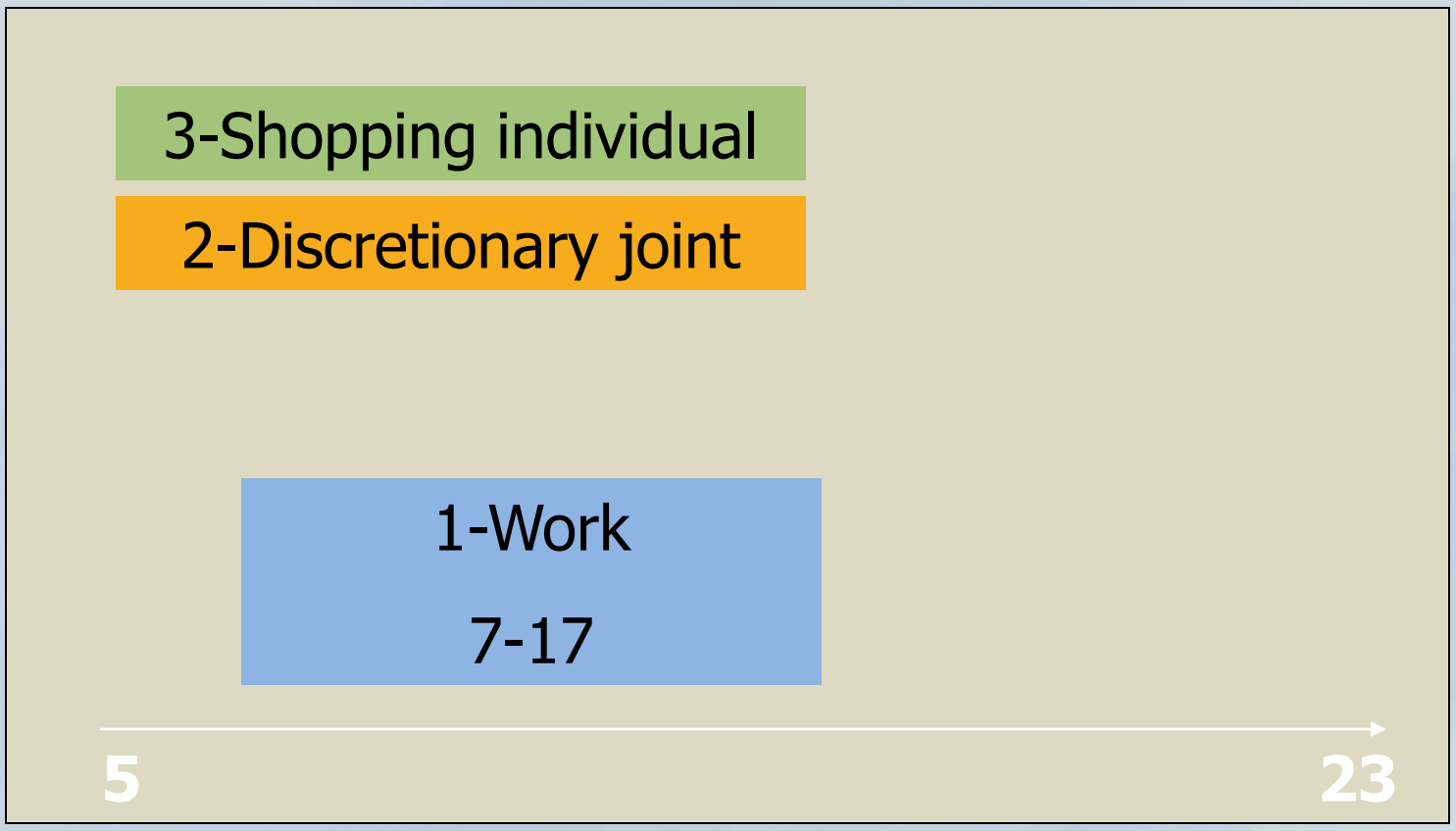
Example of choice tree for 3-person household (without joint tour indicator)



