CAMBRIDGE SYSTEMATICS



District 3 Modeling Support

Modeling Basics – What Modelers Do

presented to District 3 Staff



April 17, 2017 Morning Session

April 18 – AM Session

- Objectives
- Interests
 - » What is needed to be learned
 - » Basic through advanced
- Individual models
- Traffic studies, TCR, PI, other studies
- Framework for the rest of the Task Order



District 3

 Diverse
 Many models
 Interregional/ » Inter-county travel





Task Order Objectives

- Train Caltrans staff for use and review of models/model data
- Assist with actual/real projects (if possible)
- Group and individualized training appropriate for skill level and job requirements
- Documentation and resources to serve as knowledge bank for future employees
- Assist with presentation and analysis of model data produced in-house and by others



District 3 Interests





District 3 Models

➢ SACSIM (SACOG) » Various SACOG Region County Models TRPA Model BCAG Model ➢ NCTC Model Other Models



A Changing Planning Framework



CAMBRIDGE SYSTEMATICS

District 3 Modeling Context

- Need to understand multiple models / multiple county/regional conditions
- Support traffic microsim
- ➢ SB 743, AB 32
- Weekday versus weekend travel
 Interregional travel, truck travel
- Staff retention (Issue at other districts)



Modeling Group as Service Bureau

Caltrans Management

Caltrans Planning Staff

Direct Supervisors

Other Caltrans Technical Staff

Caltrans PMs

Public Agency Modelers

Consultants

Others

Time sensitive Critical path Credible



District Planning Process



CAMBRIDGE SYSTEMATICS

Project Delivery



Modeling activities are generally front-loaded: This applies for both project delivery and for planning activities



Transportation Concept Reports

- All State Highways
 - » Updated periodically
- Generally straightforward data requirements

 Except when they are not
 - » CSMP
- Base year / Horizon year
- Auto / Truck splits
 - » AADT
 - » Peak hour splits
 - » VMT
- ¹² » LOS, V/C



TCR Reporting – Example 1

SR-54 Corridor Performance

54-1 Location Descripion: I-5 IC to the I-805 IC						
WESTBOUND						
BASE YEAR (BY): 2010	HORIZON YEAR (HY): 2040					
BY AADT: 58,000	HY AADT: 72,575					
BY LOS: C	HY LOS with RTP Improvements:C					
	HY LOS with no RTP Improvements: D					
BY VMT: 110,200	HY VMT: 137,892.5					
BY Vehicle Occupancy Rate: Not available	HY Vehicle Occupancy Rate: Not available					
BY Daily Vehicle Hours of Delay (35 MPH): Not available	HY Daily Vehicle Hours of Delay (35 MPH): Not available					
BY Truck Traffic AADT: 1508	HY Truck Traffic AADT: 1887					
BY Total Trucks (% of AADT): 2.60%	HY Total Trucks (% of AADT): 2.60%					
BY 5+ Axle Truck Traffic AADT: 109	HY 5+ Axle Truck Traffic AADT: 136					
BY 5+ Axle Trucks (% of AADT): 0.19%	HY 5+ Axle Trucks (% of AADT): 0.19%					
BY Peak Hour Volume: 4,250	HY Peak Hour Volume: 5,443					
BY Peak Hour VMT: 8,075	HY Peak Hour VMT: 10,341.7					
BY Peak Hour V/C: 0.64	HY Peak Hour VC: 0.82					
BY Peak Hour Average Speed: >60 mph	HY Peak Hour Average Speed: >60 mph					

Peak Period Length: 1 hour

Peak Hour Time of Day: 0700-0

Peak Hour Directional Split: 65%

Bottlenecks: No reoccurring observed bottlenecks

CAMBRIDGE SYSTEMATICS

District 12 SR 54

TCRs – Model Data

Select roadway segments Observed Base Year Data » Traffic Counts, PeMS, Caltrans Count Book Travel Model » Base horizon + Horizon year » Horizon year: With and without projects Adjust future forecasts » Observed + model growth ➤ HCM » For LOS – may involve Traffic Ops



TCR Reporting – Example 2

								2020						
FUTURE 2020								CONCEPT						
			2020				2-WAY	TRUCK						
	POST	LIMIT	NO	R/U	2020	PEAK	PEAK	PEAK	DIRECT	2020	2020	FACILITY	Lanes	LOS
Seg.	MILE		BUILD	UB	ADT	Hr	Hr Vol	Hr	SPLIT	V/C	LOS		Added	
1	0.0/R2.4	Jct I-15 to Main St./Montara Road	4 MF	U	30,000	10.8%	2,700	10%	65%	0.41	А	4 MF	0	А
2	R2.4/7.2	Main St/Montara Road to "A" St	4 MF	R	25,000	10.8%	2,700	10%	<mark>65%</mark>	0.41	А	4 MF	0	А
3	R7.2/107.2	"A" St to Goffs Road	4 MF	R	22,500	12.4%	2,800	12%	70%	0.46	В	4 MF	0	В
4	15.0/44.2	Goffs Road to Jct SR 95N	4 MF	R	20,000	12.5%	2,500	14%	70%	0.47	В	4 MF	0	В
5	44.2/49.5	Jct SR 95N to Jct SR 95S	4 MF	R	19,000	12.4%	2,350	14%	70.0%	0.44	В	4 MF	0	В
6	49.5/59.4	Jct SR 95S to Arizona State Line	4 MF	R	15,000	10.0%	1,500	12%	75.0%	0.37	В	4 MF	0	В

District 8 I-40



Project Study Report

Early Project Delivery Document » Inform Purpose and Need Travel Model Forecasts Required » Traffic counts collected specifically for project (plus off the shelf data - HPMS) » Big Data (Origin-Destination) Base Year / Opening Year / Horizon Year » Mainline, ramps, intersections » Detailed, link level analyses Auto, truck, multimodal Traffic assignment to inform HCM » Changes in VMT/GHG? 16

