



Cal-B/C Training Module 8a

Cal-B/C Sketch

Understanding Project Input Sheets and Data

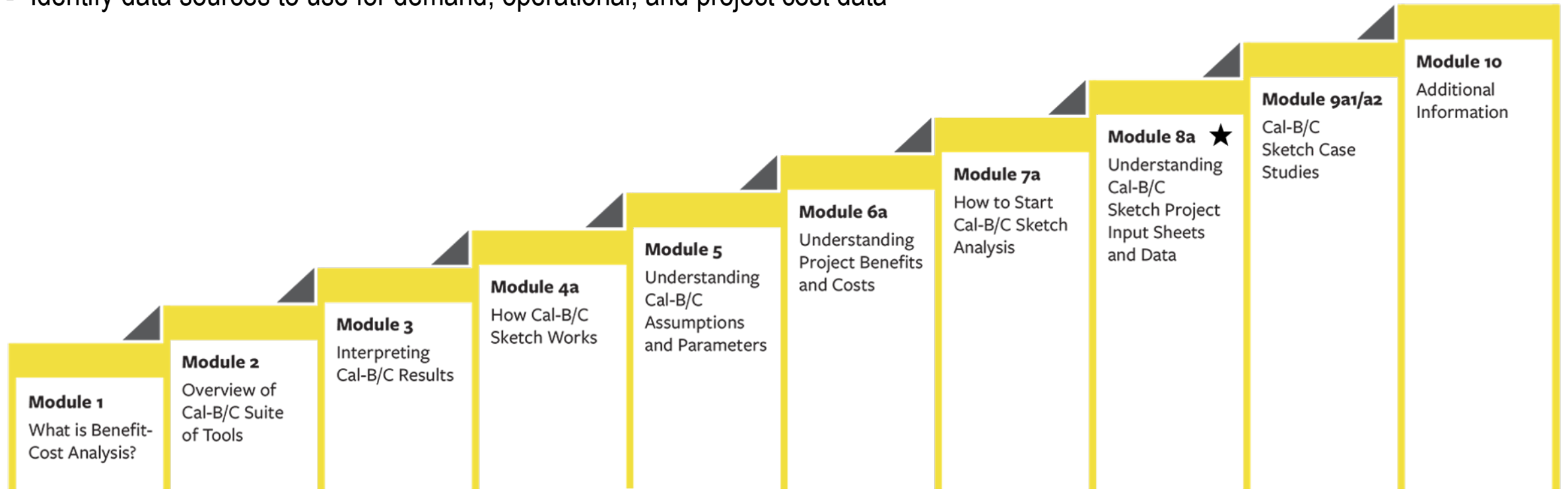


01

About This Module

This module will...

- Builds on Module 4a to provide more details on how to get data for your benefit-cost analysis (BCA) using Cal-B/C Sketch
- Identify data sources to use for demand, operational, and project cost data



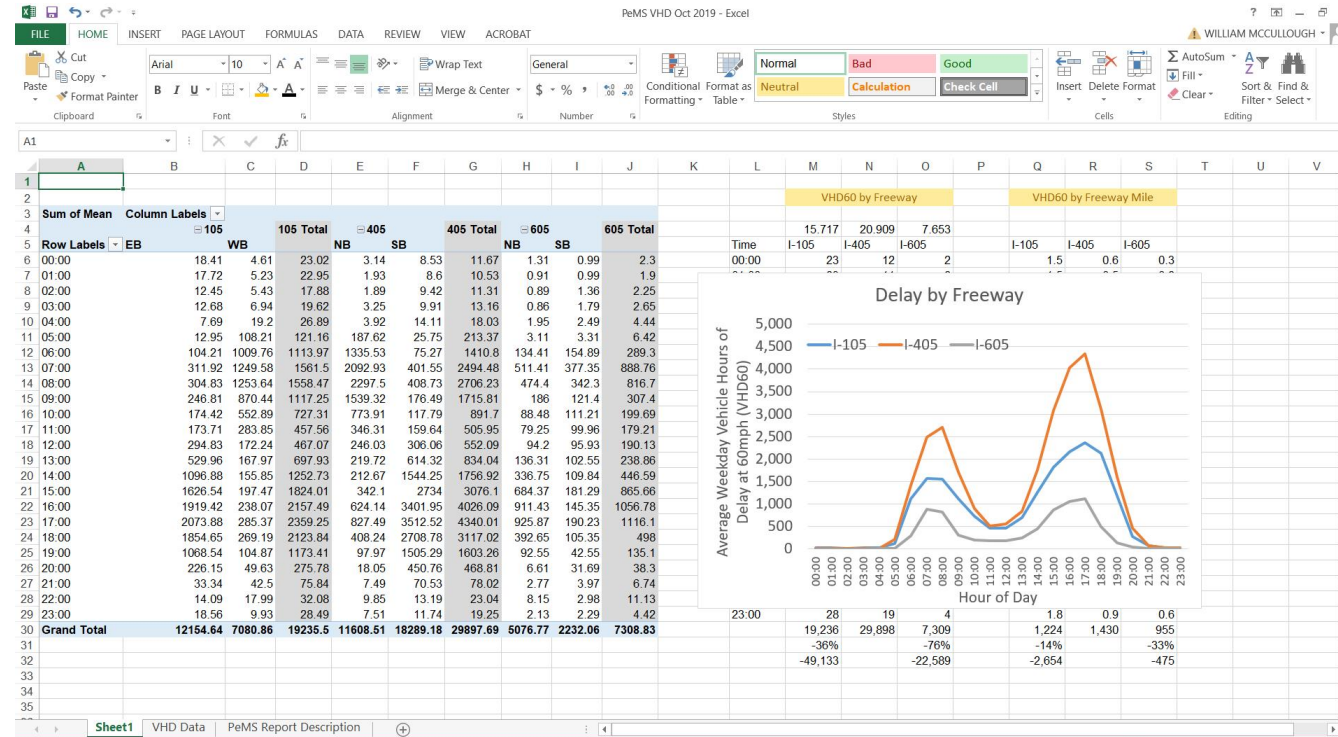
★ *This module is covered in this presentation*

Previous Modules...

- **Module 1** provided a basic introduction on benefit-cost analysis (BCA) and a general overview of how to conduct a BCA
- **Module 2** described the Cal-B/C suite of tools, discussed the types of projects that can be evaluated, and provided guidance on which tools to use for various project types
- **Module 3** presented the Cal-B/C results page, detailed what each output measure means, and explained how they are calculated
- **Module 4a** presented an overview of how Cal-B/C Sketch works including a review of all worksheets and inputs
- **Module 5** highlighted the information in the Parameters worksheet and discussed key assumptions used by Cal-B/C
- **Module 6a** provided detailed information on how Cal-B/C Sketch calculates benefits
- **Module 7a** presented the 1-2-3 approach to starting a Cal-B/C Sketch analysis

Requirements for Making Full Use of This Module

- Basic understanding of traffic engineering and transportation planning methodologies, data and terminology
- Ability to navigate websites and download relevant data
- Knowledge of Microsoft Excel and data analysis features such as pivot tables and charting tools

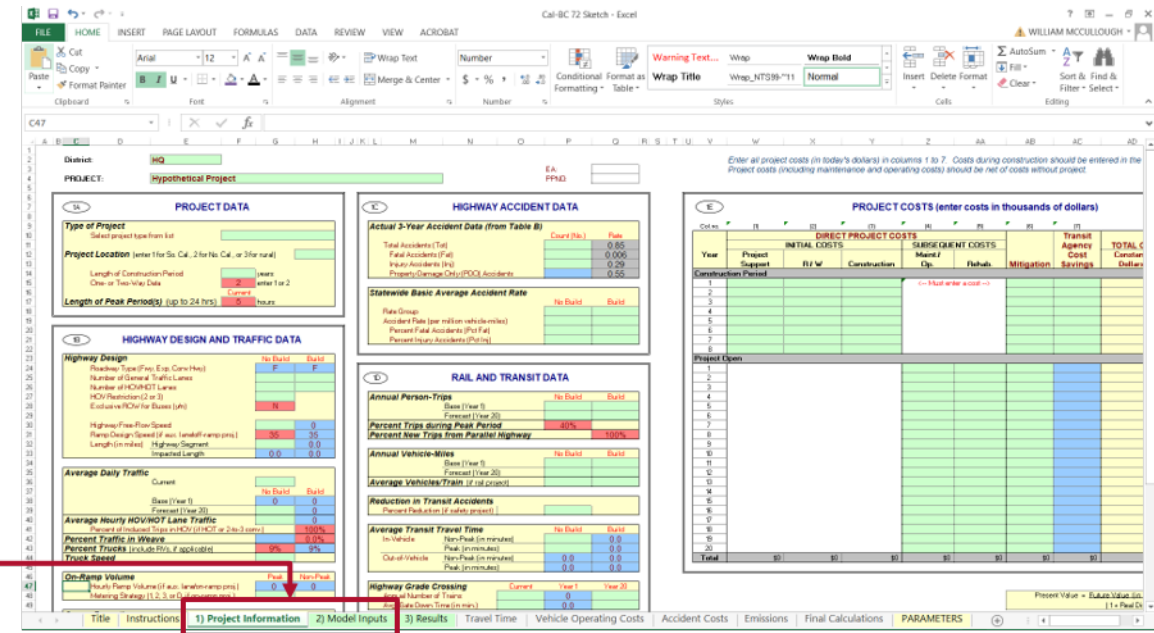


02

Cal-B/C Sketch Data Entry Worksheets Overview

Primary Cal-B/C Data Entry Worksheet

- For most analyses, two worksheets will be need for data entry
- Not all data entry needs will be covered such as:
 - Project specific information: project location, design and geometric data



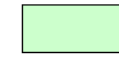
Worksheets where data will be entered

Worksheets where Cal-B/C performs calculations and tabulates results

Title	Instructions	1) Project Information	2) Model Inputs	3) Results	Travel Time	Vehicle Operating Costs	Accident Costs	Emissions	Final Calculations	PARAMETERS
	Summary instructions on how to fill out each data item in Cal-B/C	<ul style="list-style-type: none"> Project Description/ Type of Project Highway Geometric and Traffic Data Highway Collision Data Rail and Transit Data Project Costs 	<ul style="list-style-type: none"> Default calculations for: <ul style="list-style-type: none"> Speeds Volumes Collisions Additional ramp and arterial inputs Person-trip verification for HOV/HOT projects 	<ul style="list-style-type: none"> BCA results Itemized Benefits (\$) Emission Savings (Tons) 	Calculates No Build and Build Person-Hours and Costs by: <ul style="list-style-type: none"> Year Facility Mode 	Calculates Highway No Build and Build Fuel and Non-Fuel Costs by: <ul style="list-style-type: none"> Year Facility 	Calculates No Build and Build Collision Costs by: <ul style="list-style-type: none"> Year Facility Mode 	Calculates No Build and Build Running and Starting Emissions and Costs: <ul style="list-style-type: none"> Year Facility Mode 	Tabulates final results, including: <ul style="list-style-type: none"> Net present value Internal rate of return 	Key default analysis parameters and assumptions for all Cal-B/C tools

Review: Cell Color-Coding

- Cal-B/C Sketch requires few user inputs, but allows you to enter more inputs when data is available
- **Green** cells indicate required data
 - You must input values for Cal-B/C to work for the particular analysis being performed
 - Cal-B/C descriptions tell you what cells need to be used for a given analysis
 - For example, if analyzing a highway project, highway traffic data must be entered in the appropriate green cells
- **Red** cells provide default values that you can change if needed
 - For example, Cal-B/C provides default values for percent trucks and average vehicle occupancy (AVO)
- **Blue** cells contain values calculated by the model for No Build and Build Scenarios
 - You can override the values in these cells if better data is available



- User must enter data for Cal-B/C to work correctly.



