



MWCOG TFS

July 12th 2024

Agenda



Introducing OpenPaths
Q&A
Studio Updates and Advancements
Q&A



Introducing OpenPaths

Bentley Systems

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Introducing OpenPaths

Transportation Planning, Modelling and Analysis

- OpenPaths is a new, unified brand and license for Bentley's multimodal transport modelling software
- EMME, CUBE, AGENT, DYNAMEQ and CityPhi are now part of OpenPaths
- OpenPaths applications now benefit from common installation, software releases



OpenPaths™



OpenPaths Applications



OpenPaths™ EMME



OpenPaths™ CUBE



OpenPaths™ CityPhi



OpenPaths™ AGENT



OpenPaths™ DYNAMEQ

OpenPaths Editions

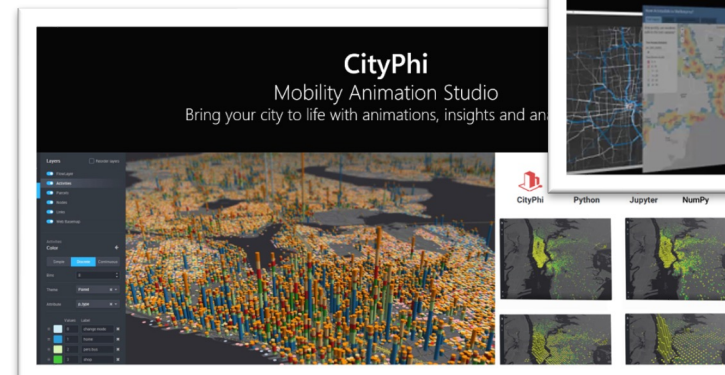
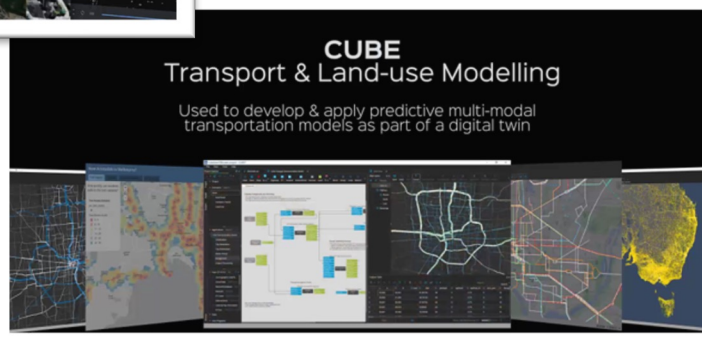
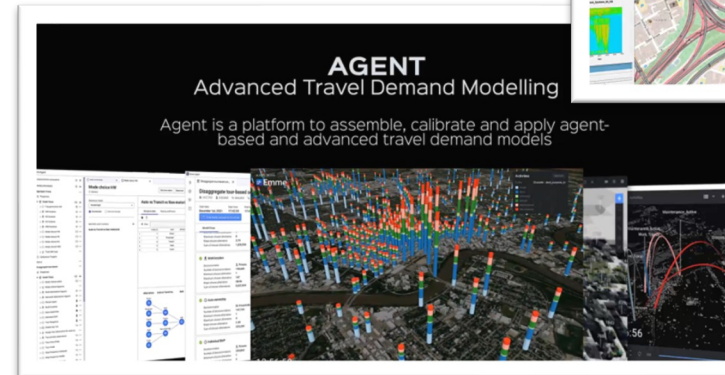
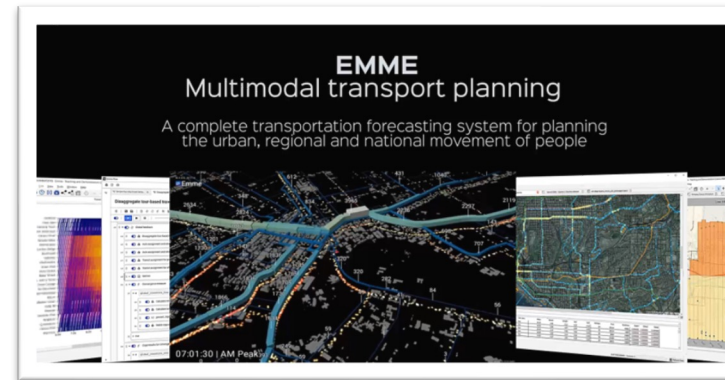
OpenPaths Advanced (SELECT)

- Essential capabilities for multimodal transport modelling and analysis
 - OpenPaths EMME
 - OpenPaths CUBE
 - OpenPaths CityPhi

OpenPaths Ultimate (SELECT & E365)

- Adds advanced demand modelling (ABM, data fusion, automated calibration) and dynamic traffic assignment
 - OpenPaths AGENT
 - OpenPaths DYNAMEQ
 - OpenPaths CUBE, OpenPaths EMME, OpenPaths CityPhi

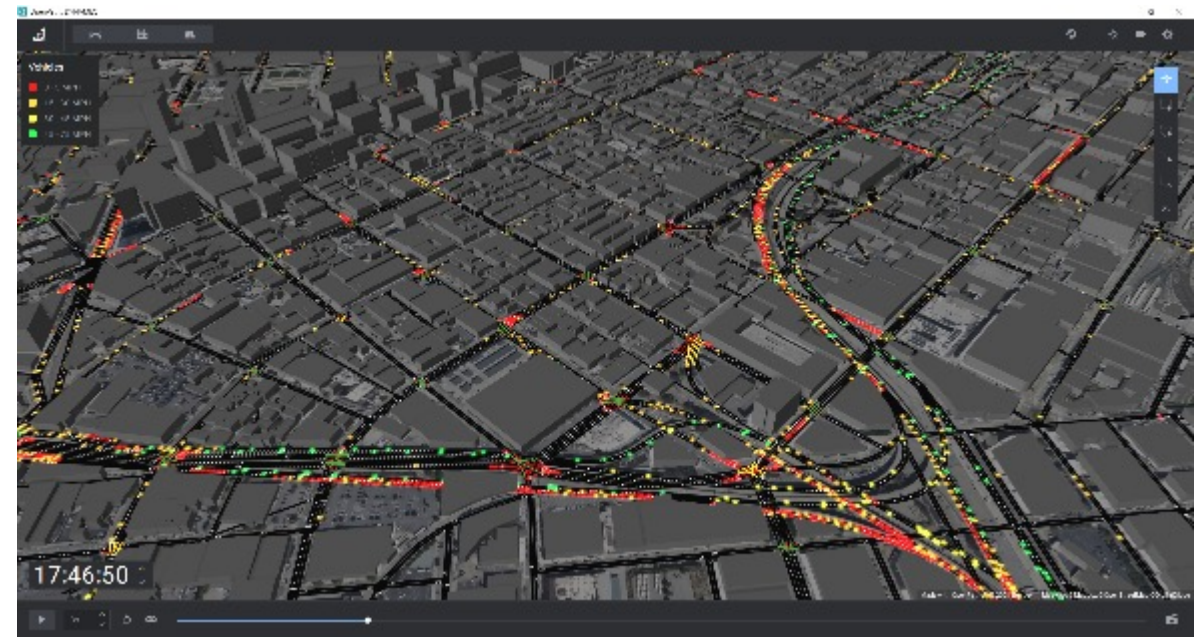
With OpenPaths you can **capture a complete representation of mobility** to answer 21st century strategic and operational planning questions.



Making the Most of OpenPaths

With OpenPaths Ultimate:

- Apply virtually any travel demand model structure without the high costs of changing software.
- Leverage all your mobility data sources in the modelling process, including big data.
- Eliminate costly trial-and-error approaches to model calibration and improve response time for more agile modelling.
- Support operational traffic planning applications in a more consistent manner with simulation-based dynamic traffic assignment.



