Florida Department of Transportation | District 4

Districtwide
Urban Model
Development

SE Regional Planning Model

FDOT System Setup

FDOT System Setup

- Model implemented on three servers, running independently of each other
  - dotsd4hqmodel1.d4b.state.fl.us
  - dotsd4hqmodel2.d4b.state.fl.us
  - dotsd4hqmodel3.d4b.state.fl.us
- Remote access via FDOT VPN
  - At this time access to FDOT cluster is limited to teams working on LRTP

FDOT Machine Specifications

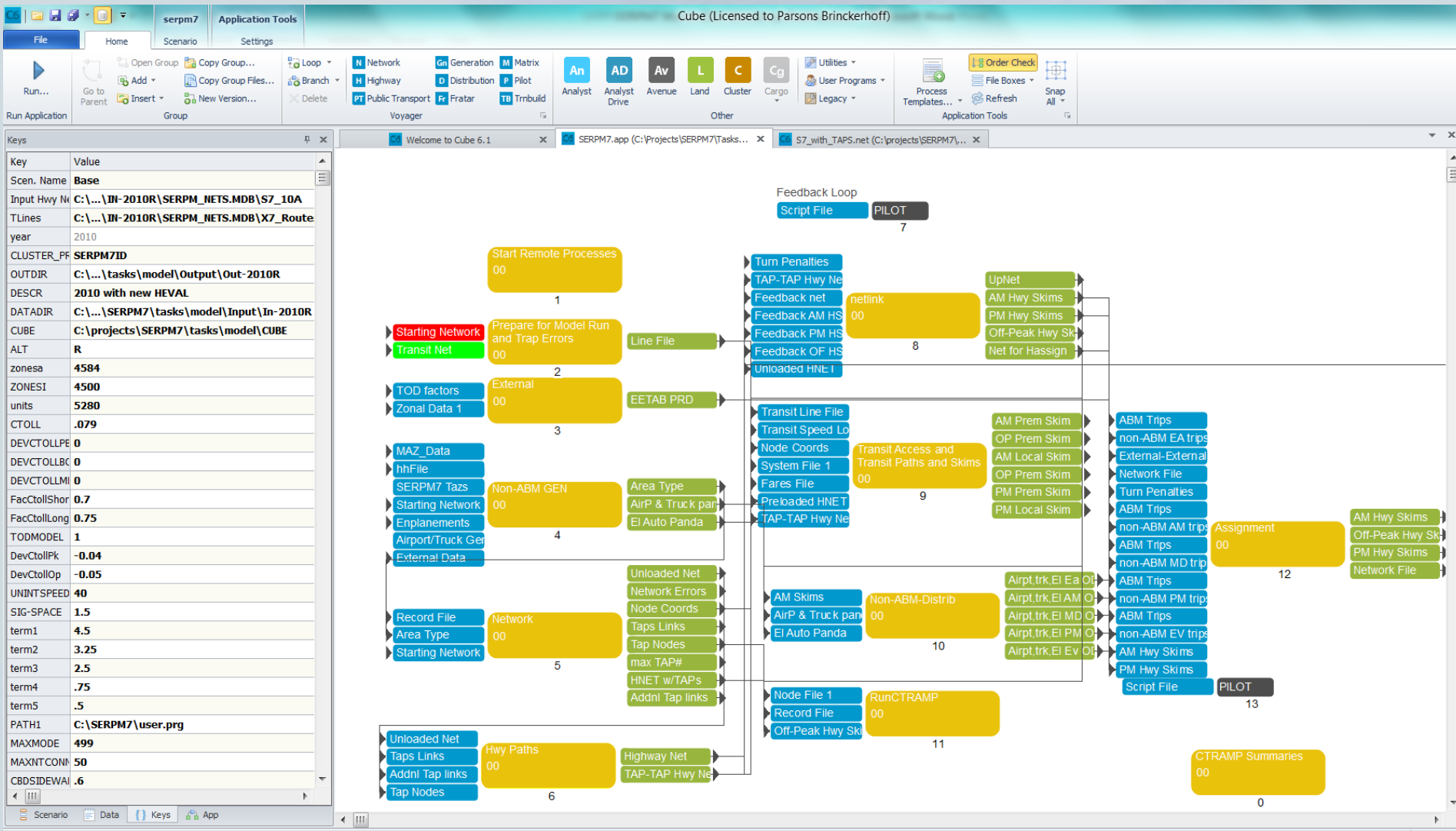
Unit	Brand and Model #	CPU, Speed & # of Logical Cores	RAM	Hard Drive
D4 Model Server 1	Dell PowerEdge R710	Intel Xeon X5690 @ 3.47GHz 2 processors, 12 cores, 24 threads	192 GB	135 GB
D4 Model Server 2	Dell PowerEdge R710	Intel Xeon X5690 @ 3.47GHz 2 processors, 12 cores, 24 threads	192 GB	930 GB
D4 Model Server 3	Dell PowerEdge R720	Intel Xeon E5-2650 @ 2.00GHz 2 processors, 16 cores, 32 threads	256 GB	465 GB & 3.63 TB
D4 Model WorkStation	Dell Precision WorkStation T7500	Intel Xeon W5580 @ 3.20GHz 2 processors, 4 cores, 8 threads	100 GB	279 GB & 1.36 TB

FDOT System Setup

Name	Date modified	Type	Size
ctramp	2/7/2014 4:02 PM	File folder	
cube	3/12/2014 1:59 AM	File folder	
input	2/7/2014 4:04 PM	File folder	
installers	2/7/2014 4:04 PM	File folder	
Output	2/7/2014 4:12 PM	File folder	
SERPM_ABM_UserGuide_V4.docx	10/7/2013 10:15 PM	Microsoft Word D...	1,703 KB
serpm7.cat	2/7/2014 10:16 PM	Security Catalog	8 KB

Open the catalog to access the model

Cube User Interface / Modeling Platform



Running SERPM7 – Existing Scenario

- Step 1 -- Select a scenario
- Available scenarios
  - 2010 Base Year Validation
  - 2040 LRTP Existing plus Committed Scenario
  - 2040 LRTP Needs Plan Scenario
- Scenario data are stored in the \input and \output folders

Running SERPM7

- Step 2 – Update the catalog keys to point to the selected scenario folders and scenario input file names

Catalog Key	Description
DESC	Scenario descriptive label (used in reports)
ALT	Scenario identifier (one letter)
year	Year
DATADIR	Input folder (full path name)
OUTDIR	Output folder (full path name)
Input Hwy Net	Input highway network layer (full path name)
TLines	Input transit route layer (full path name)

Running SERPM7

- Step 3 (Optional) – Update HEVAL catalog keys with appropriate values for the run. Default values in parenthesis.

Catalog Key	Description
AnalysisYr_TTV_VOC	Analysis Year (2010)
BaseYr_TTV_VOC	Base Year (2010)
Inflation_TTV	Value of time inflation rate (0%)
Inflation_VOC	Auto operating cost inflation rate (0%)

Running SERPM7

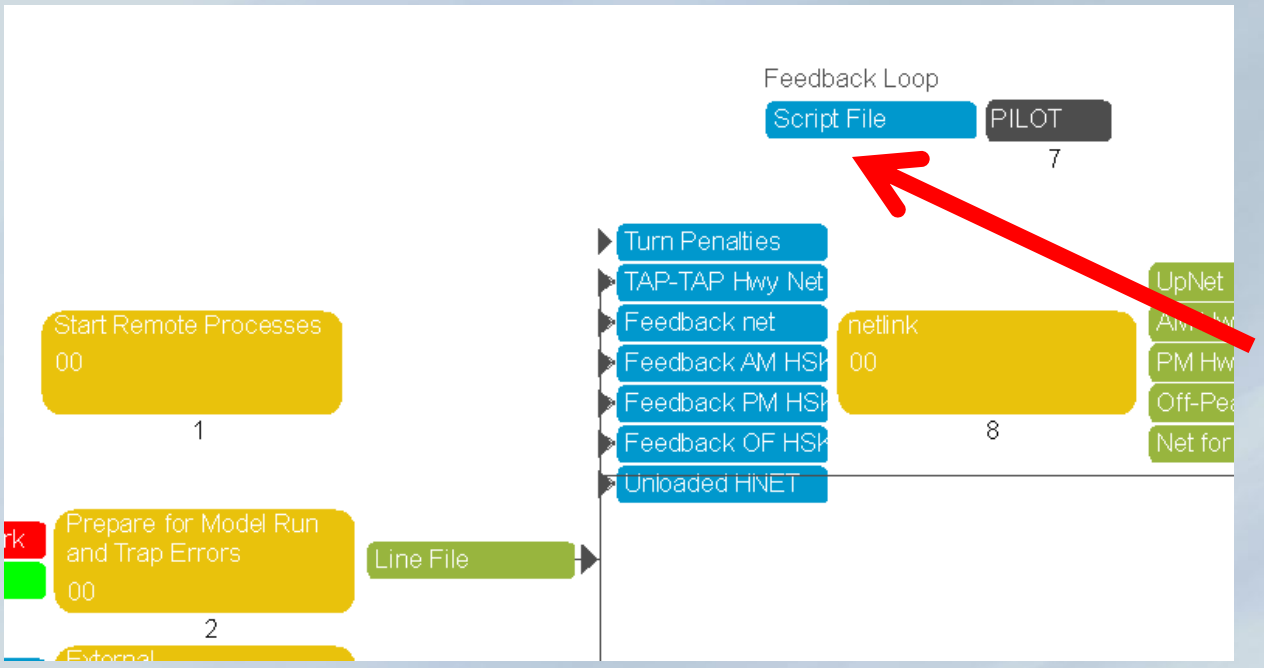
- Step 4 -- Set the population sampling rates

Catalog Key	Description
SAMPLERATE	Sampling rate for the resident population
VSAMPLERATE	Sampling rate for the visitor population

- Example:
  - samplerate = 0.5 …. 1 out of every 2 households is simulated
  - samplerate = 0.1 …. 1 out of every 10 households is simulated
  - vsamplerate = 0.25 …. 1 out of every 4 visitor parties is simulated

Running SERPM7

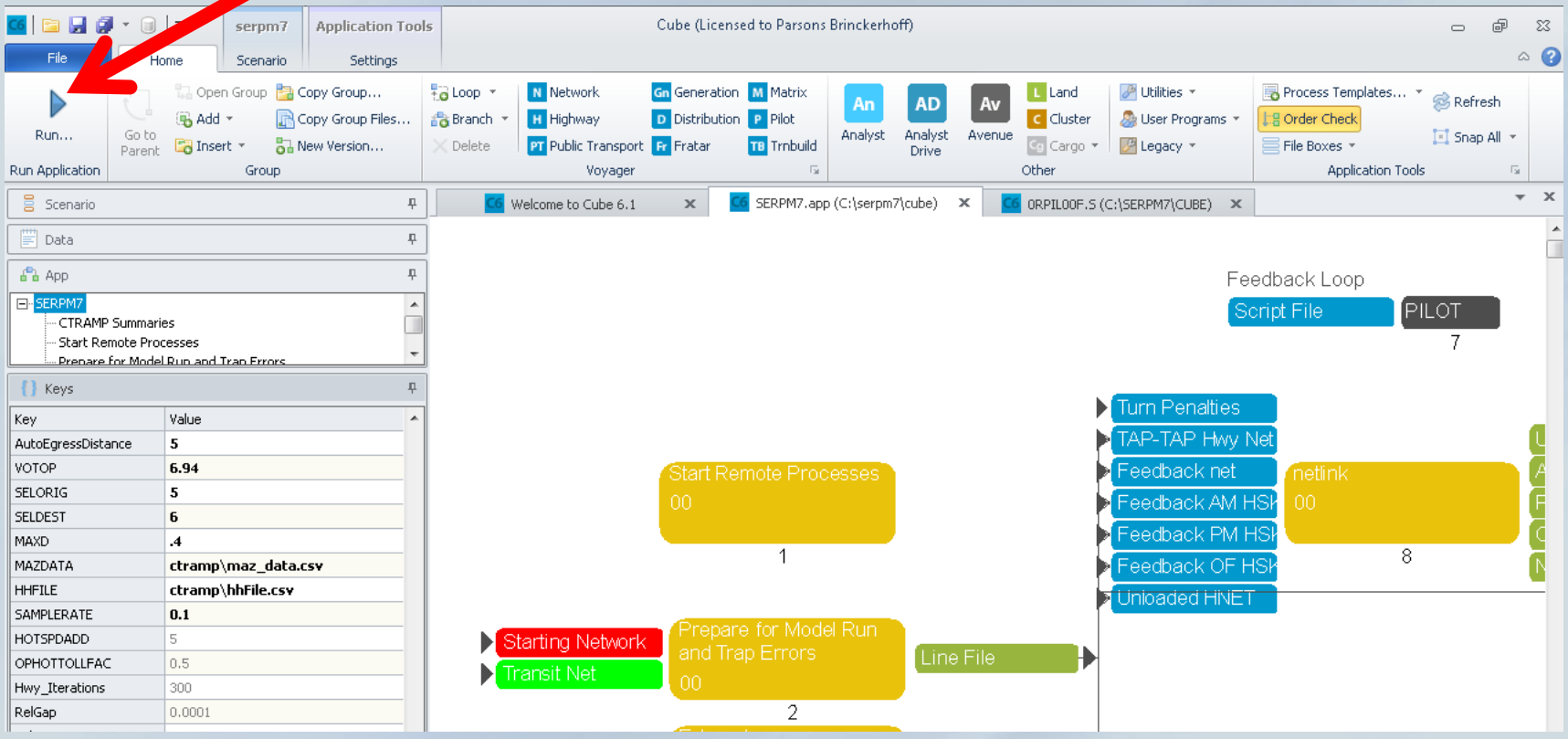
- Step 5 (Optional) – Update the number of feedback iterations
  - Default settings
    - Run until travel time convergence (0.1 RMSE)
    - Maximum 5 feedback loops



Set the loop counter; can be more or less than 5

Running SERPM7

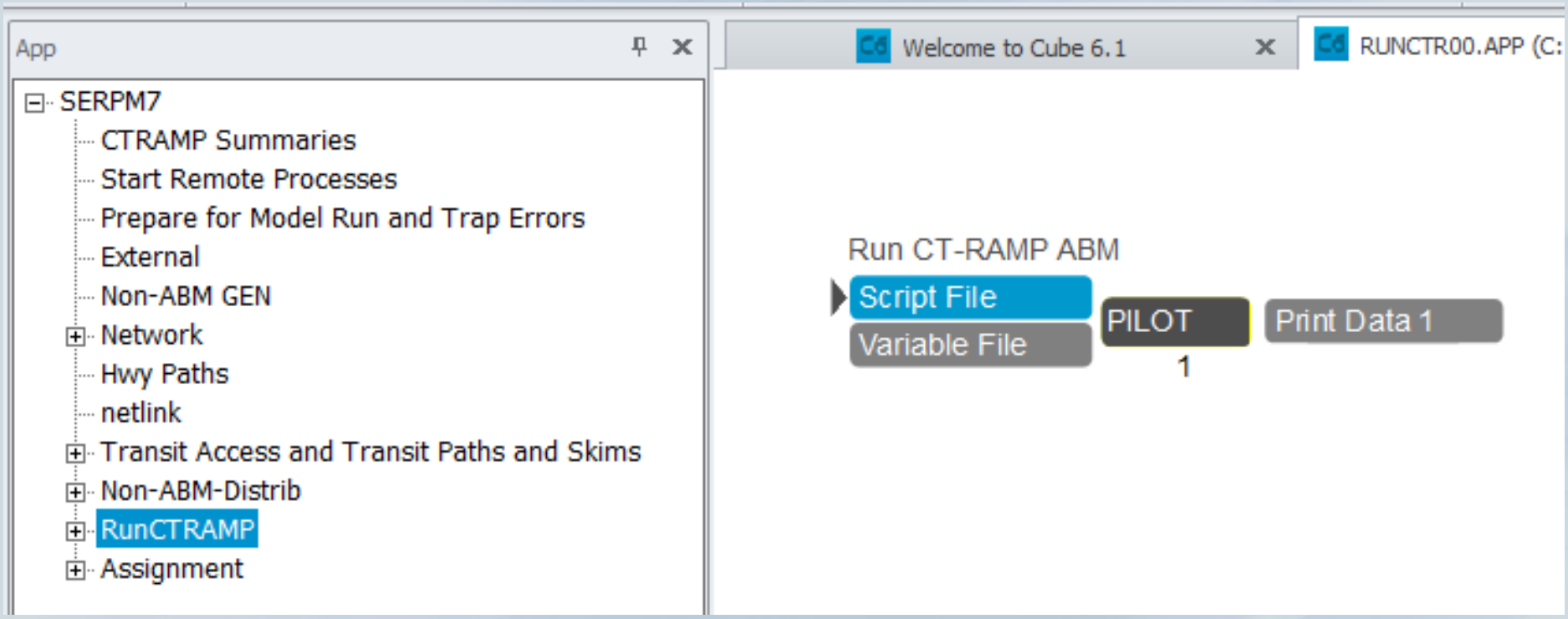
- Step 6 – Press Run



Running SERPM7

- All model steps except CT-RAMP and Visitor Model are implemented in Cube Script:
  - Highway Network Building
  - Transit Network Building
  - Non-ABM Trip Generation and Trip Distribution
  - Highway and Transit Assignment
  - Highway Evaluation Reports
- CT-RAMP and Visitor Model are implemented in Java; they are run by Cube using DOS prompt commands

