Data Structure and Workflow of DTALite

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1. Introduction

1.1. Motivation

Motivated by a wide range of application needs, such as region-wide emissions analysis and route guidance provision, dynamic traffic assignment models have been increasingly recognized as an important tool for assessing operational performances of those applications at different spatial resolutions (e.g., network, corridor and individual segment levels) and across various analysis temporal regimes (e.g., second-by-second, peak hours, entire day and multiple days). The advances of DTA in this aspect are built upon the capabilities of DTA models in describing the formation, propagation and dissipation of traffic congestion in a transportation network. Planning practitioners have recognized the full potential of DTA modeling methodologies that describe the propagation and dissipation of system congestion with time-dependent trip demands in a transportation network. In April 2009, the TRB Network Modeling Committee conducted a DTA user survey through the FHWA TMIP mail list, which indicated that more than 70% of the 85 respondents plan to apply DTA tools within 2 years. On the other hand, they also clearly identified the following top 5 technical and institutional barriers:

- DTA requires more data than are available or accessible to most users (47%)
- Setting up a DTA model consumed inordinate resource (44%)
- Cost/benefit of implementation is unclear (45%)
- DTA tools take too long to run (35%)
- The underlying modeling approaches are not transparent (35%)

Emerging multi-core computer processor techniques are offering unprecedented available parallel computing power, on most of laptops and desktops currently available in the market. To exploit this paradigm change in computing will require a new software architecture and algorithm design so as to facilitate the most efficient use of emergent parallel hardware. Designed for and implemented on serial single-core processor architecture, most existing DTA software packages have no or very limited distributed computing capabilities.

With both open-source traffic simulation engine and graphic user interface (GUI), the software suite of DTALite + NEXTA aims to
(i) provide an **open-source code base** to enable transportation researchers and software developers to expand its range of capabilities to various traffic management analysis applications.
(ii) present results to other users by **visualizing time-varying traffic flow dynamics** and traveler route choice behavior in an integrated 2D/3D environment.
(iii) provide a **free education tool** for students to understand the complex decision-making process in transportation planning and optimization processes.

1.2. System Architecture

In general, a dynamic traffic simulation-assignment tool needs to read time-dependent origin-destination (OD) demand matrices and then assign vehicles to different paths based upon dynamic link travel time. As shown in Fig. 1.1, the physical process of moving vehicles through a transportation network works in a two-step process. First, a vehicle is moved across a link by a **link traversal** model, and then moved between links at the node by a **node transfer** function. In particular, the link traversal model typically involves speed-density relationship and hard outflow capacity constraints, determined by the number of lanes and link type. The node transfer model involves specific left-turn or through movement capacity determined by green time allocation at signalized nodes or other attributes. Link travel times from the traffic simulator are fed to the **time-dependent shortest path** model for path selection through a certain **route choice utility function** or traffic assignment rules. The new paths are then fed back into the traffic simulator in the next iteration.

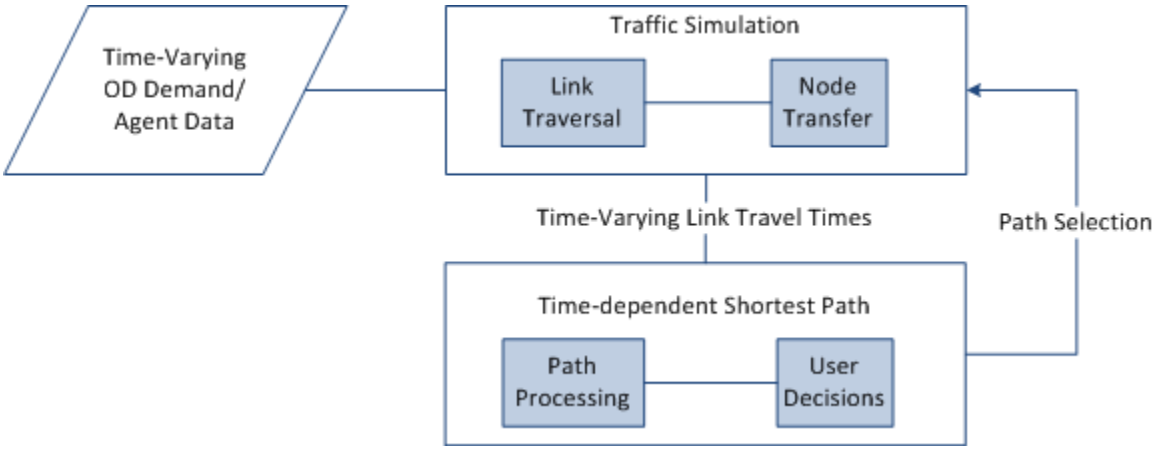


Figure 1.1. Typical Simulation-based Dynamic Traffic Assignment Modelling Framework

The software architecture of DTALite aims to integrate many rich modeling and visualization capabilities into an open-source dynamic traffic assignment model suitable for practical everyday use within the context of an entire large-scale metropolitan area network. Using a modularized design, the open-source suite of **simulation engine + visualization interface** can also serve future needs by enabling transportation researchers and software developers to continue to build upon and expand its range of capabilities. The **streamlined data flow** from static traffic assignment models and common signal data interfaces can allow state DOTs and regional MPOs to rapidly apply the advanced DTA methodology, and further examine the effectiveness of traffic mobility, reliability and safety improvement strategies, individually and in combination, for a large-scale regional network, a subarea or a corridor.

