

# Highway Performance Monitoring System (HPMS)

**California Department of Transportation**

Division of Research, Innovation & System Information

March 15, 2017

# What is HPMS?

HPMS is a national highway information system that includes data on the extent, condition, performance, use, and operating characteristics of the Nation's highways.

Details can be found on this website:

<https://www.fhwa.dot.gov/policyinformation/hpms.cfm>

Caltrans is required to:

- 1) Submit HPMS dataset to FHWA by June 15<sup>th</sup>.
- 2) Submit CA Public Road Mileage Certification by June 1<sup>st</sup>.

# What is HPMS Data Used for?

- Fund Apportionment
- MAP 21 and FAST Act Performance Measure
- Conditions and Performance Report to Congress
- Annual Highway Statistic Report and other Federal Publications
- Providing Vehicles Miles Travel (VMT) to Environmental Projection Agency (EPA)
- Transportation Planning, Analyses, and Decision-Making Purposes by Various Governmental and Public Agencies, and Research Institutions, etc.

# HPMS- What to submit?

- Sixty-Nine (69) data items on all “Public Roads” Full Extent, Sample Panels or Summary.  
(HPMS Field Manual)
- Linear Reference System (LRS) Network links  
HPMS sections data by Route ID.

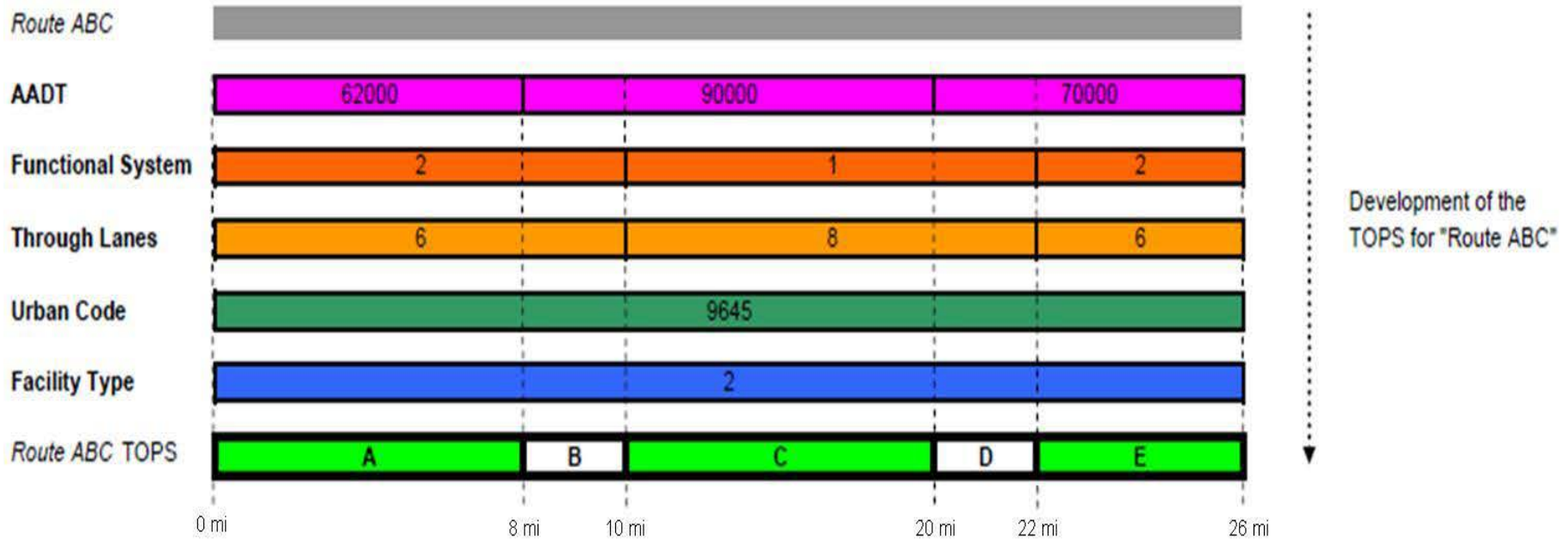
# Public Road

- A public road is any road or street owned and maintained by a public authority and **open to public travel**. [23 U.S.C. 101(a)]
- To be open to public travel, a road section must be available, except during scheduled periods, extreme weather, or emergency conditions, passable by **four-wheel standard passenger cars**, and open to the general public for use without restrictive gates, prohibitive signs, or regulation other than restrictions based on size, weight, or class of registration. [23 CFR 460.2(c)]

# HPMS Data Type

- **Full Extent (FE):**  
Data reported for the full extent of the system (e.g. section level for AADT).  
(Federal-Aid Eligible: Urban FC1-6; Rural FC1-5)
- **Sample Panel (SP):**  
Data reported for HPMS sampled panel sections (see diagram on next slide).
- **Summary:**  
Data reported in aggregate form (e.g. Total VMT on Urban FC 6 or Rural FC 6 & 7).