PSR Example

Segr		Balanced 2040 No- Project		
From	То	Туре	AM Peak Hour (vph)	PM Peak Hour (vph)
Santa Anita Ave On-Ramp	Peck Pd SB Off-Pamp	Mainline	0	0
	Peck Ku Sb Oll-Kallip	Express	214	1,885
Peck Rd SE	Off-Ramp	0	0	
Back Dd SB Off Damp	Back Bd NR Off Damp	Mainline	6,114	4,933
Реск ка зв оп-катр	Feck ku NB Off-Kallip	Express	214	1,885
Peck Rd N	Off-Ramp	521	704	
Bock Bd NR Off Domp	Valley Blud On Bamp	Mainline	5,593	4,229
Peck ku NB OII-kamp	valley bivd Off-Kallip	Express	214	1,885
Valley Blvc	On-Ramp	234	167	
Valley Blyd On-Pamp	Stewart St On-Bamp	Mainline	5,827	4,396
valley bivo on-kamp	stewart st Oll-Kallip	Express	214	1,885

SR 60/I-605/I-10 PSR



Project Approval and Environmental Document

Purpose & Need

- Environmental document
 - » CEQA, NEPA
- Travel model forecasts required support traffic microsimulation
 - » Traffic counts collected specifically for project
 - » Big Data (Origin-Destination)
- Base year / Opening year / Horizon year
 - » Primarily trip tables to inform traffic analysis
 - Traffic assignment may be conducted
- ➤ Auto/ HOV, truck, transit
- ➢ SB 743 VMT analysis



Other Areas Where Model Data Are and Can Be Used

Discussion



Travel Modeling Basics

Opening the Black Box



The Four Steps



Inputs

Transportation Networks

Socioeconomic Data

> External Data

Special Generators

Model Parameters Outputs

Trips by Mode

Traffic Volumes

Congested Speeds

Transit Volumes

Summary Information



Inputs

Transportation Networks

Socioeconomic Data

> External Data

Special Generators

Model Parameters

Roadway Networks

- Contains roadway characteristics
 - Number of Lanes
 - Roadway Type (Freeway, arterial, etc.)
 - Area Type (CBD, Urban, Suburban, Rural)
- Transit Networks
 - » All fixed route transit service





Identifies demand for travel Household data » Average household size » Median household income » Number of resident workers » Age of household residents » And more... Employment data » By 13 industries » By Wage level



25















Represent the way people behave

- » How many trips are made?
- » How far will people travel?
- » What impacts decisions about travel mode?
- » How does congestion impact travel?

Source Data

- » Household Travel Surveys
- » On-Board Transit Surveys
- » Speed Surveys
- » Big Data
- » Validated to traffic counts



Information about each trip

- » Start/end
- » Time of day
- » Mode of travel
- » Purpose of trip
- » Trip time and distance



By Time of Day

- » Daily
- » AM, PM, Mid-Day, Evening, Night
- » AM and PM Peak Hours
- Turn Movements
 - » Better estimated with assistance of base-year counts
- Congested speed based on volume





By Time of Day

- » Peak and Off-Peak
- » Daily sum
- By route or route group
 Also by stop, but with less accuracy

Useful for Big-Picture transit analysis

- » Detailed analysis requires localized model refinement
- Transit trips are removed from the highway network





Performance Report

- » Summaries of model results
- » Useful for planners and engineers
- Planning Tools
 - Maps and charts

» Results presented for general understanding

- VMT, VHT, Delay
- Level of Service
- Trip Lengths
- Trip Patterns





Example Applications

The model can estimate level of service to help identify problem areas.

	Uncongested			Congesting	Congested		
	Α	В	С	D	E	F	
Driver Comfort	High	High	Some Tension	Growing Tension	Uncomfortable	Distressed	
Average Travel Speed	Speed Limit	Close to Speed Limit	Close to Speed Limit	Some Slowing	Significantly Slower than Speed Limit	Significantly Slower than Speed Limit	
Maneuverability	Almost Completely Unimpeded	Only Slightly Restricted	Somewhat Restricted	Noticeably Limited	Extremely Unstable	Almost None	

CAMBRIDGE SYSTEMATICS

Household And Employment Growth



CAMBRIDGE SYSTEMATICS
Household And Employment Growth



Travel Patterns



Today



38

38

Travel Patterns



Future



Traffic Volumes And Congestion



Today

Travel Times				
From/To	Today	2030	Increase	
Fort Collins to Denver	73 Minutes	119 Minutes	46 Minutes (63%)	
Fort Collins to Greeley	37 Minutes	49 Minutes	12 Minutes (32%)	
Greeley to Loveland	29 Minutes	39 Minutes	10 Minutes (34%)	
Berthoud to Windsor	24 Minutes	37 Minutes	13 Minutes (54%)	



Traffic Volumes And Congestion



Future

Travel Times					
From/To	Today	2030	Increase		
Fort Collins to Denver	73 Minutes	119 Minutes	46 Minutes (63%)		
Fort Collins to Greeley	37 Minutes	49 Minutes	12 Minutes (32%)		
Greeley to Loveland	29 Minutes	39 Minutes	10 Minutes (34%)		
Berthoud to Windsor	24 Minutes	37 Minutes	13 Minutes (54%)		



Where Does The Traffic Go?







Intersection Los Reporting





Traffic Impact Analysis





Model Validation / Post-Processing

Matching Local Data

- Surveys & reasonableness checks
 - » Final Trip Rates
 - » Travel Times
 - » District to District travel patterns
- Traffic count data
 - VMT by subregion, facility type, and area type

» Corridor and localized review



Matching Counts

How does the model work for today

- » Statistics
 - R-Squared
 - % RMSE
 - Volume / Count Ratio
 - Etc...
- » Screenlines
 » Corridor Review
 » Highest Errors



Example Only



Testing Sensitivity

Dynamic validation
 Observe how the model reacts changes
 Test big and small changes
 Test the base and forecast year
 Do results make sense?



