

PTV GROUP

ABM Data Integration and Analysis



SEFL Model User's Group
July 2024

01

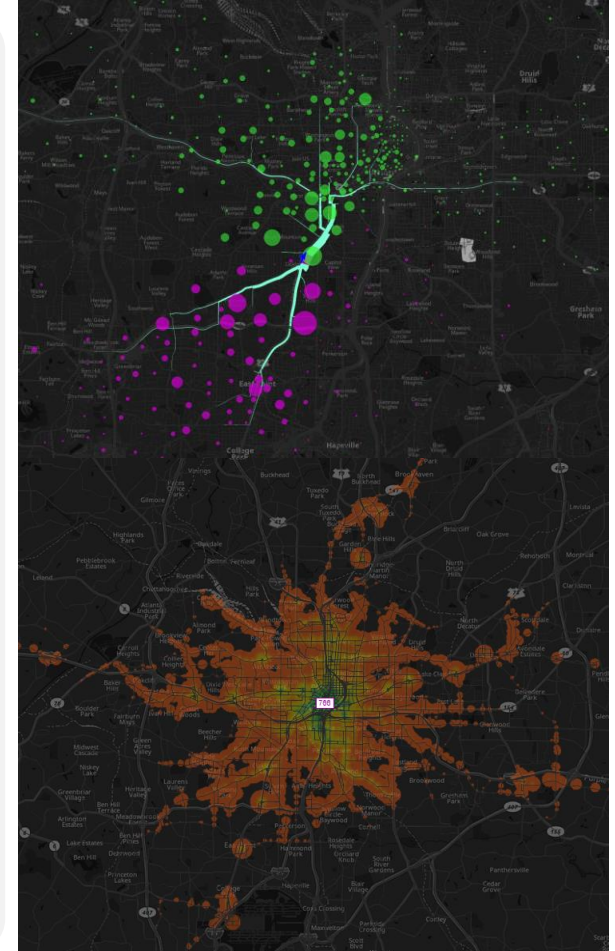


Overview

Activity Based Models

Advanced ABMs offer greater ability to analyze transportation systems...

- Flexibility – a synthetic travel diary for the population that you can analyze
- Store entire day schedule at individual level – no more P and As and “home-based”
- Equity analysis – summarize results by gender, age, income, worker status, etc.
- Active transportation planning – increased spatial resolution for bike and walk planning
- Many more forecasting models – work from home, telecommute frequency, vehicle fleet (gas, EV, AV), intra-household travel planning, joint travel, stop models on tours, etc.



New Objects Containerize Storage of Disaggregate ABM Data

Relational data tables store disaggregate model components as objects:

- Locations
- Activity Locations
- Households
- Persons
- Schedules
- Activity Executions
- Tours
- Trips

The screenshot displays a network editor interface with a map of Miami and several data tables. The map shows a path between locations labeled (Home, 1), (Shop, 2874), and (Shop, 3636). The data tables are as follows:

List (Tours)

PersonNo	ScheduleNo
1	21
2	21
3	22
4	23
5	23
6	24
7	24
8	25
9	25
10	25
11	26
12	26
13	28
14	29
15	30
16	31
17	32
18	33
19	35
20	36
21	37
22	38
23	38
24	39
25	40

List (Trips)

PersonNo	ScheduleNo	TourNo	Index	DSegName	Duration
6	22	29	1	1	24min 43s
7	22	29	1	2	25min 2s
8	23	30	1	1	9min 20s
9	23	30	1	2	9min 20s
10	23	1658514	1	1	16min 56s
11	23	1658514	1	2	5min 22s
12	23	1658514	1	3	16min 8s
13	24	31	1	1	12min 38s
14	24	31	1	2	8min 14s
15	24	31	1	3	13min 58s
16	24	1658514	1	1	16min 56s
17	24	1658514	1	2	5min 22s
18	24	1658514	1	3	16min 8s
19	25	32	1	1	9min 20s
20	25	32	1	2	9min 20s
21	25	33	1	1	14min 31s
22	25	33	1	2	14min 31s
23	25	34	2	1	11min 40s
24	25	34	2	2	11min 40s
25	26	1	1	1	28min 17s
26	26	1	1	2	26min 29s
27	26	2	2	1	28min 28s
28	26	2	2	2	2min 18s
29	28	3	1	1	11min 6s
30	28	3	1	2	11min 6s
31	29	4	1	1	16min 20s
32	29	4	1	2	17min 18s

List (Households)

No	ResidenceKey
1	1 (Home.1)
2	2 (Home.1)
3	3 (Home.1)
4	4 (Home.1)
5	5 (Home.1)
6	6 (Home.1)
7	7 (Home.1)
8	8 (Home.1)
9	9 (Home.1)
10	10 (Home.1)
11	11 (Home.1)
12	12 (Home.1)
13	13 (Home.1)
14	14 (Home.1)
15	15 (Home.1)

List (Persons)

No	HouseholdNo	Index	AGE	EDUC	GRADE	HHID	INDCEN
1	1	1	32	9	0	1	668
2	2	1	29	9	0	1	699
3	3	1	3	0	0	1	0
4	4	1	4	51	9	0	398
5	5	1	5	18	9	0	992
6	6	2	1	36	5	0	907
7	7	2	2	29	5	0	2
8	8	2	3	6	2	0	2
9	9	3	1	55	13	0	3
10	10	3	2	51	14	0	3
11	11	4	1	45	9	0	4
12	12	4	2	45	11	0	4
13	13	4	3	20	9	0	4
14	14	4	4	15	5	5	4

