

TransModeler Training

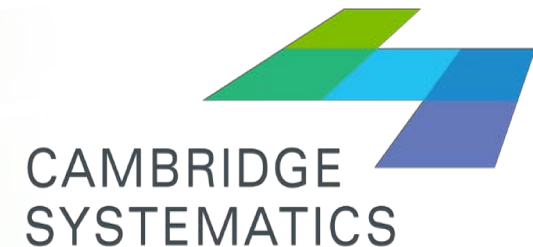
4- Matrix Estimation

presented to

Caltrans, District 1-Eureka

presented by

Shaghayegh (Rira) Shabanian, CS



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Think  Forward

Preparation

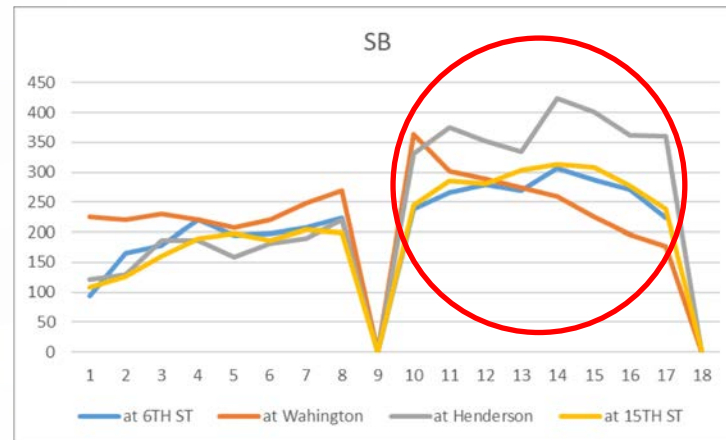
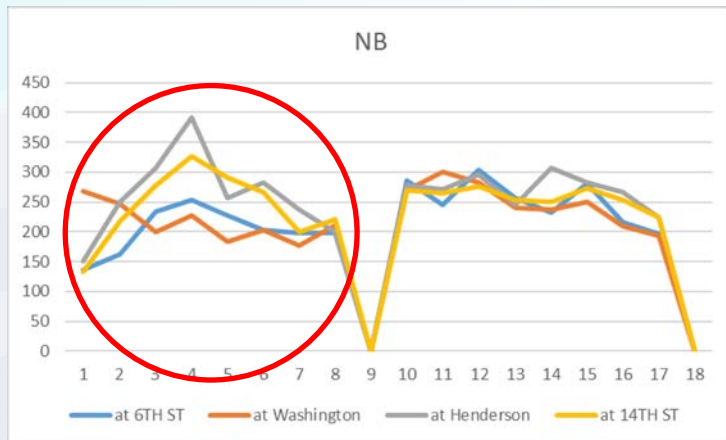
- Edited network, deleted some centroids, modified some centroid connectors, added missing lane connectors, such as left turns.
- Made sure there is a one-to-one association between network centroids and matrix rows (with lookup table, found centroids that didn't have corresponding row in the matrix, and found rows in the matrix that didn't have corresponding centroid in the network)
- Edited the turning movement count table, some "ToLink", "From Link" and "Node" had to be modified because the network was modified and link and node numbers were changed.
- During modification of the turning movement table, I noticed some errors in the turning movement data. (refer to notes)

Initial demand profiling

- Initial seed matrix from TransCAD is for 2-hour peak period, and needs to be distributed over 15-minute period.
- The simplest approach is to divide the trips equally into 8 slices. But is better to slice the demand based on data, if available.
- It is hard to judge the directionality on Broadway by time of day. A permanent count station on Broadway south of Harris st showed that in AM, NB has higher traffic and SB has lower traffic. So we decided to slice the AM demand based on counts on NB, and profile the PM demand based on counts on SB.

Matrix and link count profiling

- SB through and NB through movements from intersection counts were used for demand slicing. Three locations were used: Broward intersection with 6th st, 14th st, and Henderson st.



- At 10 locations, hourly hose data was available, which was sliced into 15-minute counts by interpolation.

Matrix Aggregation

- After Network editing and assuring each row in the matrix is associated with a centroid in the network, 262*262 matrices were produced for AM and PM, were reduced to 250*250 matrices.