- Cal-B/C provides default values that can be overridden by the user if better data is available.



- Cal-B/C calculates cell value, but user can override result if better data is available.

Cal-B/C Data Entry Worksheet – Project Information

- Not all cells require data entry
- Cal-B/C Sketch data item headers indicate if data is required
 - Pavement condition data is required only for pavement projects
 - Percent reduction in transit accidents is needed only for transit safety improvement projects

The screenshot shows a complex spreadsheet interface for entering project data. It is divided into several sections, each with a callout box:

- Section 1A: Project Data:** Includes fields for District (H9), Project Name (Hypothetical Project), Type of Project, Project Location, Length of Construction Period, and Length of Peak Period(s).
- Section 1B: Highway Design and Traffic Data:** Includes Highway Design (Right-of-Way, Number of Lanes, etc.), Average Daily Traffic, Average Hourly HOV/HOT Lane Traffic, Percent Traffic in Weave, Percent Trucks, Truck Speed, On-Ramp Usage, Queue Formation, Pavement Condition, and Average Vehicle Occupancy (AVOC).
- Section 1C: Highway Accident Data:** Includes Highway Accident Data (Properties Damage Only (PDO) Accidents, Statewide Basic Average Accident Rate, etc.) and Rail and Transit Data (Annual Person-Trips, Percent Trips during Peak Period, etc.).
- Section 1D: Rail and Transit Data:** Includes Average Transit Travel Time (In-Vehicle, Out-of-Vehicle).
- Section 1E: Project Costs:** A table for entering project costs in thousands of dollars, categorized by Year, Project Support, R/W, Construction, Maintenance, etc.
- Project Information Worksheet Tab:** A button at the bottom to analyze multiple roads for bypass and intersection projects.

Additional callouts include: "Section 1A: Project Data" (pointing to the top section), "Section 1B: Highway Design and Traffic Data" (pointing to the middle-left section), "Section 1C: Highway Accident Data" (pointing to the middle-right section), "Section 1D: Rail and Transit Data" (pointing to the bottom-middle section), "Section 1E: Project Costs" (pointing to the right section), and "Button to analyze multiple roads for bypass and intersection projects" (pointing to a button at the bottom right).

Cal-B/C Data Entry Worksheet – Model Inputs

- Blue cells are calculated based on inputs from 1) Project Information worksheet
- Green cells are “Changed by User”
- Gray cells are what is used for project evaluation
- This allows user to review detailed information estimated from the model and make adjustments if necessary

The screenshot displays the 'Model Inputs' worksheet with several sections highlighted by callout boxes:

- Section 2A: Highway Speed and Volume Inputs:** This section contains multiple tables for 'Year 1' and 'Year 20' data, including 'Peak Period', 'Mid Day', and 'Night' volumes and speeds. It is divided into 'No Build', 'Build', and 'No Build (Peak Period Only)' scenarios.
- Section 2B: Highway Accident Rates:** This section includes a table for 'Highway Accident Rates' with columns for 'Calculated by Model', 'Classified by User', and 'Used For Proj. Cost'. It also includes a 'May Safety or Warning Improvement?' section.
- Section 2C: Ramp and Arterial Inputs:** This section contains tables for 'Ramp' and 'Arterial' inputs, including 'Average Ramp Volume', 'Average Arterial Volume', 'Average Ramp Speed', and 'Average Arterial Speed'.
- Section 2D: Annual Person-Trips:** This section includes a table for 'Annual Person-Trips' with columns for 'No Build', 'Build', and 'Induced'.
- Project Information Worksheet Tab:** A callout points to the 'Project Information' tab in the worksheet's navigation bar.

The worksheet interface includes a standard Excel grid with columns A through AH and rows 1 through 88. The bottom status bar shows the current tab as 'Model Inputs' and lists other tabs: 'Instructions', '1) Project Information', '3) Results', 'Travel Time', 'Vehicle Operating Costs', 'Accident Costs', 'Emissions', and 'Final C'.

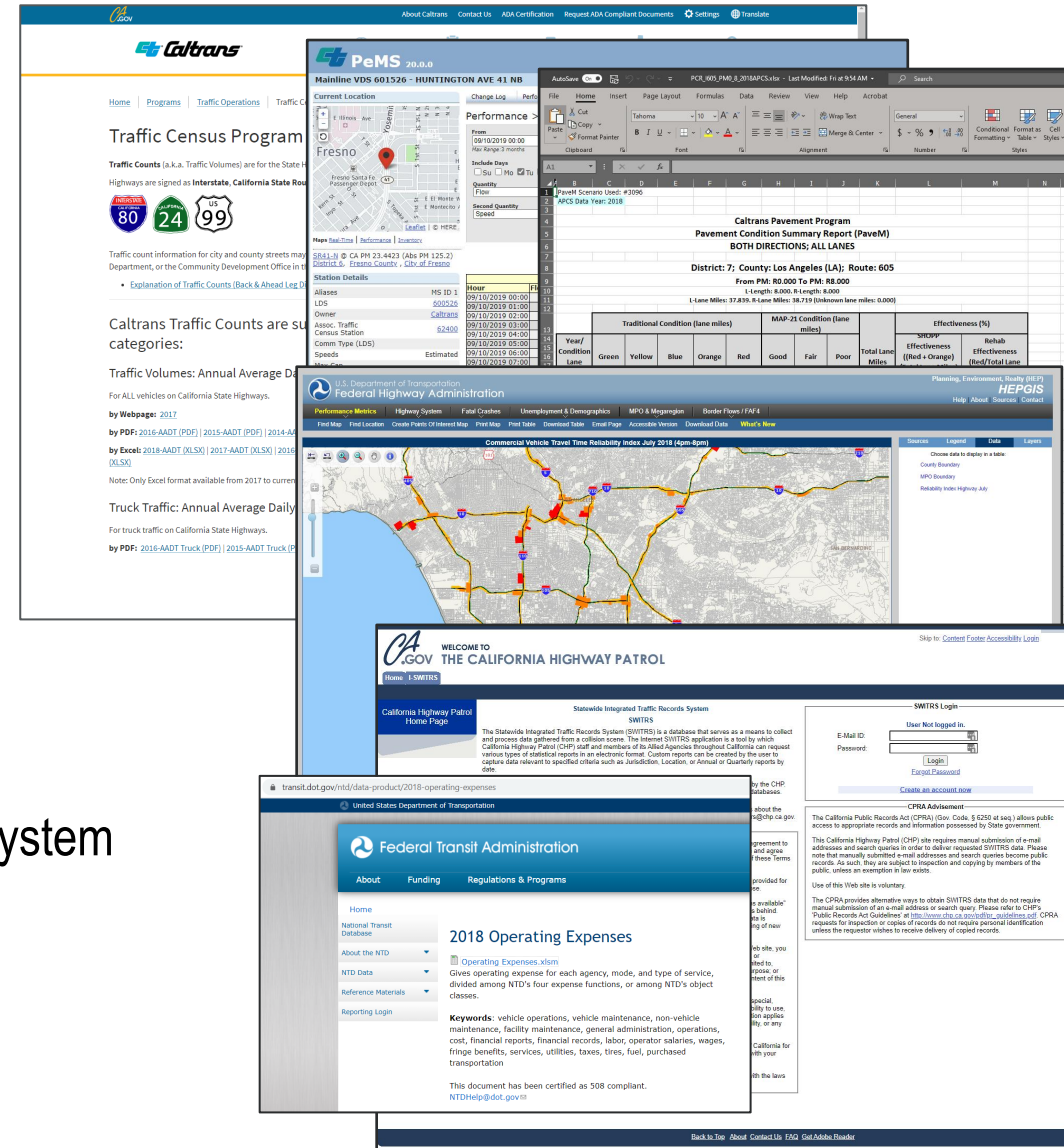
Suggested Data Sources for Evaluations in Cal-B/C Sketch

Traffic and Transit Passenger Demand and Performance Data

- Caltrans Performance Measurement System (PeMS)
- Caltrans Division of Traffic Operations, Traffic Census Program Traffic Volumes
- Caltrans Managed Lane Annual Report
- Federal Highway Administration (FHWA) Performance Measures
- Federal Transit Administration (FTA) National Transit Database
- Other Sources for data (Field data collection, crowd-sourced data)

Traffic Collision and Safety Data

- Caltrans Traffic Accident Surveillance and Analysis System (TASAS)
- California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS)
- Other Sources (e.g., Transportation Research Board publications)



Suggested Data Sources for Evaluations in Cal-B/C Sketch (cont.)

Traffic Pavement Data

- Caltrans Pavement Program, Pavement Condition Report (PCR) Pavem Summary

Project Costing Data

- Project Study Report (PSR) or other Project Initiation Document
- Project Report (PR)
- Regional Transportation Improvement Program (RTIP)
- State Highway Operations and Protection Program (SHOPP)
- FTA Capital cost database



Suggested Data Sources for Cal-B/C Sketch Evaluations by Input Item

Section Title	Data Input Item		To Find, Look at Cell	Suggested Data Sources (for required input cells; or to update Cal-B/C estimates or default values)
1A) Project Data	Type of Project		D10	Depends on proposed project
	Project Location		D12	Depends on proposed project location
	Length of Construction Period		D14	Project Initiation Document (PID)/Project Study Report (PSR)/Project Report (PR) or other source
	One- or Two-Way Data		D15	Caltrans Traffic Census (AADT) or PeMS for two-way data; PeMS for one-way data
	Length of Peak Period(s)		D17	PeMS; Travel time studies
1B) Highway Design And Traffic Data	Highway Design		D24-E33	Depends on proposed project
	Average Daily Traffic (ADT)	Current	E36	Caltrans Traffic Census (AADT), PeMS
		Base (Year 1)	E38	Calculated by Cal-B/C, but user can update if better estimate available.
		Forecast (Year 20)	E39	Value or growth factors provided by modeling/forecasting or other estimation method
	Average Hourly HOV/HOT Lane Traffic		D40	PeMS, Caltrans Managed Lane Annual Report
		Percent of Induced Trips in HOV	D41	Provided by modeling/forecasting or other estimation method
	Percent Traffic in Weave		D42	Calculated by Cal-B/C; Field data collection can be used for refined estimate.
	Percent Trucks		D43	Cal-B/C default value; Caltrans Traffic Census (Truck AADT)
	Truck Speed		D44	FHWA HEPGIS; Field data collection
	On-Ramp Volume	Hourly Ramp Volume	D47	Provided by Cal-B/C using standard design volumes, but can be changed depending on project
		Metering Strategy	D48	Depends on proposed project
	Queue Formation	Arrival and Departure Rates	D51-D52	Calculated by Cal-B/C; Field data collection (if better data available)
	Pavement Condition	IRI (inches/mile)	E55-E56	Caltrans Pavement Program, Pavement Condition Report (PCR) Pavem Summary
Average Vehicle Occupancy (AVO)	General Traffic	E59-E60	Calculated by Cal-B/C; Caltrans Managed Lane Annual Report can provide refined estimates	
	High Occupancy Vehicle (if HOV/HOT lanes)	D61		

Suggested Data Sources for Cal-B/C Sketch Evaluations by Input Item (cont.)