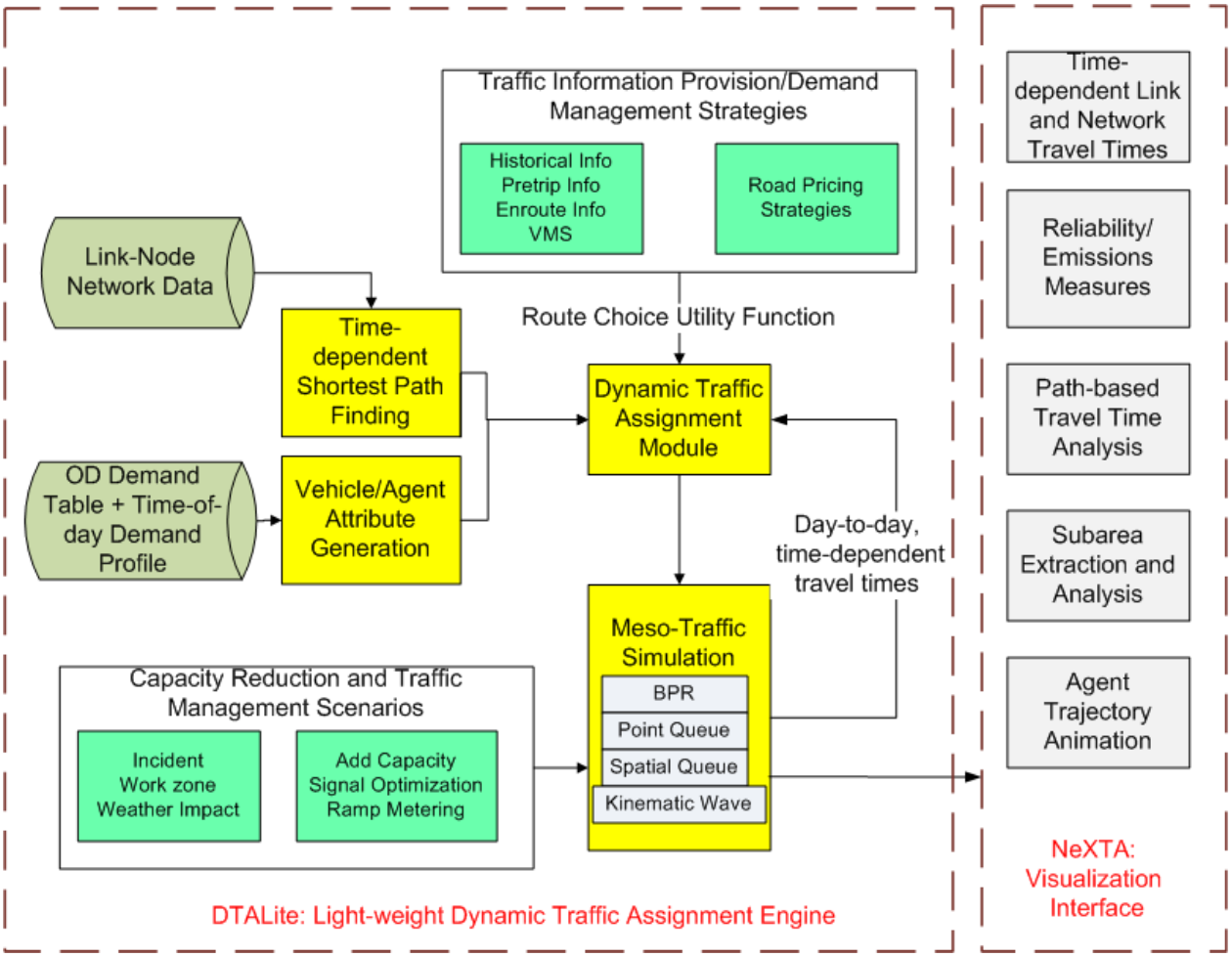


Figure 1.2 Software System Architecture with Key Modeling Components

The overall structure is given in Fig. 1.2, which integrates four major modeling components highlighted in yellow:
(1) **time-dependent shortest path finding** based on a node-link network structure from regional planning models;
(2) **vehicle/agent attribute generation** that converts traditional OD demand matrix in conjunction with additional time-of-day departure time profile as well as possible variable value of time distribution;
(3) **dynamic traffic assignment method** that considers major factors affecting agents' route choice or departure time choice behaviour, such as (i) different types of traveller information supply strategies (e.g. historical information, pre-trip, enroute and on-road variable message signs and (ii) road pricing strategies where the dollar values are converted to generalized travel time through a typical value of time coefficients (e.g. $10 per hour).
(4) a wide range of **traffic management scenarios** that can take essential road capacity reduction or enhancement measures, such as work zones, incidents and ramp meters.

The traffic assignment and simulation modules are fully integrated and iterated to either capture

day-to-day user response or find steady-state equilibrium conditions. Within this simulation-assignment framework, the rich set of output data include traffic MOEs at different spatial and temporal scales, ranging from network, corridor-level and specific links. Typical speed, volume and density measures and agent-based trajectories can be visualized through the NeXTA user interface. The following discussions will focus on how to design flexible and efficient algorithms to model essential traffic dynamics and user behaviour responses.

The white paper of DTALite is " DTALite: A queue-based mesoscopic traffic simulator for fast model evaluation and calibration. Xuesong Zhou, Jeffrey Taylor. Cogent Engineering, Vol. 1, Iss. 1, 2014 ".

1.3. Data Flow for Performing Dynamic Traffic Analysis

There are a number of practical challenges in enabling rapid data importing, analysis and exporting for multi-scale dynamic traffic analysis. The typical input data for mesoscopic DTA models include:

Network Data: Existing static traffic assignment network has a few link attributes but very different field naming conversions (e.g. from node, to node vs. A and B); the network topology has been widely coded in GIS format but with very different coordinate systems.
Demand Data: Trip tables at a TAZ level can be imported from regional traffic planning models for different peak and off peak periods, but the corresponding data files are available in many possible formats, such as column-by-column (origin, destination, value) vs. matrix, ASCII text.

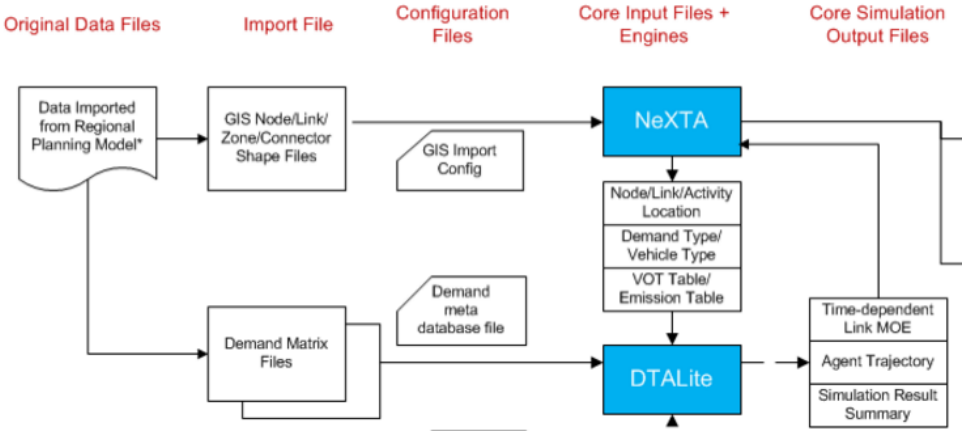


Figure 1.3 Work Flow Chart for Importing, Analyzing and Exporting Data

Fig. 1.3 gives the system importing, analysis and exporting data flow for the bundle of DTALite and NeXTA. In particular, our solution to import GIS data from multiple planning packages is to develop an **open data format** that allows DTALite users to feasibly convert their own data in proprietary format to a unifying data structure and widely used longitude and latitude coordinate system (WGS 84 used by Google Maps, Google Earth and on-line Google Fusion Tables), akin to the Open Document format which creates a standardized file format that allows users to open, edit, and save Microsoft Word documents from other applications such as

Google Docs.

1.4. Tutorial for downloading and using DTALite/NeXTA Software Package

The latest software release can be downloaded at our Github website. The source code can be downloaded at here.

The basic control and interfaces of NeXTA are described in this user's guide document.

A **working sample project** folder can be found here (Salt_Lake_City_West_Jordan - BaseLine) with a step-by-step learning document.

The **software package** includes two software applications: NEXTA as GUI and data hub; DTALite as DTA simulation engine. The specific instruction for the use of NeXTA and DTALite is as follows:

Step 1: make sure that you have installed the Microsoft Visual C++ 2015 Redistributable Package (x86) for parallel computing in DTALite (https://www.microsoft.com/en-us/download/details.aspx?id=3387)

Step 2: make sure that you have installed Gnuplot Software for some visualization functions in NeXTA (http://www.gnuplot.info/)

Step 3: Download and unzip the NeXTA/DTALite software package.

Step 4: Click "NeXTA"--"File"--"Open Traffic Network Project" to choose the tnp file in your network data set.

Step 5: Click "Project"--"Perform Traffic Assignment" to input your settings and run "DTALite" for dynamic traffic assignment and simulation.

For importing the GIS information of traffic networks from external files, such as, GIS shape files, please download the NeXTA_GIS version at our Github website.

Hardware requirements. As shown in Fig 1.4, a large-scale network provided by the NCSU team has about 2,300 Zones, 9,500 nodes, 20,000 links and 1,900 signals, and 1 million vehicles from 5AM to 10 AM, with 490K household.

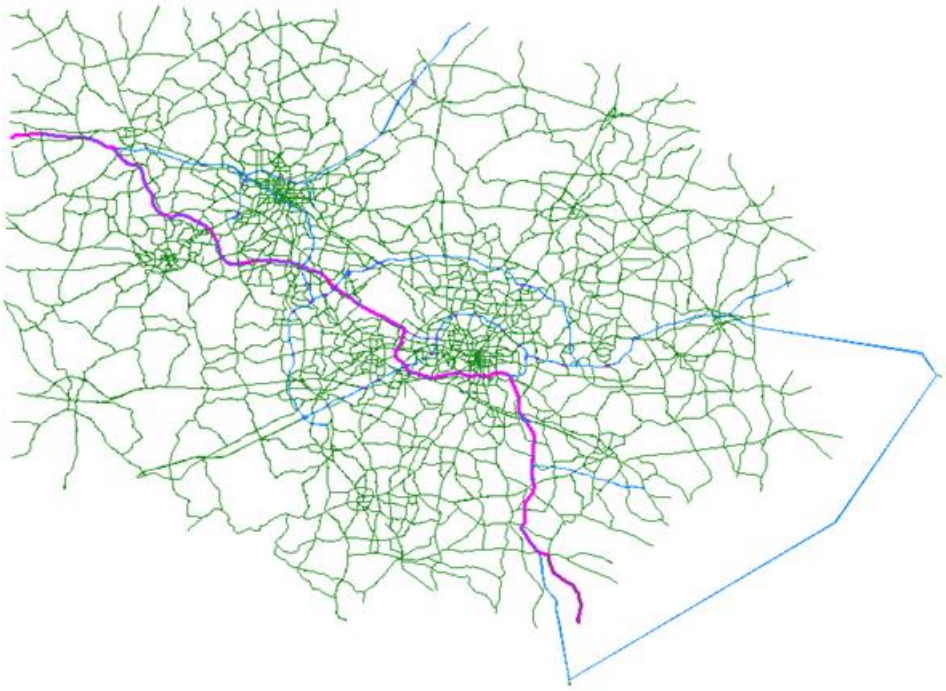


Fig 1.4 a large-scale network example

The average running time is about 1 hours for 20 user equilibrium iterations on a PC with the following specification.