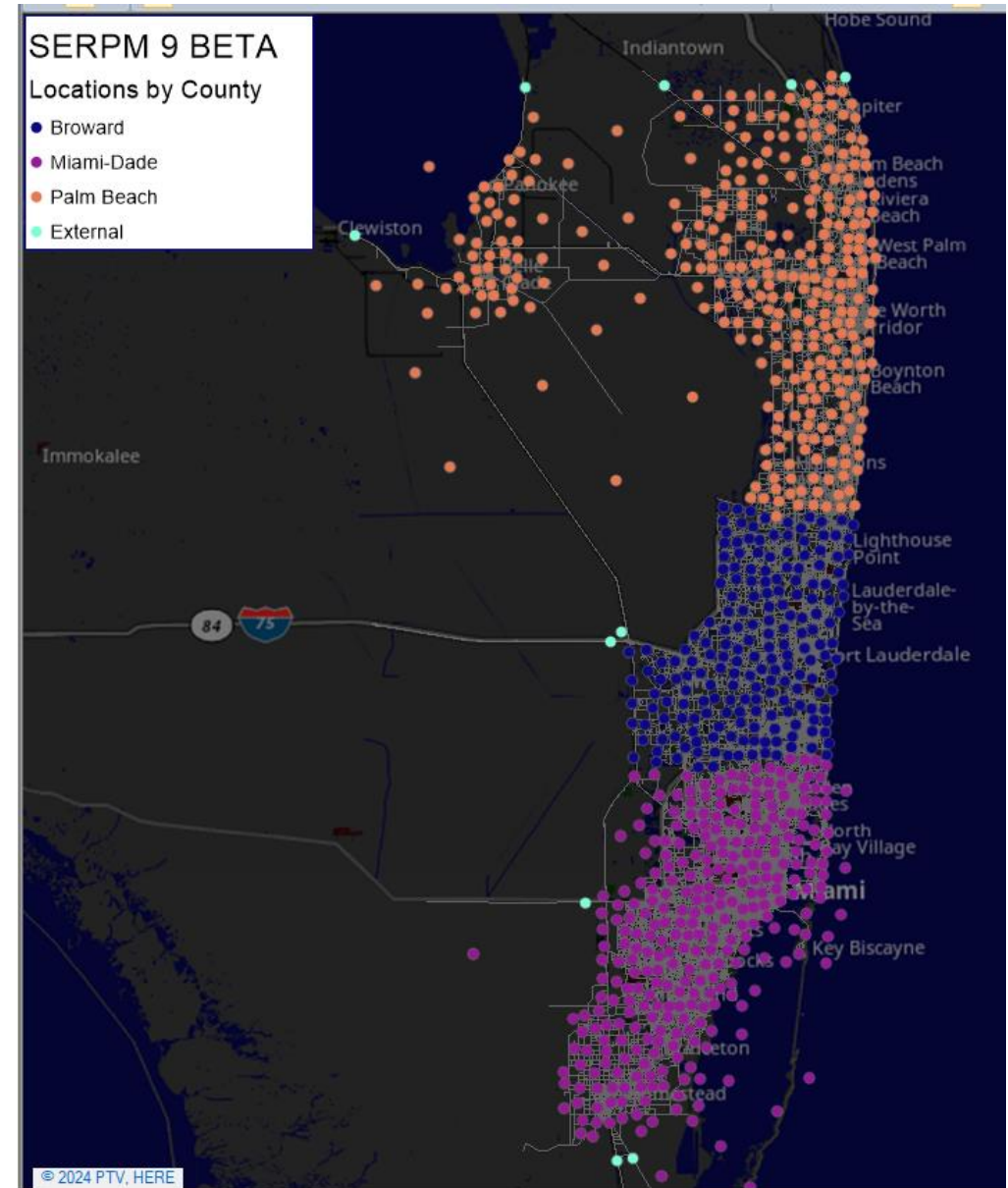
List (Locations)

No	XCoord	YCoord	ZoneAssociationGeometric	ZoneNo	POIKey
1	841743.6962	586818.8003		2901	(1.6678)
2	855391.4530	585704.9850		2902	(1.6679)
3	858417.1794	549491.9597		2903	(1.6680)
4	858468.1571	552268.5440		2903	(1.6681)
5	859899.0516	552160.7679		2903	(1.6682)
6	859712.5146	550239.0512		2903	(1.6683)
7	859951.3732	548979.1020		2903	(1.6684)
8	855202.9605	576558.9722		2904	(1.6685)
9	857809.0052	570210.4461		2904	(1.6686)
10	860759.3502	573138.0496		2905	(1.6687)
11	858245.2090	569857.9930		2905	(1.6688)
12	866665.1318	582510.2986		2906	(1.6689)
13	861757.4126	579948.4616		2906	(1.6690)
14	864829.5050	579956.7765		2906	(1.6691)
15	864519.0661	576921.9415		2907	(1.6692)
16	865825.6526	579143.8141		2907	(1.6693)
17	864972.8234	572014.7249		2908	(1.6694)
18	868775.8008	572176.9946		2909	(1.6695)
19	872182.6887	572708.8705		2910	(1.6696)

Disaggregate Storage of Locations

Location object introduced to model disaggregate locations (xy)

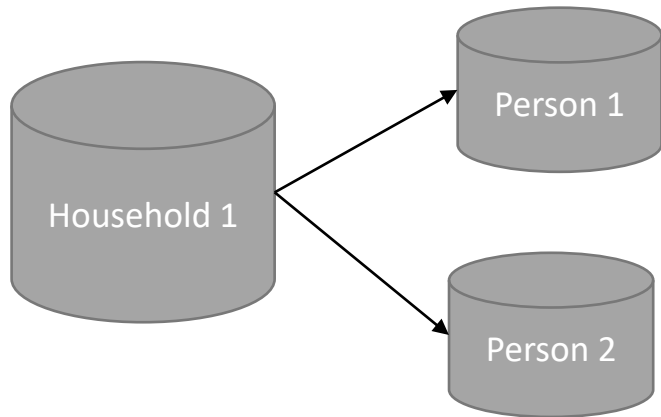
- Can be used to represent more aggregate features such as micro-analysis-zones (mazs)
- Connected further to Activities to model Activity Locations
- Knows its parent zone (TAZ) to allow quick population attributes in ABM tables (trip duration etc.)
- Will become more intelligent further downstream for
 - Disaggregate skimming and assignment
 - Multi-zone model structures...



Synthetic Population

Person and Household objects to store synthetic population

- Store complete cross-section of household and person characteristics at the individual level
- Spatially connected to Locations for convenient feature mapping
- Consistently held relate between Household and Person data tables



The screenshot displays a software interface for managing synthetic population data. It is divided into three main sections:

- Map View:** A map titled "SERPM 9 BETA Synthetic Population" showing a geographic area with numerous blue dots representing individual households. A tooltip for "Household 335" is visible, showing its location at "2011 home.8172".
- List (Households) Table:** A table listing household data. The selected row for household 335 is highlighted in blue.
- List (Person) Table:** A table listing individual person data. The selected row for person 1036 is highlighted in blue.

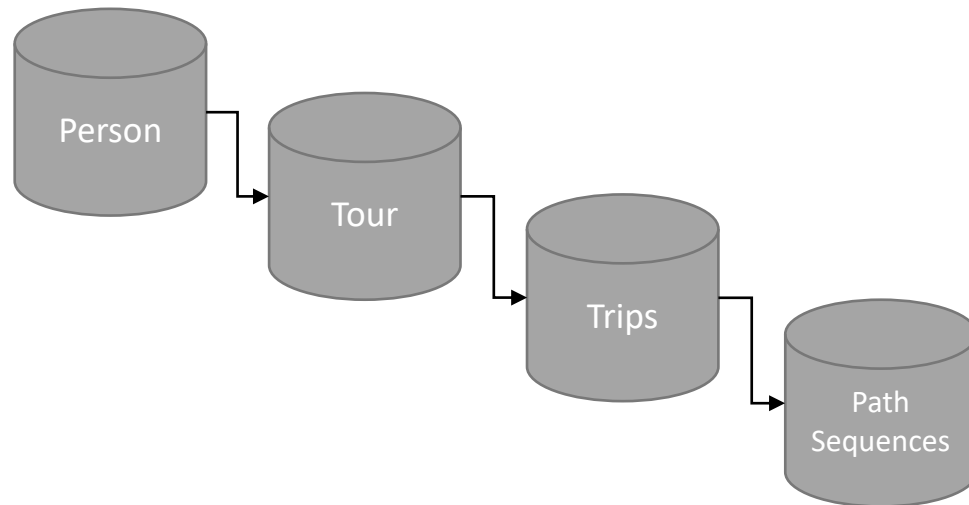
No	ResidenceKey	lowinc	auto_ownership	BLDGSZ	family	has_children6_to_12	has_young_children	hsize	
328	1974	home.8172	<input type="checkbox"/>	2	2	True	True	False	4
329	1977	home.8172	<input type="checkbox"/>	3	2	True	True	False	7
330	1978	home.8172	<input type="checkbox"/>	3	2	True	False	True	4
331	1994	home.8172	<input type="checkbox"/>	2	2	True	False	True	3
332	2000	home.8172	<input type="checkbox"/>	3	2	True	False	False	2
333	2003	home.8172	<input type="checkbox"/>	1	2	False	False	False	1
334	2004	home.8172	<input type="checkbox"/>	1	5	False	False	False	1
335	2011	home.8172	<input checked="" type="checkbox"/>	1	2	True	True	False	4
336	2020	home.8172	<input type="checkbox"/>	1	2	True	False	False	4
337	2021	home.8172	<input type="checkbox"/>	2	2	True	True	False	3
338	2024	home.8172	<input type="checkbox"/>	3	2	True	False	False	4
339	2026	home.8172	<input type="checkbox"/>	2	6	True	False	False	4
340	2029	home.8172	<input type="checkbox"/>	2	2	True	True	False	4
341	2033	home.8172	<input type="checkbox"/>	3	2	True	False	False	4
342	2043	home.8172	<input type="checkbox"/>	2	2	True	False	True	4
343	2046	home.8172	<input type="checkbox"/>	1	2	True	False	True	4
344	2056	home.8172	<input type="checkbox"/>	1	5	False	False	False	1
345	2058	home.8172	<input type="checkbox"/>	1	8	False	False	False	1
346	2061	home.8172	<input type="checkbox"/>	2	2	True	True	True	5
347	2063	home.8172	<input checked="" type="checkbox"/>	1	4	True	True	True	6
348	2067	home.8172	<input type="checkbox"/>	2	2	True	True	False	4