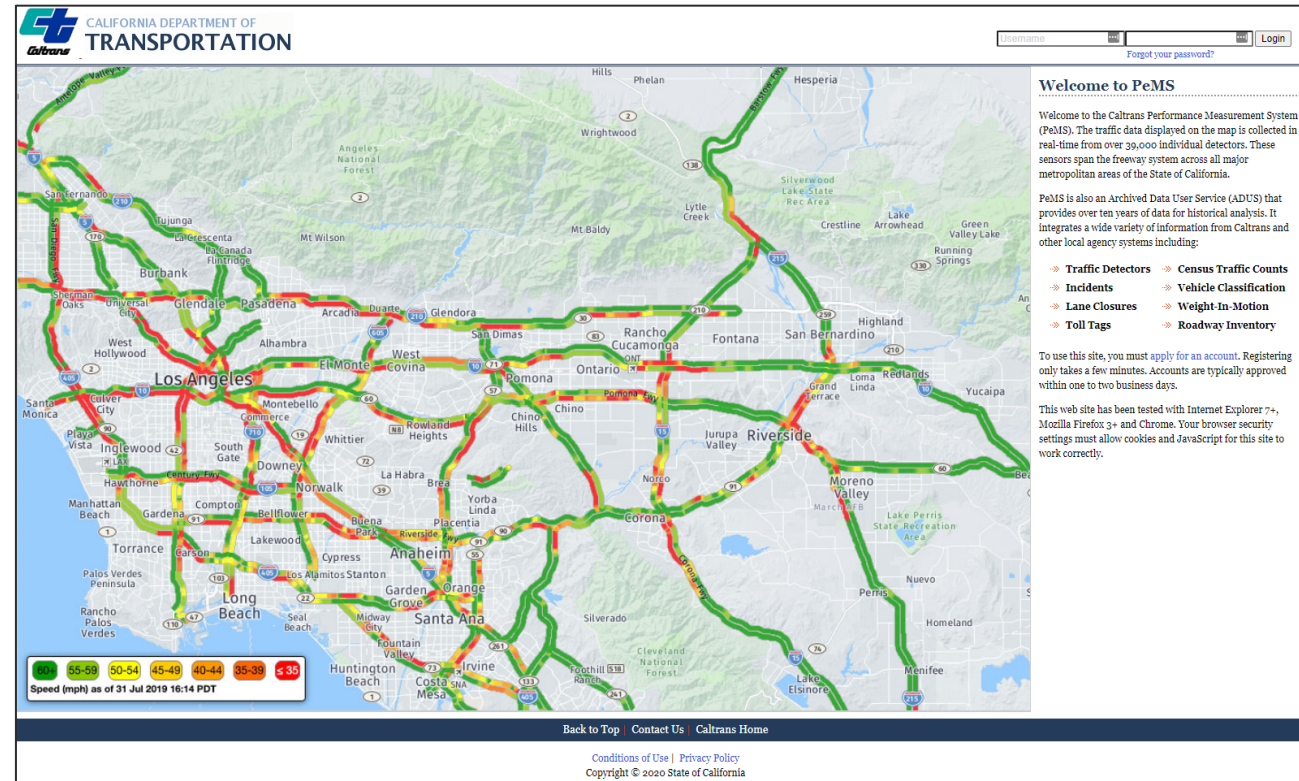
Section Title	Data Input Item		To Find, Look at Cell	Suggested Data Sources (for required input cells; or to update Cal-B/C estimates or default values)
1C) Highway Accident Data	Actual 3-Year Accident Data (from Table B)	Total, Fatal, Injury, PDO	M11-M14	TASAS (Table B)/SWITRS
	Statewide Basic Average Accident Rate	Rate Group	M18	TASAS
		Accident Rate (per million vehicle-miles)	M19	
		Percent Fatal/Injury	M20-M21	
1D) Rail And Transit Data	Annual Person-Trips		N28-N29	Modeling/Forecasting; FTA National Transit Database
	Percent Trips during Peak Period		L30	Calculated by Cal-B/C; FTA National Transit Database
	Percent New Trips from Parallel Highway		L31	Calculated by Cal-B/C; Modeling/Forecasting
	Annual Vehicle-Miles		N34-N35	Modeling/Forecasting; FTA National Transit Database
	Average Vehicles/Train		L36	FTA National Transit Database
	Reduction in Transit Accidents	Percent Reduction (if safety project)	L39	Depends on safety treatment; Online resources
	Average Transit Travel Time	In-Vehicle	N42-N43	Depends on project; FTA National Transit Database for average speeds by modes converted to travel times
		Out-of-Vehicle	N44-N45	Calculated by Cal-B/C; but commonly assumed to be 1/2 the headway
	Highway Grade Crossing	Annual Number of Trains	M48	Depends on proposed project
		Avg. Gate Down Time (in min.)	M49	
	Transit Agency Costs	Annual Capital Expenditure	M52	Depends on proposed project
Annual Ops. And Maintenance Expenditure		M53		
1E) Project Costs	Direct Project Costs	Initial Project Costs (Support, R/W, Const.)	W12-Y12	PS&E, PR, PSR/PAED, RTIP/SHOPP, other planning documents
		Subsequent Costs (O&M, Rehab)	Z24-AA43	
	Other Costs	Mitigation/Transit Agency Cost Savings	AB10-AC10	

03

Traffic and Transit Passenger Demand and Performance Data

Caltrans Performance Measurement System (PeMS)

- Provides real-time and historical performance data in a range of presentation styles and downloadable data sets
- Data available where Vehicle Detection Station (VDS) sensors are located
- Can perform analyses at single VDS locations or along a defined corridor
- Data includes:
 - Volumes (5-minute to annual) and VMT
 - Speeds
 - Performance measures (delay, productivity)
- Data that can be used in Cal-B/C includes:
 - Lengths of Peak Periods (estimated from average hourly speed, flow, or delay data)
 - ADT
 - Average Hourly HOV/HOT Lane Traffic
- Apply for an account at <http://pems.dot.ca.gov/>



PeMS – Single VDS Analysis

- PeMS allows user to analyze and download traffic data at specific VDS locations
- Provides aggregate data for ADT, hourly flows and speeds for a single detector station can be exported
- Allows data to be selected for time series and by time intervals (hour, day, month)
- Able to select specific days of the week to analyze
- Data can be downloaded from the PeMS clearinghouse by Caltrans District

Fall and/or Spring
Non-Holiday, Mid-Week

The screenshot shows the PeMS 20.0.0 interface for station 1001710. The 'Performance > Aggregates > Time Series' section is active. The 'From' date is 09/09/2019 00:00 and the 'To' date is 11/22/2019 23:59. The 'Include Days' filter is set to Tu, We, Th, Fr. The 'Quantity' is set to Flow and the 'Second Quantity' is Speed. The 'EXPORT to XLS' button is highlighted with a red box, and an arrow points to an Excel spreadsheet showing the exported data. Another red box highlights the 'Include Days' filter, and an arrow points to the text 'Fall and/or Spring Non-Holiday, Mid-Week'.

Hour	Flow (Veh/Hour)	Speed (mph)	# Lane Points	% Observed
09:00	585.0	67.5	36	100.0
09:05	670.0	67.4	36	100.0
09:10	1,104.0	70.2	36	100.0
09:15	2,635.0	70.7	36	100.0
09:20	3,435.0	69.4	36	100.0
09:25	3,909.0	66.0	36	100.0
09:30	4,212.0	65.4	36	100.0
09:35	1,240.0	66.7	36	100.0




Caltrans Division of Traffic Operations Traffic Census Program

- Caltrans Traffic Counts are summarized annually into four categories (presented in detail on following slides):
 - Traffic Volumes: Annual Average Daily Traffic (AADT)
 - Truck Traffic: Annual Average Daily Truck Traffic
 - Ramp Volumes
 - Peak Hour Volume Data
- Data that can be used in Cal-B/C includes:
 - Traffic Volumes: Annual Average Daily Traffic (AADT)
 - Average Daily Traffic (ADT)
 - Truck Traffic: Annual Average Daily Truck Traffic
 - Truck Percent of Total Vehicles
 - Ramp Volumes
 - Ramp Average Daily Traffic (ADT)
- <https://dot.ca.gov/programs/traffic-operations/census>

The screenshot shows the Caltrans website's Traffic Census Program page. The header includes the Caltrans logo and navigation links for Travel, Work with Caltrans, Programs, Caltrans Near Me, and Search. The main content area is titled "Traffic Census Program" and includes a description of Traffic Counts, a list of highway shields (Interstate 80, State Route 24, and US Route 99), and a list of related resources. The page also provides links to download traffic count data in various formats (PDF, XLSX) for different years (2013-2017).

Traffic Census Program

Traffic Counts (a.k.a. Traffic Volumes) are for the State Highway System only (in various formats). Highways are signed as **Interstate**, **California State Route**, or **United States Route**. See examples below:

Traffic count information for city and county streets may be found at the city Traffic Engineering or Public Works Department, or the Community Development Office in the area where the street is located.

- [Explanation of Traffic Counts \(Back & Ahead Leg Diagrams\) \(PDF\)](#)

Caltrans Traffic Counts are summarized annually into four categories:

Traffic Volumes: Annual Average Daily Traffic (AADT)

For ALL vehicles on California State Highways.

by **Webpage**: [2017](#)

by **PDF**: [2016-AADT \(PDF\)](#) | [2015-AADT \(PDF\)](#) | [2014-AADT \(PDF\)](#) | [2013-AADT \(PDF\)](#)

by **Excel**: [2018-AADT \(XLSX\)](#) | [2017-AADT \(XLSX\)](#) | [2016-AADT \(XLSX\)](#) | [2015-AADT \(XLSX\)](#) | [2014-AADT \(XLSX\)](#) | [2013-AADT \(XLSX\)](#)

Note: Only Excel format available from 2017 to current year.

Truck Traffic: Annual Average Daily Truck Traffic

For truck traffic on California State Highways.

by **PDF**: [2016-AADT Truck \(PDF\)](#) | [2015-AADT Truck \(PDF\)](#) | [2014-AADT Truck \(PDF\)](#) | [2013-AADT Truck \(PDF\)](#)

Related Resources

- [Traffic Census Homepage](#)
- [Monthly Vehicle Miles of Travel \(MVMT\)](#)
- [Traffic Counts \(Volumes\)](#)
- [Explanation of Traffic Counts \(PDF\)](#)
- [Traffic Volume Trends \(TVT\) FAQ](#)
- [Traffic Data FAQ \(PDF\)](#)

Related Resources

- [Planning Economic Forecasting](#)
- [Highway Performance Monitoring System \(HPMS\)](#)
- [GIS Data Library](#)
- [Mobility Performance Reporting and Analysis Program](#)
- [Performance Measurement System \(PeMS\)](#)
- [Weigh-In-Motion \(WIM\) Data](#)
- [Freight Mobility & Planning](#)
- [Quick Map](#)
- [FHWA Office of Travel Monitoring](#)

Census – Traffic Volumes: Annual Average Daily Traffic (AADT)

- Traffic Volumes for count locations on the California State Highway System
 - Annual Average Daily Traffic (AADT)
 - Peak Month Average Daily Traffic (ADT)
 - Peak Hour
- Locations remain fairly consistent over the years
- Data that can be used in Cal-B/C includes:
 - Ahead/Back AADT