OpenPaths 2024 Release Highlights



OpenPaths™ EMME™

Accelerated traffic assignment especially for larger networks | Better support for mixed-mode transit assignment | Flow gets edit mode, file browse / paths, tab re-ordering | Python 3.11



OpenPaths™ CUBE™

New GIS Window and Network Editor | AGENT integration | New Network Editor | New Table Editor | CubePy APIs for network/matrix processing | Application Editor, Run Monitor and Scenario Manager improvements | New toolbox and upgrade utilities



OpenPaths™ AGENT™

Automated calibration improvements | Freight modeling (firms, truck trips and tours) | Demand model re-start, tab re-ordering



OpenPaths™ DYNAMIQ™

O-D Path Editing | Python 3.11



OpenPaths™ CityPhi™

3D label layers | Lateral offset for directional networks | New expression language & engine | Updated time slider | Optimizations



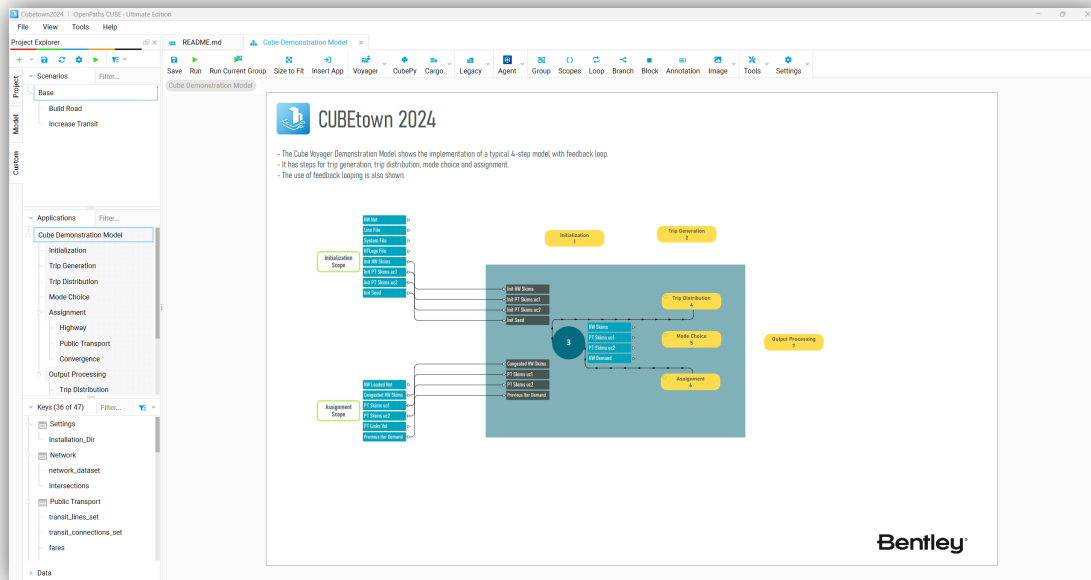
Moving to OpenPaths CUBE 2024

Must do:

- Convert to .cube-project
- Adjust application/scenarios
- Cluster updates
- Network management (pre/post)

Should/could do:

- Set up Scopes
- Set up Cube Maps templates
- Move existing Pilot & Python to CubePy
- Update existing Network/Matrix processes to CubePy
- Re-platform demand modelling to AGENT



Harmonized Demand Modeling with OpenPaths



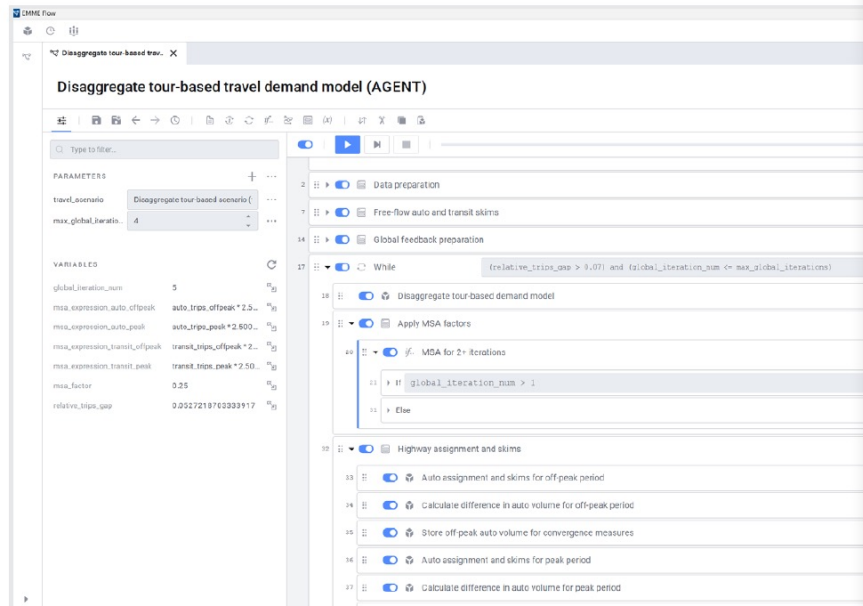
OpenPaths™ EMME®



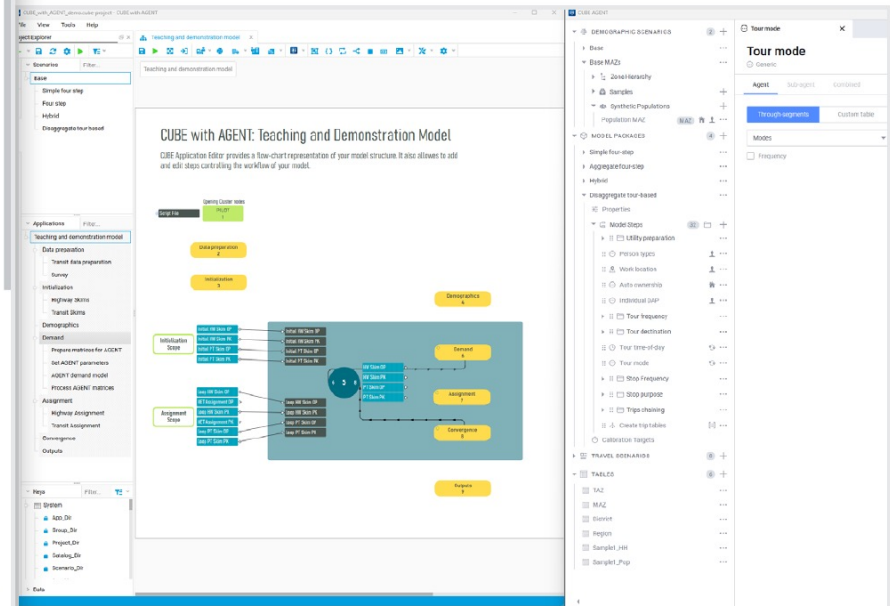
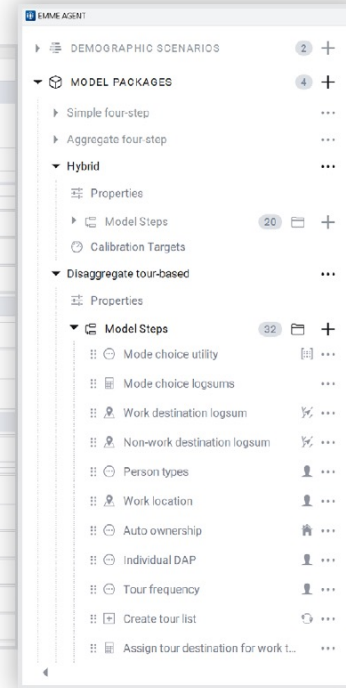
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OpenPaths™ CUBE™