# Table of Potential Samples (TOPS)



Geospatial intersection of five key data items

# 69 HPMS Section Data

Data Item Type	Item Number	Database-Specific Data Item Name	Data Item Name	Extent	
Inventory	1	F_System	Functional System	FE + R	
	2	Urban_Code	Urban Code	FE + R	
	3	Facility_Type	Facility Type	FE + R	
	4	Structure_Type	Structure Type	FE**	
	5	Access_Control	Access Control	FE*	SP*
	6	Ownership	Ownership	FE	
	7	Through_Lanes	Through Lanes	FE + R	
	8	HOV_Type	HOV Operations Type	FE**	
	9	HOV_Lanes	HOV Lanes	FE**	
	10	Peak_Lanes	Peak Lanes		SP
	11	Counter_Peak_Lanes	Counter Peak Lanes		SP
	12	Turn_Lanes_R	Right Turn Lanes		SP
	13	Turn_Lanes_L	Left Turn Lanes		SP
	14	Speed_Limit	Speed Limit		SP
	15	Toll_Charged	Toll Charged	FE**	
	16	Toll_Type	Toll Type	FE**	
Route	17	Route_Number	Route Number	FE*	
	18	Route_Signing	Route Signing	FE*	
	19	Route_Qualifier	Route Qualifier	FE*	
	20	Alternative_Route_Name	Alternative Route Name	FE	



# 69 HPMS Section Data

Data Item Type	Item Number	Database-Specific Data Item Name	Data Item Name	Extent	
Traffic	21	AADT	Annual Average Daily Traffic	FE + R	
	22	AADT_Single_Unit	Single Unit Truck and Bus AADT	FE*	SP*
	23	Pct_Peak_Single	Percent Peak Single-Unit Trucks and Buses		SP
	24	AADT_Combination	Combination Truck AADT	FE*	SP*
	25	Pct_Peak_Combination	Percent Peak Combination Trucks		SP
	26	K_Factor	K-factor		SP
	27	Dir_Factor	Directional Factor		SP
	28	Future_AADT	Future AADT		SP
	29	Signal_Type	Signal Type		SP
	30	Pct_Green_Time	Percent Green Time		SP
	31	Number_Signals	Number of Signalized Intersections		SP
	32	Stop_Signs	Number of Stop-Sign Controlled Intersections		SP
	33	At_Grade_Other	Number of Intersections, Type - Other		SP

# 69 HPMS Section Data

Data Item Type	Item Number	Database-Specific Data Item Name	Data Item Name	Extent	
Geometric	34	Lane_Width	Lane Width		SP
	35	Median_Type	Median Type		SP
	36	Median_Width	Median Width		SP
	37	Shoulder_Type	Shoulder Type		SP
	38	Shoulder_Width_R	Right Shoulder Width		SP
	39	Shoulder_Width_L	Left Shoulder Width		SP
	40	Peak_Parking	Peak Parking		SP
	41	Widening_Obstacle	Widening Obstacle		SP
	42	Widening_Potential	Widening Potential		SP
	43	Curves_A through Curves_F	Curve Classification		SP*
	44	Terrain_Type	Terrain Type		SP
	45	Grades_A through Grades_F	Grade Classification		SP*
	46	Pct_Pass_Sight	Percent Passing Sight Distance		SP

# 69 HPMS Section Data

Data Item Type	Item Number	Database-Specific Data Item Name	Data Item Name	Extent	
Pavement	47	IRI	International Roughness Index	FE*	SP*
	48	PSR	Present Serviceability Rating		SP*
	49	Surface_Type	Surface Type		SP
	50	Rutting	Rutting		SP
	51	Faulting	Faulting		SP
	52	Cracking_Percent	Cracking Percent		SP
	53	Cracking_Length	Cracking Length		SP
	54	Year_Last_Improv	Year of Last Improvement		SP
	55	Year_Last_Construction	Year of Last Construction		SP
	56	Last_Overlay_Thickness	Last Overlay Thickness		SP
	57	Thickness_Rigid	Thickness Rigid		SP
	58	Thickness_Flexible	Thickness Flexible		SP
	59	Base_Type	Base Type		SP
	60	Base_Thickness	Base Thickness		SP
	61	Climate_Zone**	Climate Zone**		SP
62	Soil_Type**	Soil Type**		SP	

# 69 HPMS Section Data

Data Item Type	Item Number	Database-Specific Data Item Name	Data Item Name	Extent	
Inventory	63	County_Code	County Code	FE	
Special Networks	64	NHS	National Highway System	FE**	
	65	STRAHNET_Type	Strategic Highway Network	FE**	
	66	Truck	National Truck Network	FE**	
	67	Future_Facility	Future National Highway System	FE**	
Inventory	68	Maintenance_Operations	Maintenance & Operations	FE	
Traffic	69	Capacity	Capacity		SP

# HPMS Current Challenges

- **Update/maintain local data:**  
To coordinate with 482 cities + 58 counties + 18 MPOs to maintain and update the network data, traffic data, pavement data and shapefiles.
- **Update/maintain current (Caltrans) All-Roads network:**  
To continue clean up our All Roads LRS network to reflect current ownership, geometry, public roads and mileage.