	A	B	C	D	E	F	G	H	I	J	K	L	M	N										
1	DIS	RTE	RCNTY	PM	PM	PM	DESCRIPTION	BACK	PEAK	HOUR	BACK	PEAK	MDT	BACK	AADT	AHEAD	PEAK	HOUR	AHEAD	PEAK	MDT	AHEAD	AADT	
2501	12	055	ORA			1.513	COSTA MESA, EAST 17TH STREET	4450			64000			55700			7000					101000		87800
2502	12	055	ORA			1.820	COSTA MESA, HARBOR BOULEVARD	7000			101000			87800			5700					82000		71700
2503	12	055	ORA			2.021	COSTA MESA, 19TH STREET	5700			82000			71700			6400					100000		94700
2504	12	055	ORA	R		2.772	COSTA MESA, VICTORIA/22ND STREET	6600			104000			98500			10000					140000		133400
2505	12	055	ORA	R		4.022	COSTA MESA, MESA DRIVE	10000			140000			133900			11800					158000		153600
2506	12	055	ORA	R		5.990	JCT. RTE. 405	11800			159000			155000			12400					167000		162300
2507	12	055	ORA	R		6.990	SANTA ANA, MAC ARTHUR BOULEVARD	21600			290000			282000			21500					293000		282000
2508	12	055	ORA	R		7.850	SANTA ANA, DYER ROAD	20700			283000			272500			21900					306000		288600
2509	12	055	ORA	R		9.437	SANTA ANA, EDINGER AVENUE	21900			306000			288600			22500					320000		303900
2510	12	055	ORA	R		9.960	TUSTIN, MC FADDEN STREET	22500			320000			303900			21200					303000		287500
2511	12	055	ORA			10.450	TUSTIN, JCT. RTE. 5	19200			276000			261500			18800					254000		238600
2512	12	055	ORA			10.979	SANTA ANA, FOURTH STREET	18800			255000			239000			20500					277000		259400
2513	12	055	ORA			11.785	TUSTIN, SEVENTEENTH STREET	20500			277000			259400			19900					269000		251500
2514	12	055	ORA			12.967	JCT. RTE. 22 WEST	19900			270000			251700			20900					282000		263700
2515	12	055	ORA			13.700	CHAPMAN AVENUE	20900			282000			263700			18200					247000		231100
2516	12	055	ORA			15.242	ORANGE, KATELLA AVENUE	18200			247000			231100			17200					229000		215100
2517	12	055	ORA			16.981	ORANGE, LINCOLN AVENUE	17200			229000			215100			17300					231000		216000
2518	12	055	ORA	R		17.876	JCT RTE 91	17300			231000			216000										
2519	11	056	SD			0.000	JCT. RTE. 5										4500					59000		57000
2520	11	056	SD			0.309	EL CAMINO REAL	4500			59000			57000			6300					77000		74000
2521	11	056	SD			0.820	CARMEL CREEK ROAD	6300			77000			74000			7500					84000		81000
2522	11	056	SD			1.808	CARMEL COUNTRY ROAD	7500			85000			81000			7000					77000		74000
2523	11	056	SD			3.103	CARMEL VALLEY ROAD	7000			77000			74000			5700					70000		66000

Census – Annual Average Daily Truck Traffic

- Truck Traffic on California State Highways System
- Truck Traffic is classified by number of axles by location
- Locations remain fairly consistent over the years
- Data that can be used in Cal-B/C includes:
 - Truck AADT Total
 - Truck Percent of Total Vehicles

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1					L		VEHICLE	TRUCK	TRUCK		TRUCK	AADT	TOTAL	%	TRUCK	AADT		EAL	YEAR
2				POST	E		AADT	AADT	% TOT		By Axle				By Axle			2-WAY	VER/
3	RTE	DIST	CNTY	MILE	G	DESCRIPTION	TOTAL	TOTAL	VEH	2	3	4	5+	2.00	3.00	4.00	5+	(1000)	EST
509	010	08	RIV	R105.08	B	JCT. RTE. 177 NORTH	27300	9648	35.34	1,232	220	104	8,092	12.77	2.28	1.08	83.87	2,870	15E
510	010	08	RIV	R105.08	A	JCT. RTE. 177 NORTH	26400	9715	36.80	1,256	188	107	8,163	12.93	1.94	1.10	84.02	2,893	15E
511	010	08	RIV	11.333	B	BANNING, SUNSET AVE	135000	19305	14.30	5,023	1,583	888	10,811	31.20	8.20	4.60	56.00	4,185	85V
512	010	08	RIV	R14.76	A	EAST RAMSEY ST	125000	22875	18.30	3,203	1,830	1,373	16,470	14.00	8.00	6.00	72.00	6,115	86V
513	010	08	RIV	R14.76	B	EAST RAMSEY ST	122000	19520	16.00	3,709	1,542	976	13,293	19.00	7.90	5.00	68.10	4,960	86E
514	010	08	RIV	R149.15	A	JCT. RTE. 78 SOUTH	29000	9541	32.90	1,261	212	116	7,951	13.22	2.22	1.22	83.33	2,824	15E
515	010	08	RIV	R149.15	B	JCT. RTE. 78 SOUTH	28000	9660	34.50	1,165	196	147	8,153	12.06	2.03	1.52	84.40	2,893	15E
516	010	08	RIV	R154.16	A	JCT. RTE. 95 NORTH	30000	10845	36.15	1,471	243	137	8,995	13.56	2.24	1.26	82.94	3,197	04E
517	010	08	RIV	R154.16	B	JCT. RTE. 95 NORTH	29000	10275	35.43	1,358	228	125	8,562	13.22	2.22	1.22	83.33	3,041	04E
518	010	08	RIV	R156.49	B	ARIZONA STATE LINE	30000	10824	36.08	1,468	242	136	8,977	13.56	2.24	1.26	82.94	3,297	04E

Census – Ramp Volumes

- Ramp Volumes on California State Highways System
- Ramp ADT for location over ten-year period
- No seasonal or daily adjustment is made
- Ramps are not counted every year, but generally every three years
- Ramps without an ADT in the last ten years will not be published.
- Locations remain fairly consistent over the years
- Data that can be used in Cal-B/C Sketch includes:
 - Ramp ADT (ADT_YEAR)

1	YR	D_C_R	PP	POSTMILEPS	DESCRIPTION	ADT_2009	ADT_2010	ADT_2011	ADT_2012	ADT_2013	ADT_2014	ADT_2017	ADT_2018	CREATE_DATE
242	2018	11-SD-005 R		39.606	SB ON FROM BIRMINGHAM DRIVE			5,800		5,400	5,500	5,700		04/24/2019
243	2018	11-SD-005 R		39.656	NB OFF TO BIRMGHAM DRIVE					4,350	4,750			04/24/2019
244	2018	11-SD-005 R		39.959	NB ON FROM BIRMINGHAM DRIVE					5,100	5,300	5,400		04/24/2019
245	2018	11-SD-005 R		39.987	SB OFF TO BIRMINGHAM DR.			3,750		4,000	4,500	4,150		04/24/2019
246	2018	11-SD-005 R		40.439	NB OFF TO SANTA FE DRIVE			5,400		5,000		5,100		04/24/2019
247	2018	11-SD-005 R		40.448	SB ON FROM SANTA FE DRIVE			5,500		5,200	5,000	5,100		04/24/2019
248	2018	11-SD-005 R		40.745	NB ON FROM SANTA FE DRIVE			7,600		8,200	6,500	6,700		04/24/2019
249	2018	11-SD-005 R		40.782	SB OFF TO SANTA FE DRIVE			4,600		4,950	5,000	5,100		04/24/2019
250	2018	11-SD-005 R		41.330	NB OFF TO ENCINITAS BLV			8,000		8,300		9,000		04/24/2019
251	2018	11-SD-005 R		41.376	SB ON FRM ENCINITAS BLV			7,700		7,900		8,700		04/24/2019
252	2018	11-SD-005 R		41.663	NB ON FROM ENCINITAS BLVD.					8,500	8,500	8,700		04/24/2019
253	2018	11-SD-005 R		41.739	SB OFF TO ENCINITAS BLVD			7,800		7,500	7,600	8,100		04/24/2019
254	2018	11-SD-005 R		42.542	NB OFF TO LEUCADIA BLVD.			7,300		7,600	8,600	7,800		04/24/2019
255	2018	11-SD-005 R		42.591	SB ON FRM LEUCADIA BLVD.			9,400		9,700	10,500	10,700		04/24/2019
256	2018	11-SD-005 R		42.838	NB ON FRM LEUCADIA BLVD.			7,200		6,900	7,300	6,900		04/24/2019
257	2018	11-SD-005 R		42.865	SB OFF TO LEUCADIA BLVD			6,500		6,300	6,800	6,200		04/24/2019
258	2018	11-SD-005 R		43.885	SB ON FRM LA COSTA AVE			9,100		9,300	10,000	9,800		04/24/2019
259	2018	11-SD-005 R		43.911	NB OFF TO LA COSTA AVE			9,200		9,500	10,300	9,900		04/24/2019
260	2018	11-SD-005 R		44.210	NB ON FRM LA COSTA AVE			7,500		7,300	7,300	8,100		04/24/2019
261	2018	11-SD-005 R		44.290	SB OFF TO LA COSTA AVE			7,300		7,100	7,300	7,800		04/24/2019
262	2018	11-SD-005 R		45.409	SB ON FROM POINSETTIA LN.			7,900		8,100	8,200	8,300		04/24/2019
263	2018	11-SD-005 R		45.410	NB OFF TO POINSETTIA LANE			8,500		8,700	9,100	9,500		04/24/2019
264	2018	11-SD-005 R		45.724	NB ON FROM POINSETTIA LN.			6,400		6,200	5,900	6,500		04/24/2019
265	2018	11-SD-005 R		45.754	SB OFF TO POINSETTIA LANE			6,200		6,000	5,700	6,700		04/24/2019
266	2018	11-SD-005 R		46.826	NB OFF TO PALOMAR AIRPRT			13,800		14,300	14,100	13,400		04/24/2019
267	2018	11-SD-005 R		46.889	SB ON FRM EB PALOMAR AIRPRT					2,300	2,450	2,250		04/24/2019

Caltrans Managed Lane Annual Report

- Caltrans district offices prepare annual reports with statistics on managed facilities
 - Covers express lanes and high occupancy vehicle (HOV) lanes
- Provides vehicle classification and occupancy counts during peak travel periods for managed lanes and adjacent general purpose lanes
- Data that can be used in Cal-B/C Sketch includes:
 - Managed lane peak period and peak hour volumes
 - Average vehicle occupancy (AVO) statistics for managed lane and adjacent general purpose lane

2016 MANAGED LANE ANNUAL REPORT



www.dot.ca.gov/dist07



District 7
Los Angeles and Ventura Counties

Division of Traffic Operations
Office of System Performance
Managed Lanes Branch

May 2017

CALTRANS - DISTRICT 7 HOV Lane Operation on Route 134

Co. Rte. Dir.	LA 134 WB		LA 134 EB	
	JACKSON	JACKSON	JACKSON	JACKSON
Post Mile	7.41		7.41	
Date	11/02/16		11/02/16	
Occupancy Requirement	2 +		2 +	
	AM HOV Peak 1-Hour 7:30 - 8:30	AM HOV Peak 2-Hour 6:30-8:30	PM HOV Peak 1-Hour 15:45 - 18:45	PM HOV Peak 2-Hour 16:00-18:00
High Occupancy Vehicle (HOV) Lane Vehicle Summary				
Carpools (Vehicles with 2-5 occupants only)	1051	1931	972	1769
Vanpools	13	28	7	32
Buses	3	3	5	4
Motorcycles (MC's)	23	58	29	53
Single Occupant Vehicles	7	11	94	144
White Decal Vehicles (Electric Veh. & Compressed Natural Gas)	80	128	35	86
Green Decal Vehicles (plug-in Hybrids)	86	140	29	80
Total Vehicles in HOV Lane	1263	2297	1171	2168
2 person carpool volume in HOV lane (vehicles)	959	1765	892	1638
2 or more (2+) person carpool volume in HOV Lane (veh.)*	1064	1959	979	1801
3 person carpool volume in HOV lane (vehicles)	85	155	65	108
3 or more (3+) person carpool volume in HOV Lane (veh.)*	105	194	87	163
HOV Lane People Summary				
People in Carpools (Vehicles with 2-5 occupants only)	2203	4041	2048	3702
People in Vanpools	78	168	42	192
People in Buses	70	70	110	100
People in CNG/EV/Plug-in Hybrid, Single Occ. Veh. and MC's	196	335	187	363
Total HOV Lane People	2547	4614	2385	4357
General Purpose (GP) Lane Summary†				
Number of General Purpose Lanes	4	4	4	4
General Purpose Lane Vehicles**	7800	15241	6841	13819
General Purpose Vehicles per Lane**	1950	3810	1710	3405
General Purpose Lane People**	8384	16334	7548	15035
General Purpose People per Lane**	2096	4083	1887	3759
Freeway Summary				
Total Freeway Vehicles	9063	17538	8012	15787
Total Freeway People	10931	20948	9933	19392
Percent of Total Freeway Vehicles in HOV Lane	13.94%	13.10%	14.62%	13.73%
Percent of Total Freeway Vehicles per General Purpose Lane	21.52%	21.73%	21.35%	21.57%
Percent of Total Freeway People in HOV Lane	23.30%	22.03%	24.01%	22.47%
Percent of Total Freeway People per General Purpose Lane	19.17%	19.49%	19.00%	19.38%
GP Lane Carpool Summary†				
2+ Carpool volume in GP Lanes (vehicles)*	480	913	490	1044
2+ Percent Carpools in GP Lanes	6.15%	5.99%	7.16%	7.66%
3+ Carpool Volume in GP Lanes (vehicles)*	35	73	55	99
3+ Percent Carpools in GP Lanes	0.45%	0.48%	0.80%	0.73%
Average Occupancy				
HOV Lane Average Occupancy (people)	2.02	2.01	2.04	2.01
General Purpose Lane Average Occupancy (people)	1.07	1.07	1.10	1.10
HOV Lane Violation				
HOV Lane Violation (percentage)	0.55%	0.48%	0.03%	6.64%
Equivalent Number of GP Lanes				
Equivalent number of GP Lanes needed to carry HOV people	1.22	1.13	1.26	1.16