Running SERPM7



Running SERPM7

RunCTRAMP Pilot Script

```
*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
```

Run CT-RAMP Pilot Script

Step 1 – Create access files

```
*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
```

Run CT-RAMP Pilot Script

- Step 1 – **runCreateAccessFiles.cmd**
  - Creates the walk and transit access & egress connectors:
    - MAZ to MAZ connectors
    - MAZ to TAP walk connectors
    - TAZ to TAP drive connectors
  - Fully implemented in Cube script
  - Runs only during the initial feedback loop

```
rem ### Set location of Voyager for running Cube scripts
set VOYAGER="C:\Program Files
(x86)\Citilabs\CubeVoyager\Voyager.exe"

rem ### create CT-RAMP maz impedances and maz densities
%VOYAGER% C:\serpm7\ctramp\application\save_maz_dbf.s /Start
%VOYAGER% C:\serpm7\ctramp\application\abm_access_files.s /Start
%VOYAGER% C:\serpm7\ctramp\application\maz_densities.s /Start
```

Run CT-RAMP Pilot Script

Step 2 – Start Household & Matrix Managers

```
*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
```

Run CT-RAMP Pilot Script

- Step 2 – Start Household and Matrix Managers
  - Java applications used by the ABM software to read/write Cube matrices and for distributing household “jobs” to computer threads

Run CT-RAMP Pilot Script

Step 3 – Run SERPM ABM and Visitor Model

```
*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
```

Run CT-RAMP Pilot Script

- Step 3 – Run SERPM ABM and Visitor Models
  - Sets and runs SERPM ABM (runSERPMABM.cmd)
    - Sets environment variables
    - Gets sampling rates, project folders and other run-time variables
    - Sets the ABM properties file
    - Calls SERPM ABM and Visitor Model JARS (executables)

Run CT-RAMP Pilot Script

Step 4 – Create Trip Tables for Assignment

```
*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
```

Run CT-RAMP Pilot Script

- Step 4 – **createDemandMatrices.cmd**
  - Creates Cube format trip tables for highway and transit assignment
  - Translates the ABM & Visitor Model list of trips into matrix format
  - Three sets of demand matrices
    - Resident trips
    - Visitor trips
    - Resident + Visitor trips
  - This step is implemented in Cube Script

The CT-RAMP Properties File

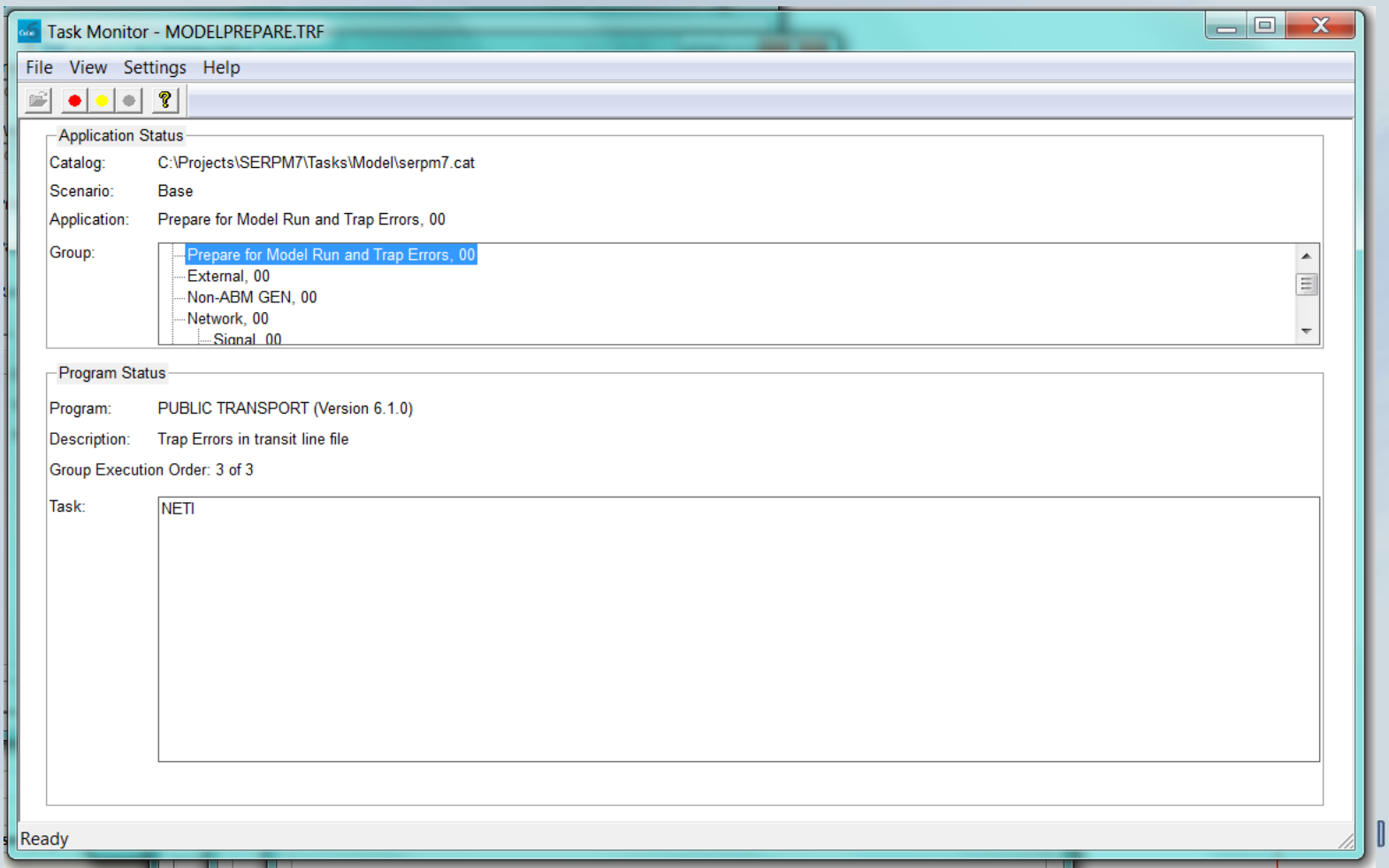
- A settings file is used to control the ABM software
  - **\ctramp\serpm_abm.properties**
- The majority of the properties (settings) in this file are set during model installation and do not need to be changed for a typical model run
- Properties are described in the User Guide
- Example properties:
  - Settings to control trace calculations
  - System environment properties
  - Input and output filenames
  - Settings that specify how to read the utility expression calculators (UECs)

The CT-RAMP Properties File

- Exhibit: serpmabm.properties

Monitoring Run Status/Progress

- Cube scripted components: progress is tracked by Cube's Task Monitor



Monitoring Run Status

- Java components: status is reported to the log files
  - ..\Cube\logFiles\event.log
  - ..\Cube\logFiles\...
- The log files are text files that can be opened with any text editor (Notepad, Wordpad, Ultraedit, etc.)
- What is reported?
  - Step being executed
  - A few model output summaries
  - Errors
  - Trace calculations
- *While Java components are running, status of Task Monitor does not change*

Monitoring Run Status

- Exhibit: cube\event.log

Running SERPM7 – New Scenario

- Step 1 – Create input and output scenario folders
  - Suggested scenario naming convention
    - ..\input\IN-{YEAR}{ALT}
    - ..\output\OUT-{YEAR}{ALT}
- Copy all input files from an existing scenario, including all subfolders
- Update new scenario-specific files
  - Highway / transit networks
  - Household / person synthetic population
  - Land use data
- Proceed with Steps 2 thru 6 for running an existing scenario

FDOT Servers Run Times

Model Server 3, 20% Sample

Feedback Loop	End Time	Runtime (HH:MM)	RMSE (AM & PM)
1	9:45	10:45	12.26 & 13.63
2	16:48	7:03	0.60 & 0.58
3	1:19	8:31	0.23 & 0.20
4	8:06	6:47	0.12 & 0.09
5	14:58	6:52	0.08 & 0.06
Total		~40 hrs	

FDOT WorkStation Run Times

CT-RAMP Only

Machine	Sample Size	Run Time (HH:MM)
Model WorkStation	1%	0:48
	5%	2:40
	10%	5:03
	20%	9:49
Model Server 3	20%	4:00

Model Installation

SERPM7 Installation

- Installation package and User Guide available from Florida DOT, via FSUTMS Online
- Hardware and software requirements, and installation instructions described in User Guide
- Sample model output available from Florida DOT

SERPM7 Installation

- Hardware Requirements
  - 64-bit Operating System
  - Intel Xeon X5690 @ 3.47 GHz 6 core processors or similar
  - Minimum 96 GB RAM
  - Minimum 1 TB space for storing model output
- Software
  - Cube 6.1 w/cluster license
  - SQL / SQL Express
  - Java
  - Microsoft Excel (optional)

SERPM7 Installation

- Step 1 – Create the Project Folder
  - Set user permission level to ‘Everyone’
- Step 2 – Configure the machines
  - Set environment variables
  - Install Java and set its environment variables
  - Verify/install Cube 64-bit matrix I/O DLL
  - Other …
- Step 3 – Configure the JPPF services
- Step 4 – Configure the “Run” component files
- Step 5 – Configure SERPM7 in Application Manager
- Step 6 – Create the seed skims

Application 1: Working with a Population Sample

Working with a Population Sample

- A simulation of the entire population is not required for every single application
  - Small sample sizes are sufficiently accurate for forecasting aggregate region or county-wide statistics
  - Small sample sizes save run time during model calibration, and when testing initial versions of new networks and other input data

Working with a Population Sample

- Developing a region-wide forecast using travel outcomes for a sample of the population is analogous to estimating region-wide travel statistics using a survey sample

Survey	Simulation
Gathers trip diary information for a sample of households	Simulates trips for a sample of households
Typical sampling rate: 0.20% - 0.25%	Typical sampling rate: 5% - 50%
Estimates travel patterns for entire population by multiplying each *surveyed trip record* by an expansion factor	Estimates travel patterns for entire population by multiplying each *simulated trip record* by an expansion factor
Typical expansion factors: 100 - 1000	Typical expansion factors: 2 - 20

Working with a Population Sample

- The ABM assumes that each household makes travel decisions independently of the decisions made by all other households
- Households are simulated independently of each other
- The ABM samples randomly from the list of households to select the ones it simulates
- It is prudent to verify that the selected population sample is unbiased
  - A very small (1% or less) simple random sample is likely to be biased, for example it will likely mis-represent households that are found infrequently in the population
  - Samples of 10% or more are typically sufficiently unbiased for travel demand forecasting applications

Working with a Population Sample

- How big a sample to use?
  - The more localized the expected impact of a project, the larger the required sample
- Some recommendations ...
  - For model calibration and validation, 10%-25% is typically sufficient
  - For comparing aggregate county-wide and sub-county average travel statistics: 10% - 25%
  - For estimating daily traffic volumes on high capacity facilities and high capacity transit: 25% - 50%
  - For traffic impact studies: 50% - 100%
- … but testing highly encouraged!

Working with a Population Sample

- A sample expansion factor is applied when creating the trip tables for assignment
- Expansion factor = 1/samplingRate
- Loads on highway and transit networks are representative of the entire population
- Summaries produced from the ABM list output need to be expanded to be representative of the entire population

Running SERPM7 with a Population Sample

- Setting the run:
  - Set the sampling rate for residents and visitors in Cube
  - All other model settings can remain unchanged

Catalog Key	Description
SAMPLERATE	Sampling rate for the resident population
VSAMPLERATE	Sampling rate for the visitor population

- The same sampling rate is used on all feedback loops

Running SERPM7 with a Population Sample

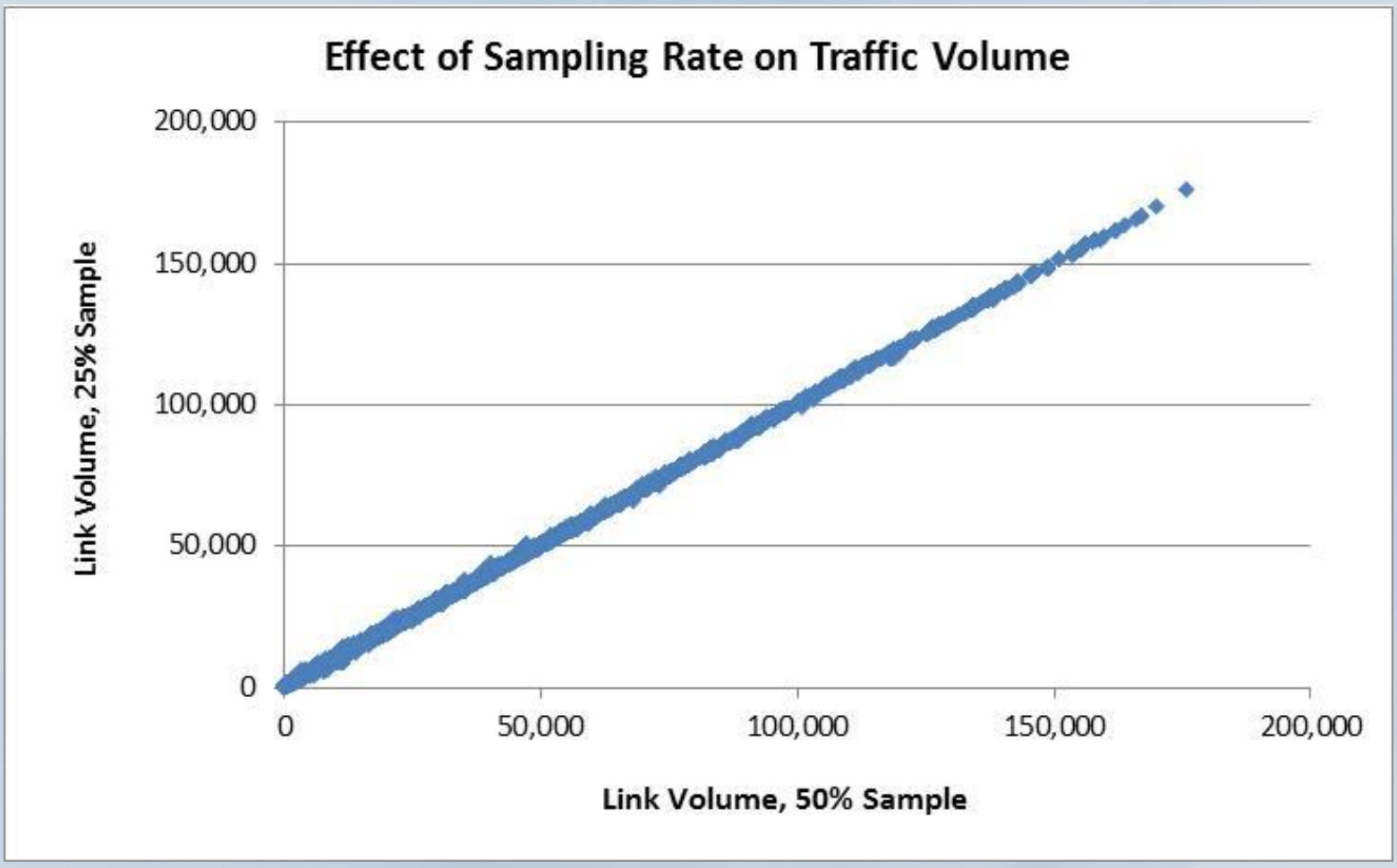
- When working with a “less than 100%” model run, each record in the output list files has to be expanded by 1/samplingRate
  - householdData_v1.csv
  - personData_v1.csv
  - indivTourFile_v1.csv
  - jointTourFile_v1.csv
  - indivTripFile_v1.csv
  - jointTripFile_v1.csv
- Trip tables are already expanded
  - TAZ_Demand_{t}.mat
  - TAP_Demand_{t}.mat