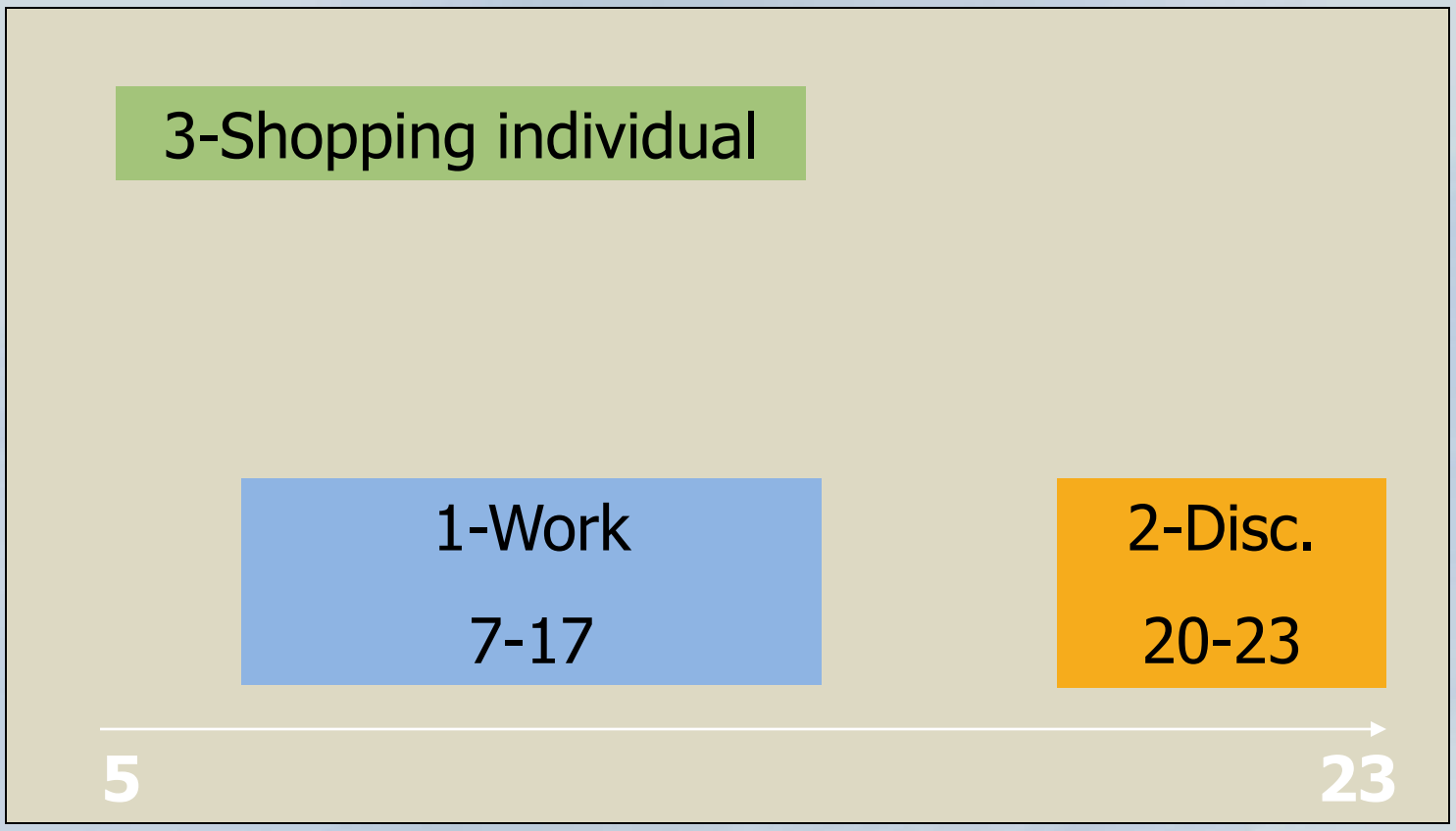
Sequential Processing of Tours



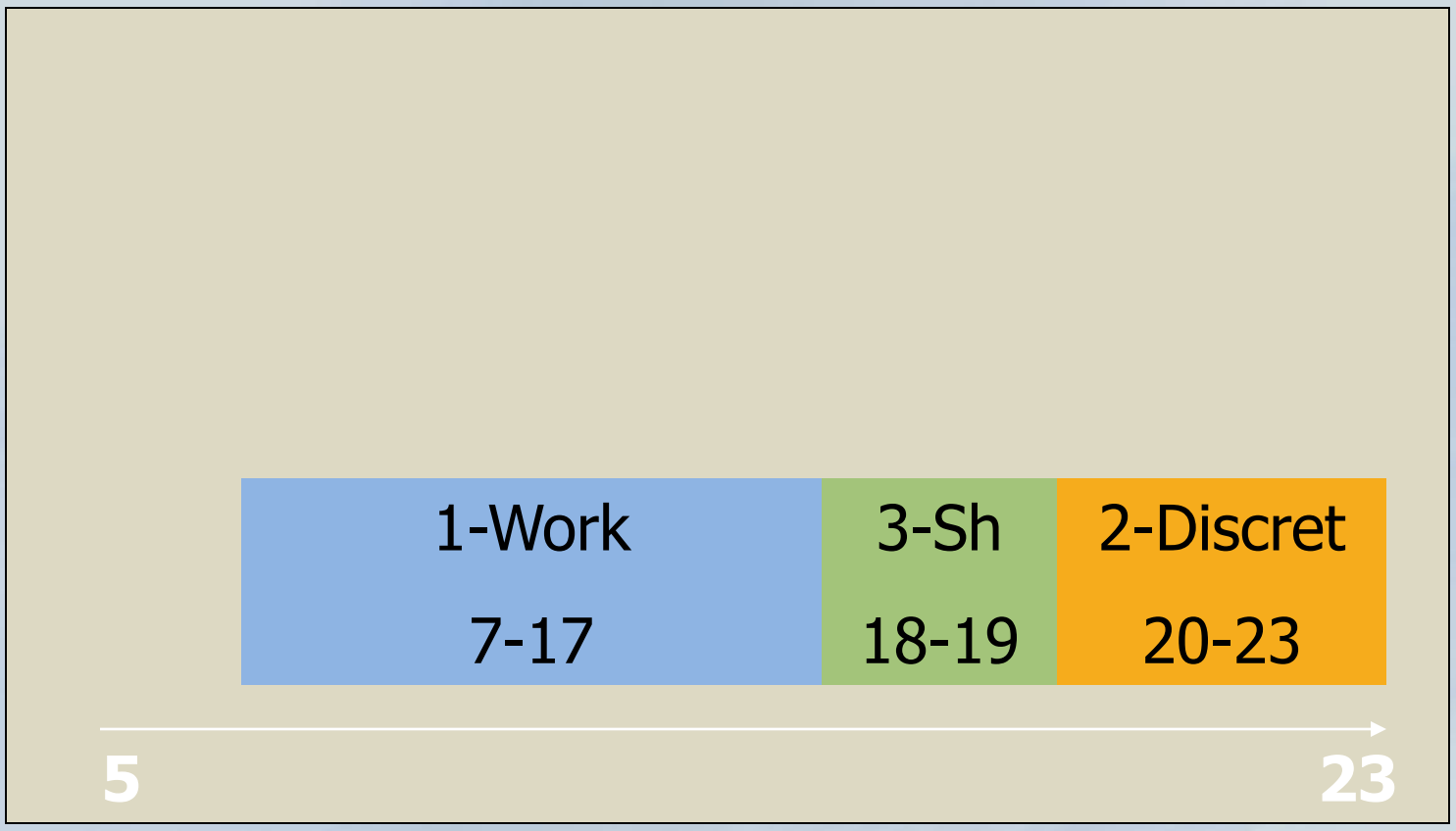
Sequential Processing of Tours



Sequential Processing