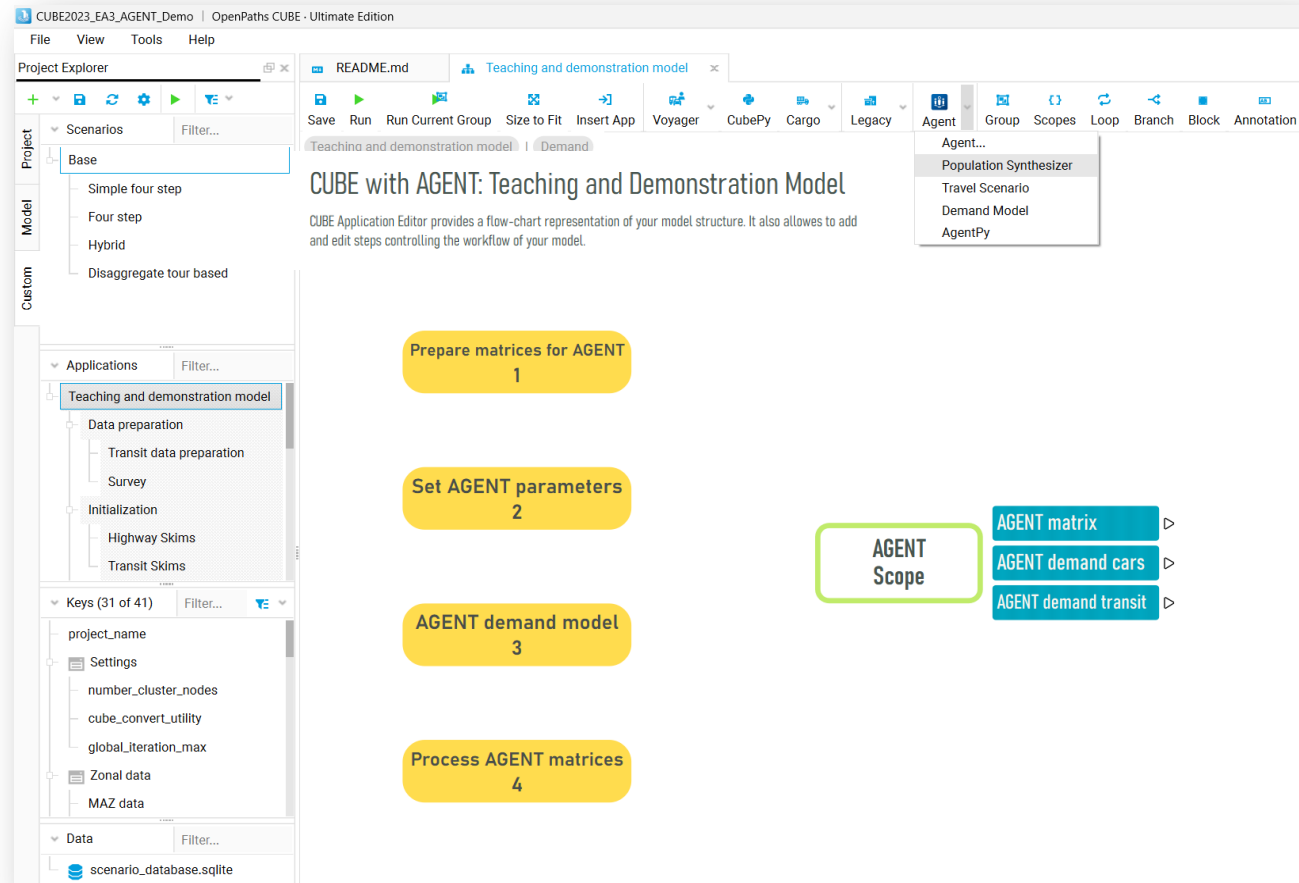


Leverage EMME features like Modeler, APIs, Notebooks, Scenes, and Flow with AGENT.



Leverage CUBE features like Application Manager, Scenario Manager, and Voyager with AGENT.

- OpenPaths AGENT is a modern platform to assemble, calibrate and apply travel demand models.
- Add AGENT program boxes directly into your applications with the application editor.
- Access the AGENT graphical user interface (GUI) from within CUBE's application toolbar.
- Support for AGENT API.

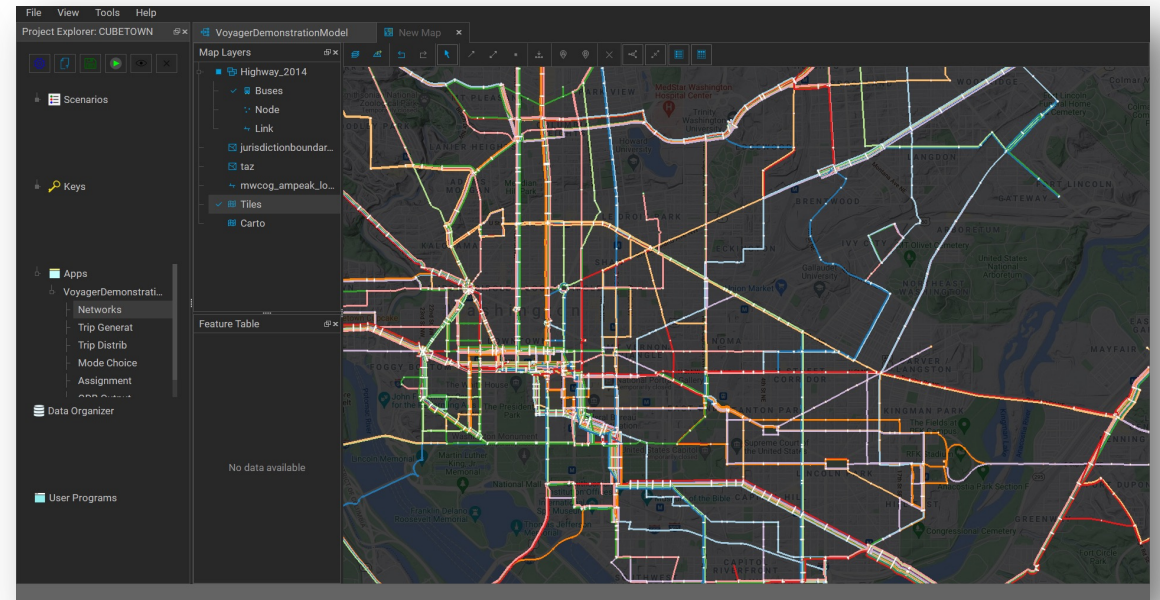
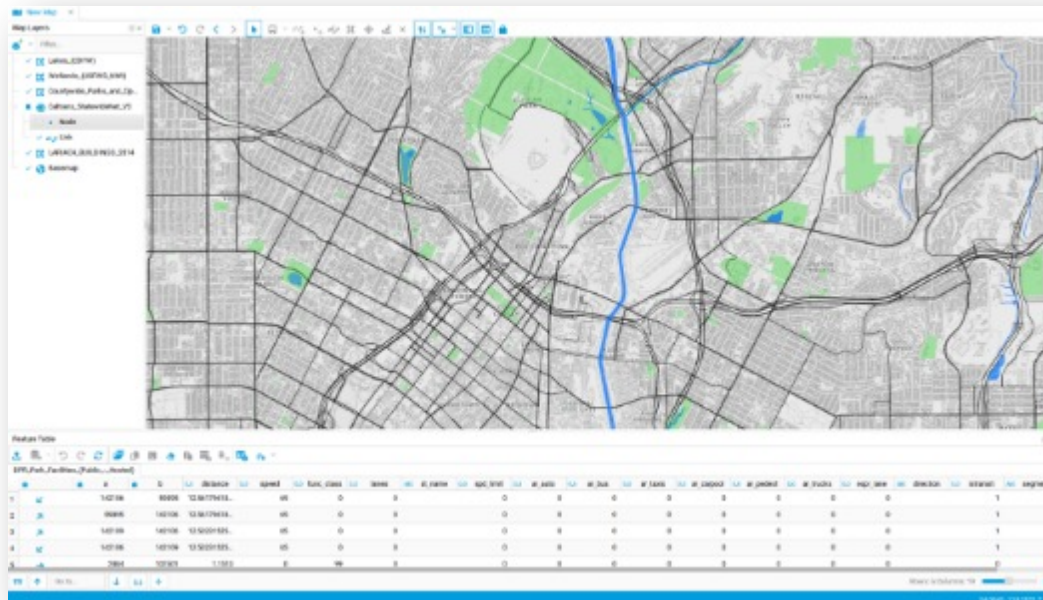


**CUBE with AGENT demo model available on request*



New GIS Window

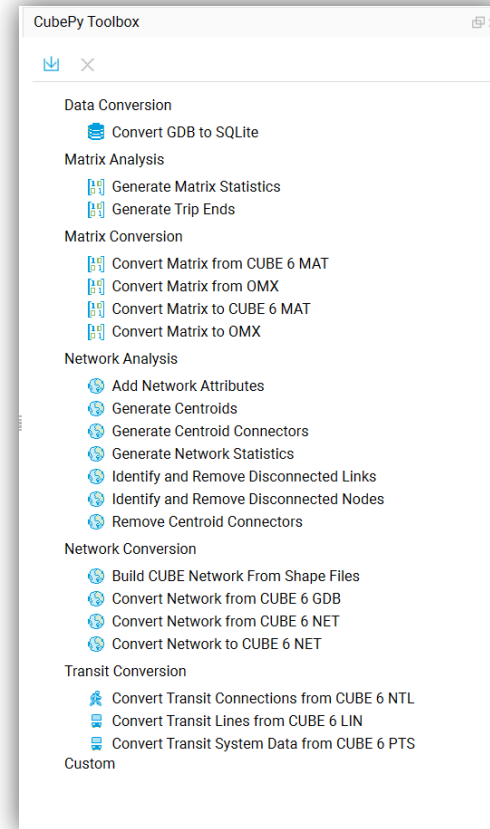
- A new GIS window provides more responsive mapping and network editing as well as improved support for large datasets.
- The mapping engine brings faster loading and refresh speeds and introduces convenient expressions for data-driven rendering. Expect all-streets centerline maps to load 3x-4x faster than CUBE 6.