Aggregate Matrix File: Sub-Area AM OD Matrix ? X

Aggregation Type

Sum Mean Minimum Maximum Count

	Rows	Columns
Dataview	Centroids	Centroids
Matrix ID Field	ID	ID
Aggregation Field	AggregatedZone	AggregatedZone

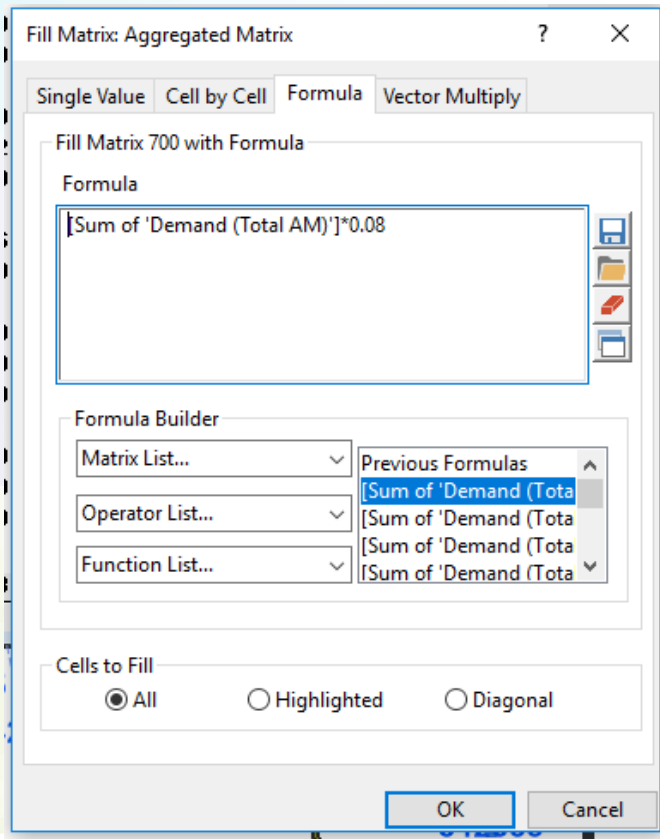
Aggregate Matrices

Demand (Total AM)

OK Cancel

Creating 15-minute Trip Tables

- The aggregated matrices for AM and PM were each converted to 8 matrices, containing 15-minute demand.



Time	Profile
7:00:00 AM	0.08
7:15:00 AM	0.11
7:30:00 AM	0.15
7:45:00 AM	0.17
8:00:00 AM	0.14
8:15:00 AM	0.13
8:30:00 AM	0.11
8:45:00 AM	0.11

Validating Turning Movement and Link Counts

- You can create link volume based on turning movements.
- Demand → Turning Movement Volumes → Aggregate Turning Volumes by Link
- AB_Exiting and AB_Entering are expected to be similar. If they are not, upstream and downstream intersection counts should be reviewed. Also, the reason for discrepancy may be a minor road or driveway that has not been modeled, but attracts or generates significant number of trips. Modifying centroid connector can be helpful in this case.

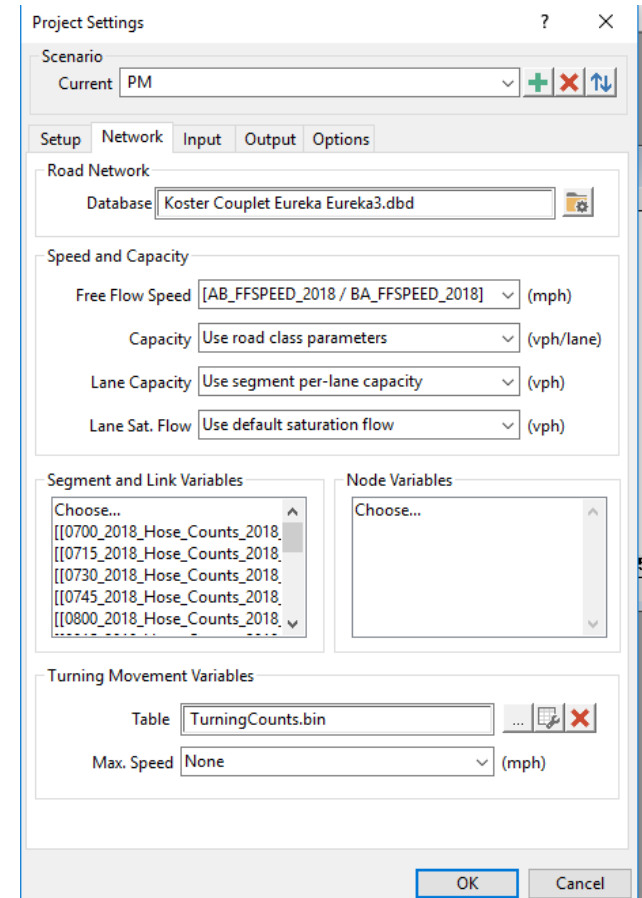
LinkVolFromTMC_700.ID	AB_Exiting	BA_Exiting	AB_Entering	BA_Entering	AB_Average	BA_Average
4951	333	--	283	--	308	--
7616	260	--	--	276	260	276
7977	212	--	--	358	212	358
4627	210	--	--	--	210	--
4516	205	--	235	--	220	--
4904	192	--	28	--	110	--
8023	162	--	--	--	162	--
5084	160	--	454	--	307	--
3788	159	--	--	--	159	--