Sequential Processing of Tours

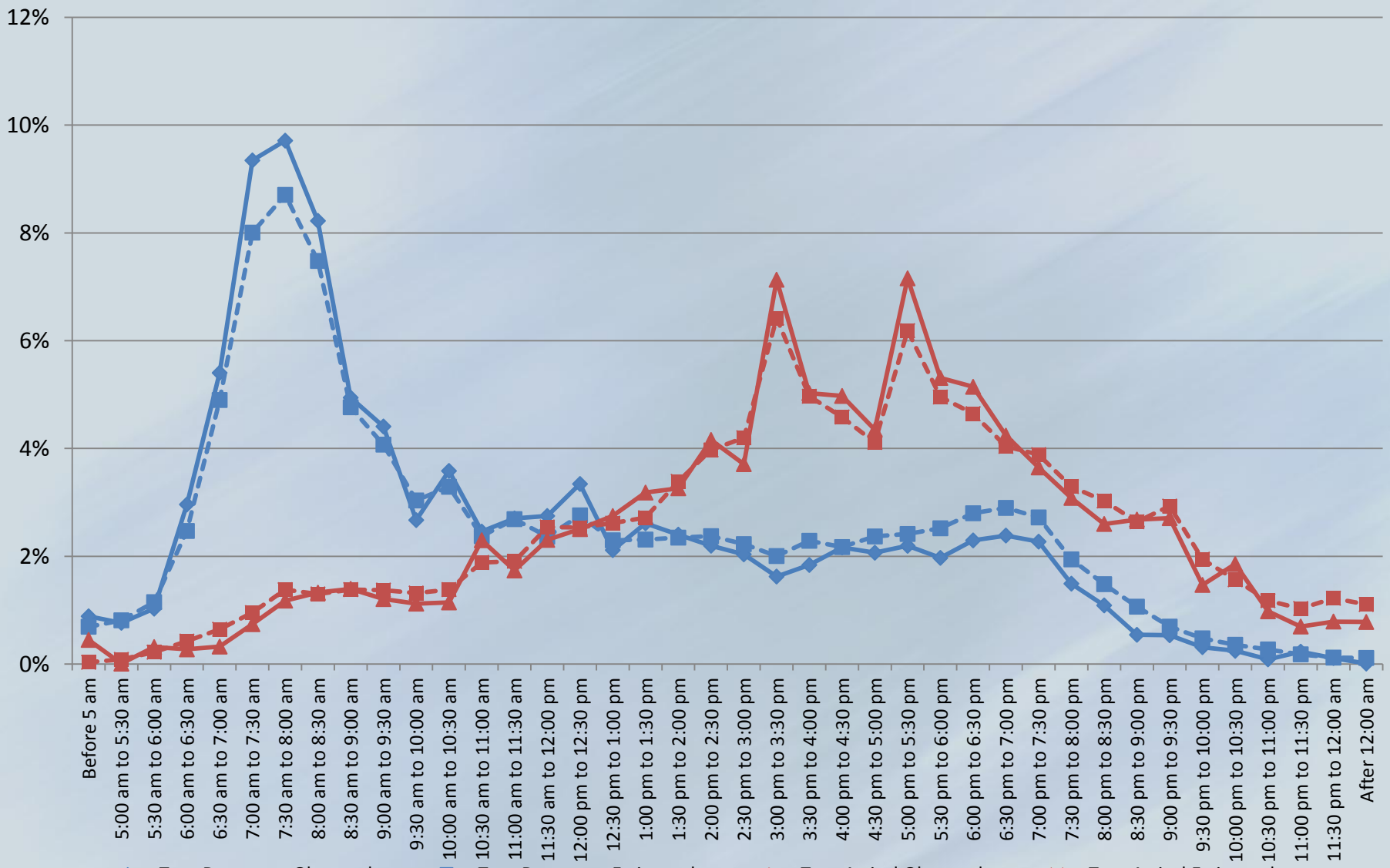


Tour Scheduling

- Determines home departure and arrival times

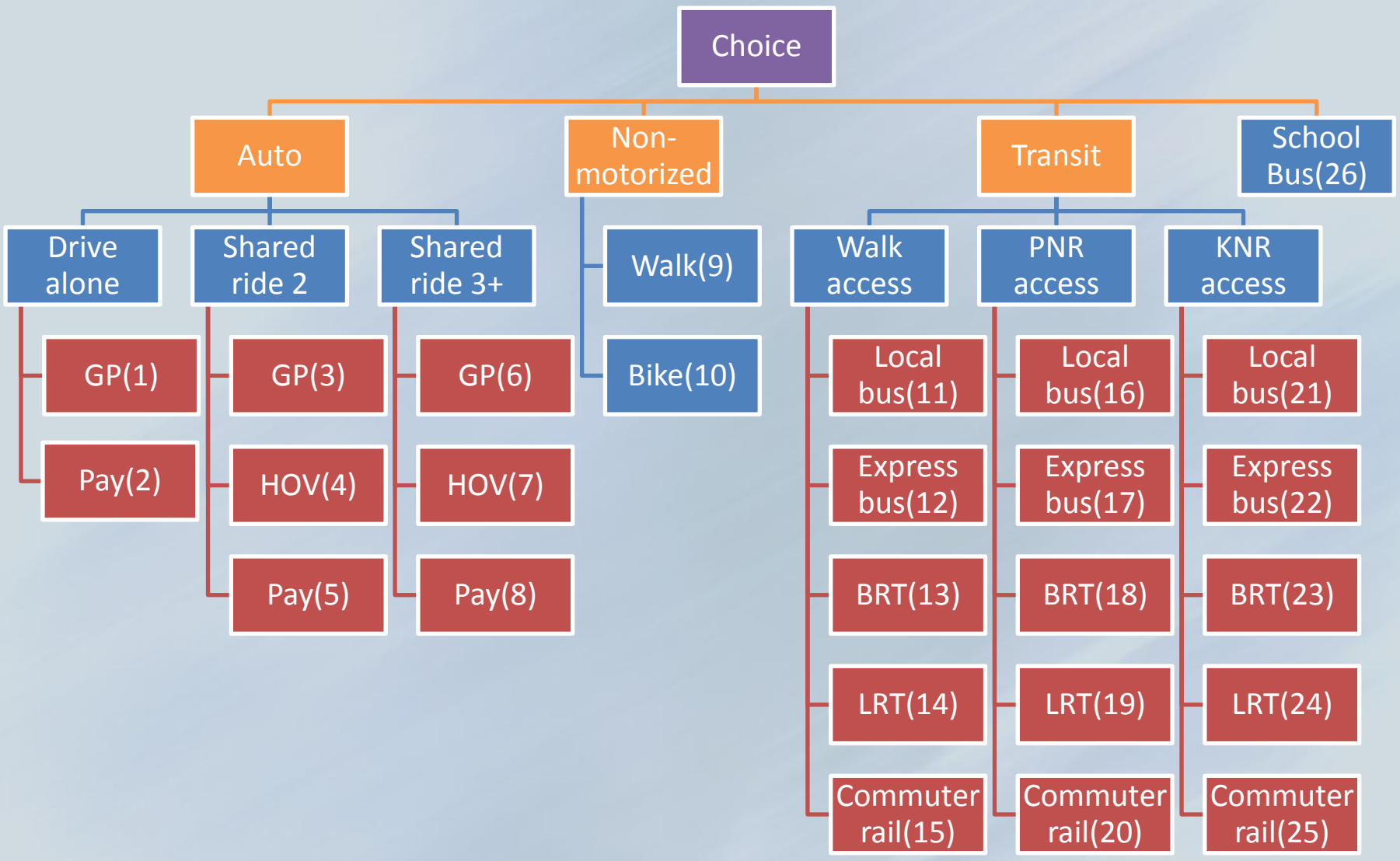
Number of Models:	10 (one per tour purpose)
Decision-Making Unit:	Tours
Model Form:	Multinomial Logit
Alternatives:	861 (combinations of tour departure and arrival half-hour periods)