# HPMS Data Collection

# HPMS Data Source

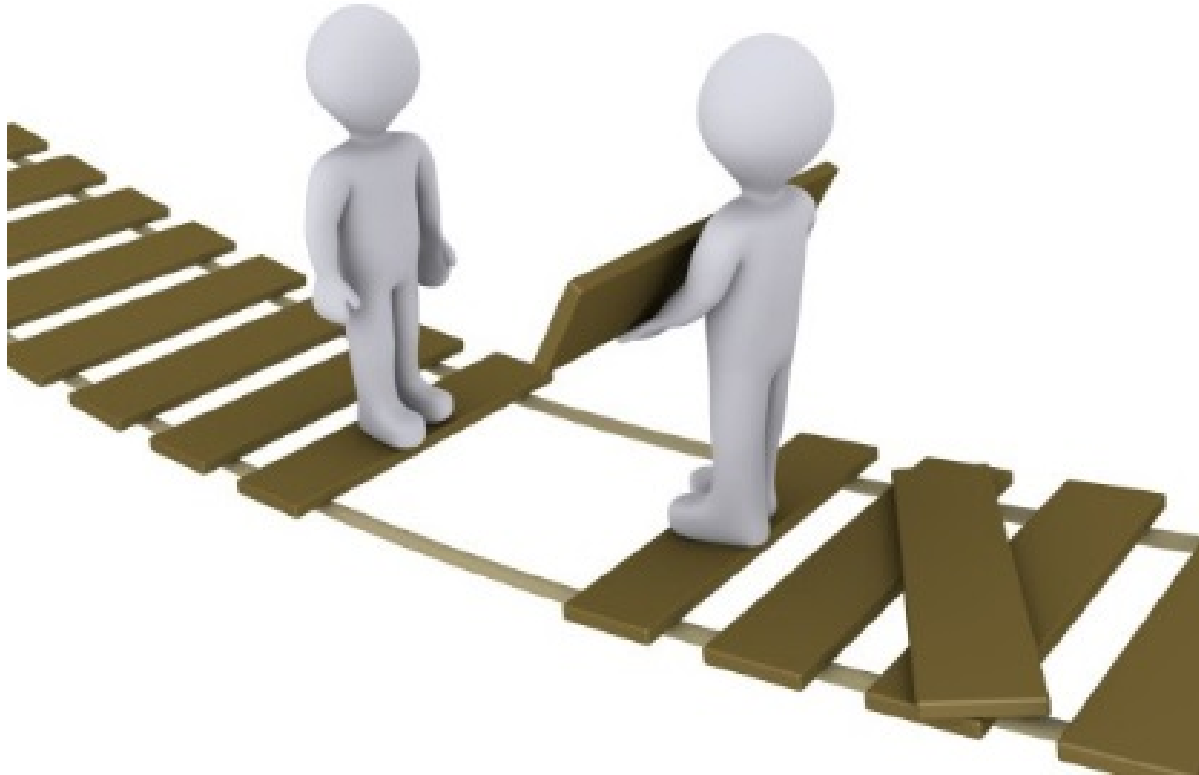
## State Highway System:

- Transportation System Network (TSN) Database
- Other Caltrans' Databases (Division of Maintenance, Pavement, and Planning)

## Local Roads:

- Caltrans' annual contracts (traffic and pavement), but only cover samples and NHS sections
- Caltrans' manual collection effort from Google Map/Earth, Google Street View, Bing Map
- Local agencies

# HPMS Data Gap





# HPMS Data Requesting from Local Agencies

Traffic Data

Inventory Data

Pavement Data

# Traffic Data

## AADT: Annual Average Daily Traffic (FE)

- Represent an average day of the year
- Must reflect application of day of a week and seasonal factor
- The latest three years historical AADT

**OR**

## ADT: Average Daily Traffic (FE)

- Preferably 48 hours count but 24 hours count is also acceptable
- Counts should be taken during a typical weekday (Tuesday, Wednesday or Thursday)
- The latest three years historical ADT

# Inventory Data

## Facility Type (FE):

- One way or two way street

## Ownership (FE):

- The entity that has legal ownership of a roadway (city, county, tribal, state or federal...etc)

## Through Lane (FE): # of lanes designated for through traffic

- Exclude turn lanes (left turn and right turn pocket lane, two way left turn lane in center)

## Speed Limit/Posted Speed (SP):

# Pavement Data

## Year Last Improvement (SP):

- 0.5 inch or more of compacted material must be put in place
- Completion date is the actual date when the project was opened to traffic

## Year Last Construction (SP):

- Replacement of the existing the pavement structure.