CPU: Intel i7-2960XM @ 2.70 GHz *8;
Memory: 16.0 GB;
System Type: 64-bit Windows 7

All DTALite **data files** are in CSV format. The files for node, link and zone layers have geometric fields for importing from and exporting to GIS software, Google Earth, Google Fusion Tables. Each project folder should only store one data set with a project file (*.tnp) that serves as a reference point for locating the other files. DTALite data files have prefix of input_xxx, output_xxx for input and output files. NeXTA can load multiple projects.

List of Internet Resources: www.learning-transportation.org (for hosting general learning material about network modelling)

2. Data Structure of Files

This document describes all input and output files associated with DTAlite/NeXTA package. Each input/output file includes descriptions for required variable names, followed by a short description of their type, purpose, function, interaction with other variables, and the use cases in which the variable is required/not required. Since NeXTA uses DTALite for transportation

network analysis, not all variables required as inputs to DTALite are required as inputs for visualization in NeXTA, and not all variables required as inputs to NeXTA are required as inputs to DTALite.

Dynamic traffic assignment encompasses many problem formulation and representation methods, for example, trip-based vs. activity-based, fixed departure time vs. flexible departure time. As the DTA models expand to include greater behavioral and policy realism, the complexity of the model data structure increases. To reach the right balance between the representation details and required data preparation efforts, DTALite adopts an **agent-based, simulation-based mesoscopic dynamic traffic assignment framework** using time-dependent origin-destination matrices. Overall, it is a link-based simulation with capacity constraints. The capacity constraints make calibrating network capacities a very important step in the process of building our models. On the other hand, this modeling framework can be flexibly enhanced to meet specific modeling needs. For example, one advanced user can embed alternative traffic flow models to generate high-fidelity simulation results, or allow traveler-specific value of time attributes to recognize the heterogeneity of the network users in road pricing applications.

Network data structure defines the basic node-link structure used in DTALite and NeXTA, along with attributes for each link and node. Additionally, nodes are related to zones and activity locations, which can be used to disaggregate trips from zones to nodes and activity locations.

Demand/agent data structure describes the number of trips between zones or nodes. Through a demand meta data file, there are many different ways to define the time-dependent demand inputs: 1) Demand table with starting time and ending time, 2) Demand table with time-dependent 15-min departure time profile, and 3) Input vehicle file. Methods 1 and 2 will generate vehicles in the network based on the time period information provided. The vehicle data file describes all vehicle trips in the network, allowing the user to provide very detailed trip information, such as vehicle type, traveller information type, value of time, vehicle age as well as specific path sequences.

Below is a short list of **key features** for DTALite/NeXTA data files and data structure.

- Different layers: different files for node, link, zone, activity locations
- Many model attribute files: node control type, link type, demand type and vehicle type
- Time representation: 24 hour (for demand and sensor data), day number= iteration number, work zone has day attributes (for modelling day-to-day learning)
- Demand meta database file: “Dynamic demand data manager”, read multiple demand files, in different format: column, matrix, agent file, DYNASMART file, different demand loading periods, additional departure time profile
- Scenario setting file: traffic flow model, traffic assignment model, scenario number for multiple scenario runs
- Scenario files for advanced modelling features: work zone, incident, tolling, VMS files
- Sensor data file: for model validation and calibration, different time period
- Output files: simulation summary, network MOE, link MOE, trajectory file

Group I: Network files

High-level introductions:

- **A generic network** used for DTALite and NeXTA includes a set of four layers: node, link, activity location and zones.
- The specific **file names** are input_node.csv, input_link.csv, input_zone.csv and input_activity_location.csv.
- A **node** has a certain control type such as pretimed signals or 4-way stop signs. A cycle length is required for signalized intersections/nodes.
- A **link** is defined using upstream node and downstream node ids, with essential attributes such as length, speed limit, number of lanes and capacity, typically required for static traffic assignment and meso-scopic traffic assignment.
- A **zone** can be a typical Traffic Analysis Zone (TAZ) that contains one or multiple centroids. The zone number is the index used in the OD demand table. The geometric field for a zone is not required for running DTA simulation, especially for external zones/stations.
- The **activity location** file serves as a mapping layer that maps zones to individual nodes. Activity locations are a special case of nodes for generating and attracting trip demand. In DTALite's agent-based simulation method, an agent is a vehicle and it is generated based on an OD demand table from zone i to zone j with a certain vehicle type. An agent's path is computed from one activity location in zone i to another activity location in zone j. One activity location can be a centroid (typically used in traditional static traffic assignment) or a physical node in the urban network.
- The node and link layers can use arbitrary **coordinate system**, but a WGS 84 (long/lat) coordinate system is preferred to export data to Google Earth/Google Map.
- The **geometric attribute** of node, link and zone layers is coded in a field of "geometry" for individual records. The "geometry" field uses the format required by Google Fusion Tables, so one can easily import node, link and zone data to Google Earth/Google Maps.
- NeXTA provides a number of methods to **import network data** from GIS planning packages in generic shape file format, Excel files, Openstreetmap OSM format and Synchro UTDF format.
- A user can also manually **create a new network** from the scratch by using a click-and-draw method based on a background image file.

input_node.csv

Field Name	Description	Sample Value
name	Optional for visualization only	Main street @ Highland Dr.
node_id	Node identification number	1001

control_type	Intersection control type, defined in input_node_control_type.csv. Typical range: 1-7. E.g. 5: pretimed signal.	5
control_type_name	The text name corresponding to the control type number in the control_type field. This text is automatically generated based on the numeric value in field control_type when a user saves the network in NeXTA.	input pretimed_signal
cycle_length_in_second	The signal cycle length for a specific node, unit: second.	120
x	Longitude or horizontal coordinate in any arbitrary geographic coordinate system.	100
y	Latitude or vertical coordinate horizontal coordinate in any arbitrary geographic coordinate system	200
geometry	Text string used to describe node location (typically in WGS84 geographic coordinate system)	<Point><coordinates>-111.979958,40.703899</coordinates></Point>

Minimum set of fields: node_id, x and y. The geometry field can be generated from NeXTA based on fields x and y. The control_type (specifically signal location) can be identified by NeXTA through menu->tools->traffic control tools->generate signal locations.

input_link.csv

Field Name	**Description**	**Sample Values**
name	Optional for visualization purposes	Main Street
link_id	Optional link identification number, generated from NeXTA	101
from_node_id	Upstream node number of the link, must already defined in input_node.csv	2

to_node_id	Downstream node number of the link, must already defined in input_node.csv	3
link_type_name	Optional text label for visualization and data checking purposes, generated from NeXTA based on field link_type and name defined in input_link_type.csv	Minor arterial
direction	Identifies the direction of travel on the link. Default value = 1. When -1, NeXTA reverses from_node_id and to_node_id for correct orientation. When 0 or 2, NeXTA automatically converts link into two one-way links.	1
length	The length of the link (between end nodes), measured in units of miles.	1.0
number_of_lanes	The number of lanes on the link	2
speed_limit	Speed limit on defined link in units of miles per hour. Unit: mph	20
lane_cap	Maximum service flow rate for each lane on the link, in vehicles per hour. This capacity value is not used used for signalized control with a positive cycle length defined. Typical values are 1800 for a freeway lane, 900 for an arterial lane, 1500 for a single on-ramp lane.	1500
link_type	Link type identification number, corresponding to link functional class (freeway, ramps), must be defined in input_link_type.csv	7
jam_density	Jam density (in vehicles per mile per lane), input for two traffic flow models (spatial queue and Newell's simplified kinematic	180

	wave model). Unit: number of vehicles per mile per lane: default value 180 for freeway links, 190 for arterial street links.	
wave_speed	Backward wave speed in miles per hour, only used in Newell's simplified kinematic wave model to define the vehicle storage space on a link: Default = 12 mph	12
geometry	Text string used to describe link shape and location (typically in WGS84 geographic coordinate system). The initial value can be empty, and NeXTA will generate the text string based on the coordinates of upstream and downstream nodes.	<LineString><coordinates>4165.673828,23656.343750,0.0 5207.092773,23656.343750,0.0 </coordinates></LineString>

Remarks:

Requirements: the from_node_id, to_node_id fields must be defined in input_node.csv. If the downstream node is a signalized intersection, the effective_green_time_length_in_second field is required.

