# TransModeler Training 1-Network Development

presented to

Caltrans, District 1-Eureka

presented by

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Think *Forward* 

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# Webinar 1- May 1<sup>st</sup>, 2018

- Overview
- Creating Network From Scratch
- TransCAD Model Conversion
- Network Editing
- Network Parameters
- Eureka Model Developed by Caliper
- Signal coding
- Count coding
- Zone Connector/Aggregation



#### Create Network From Scratch



#### Network Editing - Editing Toolbox

Project → Road Editor → Toolbox





# Editing Toolbox-Settings

	Road Editor Configuration ? X	Road Editor Configuration ? ×
	New Features Parameters Options Key	New Features Parameters Options Key
Road Editor 🗙	Links	Road Editing Buffer Symbol Key
lle le ·   /+ /× /+ /→   //+ //× /∓ ·	Road Class Major Arterial	
/+ /∗ @ - № №   /+ /∞   4 🦠	Elevation 0 (feet)	
	✓ New Links Intersect	
	Click Curves	
Road Class Undefined 🗸	Segments	
	Fidelity Micro ~	Symbol and Keyboard Shortcut Descriptions:
Lanes on Left 1 🗘 on Right 1 🗘	One Way Lanes on Left (BA) 1	Shape Point
Lane Width (ft) 12 One Way	Lanes on Right (AB) 1	Shape Point at End of Segment
		Shape Point at End of Link
	Lanes	Other Tips
	Lane Width (feet) 12	<ol> <li>Click and drag the pavement (rather than shape points) on a segment or</li> </ol>
	Turn Bays	points together.
	Create Island Island Length (feet) 100	2. Press the 'T' key when clicking a
	Dual	set the desired position of the
	Shift Centerline	end of taper.
	OK Cancel	OK Cancel



## Editing Toolbox-Properties-Line Layers

Road Editor ×
14 /x /4 /4 /F /X /F ·
/+ /∗ @ •   ⊾+ ⊾∗   /4 /∞   � � ↓
1 🕅 🔄 😗 🌈 % 🍂 - 🖹 🛎 🌞 -
Road Class Undefined
Lanes on Left 1 + on Right 1 +
Lane Width (ft) 12 One Way

	Edit Road Properties	? ×
11	Link Segment Lane	
11/2	General	
	Link ID 5253	Direction SWB (AB)
	From Node 842890	To Node 842043
	Link Attributes Road Class Major Collect	or Edit Class

dit Road Properties ? X	Edit Road Properties ? ×
Link Segment Lane	Link Segment Lane
General Segment number 1 out of 1 link segments. (Counting in the direction of traffic) Segment ID 5253 Direction SWB (AB)	General Lane number 1 out of 2 segment lanes. (Counting from left to right) Lane ID 43 Direction SWB (AB)
Segment Attributes Number of Lanes 2  Reversible 0	Lane Attributes Width (feet) 12.00 Shoulder Passing
Median Divided  Shared Center Lane  Tunnel	Lane Changing To Left Prohibited V To Right Allowed V
Segment Fidelity     On Street Parking <ul> <li>Microscopic</li> <li>Left Side</li> <li>Mesoscopic</li> <li>Right Side</li> <li>Macroscopic</li> </ul> <li>Image: Strength Strengt Strength Strength Strength Strength Strength Strength Str</li>	Lane Use ETC No ~ Transit None ~ HOV No ~ Truck None ~
Tapering ✓ Expand the road gradually when 2+ lanes merge or diverge Length (feet):	HOT No VUser A None V Bicycle None VUser B None Copy Lane Properties
OK Cancel	OK Cancel



# Editing Toolbox-Properties Node & Lane Connector Layers

				Edit Lane Connec
Edit Node Properties		?	×	Lane Connector
Node				General
General Node ID 842043				Lane C Turning Mov
Priority Priority Road Node Fidelity	~			Lane Connect Connectiv
<ul> <li>Mesoscopic</li> <li>Macroscopic</li> </ul>				Options

Edit Lane Connector Properties	?	×
Lane Connector		
General		
Lane Connector ID 902		
Turning Movement Type Through		
Lane Connector Attributes		
Connectivity Bias (0-1) 1.00		
Waiting Zone		
Options		
Reset Vield Position		



# Network Editing – Line Layers

Not only different line layers carry specific network parameters, but each produce certain output.

#### Segment:

Flow, Density, and Speed will be updated continuously during the simulation, and output report can be generated based on user-defined time aggregation.