## Last Overlay Thickness (SP):

- New pavement surface places on the top the old pavement surface
- Must be more than 0.5 inch

# HPMS Data Collection Format

Full Extent Data Items (AADT/ADT, Facility Type, Ownership, Through Lane) :

- Excel Format

Section Identification			Either of these		Month and Year of Traffic Count
Street Name	Street_From	Street_To	AADT	ADT	

- Shapefile

Local agencies populate these data to the extent they are available

# HPMS Data Collection Format

Sampled Data Items (Speed Limit, Year Last Improvement, Year Last Construction, Last Overlay Thickness) :

- Caltrans will provide a list of sampled sections in tabular format for local jurisdictions to fill in with the requested data

# All Road Network of Linear Referenced Data (ARNOLD)



# All Road Network of Linear Referenced Data (ARNOLD)

In 2012, FHWA expanded the HPMS reporting requirement for State DOTs to submit all public roads in a Linear Referencing System (LRS)

This requirement is referred to as the “All Road Network of Linear Referenced Data (ARNOLD)”



# All Road Network of Linear Referenced Data (ARNOLD)

## Why All Roads?

1. Geospatial data for transportation is a key data theme within the National Spatial Data Infrastructure
2. All roads datasets are needed by the Federal government, the States, and many of the local agencies to support planning and management infrastructure.
3. Meeting the business needs of these functions:
  - Certified Public Miles
  - Fiscal Management Information System (FMIS)
  - Fatal and Serious Injury Crashes
  - Freight
  - Performance Measures for Safety
  - Performance Measures for Pavement

# What is LRS?

Spatial referencing method, in which locations of features are described in terms of measurement along a linear element, from defined starting point

LRS is suitable for management data related to:

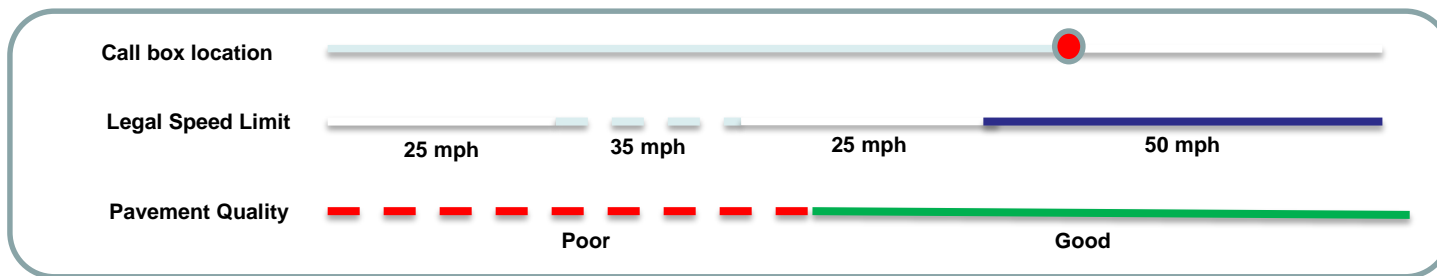
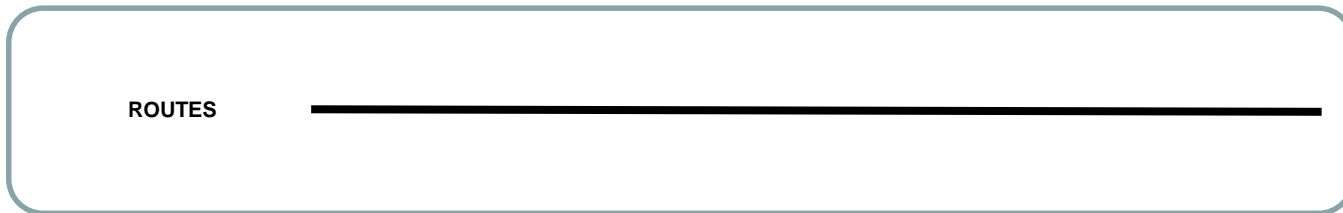
- Roads
- Railways
- Oil and gas transmission pipeline

**LRS = Route (Base Geometry) + Event Table**

# What is LRS?

Route_ID	From	To	Speed
1st	0	5	25
1st	5	15	35
1st	15	30	40

Event Table  
(Attribution Information)



# All Road Network of Linear Referenced Data (ARNOLD)

Caltrans' efforts in meeting the requirement:

- 2012 – SACOG Pilot Project
- 2013 – Development of a Statewide LRS for All Public Roads
- 2016 – Network Clean up and Validation