Minimum required set of fields: from_node_id, to_node_id, length_in_mile, number_of_lanes, speed_limit_in_mph, lane_capacity_in_vhc_per_hour, link_type.

Fields can be generated or populated by NeXTA:
geometry fields can be imported from GIS shape files or generated based on the coordinates of upstream and downstream nodes. direction = 1 by default. saturation_flow_rate_in_vhc_per_hour_per_lane =2000 by default. jam_density_in_vhc_pmpl is 180 by default for freeway links, 190 for arterial links. wave_speed_in_mph is 12 by default.
effective_green_time_length_in_second can be computed as cycle length*lane_capacity/saturation flow rate. E.g. 120 second cycle length * 900 lane capacity / 1800 saturation flow rate = 60 as effective green time.

input_zone.csv

Field Name	Description	Sample Value
zone_id	Zone identification number. A zone number used in OD	1001

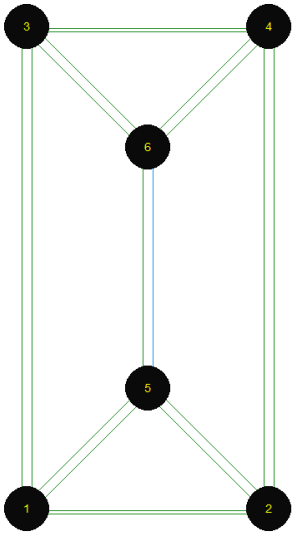
	demand table files must be defined here first. Zone numbers are not required to be consecutively sequential.	
production	Reserved for trip distribution step and not used in DTALite.	
attraction	Reserved for trip distribution step and not used in DTALite.	
geometry	Optional: Text string used to describe zone location for visualization (typically in WGS84 geographic coordinate system).	"<Polygon><outerBoundaryIs><LinearRing><coordinates>-111.907241,40.802401,0.0 -111.870550,40.789266,0.0 -111.822437,40.768850,0.0 -111.907241,40.802401,0.0<coordinates></LinearRing></outerBoundaryIs></Polygon>"

input_activity_location.csv

Field Name	Description	Sample Value
zone_id	Zone identification number	1001
node_id	Node identification number associated with the zone identification number in the same row. Must defined in input_node.csv.	1001
external_OD_flag	Used to identify the type of activity location as non-external (default = 0) or external (-1 or 1). When 0, acts as both origin and destination.	0

Remarks:
Requirements: A zone used in OD demand tables (with a positive number of trips generated) must contain at least one node as it activity locations. node_id must be defined in input_node.csv.

Example Files for 6-node network



input_node.csv

name	node_id	control_ty	control_ty	cycle_leng	signal_off	x	y	geometry
	1	0	unknown_	0	0	0	0	
	2	0	unknown_	0	0	1.8314	0	
	3	0	unknown_	0	0	0	3.6628	
	4	0	unknown_	0	0	1.8314	3.6628	
	5	0	unknown_	0	0	0.9157	0.9157	
	6	0	unknown_	0	0	0.9157	2.7471	

input_link.csv

name	link_id	from_nod	to_node_i	direction	length_in	number_c	speed_lin	saturation_flow_ra
(null)	0	1	2	1	2	2	35	2000
(null)	0	1	3	1	4	2	45	2000
(null)	0	1	5	1	1	4	35	2000
(null)	0	2	1	1	2	2	35	2000
(null)	0	2	4	1	4	2	45	2000
(null)	0	2	5	1	1	2	35	2000
(null)	0	3	1	1	4	2	45	2000
(null)	0	3	4	1	2	2	35	2000
(null)	0	3	6	1	1	2	35	2000
(null)	0	4	2	1	4	2	45	2000
(null)	0	4	3	1	2	2	35	2000

link_type	jam_dens	wave_spe	mode_code	grade	geometry
4	120	12			<LineString><coordinates>0.000000,-0.015151,0.0 1.831400,
2	120	12			<LineString><coordinates>0.015151,0.000000,0.0 0.015151,3
4	120	12			<LineString><coordinates>0.010714,-0.010714,0.0 0.926414,
4	120	12			<LineString><coordinates>1.831400,0.015151,0.0 -0.000000,
2	120	12			<LineString><coordinates>1.846551,0.000000,0.0 1.846551,3
4	120	12			<LineString><coordinates>1.842114,0.010714,0.0 0.926414,(
2	120	12			<LineString><coordinates>-0.015151,3.662800,0.0 -0.015151
4	120	12			<LineString><coordinates>0.000000,3.647649,0.0 1.831400,3
4	120	12			<LineString><coordinates>-0.010714,3.652086,0.0 0.904986,
2	120	12			<LineString><coordinates>1.816249,3.662800,0.0 1.816249,-
4	120	12			<LineString><coordinates>1.831400,3.677951,0.0 -0.000000,

input_zone.csv

zone_id	productio	attraction	geometry
1			<Polygon><outerBoundaryIs><LinearRing><coordinates>-0.59300,0.66112,0.0 0.3240
2			<Polygon><outerBoundaryIs><LinearRing><coordinates>1.30652,0.39257,0.0 2.29558
3			<Polygon><outerBoundaryIs><LinearRing><coordinates>-0.59300,4.06716,0.0 0.4746
4			<Polygon><outerBoundaryIs><LinearRing><coordinates>1.03797,4.19161,0.0 2.36108

input_activity_location.csv

zone_id	node_id	external_OD_flag
1	1	0
2	2	0
3	3	0
4	4	0

Group II: Advanced type definition files

High-level introductions:

- DTALite and NeXTA aim to accommodate and preserve **flexible data types** defined by users. We do not impose limitations on the number of link types, demand types, and users can use their existing link type, demand type as is to maintain a seamless connection from their existing static planning models to the new DTA tools.
- **Typical definitional files** include input_node_control_type.csv, input_link_type.csv, input_demand_type.csv.
- When creating a new data set, a user does not need to create those files manually and NeXTA can fetch all default files to the current project folder **automatically**.
- A number of **mapping fields** are provided to relate the user-defined type to the essential data type used in DTALite. E.g. link type 100 is mapped to the freeway type in DTALite through a code of f . A demand type of 3 is mapped to the truck type in DTALite as pricing type of 2.
- DTALite performs an agent-based routing for road pricing applications. with the following individual generalized cost function. $Cost = Travel\ Time * VOT + Toll$

input_node_control_type.csv

The input_node_control_type table defines the control type of nodes in the network in terms of control type name, unknown control, no control, yield sign, 2way stop sign, 4way stop sign, pretimed signal, actuated signal and roundabout. This file is required when using the network import tool, and the control type field is read from the node shape file.

control_ty	unknown_	no_contrc	yield_sign	2way_sto	4way_sto	pretimed_	actuated_	roundabout
control_ty	0	1	2	3	4	5	6	100

input_link_type.csv

The input_link_type table allows users to define their own specific link types, as long as the flag variables are correctly used to identify how the different link types are connected/related (e.g., freeways connect to arterials using ramps). Only one flag may be used for each link type. Link types can also be used to determine how links are visualized in NeXTA. This file is required when using the network import tool to interpret the link type field in the link shape file.

Field Name	Description	Sample Value
link_type	Link type identification number	100
link_type_name	Optional: Name label assigned to link type in the same row, used for visualization purposes in NeXTA	freeway
type_code	A text character which identifies which type of link is mapped to the link type identification number. f = freeway, h = highway/expressway, a = arterial, c = connector, r = ramp, t = transit, w = walk	f
default_lane_capacity	According to the link type, the lane capacity assigned by default to new links created in NeXTA.	1900
default_speed_limit	According to the link type,the speed limit assigned by default to new links created in NeXTA.	60
default_number_of_lanes	According to the link type, the new of lanes assigned by default to new links created in NeXTA.	3

default link type file:

link_type	link_type_name	type_code	default_lane_capacity	default_speed_limit	default_number_of_lanes
1	Freeway	f	1800	65	3
2	Highway/Expressway	h	1450	50	3
3	Principal arterial	a	1000	40	3
4	Major arterial	a	900	35	3
5	Minor arterial	a	850	30	2
6	Collector	a	650	25	1
7	Local	a	600	20	1
8	Frontage road	a	1000	45	2
9	Ramp	r	1300	30	2
10	Zonal connector	c	2000	100	2
100	Transit link	t	1000	40	1
200	Walking link	w	1000	5	1

input_demand_type.csv

The input_demand_type table is used to define the characteristics for different demand types for the trips in demand files such as input_demand.csv. There are three different demand types by default (1 = SOV, 2 = HOV, 3 = Trucks), but additional types can be defined in the table (e.g., trip purpose – HBW, HBO, etc.).