Running SERPM7 with a Population Sample

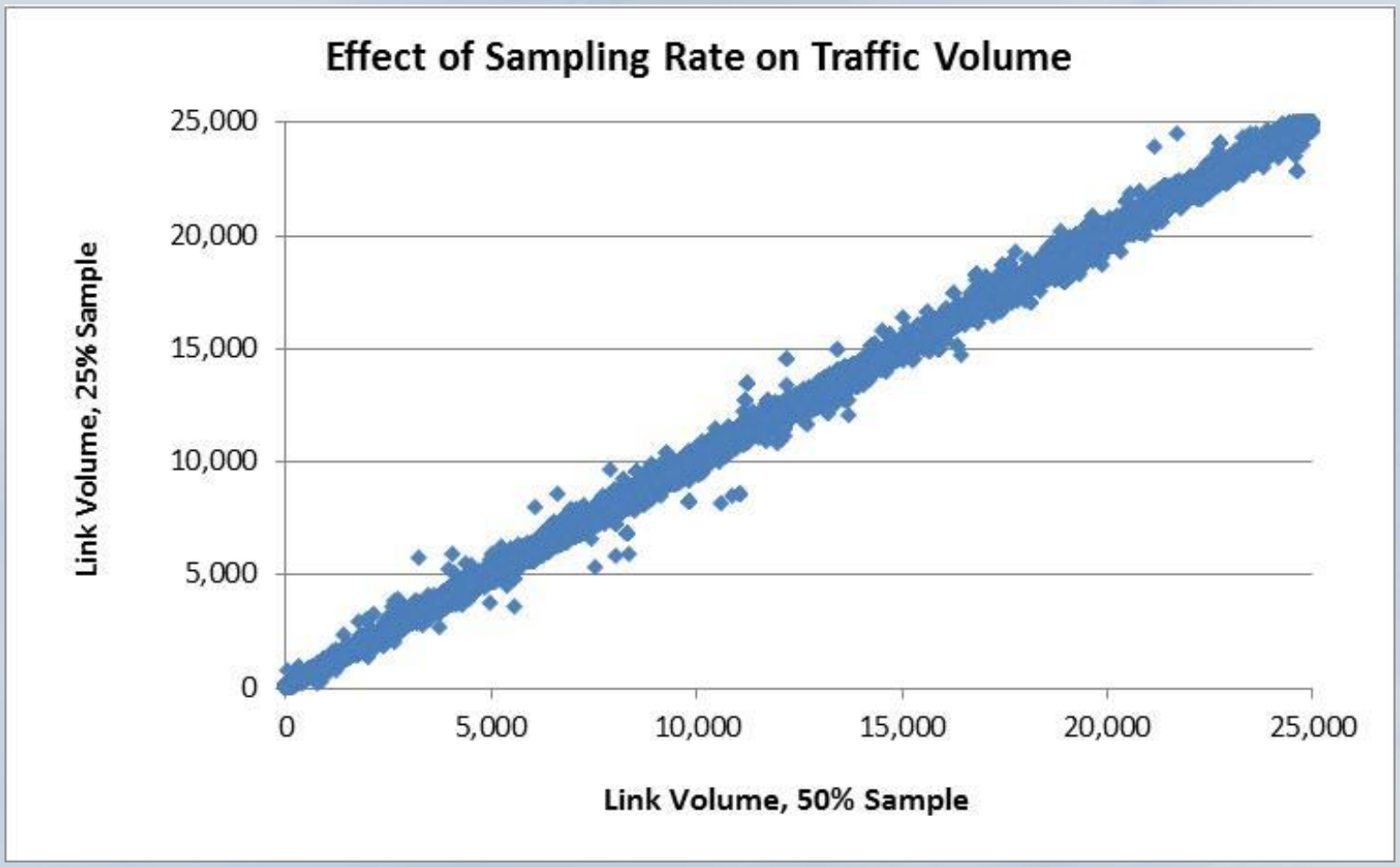
- Sample Output – County-wide highway assignment statistics

Screenline	25% Sample	50% Sample	Diff (%)
BO:EW Northern SL along Pompano Canal	842,418	843,591	-0.1%
BO:EW Middle SL along Oakland Park Blvd	1,187,251	1,183,529	0.3%
BO:EW Southern SL along River Canal	881,601	879,618	0.2%
BO:NS Western SL between I75 and TPK	586,412	587,353	-0.2%
BO:NS Middle SL along TPK	1,441,311	1,437,065	0.3%
BO:NS Eastern SL along Intracostal Wway	328,855	326,298	0.8%
BO:EW SL BO/PB County Line	648,960	648,771	0.0%
BO:EW SL BO/MD County Line	979,327	976,276	0.3%
BO:Western Ext CL @ Collier County Line	31,059	31,059	0.0%
BO:NS I-95 CL from Miami-Dade to I-595	510,207	509,537	0.1%
BO:NS Western CL along SR897 frm PB-SR816	494,591	495,547	-0.2%

Running SERPM7 with a Population Sample

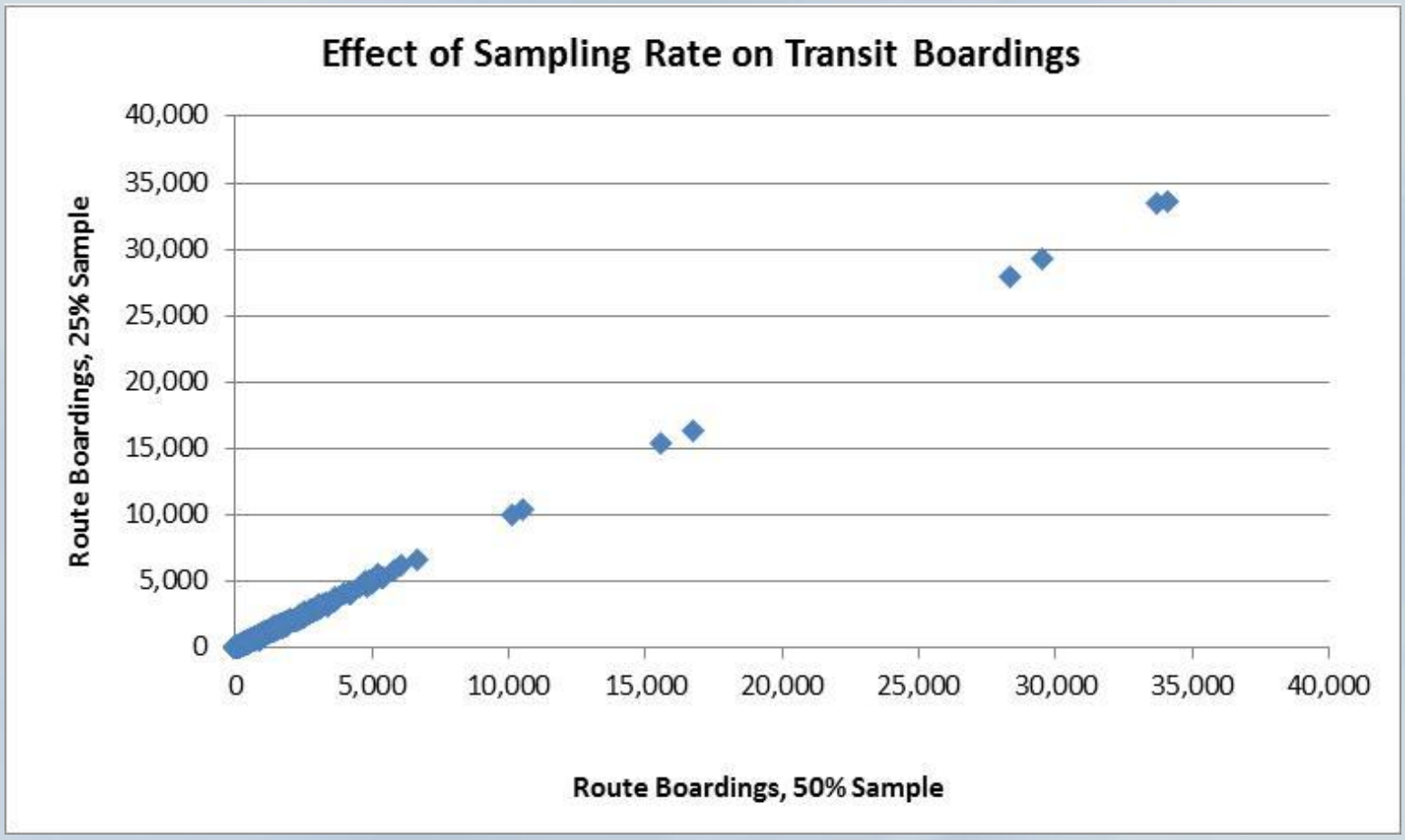


Running SERPM7 with a Population Sample



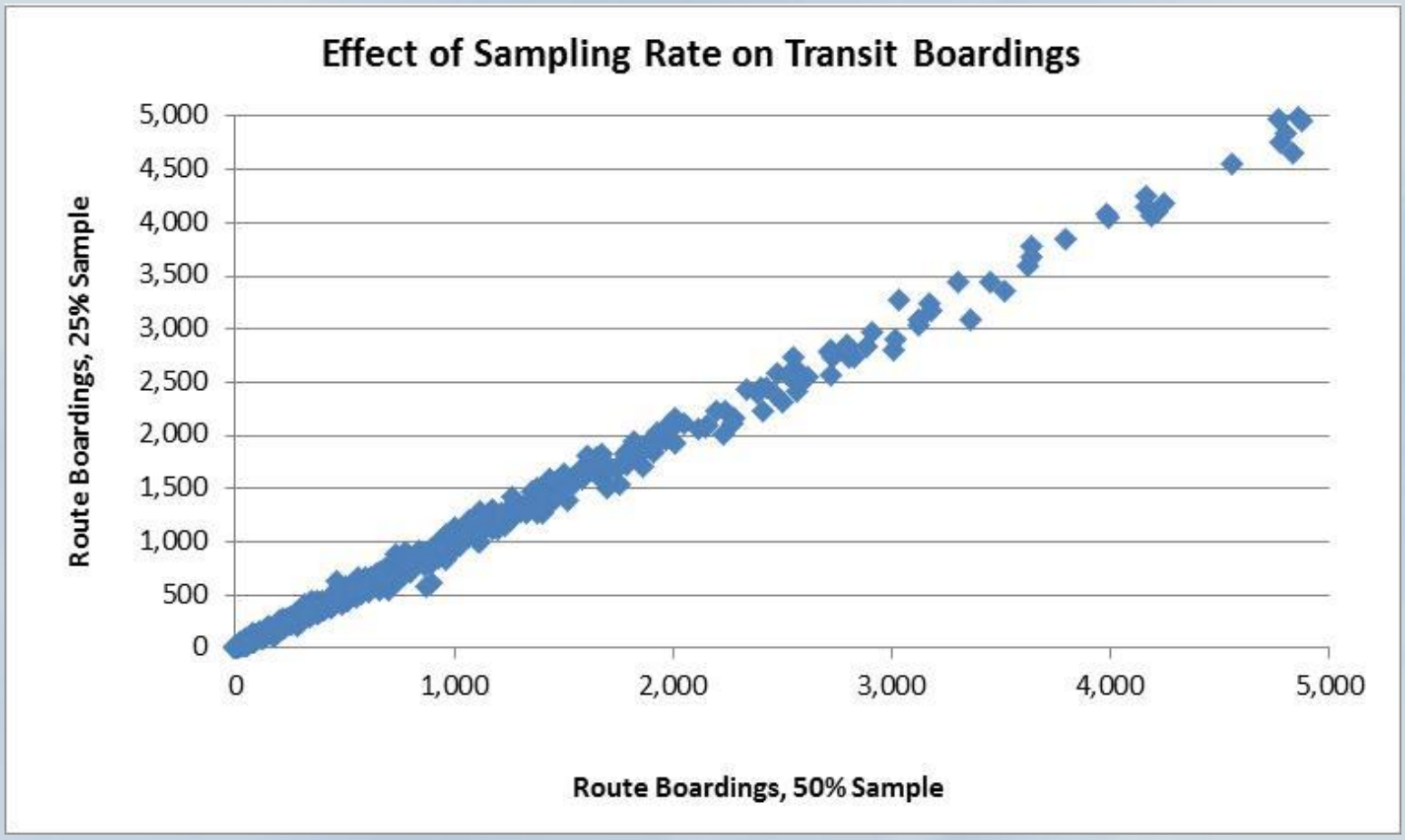
Running SERPM7 with a Population Sample

- Sample Output – Individual Route Boardings



Running SERPM7 with a Population Sample

- Sample Output – Individual Route Boardings



Running SERPM7 with a Population Sample

- Sample Output – Regionwide Household Income Profile

Household Income	25% Sample	100% Sample
Less than $10,000	10.15%	10.21%
$10,000 to $15,000	4.70%	4.68%
$15,000 - $20,000	5.66%	5.64%
$20,000 to $25,000	5.19%	5.16%
$25,000 to $30,000	4.93%	4.94%
$30,000 to $35,000	4.75%	4.77%
$35,000 to $40,000	3.87%	3.87%
$40,000 to $45,000	3.43%	3.45%
$45,000 to $50,000	3.48%	3.48%
$50,000 to $75,000	17.54%	17.47%
$75,000 to $100,000	14.32%	14.33%
$100,000 or More	21.98%	22.00%

Application 2: Population Synthesis

Population Synthesis

- Each SERPM7 scenario requires a synthetic population
  - List of households -- hhFile.csv
  - List of persons that make up the households -- personFile.csv
- Two synthetic populations have been developed to date:
  - 2010 base year population
  - 2040 long range transportation plan population

Population Synthesis

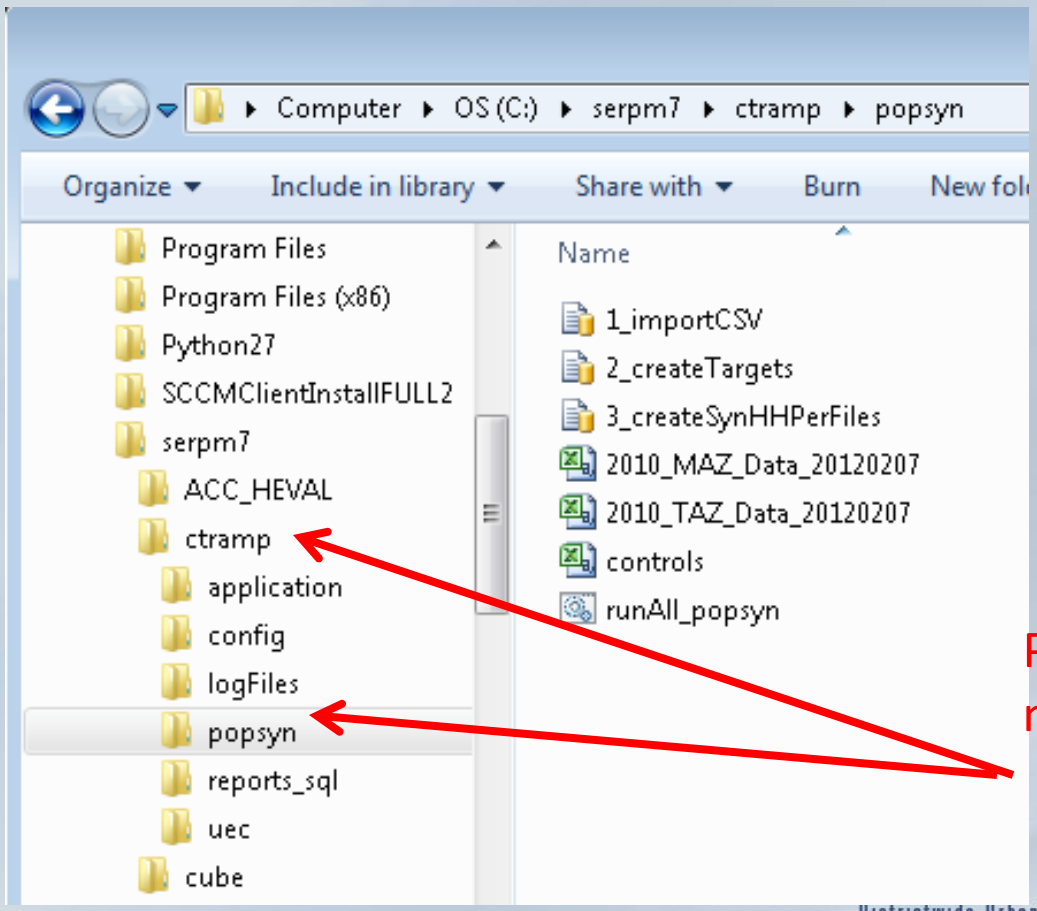
- New synthetic populations will be required for:
  - Other regional scenario years (e.g., 2020, 2025, 2045)
  - To test population and land use scenarios, such as
    - Traffic impact study for a new housing or commercial development
    - Impact of aging population
    - Impact of rising sea levels (because some neighborhoods will no longer be inhabitable)
    - Refinements to the 2010 and 2040 populations