New CubePy API

- CubePy - Python API for scripted network and matrix processing.
- CubePy Toolbox

```
1 import os
2 import contextlib
3 import math
4 from pathlib import Path
5 import shutil
6 import cubeapi as cp
7
8 # This example takes an input Cube Database that has
9 # been created previously and performs various
10 # operations on it. Note, it makes a copy of the
11 # original Spatialite file.
12
13 if __name__ == "__main__":
14     data_dir = f"{Path.home()}/data/cube7_test_data"
15     output_dir = "output"
16     source_db = f"{data_dir}/cube7_networks/jacksonville_cube.db.sqlite"
17     network_name = "test_network"
18     link_count = 10000
19     working_db = f"{output_dir}/jacksonville_misc_processing_cube.db.sqlite"
20
21     # copy the source db to a working db we will modify
22     with contextlib.suppress(FileNotFoundError):
23         os.remove(working_db)
24     shutil.copyfile(source_db, working_db)
25
26     # database already exists
27     db = cp.CubeDatabase(working_db)
28
29     # get the network names and list them
30     networks = db.getNetworkNames()
31     print("Networks: ")
32     for index in range(len(networks)):
33         print(f"\t{index + 1}: {networks[index]}")
34
35     # get the first network name
36     network_name = networks[0]
37
38     # We can find intersecting links for a geometry.
39     wkt = "LineString(-81.46202999978460468 30.6774699996407989, -81.45469999998500298 30.6702799992210141)"
40     # This returns a list of LinkGeometryEntry with "a", "b", and "wkt"
41     links = db.getLinkIntersectionForGeometry(network_name, wkt)
42     print("====> Finding links that intersect with the following geometry:")
```





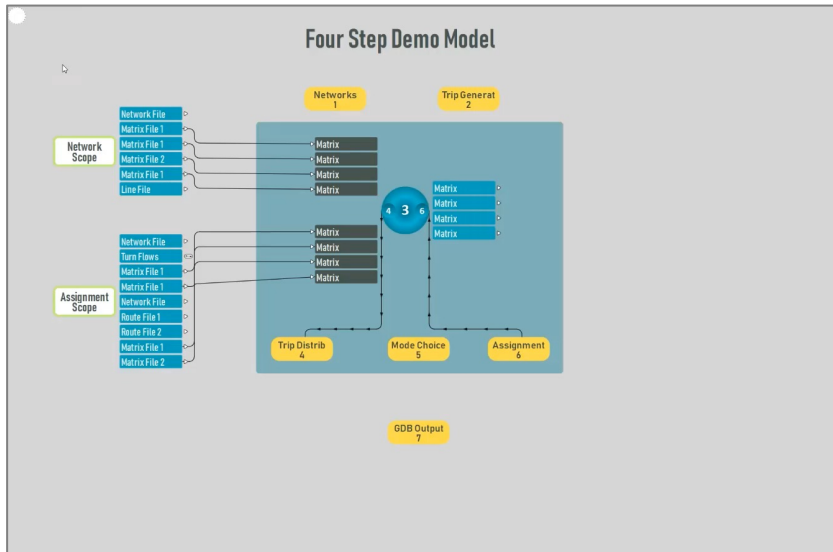
Other Highlights

- Network Editor for multimodal network editing
- A new Table Editor
- Cluster improvements
- Application Editor and Run Monitor
- ...

Model Dimensions

The study area is the one for Winnipeg (capital of the Canadian province of Manitoba):

- Number of Internal Zones: 164
- Number of External Stations: 17
- External Station zones (N): 21, 124, 132-148
- Base Year Households: 147,745
- Base Year Population: 361,841
- GIS Spatial Reference: WGS 84 / UTM zone 14N
- Model Boundary:



Cube Voyageur Demos/Model - TRIPGENS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
2	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
3	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
4	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
5	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
6	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
7	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
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11	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
12	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
13	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
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15	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
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18	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
19	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
20	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
21	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
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25	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000
26	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000





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Questions?



Studio Updates and Advancements

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Industry- Focused Team

- Chris Simons, Head of Data Science
30 years transportation experience
- Katie Brinson, Sales Director
11+ years transportation experience
- Keith Hangland, Head of Commercial
30 years transportation experience
- Ben Nault, Customer Experience Director
7+ years professional transportation experience



Strategic Partnerships



THE EASTERN
TRANSPORTATION
COALITION



About HERE Technologies

Our mission is to enable a digital representation of reality to radically improve the way the world moves, lives and interacts

▶ Play video

35+ years of experience in map-making and location technology

200m+ vehicles shipped with HERE maps data & solutions on board

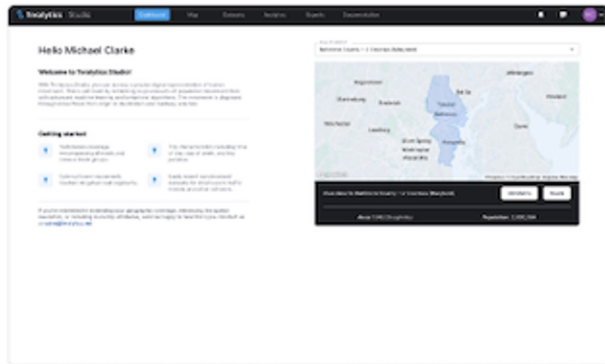
6,400+ employees across 52 countries



“

Completed an OD Key Bridge flow analysis using ZIP codes. The analysis will assist BMC staff in responding to policy board questions on how many, what location, and what travel is impacted. The software was flexible allowing BMC staff to upload geography (zip codes), identify a gate (Key Bridge), and capture/display OD flows.”

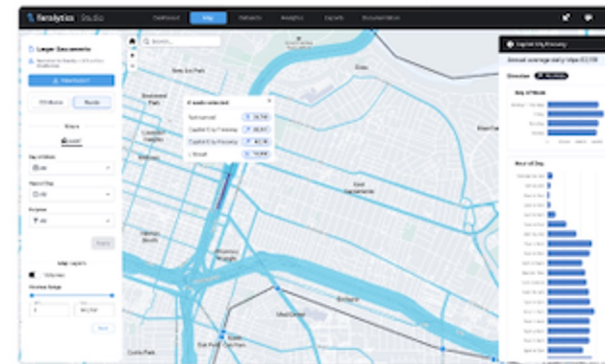
Charles Baber, Baltimore Metropolitan Council



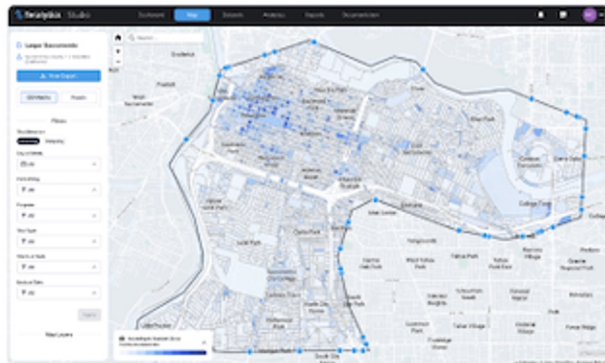
The Studio Dashboard: Access and share coverages and attributes.