Validate Turning Movement and Link Counts

- TransModeler doesn't report turning movement after static ODME, it only reports link volume.
- We need to evaluate goodness of fit BEFORE running the simulation.
- We can assume the link volume that we generated from turning movements (previous slide) is link count, and then compare the link volume output from ODME vs this volume.
- I used default capacity (link user class), free flow time (link user class), alpha (0.15) and beta (4)

Demand – Matrix Estimation

- Make sure segment-coded counts and weight (shows count reliability or importance) are defined in Project Settings → Network → Segment Variables
- Open the matrix that you want to perform ODME on it
- Demand → OD Matrices → OD Matrix Estimation
- You need to separately run ODME for 8 matrices in AM and 8 matrices in PM



Demand – Matrix Estimation

Single Class Matrix Estimation

Inputs

Method: N Conjugate UE

Delay Function: Bureau of Public Roads (BPR)

Matrix File: Aggregated Matrix

Matrix: 700

Count: [[0700_2018_Hose_Counts_2018_AB] / [C

Demand Interval: 0.25 (hours)

Parameters

Name	Field	Value
Time	None	n/a
Capacity	None	n/a
Alpha	None	0.15
Beta	None	4

Assignment Settings

Iterations: 500 Rel. Gap: 0.0001

Function: N-Conjugate 2

O-D Matrix Estimation Settings

Single Path Multiple Paths Gradient

Iterations: 10 Convergence: 0.0001

Options

Outputs

Report Cold Start

Cold Start Period (sec): 505

Produce Tabulation

Create Themes

Estimate for no-count OD pairs

Save Iteration Log

Weights

By Link/Segment Field: Weight

Value Change Constraints

Lower Bound Upper Bound

Matrix File: None None

Matrix:

Movement Count Table

Table in Project !: C:\...\Eureka\40DME\TurningCounts.bin

Count Field: Cnt_0700

Evaluation, Manual Adjustment

- How well our counts are replicated? Start with most important locations or locations with the highest discrepancy
- Are the major routes being used as we expected? If not, check network connectivity, link class, free flow speed. Output tools such as desired lines, trip browser, critical path, etc can be very helpful to identify the problem, however, they are only available after simulation run (not after the ODME)
- Modifying count weight may help to put more emphasis on correctly replicate more important counts.