Population Synthesis

- The population synthesizer (PopSynII) does not run normally as part of SERPM7
  - SERPM7 expects input population files in the \input folder
  - User is responsible for running PopSynII to generate the required population files and place them in the scenario folders prior to a SERPM7 run
- Why?
  - Because a new synthetic population is not required for every run

PopSyn II Setup

- PopSynII is already configured to run on the FDOT servers
- Java application using SQL data storage



PopSynII installed in the main ctramp folder

PopSynII Setup

- The \ctramp\popsyn folder

Filename	Description
runAllPopsyn.bat	Batch file that controls the execution of PopSynII
controls	SQL settings file that specifies the population attributes used as controls
1_importCSV.sql 2_createTargets.sql 3_createSynHHPerFiles.sql	SQL scripts that run the PopSynII software
2010_TAZ_Data.csv	TAZ input control data
2010_MAZ_Data.csv	MAZ input control data

Developing a New Synthetic Population

- Step 1 – Prepare the input files
  - TAZ controls: 2010_taz_data.csv
  - MAZ controls: 2010_maz_data.csv

Developing a New Synthetic Population

- MAZ Control input file, e.g., 2010_maz_data.csv
  - Estimates of total households and persons living in group quarters
    - Total households
    - Total group quarter population
  - One record for each MAZ

Developing a New Synthetic Population

- TAZ Controls input file -- e.g., 2010_taz_data.csv
  - Estimates of number of households or population for each SERPM7 controlled attribute:
    - Household size
    - Household income
    - Household workers
    - Type of dwelling unit
    - Presence of children in the household
    - Population age group
    - Gender
    - Race/ethnicity
    - Population in group quarters
  - One record per TAZ

Analogous to the TAZ SE data file in the trip-based model!

Developing a New Synthetic Population

When preparing TAZ and MAZ control data, it is critically important to maintain internal data consistency!

Developing a New Synthetic Population

- Some data checks to perform and problems to look out for:
  - The household and person marginals pertain to household residents only, except for the group quarter controls
  - All household-based marginals add up to the same total households for each TAZ
  - All person-based marginals add up to the same total persons for each TAZ
  - The total number of persons implied by the household size marginal is consistent with the sum total of the person marginals
  - The total number of children obtained from the age marginal is consistent with the marginal of households by presence of children
  - Large deviations from 50/50 split of persons by gender is suspect
  - The household income distribution is consistency with the workers-in-household distribution

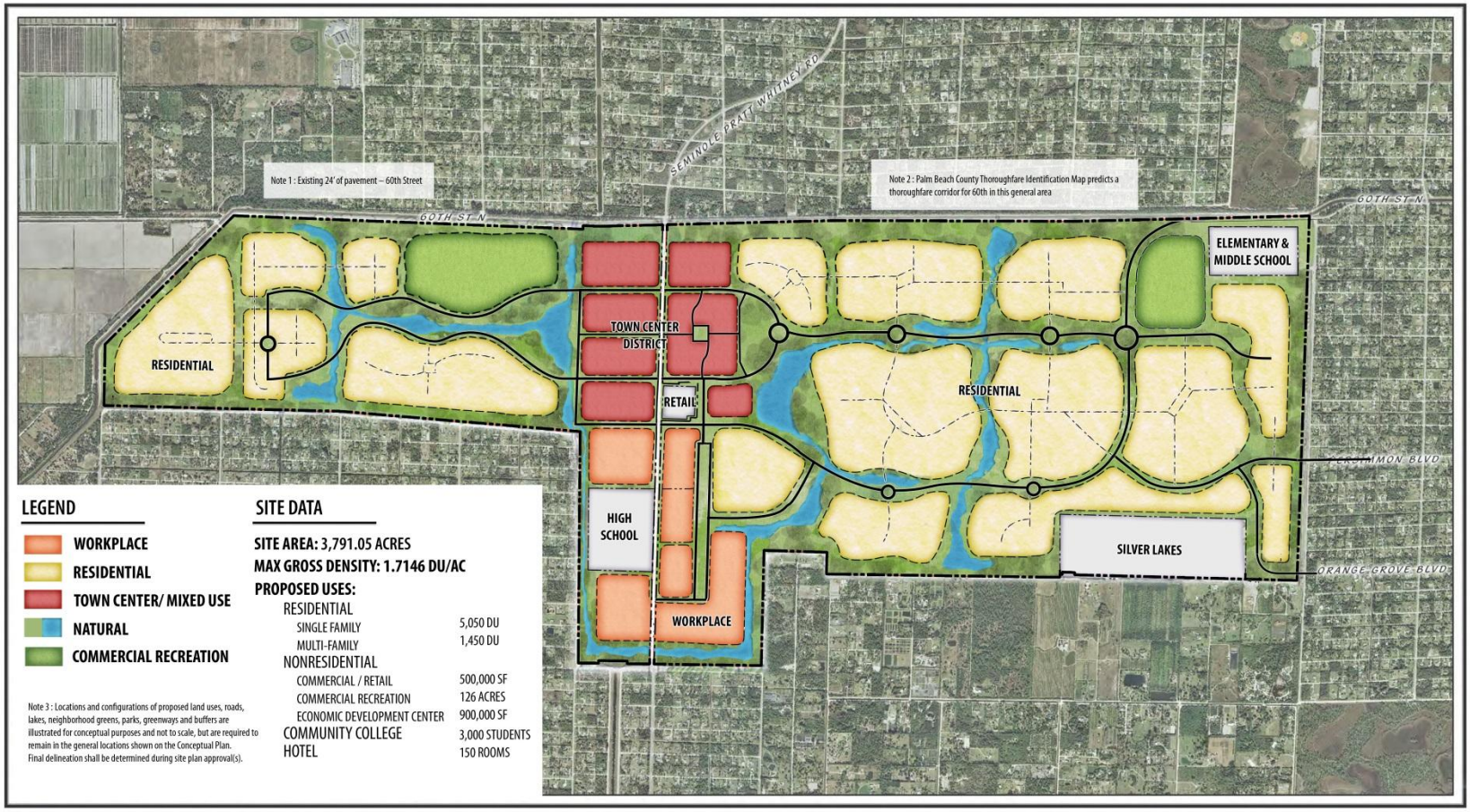
Developing a New Synthetic Population

- More data checks ...
  - The MAZ and TAZ controls should add up
    - to the same number of households by TAZ
    - to the same number of persons in group quarters by TAZ

Developing a New Synthetic Population

- Exhibit – SERPM7 2010 TAZ control file

Example – Minto West, Palm Beach Co



Example – Minto West

- Mixed-use development in a agricultural area, adjacent to an existing housing development
- Information available from proposed/approved plans
  - Single-family dwelling units – 5,050
  - Multi-family dwelling units – 1,040
  - Total population – 14, 535 persons
  - Spatial location of dwelling units by type
- Other PopSyn required data not available from plans (income distribution, age distribution, etc.)
  - Estimate/assert it based on similar existing developments, surrounding neighborhood

Example – Minto West

- Adding households/persons to a TAZ:

Trip-Based Model	Modify the input zonal data file
Activity-Based Model	Modify the population synthesis control file

- Adding TAZs or MAZs to SERPM7 should be a rare occurrence:
  - Households are ultimately allocated to MAZs, and there's already 12,000 of them!
  - Households are represented individually, so the zone attributes are derived from them

Running PopSynII

- Step 2 – Modify the PopSyn settings file for this run
  - Update TAZ and MAZ control filenames in **runAll_popsyn.bat**

```
REM ### BATCH FILE TO SETUP POPSYN RUN, RUN POPSYNII AND OUTPUT CSV FILES #####
REM ################################SETUP#####################################

REM ##PLEASE SET PATH NAMES FOR WORKING FOLDER AND CSV FILE LOCATIONS!!########
SET SERVERNAME=W-AMSTL-D-00052\SQLEXPRESS
SET DATABASENAME=popSyn
SET ARCPATH=C:\popsyn
SET CSVPATH_CONTROLS=C:\popsyn\inputs\controls.csv
SET CSVPATH_MAZ=C:\popsyn\inputs\2010_MAZ_Data_20120207.csv
SET CSVPATH_TAZ=C:\popsyn\inputs\2010_TAZ_Data_20120207.csv


REM ##############################MAIN SCRIPT#################################

REM ##MAKE FILENAMES TABLE#####################################################
REM ##sqlcmd -S SERVER NAME -E -i "INPUT FILE PATH (SCRIPT)" -o "OUTPUT LOG"
REM ##-E means to use Windows authentication for the user that is running the batch
file
SQLCMD -S %SERVERNAME% -d %DATABASENAME% -E -Q "IF OBJECT_ID('dbo.csv_filenames') IS
NOT NULL DROP TABLE csv_filenames;" -o %ARCPATH%\ResultLog.txt
....
....
```

Running PopSynII

- Other PopSyn settings – rarely used in a production run
  - Change the control attributes
  - Change the priority of control attributes

Running PopSynII

- Step 3 – Run PopSynII -- **runAll_popsyn.bat**

Running PopSynII

- Step 4 – Review Output & Check Fit to Controls

Output File	Description
hhFile.csv	List of households
personFile.csv	List of persons
ZoneResults.csv	Comparisons of synthetized households to controlled and uncontrolled attributes
BalanceDetails.csv	
ValidationStats.csv	
ValidationStatsByPuma.csv	

Reviewing PopSyn Output

- Zone_Results.csv
- Comparison of synthesized totals to target totals for each TAZ and controlled attribute

	TOTAL_HOUSEHOLDS			
ZONE	TARGET	SYNTHESIZED	DIFFERENCE	PCTDIFF
1	715	715	0	0
2	811	811	0	0
3	878	878	0	0
4	826	826	0	0
5	1181	1181	0	0
6	212	212	0	0
7	459	459	0	0
8	253	253	0	0

Reviewing PopSyn Output

- Balance_Details.csv
- Same output as Zone_Results, different format

Zone	Control ID	ControlCat	Target	PUMSVal	ConStat
1989	109	TOTAL_HOUSEHOLDS	1508	1508	yes
1989	249	INCOME_25K	273	271	no
1989	19	HHSIZE_4PLUS	467	467	yes
1989	160	FEMALE	2196	2108	no
1989	55	INCOME_100K	258	257	yes
1989	67	MULTI_UNIT	423	407	no
1989	31	WORKERS_3PLUS	164	166	no

Reviewing PopSyn Output

- Validation_Stats.csv
  - Comparison of synthesized attributes to input Census data (5% PUMS)
  - Includes uncontrolled attributes

Description	popSynSum	censusSum	meanDiff	stdDev	minDiff	maxDiff
Universe 1: number of households	2,085,375	1,964,881	17	61	-97	331
% family	67	65	3	17	-26	48
% non family	33	35	0	34	-58	111
% size 1	27	28	0	36	-59	111
% size 2	31	32	-3	14	-30	30
% size 3	17	17	1	22	-37	53
% size 4	25	23	18	50	-46	160

Reviewing PopSyn Output

- Validation_StatsByPuma.csv
  - Same as validation_stats but for each PUMA

- Note that synthesized population may differ from 5% Census population <u>by design</u>

Application 3 – Highway Project

Highway Project

Example Projects

- Toll road extension
- Reversible lanes
- Managed lanes

Overview

How to use SERPM7 to perform a model run and do some standard analysis:

- Option 1 -- Code the project directly on the geodatabase
  - Roadway links
  - Node links
  - Turn penalties
  - [assume no change to transit]
- Option 2 --Code the project on .net files and then build the geodatabase
  - Use flowchart script to build the geodatabase
- Coding is very similar to earlier versions of SERPM
  - Facility types are the same

SERPM Facility Types (not new)

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.

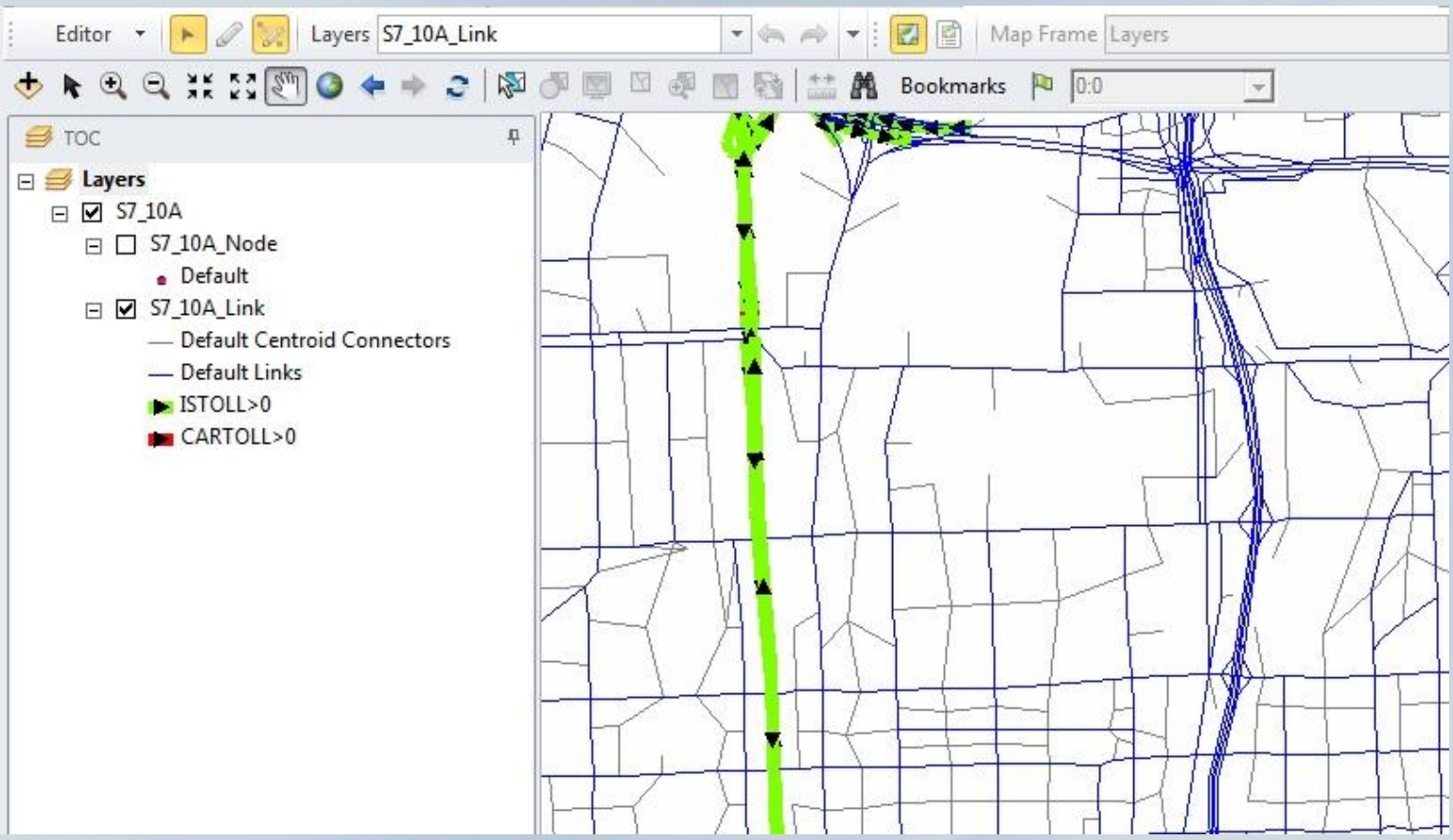
2. All possible variables/adjustments are shown here; some may not be triggered for a given link depending on whether the roadway is divided, is oneway and/or has a left-turn bay.