Field Name	**Description**	**Sample Value**
demand_type	Demand type identification number	1
demand_type_name	Optional: Name label assigned to demand type in the same row, used for visualization purposes in NeXTA	SOV
avg_VOT	Average Value of Time (in units of dollars/hour) assigned to the demand type in the same row. This value is not used when the file input_VOT.csv is provided, which contains more detailed distributions for VOT.	10
percentage_of_pretrip_info	Percentage of vehicles with pre-trip travel time information. Affects routing behavior in DTALite.	5
percentage_of_enroute_info	Percentage of vehicles with en-route travel time information. Affects routing behavior in DTALite. Drivers with historical information = 100 – percentage_of_pretrip_info – percentage_of_enroute_info.	5
percentage_of_vehicle_type1	Percentage of vehicles of vehicle type 1 for the demand type in the same row. Percentages in row should sum to 100.	80
percentage_of_vehicle_type2	Percentage of vehicles of vehicle type 2 for the demand type in the same row. Percentages in row should sum to 100.	20
percentage_of_vehicle_type#	Additional columns (with incremental #) can be used	0

	when more vehicle types are defined.	

Default file:

demand_t	demand_t	avg_VOT	percentag	percentag	percentag	percentag	percentag	percentag	percentage_of_vehicle_type5	
1	SOV	10	0	0	0	0	0	0	0	0
2	HOV	10	0	0	0	0	0	0	0	0
3	truck	20	0	0	0	0	0	0	0	0
4	transit	20	0	0	0	0	0	0	0	0

optional_vehicle_type.csv

The input_vehicle_type table is used to define different vehicle types for emissions analysis.

Field Name	**Description**
vehicle_type	Vehicle type identification number
vehicle_type_name	Name label assigned to vehicle type in the same row
rolling_term_a rotating_term_b drag_term_c source_mass	Fields used for calculating vehicle-specific power (VSP)
percentage_of_age_0 percentage_of_age_5 percentage_of_age_10 percentage_of_age_15	Percentage of vehicles in specific age group

Default file:

vehicle_type	vehicle_type_name	rolling_term_a	rotating_term_b	drag_term_c	source_mass	percentage_of_age_0	percentage_of_age_5	percentage_of_age_10	percentage_of_age_15
1	passenger car	0.156461	0.00200193	0.000492646	1.4788	5.9059	47.9479	28.3283	17.8179
2	passenger truck	0.22112	0.00283757	0.000698282	1.86686	2.9949	43.372	26.3805	27.2526
3	light commercial truck	0.235008	0.00303859	0.000747753	2.05979	3.0918	44.2272	25.9693	26.7117
4	single unit short-haul truck	0.561933	0	0.00160302	7.64159	3.994	51.9218	23.4647	20.6195
5	combination long-haul truck	2.08126	0	0.00418844	31.4038	3.9991	51.9888	23.495	20.5171

The data structure of files input_crash_prediction_model.csv, input_cycle_emission_factor.csv, input_vehicle_emission_rate.csv, input_base_cycle_fraction_of_OpMode.csv is not listed here, as it should be kept with the default values.

Sample files:

optional_vehicle_emission_rate.csv

vehicle_ty	opModeID	meanBase	meanBase	meanBase	meanBase	meanBaseRate_HC_(g/hr)
1	0	68371.1	4913.603	0.05385	2.36609	0.039171
1	1	52728.1	3789.393	0.008979	4.05557	0.000418
1	11	85288.1	6129.372	0.146868	6.52187	0.022892
1	12	106704	7668.461	0.155233	2.82379	0.02085
1	13	153460	11028.66	0.363034	9.76815	0.052262
1	14	194390	13970.16	0.657844	14.2137	0.072532
1	15	234348	16841.81	1.18797	20.8813	0.103686

Group III: Simulation Configuration files

High-level introductions:

- DTALite and NeXTA aim to accommodate and preserve **flexible demand file format** used by users. DTALite can use the demand file as is.
- DTALite accepts **multiple demand file types,** such as 3-column, NXN matrix, agent-base file, DYNASMART format
- Through a very flexible **demand meta database** configuration file, a user only needs to provide specific information to map demand type and demand loading time periods from their existing demand table to the new DTA tools.
- To create **time-dependent demand loading patterns**, a user can define loading ratio for each 15 min interval.
- DTALite uses a **24-hour demand horizon** /representation to facilitate 24-hour dynamic traffic assignment and compare simulated results with sensor data easily (defined in the format of 24-hour horizon)
- Typical configuration files include meta demand database, scenario setting, MOE settings.

input_demand_file_list.csv

The input_demand_meta data table is used to define the characteristics of demand data. Through a temporal demand profile table per record, users can define the proportion of demand in the network as a function of time, which is used to initiate trips in the simulation over the modeling horizon. This table can be used to supplement demand type information in an input demand table, where DTALite will use the temporal demand profile information in place of other time information.

This meta-data file requires several entries, but the relevant entries are as explained below:

1) Specify the demand file name (e.g., sov_14_15.mtx) and format (e.g., column)
2) Specify the number of lines in the demand file to be skipped by NeXTA (8 for MTX file)
3) Indicate whether subtotals are present in the last column (zero for none)
4) Specify the loading start time and end time for the demand file (840 to 900, or 2PM to 3PM)
5) Specify the demand types associated with the demand file (only demand_type1)

Field Name	Acceptable Values	Description	Sample Value
scenario_no	$\text{Value} \geq 0$	Scenario identification number	1
file_sequence_no	Value > 0	File identification number	1
file_name	demand.dat	Name of demand file	
format_type	column, matrix, full_matrix agent_csv, agent_bin	Input file format type	
number_of_lines_ to_be_skipped	$\text{Value} \geq 0$	The number of lines to be skipped at the beginning of demand file	0
loading_multiplier	Value > 0	Local multiplication factor applied to the number of trips in the demand file	
start_time_in_min	0 to 1440	Demand loading start time, which is the time gap in min from 0:00	
end_time_in_min	0 to 1440	Demand loading end time, which is the time gap in min from 0:00	
apply_additional_ time_dependent_ profile	0 or 1	0: not use the time dependent profile in this table, that is, a flat demand pattern is used between time period [start_time_in_min, end_time_in_min] 1: use the time dependent profile in this table	
subtotal_in_last_ column	0 or 1	flag used for subtotal in last column of matrix demand file	

number_of_ demand_types	Value ≥ 1	Number of demand types stored in demand file	
demand_type_in_3rd_column	default value 0 1: a demand type is specified for each record	demand type for format: origin, destination, demand value, value	2,100,1, 10 2,100,2, 20 zone 2 to zone 100, 10 vehicles for demand type 1 zone 2 to zone 100, 20 vehicles for demand type 2
demand_type_1	Value ≥ 1		
demand_type_2	Value ≥ 1		
demand_type_3	Value ≥ 1		
demand_type_4	Value ≥ 1		
'00:00	0 to 1	Proportion of demand in specified time interval compared to 24-hour time period	
'00:15	0 to 1	Proportion of demand in specified time interval compared to 24-hour time period	
…			
'23:45	0 to 1	Proportion of demand in specified time interval compared to 24-hour time period	

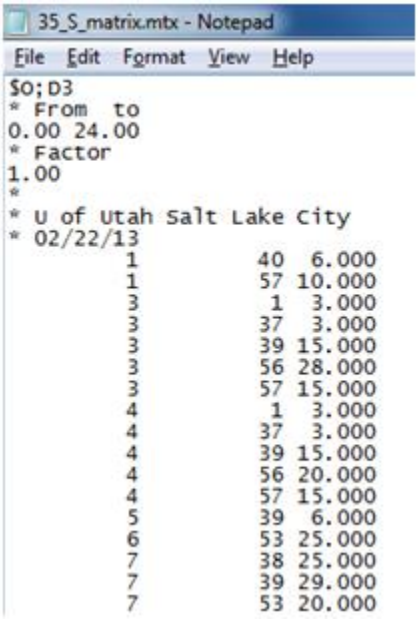
Remarks:
We first show a few examples to show how to configure the following key parameters for different demand files.

format_type: subtotal_in_last_column; number_of_demand_types

Example 1: column format

Below is an OD demand file titled “35_S_matrix.mtx” from VISUM for both LOV and HOV demand types during 6AM and 11AM. This combined demand matrix has 90% LOV and 10%

HOV.