Peak 1-hour & peak 2-hour totals are based on the highest volume during the following peak period counts: 6:30-8:30 & 15:30-18:00.
 †The peak hour of the general purpose lane may vary from the peak hour of the HOV lane.
 * Carpools and vanpools only.
 ** Single occupant vehicles, carpools, vanpools, buses, motorcycles, CNG/EV/Plug-in Hybrids and trucks.

Federal Highway Administration (FHWA) – Truck Speeds

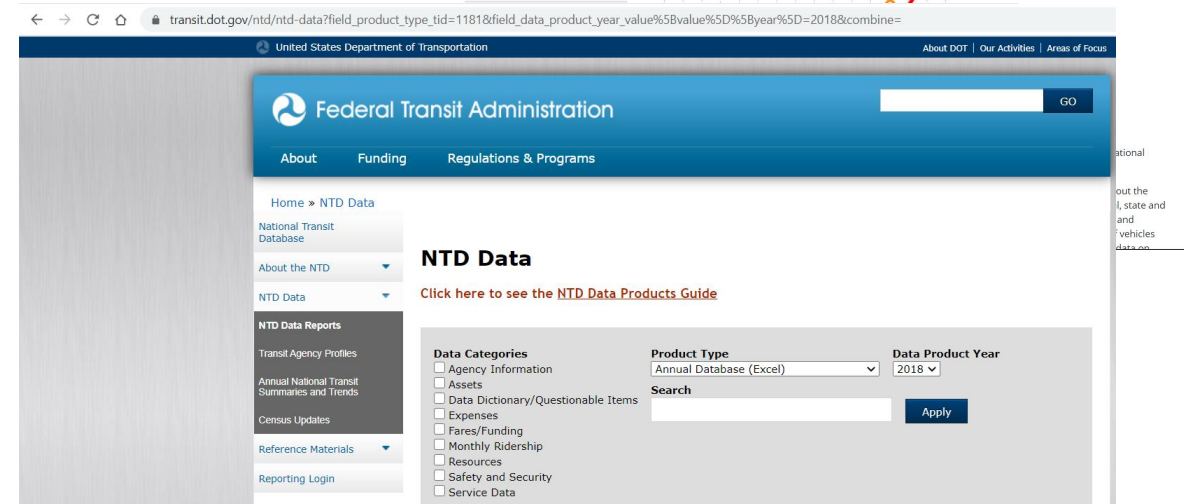
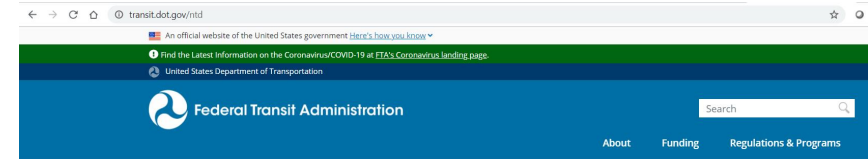
- Planning, Environment, Realty (HEPGIS) website map server allows users to navigate, view, and print maps and tabular performance measure data
- National Performance Management Research Data Set: has average travel times for trucks on the National Highway System
- Monthly Travel Time Reliability Index Layer can be used to calculate Truck Speeds by Traffic Message Channel (TMC) segment:
 - Length (TMC segment in miles)
 - Truck Weekday [time period] Avg (TMC Average Travel Time in Seconds)
 - Speed (mph) = Length / (Truck Weekday [time period] Avg/3600)
- <https://hepgis.fhwa.dot.gov/>

The screenshot displays the HEPGIS interface for the 'Commercial Vehicle Travel Time Reliability Index July 2018 (4pm-8pm)'. The map shows various highway segments in the San Bernardino region, with a data table overlaid at the bottom. The table has columns for Length, TMC, and various time period averages. Below the map, an Excel spreadsheet is open, showing the same data in a tabular format.

LENGTH	TMC	Truck Weekday 6 to 10am Avg	Truck Weekday 10am to 4pm Avg	Truck Weekday 4pm to 8pm Avg	Truck Weekend 6am to 9pm Avg	Truck Overnight 8pm to 5am Avg
4674		0.00	0.00	0.00	0.00	0.00
4128		36.82	36.46	42.38		37.50
4128		33.51			38.78	40.48
4128		39.62	40.74		40.79	40.67
4674		42.88	42.54		40.60	44.01
4128		44.01	43.32	44.06	38.26	42.94
4127		46.53	49.43		23.37	25.21
4127		26.34	25.81	25.44	67.07	69.93
4127		41.83	45.70	29.68	35.04	38.44
4127		243.11	235.83	237.79	224.53	228.11
4126		269.10	270.93	216.33	246.56	247.60
4126		54.89	54.00	55.85	51.86	54.52
4126		47.16	42.80	40.50	40.11	43.76
4125		91.91	73.35	67.07	69.93	81.04
4126		70.65	70.83	76.97	67.32	69.94
4872						
4872						
4125		52.27	40.66	42.69	38.43	40.10
4125		41.30	41.09	45.55	40.42	40.59

FTA National Transit Database (NTD)

- NTD data products include:
 - Detailed transit capital and operational data and measures
 - Time series data on transit systems dating back to 1991
 - Time series of monthly ridership data
- NTD data can be used to supplement Cal-B/C transit evaluations:
 - Ridership trends and ridership per unit of service provided to help estimate potential ridership
 - Estimate transit in-vehicle speeds and trip lengths for similar systems (Vehicle Service Miles/Average Speed)
 - Estimate cars per train based on other systems (Vehicle Service Miles/Train Service Miles)