Post Processing: *Reconciling* to *Counts*

- Is the model too low in the base year?
 Then the forecast is <u>increased</u> by the same amount
- Is the model too high in the base year?
 Then the forecast is <u>decreased</u> by the same amount
- Both Post Processed and Raw volumes are available for analysis



Post Processing: *Reconciling* to *Counts*

Use % Growth (e.g., traffic increases by 30%) $Forecast_{ratio} = Raw Volume \cdot \frac{Count Volume}{Raw Base Year Volume}$

Use Volume Growth (e.g., traffic increases by 5,000 vehicles)

Use the Average

$$Forecast_{avg} = \frac{Forecast_{ratio} + Forecast_{diff}}{2}$$



Travel Model



Testing Demand Changes

» Evaluate base, interim, and forecast year datasets

- Consider testing large development proposals (e.g., over 200 households or employees)
 - Use the model's trip distribution to compare to traffic study assumptions
 - Cross-check development model runs with ITE-based traffic studies

Use the model to test very small developments
 Test unreasonable changes to the jobs/housing balance



Testing Roadway Changes

Test large and medium-scale capacity changes

- Test different roadway alternatives
- Test a comprehensive roadway plan
- Test various corridor configurations

00n't),

Test scenarios that do not impact system capacity Try to model very small capacity or speed changes Rely on the demand model to test interchange configurations



Non-motorized Results

Focus on potential non-motorized demand

- E.g., 1, 2, and 5 mile trip bandwidths
- Identify good places for infrastructure improvements
- » Consider non-motorized model results to be a rough estimate
 - The model is only one tool to aid in analysis

Expect detailed numbers

- YES: "There is a high demand for a new bike lane in this corridor"
- NO: "This new bike lane will result in X new bike trips"

Transit Results

Evaluate major system adjustments

- Test large route changes
- Focus on a system-wide results

Test fine tuning of route alignments

- Expect detailed forecasts by transit route or transit stop
 - This information is available, but must be interpreted carefully by a transit professional



Traffic Results

- Post process traffic volumes based on counts
- Focus on forecast growth rather than values
- Consider corridors as a whole
- » Use the model to plan freeways, expressways, and arterials

Rely on raw model volumes

- Expect detailed collector and intersection forecasts
 - This information is available, but must be interpreted and may require additional post processing



Model Steps

Trip Generation: How Many Trips?

- Based on household survey
- Different trip purposes
- Generate all trips*
 - Walk
 - Bike
 - Transit
 - Auto

* This is different than ITE Trip Generation, which only considers vehicle trips





Trip Generation: How Many Trips?

Cross-classified production rates

- » Household size & income
- » Household Workers & Income





Trip Distribution: Where will they go?

Match

60

» Productions & attractions

Survey Data

- » Trip length distributions
- » Subregion to subregion patterns



The *Gravity* concept can be used to model travel!

Mode Choice: What Mode?



61

Traffic Assignment: What Route?

- 4 to 5 time periods (depending on model version)
- Account for localized and peak period congestion





Morning Wrap-Up





CAMBRIDGE SYSTEMATICS



TransCAD Travel Demand Model Training

presented to Caltrans District 3 presented by

Cambridge Systematics, Inc. Caliper Corp. April 18-19, 2017

Agenda

- TransCAD Files
- Layers
- Dataviews
- Selection Sets
- Joining Data
- Color theme
- Labels
- Scaled Symbol Theme
- Flow Map Utility

- Importing Shapefiles
- Creating Districts
- Calculating VMT by District
- Desire Lines
- Creating Networks
- Shortest Paths
- Network Skims
- Traffic Assignment



TransCAD Files



File and Data Types

Data Files actually contain information:

- » Tables (.bin, .DBF)
- » Geographic Files or Layers (.dbd, .shp)
- » Matrices (.mtx)



S. D. Start

File and Data Types

Some files do not contain information:

- » Dataviews (.dvw)
- » Maps (.map) and workspaces (.wrk)
- » Matrix Views (.mvw)

These files refer to other file types that contain data

» Same concept as a project file (.mxd) in ArcMAP

Never use File \rightarrow Save As \rightarrow "Dataview (.dvw)" or "Map (.map)" to save a copy for modification!



AT

File and Data Types

- Geographic Files (.dbd) are GIS layers and can be edited and viewed.
 - » We use line layers as "roadway networks"
- Route Systems (.rts) contain transit information
 - Route systems are linked to line layers
- Routable Network Files (.net, .tnw) are routable networks used internally by TransCAD.
 - » Routable network files must be created before running certain tasks.
 - » Separate networks for roadway and transit







Working with Layers

- Start by opening a map <u>or</u> a geographic (dbd) layer file
 - » Opening a layer will create a new map and add the layer
 - » Opening a map will load all saved layers, settings, etc.
- Access layers with the layers dialog box (





Working with Layers

The Layers Dialog ()




Working with Layers

Layers are drawn from TOP to BOTTOM





Display Manager

- \rightarrow Activate from Map \rightarrow Display Manager
- Quick access to layers, settings, etc.
 - » Right-click for more settings, including make working layer



CAMBRIDGE SYSTEMATIC

Data Tables ("Dataviews")



Working with dataviews

- Open a dataview for any existing layer ()
- \rightarrow Open a standalone table with File \rightarrow Open
- Add/Remove fields with Dataview → Modify Table » (or m)
 - » Be careful: Changes are permanent once you click "OK"
- Data can be edited directly in the dataview
 - » Be careful: Changes are saved as you go
- \rightarrow Create formula fields with $\frac{\times \cdot \cdot \cdot \cdot}{2}$
- Right-Click on a column header for more options
 - » Including a formula Fill



Working with Dataviews

Formula Field vs. Add Field & Formula Fill

- » Formula *Fill* adds new data and saves values in the table
- » Formula *Fields* are updated when other values change, but are not stored in the data table
 - Formula fields are stored in a map, dataview (*.dvw), or workspace (*wrk)
- 1. Enter a formula
- 2. Use the Field List to find field names
- 3. Name the formula field

Tip: nz([Field]) converts null values to zero values

Formula (Dataview: OCTA	A_Links)	X
nz(AB_LN_05) + nz(BA_LN_05)		OK
	(1)	Cancel
		<u>D</u> elete
		<u>C</u> lear
		⊻erify
		<u>N</u> ode Fields
- Formula Builder	Formula Fields	Save
Field List	TOT_LANES	Load
Operator List	Previous Formulas	
Function List		•
Values of BA_LN_05 💌		