# All Road Network of Linear Referenced Data (ARNOLD)

## Challenges we are facing:

- TIGER/Line®: unclean, missing geometry, include non-public roads
- Discrepancy on public road maintained mileage  
(*For instance: LA county reported: 21,858 miles*  
*Statewide LRS: 25,615 miles*)

# All Road Network of Linear Referenced Data (ARNOLD)

Assistance requesting from local jurisdictions:

- Review and provide feedbacks on LRS Route Layer
- Provide Caltrans with your city/county street centerline shape file with public, non-public streets, and ownership information

# All Road Network of Linear Referenced Data (ARNOLD)

ARNOLD Reference Manual:

[http://www.fhwa.dot.gov/policyinformation/hpms/documents/arnold\\_reference\\_manual\\_2014.pdf](http://www.fhwa.dot.gov/policyinformation/hpms/documents/arnold_reference_manual_2014.pdf)

# Model Inventory Roadway Element Fundamental Data Element (MIRE FDE)



# What is MIRE FDE?

- A listing of 37 roadway inventory and traffic elements fundamental to safety analysis and to support State's Highway Safety Improvement Program
- A new requirement per MAP-21 and FAST Act Legislation
- States are required to incorporate MIRE FDE data collection plan into their Traffic Records Strategic Plan by July 1, 2017, and have access to the complete collection of MIRE FDE by September 30, 2026

# MIRE FDE

MIRE FDE includes roadway segments, intersection and ramp/interchange elements on all public roads and is divided into three roadway categories:

Roadway Category	Number of MIRE FDEs
Non-local paved roads (FC* 1-6)	37
Local paved roads (FC 7)	9
Unpaved roads (FC1-7)	5

\* FC : Functional Classification

# MIRE FDE

## MIRE FDE for Non-Local Paved Road (FC 1-6):

MIRE Name (MIRE Number)^	
Roadway Segment	Intersection
Segment Identifier (12)	Unique Junction Identifier (120)
Route Number (8)*	Location Identifier for Road 1 Crossing Point (122)
Route/street Name (9)*	Location Identifier for Road 2 Crossing Point (123)
Federal Aid/ Route Type (21)*	Intersection/Junction Geometry (126)
Rural/Urban Designation (20)*	Intersection/Junction Traffic Control (131)
Surface Type (23)*	AADT (79) [for Each Intersecting Road]
Begin Point Segment Descriptor (10)*	AADT Year (80) [for Each Intersecting Road]
End Point Segment Descriptor (11)*	Unique Approach Identifier (139)
Segment Length (13)*	
Direction of Inventory (18)	Interchange/Ramp
Functional Class (19)*	Unique Interchange Identifier (178)
Median Type (54)	Location Identifier for Roadway at Beginning Ramp Terminal (197)
Access Control (22)*	Location Identifier for Roadway at Ending Ramp Terminal (201)
One/Two-Way Operations (91)*	Ramp Length (187)
Number of Through Lanes (31)*	Roadway Type at Beginning Ramp Terminal (195)
Average Annual Daily Traffic (79)*	Roadway Type at Ending Ramp Terminal (199)
AADT Year (80)*	Interchange Type (182)
Type of Governmental Ownership (4)*	Ramp AADT (191)*
	Year of Ramp AADT (192)*
	Functional Class (19)*
	Type of Governmental Ownership (4)*

<sup>^</sup>Model Inventory of Roadway Elements—MIRE, Version 1.0, Report No. FHWA-SA-10-018, October 2010,

# MIRE FDE

## MIRE FDE for Local Paved Road (FC 7):

<b>MIRE Name (MIRE Number)^</b>
<b>Roadway Segment</b>
Segment Identifier (12)
Functional Class (19)*
Surface Type (23)*
Type of Governmental Ownership (4)*
Number of Through Lanes (31)*
Average Annual Daily Traffic (79)*
Begin Point Segment Descriptor (10)*
End Point Segment Descriptor (11)*
Rural/Urban Designation (20)*

# MIRE FDE

## MIRE FDE for Unpaved Road (FC 1-7):

<b>MIRE Name (MIRE Number)^</b>
<b>Roadway Segment</b>
Segment Identifier (12)
Functional Class (19)*
Type of Governmental Ownership (4)*
Begin Point Segment Descriptor (10)*
End Point Segment Descriptor (11)*

# MIRE FDE

## Caltrans' efforts in meeting the requirement:

- Completed data gap analysis
- Received 18 months technical assistance from FHWA to develop a Safety Data Integration Plan
- Awarded a contract to UCB SafeTREC to develop a MIRE FDE collection plan which is scheduled for completion by May 1, 2017

# MIRE FDE

Guidance Memorandum on MIRE FDE can be found from the following website:

[https://safety.fhwa.dot.gov/legislationandpolicy/fast/sds\\_guidance.cfm](https://safety.fhwa.dot.gov/legislationandpolicy/fast/sds_guidance.cfm)