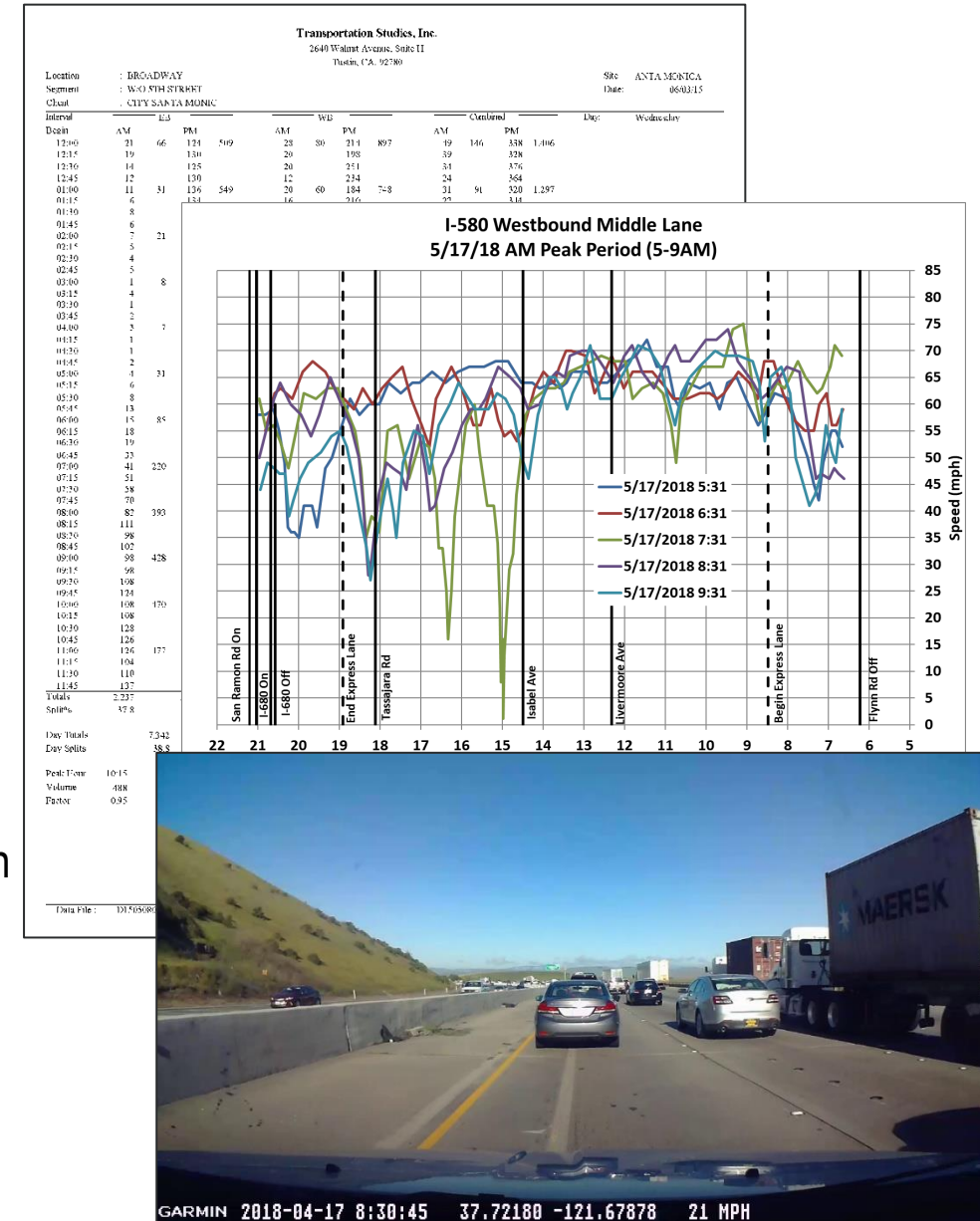


Agency	City	Mode	Type of Service	VOMS	Max Trains in Operati	Average Speed (mi/hr)	Average Passenger Trip Length (mi)	Passengers per Hour	Vehicle Revenue Miles	Vehicle Revenue Hours	Train Revenue Miles	Train Revenue Hours	Unlinked Passenger Trips	Passenger Miles	Directional Route Miles
11 New Jersey Transit Corporation	Newark	LR	PT	42	20	16.49	3.85	122.81	2,084,803	126,422	1,239,042	73,848	15,526,126	59,777,983	34.1
14 New Jersey Transit Corporation	Newark	LR	DO	14	14	10.02	2.33	108.06	503,616	50,262	503,616	50,262	5,431,405	12,633,883	12.4
17 Los Angeles County Metropolitan Trans	Los Angeles	LR	DO	196	74	20.78	7.46	76.64	17,999,250	866,272	7,233,941	339,891	66,387,207	495,011,734	171.9
36 Metropolitan Transit Authority of Harris C	Houston	LR	DO	54	33	11.78	2.83	63.24	3,535,806	300,133	2,173,944	199,878	18,980,255	53,624,968	43.6
49 Massachusetts Bay Transportation Auth	Boston	LR	DO	151	86	8.48	2.50	80.41	5,986,849	706,032	3,094,405	357,618	56,768,835	141,734,607	51.0
65 Maryland Transit Administration	Baltimore	LR	DO	38	18	19.76	6.04	49.03	2,988,892	151,280	1,620,946	84,045	7,416,504	44,778,153	57.6
85 Denver Regional Transportation District	Denver	LR	DO	163	56	16.33	7.12	35.16	11,758,421	720,150	4,412,895	272,969	25,322,058	180,411,468	115.2
102 Utah Transit Authority	Salt Lake City	LR	DO	92	30	18.37	4.98	49.41	6,655,535	362,257	2,932,154	164,865	17,899,716	89,112,550	93.9
112 Dallas Area Rapid Transit	Dallas	LR	DO	109	51	22.33	8.05	62.99	10,236,821	458,345	5,568,402	249,897	28,873,235	232,288,823	182.4
122 City and County of San Francisco, dba:	San Francisco	LR	DO	146	126	9.57	2.74	89.54	5,324,769	556,545	3,691,470	382,942	49,833,591	136,717,088	64.4
132 Tri-County Metropolitan Transportation D	Portland	LR	DO	116	58	14.27	5.40	62.16	8,932,446	626,091	4,486,727	314,378	38,919,828	210,180,550	118.9
136 Port Authority of Allegheny County	Pittsburgh	LR	DO	58	29	12.82	3.95	44.94	2,184,781	170,363	1,491,379	114,507	7,656,539	30,261,649	49.6
137 Metro Transit	Minneapolis	LR	DO	76	23	12.54	4.02	58.64	5,336,357	425,583	1,934,151	146,891	24,955,617	100,276,941	44.3
160 San Diego Metropolitan Transit System	San Diego	LR	DO	97	33	18.10	5.79	77.37	8,656,486	478,175	3,109,789	172,358	36,995,201	214,376,455	108.4
181 Santa Clara Valley Transportation Autho	San Jose	LR	DO	61	29	15.03	5.52	38.57	3,314,903	220,589	2,091,151	142,376	8,507,096	46,981,059	81.0
206 Bi-State Development Agency of the Mis	St. Louis	LR	DO	58	29	23.46	6.86	51.18	6,210,574	264,761	3,105,288	132,380	13,550,443	92,945,521	91.1
210 The Greater Cleveland Regional Transit /	Cleveland	LR	DO	13	11	13.93	5.85	33.43	682,556	48,997	678,568	48,997	1,638,170	9,580,135	30.4
230 City of Charlotte North Carolina, dba: Ch	Charlotte	LR	DO	21	18	15.84	5.15	64.55	1,420,469	89,679	714,968	45,123	5,788,961	29,838,989	37.3
240 Transportation District Commission of H	Hampton	LR	DO	6	6	13.11	3.48	47.93	387,609	29,571	387,609	29,571	1,417,350	4,932,543	14.8
245 Central Puget Sound Regional Transit A	Seattle	LR	DO	54	19	20.54	6.59	92.56	5,429,764	264,385	1,979,508	96,212	24,470,264	161,293,358	40.4
253 Niagara Frontier Transportation Authority	Buffalo	LR	DO	23	7	11.21	2.68	54.65	926,900	82,671	354,059	31,578	4,518,285	12,128,749	12.4
399 Sacramento Regional Transit District	Sacramento	LR	DO	69	18	17.77	6.32	41.72	4,418,237	248,656	1,649,800	94,670	10,372,688	65,530,788	84.9
1173 Valley Metro Rail, Inc.	Phoenix	LR	PT	38	18	15.13	7.17	72.45	3,297,498	217,912	1,567,840	103,590	15,786,911	113,208,491	50.8

<https://www.transit.dot.gov/ntd>

Field Data Collection

- Field data collection can be used where other automatically collected data may not be available or have sufficient quality
- Travel Time Studies (Probe / Floating Vehicles)
 - Uses cars equipped with Global Positioning System (GPS) devices that drive at regularly spaced intervals along the study corridor
 - Results include direction of travel, travel times, and speeds along a corridor and can indicate where queuing occurs
- Vehicle Classification and Occupancy Counts
 - Conducted using field observations at key locations, typically over a 2-3 midweek period in spring or fall of year
 - Vehicles classified (e.g. SOV, High Occupancy Vehicle 2 people (HOV2), HOV with 3 or more persons (HOV3+), buses, motorcycles, trucks, etc.)
- ADT counts
 - Hourly and daily volumes where no current data is available
 - Typically collected over continuous 2 to 3 midweek days during the fall or spring
 - Hourly volumes can help identify the number of hours in the peak period



04

Traffic Collision Data

Traffic Accident Surveillance and Analysis System (TASAS) – Transportation Systems Network (TSN) Reports

- Highway inventory database which contains the current and historical collisions on the SHS
- This is the preferred source for SHS accidents for projects
- Data/Reports only accessible through Caltrans Staff
- Data that can be used in Cal-B/C includes:
 - Total Accidents (Tot)
 - Fatal Accidents (Fat)
 - Injury Accidents (Inj)
 - Property Damage Only (PDO) Accidents (Tot – (Fat+Inj))
 - Accident Rate (per million vehicle-miles)
 - Percent Fatal Accidents (Pct Fat)
- <https://dot.ca.gov/programs/research-innovation-system-information/office-of-highway-system-information-performance>

The screenshot shows the Caltrans website interface for the Traffic Accident Surveillance and Analysis System (TASAS). It includes navigation links like 'About Caltrans', 'Contact Us', and 'Request ADA Compliant Documents'. The main content area provides information about the TASAS Branch, its role in maintaining the highway inventory database, and lists various reports available, such as Highway Sequence Listing, Annual Collision Data on California State Highways, Place Name Publication, and Name Freeway Publication.

Below the text is a table titled 'Table B - Selective Accident Rate Calculation' from the California Department of Transportation. The table includes columns for 'Location Description', 'Rate Group (RUS)', 'No. of Accidents / Significance' (with sub-columns for Tot, Fat, Inj, F+I, Veh, Wet, Dark), 'Pers KD Inj', 'ADT Main X-St', 'Total MV+ or MVM', and 'Accident Rates' (with sub-columns for Actual Fat, Actual F+I, Average Fat, Average F+I, and Tot). Several cells in the table are highlighted with red boxes, including the 'Total' column for the second row (1.09) and the 'Actual' and 'Average' columns for the same row.

Location Description	Rate Group (RUS)	No. of Accidents / Significance							Pers KD Inj	ADT Main X-St	Total MV+ or MVM	Accident Rates					
		Tot	Fat	Inj	F+I	Veh	Wet	Dark				Actual Fat	Actual F+I	Average Fat	Average F+I	Tot	
	8,293 MI H U	627	5	243	248	488	64	221	5	131.2	794.27	0.006	.31	.79	0.003	.24	.77
	43,789 MI H NA	10598	31	2854	2885	9474	465	3609	34	226.8	7249.88	0.004	.40	1.46	0.004	.34	1.09
	16,763 MI H NA	13269	24	3676	3700	11844	654	4626	25	237.3	8100.70	0.003	.46	1.64	0.004	.34	1.08
	11,506 MI H NA	1475	3	394	397	1255	76	478	3	177.1	1487.53	0.002	.27	.99	0.004	.27	.85

Statewide Integrated Traffic Records System (SWITRS)

- Database that collects and processes detailed data gathered from a collision scene by CHP and local law enforcement
- Account required to access detailed reports and data
- California accident data by locations, dates and collision types
- Used for collision data off the State Highway System (SHS) – TASAS should be used for SHS projects
- Downloadable but requires extensive data manipulation
- Data that can be used in Cal-B/C includes:
 - Total Accidents (Tot)
 - Fatal Accidents (Fat)
 - Injury Accidents (Inj)
 - Property Damage Only (PDO) Accidents
- <https://iswitrs.chp.ca.gov/Reports/jsp/index.jsp>

The image displays two screenshots. The top screenshot shows the SWITRS website interface, including the California Highway Patrol logo, a search bar, and a login section. The bottom screenshot shows an Excel spreadsheet with a table of traffic collision data. The table has columns for Case ID, Accident Date, Jurisdiction, Collision Date, Collision Time, Officer ID, Reporting District, Day of Week, CHP Shift, Population, and City. A pivot table is also visible, summarizing the data by reporting district and year.

CASE_ID	ACCIDENT PROC DA	JURIS	COLLISION_DATE	COLLISION_TIME	OFFICER_I	REPORTING_DISTRICT	DAY_OF_WEEK	CHP_SHIF	POPULATI	CNTY	CITY	LO
6980428	2015	20151112	1941	20150621	1247	10658		7	5	7		194
8371443	2017	20170609	1941	20170506	2500	10861						
8068295	2016	20160621	1941	20160610	500	6311						
8347200	2017	20170417	1941	20170405	333	10911						
8064659	2016	20160624	1941	20160603	556	10805						
8513141	2017	20180119	1931	20171213	837	5304						
6244413	2013	20140421	1941	20131007	1748	6287						
8422238	2017	20170803	1941	20170721	520	11007						
8151848	2016	20161026	1941	20161009	1244	10042						
8041984	2016	20160527	1909	20160514	1245	560						
8486588	2017	20180109	1931	20171011	912	5304						
8440707	2017	20170911	1931	20170817	1631	5304						
8399963	2017	20170705	1907	20170619	1015	238						
6941724	2015	20151019	1941	20150525	2254	10545						
6446622	2014	20150305	1941	20140407	503	6287						
8283016	2016	20170125	1941	20161227	2140	6042						
8085729	2016	20160727	1948	20160626	235	450						
6693006	2014	20141202	1973	20140924	1900	607						

Count of CASE_ID	2013	2014	2015	2016	2017
Atlantic_Primary		1		4	1
Atlantic_Secondary					1
Cherry/Garfield/Eastern_Primary		5	1		3
Cherry/Garfield/Eastern_Secondary					2
Fwy_At_Atlantic			1		1
Fwy_At_Cherry/Garfield/Eastern		1	1		
Fwy_At_Eastern (West)			1		1
Not a 710 ICM Arterial		1	3	2	3
(blank)		63	70	78	71
Grand Total		72	76	84	80