Practice 4: Add total number of lanes in a NEW FIELD

Start with the results from Practice 3

- Open the saved map if needed \checkmark
- 1. On the top ribbon, click daataview table
- will open the links layer

F

- Use Dataview \rightarrow Modify Table or click 2.
 - Click 'Add Field' \checkmark
 - Name the field "TOT LANES"
 - You can move the field position using Move Up and Move \checkmark Down buttons to the right
 - Click 'OK' \checkmark
- Go to 'Dataview' window 3.
 - Right click the top part of the 'TOT_LANES' field \checkmark
 - Select 'Fill' \checkmark
 - Select the 'Formula' in the fill method options \checkmark
 - Type: nz(AB AMLANES) + nz(BA BALANES) \checkmark
 - Alternatively you can use the formula builder
 - Click 'OK' button.
 - This fills in two-way number of lanes \checkmark

	N	Addify Table								-	×
	Г	Table Specificati	ons								2
		Field Name	Туре	Width	Deci	Index	Default	Format	Display Name	-	ОК
		AB_EVE_FX_TOL	Real (8 bytes)	10	3			None		-	Cancel
		BA_EVE_FX_TOL	Real (8 bytes)	10	3			None			
		AB TOLLV EVE T	Real (8 bytes)	10	3			None			Add Field
		BA TOLLV EVE T	Real (8 bytes)	10	3			None			Drop Field
		AB NT PM TOL	Real (8 bytes)	10	3			None			Move Up
		BA NT PM TOL	Real (8 bytes)	10	3			None			Move Down
		AB NT FX TOLI	Real (8 bytes)	10	3			None			
		BA NT FX TOLI	Real (8 bytes)	10	3			None			Attach Codes
		AB TOLLV NT T	Real (8 bytes)	10	3			None			Drop Codes
		BA TOLLV NT T	Real (8 bytes)	10	3			None			Export Codes
		TOT LANES	Real (8 bytes)	10	3			None			Export cours
	1	TOT_DAINED	near (o bytes)	10	-					-	Aggregation
		Field Description									
AJTUT_LANES MAP_FI											
		L									
		Record Informat	ion								
		Add Records		Set	ings						
1						·					
1											
				_	_						
Fill						25					
	Moth	od									
1	ivicui	ou									
	Single	Value				_					
- 1	-					_					
no - 1 O	Seque	ence Start 1	Ste	p 1							
- 1	_										
	Form	ula			_	_		_			
- 1	- Fo	rmula (Dataviev	v: 16r16p_link	s)					×	1	
DO - 1	1 (F		C)(D.A. A.I.								
- 1	Isi		5) + nz(BA_AI	VILANE	>)				ОК		
00 1	lan I								Cancel		
DO 1	100								Delete		
DO 1										i -	
DO 1									Clear		
DO 1 [Verify		
DO - 1 [Node Fields		
. 1											
DO 1		Formula Builder		Fo	rmul	a Field	ls		Sum Fields		
. 1 0	A	Field List	•	Fo	ormu	la		-	Save		
- 1									Load		
	CI (Operator List	•	Pr	eviou	is Forr	nulas		Load		
2	F	Function List	•	if	AB_F	acility	_Type :	= 100 or B/	A_Facility_Typ ▼		
		Values of BA_AN	ALANES 👻								



Bonus: Try this example using a formula field instead!

Selection Sets



Selection Sets

- Add additional formatting capability
- Useful for analysis and data processing
- Use the Selection Set Toolbox
 - » Select items with a query
 - » Select items by pointing
 - » View the Selection Settings



- One map can contain many selection sets
 - » Show or hide selected items
 - » Format selected items with different colors, styles, and labels



Joining Data



Joining Data

- Layers have an associated data table ()
- Data can be joined (>>) to other tables
 - » Roadway Network + Traffic Assignment results
 - » TAZ layer + Land Use Data
 - » Roadway Network + Lookup Table
 - » More...
- This is how traffic assignment results are viewed in TransCAD



Joining Data

J	oin	
ſ	Settings Op	itions
	- Create Join	ed View
	<u>N</u> ame	OCTAM33_TAZ+ZonePABalanced 3
	-Joining from	n (left side of join)
	Table	OCTAM33_TAZ
	Field	TAZ
	Examples	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
	– To (right sid	de of join)
	Table	ZonePABalanced
	Field	
	Examples	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
		OK Cancel

- 1. Select the Primary join table
 - » Be careful: Check the Field
- 2. Select the secondary join table
 - » Be careful: Check the Field
- 3. Create a name for the view, or use the default

Tip: You can open a file from the join dialog box

To (right sid	de of join)	
Table	File Open	-
Field	File Open	
Examples		



Color Theme



Creating Maps

- Create a new map by opening a Geographic File (*.dbd)
- Add more layers if desired
 - » 🛃 then 🛛 Add Layer
- Choose the active layer
 - » Use the dropdown selector
 - » Or use the display manager

File	Edit	N	/lap	Dat	aview	Selection	Tools	Proce	dure
	2			•	TAZ_t1			-	
7	Υ.	ъ	T	₹.	TAZ_t1			6	
	Map	L - ~	iz49	78	16r16p_	<u>links</u>			

- Change the "default" styles for the layers
- Hide or show layers
 - » 🚘 or the display manager



Color and Pattern Themes

- Set feature colors and styles based on attributes
 - » Color Themes () are often used to display facility type on a roadway network
 - » Pattern Themes (Map → Pattern Theme...) is sometimes used to display number of lanes on a roadway network



Color and Pattern Themes

The Settings Tab

Settings S	tyles
General	\frown
Field	[Road Type]
Metho	d List of Values 2 Load
Max Classe	s 512 3 • Recalculate
Ignore val Std. Dev	es below or above
T	reat zeros as missing values
√ R	ound off the values in each class
Ir Ir	clude counts in legend
ОК	Cancel Apply Remove Customize

- 1. Choose a field to represent
- 2. Choose a method to create categories and number of classes
- * Use the Load and Save buttons to store and recall settings
 - This is a huge time-saver!