Evaluation, Manual Adjustment

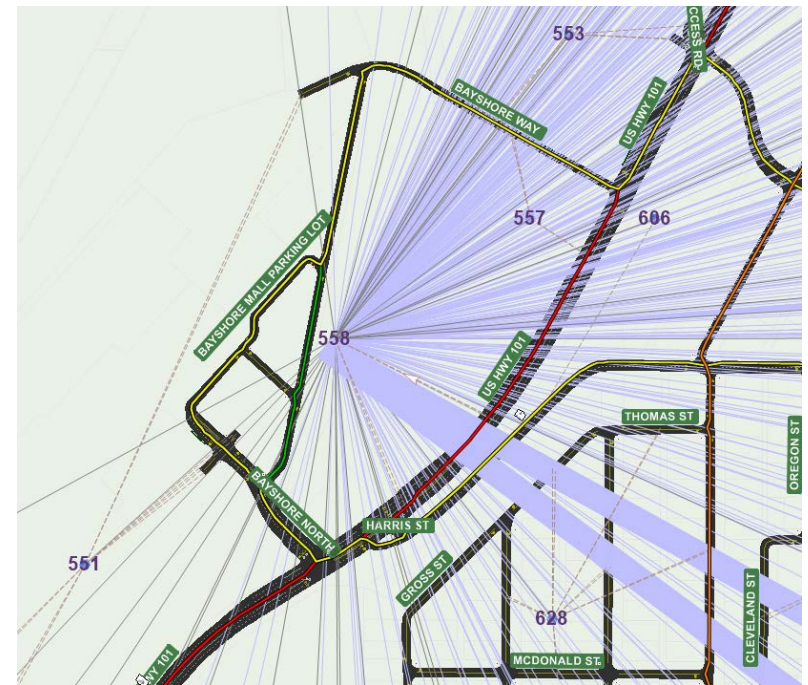
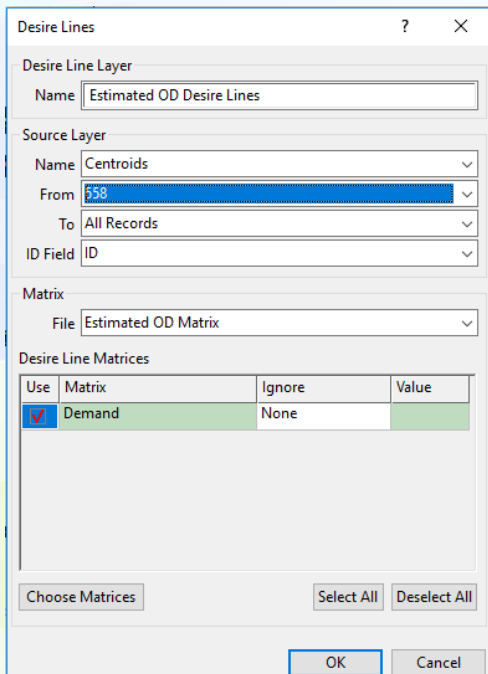
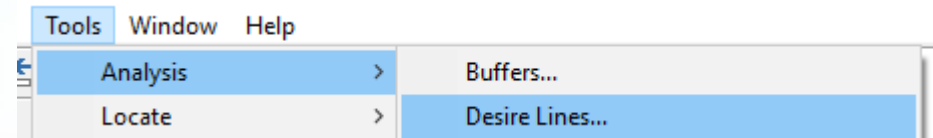
- Check absolute or relative change in each matrix cell before/ after ODME create a matrix of difference between matrices before and after ODME, and observe the highest values in 3d matrix
- No jump between each OD pair value is justifiable between successive 15-minute intervals)
- Use constrain matrices to control deviation from the seed matrix. We may constrain the OD pairs that have low initial values, or we have high confidence about their initial values and we don't want to change it during ODME
- Controlling the total trips. If reliable counts are available on links that are origins or destinations, it means that the trip ends are reliable and shouldn't change during ODME. If they do, we can force the initial values through Fratar)

Evaluation, Manual Adjustment

- TransModeler's Desire Line tool may help to visualize how trips are distributed from a zone or to a zone. It may help to see how reasonable the estimated trips are, and to visualize the difference between before/after ODME
- Critical Tool is a great way to evaluate and manually adjust the trip tables.