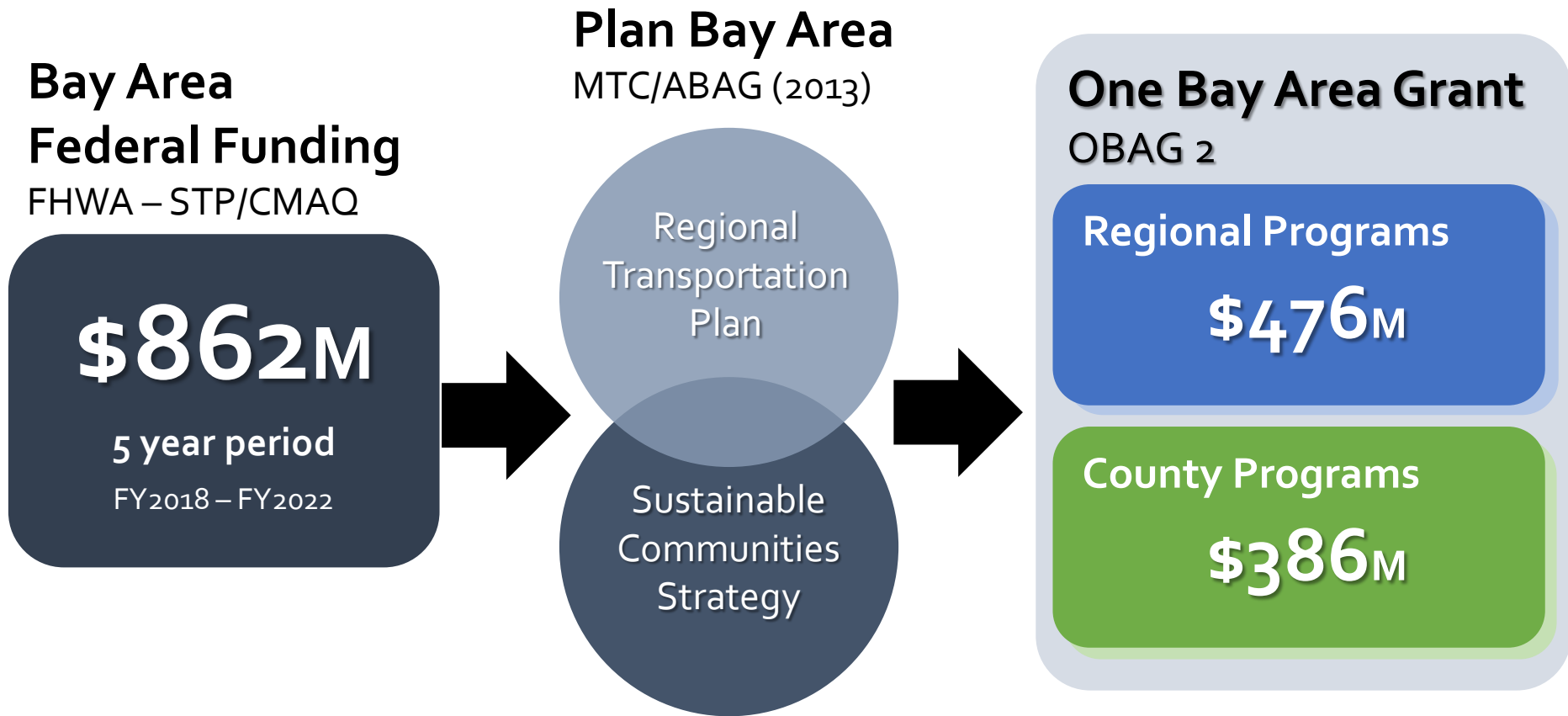




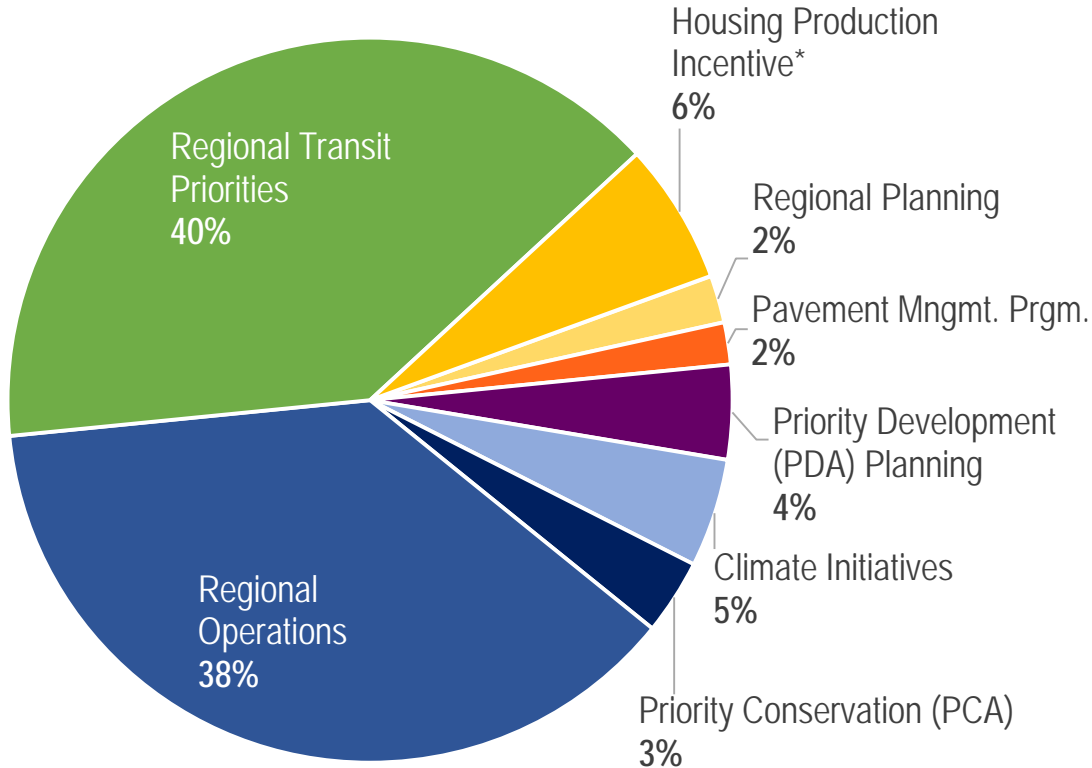
# One Bay Area Grant (OBAG 2)