Color and Pattern Themes

The Styles Tab

Color Theme (Layer: 16r16p_links)	23
Settings Styles	
Choose a class	
Other St	e
Centroid Connector	
Copy P	attern
HOT Interstate	Text
HOV Other	
HOV - Interstate	
HOV - Limited Access	
HOV Interstate	
Legend Text	
Centroid Connector 2	
Color Sets	
<< Previous Next >> Swap Start and End	
From to via	_
OK Cancel Apply Remove Cu	stomize

- 1. Choose a style for each class
- 2. Select a legend text for each class
- 3. Choose from predefined color settings if desired







- Labels () can be used to show things including:
 - » Traffic Volumes
 - » Number of Lanes
 - » Centroid Numbers
 - » SED/Land Use Data



Labels can be set differently for different selection sets



The Labels Tab

Labels Overlaps Background Callouts General Field [AB_AMLANES / BA_AMLAN[S]] Save Position Centered above Load Rotation Along line feature 2 Ø Smart Alignment Stretch Skip Partial Labels Ø Allow Duplicates Spacing Inches Limit Lines to Characters Do not display on the map Size 12 3 Font Size 12 3 QsimSun-ExtB Size 12 3 Agency FB Aharoni Color 5 Andalus Format Default 4 Angsana New Format Default 5 Arabic Transparent Format Bold Italic Arabic Typesetting Ie Shows what Label Text will OK Cancel Apply Remove	Labels (Layer: 16r16p_links)
General Field [AB_AMLANES / BA_AMLAN S] Position Centered above Position Centered above Rotation Along line features Q Smart Alignment Stretch Size Imit Lines Imit Lines Do not display on the map Do not display on the map Font Size Imit Lines QSimSun-ExtB Size Imit Lines Agency FB Color Imit Lines Aharoni Andalus Format Default Angsana New Imit Line Height Imit Line Angsana New Imit Line Height Imit Line Marajita Imit Line Imit Line Arabic Transparent Imit Line Imit Line Arabic Typesetting Imit Line Imit Line OK Cancel Apply Remove	Labels Overlaps Background Callouts
Field [AB_AMLANES / BA_AMLANES] Position Centered above Rotation Along line features Smart Alignment Stretch Stretch Skip Partial Labels Allow Duplicates Spacing Allow Duplicates Spacing Allow Duplicates Spacing Imit Lines to Characters Do not display on the map Font Size 12 Imit Lines Size Imit Lines Color Agency FB Aharoni Angsana New Color Angsana New Line Height Arabic Transparent Imit Lines Arabic Typesetting Imit Line Height Imit Lines Stretch Marabic Typesetting Imit Line Height OK Cancel Apply Remove	General
Position Centered above Rotation Along line features Smart Alignment Stretch Smart Alignment Stretch Skip Partial Labels Allow Duplicates Limit Lines to Characters Do not display on the map Font SimSun-ExtB Agency FB Aharoni Algerian Andalus Angsana New Angsana New Arabic Transparent Arabic Trypesetting Arial OK Cancel Apply Remove	Field [AB_AMLANES / BA_AMLANIS]
Rotation Along line features Smart Alignment Stretch Smart Alignment Stretch Allow Duplicates Spacing Allow Duplicates Spacing Limit Lines to Characters Do not display on the map Font Size 12 Agency FB Aharoni Algerian Andalus Angsana New Angsana New Angsana New Angsana VPC Aparajita Arabic Transparent Arial Mial Mial OK Cancel Remove	Position Centered above Load
Smart Alignment Stretch Skip Partial Labels Allow Duplicates Spacing Inches Limit Lines Characters Do not display on the map Font SimSun-ExtB Agency FB Aharoni Algerian Andalus Angsana New Angsana New Angsana New Angsana New Arabic Transparent Arabic Typesetting Arial OK Cancel Apply Remove	Rotation Along line features
 Allow Duplicates Spacing 0 Inches Limit Lines to Characters Do not display on the map Font Size 12 3 Agency FB Color 3 Aharoni Color 5 Andalus Format Default 6 Angsana New Line Height 100 % Arabic Transparent Format Label Text will 100 % Arial V Bold Italic OK Cancel Apply Remove	Smart Alignment Stretch Skip Partial Labels
□ Limit Lines to Characters □ Do not display on the map Font □ Do not display on the map Font □ Do not display on the map Color □ Algerian Andalus Angsana New Angsana New Angsana New Angsana New Angsana VPC Aparajita Arabic Transparent Arial ✓ OK Cancel Apply Remove	Allow Duplicates Spacing 0 Inches
Do not display on the map Font	Limit Lines to Characters
Font @SimSun-ExtB Agency FB Aharoni Algerian Andalus Andalus Angsana New Angsana New Angsana New Angsana New Angsana VPC Aparajita Arabic Transparent Arabic Typesetting Arial OK Cancel Apply Remove Size 12 3 Color Format Default Line Height 100 % ØBold Italic Ie Shows what Label Text will	Do not display on the map
@SimSun-ExtB Agency FB Aharoni Algerian Andalus Angsana New Arabic Transparent Arabic Typesetting Arial OK Cancel Apply	Font
Agency FB Aharoni Algerian Andalus Angsana New Angsana New Angsana Wev Angsana UPC Aparajita Arabic Transparent Arabic Typesetting Arial OK Cancel Apply Remove	@SimSun-ExtB Size 12 3
Algerian Algerian Andalus Angsana New Angsana VPC Aparajita Arabic Transparent Arabic Typesetting Arial OK Cancel Apply Remove	Agency FB Abaroni
Andalus Angsana New Angsana Vev Angsana UPC Aparajita Arabic Transparent Arabic Typesetting Arial OK Cancel Apply Remove	Algerian
Angsana New AngsanaUPC Aparajita Arabic Transparent Arabic Typesetting Arial OK Cancel Apply Remove	Andalus Format Default -
Aparajita Arabic Transparent Arabic Typesetting Arial OK Cancel Apply Remove	Angsana New
Arabic Transparent Arabic Typesetting Arial OK Cancel Apply Remove	Aparajita
Arabic Typesetting Arial OK Cancel Apply Remove	Arabic Transparent Bold Italic
OK Cancel Apply Remove	Arabic Typesetting
OK Cancel Apply Remove	
OK Cancel Apply Remove	
	OK Cancel Apply Remove