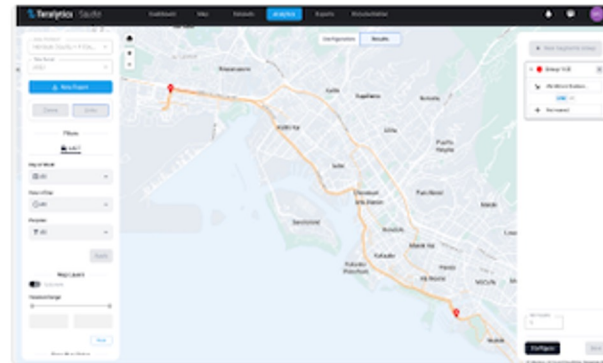
Origin-Destination View: Create custom views of travel flows by geographic area, time, purpose, and mode.



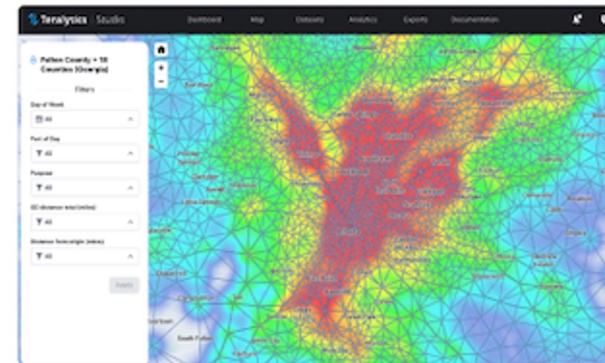
Volume View: View travel on the transportation network by geographic area, time, purpose and mode.



Customs Zones and Export: Create custom views of origin-destination flows by uploading custom zone layers. Trips are reallocated based on the latitude and longitude and external travel is automatically allocated to external gateways. Export an integrated, fully-routable transportation network and OD.



Select Link: Select links and zones using powerful AND and OR functions to isolate travel along selected infrastructure and to and from selected locations.

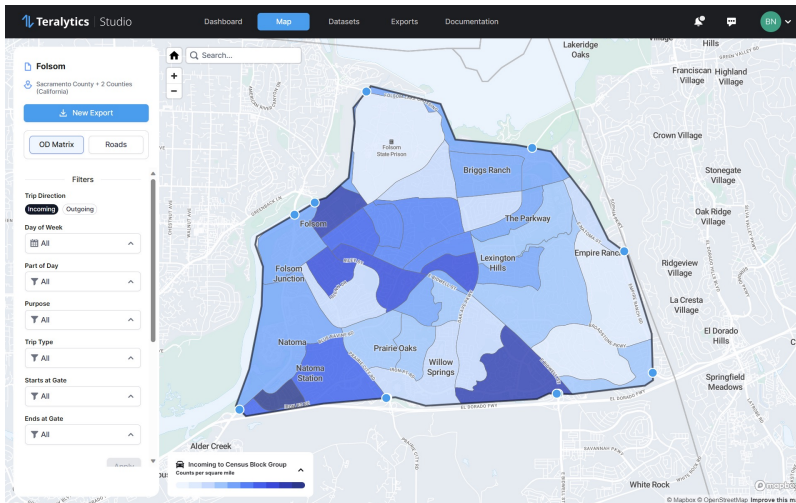


Corridor Discovery: Aggregate selected origin-destination flows across direct connection networks and network meshes to focus travel demand in useful ways for the planning of public transport operations, cycle lanes and roadways.

Datasets – Customize your data

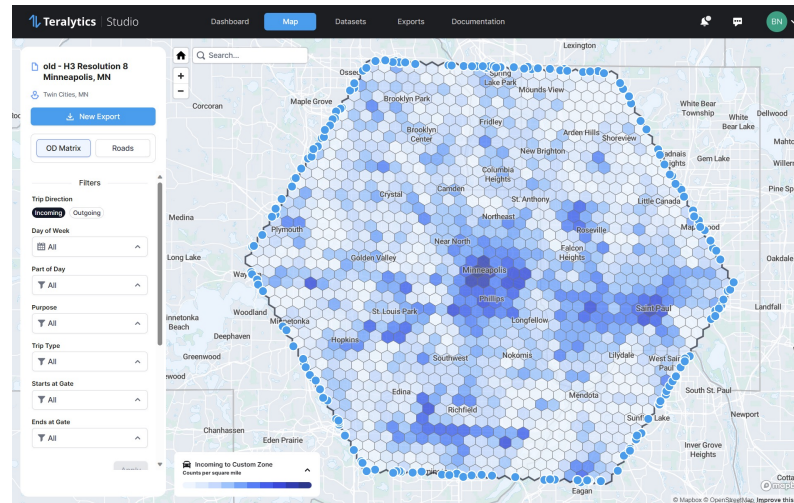
Subarea Extraction

- Pull a subset of your data for project specific work



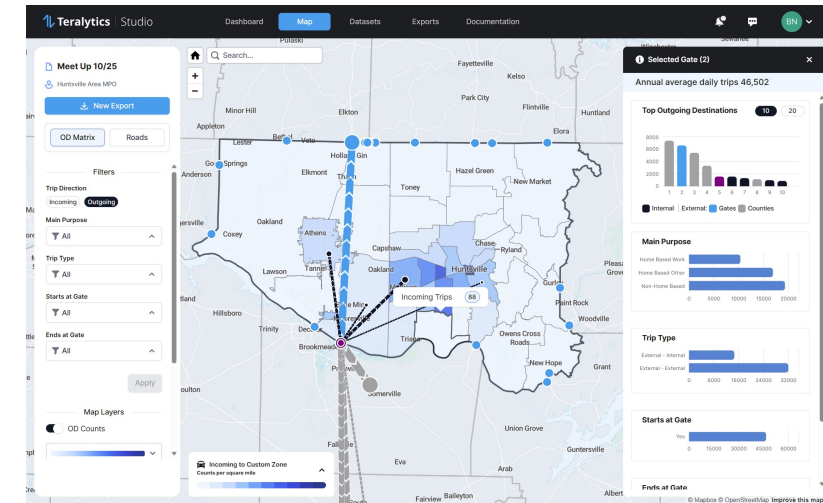
Custom Zoning

- Re-calibrate the GPS readings to your zone system
- Calculated based on precise path start and end



Gates

- Add gates to your OD table to tie roads and zones together
- See pass-through trips