Editing the Highway Network

- SERPM 7 requires a geodatabase
- Editing can be done either to a .net file or directly on the geodatabase.
- The user can use utilities in the model flowchart to write a .net file from the geodatabase, edit the net, and then write it to the geodatabase.
- The geodatabase must exist to run the model.

Editing in the Geodatabase

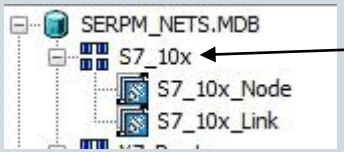
- Simplest and most direct method
- Requires an understanding of the Cube/ArcGIS tools.



Export geodatabase and edit as a .net

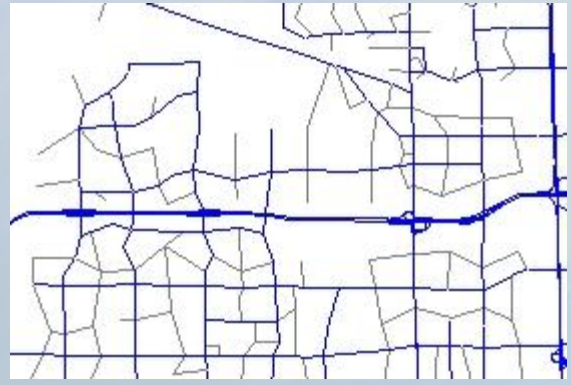
- Start Data Manager
- Open geodatabase (SERPM_NETS.MDB)
- Double click on the network {Input Hwy Net} and specify an output file (maybe “edit.net”)
- Open from Cube and edit as usual
- Use “Prepare for Model Run and Trap Errors” (2) utilities to write back to geodatabase – Reload geodatabase from Cube files:
  - Cull and sort
  - Write to geodatabase

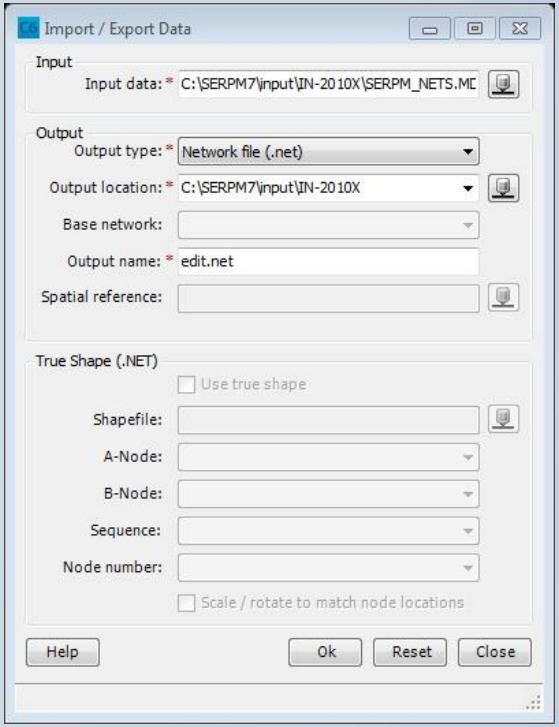
Edit as a .net



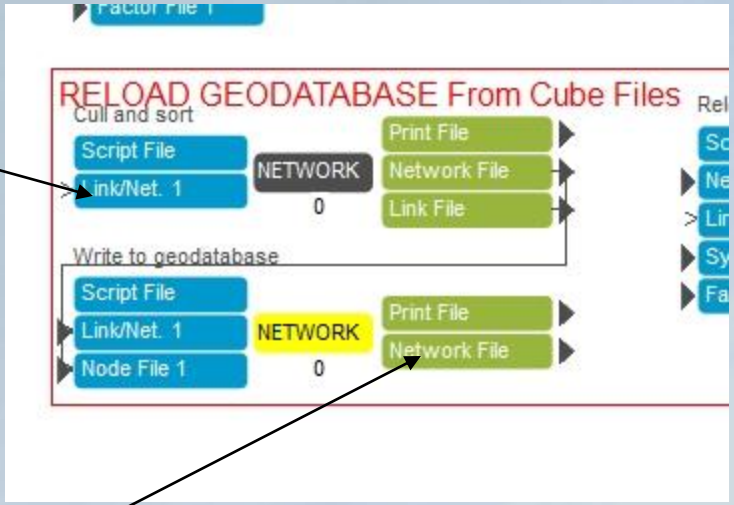
Export

Edit in Cube





Change to point to edited network



{Input Hwy Net}

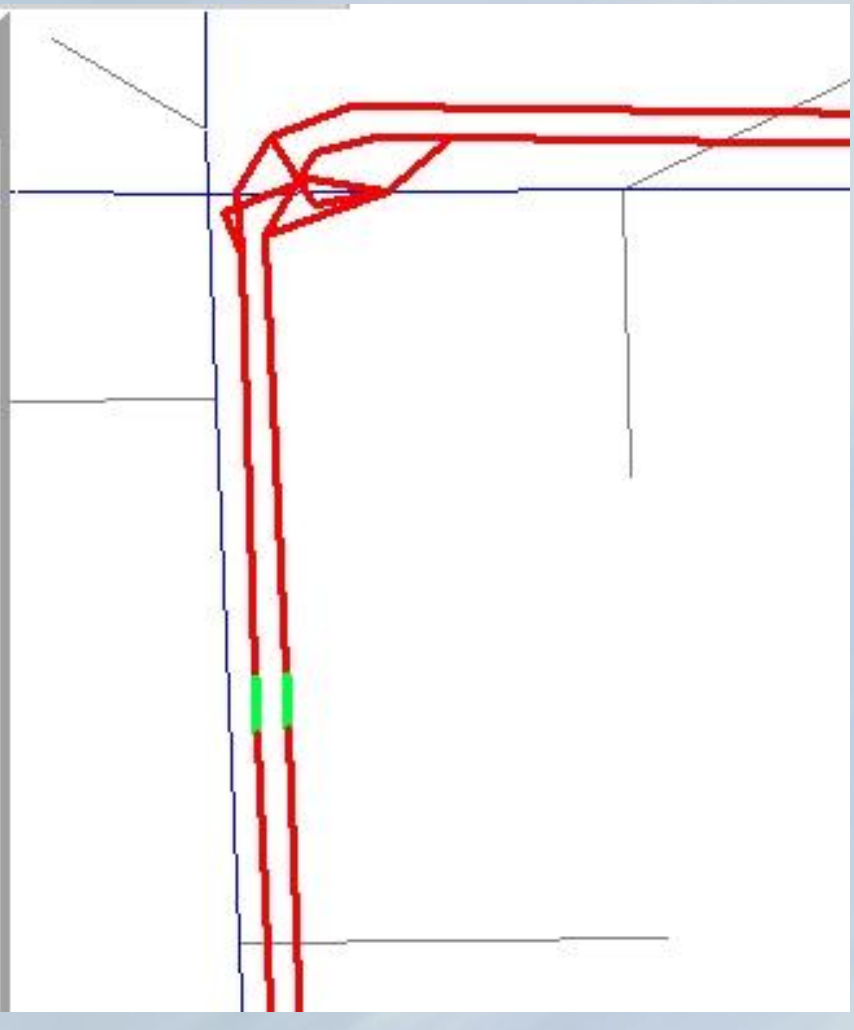
Toll Road Extension

- Short Cut – copy an existing toll link
- No special NODE attributes
- Only new attribute is ISTOLL=1 for all links that could not be used unless a toll were paid
- Toll Mainline: FTC2=91, ISTOLL=1, DIRCODE=1
- Plaza (gantry) – assume all will be electronic collection
  - TOLL=1 DIRCODE=1
  - TOLLTYPE=3 CARTOLL=toll in dollars
  - FTC2=95
  - ISTOLL=1
  - SVCSECONDS=0.01
  - DELCODE=1 ACCELCODE=1 AVILANES=2

Toll Road Extension

Highway Links

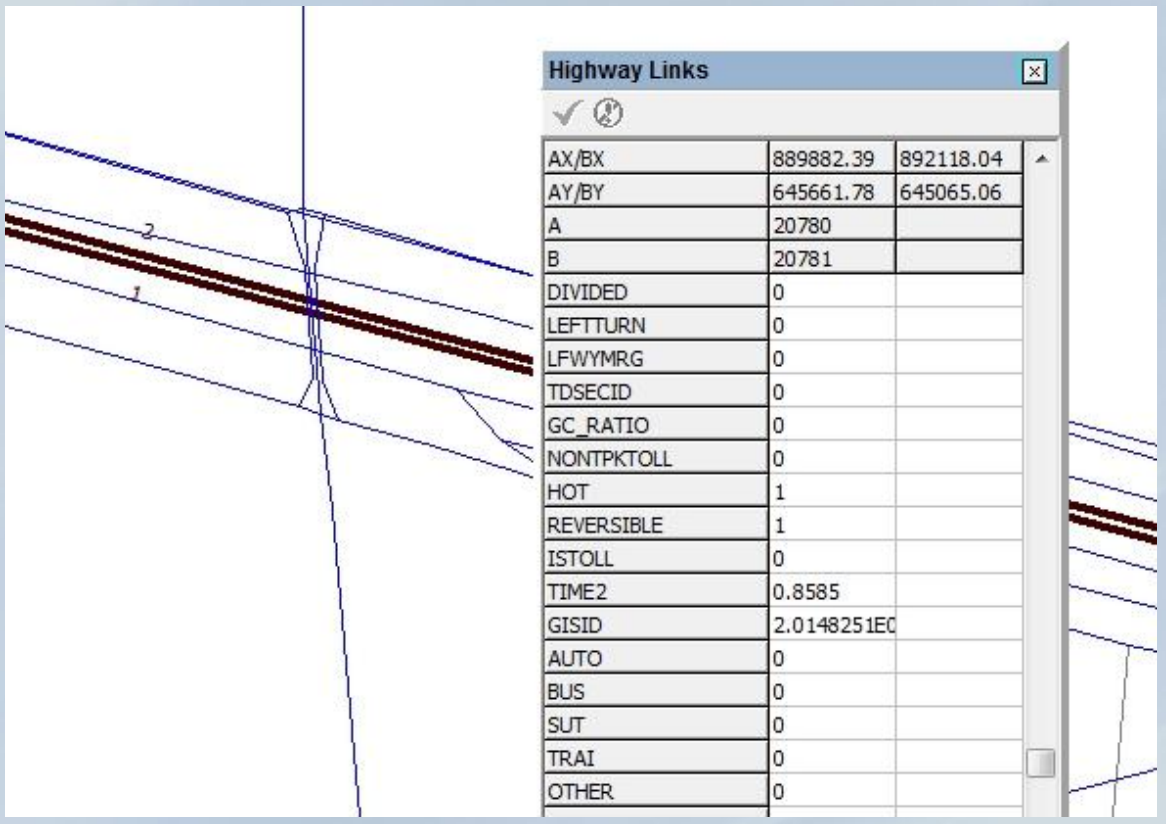
AX/BX	827908.23	827890.45
AY/BY	512141.68	512835.25
A	35328	
B	35327	
DISTANCE	0.1313	
TIME_	0.259	
SCREENLINE	42	
NUM_LANES	2	
TOLL	1	
TWOWAY	0	
DIRCODE	1	
LOCATION	3	
TMODE	0	
TDIST	0	
TSPEED	0	
TTIME	0	
SEGID	0	
POSTSPD	55	
TOLLTYPE	3	
PLAZADESC		



Not much different from earlier versions of SERPM

Reversible Lanes

- Control by the link attribute REVERSIBLE
  - REVERSIBLE=1 means AM operation only
  - REVERSIBLE=2 means PM operation only
  - I-595 example:



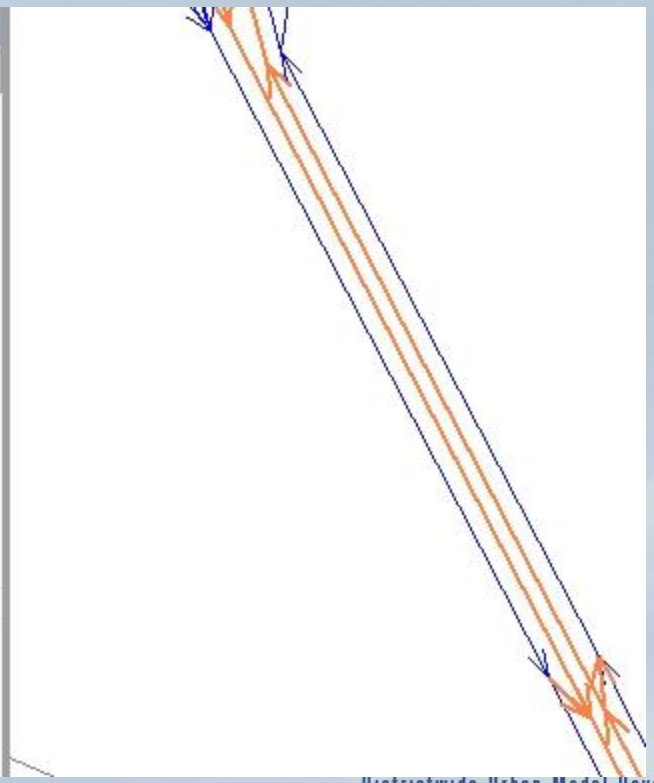
AX/BX	889882.39	892118.04
AY/BY	645661.78	645065.06
A	20780	
B	20781	
DIVIDED	0	
LEFTTURN	0	
LFWYMRG	0	
TDSECID	0	
GC_RATIO	0	
NONTPKTOLL	0	
HOT	1	
REVERSIBLE	1	
ISTOLL	0	
TIME2	0.8585	
GISID	2.0148251E0	
AUTO	0	
BUS	0	
SUT	0	
TRAI	0	
OTHER	0	

Managed Lanes (typically Express)

- HOT=1 – 98 (99 makes the link a dummy)
- FTC2 most likely=91, but other types permitted
- TOLL=0, ISTOLL=0
- Tolls set by HOTTOLL.dbf

Highway Links

AX/BX	872510.34	871106.5
AY/BY	610067.19	612727.47
A	28334	
B	28335	
STCARD	S	
ROADNAME		
CORRIDOR	0	
RDNAME	I-75 HOT Lar	
CONUM	2	
FTC2	91	
OVERIDE	0	
DIVIDED	0	
LEFTTURN	0	
LFWYMRG	0	
TDSECID	0	
GC_RATIO	0	
NONTPKTOLL	0	
HOT	1	
REVERSIBLE	0	
ISTOLL	0	



HOT Lanes Tolls

- Set as a function of the V/C
- Updated in the travel time feedback loop
- Affects the Toll/Free split in mode choice
- Column HOT_x, were x=HOT link attribute
- HOT_1 is the current 95 Express rate, HOT_2 is a placeholder

V_C	HOT_1	HOT_2
0	0.024752	0.39604
0.3	0.024752	0.39604
0.48	0.148515	0.39604
0.7	0.39604	0.39604
0.9	0.693069	0.39604
1	0.693069	0.39604
10	0.693069	0.39604

Common Errors

- Errors to watch out for
  - If network steps fail, look for missing attributes
  - Update transit routes as needed due to changes to underlying highway network
  - Check for dangling links and unconnected zones
  - Verify that all TAZs are connected to 'free' roads
    - Special procedures required for TAZs that have toll-only access must include the attribute ISRCTOLLINK=1 (currently used for the Rickenbacker Causeway)
  - Some CT-RAMP errors caused by network coding errors may not be apparent until feedback loop 2 because in loop 1 CT-RAMP uses seed skims
    - Use small sample size when testing a new network

Was the Run Successful?