1. Select the field to use for labels

- 2. Set label placement options
 - » Note the "Allow Duplicates" checkbox

3. Set the label style options



The Overlaps Tab

Labels (Layer: abmload_byr)
Labels Overlaps Background Callouts
Overlaps
Alt. Field None 👻
Layer Priority 7 (Low)
Within the layer based on Higher -
values of Length 👻
Autoscale
Current Scale 1:611 Clear
Smallest
OK Cancel Apply Remove

- Overlapping labels can be allowed if desired
- Different layers can have different priorities
- Autoscale can turn labels on and off automatically



The Background Tab

Labels (Layer: abmload_byr)					
Labels Overlaps	Background	Callouts			
Туре					
None		Interstate	â		
 Snadow Halo Frames 		Interstate			
Shields		Interstate			
		Interstate			
	\bigcirc	Interstate			
		Business Loop/Spur			
			-		
ОК	Cancel	Apply Rer	nove		

Shadows, halos, frames, or shields can be added to labels to create better looking and more informative maps



The Callouts Tab

abels (Layer: abmlo	ad_byr)		X
Labels Overlaps	Background	Callouts	
		<u>S</u> tyle <u>W</u> idth Hairline <u>C</u> olor	
ОК (Cancel	Apply	Remove

Set the default callout style to use when labels are manually repositioned



Practice 2: Add number of lanes labels

TIP

Right click on the gray area of the layout and print to pdf.

1.	Start with the results from Practice 1	Labels (Laver 16r16n links)
	✓ Open the saved map if needed	Labels Overlaps Background Callouts
2.	Use the and zoom-in tool ((\mathbf{R}) to zoom in to the area of interest	General Field [AB_AMLANES / BA_AMLANES]
3.	 On the top ribbon, click the labels icon (Select the [AB_AMLANES/BA_AMLANES] field Change the size and color to match your preference Change the format to have numbers by comma separated Click 'OK' button 	Position Centered above Load Rotation Along line features Stretch Skip Partial Labels Allow Duplicates Spacing 0 Inches Limit Lines to Characters Do not display on the map Font Size 12 Aharoni Color Color
In tra	ining, save the map for future use	Algerian Andalus Angsana New Angsana UPC Aparajita Arabic Tyresetting Arabic Tyresetting Arial
		OK Cancel Apply Remove



Scaled Symbol Theme





Scaled Symbol Themes

- Scaled Symbol Themes (*) are often used to:
 - » Display traffic volumes
 - » Display results of a select link or node analysis





Scaled Symbol Themes

Scaled-Symbol Theme (Layer: abmload_byr)
Settings Styles Choose a field U Dua Fields AB_VMT / BA_VMT AB_VHT / BA_VHT AB_FLOW_EA / BA_FLOW_EA AB_FLOW_MD / BA_FLOW_AM AB_FLOW_MD / BA_FLOW_MD AB_FLOW_PM / BA_FLOW_PM AB_FLOW_EV / BA_FLOW_EV AB_PCE_EA / BA_PCE_EA AB_PCE_AM / BA_PCE_AM AB_PCE_MD / BA_PCE_MD Filter
Symbol Sizes ○ Map Wi <u>z</u> ard
Low Value 0 Size 3 High Value 24265 Size 25
OK Cancel Apply <u>R</u> emove

The Settings Tab

Show directional fields only, or all fields

- Select a field to use
- Specify a scale, or let TransCAD specify one automatically



Flow Map Utility



Creating Flow Map

- Make sure your assigned volumes are joined to the network
- Go to Planning –
 Assignment utilities Create flow map
- Select fields corresponding to volume and V/C ratios

Create a Traff	ic Flow Map
Line Laver	Master Network
	✓ Dual Fields
Flow	AB_Flow / BA_Flow
V/C	AB_VOC / BA_VOC 🗸
Max. V/C	1.8 Size of Intervals 0.25
From	to via 💷 🗸
ļ	
	OK Cancel Reset
37	



Importing Shapefiles



Importing Shapefiles

- Open the desired .shp file
- Select "Import layer" checkbox
- Most common option is to merge the overlapping polygons

Esri Shapefile		x
File	C:\Projects\CaltransOnCall\District3\Ti	ОК
Version	1000	Cancel
Extent	(6542268.975627,2232298.94812)-(682175	6.141389,25460
Туре	Polygon	Coordinates
Layer Name	BCAG_TAZ	
	V Import layer	
-Import Options-		
	Eliminate duplicate boundary lines	
	If areas overlap	
	Merge the overlap with one of the	m
	Create a new area	
	Maintain overlapping areas	



Creating Districts



Merging TAZs into Districts

- Use Tools-Geographic Analysis- Merge by Value
- Create Districts layer based on District_ID attribute
- Can compute attributes by adding them, copying them etc.

Merge by Value (Laye	er: BCAG_TAZ)
Merge Settings	
Merge All Fe	eatures (933) 🔹
Based on Distr	ict_ID 👻
Create Layer Distr	ricts
Attributes	
Compute Att	tributes Attributes
	OK Cancel



Calculating VMT by District



Calculating VMT by District

- Open District layer and add a VMT column by using Dataview- Modify Table
- Make the new VMT field "Real"

Field Name	Туре	Width	Deci	Index	Default	Format	Display Name	•	OK
HOTEL_RMS	Integer (4 bytes)	11				None		_	Cancel
UNIV_STU	Integer (4 bytes)	11				None			Add Eigld
CC_STU	Integer (4 bytes)	11				None			
K12_STU	Integer (4 bytes)	11				None		_	Drop Field
PARK_AC	Real (8 bytes)	13	2			None		_	Move Up
CASINO_SLT	Real (8 bytes)	13	2			None		_	Move Dow
CASINO_PRD	Integer (4 bytes)	11				None			
VMT	Real (8 bytes)	10	2			None		_	Attach Code
VHT	Real (8 bytes)	10	2			None		=	Drop Code
HBW_Intrazonal	Real (8 bytes)	10	2			None			Export Code
VMT	Real (8 bytes)	10	2			None		-	
Field Description									Aggregatio
icia o escription								_	