No	HouseholdNo	Index	LongTermChoiceKeys	XCoord	YCoord	adult	age	age_16_p	age_16_to_19
1028	6180	1978	4 (school.6810)	873828.3295	487176.1939	False	1	False	False
1029	6223	1994	1 (work.9910)	873828.3295	487176.1939	True	54	True	False
1030	6224	1994	2	873828.3295	487176.1939	True	21	True	False
1031	6225	1994	3 (school.6907)	873828.3295	487176.1939	False	1	False	False
1032	6243	2000	1	873828.3295	487176.1939	True	69	True	False
1033	6244	2000	2 (work.7705)	873828.3295	487176.1939	True	57	True	False
1034	6249	2003	1	873828.3295	487176.1939	True	78	True	False
1035	6249	2004	1	873828.3295	487176.1939	True	43	True	False
1036	6262	2011	1	873828.3295	487176.1939	True	51	True	False
1037	6263	2011	2	873828.3295	487176.1939	True	45	True	False
1038	6264	2011	3 (school.6951)	873828.3295	487176.1939	False	14	False	False
1039	6265	2011	4 (school.6907)	873828.3295	487176.1939	False	12	False	False
1040	6293	2020	1	873828.3295	487176.1939	True	57	True	False
1041	6294	2020	2 (work.7682)	873828.3295	487176.1939	True	51	True	False
1042	6295	2020	3 (school.7946)	873828.3295	487176.1939	False	14	False	False
1043	6296	2020	4	873828.3295	487176.1939	False	13	False	False
1044	6297	2021	1	873828.3295	487176.1939	True	56	True	False
1045	6298	2021	2	873828.3295	487176.1939	True	56	True	False
1046	6299	2021	3	873828.3295	487176.1939	False	12	False	False
1047	6307	2024	1	873828.3295	487176.1939	True	22	True	False

Daily Activity Plans with Tour and Trip representation

Tours and Trips objects to store day travel plans

- Interlinked Tour and Trip data objects store individual day plans
- Spatially connected to Locations for convenient feature mapping
- Connected to path sequences for detailed select link analysis
- Supports multimodal tour structure