Fidelity, grade and parking information are input to this layer

🔢 Dataview1 - Segments Info		_		×
	ID		525	j3 🔺
	Link		525	j3
	Position			1
	Length		0.0	)9
	Lanes_AB			2
	Lanes_BA			2
[Re	eversible Lanes]			0
	[Center Lane]		N	lo
	Divided		N	lo
	Fidelity		Mic	ro
[Fr	ee Flow Speed]		35	.0
	[Speed Limit]		25	.0
	Curvature		0	0
	Grade_AB		0	.0
	Grade_BA		-0	.0
	Tunnel		No	-
	Parking_AB		None	-
	Parking_BA		None	-
	Flow_AB			
	Flow_BA			
	Density_AB			
	Density_BA			
	Speed_AB			
	Speed_BA			
	[K/Kjam_AB]			
	[K/Kjam_BA]			
	[Dir:1]			0
	[Length:1]		0.1	0
	ValNotes			54
	CTDEETNIAME	1	IC LIVEN 10	11

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## Network Editing – Line Layers

#### Link:

Queue and toll information will be dynamically updated during simulation. Road class, car following, priority, are examples of parameters that are only editable through link layer.

l - Links Info	– 🗆 ×
ID	5253
Dir	0
AB	SW
BA	NE
ANode	842890
BNode	842043
Superlink	5253
Length	0.09
Segments	1
Туре	Street
Priority	9
Domain	-
Access_AB	
Access_BA	
Control_AB	
Control_BA	
Facility	
Name	US HWY 101
Class	Undefined 🚽
Disabled_AB	No 🗸
Disabled_BA	No 🗸
[Car Following]	•
Toll_AB	
Toll_BA	
Queue_AB	0
Queue BA	0



## Network Editing – Line Layers

lane:	Lanes Info	— C
	ID	
Density and speed per lane are dynamically	Segment	
Bonony and opeou per lane are dynamically	Link	
updated during simulation and can be	Position	
	Left	
collected by user-defined aggregation	Right	
	Turns	
level after simulation.	Group	
	Reversible	
	Side	
Lana restriction/discount for sortain usor	Auxiliary	
Lane restriction/ discount for certain user	Mergea	
auch as trucks $HOV$ are defined in this lower	Pivot	
Such as trucks, nov are defined in this layer	Exit	
	Dropped	
	Parking	
Lane change restriction is defined	Stopbar	
Lane change restriction is defined	Width	
in this laver	Passing	
in this layer.	Shoulder	
	Change	
	ETC	
	HOV	
	Transit	
	Truck	
	[User A]	
	[User B]	
	HUI	
	Automation	
	Densitu	
	Speed	

 $\times$ 

685 5253

5253

Right

No

No No No 0.00

12.00

No 🚽 No 🚽 None 🕳 Left 🕳

-1 2 684

Lane:

## Create Network From Line Layer

#### Import Subarea Model

- 1. File  $\rightarrow$  Open (.dbd)
- 2. Make a selection set of TAZs in the TranCAD .dbd (activate the node layer)\*
- Optional: Create a custom lookup table for road classification: Parameters → Road Classification → Default Road Classes & Lookup Tables Right click on Lookup Tables and select Add. You can later edit this list.

Default Road Classes & Lookup Tabl	ies -			
🖃 Default Road Classes	Tiger			
Modified Greenshields Piecewise Linear	Road Cla	ss Lookup Table	+ + + × ⊥	<u>יייי</u> ן ,
i San Aerde ⊡- Lookup Tables	Code	Class	Description	^
Tiger	A11	Freeway	Primary highways, unseparated	-
- Planner HEBE	A12	Freeway	Primary highways, unseparated, in tunnel	
	410	Freeway	Primary highways, unseparated, underpassing	
Add a New Road Classification	×	Freeway	Primary highways, unseparated, with rail line in center	
Enter a Name		Freeway	Primary highways, separated	
Eureka		Freeway	Primary highways, separated, in tunnel	
		Freeway	Primary highways, separated, underpassing	
OK	Cancel	Freeway	Primary highways, separated, with rail line in center	
	Cancel	Major Arterial	Primary roads, unseparated	



\* Refer to slides 8-10

#### Create Network From Line Layer

#### Import Subarea Model

- 4. File  $\rightarrow$  New Simulation Project
- The program will ask you to save the .dbd, save it in a new folder in which you want to have your simulation database. This way, the original .dbd file in the old folder will remain accessible/editable by TransCAD.
   \*Note: If you have not created a road classification lookup table in step 3, select