Calculating VMT by District 2

- With Districts as your active layer, use Tools-Geographic Analysis- Overlay
- Under attributes select Add Tot_V_Dist_T

	in pristricts,									
Overlay	All Feature	s (17)				•	- (ОК		
Puffor cizo	0		lilor					Cancel		
Duffer Size	V		incs.				. (Cancer		
With										
Laver	Master Network									
Layer	Muster_Net	L.WOIK	•					Attributes		
Include	All Feature	s (16,!	579)				-			
	Country									
	Count t	ne Ni	umbe	r of Fea	tures					
Overlay Attributes									x	
									aal	
[_								
Field		Сору	Add	Highest	Lowest	Std Dev	Average	Weight by	^	
Max_Time								None		
AB_VOC								None		
BA 140.0										
BA_VOC								None		
BA_VOC Max_VOC								None		
BA_VOC Max_VOC AB_V_Dist_T								None		
BA_VOC Max_VOC AB_V_Dist_T BA_V_Dist_T								None None None		
BA_VOC Max_VOC AB_V_Dist_T BA_V_Dist_T Tot_V_Dist_T			•					None None None None		
BA_VOC Max_VOC AB_V_Dist_T BA_V_Dist_T Tot_V_Dist_T AB_VHT			•					None None None None None	III	
BA_VOC Max_VOC AB_V_Dist_T BA_V_Dist_T Tot_V_Dist_T AB_VHT BA_VHT			•					None None None None None None	III	
BA_VOC Max_VOC AB_V_Dist_T BA_V_Dist_T Tot_V_Dist_T AB_VHT BA_VHT Tot_VHT			•					None None None None None None None	III	
BA_VOC Max_VOC AB_V_Dist_T BA_V_Dist_T Tot_V_Dist_T AB_VHT BA_VHT Tot_VHT Volumes_Daily.A	3_Speed		•					None None None None None None None None	III	
BA_VOC Max_VOC AB_V_Dist_T BA_V_Dist_T Tot_V_Dist_T AB_VHT BA_VHT Tot_VHT Volumes_Daily.A	B Speed		•					None None None None None None None None		
BA_VOC Max_VOC AB_V_Dist_T BA_V_Dist_T Tot_V_Dist_T AB_VHT BA_VHT Tot_VHT Volumes_Daily.A Choose Attribute	9_Speed s:		•					None None None None None None None None		



Desire Lines


- Desire lines can show aggregate flows between areas
- Open TAZ layer
 - » Should have District_ID
- Open PA.mtx trip table
- Aggregate based on TAZ layer to District_ID
- Save as Aggregated matrix



To label with district name instead of ID, create matrix view and label with ATYPE_STR from the district dataview

🏙 Matrix1 -	Aggregated Ma	trix (Sum of 'HB'	W')			
	1	2	3	4	5	6
1	630.37	79.24	0.38	20.07	0.00	0.00
2	248.54	3289.81	0.84	7943.19	9.06	0.04
3	7.34	Matrix Labels				× 10
4	14.87	IVIALITA EGDEIS		and the second s		0
5	2.37		Row/Colum	n Settings		
6	0.24	Dataviou	Districts			- 8
7	0.48	Dataview	Districts			0
8	0.00	ID	ID			- 0
9	175.03	Label With	ATYPE_STR			0
10	0.00					0
11	0.19	Same settir	ng for Rows/(Columns		0
12	2.03					0
13	145.57		OK	Cancel	Clea	r 0
14	0.13		-			
15	0.17	5.05	0.00	11.45	0.00	0.00
16	2.63	27.45	0.02	6.38	0.00	0.00
17	0.04	125.36	0.00	601.74	0.00	0.00



- To create flows from and to Chico, go to Matrix- Contents and add "Chico"
- Then Select the Chico row and click "Fill"
- Add all other matrices and fill only Highlighted cells
- Do the same for Chico column

	Biggs	Butte	Central G	Chico	East Butt	East Chic	East Orov	External	Gridley	North
iggs				754.48						
utte				46696.11						
Central G				19.89						
hico	55.99	18811.57	0.17	249569.31	0.07	29.50	0.03	0.00	116.08	3218
ast Butt				669.36	Construction					×
ast Chic				166.44	Fill Matrix:	Aggregated N	latrix			
ast Orov				800.47	Carde M	Cell by	Coll Commute La			- 11
xternal		-		0.00	Single Vi	side Cell by	Formula	ector Multip	iy	_
iridley				1635.79	Metho	d to Fill Matri	Chico			- 11
lorth Chi	-	-	-	938.71	ο Δd	d matrices	Mu	Itinly matrice		
lorth Par				97.69		a mances	0.00	inply manie	-	
lorth Paradise				2837.38	Su 🔘 Su	btract matrice	s Olv	ide matrices		
Iroville				11495.47						_ 11
aradise				12257.73	Matric	es to Use (Add	lition)			
outh Chi				61.28	Matrix	File	Matrix	Factor		61 U.U.
outh Oro				220.99	Anna	control Mathematic	Curra of ULIDIAN	1		
outh Par				2093.62	Aggre	gated Matrix	Sum of HBVV	1		<u>•</u>
					Aggre	gated Matrix	Sum of 'HBO'	1	6	2
					Aggre	gated Matrix	Sum of 'NHB'	1		
					Aggre	gated Matrix	Sum of 'SCHOO)L' 1		
					Aggre	gated Matrix	Sum of 'CASING	D' 1	-	
					Aggre	gated Matrix	Sum of 'UNIV'	v 1		
					Cells t	o Fill				- 11
						All	Highlighted	O Diac	Ional	
								0 0109	,	
						I reat missir	ng values as zeros			_



- Go to Tools-Geographic Analysis- Desire Lines
- Save as a geographic file
- Display the volumes using Scaled Symbol Theme