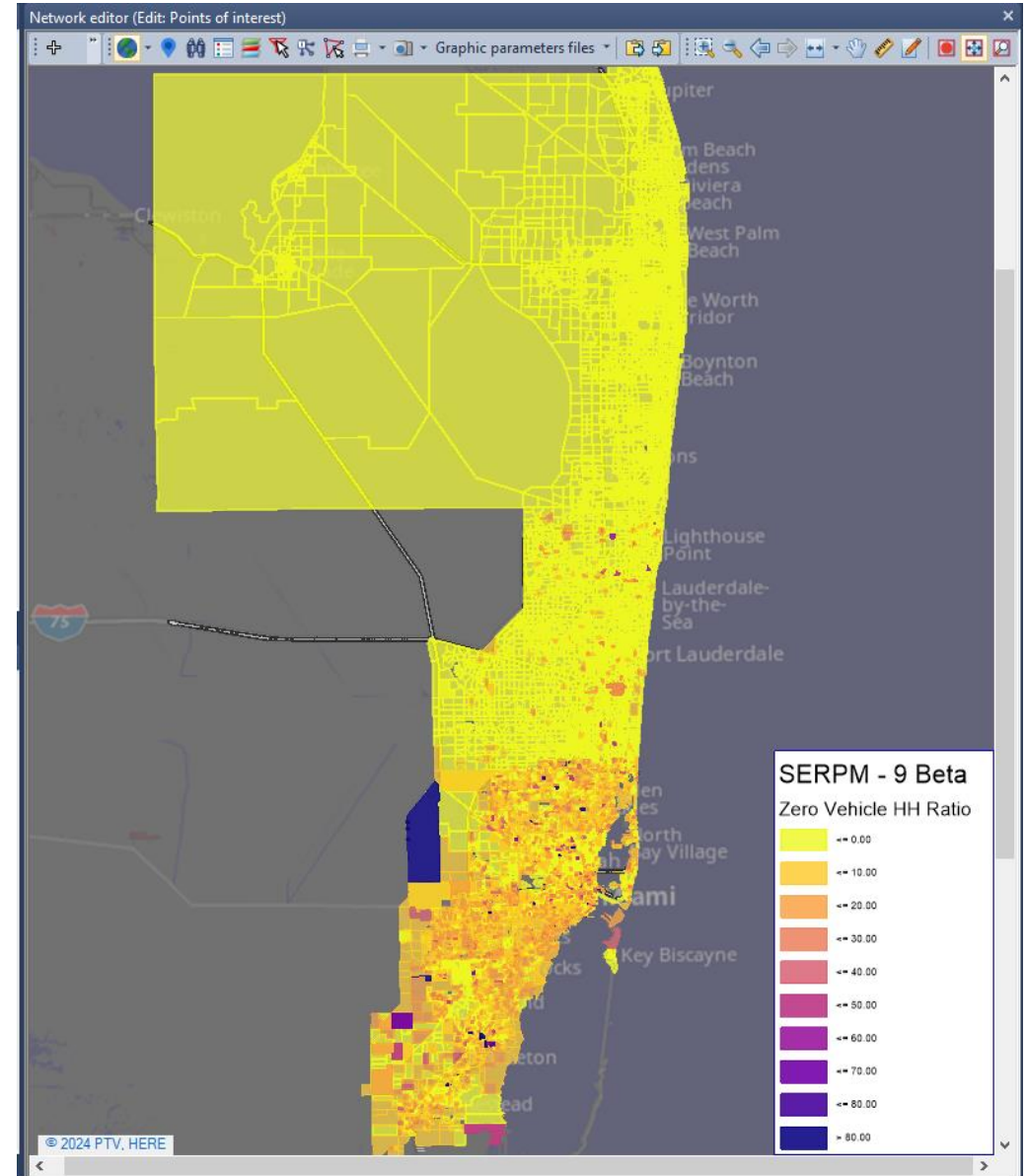
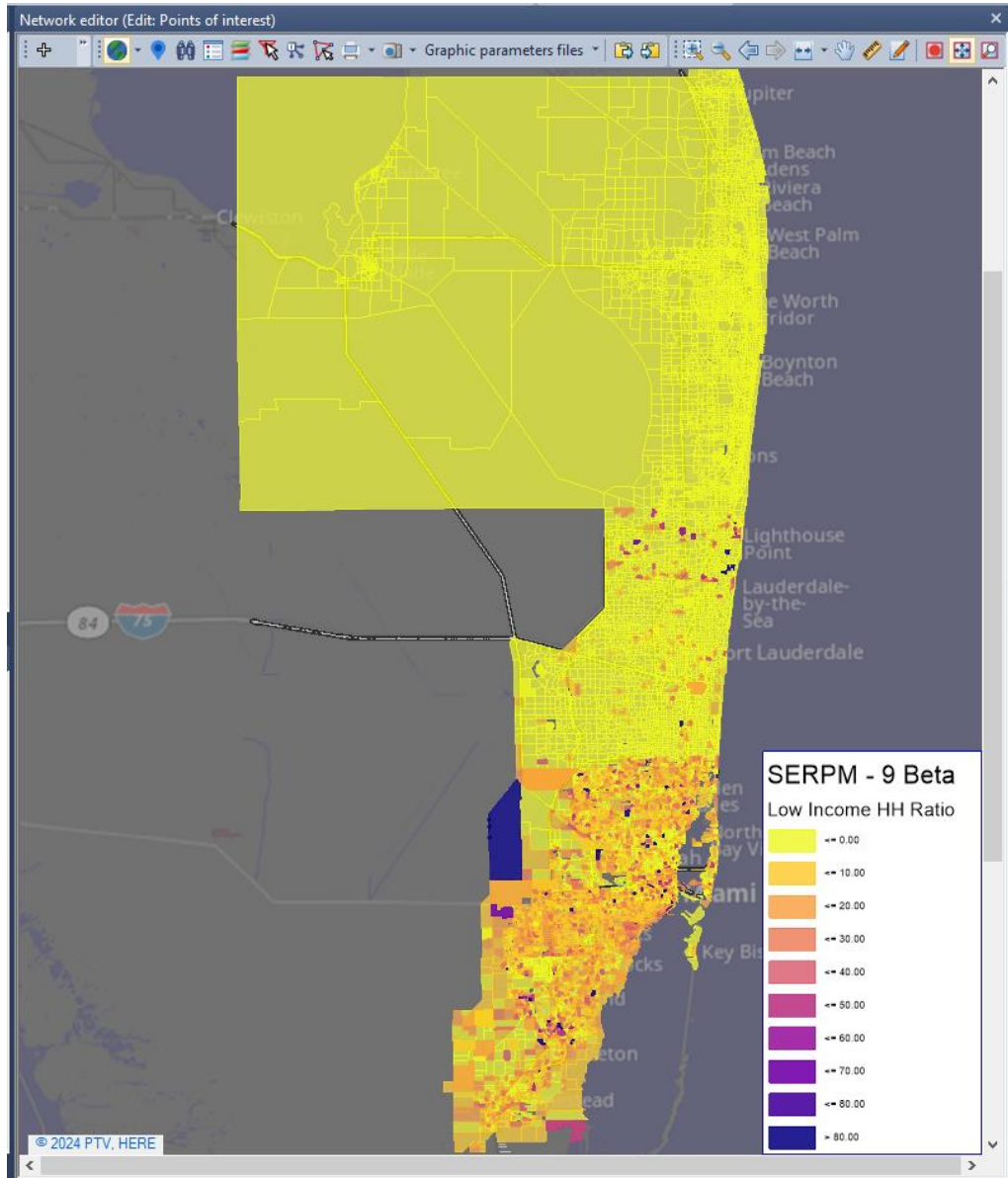
Number	OrigZoneNo	DestZoneNo	Index	Vol	VolFlowBundle	Name	AddVal	PersonNo	ScheduleNo	TourNo
23	1	1	23	1.000			0	5770038	1338966	
24	1	1	24	1.000			0	5770038	1778577	
25	1	1	25	1.000			0	5770052	1338957	
26	1	1	26	1.000			0	5770052	1778576	
27	1	1	27	1.000			0	5770053	1338958	
28	1	1	28	1.000			0	5770053	1778576	
29	1	1	29	1.000			0	5770059	1338996	
30	1	1	30	1.000			0	5770064	1339136	
31	1	1	31	1.000			0	5770077	1339249	
32	1	1	32	1.000			0	5770084	1339336	
33	1	1	33	1.000			0	5770092	1339278	
34	1	1	34	1.000			0	5770096	1339378	
35	1	1	35	1.000			0	5770100	1339393	
36	1	1	36	1.000			0	5770101	1339394	
37	1	1	37	1.000			0	5770104	1339265	
38	1	1	38	1.000			0	5770104	1778613	
39	1	1	39	1.000			0	5770104	1778614	
40	1	1	40	1.000			0	5770105	1339270	
41	1	1	41	1.000			0	5770105	1778614	
42	1	1	42	1.000			0	5770105	1778614	
43	1	1	43	1.000			0	5770110	1339208	
44	1	1	44	1.000			0	5770110	1339209	
45	1	1	45	1.000			0	5770111	1339211	
46	1	1	46	1.000			0	5770112	1339212	
47	1	1	47	1.000			0	5770114	1339222	

Person	ScheduleNo	TourNo	Index	DSeg Name	Duration	travdist	SchedDepTime	SchedArrTime
65	51	9	3	DRIVEALONEPAY	19min 44s	12.57	17:30:00	17:49:44
66	52	10	1	SHARED2GP	35min 23s	27.42	04:00:00	04:35:23
67	52	10	1	SHARED2GP	35min 23s	27.42	14:00:00	14:35:23
68	53	11	1	SHARED3GP	10min 51s	6.60	03:30:00	03:40:51
69	53	11	1	SHARED3GP	10min 51s	6.60	10:30:00	10:40:51
70	55	12	1	SHARED2GP	15min	8.83	04:00:00	04:15:00
71	55	12	1	SHARED2GP	15min	8.83	11:00:00	11:15:00
72	68	35	1	DRIVEALONEPAY	25min 20s	19.24	05:00:00	05:25:20
73	68	35	1	DRIVEALONEPAY	9min	5.29	05:00:00	05:09:00
74	68	35	1	DRIVEALONEPAY	25min 6s	17.63	15:00:00	15:26:06
75	68	36	2	DRIVEALONEFREE	20s	0.17	08:00:00	08:00:20
76	68	36	2	DRIVEALONEFREE	20s	0.17	00:00:00	00:00:20
77	69	37	1	DRIVEALONEPAY	26min 4s	18.68	02:30:00	02:56:04
78	69	37	1	DRIVEALONEPAY	0min 33s	4.36	10:00:00	10:08:33
79	69	37	1	DRIVEALONEPAY	16min 1s	12.00	16:00:00	16:16:01