Desire Line

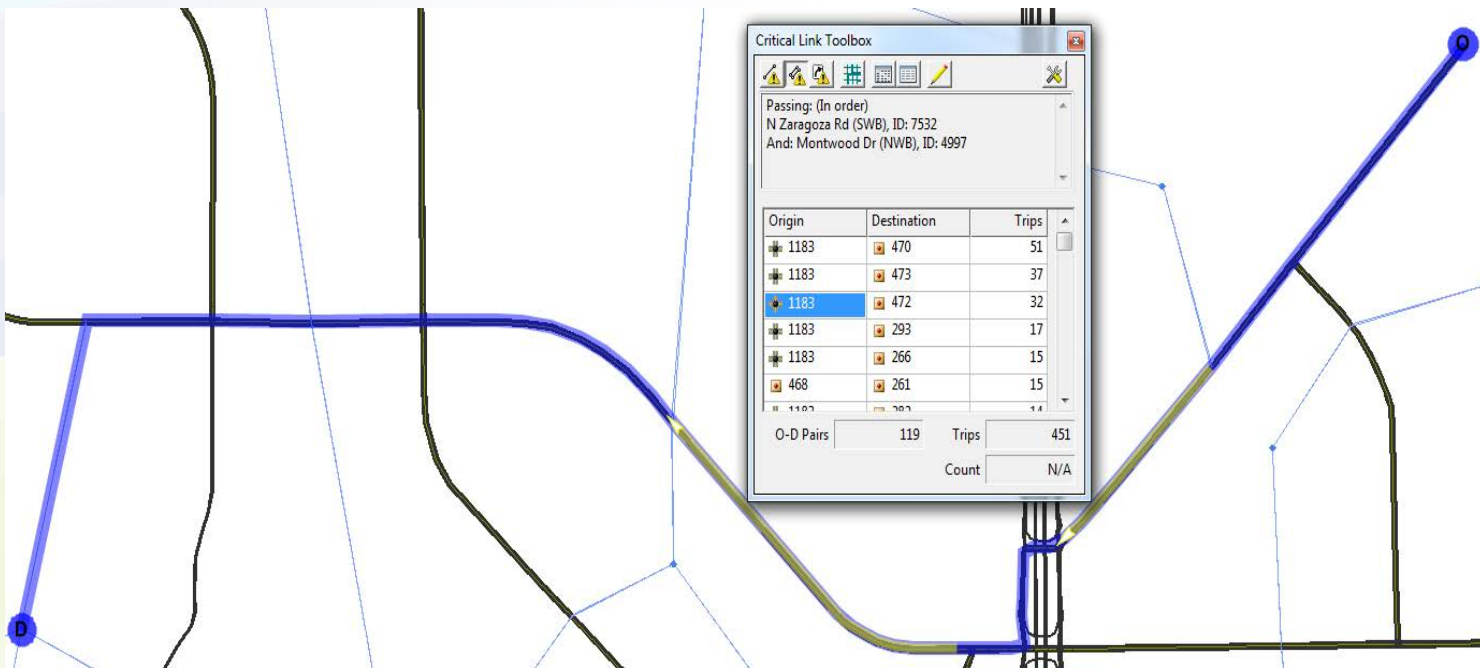
- Set the layer to node or centroid
- Open the trip table
- Tools → Analysis → Desire Lines



Critical Link Toolbox

➤ Demand → Critical Link Tools

This is a very powerful feature, acts similar to Select Link Analysis (SLA) in TransCAD. It gives the list of trips that passed through one link, 2 links, or made a turn. If the associated trip table is open, you can click on any OD, and edit the associated cell in the trip table.



Critical Link Toolbox

- Editing a cell in the trip table (have the desired trip table open):

The screenshot displays the 'Critical Link Toolbox' interface. On the left, a map shows a network of roads with a highlighted blue path. A 'Critical Link Tools' dialog box is open, showing the following information:

Passing: (In order)
WASHINGTON ST (WB), ID: 4792
And: BROADWAY (SWB), ID: 5078

Origin	Destination	Trips
443	554	2
445	712	1
438	2203	1

At the bottom of the dialog, it shows 'O-D Pairs: 3' and 'Trips: 4'. The 'Count' field is set to 'N/A'.

On the right, the 'Matrix1 - Estimated OD Matrix' window is open, displaying a table of values. The cell for origin 443 and destination 554 is highlighted with a red circle and contains the value 0.19.

	553	554	5
434	0.01	0.00	0.
435	0.09	0.01	0.
436	0.02	0.01	0.
437	0.00	0.18	0.
438	0.02	0.00	0.
439	0.01	0.00	0.
440	0.00	0.01	0.
441	0.01	0.01	0.
442	0.01	0.01	0.
443	0.01	0.19	0.
444	0.00	0.00	0.
445	0.01	0.02	0.

Critical Link Toolbox

➤ Editing trip table(s) based on percent contribution to a link volume:

The screenshot shows a map of a road network with a critical link highlighted in red. A 'Critical Link Tools' window is open, showing a table of origin-destination pairs and trips. A blue arrow points from the 'Critical Link Tools' window to the 'Adjust Trip Matrix' dialog box.