"None" for Functional Type Classification

New File	New Simulation Project	Import Network ? ×	
Choose a Type of File           Simulation Project         OK           Image: Cancel         Cancel	Create a New Project <ul> <li>With a New Simulation Database</li> <li>Using an Existing Simulation Database</li> </ul>	Functional Type Classification Table Eureka Link Info	
Chart Dataview	By Converting a Line Layer     Line Layer     Network     Line Set     Entire line layer	Link ID ID V Street Name STREETNAME V Options ? >	×
Geographic File	Route System	Lanes     [AB_LN / BA_LN]     Options       Class     FT     Image: Class option options    Default Fidelity Microscopic	
Table Matrix	Traffic Drives on the C Left   Right	Number of links selected:  646	
Create a new simulation project	Options Use Current Map Create a Map OK Cancel	Centroid Set InternalZones V OK Cancel Fidelity None V Number of centroids included: 59	

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## Centroids vs Boundary Nodes

- TransCAD subarea contains internal and external zones. Internal zones are the ones that were TAZs in the initial, regional model; external zones are the ones created by cutting the subarea from the regional model.
- When you make a selection set in the node layer for TAZs, Transmodeler creates centroid and centroid connectors for them.
- If your selection set only includes internal zones, Transmodeler creates centroids only for internal zones, but still recognizes the external zones as nodes with type "Boundary" when creates a simulation data base.
- Trips can be generated from and destined to both Centroids and Boundary nodes



#### Eureka Subarea-Internal Zones



Contains 59 zones.



#### Eureka Subarea-External Zones



Contains 203 zones (blue dots)

They didn't exist in the original, regional model, but were created as the subarea was cut from the regional model

Associated Matrix with this subarea is a square 262\*262 matrix

(262=203+59)



## Only Internal Zones converted to Centroids



Only Internal Zones (59 zones) are created as centroids. However, noes such as 842288 are created with Type=Boundary Shown in pink selection set

These nodes can generate and attract trips.

Select by Condition (Dataview: Nod	les:1)	?	×
Enter a Condition		-1	OK
Type= "Boundary"			UK
			Cancel
			Verify
Condition Builder	Set Name		Chara
Field List 🗸	MyExternal ~		Clear
	Selection Method		Save



#### All zones were converted to Centroids

If we select all internal and external zones to be converted to centroids during simulation database creation:

1	Select by Condition (Dataview: Nodes)	?	$\times$
4	Enter a Condition SUBAREA SET>0	Г	ОК
			Cancel
			Verify
	Condition Builder Set Name		Clear
	Field List V AllZones V		Cicai
			Save

All 262 zones (internal and external) will be converted to centroids, matching the size of the trip tables.

Centroid connectors are not supposed to connect to intersections, only to the middle of links. Therefore, centroid connectors shown in red circles should be moved.



#### **Centroid Connectors**

- Don't connect centroids to intersection/nodes
- Don't connect centroids to the major roads
- Should more or less represent the traffic loading in the real world
- May be adjusted during the calibration and based on traffic counts.
- Zones shouldn't be connected to each other with zone connectors.



## Network Checking, Cleaning

#### Project → Road Editor → Check Network

» For each problematic item, a selection set is created in the associated layer

Check Network	83	📕 💶 Check: Poor Geometry (4) 🗸 🖌 🖌 🖌 1 of 4
Check network for		
Errors in intersection geometry		
Short segments (< 10.0 feet)		
Errors in segment geometry (shape, grade, and elevation gaps exceeding 1.0	feet)	
Missing lane connections		
Check parking lanes		
Check shared center lanes		
Check reversible lanes		
Check disconnected turning movements (between links with priority < 7	)	
Potential merging conflicts		
✓ Invalid superlinks		
Reset if invalid		
Signalized intersections without timing plans		
Detectors not assigned to any phase		a the second sec
Node and segment fidelity errors		
Check All Uncheck All Remove Sets OK Ca	ancel	



## Network Editing - Imagery

- > Maps → Imagery → Google Map
  - » Slow downs panning





# Exercise - Network Editing

- Select / move / extend / add / remove shape points
- Add / remove segment (intersect / direction / lane # / road class / fidelity)
- Split / join segment / links
- Add / remove lane / lane barrier
- Add acceleration / deceleration lanes
- Add / remove lane connectors
- Add / remove zone connectors
- Add / remove median
- Add shared center lane / Turn Bay
- Add roundabout
- Smooth curves
- Reverse direction