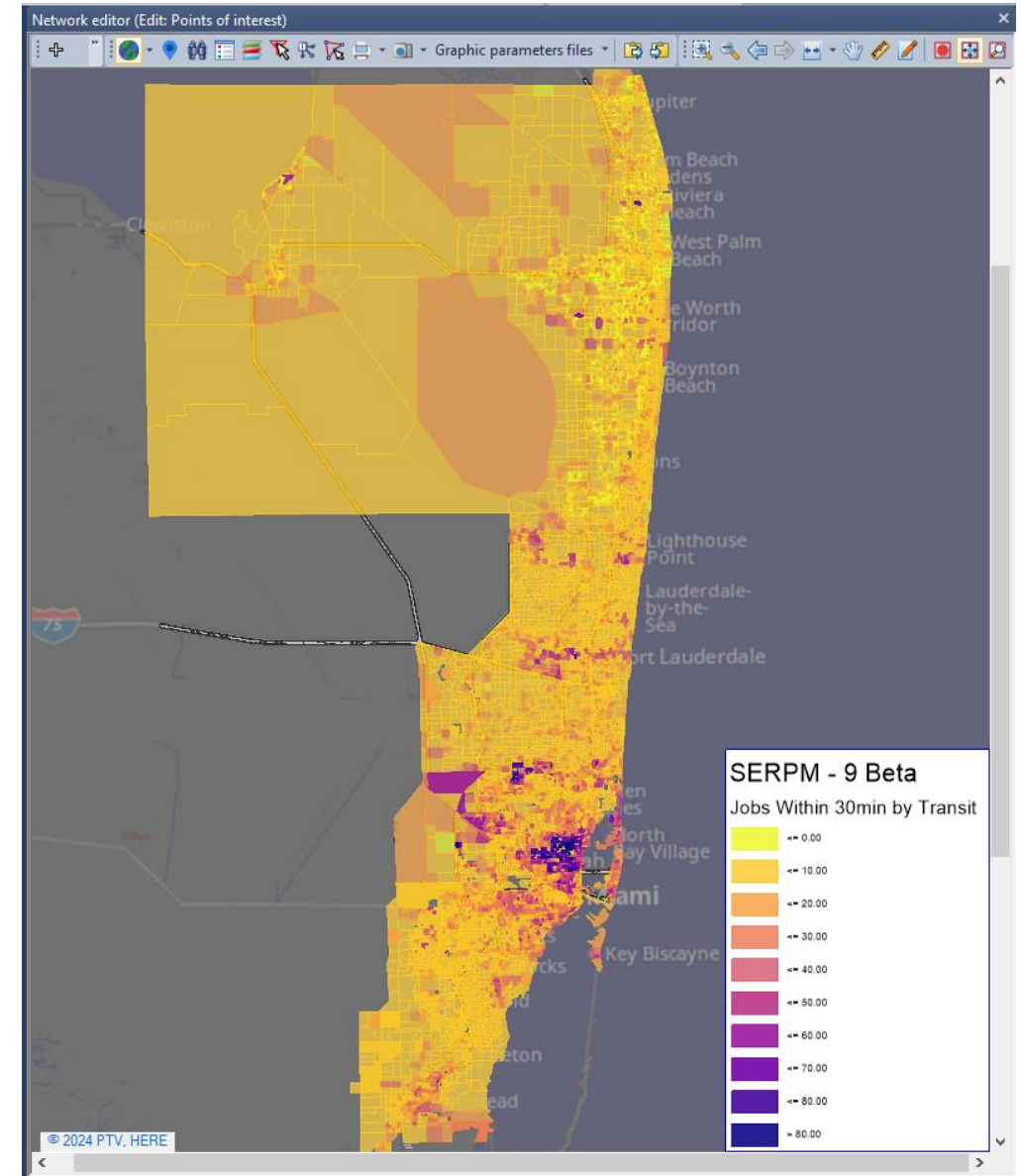
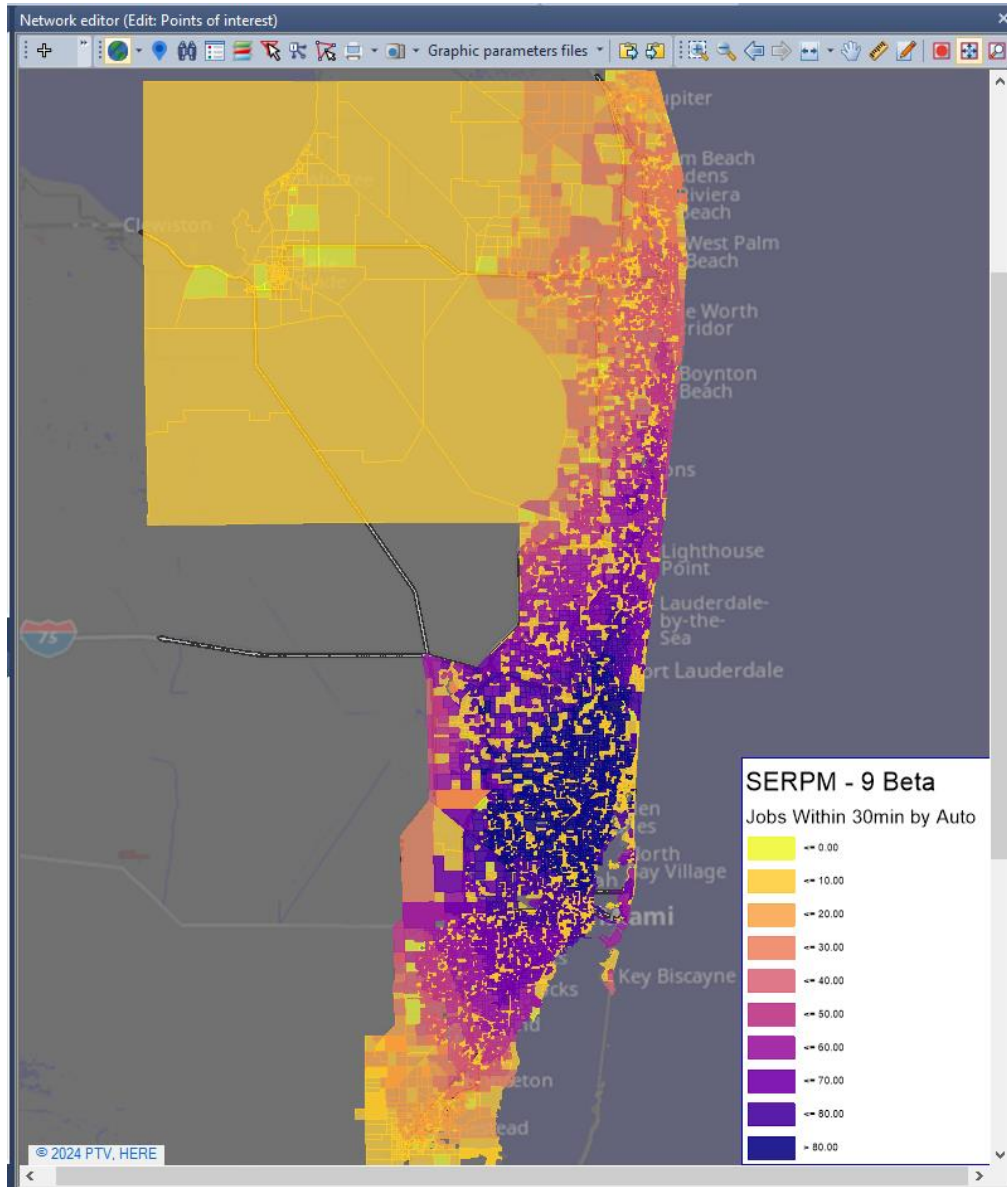
02

ABM Data Container Use
Cases

Integrated Analysis of Synthetic Population – MAZ Level



Integrated Analysis of Resource Access – Access to Jobs MAZ Level



Person Level Path Tracing for Various Types of Analysis

The screenshot displays a network editor interface with a map of Palm Beach, Florida, showing segmented path flows. A text box on the map reads: "Trace of Paths".