- Did the run converge?
  - AM and PM travel time RMSE values reported to {OUTDIR}\feedbacklog.prn
  - Run stops when RMSE is less than 0.1
  - 2010 Scenario converges in 5 loops
- What to do if it didn't converge?
  - Look for obvious errors
  - Run more iterations (future year might require more)
- Are the top-level results comparable to a similar run?
  - Use HEVAL reports
  - Examine screenlines (RMSE reports)
  - Spot check link loads

Tools for Analysis

- Analysis – perform standard highway project type analyses
- Usual analysis similar to trip-based model
  - Total daily and period-specific roadway volumes and speeds, by vehicle class
  - Vehicle trip OD matrices
- Standard FSUTMS HEVAL and RMSE reports are still available
  - Day and period assignments
  - By County
  - Truck assignment

Tools for Analysis

- Potential for customized assignment classes to address specific project questions:
  - Does the manage lane serve primarily high income users?
    - Stratify vehicle classes by low/high income to understand facility usage by income level
    - Stratify vehicle classes by disadvantaged population cohorts
- Trip and person tabulations built from ABM output
  - Trip mode shares for many different population cohorts / subareas
  - For example toll vs. non-toll shares by value of time or fine-graded income levels
  - Many other possibilities

Application 4 – Mobility Project

Mobility Project – SUNPASS Market Share

- Persons in households that own a SUNPASS transponder respond differently to managed lane and toll road policies:
  - Pay lower tolls than cash users
  - Have access to I-95 managed lanes
- Policy questions:
  - How does projected toll traffic and revenue vary with the SUNPASS penetration rate and toll discount?
  - How will SUNPASS penetration rate vary as more managed lane facilities are built in the region?

Mobility Project – SUNPASS Market Share

- Question 1 -- How does projected toll traffic and revenue vary with the SUNPASS penetration rate and toll discount?

- Procedure
  - Step1 – Assume a SUNPASS market share by modifying the toll transponder model
  - Step 2 – Run SERPM7 to produce traffic volumes
  - Step 3 – Estimate toll traffic revenue

Modifying the Toll Transponder Ownership Model

- Model specification is contained in **TransponderOwnership.xls** and can be edited with Microsoft Excel

Utility Variable	Coefficient
Expected time savings, up to 6.44 min	0.0631
Distance less than 5 miles	-0.0304
Distance between 5 and 10 miles	-0.0648
Distance 10 miles or more	-0.0648
Constant	0.4877

Modifying the Toll Transponder Ownership Model

TransponderOwnership.xls

Utility Variable	Coefficient
Expected time savings, up to 6.44 min	0.0631
Distance less than 5 miles	-0.0304
Distance between 5 and 10 miles	-0.0648
Distance 10 miles or more	-0.0648
Constant	0.4877

Increasing the constant will increase the number of households equipped with transponders

Modifying the Toll Transponder Model

- Increase the constant by how much?
  - Process is akin to model calibration
  - Several runs of the transponder model required to estimate the constant that yields the desired market share
  - 2010 market share is approximately 65%
  - Use a small sample (5% or 10%) to save run-time while establishing the right constant

Modifying the Toll Transponder Model

- Variation
  - Add terms to the model so that certain types of households are more likely to exhibit a SUNPASS market share increase:
    - High/low income households
    - Multi-car households
    - Miami-Dade households

Modifying the Toll Transponder Model

- Exhibit: TransponderOwnership.xls

Mobility Project – SUNPASS Market Share

- Question 2 -- How will SUNPASS penetration rate vary as more managed lane facilities are built in the region?

- Procedure:
  - Step 1 – Code the manage lane facilities
  - Step 2 – Run SERPM7 to forecast transponder ownership
  - Step 3 – Analyze the forecast household data for changes in the profile of households equipped with transponders

Application 5 – Land Use Project

Land Use Project

- Transportation projects comprise not only network scenarios but also land use scenarios
- Land use scenarios can be:
  - Very large scale (substantial changes to housing and employment estimates throughout the region), or
  - Small scale (localized changes, for example for a traffic impact study)
- For both large scale and small scale land use updates, the general procedure for updating the input data and running the model is the same

Land Use Project

- The land use data in SERPM7 consists of:
  - Synthetic population and derived input files
  - Employment data
  - School enrollment data
  - Parking costs and parking spaces
  - Regional shopping mall special generators
  - Beach special generators
  - Hotel and motel room data

Land Use Project

- The land use data reside in different input files

Data Item	Input File
Synthetic Population	hhFile.csv personFile.csv \ctramp\popsyn\TAZData.csv \ctramp\popsyn\MAZData.csv
Employment School Enrollment Parking Supply Data Special Generators Hotel and Motel Rooms	\inputs\IN-2010R\maz_data.csv

Land Use Project

- As demonstrated earlier, SERPM 7 requires significantly more comprehensive socio-economic inputs as compared to previous versions
  - Greater spatial detail
  - More categories/types of land uses
- These inputs require additional preparation when performing land use model runs.

Land Use Project

Data Required and examples

- Population
  - Age distribution of the population expected to live in the development
  - Income profile
  - Type of dwelling unit (single-family vs. multi-family)
- The input data need to be internally consistent (distribution of households by presence of children needs to be consistent with population age distribution, for example)

Column Name	Description
mgra	MAZ
TAZ	TAZ
hh	total number of households
pop	total population

Land Use Project

Data Required:

- Employment classification
  - Previous models had three employment classifications
  - In SERPM 7 there are 16 employment categories to better differentiate type of land use and improve the relationship between land use and activity purpose

Column Name	Description
emp_utilities_office	Utilities office support
emp_const_bldg_prod	Construction of Buildings production
emp_const_bldg_office	Construction of Buildings office support
emp_mfg_prod	Manufacturing production
emp_mfg_office	Manufacturing office support
emp_whsle_whs	Wholesale and Warehousing
emp_trans	Transportation Activity
emp_retail	Retail Activity
emp_prof_bus_svcs	Professional and Business Services
emp_prof_bus_svcs_bldg_maint	Professional and Business Services (Building Maintenance)
emp_pvt_ed_k12	Private Education K-12
emp_pvt_ed_post_k12_oth	Private Education Post-Secondary (Post K-12) and Other
emp_health	Health Services
emp_personal_svcs_office	Personal Services Office Based
emp_amusement	Amusement Services
emp_hotel	Hotels and Motels
emp_restaurant_bar	Restaurants and Bars
emp_personal_svcs_retail	Personal Services Retail Based
emp_religious	Religious Activity
emp_pvt_hh	Private Households
emp_state_local_gov_ent	State and Local Government Enterprises Activity
emp_scrap_other	Scrap other
emp_fed_non_mil	Federal Non-Military Activity
emp_fed_mil	Federal Military Activity
emp_state_local_gov_blue	State and Local Government Non-Education Activity production
emp_state_local_gov_white	State and Local Government Non-Education Activity office support
emp_public_ed	Public Education K-12 and other

Land Use Project

Data Required:

- School enrollment – note that it differentiates by grade level (K-8, high-school, college/post-secondary)
  - Don't forget to include school faculty and staff in employment

Column Name	Description
EnrollGradeKto8	Grade School K-8 enrollment
EnrollGrade9to12	Grade School 9-12 enrollment
collegeEnroll	Major College enrollment
otherCollegeEnroll	Other College enrollment
AdultSchEnrl	Adult School enrollment
ech_dist	Elementary school district
hch_dist	High school district

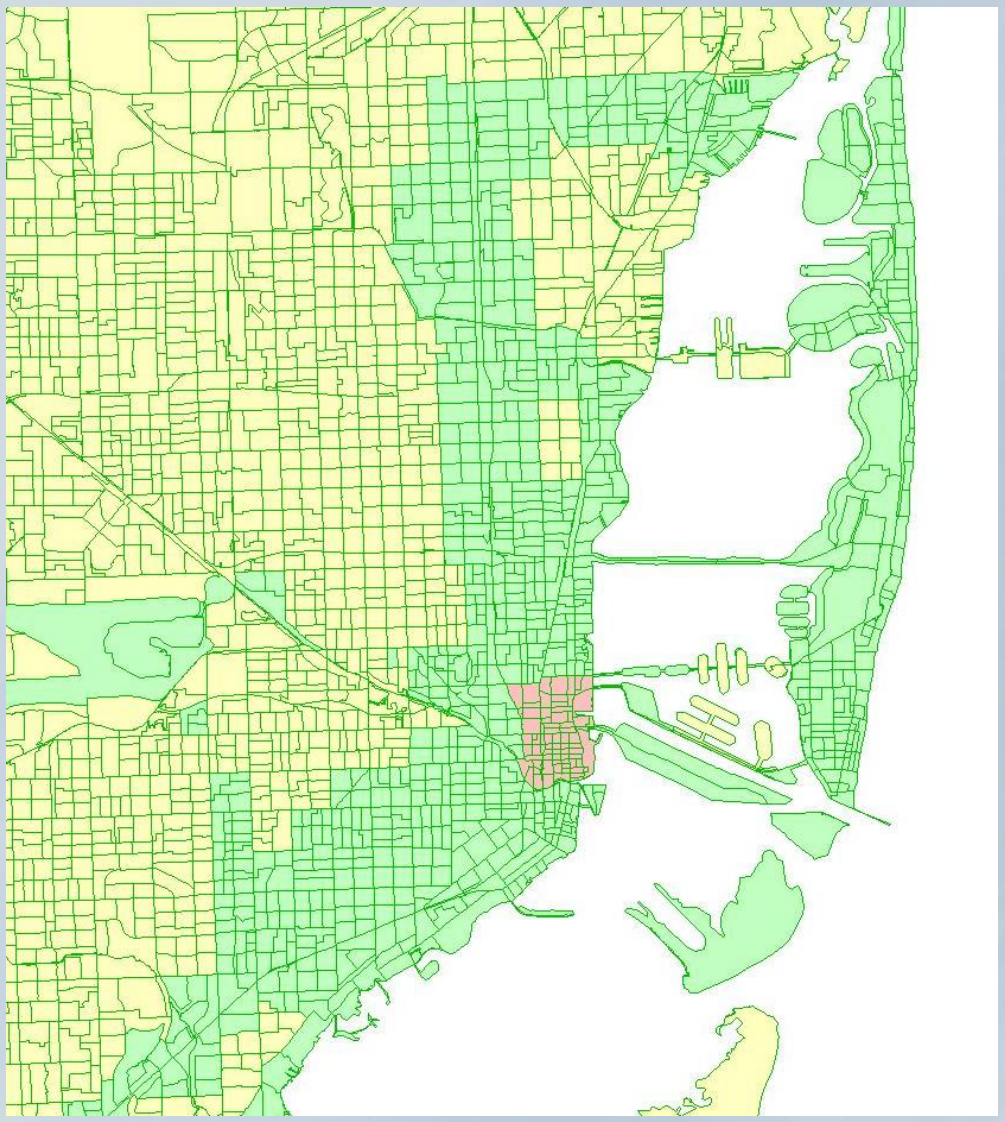
Land Use Project

Data Required:

- Parking supply and parking costs.
  - Parking spaces may reflect use restrictions
    - Monthly
    - Daily
    - Hourly
  - Parking costs consistent with type of use

Column Name	Description
parkarea	1: Trips with destinations in this MAZ may choose to park in a different MAZ, parking charges apply (downtown) 2: Trips with destinations in parkarea 1 may choose to park in this MAZ, parking charges might apply (quarter mile buffer around downtown) 3: Only trips with destinations in this MAZ may park here, parking charges apply (outside downtown paid parking, only show cost no capacity issue) 4: Only trips with destinations in this MAZ may park here, parking charges do not apply (outside downtown, free parking)
hstallsoth	Number of stalls allowing hourly parking for trips with destinations in other MAZs
hstallssam	Number of stalls allowing hourly parking for trips with destinations in the same MAZ
hparkcost	Average cost of parking for one hour in hourly stalls in this MAZ, dollars
numfreehrs	Number of hours of free parking allowed before parking charges begin in hourly stalls
dstallsoth	Stalls allowing daily parking for trips with destinations in other MAZs
dstallssam	Stalls allowing daily parking for trips with destinations in the same MAZ
dparkcost	Average cost of parking for one day in daily stalls, dollars
mstallsoth	Stalls allowing monthly parking for trips with destinations in other MAZs
mstallssam	Stalls allowing monthly parking for trips with destinations in the same MAZ
mparkcost	Average cost of parking for one day in monthly stalls, amortized over 22 workdays, dollars

Land Use Project



- Park Area 1 (pink)
  - May park in MAZ other than destination MAZ
  - Parking cost applies
- Park Area 2 (gree)
  - Parks at destination MAZ
  - Parking cost applies

Land Use Project

Data Required:

- Visitor Model
  - Number of hotel and motel rooms
- Special Generators:
  - Regional shopping malls
  - Beach recreation areas

Land Use Project

Regional Shopping Mall Special Generators

The Gardens Mall	Aventura Mall
Boynton Mall	Dolphin Mall
Delray Community Mall	Dadeland Mall
Towncenter Mall	The Falls Shopping Center
Wellington Greens Mall	Cutler Ridge Mall
Coral Square Mall	Bal Harbour Shops
Pompano Citi Centre	CocoWalk
Sawgrass Mills Mall	The Mall at 163rd Street
Broward Mall	Mall of the Americas
Galleria Mall	Mary Brickell Village
Pembroke Lakes Mall	Miami International Mall
Lakes Mall	Miracle Marketplace
Oakwood Plaza	Village of Merrick Park
The Promenade at Coconut Creek	Westland Mall

Land Use Project

Beach Special Generators

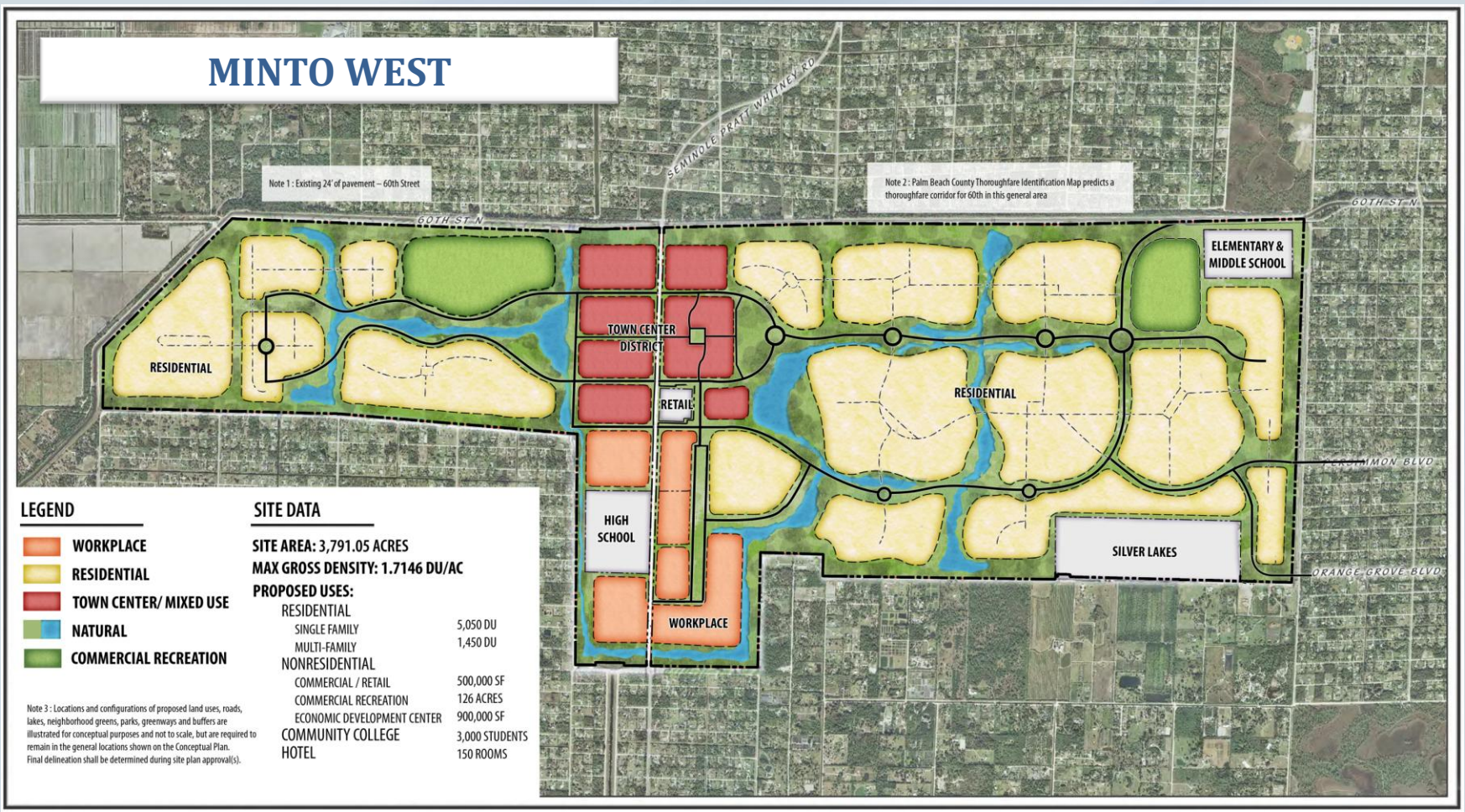
Deerfield Beach
Pompano Beach
Fort Lauderdale Beach
Fort Lauderdale Beach
Hollywood Beach
South Beach
Haulover Beach
Crandon Park
Dania Beach
Bill Baggs State Park