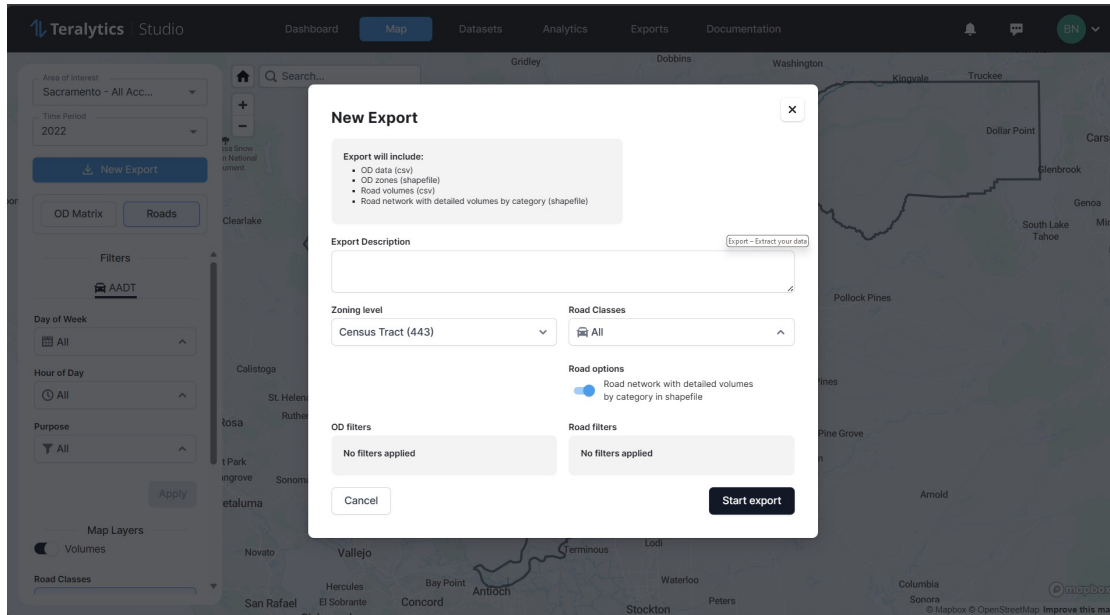
Export – Extract your data

Export Menu

- Select what you want
- Know what you're getting

Simple File Formats

- Easily use your data

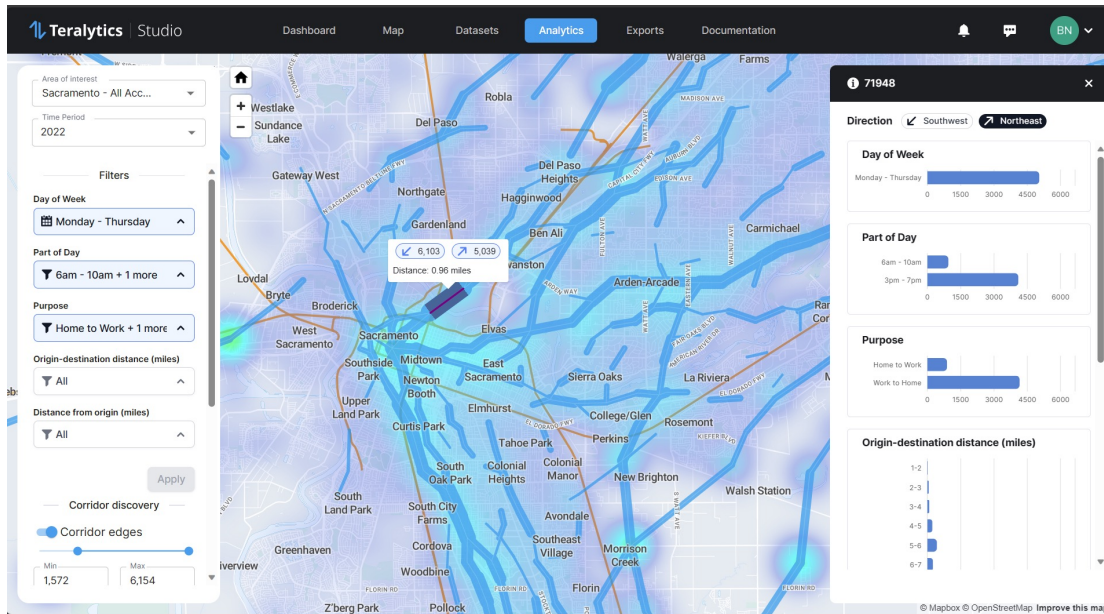


start_id	start_idseq	end_id	end_idseq	time_period	day_type	day_type_code	day_part	day_part_code	purpose	purpose_code	count
6073008702	201	6073005900	108	2019	Sun		4	15-Oct	3 O-H		4 1.9425
6073005600	105	6073020211	580	2019	Mon-Thu		1	00-06	1 H-O		3 0.0272
6073013206	300	6073021304	620	2019	Sun		4	15-Oct	3 H-O		3 0.6723
6073020306	585	6073020021	559	2019	Fri		2	10-Jun	2 H-W		1 1.5533
6073018100	481	6073017304	460	2019	Sun		4	15-19	4 W-O		5 0.7388
6073021600	623	6073004000	89	2019	Mon-Thu		1	15-19	4 NHB		7 1.2622
6073017050	445	6073014803	355	2019	Mon-Thu		1	10-Jun	2 O-W		6 0.0533
6073007100	119	6073017305	461	2019	Fri		2	10-Jun	2 H-O		3 0.0792
6073004400	93	6073008341	162	2019	Sat		3	19-24	5 NHB		7 0.5025
6073005700	106	6073008353	173	2019	Mon-Thu		1	15-19	4 NHB		7 0.1261
6073007600	126	6073008200	140	2019	Sun		4	15-Oct	3 W-O		5 14.1726
6073013905	339	6073004300	92	2019	Sun		4	15-19	4 NHB		7 0.1588
6073009304	215	6073008003	136	2019	Fri		2	19-24	5 O-H		4 1.1234
6073019902	547	6073009101	206	2019	Sat		3	19-24	5 NHB		7 0.7366
6073018803	510	6073018514	492	2019	Sun		4	15-Oct	3 O-H		4 10.3906
6073015701	374	6073015301	364	2019	Sun		4	10-Jun	2 O-H		4 0.287
6073003112	60	6073003207	67	2019	Mon-Thu		1	15-19	4 NHB		7 0.5117
6073017303	459	6073017401	463	2019	Sun		4	15-Oct	3 O-W		6 0.8808
6073013303	303	6073013203	297	2019	Sat		3	15-Oct	3 H-O		3 73.7664
6073017037	433	6073007501	124	2019	Sun		4	10-Jun	2 NHB		7 0.1464
6073008702	201	6073019702	540	2019	Mon-Thu		1	15-Oct	3 O-W		6 0.1943
6073020308	587	6073017032	428	2019	Fri		2	10-Jun	2 NHB		7 0.0133
6073003401	78	6073017022	424	2019	Mon-Thu		1	00-06	1 O-W		6 0.1714
6073017032	428	6073017106	453	2019	Fri		2	15-Oct	3 W-O		5 5.4878
6073008358	178	6073008366	186	2019	Sat		3	15-Oct	3 O-H		4 24.8218
6073019103	518	6073019208	526	2019	Sun		4	00-06	1 H-O		3 0.0098
6073020708	599	6073020307	586	2019	Fri		2	15-Oct	3 O-W		6 114.9661

Analytics – Unlock your data

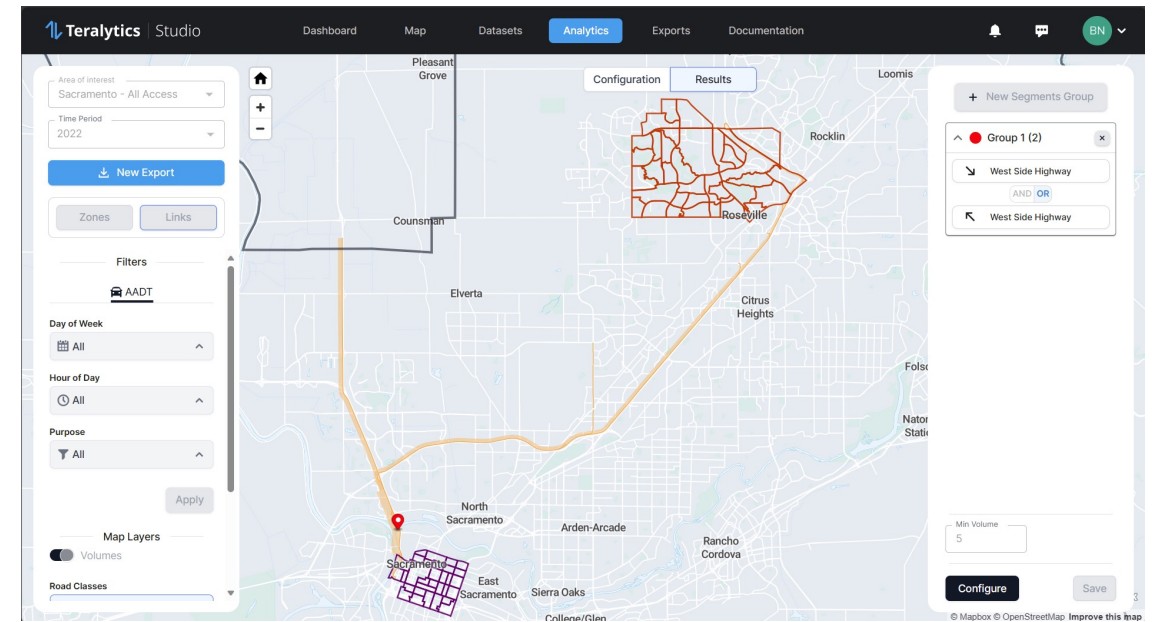
Corridor Analysis

- View your movement data on a systemwide scale



Select Link

- View your movement data on the network



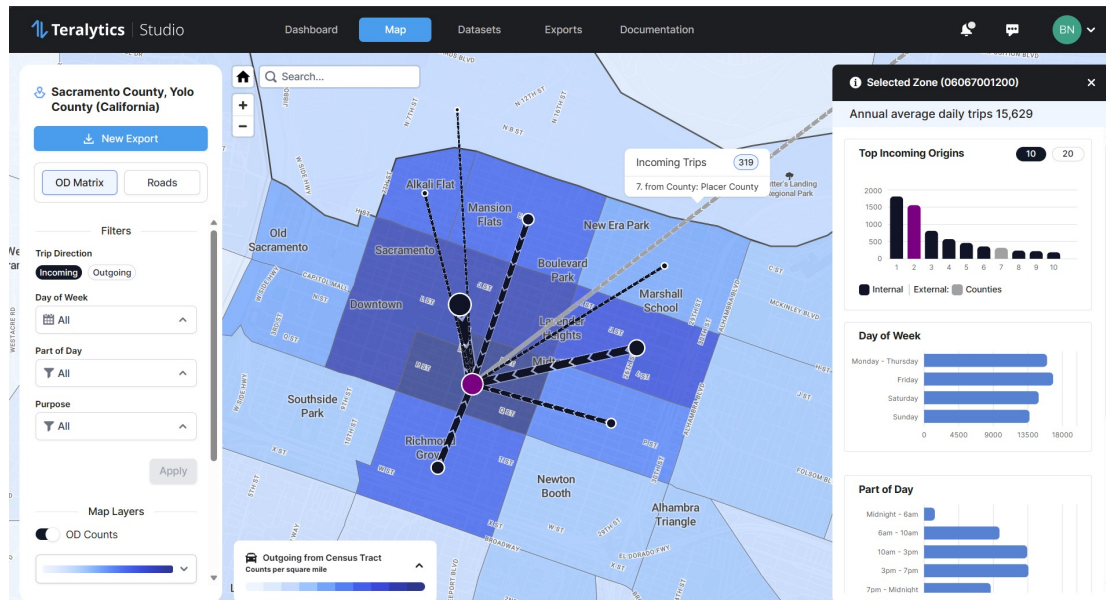
New Feature Alert: Road VMT

- Gain insights into Vehicle Miles Traveled (VMT)
- Compatible with FHWA Road Classifications
- Simple exports for reporting

Map – Visualize your Data

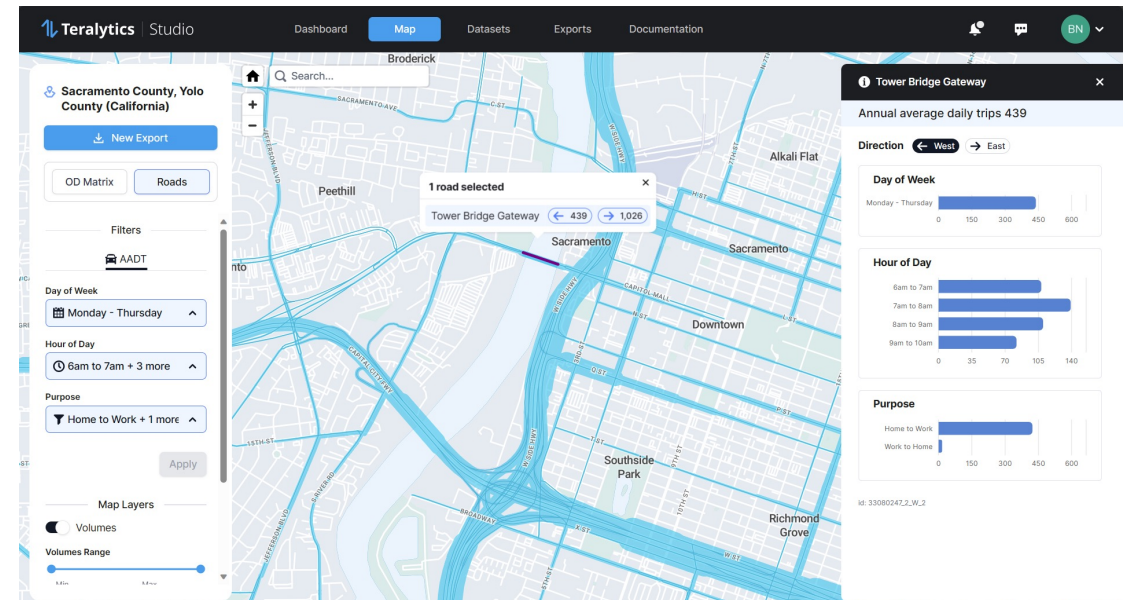
Origin Destination

- View movement to/from zones by filters
- Easy breakdown of information



Volumes

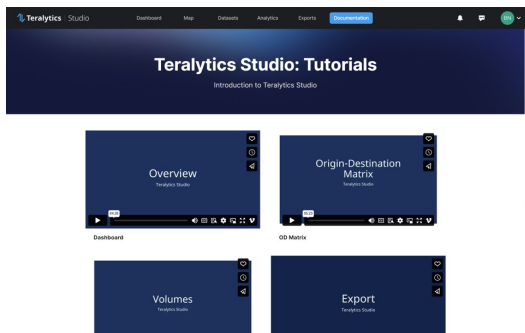
- AADT volumes on any road
- Vehicular and Pedestrian



Documentation – Understand your data

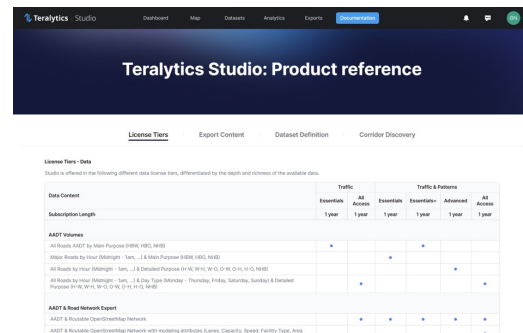
Video Tutorials

- Key tools explained



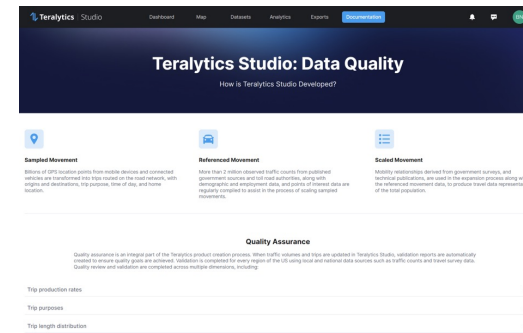
Reference

- Understand exported data



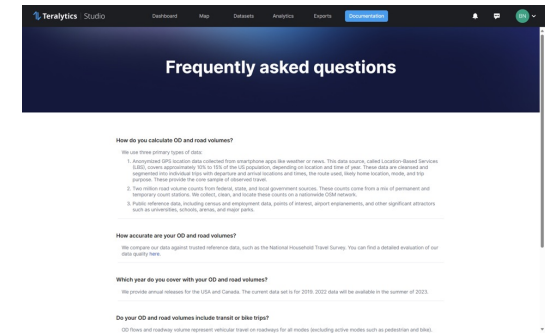
Data Quality

- See how the data quality is ensured



FAQ's

- Your most asked questions



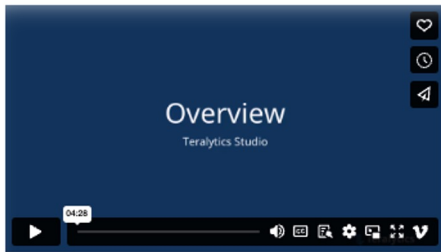
Available Resources

- Freely available user tutorials and training.