# Network Editing - Fidelity

- Nodes and Segments have a property called "Fidelity"
- Determines how travel time is calculated
- Macroscopic\*, Mesoscopic, Microscopic
- ➤ Each fidelity level requires certain set of parameters that can be edited through Parameters → Edit Road Classes, Parameters → Driver Behavior, and Parameters → Mesoscopic/Macroscopic
- Network can include all fidelity levels (Hybrid)
- Default fidelity is decided at the time of network conversion, but can be edited

\* When model fidelity is set as Macro or Meso, network details will be hidden (by default)



#### Driver Behavior X 3 main categories: Network Acceleration - Car-Following Acceleration related, general, and driver Car Following Model Parameters Variance Car Following (Advanced) Alpha Beta Gamma Theta behavior Headway 2.81 -1.67 -0.89 Accelerating 1.00 Thresholds 4.65 1.08 1.65 Decelerating 1.00 Buffor - Lane Changing Discretionary (DLC) Microscopic simulation models Model Selection Neighboring Lane Model individual vehicles' car Target Lane Model Mandatory (MLC) Look Ahead following and lane changing. Critical Distance General Fleet Segment's speed is average of - Transit Vehicles Shared Center Lanes Gap Acceptance speeds of all vehicles that Linear Model passed that segment during Non-Linear Model NGSIM Model that time interval. Passing General Desire to Pass Merging, Crossing, and Yielding Driver behavior parameters Headway Thresholds Following Headways for Merc -Yielding can be changed through - Roundabouts General Parameters >Driving Behavior. Circulating Lane Preference

- X

Default

0K

III III Filter



Cancel

Help

Apply

Fidelity - Microscopic

## Microscopic Parameters- Road Class

🚾 Edit Road Classes				×
Name Freeway	-	Add	Remove	Zoom
General Microscopic Mesoscop	pic Macroscopic			
Speed Limit (mph)	65.0			
Desired Speed Distribution Sta	indard			-
Star Sch	ndard 100l Zone 1de Zone			
Met Use Use	tered Area er 1 er 2			
		Apply	ОК	Cancel



## Fidelity - Mesoscopic

In mesoscopic simulation, vehicles are organized into platoons called traffic cells and streams. While the model tracks individual vehicles, the simulation of vehicle movements is based on aggregate speed-density relationships.

> Parameters → Mesoscopic/ Macroscopic

📮 General Parameters	Mesoscopic Parameters - Traffic Cells and Streams	
Step Size and Lane Distribution     Mesoscopic Parameters	Traffic Cell Management	
- Jam Density and Speed	Scenario	Distance (ft)
Traffic Cells and Streams	Merging two cells	100.0
	Splitting a cell	200.0
	Free flow	300.0
	Overtaking	100.0
	Traffic Cell Headways Ideal headway (sec) Typical passenger car length (ft) Minimum length for using speed density function (ft)	1.20 18.0 100.0

#### Mesoscopic Parameters – Road Class

Edit Road Classes           Name         Freeway	Add Remove Zoom
General Microscopic Mesoscopic Macroscopic	
Parameters Speed-Density Cur	ve
Curve Type Non-Linear 🔻 80	
Free Flow Speed (mph) 70.0	
Alaba 1 2000	
Beta 5.0000	
	<u>\</u>
beed	
Number of Lanes 1 0	Density (veh/mi) 300
	Apply OK Cancel



## Fidelity - Macroscopic

- Macroscopic simulation uses BPR function to estimate segment's travel time based on volume.
- Within all fidelity levels, TransModeler tracks individual vehicles, and a trajectory file can be generated regardless of fidelity level.
- Despite macroscopic models used in static traffic assignment tools, even with a link fidelity of macro, maximum number of vehicles passing a link is restrained by link capacity and storage, and queue starts forming once these values are reached.



#### Macroscopic Parameters- Road Classes

🖻 Edit Road Classes
Name Freeway  Add Remove Zoom
General     Microscopic     Macroscopic       Parameters     Capacity (pc/h/l)     2400.0
Volume-Delay Function Alpha 0.9000 Beta 9.0000
Apply OK Cancel



# Network Editing - Road Classes

- Each road class share the same network attributes such as free flow speed, VDF function parameters, capacity, saturation flow rate, etc.
- Default classes can be edited and new classes can be defined through Parameters -> Edit Road Classes.
- Capacity and free flow speed can be assigned through road class or based on segment attribute, but other network parameters can be assigned to a link only through road class definition. If any of these parameters need to be set differently for a single link, a new road class should be defined and assigned to that link.