Below the map, a text box explains the process: "Segmented path flows from network assignments snapped probabilistically to trips at person level to extend select link analysis."

On the right side, there are two data tables:

List (PrT paths)

Number	Origin	Destination	Vol(AP)	tCur	vCur	Length
1	4	1.000	5min 3s	34mph	2.881mi	
2	5	0.000	5min 31s	34mph	3.113mi	
3	6	5.000	3min 1s	34mph	1.719mi	
4	7	1.000	3min 27s	35mph	2.023mi	
5	8	1.000	3min 37s	35mph	2.112mi	
6	13	1.000	3min 54s	36mph	2.340mi	
7	14	0.000	4min 44s	36mph	2.826mi	
8	17	0.000	10min 28s	36mph	6.360mi	
9	19	0.000	6min 40s	37mph	4.081mi	
10	20	2.000	6min 54s	36mph	4.185mi	
11	21	0.000	8min 27s	38mph	5.384mi	
12	22	2.000	8min 35s	40mph	5.648mi	
13	24	0.000	11min 36s	38mph	7.405mi	
14	27	0.000	12min 57s	41mph	8.925mi	
15	40	0.000	8min 40s	36mph	5.243mi	
16	42	0.000	7min 29s	39mph	4.826mi	
17	44	2.000	6min 46s	38mph	4.327mi	
18	46	0.000	9min 56s	39mph	6.524mi	
19	51	0.000	15min 38s	42mph	10.887mi	
20	55	0.000	5min 58s	39mph	3.830mi	
21	56	2.000	5min 56s	36mph	3.555mi	
22	57	0.000	7min 25s	39mph	4.828mi	
23	59	3.000	7min 14s	39mph	4.723mi	
24	61	0.000	9min 50s	40mph	6.582mi	
25	62	0.000	9min 25s	41mph	6.367mi	

List (Trips)

Number	PersonNo	ScheduleNo	TourNo	Index	DSeg\Code	DSeg\Name	Duration
65	51	9	3	2	DRIVEALONEPAY	19min 44s	
66	52	10	1	3	SHARED2GP	35min 23s	
67	52	10	1	2	SHARED2GP	35min 23s	
68	53	11	1	5	SHARED3GP	10min 51s	
69	53	11	1	2	SHARED3GP	10min 51s	
70	55	12	1	3	SHARED2GP	15min	
71	55	12	1	2	SHARED2GP	15min	
72	68	35	1	2	DRIVEALONEPAY	25min 20s	
73	68	35	1	2	DRIVEALONEPAY	9min	
74	68	35	1	3	DRIVEALONEPAY	26min 6s	
75	68	36	2	1	DRIVEALONEFREE	20s	
76	68	36	2	2	DRIVEALONEFREE	20s	
77	69	37	1	2	DRIVEALONEPAY	26min 4s	
78	69	37	1	2	DRIVEALONEPAY	8min 33s	
79	69	37	1	3	DRIVEALONEPAY	25min 2s	
80	69	38	2	1	DRIVEALONEFREE	1min 40s	
81	69	38	2	2	DRIVEALONEFREE	1min 40s	

Path Tracing – Link User Profile

The screenshot displays the PTV Visum Expert 2024 interface. The central window shows a network editor with a map of Fort Lauderdale, Florida, overlaid with a network of links and nodes. A 'Trace of Paths' window is open, showing a volume flow bundle PrT [veh] (AP) with values 0, 9074, 18148, and 36296. A callout box highlights the text: 'Query and analyze person level characteristics for path/select link analysis'. On the right, a 'List (Path sequences)' window displays a table with columns for path sequence number, volume, flow bundle, person number, schedule number, tour number, and household characteristics.

Number	Vol	VolFlowBundle	PersonNo	ScheduleNo	TourNo	Person/Household/HINC	Person/Household/HINCCAT1
1	1.000	1.000	5771129	1339105	1	107200	4
2	1.000	1.000	5771686	1339692	1	27600	2
3	1.000	1.000	4698713	1477582	2	50100	2
4	1.000	0.359	4610303	1342344	1	68200	3
5	1.000	1.000	4610663	1342351	1	80000	3
6	1.000	1.000	4511200	1637418	1	295000	5
7	1.000	1.000	4633151	1348099	1	31000	2
8	1.000	1.000	4633618	1347850	1	79100	3
9	1.000	1.000	4633746	1348025	1	60800	3
10	1.000	1.000	4633788	1779429	1	58000	2
11	1.000	1.000	4633789	1779429	1	58000	2
12	1.000	1.000	4639373	1349674	1	64300	3
13	1.000	1.000	4654264	1352954	1	120000	4
14	1.000	1.000	4700327	1477978	1	75200	3
15	1.000	1.000	4521761	1635577	1	12720	1
16	1.000	1.000	4718663	1497503	1	50000	2
17	1.000	1.000	4718917	1497425	1	102000	4
18	1.000	1.000	4634288	1348513	1	234000	5
19	1.000	1.000	4651433	1631149	1	151000	5
20	1.000	1.000	4636505	1634708	1	71200	3
21	1.000	1.000	4703663	1631918	1	45400	2
22	1.000	1.000	4653325	1352868	1	93400	4
23	1.000	1.000	4653587	1352819	1	33900	2
24	1.000	1.000	4697928	1477288	1	427500	5
25	1.000	1.000	4680560	1557363	1	44800	2
26	1.000	1.000	4680580	1557457	1	61400	3
27	1.000	1.000	4562813	1559856	1	95400	3
28	1.000	1.000	4661469	1354949	1	36000	2
29	1.000	1.000	4661794	1354933	1	30500	2
30	1.000	1.000	4663004	1560312	1	15300	1
31	1.000	1.000	4666984	1561587	1	53700	2
32	1.000	1.000	4578679	1280244	1	40660	2
33	1.000	1.000	5030279	1370667	1	35000	2
34	1.000	1.000	5028397	1798974	1	44600	2
35	1.000	1.000	5028398	1798974	1	44600	2
36	1.000	1.000	5045025	1550572	1	104700	4
37	1.000	1.000	4990645	1567928	1	69800	3
38	1.000	1.000	5063376	1377337	1	20600	1
39	1.000	1.000	5072605	1549794	1	8000	1
40	1.000	1.000	5053992	1551687	1	76000	3
41	1.000	1.000	5079307	1548740	1	41800	2
42	1.000	1.000	5083435	1570764	1	40620	2
43	1.000	1.000	5020973	1554739	1	99200	4
44	1.000	1.000	5685782	1579473	1	77000	3
45	1.000	1.000	5690747	1577442	1	112100	4
46	1.000	1.000	5688627	1391240	1	55800	2
47	1.000	1.000	5680589	1574120	1	82920	3
48	1.000	1.000	5764855	1506540	1	45000	2
49	1.000	1.000	5694555	1801072	1	83910	3
50	1.000	1.000	5694556	1801072	1	83910	3
51	1.000	1.000	5694557	1801072	1	83910	3

Path Tracing – Average Income Distribution

The screenshot displays the PTV Visum Expert 2024 interface for path tracing analysis. The main map shows a network of roads and nodes with various colored markers representing different path sequences. A 'Trace of Paths' window is open, showing volume flow bundle data for a specific path.