Origin	Destination	Trips
312	842690	717
843901	842690	80
314	842690	74
518	844033	69
312	473	67
313	842377	61
O-D Pairs	398	Trips
		2771
	Count	N/A

The 'Adjust Trip Matrix' dialog box is shown with the following settings:

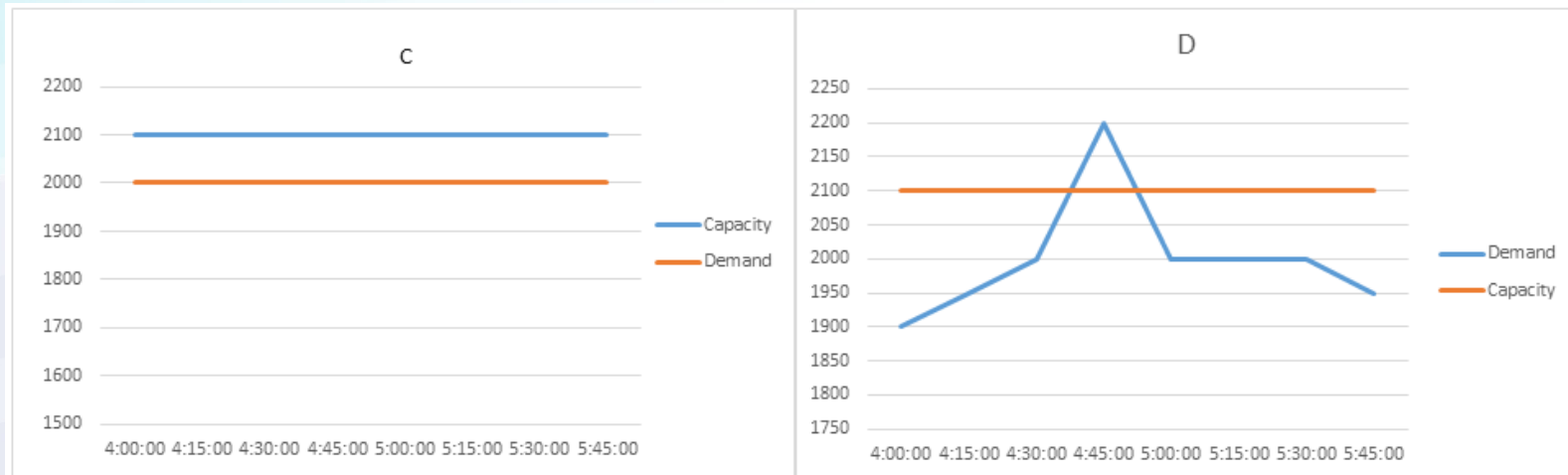
- Adjust: PM_ODME
- By Multiplying: 430, 445, 500, 515, 530, 545, ALL
- By Factor: 1.1
- Based on: Critical Link Matrix
- Threshold: 50 percent

The 'Profile (4 Matrices)' section shows a line graph of 'Trips after change' vs 'Matrix'. The bottom section shows summary statistics:

- Trips in selected matrices before adjustment: 1365
- Trips in selected matrices after adjustment: 1501
- Trips on the critical link(s) after adjustment: 2907

Importance of Slicing the Demand (and counts)

If demand exceed capacity even for a short period of time, queue forms, the smooth driving behavior will become stop and go, the capacity of the road drops and the difference between demand and capacity increases even more.