# Joining Links and Segments

Sometimes you start with FFS and capacity based on road user class (probably adopted from initial TransCAD network), but you want to switch to segment-level FFS and capacity, and change these values for limited segments. To keep these values for the segments that you don't want to change, you can create association between Links and Segments through Dataview→ Table→ Join →

Join Dataviews	?	×
Choose the type of join you want to	o create	
Join link and segment fields		
◯ Join road class fields to layer		
O Join turning movement tables		
O Join any table to a map layer		
O Join any two kinds of tables toge	ether	
ОК	Car	ncel



#### Eureka Subarea Road Class

In the .dbd layer: Network

v 🔳 🌶 👫 🖉 🗄 🔊 |

	Color Theme (Layer: Network) ? ×	Color Theme (Layer: Network)	? × 1
	Settings Styles	Settings Styles	T
	General	Choose a class	
	Field FT V Save	Other (0) ^ / / / / / / / / / / / / / / / / / /	Style
	Method List of Values V Load		Copy Pattern
	Max Classes 512 ~ Recalculate	6 (58)	Reset Text
	Ortions	7 (230)	Style (9 (74)) ? ×
	Ignore values below or above	<u> </u>	Line Settings
	Std. Dev. per class	Legend Text	Style V
	Break at	9 (74)	Width 1 v
	Treat zeros as missing values	Color Sets	Color
	Round off the values in each class	<< Previous Next >> Swap Star	Opacity 100 🜩
	Include counts in legend	From via	Arrowheads
			None ODirection of Flow O Topology     Other Settings
	OK Cancel Apply Remove Customize	OK Cancel Apply Remo	other Settings
Eacility types of 2 1 5 6 7 and			
	u 9		
			OK Cancel Apply Reset

## Eureka Subarea Road Class

#### Through

Parameters  $\rightarrow$  Road Classification  $\rightarrow$  Default Road Classes and Lookup Tables, and Parameters  $\rightarrow$  Road Classification  $\rightarrow$  Edit Road Classes you can modify the user road class. We start with a user class that corresponds with the regional model. Will revise it based on the local knowledge/ previous work by Caliper.

Default Road Classes	Eureka			
Modified Greenshields Piecewise Linear	Road Cl	ass Lookup Table		<b>+ + + ×</b> 止 💴
····· Van Aerde ookun Tables	Code	Class	Description	
- Tiger	3	Major Arterial		
- Planner	4	Minor Arterial		
Eureka	5	Local Street 🔄		
	6	Local Street		
	7	Minor Collector		
	Centroid	Connector Codes		<b>+ ↑ + ×</b> ⊥ı □□
	Code	Description		



#### Eureka Subarea Road Class

#### You can assign user-defined road class to links, but not through the Eureka Lookup Table

🕘 Edit H	Road Classes			
ame Ri	ra_MinorArterial	~	Add Re	move Zoom
General	Microscopic Mesoscopic Macr	oscopic		
Parame	eters			
	Priority	~ 1		
	Special Type	None ~		
	Saturation Flow (PCE/hr/lane)	1450		
	Travel Time Perception Error (%)	10.0		
Numbe	er of Segments Using this Class			
	Microscopic	0		
	Mesoscopic	0		
	Macroscopic	0		

🔢 Dataview1 - Links Info	_	×
ID	7642	~
Dir	0	
AB	SW	
BA	NE	
ANode	844062	
BNode	842709	
Superlink	7642	
Length	0.05	
Segments	1	
Туре	Street	
Priority	9	
Domain		
Access_AB		
Access_BA		
Control_AB		
Control_BA		
Facility		
Name	US HWY 101	
Class	Undefined 🗸 🗸	
Disabled_AB	Undefined	
Disabled_BA	Access Road	
[Car Following]	Expressway Freeway	
Toll_AB	Freeway (Piecewise Linear)	
Toll_BA	Freeway (Van Aerde) Local Street	
Queue_AB	Major Arterial	~
	Major Collector	
	Minor Arterial Minor Collector	
	Rail	
	Ramp	
	Rira MinorArterial Boundabout	
	Rural Highway	
	System Ramp Tasilar Other Land Dand	
	Trail of Other Local Hoad Tunnel	
	Waterway	
		_

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