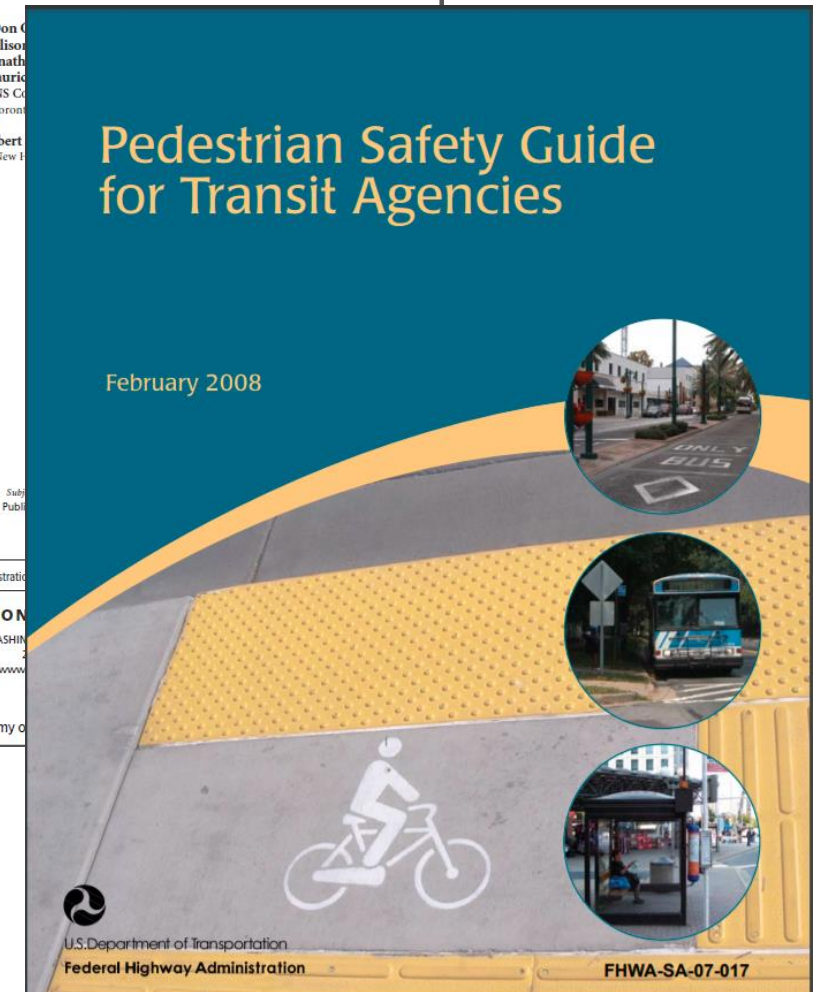
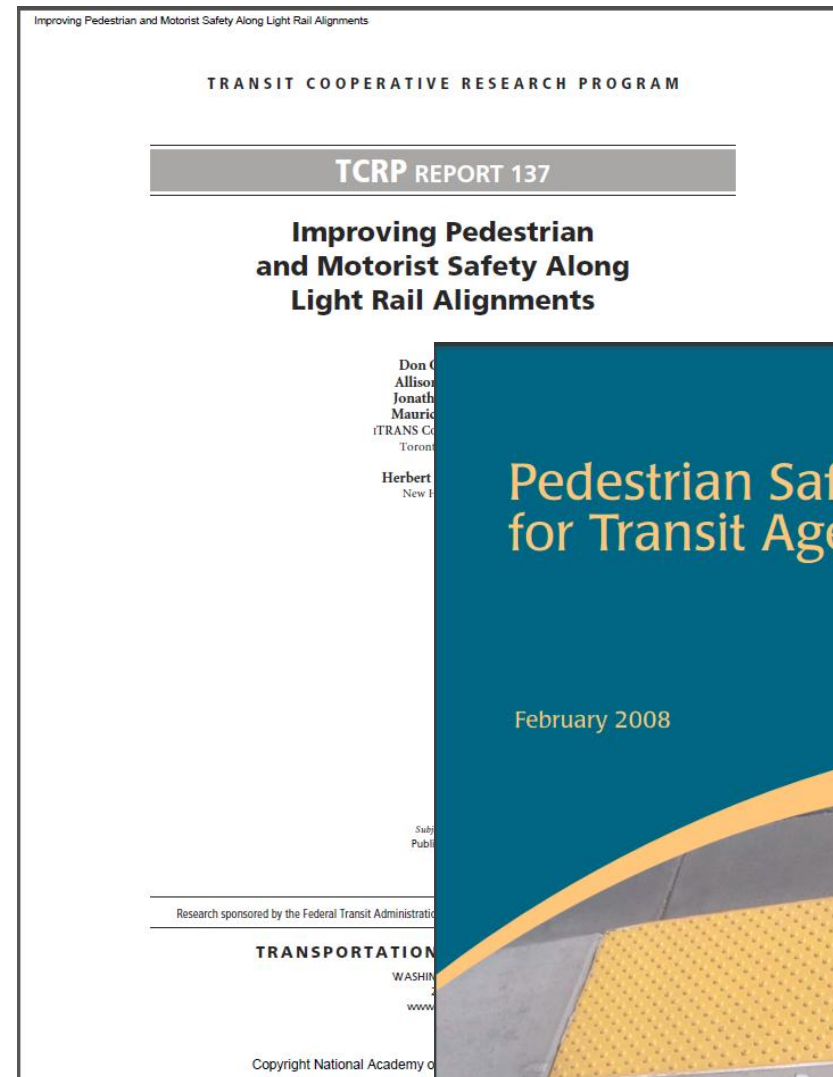
Crash Modifications Factors (CMF) Clearinghouse

- A searchable database of CMFs
- A CMF is used to compute the expected number of collisions after implementing a countermeasure
- Find appropriate countermeasures and CMFs
 - Collision type
 - Roadway type
 - Location
 - Severity
 - Time of Day
 - Roadway Condition
- <http://www.cmfclearinghouse.org/>

The screenshot shows the homepage of the Crash Modification Factors Clearinghouse. At the top, there is a dark blue header with the 'CMF' logo and the text 'CRASH MODIFICATION FACTORS CLEARINGHOUSE'. Below this is a navigation bar with links for 'ABOUT THE CLEARINGHOUSE', 'USING CMFs', 'DEVELOPING CMFs', and 'ADDITIONAL RESOURCES'. The main content area features a search bar with the placeholder text 'ENTER SEARCH TERMS...', a dropdown menu for 'Countermeasure Name', and a 'SEARCH' button. Below the search bar, there are 'FREQUENT SEARCHES' for 'ROUNDAABOUT', 'SIGNAL', 'PEDESTRIAN', 'SHOULDER', 'TSMO', and 'BROWSE ALL'. The page is divided into three columns of featured content: 'WHAT ARE CMFs?' with a description and a 'LEARN MORE' link; 'GETTING STARTED' with a description and a 'USER GUIDE' link; and 'CHANGE AHEAD' with a description and a 'LEARN MORE' link. At the bottom, there is a dark blue footer with the text 'RECEIVE THE QUARTERLY EMAIL NEWSLETTER' and a form with fields for 'EMAIL ADDRESS', 'FIRST NAME', 'LAST NAME', 'ORGANIZATION', and a 'SIGN UP' button.

Other Sources for Safety Data

- For percent reduction in transit accidents, other documentation and research can be utilized



05

Traffic Pavement Data

06

Project Costing Data

Project Costs – Direct Initial Costs

- The level of detail for cost estimates depends on where the project is in the development process
 - Plans, Specifications and Estimate (PS&E), Project Report (PR), and Project Study Reports (PSR) will provide detailed cost estimates in the appendices
 - These costs typically include support costs (e.g., design), right of way (ROW or R/W), and construction costs (including contingency)
 - Regional Transportation Improvement Programs (RTIP) and Caltrans State Highway Operation and Protection Program (SHOPP) have project costs broken down by “capital” and “support”, but without details

PROJECT COSTS (enter costs in thousands of dollars)									
Year	INITIAL COSTS			SUBSEQUENT COSTS		Mitigation	Transit Agency Cost Savings	TOTAL COSTS (in dollars)	
	Project Support	R / W	Construction	Maint./ Op.	Rehab.			Constant Dollars	Present Value
Construction Period									
1				<-- Must enter a cost -->				\$0	\$0
2				<-- Must enter a cost -->				0	0
3								0	0
4								0	0
5								0	0
6								0	0
7								0	0
8								0	0
Project Open									
1								\$0	\$0
2								0	0
3								0	0
4								0	0
5								0	0
6								0	0
7								0	0
8								0	0
9								0	0
10								0	0
11								0	0
12								0	0
13								0	0
14								0	0
15								0	0
16								0	0
17								0	0
18								0	0
19								0	0
20								0	0
Total	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Note: Remember to enter costs in thousands of dollars (1000\$). Otherwise, you will not get a correct Benefit/Cost Ratio

Project Costs – Direct Initial Costs

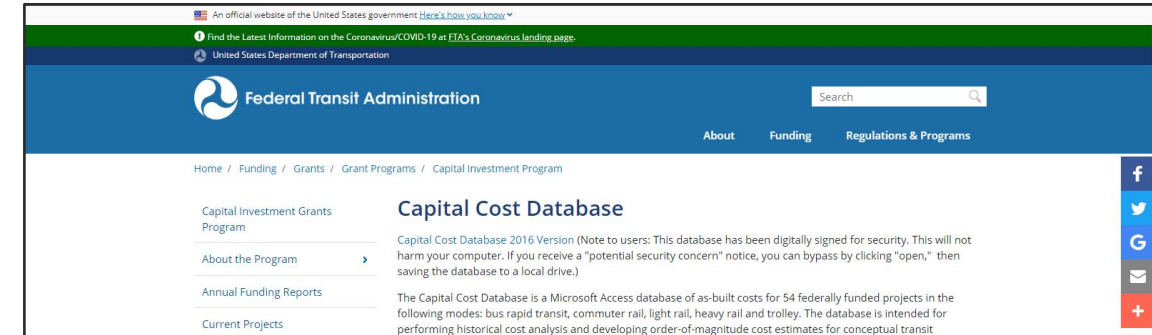
- Pre-planning stages are more difficult
 - Caltrans has a project cost database that has rule-of-thumb cost guides, but quantities will be needed to estimate project costs
 - Cost-per-mile estimates are available
 - Costs per mile vary significantly depending on the location, region, and project type
 - Look for a similar completed project in the same region with known costs, then estimate the cost per mile for the similar type of improvements
 - If ROW impacts are likely, then a reserve amount should be included. Caltrans has rule-of-thumb ROW estimates available

PROJECT COSTS (enter costs in thousands of dollars)									
Year	INITIAL COSTS			SUBSEQUENT COSTS			Transit Agency Cost Savings	TOTAL COSTS (in dollars)	
	Project Support	R / W	Construction	Maint./ Op.	Rehab.	Mitigation		Constant Dollars	Present Value
Construction Period									
1				<-- Must enter a cost -->				\$0	\$0
2				<-- Must enter a cost -->				0	0
3								0	0
4								0	0
5								0	0
6								0	0
7								0	0
8								0	0
Project Open									
1								\$0	\$0
2								0	0
3								0	0
4								0	0
5								0	0
6								0	0
7								0	0
8								0	0
9								0	0
10								0	0
11								0	0
12								0	0
13								0	0
14								0	0
15								0	0
16								0	0
17								0	0
18								0	0
19								0	0
20								0	0
Total	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Note: Remember to enter costs in thousands of dollars (1000\$). Otherwise, you will not get a correct Benefit/Cost Ratio

Project Costs – Federal Transit Administration (FTA) Capital Costs Database

- Microsoft Access database that can be used to estimate order-of-magnitude cost for conceptual transit projects
- Uses the FTA Standard Cost Category (SCC) codes for comparisons among transit operators
- Contains “as-built” costs for 54 federally funded projects:
 - Bus rapid transit
 - Commuter rail
 - Light rail
 - Heavy rail
 - Trolley



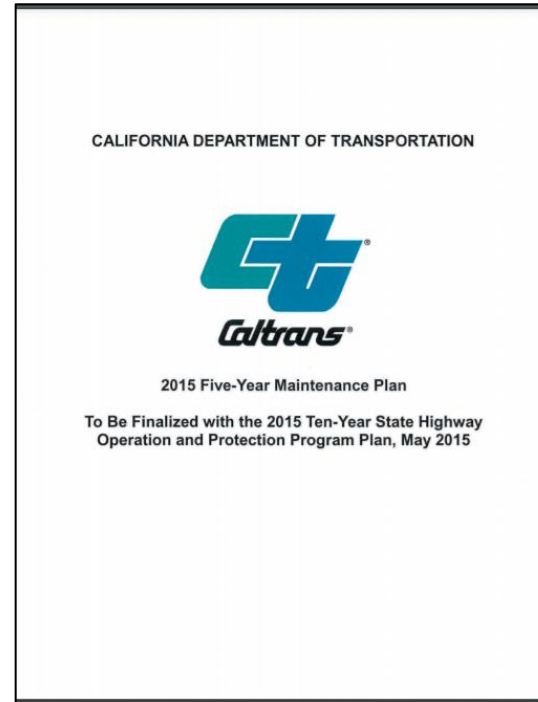
The screenshot shows a Microsoft Access database report titled 'Cost Breakdown by Project' for the 'Denver - Southwest Corridor' project. The report includes project details and a detailed cost breakdown table.