Tour Scheduling



Districtwide Urban Model Development SE REGIONAL PLANNING MODEL

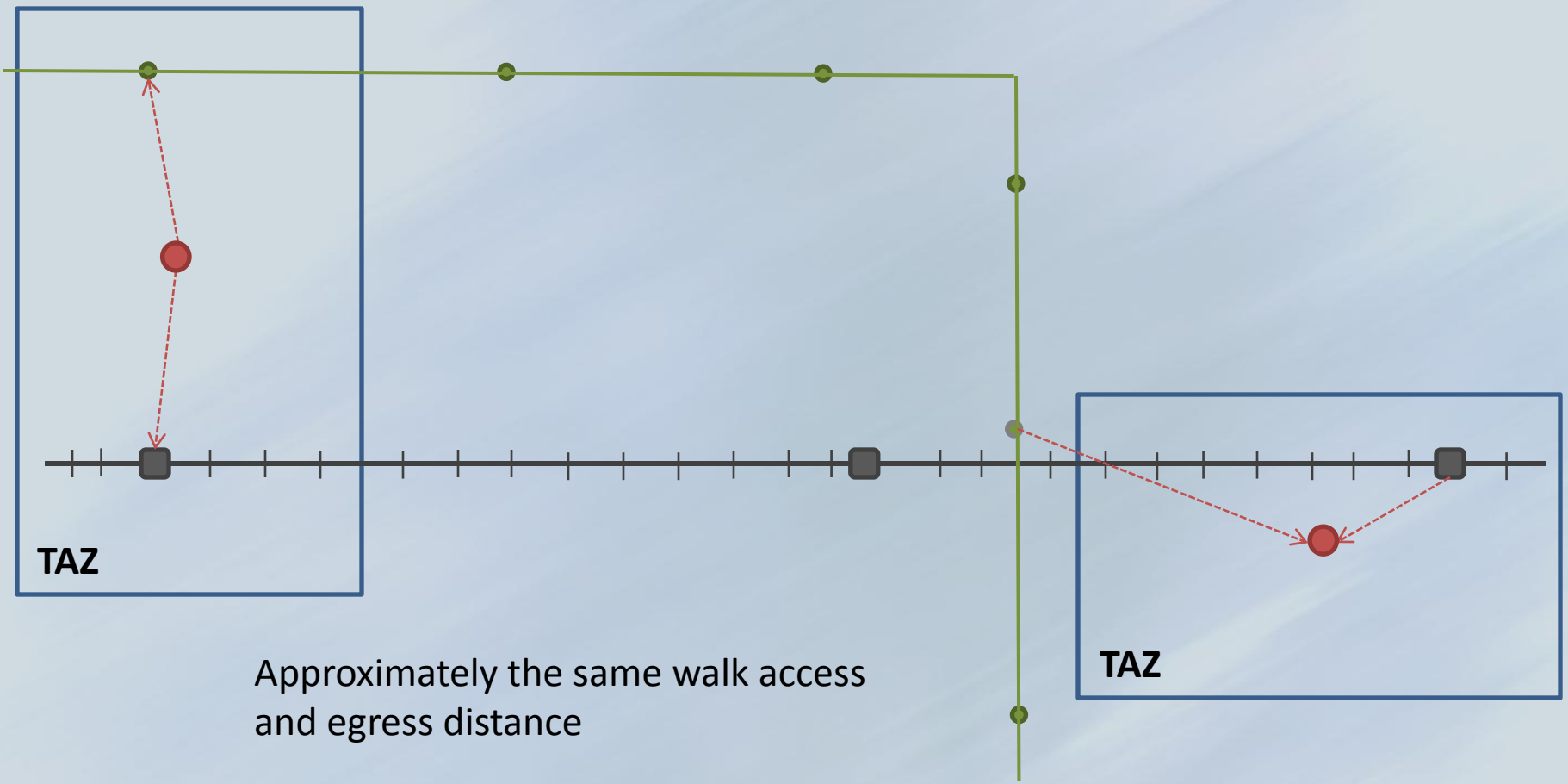
Tour Mode Choice



Tour Mode Choice

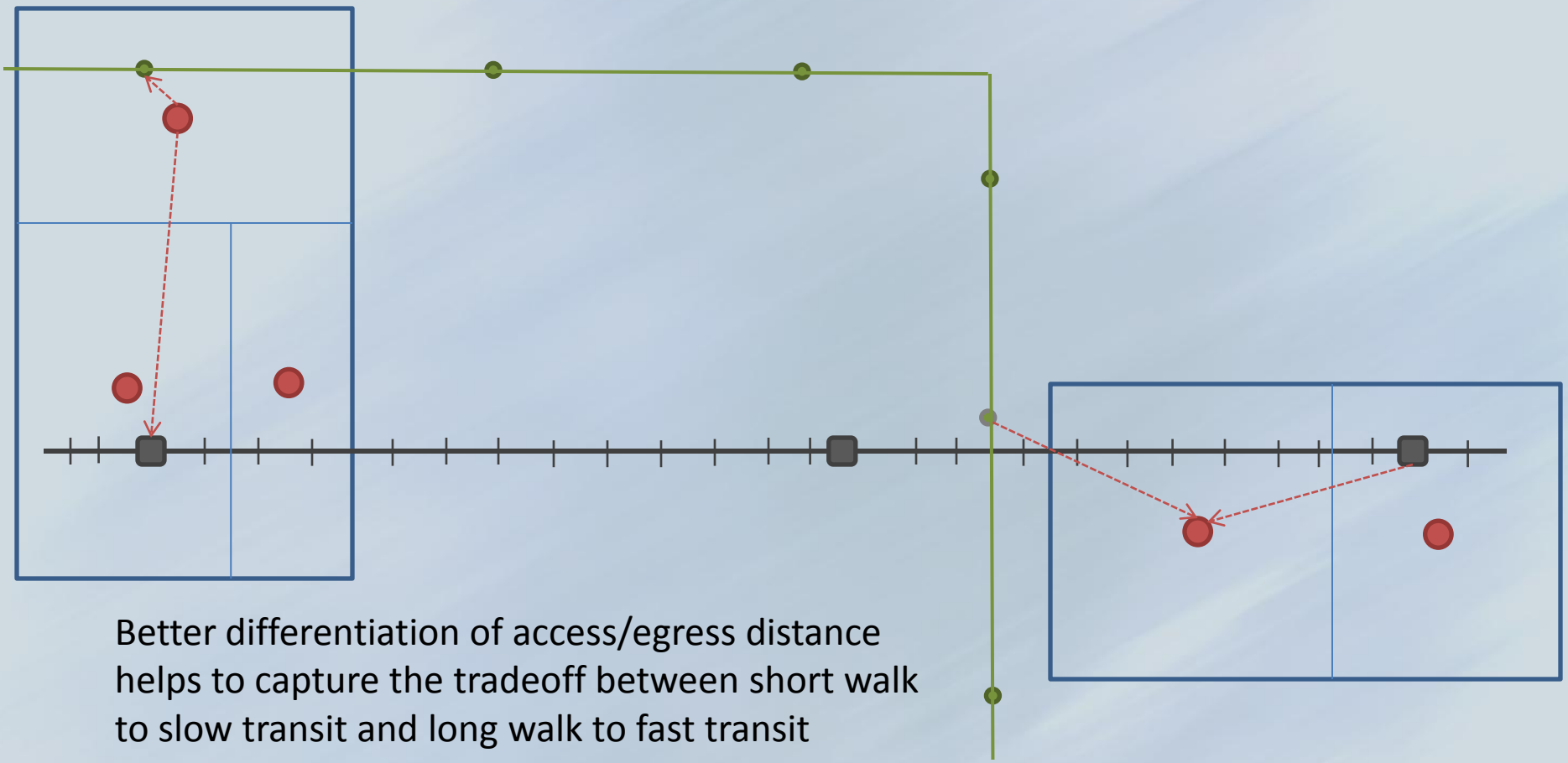
- **Round-trip** in-vehicle, out-vehicle time, cost
  - For specific time period of travel
  - Sensitivity to both ***outbound*** and ***return*** conditions
- Household and person variables
  - Income, auto sufficiency, gender, age, student status
  - Free parking eligibility
  - Toll transponder ownership
- Land-use\urban form variables
- Tour purpose, joint travel, and other situational
- Un-included attributes
  - Mode-specific constant is approximately twice the value observed in a trip mode choice model

Computation of Transit Access



Approximately the same walk access and egress distance

Computation of Transit Access



Better differentiation of access/egress distance helps to capture the tradeoff between short walk to slow transit and long walk to fast transit