The corresponding meta data configuration is shown at the following table. The main data block has a three-column format, and we need to skip the first 8 lines of comments. The first line after the comments reads combined demand 6.0 from zone 1 to zone 40.

As there are two demand types, we use two records with the same file name of "35_S_matrix.mtx", but with different loading_multiplier = 0.9 and 0.1 for different demand_type_1 = 1 (LOV for the first record) and demand_type_1 = 2 (HOV for the second record). The start_time_in_min = 360 corresponds to 6AM and the end time of 540 refers to 9AM.

demand_type_x means the x th field after the row and column indices in the three-column or multi-column format. DTAlite will have 0.9*6.0 = 5.4 LOV vehicles, and 0.1*6.0 for 0.6 HOV vehicles from zone 1 to zone 2. The 5.4 vehicles will be randomly rounded up or down according to a uniform distribution to convert to an integer number (5 or 6 vehicles) in the final simulation process.

file_name	format_type	number_of_lines_to_be_skipped	loading_multiplier	start_time_in_min	end_time_in_min	number_of_demand_types	demand_type_1
35_S_matrix.mtx	matrix	8	0.9	360	540	1	1
35_S_matrix.mtx	matrix	8	0.1	360	540	1	2

Example 2.1: matrix format

Below is an OD demand matrix file titled "demand_matrix.csv" for 4 zones (1,2,3 and 40), and the demand horizon is 7AM to 9AM. A users wants to apply time-dependent departure time profile with a relatively lower demand volume between 7AM and 8AM.

TOT	1	2	3	40	
1	0	1000	10	10	1020
2	10	0	10	10	30
3	10	10	0	10	30

40	10	10	10	0	30

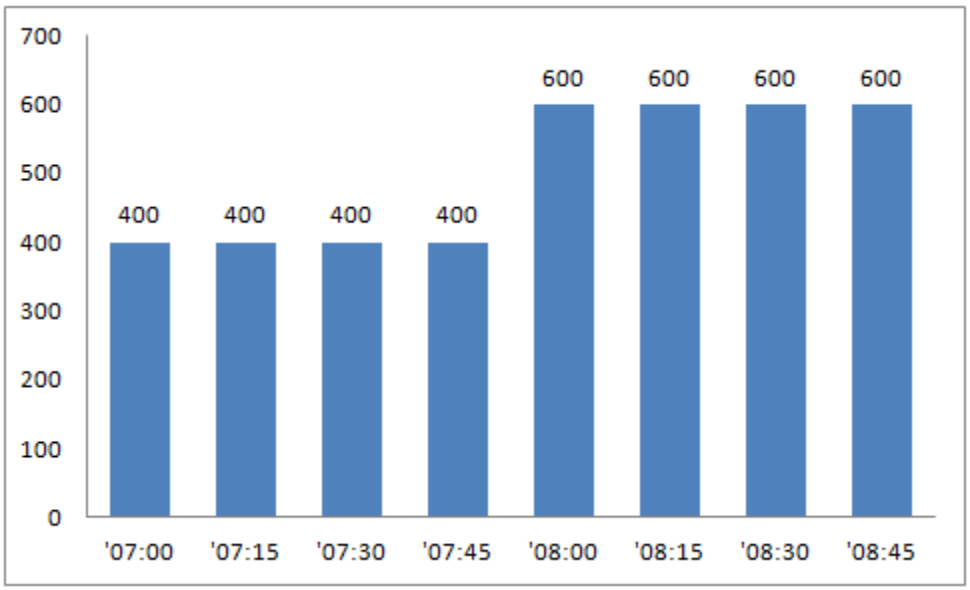
The corresponding input_demand_file_list.csv is shown below.

file_name	format_type	number_of_lines_to_be_skipped	loading_multiplier	start_time_in_min	end_time_in_min	apply_additional_time_dependent_profile	subtotal_in_last_column	number_of_demand_types	demand_type_1
demand_matrix.csv	matrix	0	2	420	540	1	1	1	1

'07:00	'07:15	'07:30	'07:45	'08:00	'08:15	'08:30	'08:45
0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3

We offer the following interpretation.

1. file_name: “demand_matrix.csv” is the OD table for the AM period being brought into DTALite/NeXTA.
2. format_type: “matrix” is the type of OD table format for this small test application. DTALite will skip the text string ‘TOT’ as it reads only numerical values.
3. Start_time is minute 420 or 7 AM and the End_time is minute 540 or 9 AM. The OD table stores number of trips between 7 and 9 AM. loading_multiplier is 2, so a multiplier of 2 is applied to each row. That is, the total demand from zone 1 to zone 2 is 1000*2 =2000.
4. subtotal_in_last_column = 1 as there an origin-based summation for each zone in the matrix.
5. As field apply_additional_time_dependent_profile is set to 1, then a time-dependent departure time profile will be read and result in the following demand loading pattern. That is, the demand from 7:00AM to 7:15 AM from zone 1 to zone 2 has a demand volume of 1000*2*0.2 = 400. Those 400 vehicles will be uniformly assigned a departure time between 7:00AM to 7:15 AM, which leads to an average departure time interval of 15 min /401 intervals = 2.24 seconds. As a result, the first three vehicles depart from zone at 7:00:00, 7:00:02, and 7:00:04, respectively.



Example 2.2: full matrix format

Below is an OD demand matrix file titled “demand_matrix.csv” for 4 valid zones (1,2,3 and 10). Note that, zones 4,5,6..,9 are not defined in input_zone.csv. A full matrix with sequential consecutive zone numbers (starting from zone 1 to the largest zone number 10) are listed for the first column and the first row, and all the OD pairs with invalid zone numbers (e.g. 1 to 4, 5, 6, 7,8,9; or zone 4 to all the other zones) have only values of zero.

trip	1	2	3	4	5	6	7	8	9	10
1	100	20	40	0	0	0	0	0	0	20
2	20	100	40	0	0	0	0	0	0	40
3	40	20	100	0	0	0	0	0	0	40
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	20	40	20	0	0	0	0	0	0	100

The corresponding input_demand_file_list.csv is shown below, assuming the demand horizon is 7AM to 9AM.

file_name	format_type	number_of_lines_to_be_ski	loading_multiplier	start_time_in_min	end_time_in_min	apply_additional_time_depende	subtotal_in_last_column	number_of_demand_types	demand_type_1

		pped				nt_pro file			
demand_matrix.csv	full_matrix	0	2	420	540	0	0	1	1

Example 3: Multiple demand files for different demand types and hours

file_sequence_no	file_name	format_type	start_time_in_min	end_time_in_min	number_of_demand_types	demand_type_1
1	Demand_Data\\1sov-14.15.mtx	column	840	900	1	1
2	Demand_Data\\2hov-14.15.mtx	column	840	900	1	2
3	Demand_Data\\3heavytruck-14.15.mtx	column	840	900	1	3
4	Demand_Data\\4mediumtruck-14.15.mtx	column	840	900	1	3
5	Demand_Data\\5sov-15.16.mtx	column	900	960	1	1
6	Demand_Data\\6hov-15.16.mtx	column	900	960	1	2
7	Demand_Data\\7heavytruck-15.16.mtx	column	900	960	1	3
8	Demand_Data\\8mediumtruck-15.16.mtx	column	900	960	1	3
9	Demand_Data\\9sov-16.17.mtx	column	960	1020	1	1
10	Demand_Data\\10hov-16.17.mtx	column	960	1020	1	2
11	Demand_Data\\11heavytruck-16.17.mtx	column	960	1020	1	3
12	Demand_Data\\12mediumtruck-16.17.mtx	column	960	1020	1	3
13	Demand_Data\\13sov-17.18.mtx	column	1020	1080	1	1
14	Demand_Data\\14hov-17.18.mtx	column	1020	1080	1	2
15	Demand_Data\\15heavytruck-17.18.mtx	column	1020	1080	1	3
16	Demand_Data\\16mediumtruck-17.18.mtx	column	1020	1080	1	3
17	Demand_Data\\17sov-18.19.mtx	column	1080	1140	1	1
18	Demand_Data\\18hov-18.19.mtx	column	1080	1140	1	2
19	Demand_Data\\19heavytruck-18.19.mtx	column	1080	1140	1	3
20	Demand_Data\\20mediumtruck-18.19.mtx	column	1080	1140	1	3

The screenshot above shows an example of working with existing demand files.
There are 20 hourly demand files exported from VISUM, and all those MTX files are put under a subfolder of Demand_Data. There are 20 records in the above input_demand_file_list.csv, and each record aims to map the data content to the overall time-dependent demand matrices used in DTALite. The first record specifies the following information:
(a) the demand file name (e.g., sov_14_15.mtx)
(b) format (e.g., column)
(c) the loading start time and end time for the demand file (e.g. 840 to 900, or 2PM to 3PM)
(d) the demand types associated with the demand file (only demand_type1), and demand types 1, 2 and 3 are SOV, HOV and truck, respectively.