Trace of Paths
 Link bars
 Volume flow bundle PrT [veh] (AP)
 0 9074 18148 36296

List (Path sequences)

Number	Cmp(PersonNo)	Cmp(ScheduleNo)	Cmp(TourNo)	Grp(Person\Household\HINCCAT1)	Avg(Person\Household\HINC)	Sum(Vol)
1	-	-	-	1	16206	7052.000
2	-	-	-	2	41773	9373.000
3	-	-	-	3	73913	9076.000
4	-	-	-	4	114648	5938.000
5	-	-	-	5	246430	5082.000

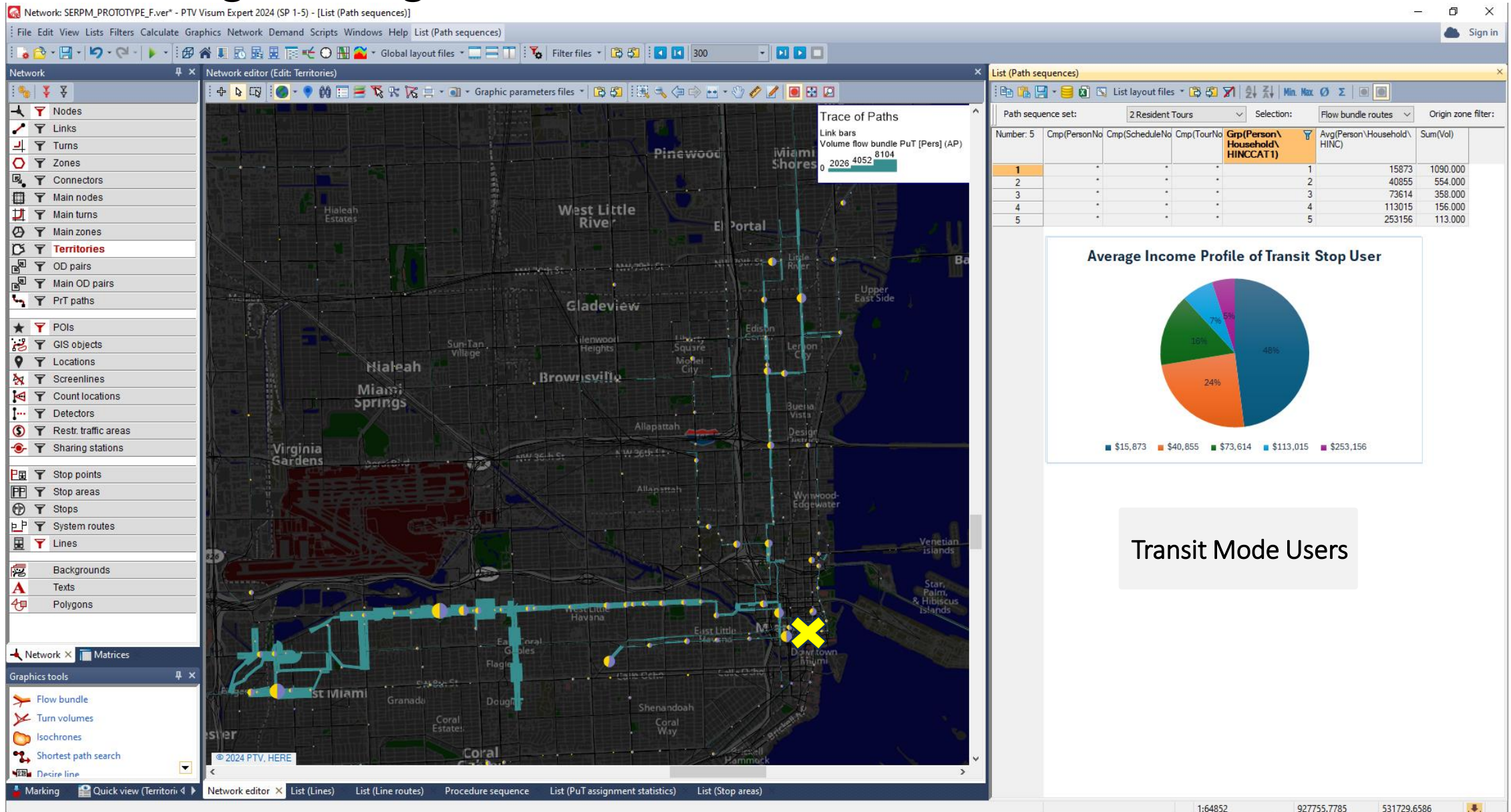
Average Income Profile of Link User

Legend for Average Income Profile of Link User:

- \$16,206 (16%)
- \$41,773 (26%)
- \$73,913 (25%)
- \$114,648 (19%)
- \$246,430 (14%)

Auto Mode Users

Path Tracing – Average Income Distribution



Transit Mode Users

Path Tracing – Average Income Distribution

Network: SERPM_PROTOTYPE_Ever* - PTV Visum Expert 2024 (SP 1-5) - [List (Path sequences)]

File Edit View Lists Filters Calculate Graphics Network Demand Scripts Windows Help List (Path sequences)

Global layout files Filter files 300

Network editor (Flow bundle) List (Path sequences)

Network editor (Flow bundle) List (Path sequences)

Path sequence set: 2 Resident Tours Selection: Flow bundle routes Origin zone filter: All

Number: 5	Cmp(PersonNo	Cmp(ScheduleNo	Cmp(TourNo	Grp(Person\Household\HINCCAT1)	Avg(Person\Household\HINC)	Sum(Vol)
1	*	*	*		14161	244.000
2	*	*	*		40325	96.000
3	*	*	*		74437	53.000
4	*	*	*		117990	26.000
5	*	*	*		301758	33.000

Trace of Paths
Link bars
Volume flow bundle PrT (veh) (AP)
0 85 171 341

Average Income Profile of Link User

Income Bracket	Percentage
\$14,161	54%
\$40,325	21%
\$74,437	12%
\$117,990	7%
\$301,758	6%