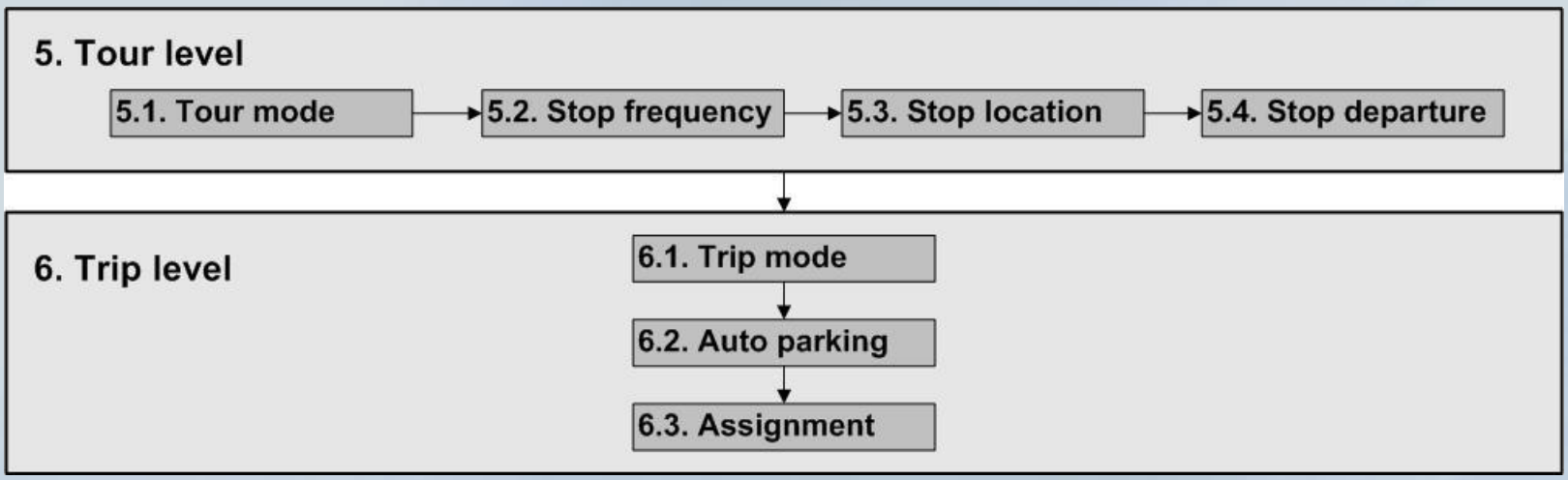
Computation of Transit Access

- Very nice. But the size of the problem increased by a factor of 10:
  - TAZ-based paths: 2 origin TAZs & 2 destination TAZs = 2 paths
  - MAZ-based paths: 5 origin MAZs & 5 destination MAZs = 20 paths
- SERPM7:
  - TAZ-based skims = 4,200 x 4,200 = ~17.6 million cells
  - MAZ-based skims = 12,000 x 12,00 = ~144 million cells
- To reduce computational burden, the MAZ-to-MAZ transit paths are constructed by piecing together the TAP skims with “on-the-fly” access calculations