Example 4: Multiple demand types as different columns per record from a TransCAD data set

A TransCAD user has the following demand file titled GH10PM_3Hrs.csv.

GH10PM_3Hrs.csv

```
1,1,0.3069,0.0484,0.0179,0.1847,0.0741,0.1242
1,2,1.9001,0.3872,0.1371,0.0782,0.0174,0.0165
1,3,0.1881,0.0172,0.0040,0.1689,0.0719,0.1736
1,4,1.7483,0.3281,0.1158,0.0752,0.0157,0.0148
1,5,0.6210,0.0707,0.0203,0.2744,0.1008,0.2907
1,6,0.9274,0.1720,0.0606,0.0417,0.0088,0.0085
1,7,0.0888,0.0114,0.0036,0.0525,0.0255,0.0439
1,8,0.5044,0.0932,0.0324,0.0576,0.0218,0.0421
1,9,1.7396,0.3067,0.1149,0.1976,0.0427,0.0533
1,10,1.0483,0.1873,0.0673,0.0681,0.0120,0.0107
1,11,0.6672,0.1230,0.0433,0.0307,0.0068,0.0063
1,12,0.7549,0.1280,0.0436,0.0533,0.0206,0.0309
```

Each record includes demand values for 6 demand types, shown in the following data structure description.

Vehicle Trip File Structure	
Field_Name	Type
Row index	Integer (4 bytes)
Column index	Integer (4 bytes)
SOV	Real (4 bytes)
HOV2	Real (4 bytes)
HOV3	Real (4 bytes)
Light Truck	Real (4 bytes)
Medium Truck	Real (4 bytes)
Heavy Truck	Real (4 bytes)

They want to use the following departure time profile from 3PM to 6PM.

Time	PM Period Proportion 15 minutes
3:00-3:15	0.07
3:15-3:30	0.07
3:30-3:45	0.08
3:45-4:00	0.08
4:00-4:15	0.08
4:15-4:30	0.08
4:30-4:45	0.09
4:45-5:00	0.09
5:00-5:15	0.10
5:15-5:30	0.10
5:30-5:45	0.09
5:45-6:00	0.09
	1.0000

The corresponding input_demand_file_list.csv is configured below.

The first part of the file is shown below, which indicates we use a “column” format, with demand

loading period from 3PM (900 min) to 6PM (1089 min) with additional time-dependent demand profile (= 1).

file_name	format_type	number_of_lines_to_	loading_multiplier	start_time_in_min	end_time_in_min	apply_additional_time_dependent_profile
GH10PM_3Hrs.csv	column	0	1	900	1080	1

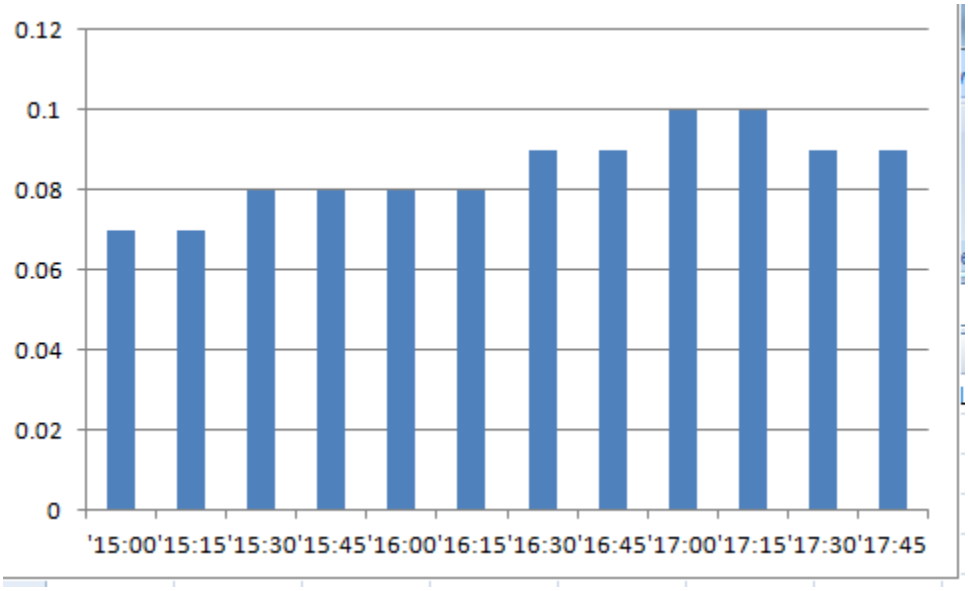
The second part of file specifies 6 demand types to be loaded.
number_of_demand_types = 6 for 6 demand types.
Field names demand_type_1, demand_type_2, demand_type_3, …, demand_type_6 requires demand type for each column after the row index and column index in the original demand file. demand_type_1 = 1 for SOV type, demand_type_2 = for HOV2 and demand_type_3 = for HOV3. demand_type_4= demand_type_5 = demand_type_6 = 3 for different types of trucks.

me_dependent_profile	number_of_demand_types	demand_type_1	demand_type_2	demand_type_3	demand_type_4	demand_type_5	demand_type_6	'00:00
1	6	1	2	2	3	3	3	

The departure time profile is specified in the third part of the meta data file. Field ‘15:00 has a value of 0.07 for the time period between 15:00 and 15:15.

'15:00	'15:15	'15:30	'15:45	'16:00	'16:15	'16:30	'16:45	'17:00	'17:15	'17:30	'17:45	'18:00	'
0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09	0.1	0.1	0.09	0.09		

leads to the following demand loading pattern.



Example 5: Multiple time-dependent demand files from a DYNASMART data set

A typical DYNASMART demand data includes three file: demand.dat, demand_HOV.dat and demand_truck.dat. The following screenshot shows a demand.data file for a 6-hour horizon from 6AM to 11AM.

demand.dat

```
     5    1
   0.0   60.0 120.0 180.0 240.0 300.0
Start Time =  0.0
    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001
    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001
    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001
    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001
    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001
    0.0001    0.0001    0.0001    0.0001    0.0001    0.0001
```

We can construct the following input_demand_file_list.csv.

file_name	format_type	number_of_lines_to_be_skipped	loading_multiplier	start_time_in_min	end_time_in_min	demand_type_1
demand.dat	dynasmart	0	1	360	660	1
demand_hov.dat	dynasmart	0	1	360	660	2
demand_truck.dat	dynasmart	0	1	360	660	3

Each record corresponds a file for a certain demand type, using the same format_type = dynasmart but different demand_type_1 = 1,2,3 for LOV, HOV and trucks. We do not need to skip the first line so number_of_lines_to_be_skipped = 0, As DTALite uses a 24-hour time clock for both input and output format, we map the demand loading period to 6AM (start_time_in_min = 360 min) and 11AM (end_time_in_min = 660.).

Please note that, the existing Dynus-T package uses the same demand format as the DYNASMART-P package, so if you have a Dynus-T data set, please use the above demand meta data settings directly.

Example 6: Agent file after OD demand estimation run

The OD estimation process will calibrate path flow pattern accoding to the observed link counts and density measurments, and the resulting calibrated results (at the last iteration of ODME) are saved as a binary file as agent.bin file, and an ASICII file called output_agent.csv.