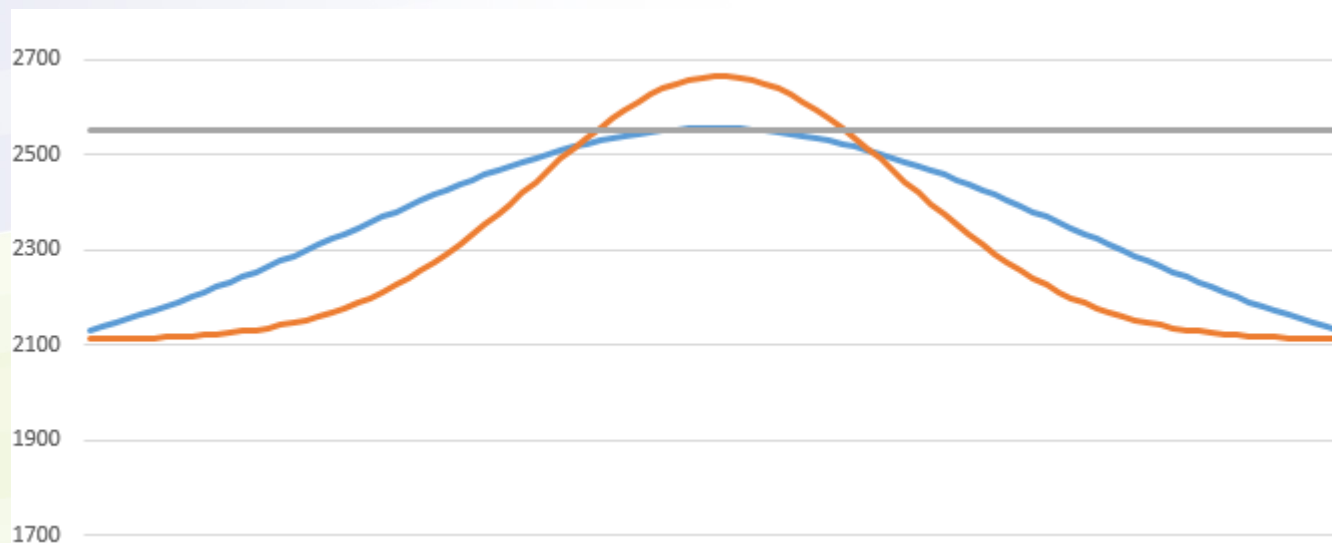


under demand pattern C, network performs at LOS of E, but performs at LOS of F under demand pattern D. In both cases, during 2 hours, the demand is 4,000 vehicle. But for one 15-minute interval in case D, the demand is greater than the capacity and delay significantly increases compare to demand pattern C.

Peak Spreading

The term peak spreading refers to the process of reducing the proportion of traffic demand in the most severely congested, or critical part of the peak period with corresponding increases in demand at time periods immediately before and after the critical peak.

It is a demand management strategy. Dynamic pricing tries to encourage the drivers to change their departure time to avoid high toll at the most congested period.



Demand Settings

- Separate calculated 15-minute matrices after ODME need to be unified in a single .mtx file (Matrix → Append) and be defined as Project Input
- Demand → OD Matrix → Trip Matrix settings

The screenshot shows the 'Trip Matrix Settings' dialog box with the 'Setup' tab selected. The 'Matrix Info' section contains a 'File Name' field with the path 'C:\Projects\Eureka\4ODME\PM_262.MTX' and a 'Description' field with the text 'Aggregated Matrix'. The 'Time Interval' section has 'Start Time (hh:mm:ss)' set to '16:00:00' and 'End Time (hh:mm:ss)' set to '18:00:00'. The 'General Parameters' section shows 'Unit Scaling Factor' as '1.000' and 'Standard Deviation (%)' as '0.0'. The 'Time Distribution' section has three radio buttons: 'Constant Over Time', 'Curve-Based', and 'Time-Dependent Matrices', with the last one selected. The 'Departure Headway Distribution' section has three radio buttons: 'Deterministic', 'Random (Uniform)', and 'Random (Negative Exponential)', with the middle one selected. 'OK' and 'Cancel' buttons are at the bottom right.

The screenshot shows the 'Trip Matrix Settings' dialog box with the 'Contents' tab selected. It displays a table with the following data:

	Matrix Name	Start Time	Vehicle Class	Driver Group
<input type="checkbox"/>	Sum of 'Demand	16:00:00		
<input checked="" type="checkbox"/>	400	16:00:00		
<input checked="" type="checkbox"/>	415	16:15:00		
<input checked="" type="checkbox"/>	430	16:30:00		
<input checked="" type="checkbox"/>	445	16:45:00		
<input checked="" type="checkbox"/>	500	17:00:00		
<input checked="" type="checkbox"/>	515	17:15:00		
<input checked="" type="checkbox"/>	530	17:30:00		
<input checked="" type="checkbox"/>	545	17:45:00		

NOTE: Cells left blank will assume values defined in the parameter: