Step by step guide to using DYNAMEQ with CUBE

In CUBE

1. (Optional) Extract subarea of network and vehicle trip matrices
2. (Optional) Adjust trip matrix based on link or turning movement vehicle volume targets
3. Export one trip matrix for each vehicle class (SOV, HOV, Truck, etc.). Export to IJ:V and reformat as a space delimited text file including a header text block and one data block for each time slice.
4. Export CUBE network as both a link and a node shapefile. In addition to any standard CUBE network attributes, the node shapefile must include an attribute that identifies which nodes are zones. If available include intersection control type node attribute and functional class link attribute.

In DYNAMEQ (Version 4.4)

For more detail, please refer to the DYNAMEQ Help Documentation Reference at the end of this guide

CUBE to Dynameq Network Attribute Conversion Table

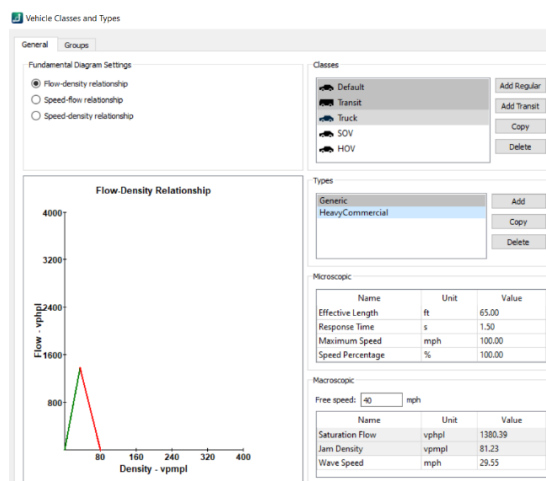|	Dynameq	CUBE
Nodes	ID	N
	Centroid	Attribute that identifies centroids with value of 1 and other nodes with value of 0
Links	ID	OBJECTID
	Start	A
	End	B
	Lanes	Number of travel lanes in direction of link
	Speed	Free flow speed of travel on a segment not including any node delay contribution

5. Create new DYNAMEQ project and define projection:
   a. Go to Project/ New and provide project directory and project name
   b. Go to Project/ Settings/ GIS and provide network projection file
6. Create new scenario and import network:
   (Requires DYNAMEQ 4.4 or later, otherwise ask Bentley for assistance)
   a. Go to Scenario/ New and provide scenario name
   b. Select Load from CUBE Shapefiles and provide node and link shapefiles
   c. Match pre-defined DYNAMEQ attributes with corresponding CUBE attributes (See table)
   d. To import additional CUBE attributes as DYNAMEQ user attributes, check boxes adjacent to each attribute
7. Import trip matrices:
   a. Go to Matrix/ New and provide matrix name for matrix file to be imported (created in step 3)
   b. Select load from DYNAMEQ matrix file and browse to desired file
   c. Repeat step 7 for each trip matrix

8. Define vehicle classes, vehicle types and vehicle class groups:
   a. Go to Scenario/ Vehicle Classes/Types
   b. In General tab, define one or more vehicle classes with Add Regular button and double click the new class to rename. One vehicle class is defined for each trip matrix, and only one matrix can be used for each vehicle class for a specific DTA.
   c. (Optional) In General tab, define one or more new vehicle types for each vehicle class with Add button, rename, and update parameters. The vehicle type composition can be specified for each DTA run.
   d. (Optional) In Groups tab define one or more new vehicle class groups with Add Group button, rename, and select permitted vehicle classes. Groups represent one or more vehicle classes and are used to prohibit travel on specific lanes or movements.

    e.   To connect a trip matrix to a vehicle class, right click on a matrix in project explorer, select matrix table, click pencil button, and update class.

9. (Optional) Add facility types:

    a.   Define facility types: go to Scenario/ Facility Types, click Add button to add facility types. DYNAMEQ facility types are positive integers ranging from 1 to N. Lower facility type values correspond to links with the highest priority such as freeways and higher facility type values correspond to links with the lowest priority such as local roads. The highest facility type value is typically used for centroid connectors.

    b.   To calculate facility type:

        i.   Go to Project Filter/Sets, set domain to links, create one filter for each DYNAMEQ facility type and enter expression based on CUBE functional class attribute if available, if unavailable go to step c.

        ii.   Go to Network/ Network Calculator, set domain to links, set filter to first facility, enter expression "facility = 1" for freeways or "facility = N" for any facility N, click Calculate button. Value N correlates to the Rank field in step 9A.

    c.   Alternatively enter facility type manually: go to Network/ Network Editor, right click on a link, select attributes, specify facility type

10. Prepare network for Dynamic Traffic Assignment (DTA):

    a.   Go to Network/ Network Editor

    b.   Adjust centroid connectors: go to Network/ Validation and Adjustments and select Move Connectors

    c.   Adjust Start/Stop Lines: go to Network/ Validation and Adjustments and select Adjust Link Start/Stop Lines at All Nodes

    d.   Review error messages in console and either apply additional adjustment procedures: go to Network/ Validation and Adjustments, or manually edit network

    e.   Update network coding on all links, intersections, and junctions relevant to use case

    f.   Review warning messages in console and resolve if relevant to use case

    g.   Update class group permissions to lanes and movements to restrict access for one or more class groups defined in step 8: right click on a link or node, select attributes, in Class Permissions tab, specify class permissions

11. Add intersection Control Type and specify Capacities/Priorities template using one of the following steps:

    a.   Manually: right click on a node, select attributes, specify control type (signalized/unsignalized), and specify Capacities/Priorities template (signalized, All-Way-Stop (AWSC), Two-Way-Stop (TWSC), Roundabout, Merge)

    b.   Import control type number and capacities/priorities template number from text file. If control type number and capacities/priorities template numbers, are include in original CUBE network prior to completing step 4, then proceed to step iv.

        i.   Prepare two free format input text files

            1.   For Control type include fields: Node Number, control type (signalized (use value 1)/unsignalized(0))

            2.   For Capacity/Priorities include fields: Node Number, priority (signalized(11), AWSC(1), TWSC(2), Roundabout(3), Merge(4))

        ii.   Create user attributes: go to Project/ User Attributes, select node domain, click Create button and provide attribute name and data type for both control type and Capacities/Priorities. These attributes are used for importing data only.

     iii.   Import control type and Capacity/Priorities template: go to Network/ User Value Attributes/ Import, select node domain, browse to text file, click Import, repeat for additional text file.

     iv.   Go to Network/ Network Calculator, select node domain. Use calculator to update attributes controltype and priorities.

  c. Estimate control type and capacities/priorities template using a script based on turn volumes obtained from a DTA run without node control:

     i.   Go to DTA/ New and provide DTA name, click next

     ii.   Select demand period from drop-down list, keep default settings for Assignment Intervals and End of Simulation

     iii.   In Assignment tab, specify demand matrix for each vehicle class

     iv.   In Vehicle Types tab, define vehicle type composition for each vehicle class

     v.   In Results tab, change Simulation Results Interval to 1-hour

     vi.   Go to DTA/ Run

     vii.   Download "Add nodes Control.ipynb" script from CUBE Communities: go to Tools/ Notebook to open Jupiter notebook, open attached Python script, update "scenario name" and "dta" and run script
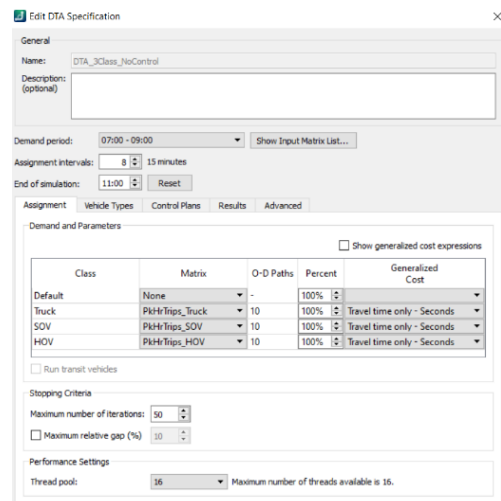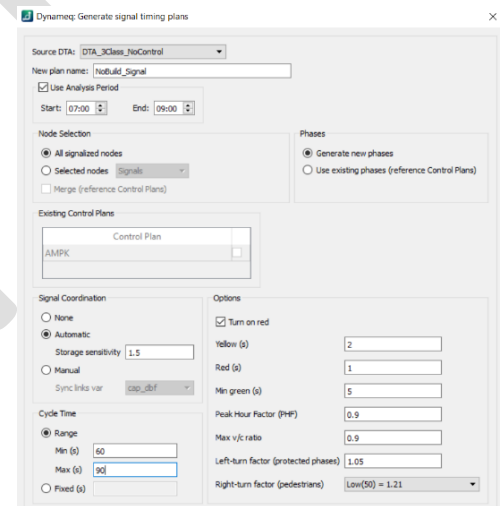
12. (Optional) Add Traffic Signal Plans using one or more of the following steps:

  a. Import from Synchro or supported formats

  b. Estimate with DYNAMEQ Signal Plan Generator:

     i.   If not already done, set up and run a DTA without node control as described in step 11c from i to vi

     ii.   Go to Network/ Control Plans, update parameters and click Generate

13. Set up and Run DTA:

  a. If a DTA without node control was not already created, follow steps 11c from i to iv to create a DTA specification, go to step c, otherwise go to step b

  b. Go to DTA/ Open, select DTA, then select DTA/ Copy, specify new DTA name and select Switch to copy automatically

  c. Go to DTA/ Edit, and in Control Plans tab, select signal plan by checking corresponding Use box

  d. Go to DTA/ Run

  e. If DTA run identifies network coding errors, review error messages in console and either:

     i.   apply additional adjustment procedures, go to Network/ Validation and Adjustments, or

     ii.   manually edit network
Alternatively, DTA can be run with node geometry errors (not recommended), go to Project Settings/ Network Editing/ Node Editing and select Allow DTA execution with node geometry errors

  f. To check assignment convergence while DTA is running, go to DTA/ Convergence and select DTA name.

14. Animation:
     a. Compute trajectories: go to Results/ Vehicle Trajectories/ Compute
     b. View animation: go to Results/ Vehicle Trajectories/ Animation
     c. Load data and play animation

DYNAMEQ Help Documentation Reference

Step	DYNAMEQ Help Documentation Reference
5	Getting Started with DYNAMEQ / Creating a project in DYNAMEQ
6	Importing data from CUBE files under Getting Started with DYNAMEQ / Creating a Scenario
7	Creating an input matrix / Loading a matrix from a DYNAMEQ file
8	Getting Started with DYNAMEQ / Defining vehicle classes and types
9	Getting Started with DYNAMEQ / Adding and editing facility types
10	The network / Validating the network
11c	Creating and Running a DTA
12a	Traffic Control / Importing Traffic Control Plans
12b	Traffic Control / Generating a control plan
14	Viewing the results of a DTA / Vehicle Trajectories

For updates, templates, questions, and additional guidance, please consult the CUBE Communities Page.

For DYNAMEQ software training, go to https://www.inrosoftware.com/en/services/training/ or e-mail us at courses@inrosoftware.com