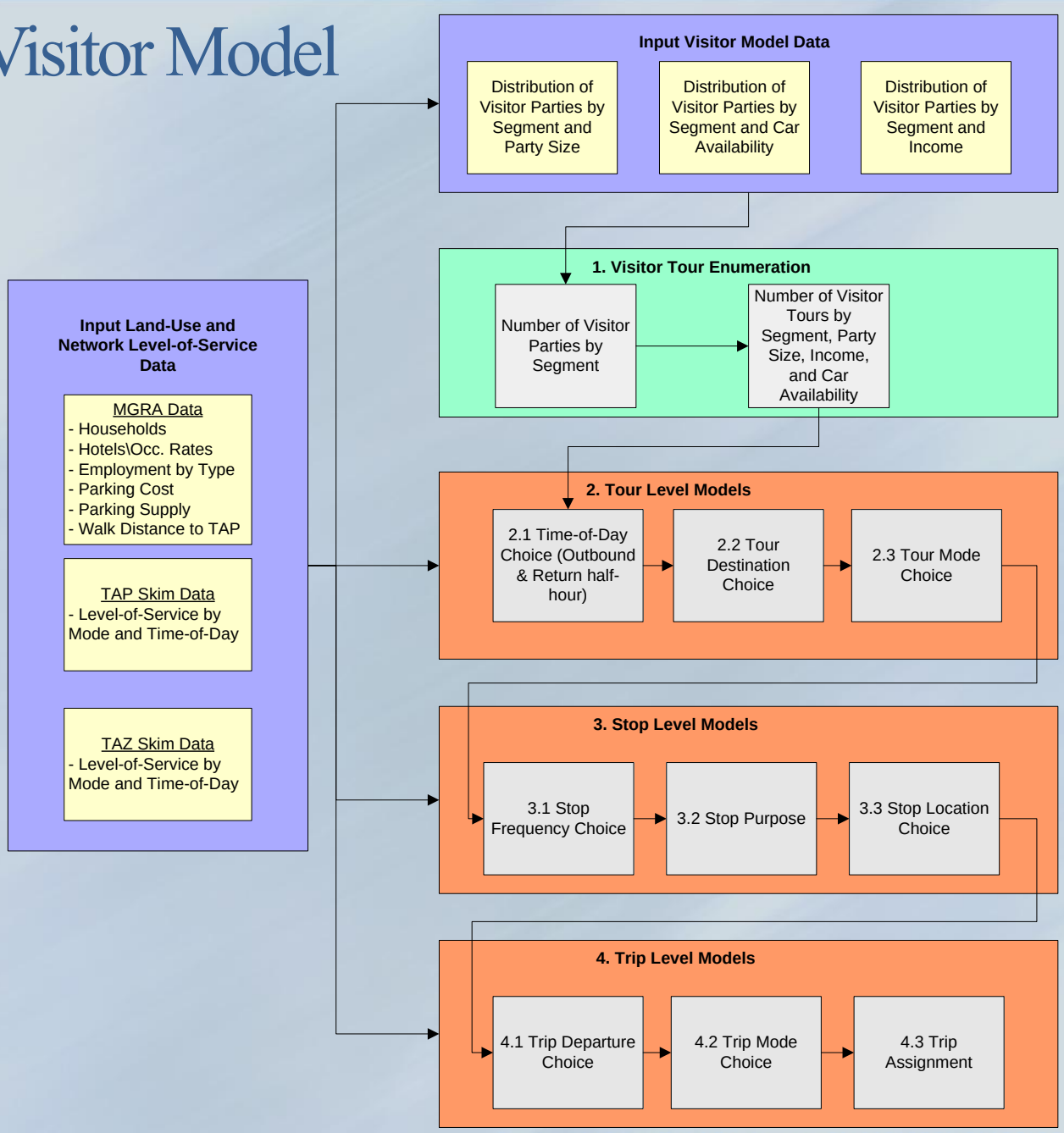
Computation of Transit Access

- Step 1: Build TAP to TAP transit skims
- Step 2: For each MAZ, find all TAPs that are walk accessible:
  - Walk paths are routed over an "all-street" network
  - Maximum access distance can vary depending on mode that serves a TAP
  - Longer access/egress distances observed on premium modes
- Step 3: For each MAZ pair that is walk accessible,
  - Compute all possible transit paths
  - Keep the best path for each line-haul mode

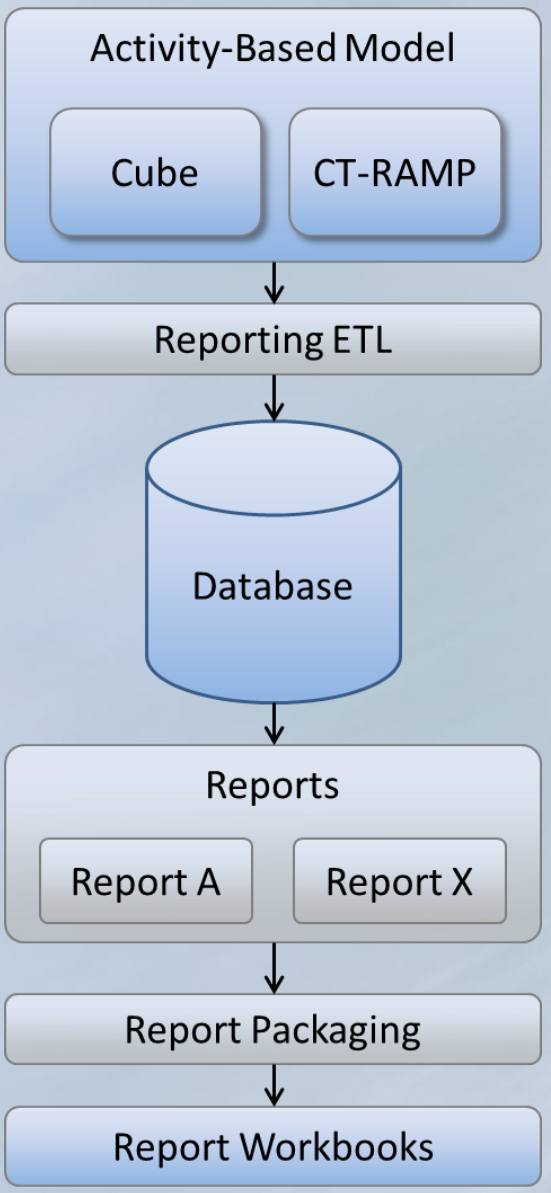
Trip-Level Choices



Visitor Model



SERPM ABM Reports



SERPM ABM Reports

- Stores relevant model inputs and outputs so the user does not need to interact with Cube or CT-RAMP to generate model reports
- The user may interact with Cube and CT-RAMP directly if desired, but it is not required
- Consistent reporting framework to be used for analysis across model runs
- SERPM7 user community can easily share the scripts that create the reports
- Reports take the form of Excel workbooks

SERPM ABM Reports