Project Name: Denver - Southwest Corridor
 City, State: Denver, CO
 Mode: Light Rail Transit
 Predominant Relationship to Grade: At-Grade
 Year of Revenue Operation: 2000

Cost Category and Element	Units	Quantity	Mid-Point of Construction	Total Element Cost at Mid-Point of Construction (\$X'000)	Unit Cost at Mid-Point of Construction	National Average, User Selected Base Year 2016
Total Project Costs (excluding finance charges):			\$177,100,001			
Cost Category	Unit of Measure	Units	Unit Cost	Total Cost at Mid-Point of Construction (\$X'000)	Total National Average, User Selected Base Year (\$X'000) 2016	Percent of Total Cost
10 Guideway & Track Elements	LF Guideway	44687	\$2,109	\$40,300	\$94,234	23%
20 Stations, Stops, Terminals, Intermodels	Stations	5	\$8,885,590	\$19,000	\$44,428	11%
30 Support Facilities: Yards, Shops, Admin. Bldgs	Vehicles	18	\$51,963	\$400	\$935	0%
40 Sitework & Special Conditions	LF Guideway	44687	\$73	\$1,400	\$3,274	1%
50 Systems	Track Feet	92546	\$293	\$11,600	\$27,124	7%
60 Row, Land, Existing Improvements	LF Guideway	44687	\$2,020	\$38,600	\$90,259	22%
70 Vehicles	Vehicles	18	\$4,247,936	\$32,700	\$76,463	18%
Total Hard Costs	LF Guideway	44687	\$7,535	\$144,000	\$336,717	81%

Project Costs – Subsequent Costs

- Caltrans and regional agencies have estimates for maintenance and operating costs for various facilities
- Transit annual operating expenses can be estimated from NTD data tables
- Subsequent costs should be entered as a NET increase or decrease from the No Build case
 - May be positive (e.g., increased cost due to a new lane being constructed)
 - May be negative (e.g., avoided maintenance or rehabilitation)



Operating Expenses_2 (1) - Excel

Agency	City	State	Vehicle Maintenance	Facility Maintenance	General Administration	Total	Vehicle Revenue Hours	
12	New Jersey Transit Corporation	Newark	NJ	\$12,433,673	\$6,441,459	\$31,530,936	\$98,086,952	126,422
14	New Jersey Transit Corporation	Newark	NJ	\$3,405,044	\$5,926,489	\$3,979,417	\$22,345,248	50,262
17	Los Angeles County Metropolitan Transportation Authority	Los Angeles	CA	\$74,608,014	\$37,603,979	\$79,906,659	\$377,416,763	866,272
30	King County Department of Metro Transit, dba: King	Seattle	WA	\$0	\$0	\$0	\$0	0
45	Metropolitan Transit Authority of Harris County, Texas	Houston	TX	\$15,117,378	\$15,199,854	\$18,482,675	\$79,277,412	300,133
50	Massachusetts Bay Transportation Authority	Boston	MA	\$58,667,899	\$17,184,275	\$36,258,468	\$213,658,148	706,032
67	Maryland Transit Administration	Baltimore	MD	\$10,014,619	\$12,324,396	\$6,509,505	\$43,950,196	151,280
86	Denver Regional Transportation District	Denver	CO	\$24,666,970	\$22,846,002	\$34,042,000	\$122,305,271	720,150
103	Utah Transit Authority	Salt Lake City	UT	\$25,371,102	\$9,594,202	\$15,292,108	\$71,414,293	362,257
117	Dallas Area Rapid Transit	Dallas	TX	\$37,319,388	\$41,659,119	\$34,853,739	\$191,495,581	458,345
127	City and County of San Francisco, dba: San Francisco	San Francisco	CA	\$72,417,984	\$29,665,742	\$38,309,599	\$221,060,950	556,545
133	Tri-County Metropolitan Transportation District of Oregon	Portland	OR	\$41,331,691	\$25,560,017	\$28,740,425	\$150,694,667	626,091
139	Port Authority of Allegheny County	Pittsburgh	PA	\$21,480,512	\$20,589,688	\$5,929,802	\$66,793,023	170,363
142	Metro Transit	Minneapolis	MN	\$12,549,095	\$11,699,847	\$28,195,729	\$73,006,195	425,583
163	San Diego Metropolitan Transit System	San Diego	CA	\$20,209,080	\$12,502,824	\$25,618,230	\$90,313,010	478,175
185	Santa Clara Valley Transportation Authority	San Jose	CA	\$41,087,099	\$27,318,635	\$18,755,072	\$128,622,203	220,589
216	Bi-State Development Agency of the Missouri-Illinois	St. Louis	MO	\$13,673,749	\$19,671,573	\$19,095,764	\$80,216,036	264,761
222	The Greater Cleveland Regional Transit Authority	Cleveland	OH	\$2,618,219	\$3,666,216	\$1,636,300	\$12,119,266	48,997
239	City of Charlotte North Carolina, dba: Charlotte Area	Charlotte	NC	\$5,167,065	\$2,854,055	\$7,450,065	\$21,366,867	89,679
249	Transportation District Commission of Hampton Roads	Hampton	VA	\$1,518,483	\$334,916	\$3,360,439	\$10,619,844	29,571
253	Central Puget Sound Regional Transit Authority, dba Seattle	Seattle	WA	\$12,209,055	\$28,789,445	\$31,408,199	\$115,567,317	264,385
262	Niagara Frontier Transportation Authority	Buffalo	NY	\$2,786,355	\$9,560,643	\$3,991,370	\$25,551,007	82,671
412	Sacramento Regional Transit District	Sacramento	CA	\$16,037,374	\$10,526,891	\$15,624,192	\$70,866,915	248,656
1190	Valley Metro Rail, Inc.	Phoenix	AZ	\$7,870,743	\$9,243,589	\$7,366,444	\$43,021,498	217,912

Project Costs – Mitigation Costs

- Mitigation costs (in thousands of dollars) include costs to protect communities and the environment from negative impacts
 - Include wetland and community preservation as well as sound walls to reduce highway or rail transit noise
- Plans, PS&E, PR, and PSR will provide mitigation cost estimates (with details found in the appendices)
- Often these costs can be included in the “construction” costs for a project and may not need to be entered into Cal-B/C as a separate costs
 - Soundwalls and environmental mitigations are examples of mitigations that are built into the cost of projects presented in PRs
- On-going mitigation costs that continue after the project construction is completed will be included in PRs

PROJECT COST ESTIMATE

EA: 31450 PID: D01234567

SECTION 5: ENVIRONMENTAL

5A - ENVIRONMENTAL MITIGATION				
Item code	Unit	Quantity	Unit Price (\$)	Cost
Biological Mitigation				
Total of Section 1-4				
130670	Temporary Reinforced Silt Fence	LF	\$ 144,076,600 x 3.0%	\$ 4,322,300
141000	Temporary Fence (Type ESA)	LF	x	- \$
				Subtotal Environmental Mitigation \$ 4,322,300
5B - LANDSCAPE AND IRRIGATION				
Item code	Unit	Quantity	Unit Price (\$)	Cost
Highway Planting				
Total of Section 1-4				
20XXXX	Highway Planting (Landscaped Status)	ACRE	\$ 144,076,600 x 3.0%	\$ 4,322,300
20XXXX	Irrigation System	LS	x 97,000.00	\$ 3,482,300
204099	Plant Establishment Work	LS	x	- \$
204101	Extend Plant Establishment Work	LS	x	- \$
20XXXX	Follow-up Landscape Project	LS	x	- \$
150685	Remove Irrigation Facility	LS	x	- \$
20XXXX	Maintain Existing (Irrigation or Planted Areas)	LS	x	- \$
206400	Check and Test Existing Irrigation Facilities	LS	x	- \$
21011X	Imported Topsoil (X)	CY/TON	x	- \$
20XXXX	Rock Blanket, Rock Mulch, DG, Gravel Mulch	QFT/SQYD	x	- \$
200122	Weed Germination	SQYD	x	- \$
208304	Water Meter	EA	x	- \$
2087XX	XX" Conduit (Use for Irrigation x-overs)	LF	x	- \$
20890X	Extended A. Unit (Use for Extension of Irrigation)	LF	x	- \$
				Subtotal Landscape and Irrigation \$ 7,804,600
5C - EROSION CONTROL				
Item code	Unit	Quantity	Unit Price (\$)	Cost
Move In/Move Out (Erosion Control)				
Total of Section 1-4				
210010	Move In/Move Out (Erosion Control)	EA	x	- \$
210350	Fiber Rolls	LF	x	- \$
210360	Compost Sock	LF	x	- \$
2102XX	Roller Erosion Control Product (X)	SQFT	x	- \$
21025X	Bonded Fiber Matrix	QFT/ACRE	x	- \$
210300	Hydromulch	SQFT	x	- \$
210420	Straw	SQFT	x	- \$
210430	Hydroseed	SQFT	x	- \$
210600	Compost	SQFT	x	- \$
210630	Incorporate Materials	SQFT	x	- \$
				Subtotal Erosion Control \$ 14,407,700
5D - NPDES				
Item code	Unit	Quantity	Unit Price (\$)	Cost
Prepare SWPPP				
Total of Section 1-4				
130300	Prepare SWPPP	LS	1 x 10,000.00	\$ 10,000
130200	Prepare WPCP	LS	x	- \$
130100	Job Site Management	LS	x	- \$
130330	Storm Water Annual Report	EA	x	- \$
130310	Rain Event Action Plan (REAP)	EA	x	- \$
130320	Storm Water Sampling and Analysis Day	EA	x	- \$
130520	Temporary Hydraulic Mulch	SQYD	x	- \$
130550	Temporary Hydroseed	SQYD	x	- \$
130505	Move-In/Move-Out (Temporary Erosion Control)	EA	x	- \$
130640	Temporary Fiber Roll	LF	x	- \$
130900	Temporary Concrete Washout	LS	x	- \$
130710	Temporary Construction Entrance	EA	x	- \$
130610	Temporary Check Dam	LF	x	- \$
130620	Temporary Drainage Inlet Protection	EA	x	- \$
130730	Street Sweeping	LS	x	- \$
				Subtotal NPDES \$ 14,417,700
				TOTAL ENVIRONMENTAL \$ 40,952,300
Supplemental Work for NPDES				
Total of Section 1-4				
065595	Water Pollution Control Maintenance Sharing*	LS	x	- \$
065596	Additional Water Pollution Control**	LS	x	- \$
065597	Storm Water Sampling and Analysis***	LS	x	- \$
XXXXXX	Storm Water BMPs	LS	1 x 12,930,000.00	\$ 12,930,000
				Subtotal Supplemental Work for NPDES \$ 12,930,000

*Applies to all SWPPPs and those WPCPs with sediment control or soil stabilization BMPs.
 **Applies to both SWPPPs and WPCP projects.
 ***Applies only to project with SWPPPs.

Project Costs – Savings to Transit Agency

- For projects with a Transit Vehicle Location (AVL) TMS Strategy, Cal-B/C will estimate annual cost savings to the transit agency
 - Based on the Transit Agency Costs data entry and the Transit Travel Time and Agency Cost Savings parameters

07

Conclusion

In this module, you learned...

- About potential data sources for data input and project costing for Cal-B/C Sketch
- How to get data from these sources

What's Next?

- **Modules 9a1** and **Module 9a2** walk through example projects showing how to perform a BCA
- **Module 10** closes out the training and will summarize other resources to learn more about BCA