FREE TRAINING

1:1 training custom tailored to your business goals

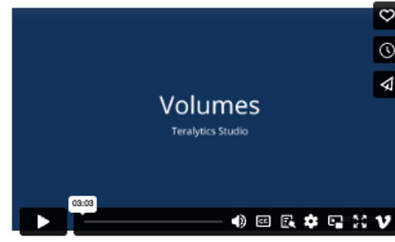
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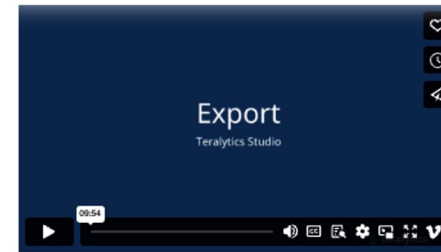
Overview



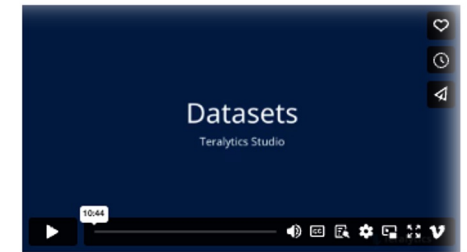
OD Matrix



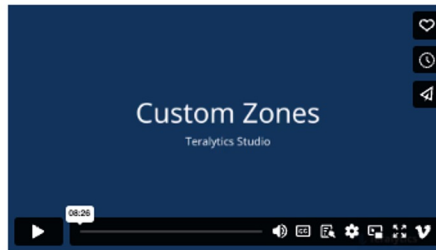
Volumes



Export OD Data



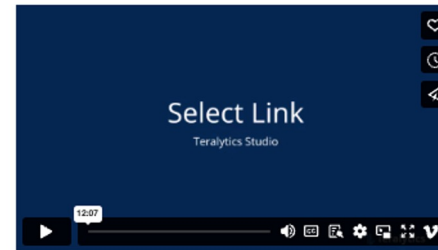
Datasets



Custom Zones



Corridor Discovery



Select Link

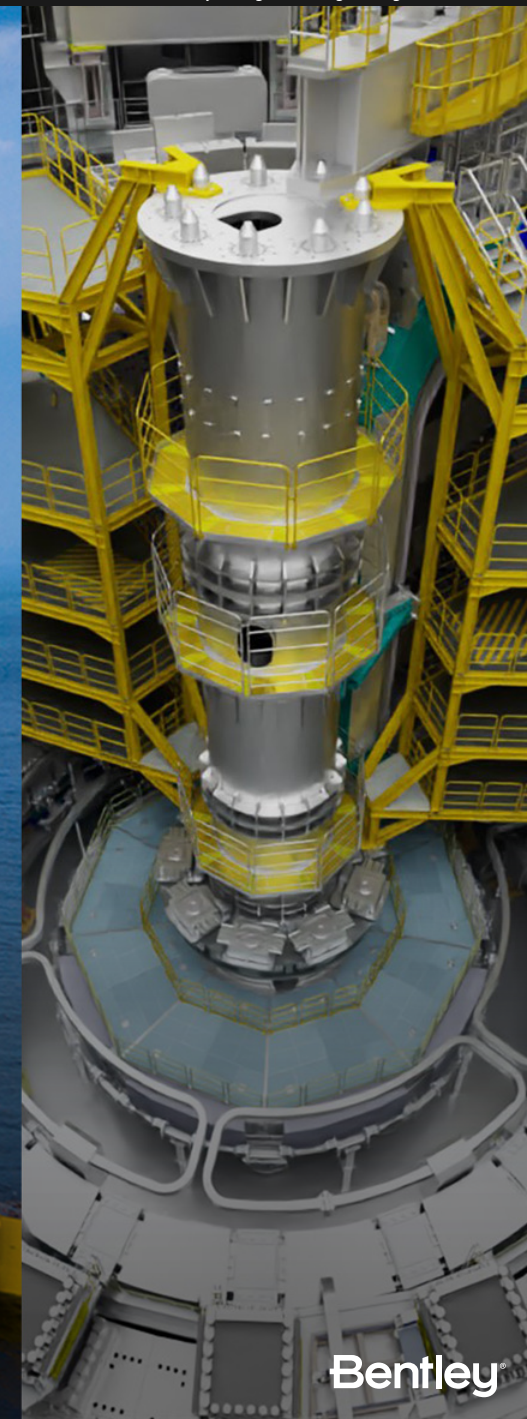
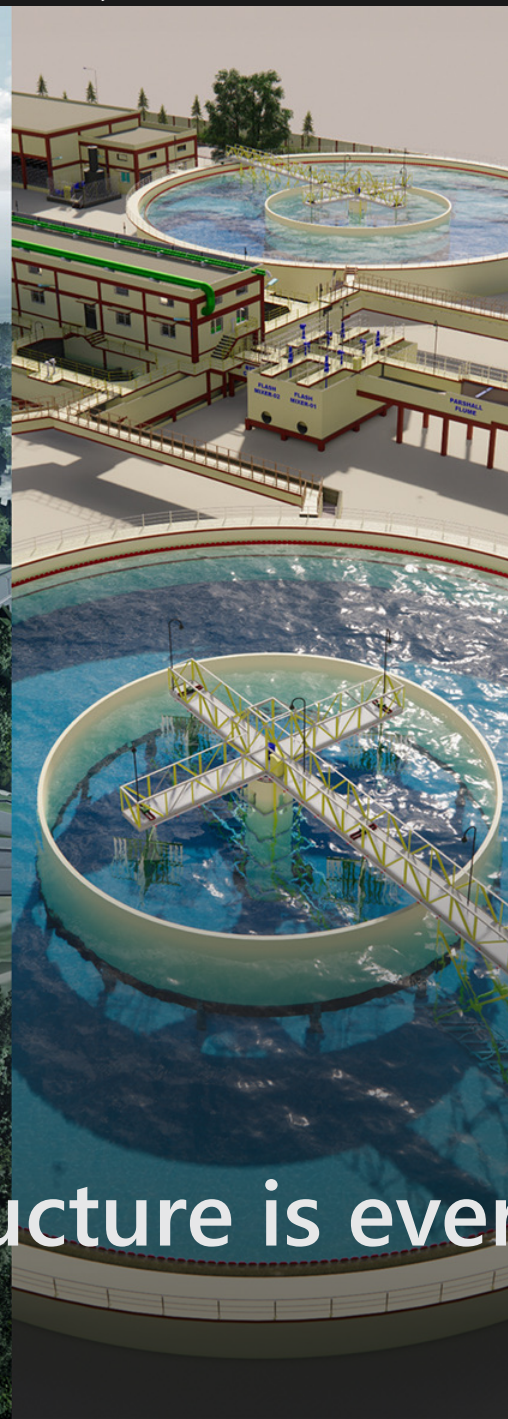
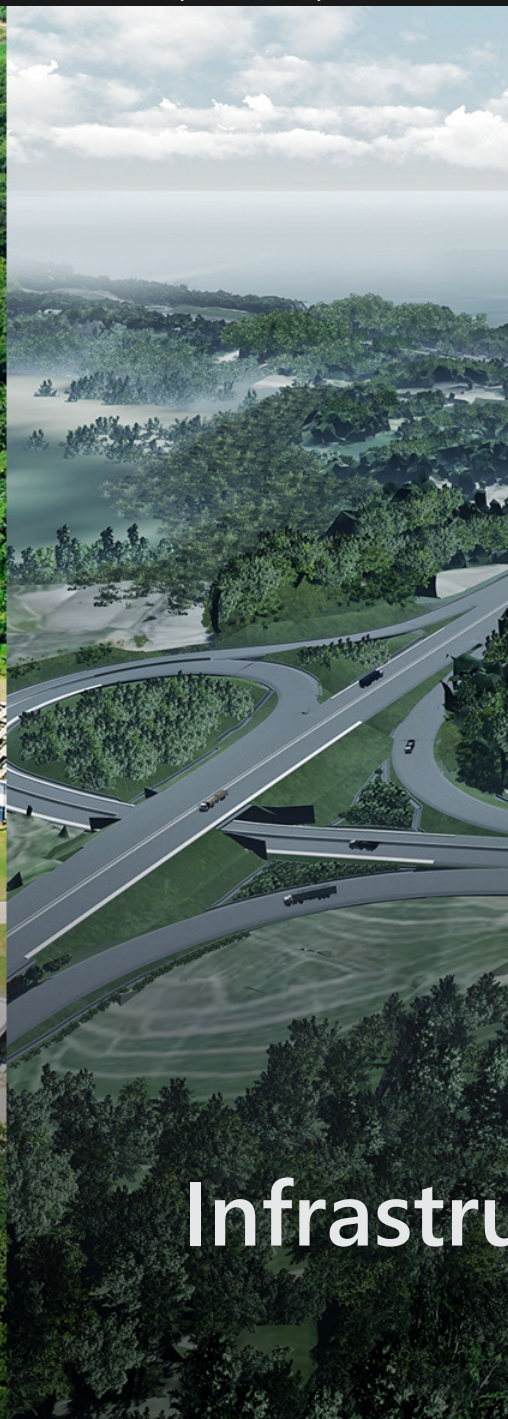


Roadway VMT



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Questions?



Infrastructure is everywhere