Desire I	Line	5				×	
Desir	e Lii	ne Layer					
Nar	Name Aggregated Desire Lines						
Sourc	ce L	ayer					
Nar	me	Districts 👻					
Fre	om	n All Records 👻					
	То	All Records				-	
ID Fi	eld	ID				-	
Matri	x						
F	File Aggregated Matrix						
Desire	Lin	ne Matrices					
Use	M	atrix	Ignore		Value	^	
	Su	m of 'SP2'	None				
	Su	m of 'SP1'	None				
	Su	m of 'IX'	None				
	Su	m of 'XI'	None			=	
	Su	m of 'EE'	None			_	
	Ch	lico	None			-	
Cho	Choose Matrices Select All Deselect All						
				ОК	Car	ncel	







Creating Networks



Creating Networks

- Open a geographic file
- Select centroids based on field TAZ

Select Centroids and Centroid Connectors
Nodes
Field TAZ
Set Centroids
Links
Field Connected to Centroid Nodes 👻
Set Connectors
Option
Hide Centroid Selection Sets
OK Cancel



Creating Networks 2

- Go to Networks/Paths-Create Network
- Use the entire line layer
- Use length field
- Add time field
- For traffic assignment will also need capacity, alpha and beta fields
- Save as network file

Create Network				×
Create From	Entire Line Lave	r (16.579)		-
Length Field	Length			•
Type Field	None			•
Description	Based on 'Mast	er_Network' (Tue May 16 1	0:11:21 2017	7)
l ookup Table				
Table	None			•
Type Field		▼ Desc Field		-
Turn Prohibition	Table			
Table	None			•
Network Fields				
Link Fields No	de Fields			
Link Fields No	de Fields	ite Minutes 👻		
Link Fields No Choose Link F	de Fields ields Time Un	its Minutes 👻		
Link Fields No Choose Link F	de Fields ields Time Un ïield	its Minutes 👻	Defaul	t
Link Fields No Choose Link F Network F Field TIME	de Fields ields Time Un ïield	its Minutes From Link Layer Field [AB_TIME / BA_TIME]	Defaul	lt
Link Fields No Choose Link F Network F	de Fields ields Time Un ïield	its Minutes ▼ From Link Layer Field [AB_TIME / BA_TIME]	Defaul	It
Link Fields No Choose Link F	de Fields Time Un ïield	its Minutes From Link Layer Field [AB_TIME / BA_TIME]	Defaul	lt
Link Fields No Choose Link F Network F TIME	de Fields ields Time Un ield	From Link Layer Field [AB_TIME / BA_TIME]	Defaul	It
Link Fields No Choose Link F Network F	de Fields Time Un ïield	its Minutes From Link Layer Field [AB_TIME / BA_TIME]	Defaul	İt
Link Fields No Choose Link F	de Fields Time Un ïield	From Link Layer Field [AB_TIME / BA_TIME]	Defaul	t
Choose Link F Choose Link F Network F TIME	de Fields Time Un field	its Minutes From Link Layer Field [AB_TIME / BA_TIME]	tions	It
Choose Link F Network F TIME Options V Drop Duplica V Exclude non-	de Fields ields Time Un ield ield ite Links drive links	its Minutes From Link Layer Field [AB_TIME / BA_TIME]	tions	It
Link Fields No Choose Link F Network F TIME TIME	de Fields Time Un Tield te Links drive links	its Minutes From Link Layer Field [AB_TIME / BA_TIME]	tions	t



Shortest Paths



Shortest Paths

- Make sure the network file is open
- Go to Networks/Paths-Shortest Path
- Select the shortest path based on TIME attribute
- Click on any origin and destination nodes to get the shortest path





Highway Skims



Calculating Highway Skims

- Skims are travel time/distances between all pairs of origins and destinations
- Make sure the network file is open
- Go to Networks/Paths-Multiple Paths
- Minimize TIME attribute and build skims from and to Centroids

Input		
Line Layer	Master_Network	OK
Network	C:\P014\Outputs\MyNet2.net	Network
Settings		Skims
Minimize	TIME	Settings
From	Centroids (982) 👻]
То	Centroids (982) 👻]
Via]
Store Resu	lts	



Traffic Assignment



Traffic Assignment

- Need line layer, network and OD matrix
- Open network file and check network attributes to make sure they include free-flow time, capacity, alpha, and beta
- Open OD matrix and check that matrix index corresponds to node ID
- If it does not, it is necessary to add a matrix index based on the nodes layer with TAZ as the original ID and ID as the new ID



Traffic Assignment 2

- Go to Planning-Static Traffic Assignment
- Assign the PM1 trip table to the network
- N-conjugate user equilibrium with 10⁻⁴ relative gap and max 500 iterations

raffic Assignment							
Inputs	Inputs OK						
Line Layer	Master	Master_Network					
Network File	C:\tw	C:\tworks\Roads_Loaded_2014_AM1.net					
Delay Function	Bureau	Bureau of Public Roads (BPR) 🔹					
Method	N Conjugate UE 🗸 🗸			Settings			
Matrix File	Matrix File OD AM						
Matrix	Duicks	um					
IVIDUIX	Quicko	um					
Parameters							
Name		Field		Value			
Time		*_Time		n/a			
Capacity		*_Hourly_Capacity_AMpkhr		n/a			
Alpha		ALPHA		0.15			
Beta		BETA		4			
Preload None 0							
Settings		500	D.L.C. C.		0.0001		
Iterations		500	Relative Gap		0.0001		
N Conjugate		2					



Exercise: Removing a Link

- Select the link you would like to disable using Select by pointing tool
- Go to Network-Settings- Update
- Select Disable Links and choose selection set
- Run assignment with new network



Exercise Continued

- Once the traffic assignment run is complete, open the original PM1 flow table and the new flow table
- Go to Planning Assignment Utilities Assignment
 Difference

Assignment Differ	ence					
Assignment Lay	/er					
Master_Network						
-Assignment Tal	bles and Fields					
Assignment 1	PM1_LinkFlows					
Assignment 2	PM1_Disable_LinkFlows					
ID	ID1 👻					
Flows	Flows [AB_Flow / BA_Flow]					
Colors						
Positive Color	· · · · ·					
Negative Color	· · ·					
Options						
Ignore difference values below						
	Line width factor 1					
	K Cancel Apply					



Exercise Continued