Land Use Project

Sample Problem:

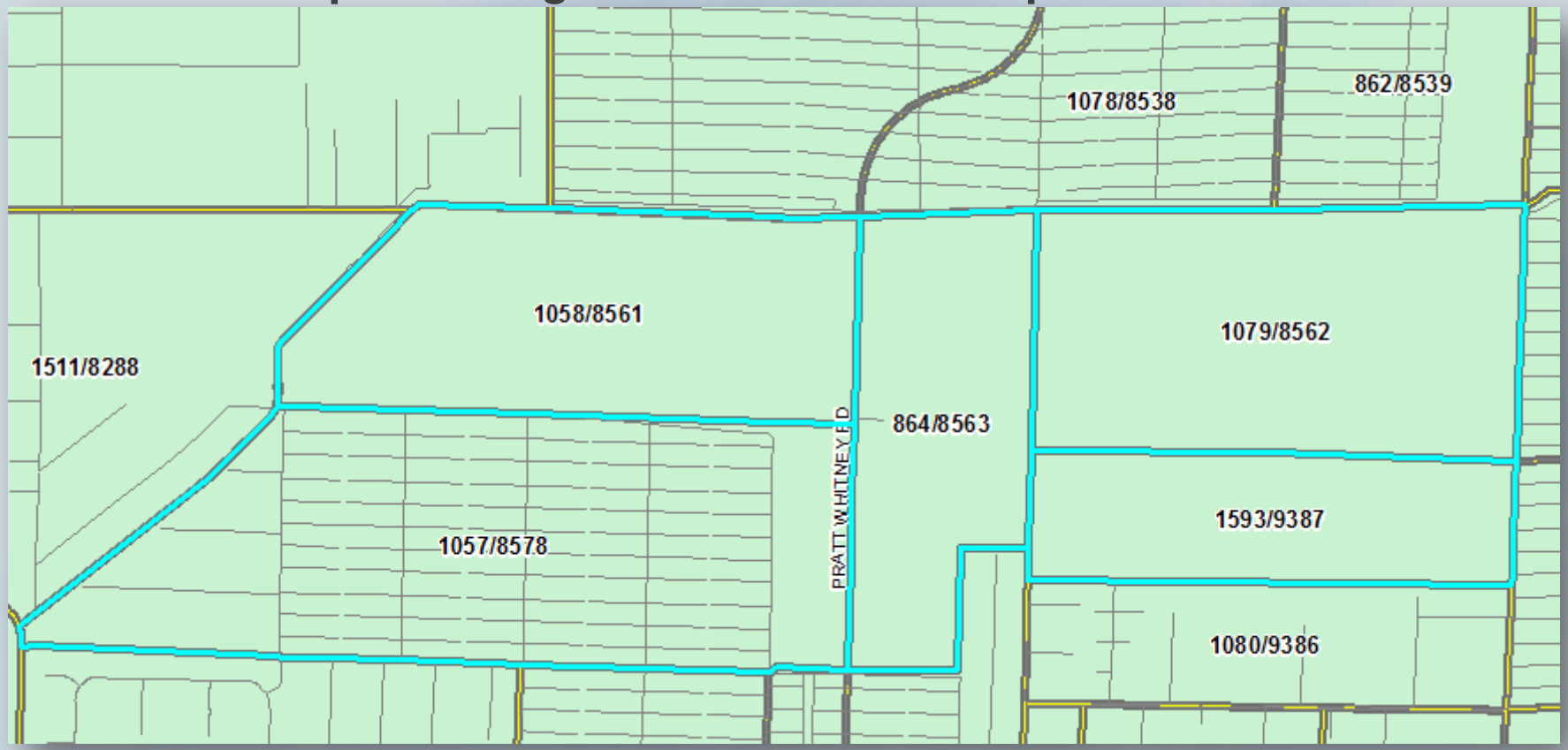
- MINTO West Example - a mixed residential/commercial development
  - 6,500 single/multi-family residential units in multiple TAZs
  - 1.4 million square feet of non-residential space
  - 150 room hotel
  - 3,000 student college campus

Land Use Project



Land Use Project

TAZs/MAZs representing MINTO West Development



Land Use Project

Need to translate population, household and employment information from developer into model input data.

- As discussed in the Population Synthesis presentation, population and household attribute estimates can be taken from other known nearby neighborhoods.
    - In this sample problem, first start by allocating percentages of total households into individual MAZs within the development area.
    - Keep in mind household density when estimating the number of households in each MAZ.

Land Use Project

- In this sample, employment can be assumed to include:
  - Retail,
  - Restaurants/Bars,
  - Offices,
  - Health services,
  - Hotel/motel employment, and
  - Educational employment.
- As with households, you'll need to apportion the employment areas to individual MAZs while keeping in mind the types of employment expected in those locations.

Land Use Project

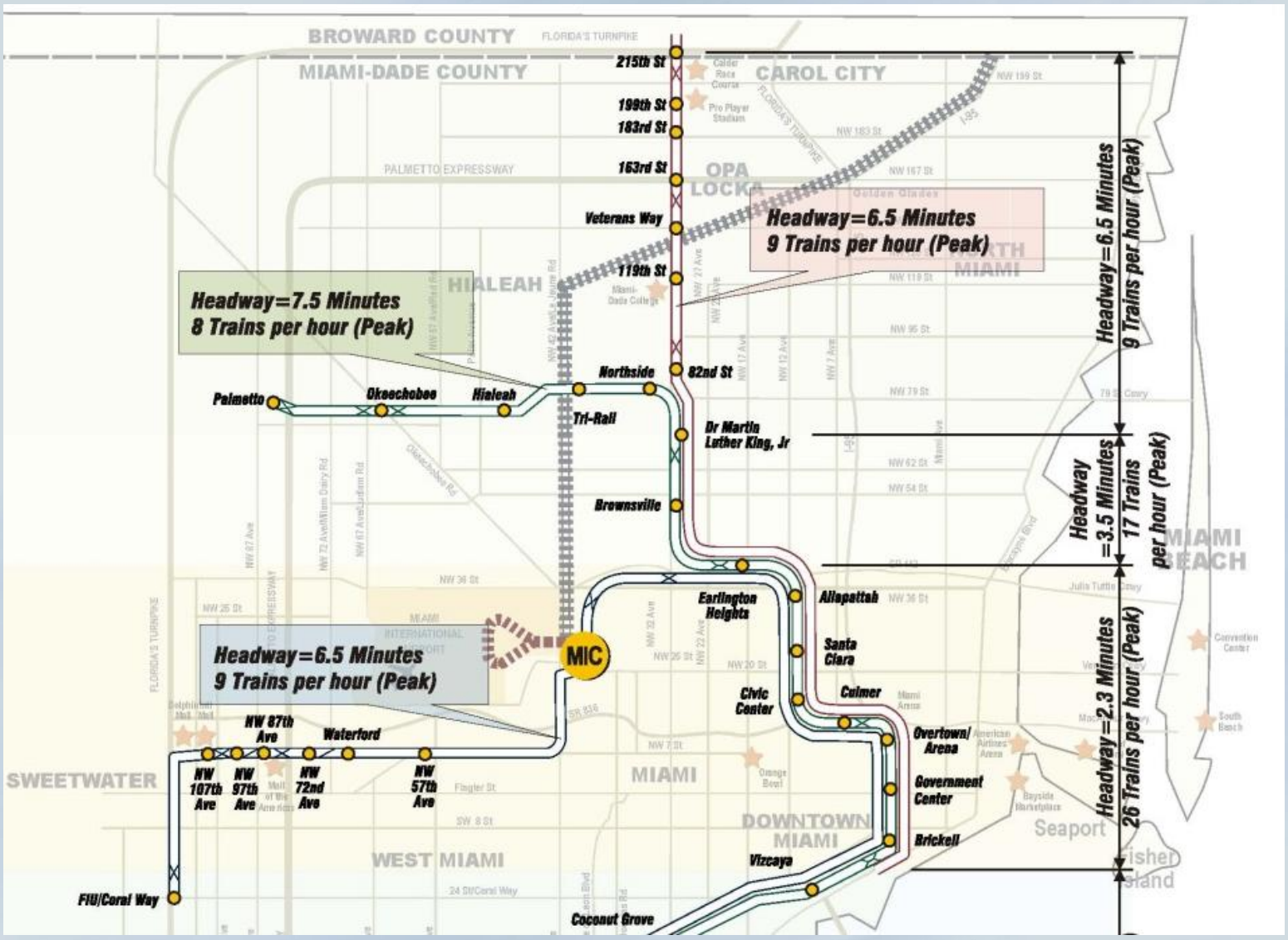
- Employment data is usually estimated by converting floor space available to individual types of employment through conversion factors.
  - i.e. – (3,000 sqft office space)/(20 sqft per office employee) = 150 office employees.

Land Use Project

- Once population, household and employment figures are estimated, they are entered into the appropriate model input file:
  - Population – TAZ synthetic population control file
  - Household – TAZ synthetic population control file
  - Employment, School, Parking, and Special Gen – maz_data.csv
- Ensure that population, household and employment figures are the same in each file.
- Prior to performing model run, PopSyn must be run and user must copy output files to SERPM7 input folders.

Application 6 –Transit Project

Transit Project – MetroRail North Corridor



SERPM Transit Modes

Transit Mode	Tour and Trip Mode	TAP Transit Skim Mode
Tri-Rail	Commuter Rail	Premium
Metrorail	Urban Rail	Premium
I-95 Inter-County Express, I-95X, I-95E	Express Bus	Premium
Busway	BRT	Premium
MDT Express	Express Bus	Premium
Metromover	Local Bus	Local Bus
MDT Local BCT Local Palm Tran Local	Local Bus	Local Bus
Breeze	Local Bus	Local Bus
Tri-Rail Shuttles	Local Bus	Local Bus

SERPM Transit Modes

Transit Mode	Tour and Trip Mode	TAP Transit Skim Mode
Mode coded on the route "cards". Used to specify boarding and transfer penalties for transit path building (most disaggregate)	Line-haul choices in the tour and trip mode choice models	Used to create sets of TAP to TAP levels of service (most aggregate)

Similar to SERPM 6.7

SERPM 7 ABM

SERPM 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

SERPM7 Transit Network Building

- Typically bus routes are coded on top of existing highway links
- SERPM7 reserves some facility type codes for transit-only use; helpful to more accurately represent route
  - Caution -- make sure network integrity is preserved once transit only links are removed
- Rail routes require coding first fixed-guideway links

SERPM7 Transit Network Building

- Route Attributes -- User Coded:
  - Name
  - Long Name
  - Mode
  - Operator
  - Headway[1] – AM Peak
  - Headway[2] – Midday
  - Headway[3] – PM Peak
  - UserA4 (stop dwell time)

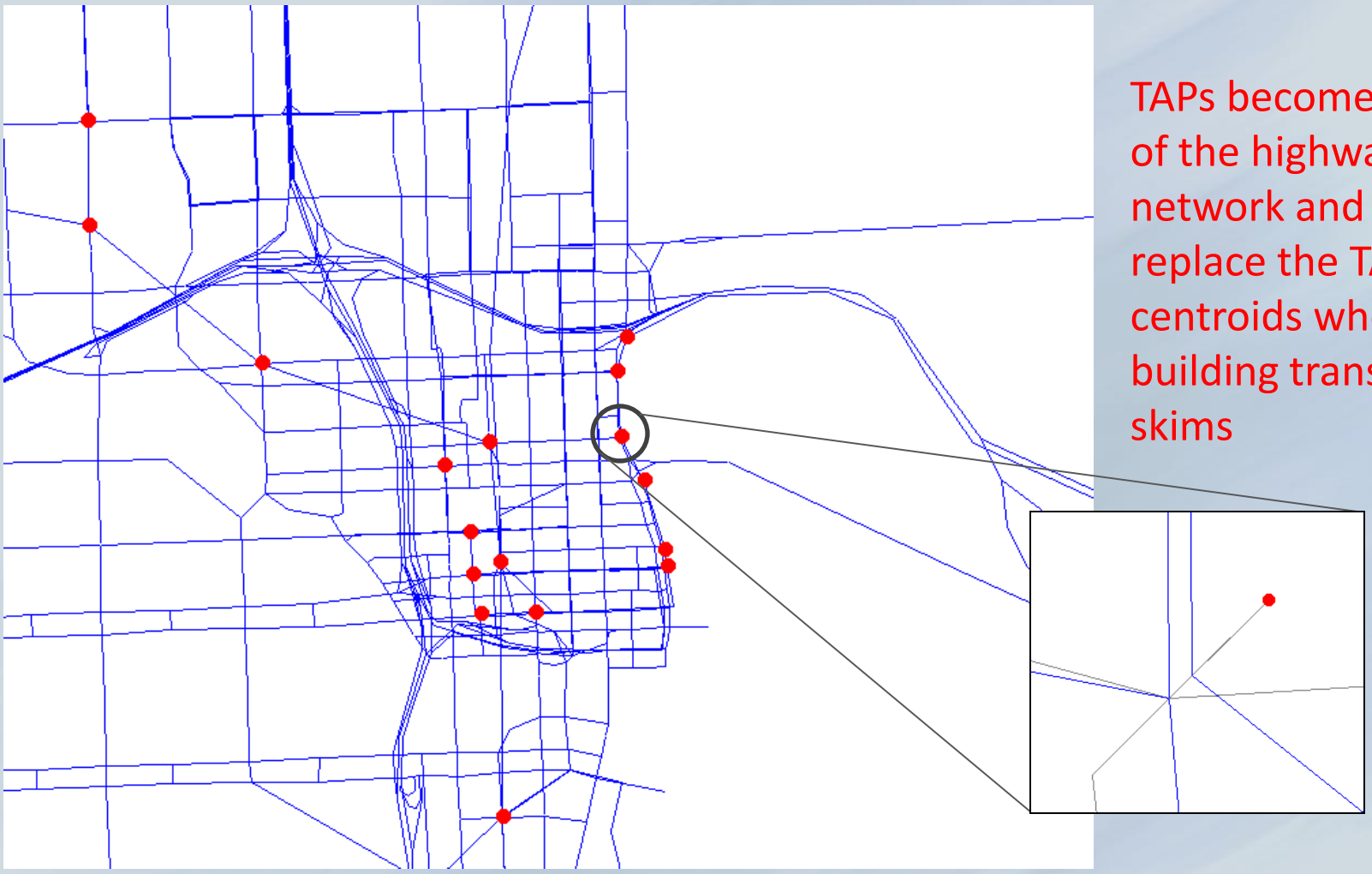
SERPM7 Transit Network Building

- PNR Node Attributes – User Coded
  - Parking Spaces
  - Parking Cost AM
  - Parking Cost MD
  - Terminal Time PNR
  - Terminal Time KNR
- At this time parking spaces is used only to identify park-n-ride locations (parking spaces > 0)