To evaluate traffic measurement strategies, after the ODME run, one can rename agent.bin to input_agent.bin, and set format_type=agent_bin in input_demand_meta.csv and run regular traffic assignment again (e.g. using traffic assignment method = MSA or fixed switching rate).

input_scenario_settings.csv

The scenario settings file allows the user to alter the characteristics of the scenarios being run, as well as create various traffic scenarios that can be run simultaneously. Scenario attributes such as demand multiplier, traffic flow model, and number of days a scenario will be run can all be changed in this file. Further, each row can contain data for a separate scenario, allowing the user to simultaneously run models with differing model attributes. The scenario settings file allows the user to alter different attributes for each scenario. Starting from the far-right column, these attributes are:

Variable	Description	Example Usage
scenario_no	This is a discrete integer value assigned to a given scenario, and will be used as the scenario's unique identifier when the simulation is running in DTALite.	scenario_no =1
scenario_name	This is the identifier by which the scenario will be displayed to the end user. This identifier, unlike the scenario_no, need not be an integer.	scenario_name = test1
number_of_assignment_days	This value, an integer, is the number of days the scenario will be run. If the user is employing Origin-Destination Matrix Estimation, the scenario should run for at least 15 assignment days.	number_of_assignment_days = 95
demand_multiplier	This value is the number by which the demand given in the input_demand.csv file will be multiplied for a given scenario, e.g. if the demand for a given OD pair is 1000, and a demand multiplier of 1.8 is used for a given scenario, then for that scenario DTALite will use a value of 1800 for the demand	demand_multiplier =0.7

	on that OD pair.	
random_seed	This value is the seed number used for the pseudorandom number generator, used to create a level of randomness in certain aspects of the simulation.	random_seed =100
traffic_flow_model	This value must be one of four possible values: 1: Point Queue Model. This model assumes vehicles "stack up" at nodes, rather than filling up the link. 2: Newell's N-Curve Model. The most thorough of the four models, which takes into account features such as wave propagation through traffic.	traffic_flow_model =1
freeway_bias_factor	This value dictates the degree to which agents modeled in the simulation will choose routes. The default value is sufficient for most simulations.	freeway_bias_factor=1

optional_MOE_settings.csv

The measure of effectiveness, or MOE, settings allow the user to test the effectiveness of the network as a whole, or smaller sections of a network, such as a single link, 3-point path, or origin-destination pair. The MOE settings file also allows the user to identify links, paths, and origin-destination pairs that are above user-defined threshold values. The following are the possible values for the moe_type field (the first column in the optional_MOE_settigns.csv file), as well as which fields must be filled in for each:

MOE_type	**Description**
network	Network MOE measures the effectiveness of the network at large. This network-wide measure can also be broken down based on attributes such as demand type and vehicle

	type.
od	This MOE type gauges the effectiveness of the network from one zone to another. The only field that must be populated are “origin_zone_id” and destination_zone_id It should be noted that it will only measure the effectiveness in the from-to direction. That is to say, if zone 1 is set as the origin zone, and zone 2 as the destination, effectiveness will only be measure from zone 1 to 2, not 2 to 1. In order to measure effectiveness in both directions, create two separate OD MOEs.
link	To measure the effectiveness of a link, only the “from_node_id” and “to_node_id” fields must be populated. As with OD MOE, the measure of effectiveness only goes in the from-to direction.
path_3point	Much the same as link MOE, 3-point path MOE measures the effectiveness of a path between three connected nodes. This MOE needs an entry in “from_node_id,” “mid_node_id,” and “to_node_id.”
network_time_dependent	This measures the effectiveness of the network on a minute-by-minute basis. The results from this MOE are displayed in the output_NetworkTDMOE.csv file.
od_critical, link_critical, and path_critical	Each of these only requires the user to enter a value in the “threshold_volume” field. For example, if link critical MOE is performed with a threshold volume of 1250, then, in the output summary file, NeXTA will print MOE results for all of the links with volume over 1250.

The “moe_group” column is used to break the MOE settings into discreet groups in the output summary. For example, to have all MOE critical values displayed together, assign them all the same group number, and they will be clustered together in the output summary. The “moe_cetegory_label” is a user-defined field used to give simpler names to each individual measure of effectiveness. Each MOE may also have an associated start and end time based on when vehicles enter or exit the network, OD pair, link, or path.

Group IV: Scenario files

The user may prepare scenarios by preparing the following input files, which describe different network conditions so that their effects on operations may be evaluated. Different scenarios available include tolling (distance-based and link-based tolls), dynamic message signs, incidents, and work zones.

Scenario_Work_Zone.csv

The work zone scenario input file is used to define the location and characteristics of work zones in the simulation, which is described in terms of capacity reduction, project duration, and speed reduction. This file can be used to model the impact of incidents, ramp meterings and traffic signal control devices.

Variable Name	Type	Acceptable Values	Description
Link	Integer	[1,2]	Node pair [upstream, downstream] used to identify the link on which work zone is located
Day No	Integer	Value > 0	Day identification number in the simulation on which the work zone causes capacity reductions
Start Time in Min	Integer	0 to 1440	Starting time for capacity reduction due to work zone
End Time in min	Integer	0 to 1440	Ending time for capacity reduction due to work zone
Capacity Reduction Percentage (%)	Float	$\text{Value} \geq 0$	Capacity reduction percentage (1 – percent remaining capacity) due to work zone
Speed Limit (mph)	Integer	$\text{Value} \geq 0$	Speed limit on link posted during work zone

Scenario_Dynamic_Message_Sign.csv

The dynamic message sign scenario input file is used to define the location and characteristics of variable message signs in the simulation, which influences driver route choice by the response percentage defined in the table.

Variable Name	Type	Acceptable Values	Description
Link	Integer	[1,2]	Node pair [upstream, downstream] used to identify the link on which the sign is installed
Start Time in Min	Integer	0 to 1440	Starting time for the dynamic message sign display
End Time in min	Integer	0 to 1440	Ending time for the dynamic message sign display
Number of Detour Routes	Integer	$\text{Value} \geq 0$	Percentage of drivers on the link which respond to the real time information displayed on the sign.
Detour Route 1	String	2;2;3;0.60	The first "2" means the route 1 is defined by 2 nodes, node 2 and node 3, represented by "2;3". "0.60" means that 60% of travelers at node 2 will choose route 1. The starting node of two routes is node 2, which is the downstream node of link [1, 2] where the vms is located. For route 2, the same explanation is also applied.
Detour Route 2	String	2;2;4;0.40	

Scenario_Link_Based_Toll.csv

The link-based toll scenario input table is used to define tolling conditions on a road segment in the simulation. Currently, there are three classes defined for different toll pricing – SOV, HOV, and trucks.

Variable Name	Type	Acceptable Values	Description
Link	Integer	[1,2]	Node pair [upstream, downstream] used to identify the link on which the toll is implemented
Day No	Integer	Value > 0	Day identification number in the simulation on which the tolling strategy is implemented
Start Time in Min	Integer	0 to 1440	Daily starting time for the link-based toll
End Time in min	Integer	0 to 1440	Daily ending time for the link-based toll
Toll for Demand Type 1 ($)	Float	0 to 999	Charge for first demand type to travel across the link
Toll for Demand Type 2 ($) ….	Float	0 to 999	
Toll for Demand Type N ($)	Float	0 to 999	Charge for the last demand type to travel across the link, the user should make sure the number of demand types is consitsent with the total number of demand types defined in input_demand_type.csv

Group V: Simulation output files from DTALite

The following table summarizes the output files from DTALite traffic assignment.

File Name	Type	Data Description
1.Output_summary.csv	Scenario statistics	Traffic assignment results for each iterations, such as **computational time, average travel distance and travel time, number of travelers and user equilibrium gaps.**
2.output_NetworkTDMOE.csv	Network	Time-dependent network-level information about assignment results over the modeling horizon, such as, **cumulative inflow count, culmulative outflow count, number of vehicles existing in the network, average trip time**.
3.Output_ODMOE.csv	OD	ODMOE simulation results, such as, **number of vehicles completing trips, trip time, trip distance for each OD pair.**
4.Output_linkMOE.csv	Overall link statistics for all links in the entire network	Detailed simulation results aggregated at each link, such as**, link volume, link speed, level of service, emissions, volume of different types of vehicles.**
5.Output_linkTDMOE.csv	Time-dependent link statistics for for all links in the entire network	Time-dependent detailed simulation results aggregated at each link at each minute, such as, **density, volume, speed, queue length, emissions.** Output_linkTDMOE.bin is read for the time-dependent network-level visualization.
6.Output_agent.csv	Vehicle/ agent	Specific information of each agent in the simulation network, such as, **origin, destination, departure time, node sequence of its path, time sequence of each node in its path, emissions;** NEXTA uses binary file for fast data processing

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ADB30 website (check special topics section):

http://www.nextrans.org/ADB30/index.php?option=com_content&view=article&id=28&Itemid=33