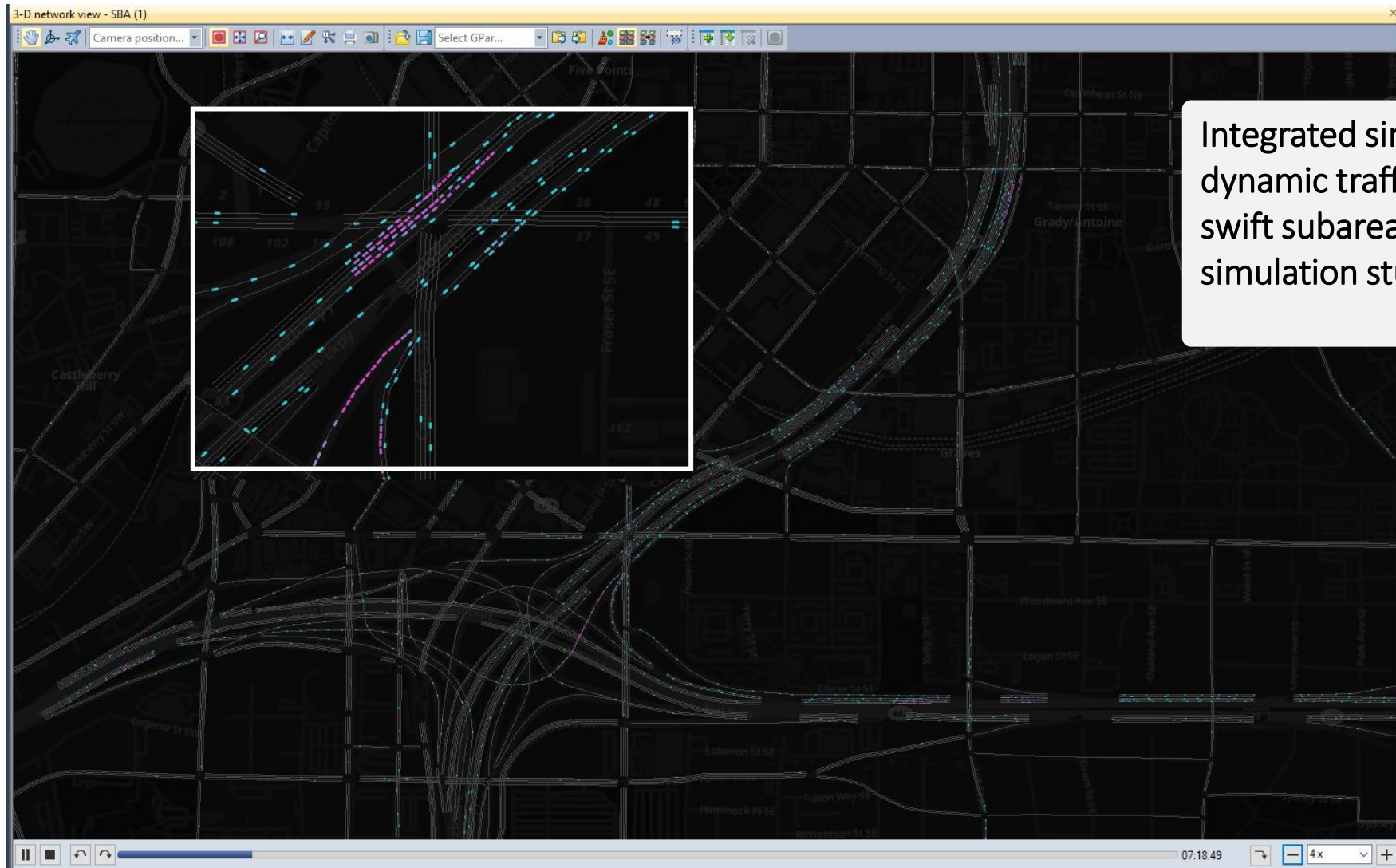
Active Mode Users

Marking Quick view Network editor Procedure sequence

03

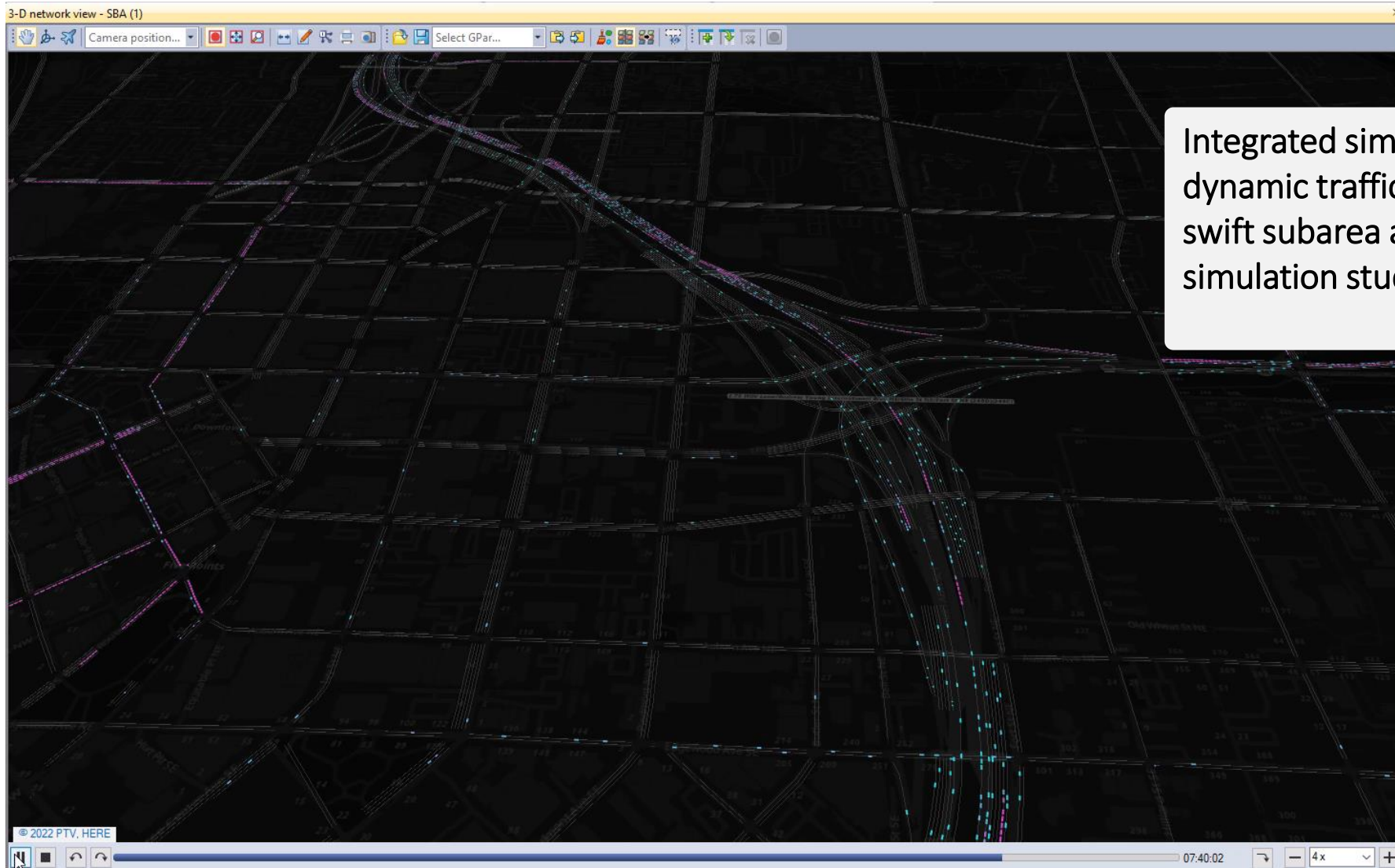
Additional Use Cases

Interface and extend with other lateral and sub-models



Integrated simulation based dynamic traffic assignment for swift subarea and corridor level simulation studies...

Interface and extend with other lateral and sub-models



Integrated simulation based dynamic traffic assignment for swift subarea and corridor level simulation studies...



PTV GROUP

Discussion / Questions?



Thank you!

<https://www.myptv.com/en/mobility-software>