SERPM7 Transit Network Building

- Transit Access Points -- Created by Cube for the ABM
  - One TAP for each stop on premium routes
    - Tri-Rail, Metrorail, Express Bus, BRT
  - One TAP for each Local Bus park-n-ride node
  - Synthesized TAPs to represent access to local bus stops
- Transit Access Point Attributes
  - TAP Mode
  - Inherit PNR node data

Sample Highway Network with TAPs



TAPs become part of the highway network and replace the TAZ centroids when building transit skims

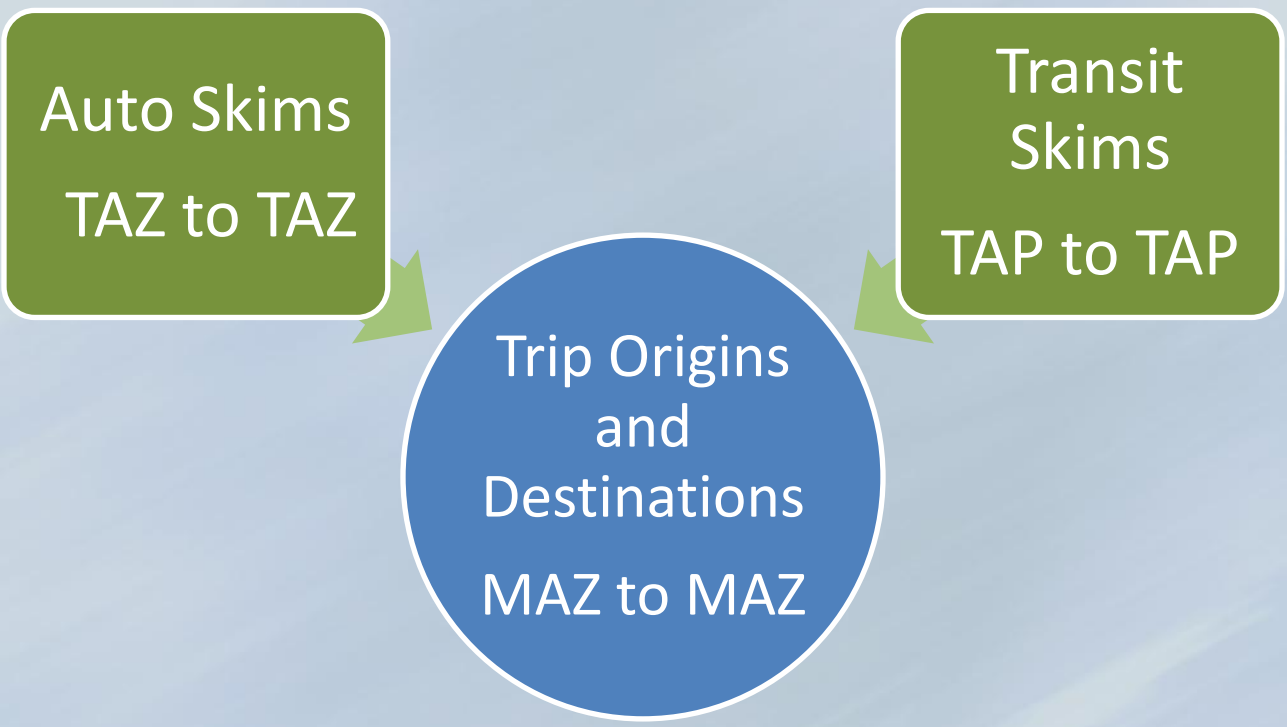
Transit Access Points and "on the fly" Path Building

- Transit skims are built TAP to TAP

*1 XFRES	2 IVT_CR	3 IVT_LR	4 IVT_BRT	5 IVT_EXP	6 IVT_LB	7 MAINMODE	8 FARE	9 IWAIT	10 XWAIT
	Sum	1	2	3	4	5	6	7	8
	62014886	12429	10998	14111	12081	12614	9345	14305	14309
1	12158	0	0	0	0	0	0	3	3
2	11117	0	0	0	0	0	0	2	2
3	14290	0	0	0	0	0	0	4	4
4	12157	0	0	0	0	0	0	4	4
5	12446	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3
6	9686	0	[illegible]						2
7	14386	4	[illegible]						[illegible]
8	14375	4	[illegible]						[illegible]
9	10193	3	2	3	3	3	2	2	2
10	9985	3	2	3	3	3	2	2	2
11	10199	3	2	3	3	3	2	2	2
12	10003	3	2	3	3	3	2	2	2

Matrix origins and destinations are TAPS!

Transit Access Points and "on the fly" Path Building



The three spatial systems are put together by the mode choice model

"On the Fly" Path Building

- TAZs, TAPs and MAZs are linked via drive and access connectors prior to 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
```

"On the Fly" Path Building

MAZ to MAZ Connectors	Created by finding shortest distance paths over an all-streets network Connects all MAZs within 1.5 mi	Used to represent walk mode distance and time
MAZ to TAP Connectors	Created by finding shortest distance paths over an all-streets network Connects each MAZ to all TAPs within 1.0 mi	Used to represent transit walk access and walk egress distance and time
TAZ to TAP Connectors	Connects each TAZ to all TAPs within the TAP maximum drive distance • Bus TAPs – 4 miles • Rail TAPs – 15 miles	Used to represent transit drive access and egress distance and time

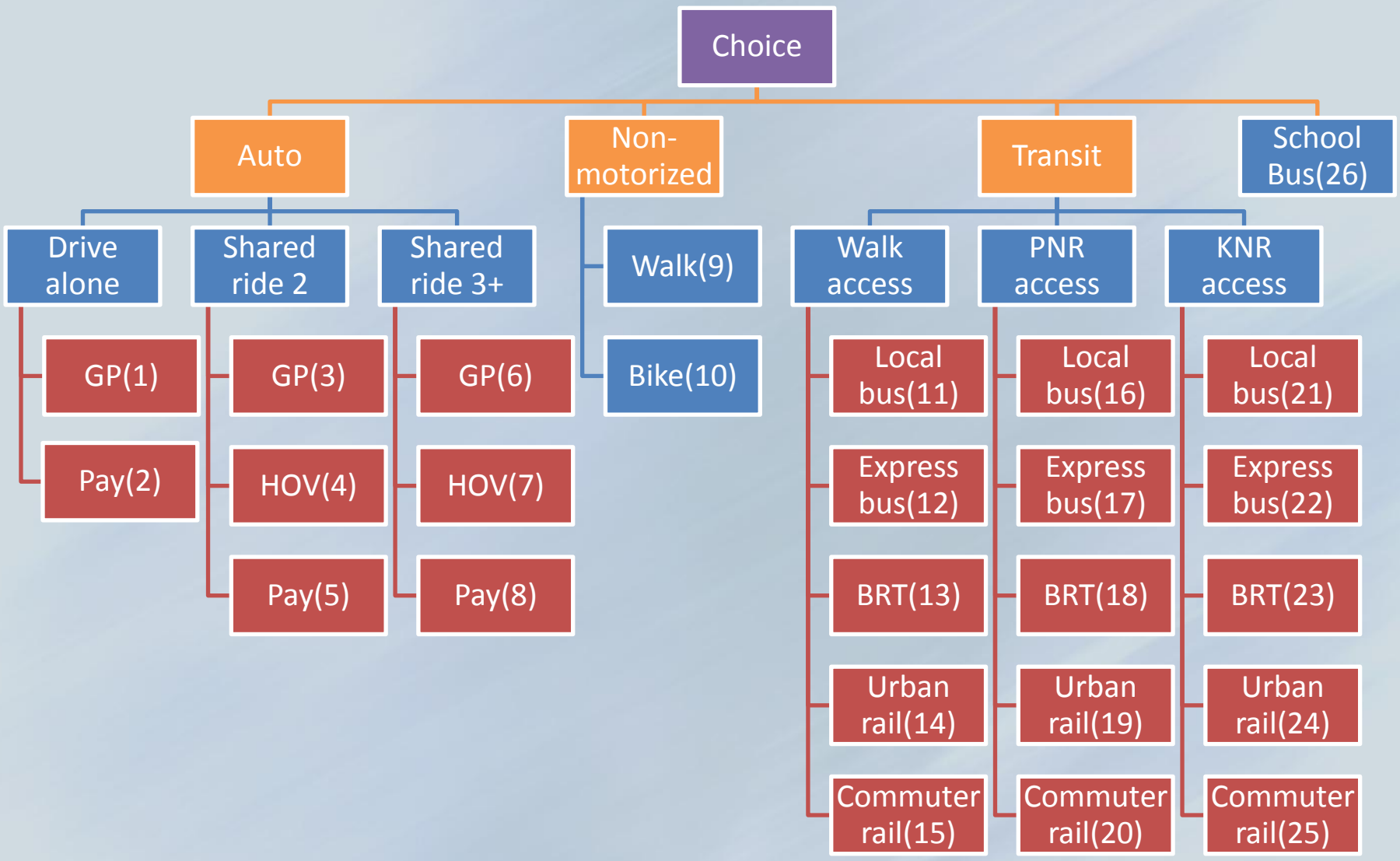
"On the Fly" Path Building

- No actual links created on the network
- Connectivity is expressed in table format

"On the Fly" Path Building

- Once the access and walk connectors are created, the mode choice model builds complete paths MAZ to MAZ transit paths
- Local-only paths are built using the "local" transit skim
- Express, BRT, Urban Rail and Commuter rail paths are all built at the same time using the "premium" transit skim
- For each MAZ to MAZ pair, CT-RAMP keeps the shortest generalized cost path for each available premium mode
- Even though only one "premium" skim is built, CT-RAMP may find competing premium paths. It may also find that the best path is a combination of two premium modes, or a premium mode and local bus.

Tour Mode Choice Model



Trip Mode Choice Model

- Same nesting structure as the tour mode choice, but conditional on the tour mode
- Some trip modes may be unavailable depending on the tour mode

Trip Switching Rules, Simplified

	DA	SR2	SR3+	Walk	Wlk-Trn	PNR-Trn	KNR-Trn
DA	Must	-	-	-	-	-	-
SR2	Can	Can	-	Can	-	-	-
SR3+	Can	Can	Can	Can	-	-	-
Walk	-	-	-	Must	-	-	-
Wlk-Trn	-	Can	Can	Can	Can	-	-
PNR-Trn	Can	Can	Can	Can	Can	Can	
KNR-Trn	-	Can	Can	Can	Can	-	Can

Transit Trip Reporting

- In SERPM7, the transit boarding and alighting location can be reported in two ways:
  - Trip list files (ABM output) -- Boarding TAP / Alighting TAP
  - Transit assignment (Cube output) – Route nodes
- Each type of reporting has its strengths
  - Trip list file allows building detailed transit trip patterns for population cohorts and time periods
    - Mode split reports
    - Transit trip distance frequency distributions, access distance TLFDs
    - Mode to mode transfers
  - Note ABM reports only the first boarding TAP and the last alighting TAP, regardless of mode
  - Cube output gives aggregate link volumes, station to station boardings, etc

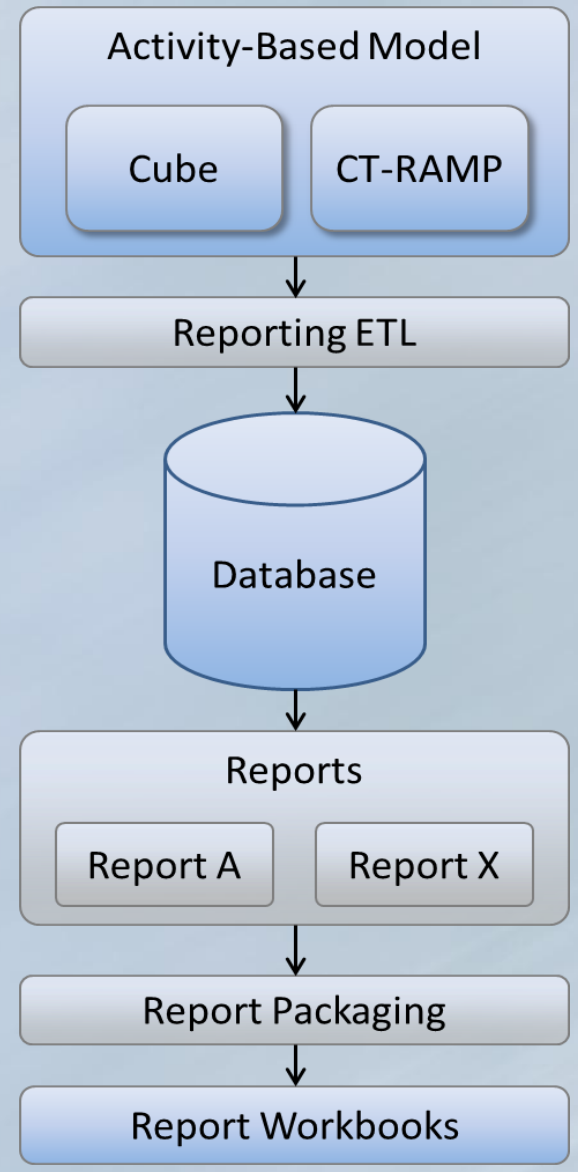
User Benefit Files

- SERPM7 can produce FTA User Benefit files for input to SUMMIT
- User benefits remain a useful analysis tool
- Steps to produce user benefit files require some manual intervention – see User Guide

SERPM ABM Reports

- Stores ABM inputs and outputs in a relational database to generate some standard model reports
- 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
- Foundation for future development of a visualization dashboard

Reporting Database Components



Reporting Database Components

- Reporting ETL (extract, transform, and load) program
  - Loads all Cube and CT-RAMP Java model outputs into the database.
  - Written in Cube scripts and Java.
- Database
  - Stores all data used in reporting, including select network skims, household, person, tour, and trip data, zonal data, etc.
  - Implemented with SQL Server.
- Report scripts to generate reports.
  - Written in T-SQL.
- Report packaging program
  - Generates Excel workbooks with one report per worksheet.
  - Written in Java.

Reporting Database Components

- Run time required to build database and generate reports varies with sample size and type of report
  - Several hours required to build the database for a 100% sample
  - ~ 30 minutes to produce reports for a 10% sample
- Report step is optional, not part of a standard model run
- Report production is transparent to the user

- … but users can contribute reports,
- … and choose which reports to build at any one time

Running SERPM ABM Reports

- Report queries reside in \ctramp\reports_sql

time_spent_traveling.sql	Total weekday travel time by person type and income group
total_trips_type.sql	Trips by trip mode, person type, county of residence and tour purpose
total_tours_type.sql	Tours by trip mode, person type, county of residence and tour purpose
tours_districts.sql	Tours by tour purpose and tour origin and destination districts
transit_access_time+dist.sql	Drive to transit trip list with many trip details
….	

Running SERPM ABM Reports

- List of reports to run is specified in properties file
  - \ctramp\serpm_reports.properties

```
sql.scripts.directory = C:/serpm7/ctramp/reports_sql
sql.scripts.schema.key = @@SCHEMA@@

sql.scripts=cleanup.sql,transit_access_time+dist.sql
worksheet.tables=temptransittrips
worksheet.names=TransitTrips

workbook.name = C:/serpm7/ctramp/reports_sql/SERPM_REPORT.XLS

database.schema = 2010R
database.ipaddress = w-ampdx-d-sag10
database.instance =
database.port = 1433
database.name=SERPMABM
database.username=serpm
database.password=s3rpm
```

Adding Reports

- Step 1 --Write report query
  - T-SQL
  - User Guide includes a database data dictionary
- Step 2 – Add query to \ctramp\reports_sql
  - Each query is contained in a single text file
  - Drop file in reports folder
- Step 3 – Add the query to the properties file

sql.query =	Query file name
Worksheet.tables =	Query output
Worksheet.names =	Name for the report worksheet

Sample SERPM ABM Reports

- Exhibit: \ctramp\reports_sql\serpm_reports.xls

More information

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