## Local Streets and Roads Requirements

# One Bay Area Grant Funding



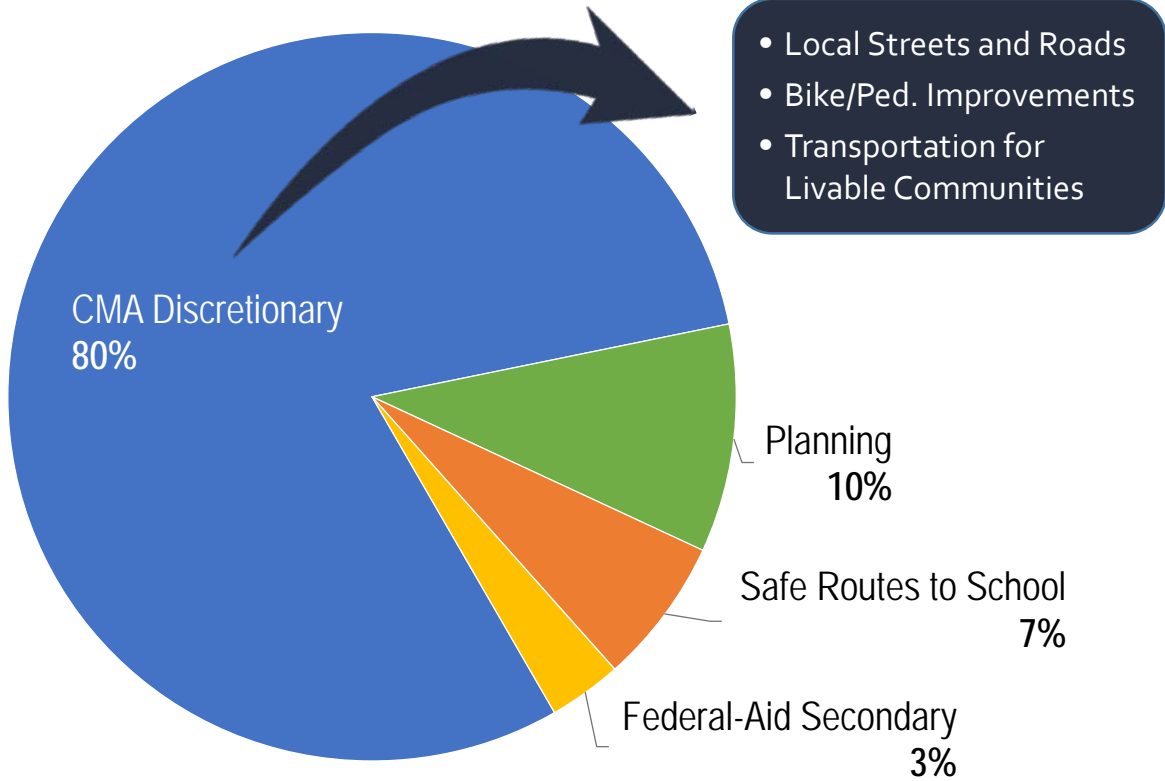
# Regional Programs



**\$451M** > **\$476M**  
**OBAG 1** **OBAG 2**  
 FY2013-2017 FY2018-2022



# County Programs

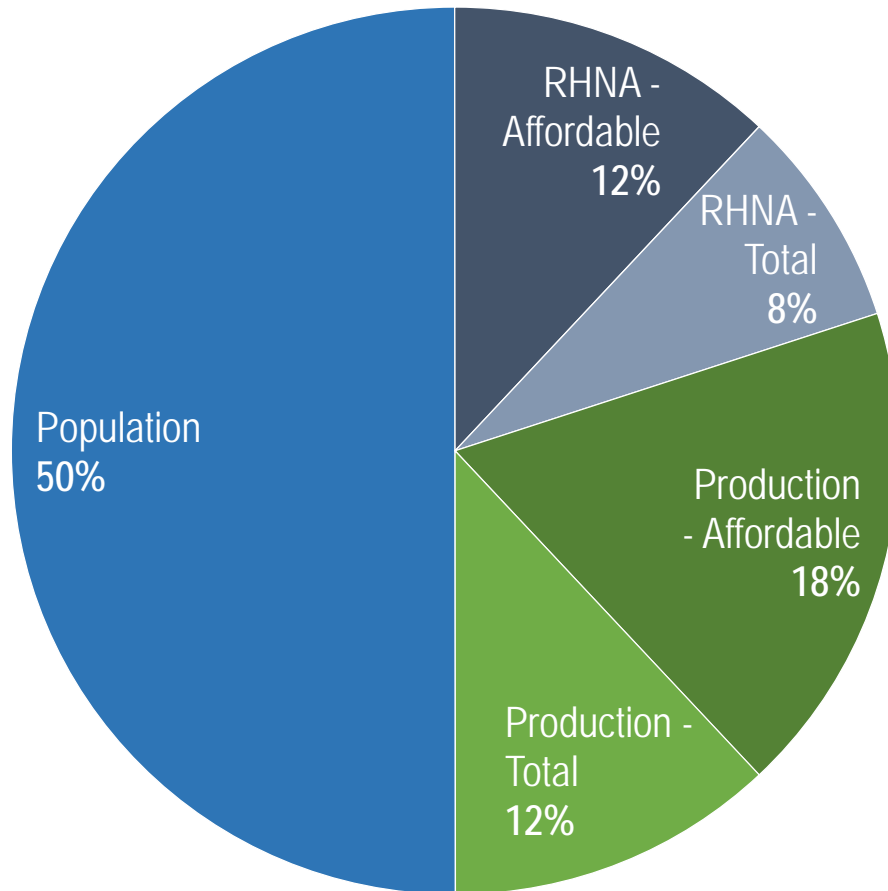


**\$327M** **>** **\$386M**  
**OBAG 1** **OBAG 2**  
 FY2013-2017 FY2018-2022



# County Program Distribution

## Distribution Formula



## Program Amounts

Alameda	\$77
Contra Costa	\$56
Marin	\$11
Napa	\$8
San Francisco	\$48
San Mateo	\$33
Santa Clara	\$104
Solano	\$21
Sonoma	\$28
<b>Total</b>	<b>\$386</b>

Millions \$, rounded

# Requirements for Local Jurisdictions



*Requirements for OBAG 2 funding reinforce existing state or federal mandates*

- **Complete Streets** resolution or plan update
- **Housing Element** certified
- **Annual reporting** of Housing Element – April 1
- **Surplus Land Act resolution** general law cities, counties
- **Local Streets and Roads** HPMS reporting, Pavement Management Program, and statewide needs assessment

# Local Streets and Roads Requirements



## Pavement Management Program

*Requirement: Maintain a certified PMP, updated at least once every 3 years*

- Updated PMP database
- Inspection of pavement sections
- Budget-need calculations for current year and next 3 years
- Pavement Management Technical Assistance Program (P-TAP) available
- Certification status on MTC website
  - [mtc.ca.gov/sites/default/files/\\_PMP\\_Certification\\_Status\\_Listing.xlsx](https://mtc.ca.gov/sites/default/files/_PMP_Certification_Status_Listing.xlsx)

# Local Streets and Roads Requirements



## Statewide Needs Assessment

*Requirement: Fully participate in statewide local streets and roads needs assessment survey*

- Biennial survey
  - Participation throughout OBAG 2
  - Surveys collected 2017, 2019, and 2021
- Purpose is to educate and inform policy makers; funding advocacy
- <http://www.savecaliforniastreet.org/>



# Local Streets and Roads Requirements



## Highway Performance Monitoring System (HPMS)

Official federal source of data on the extent, condition, performance, use, and operating characteristics of the nation's federal-aid system

- Data Reporting - 23 CFR 420.105 (b)
- Clean Air Act – 42 USC section 7512(a)
- Public Road Mileage – 23 CFR 460.6(b)
- TMS Components of Traffic Data – 23 CFR 500.204(b)

<https://www.fhwa.dot.gov/policyinformation/hpms.cfm>

# Local Streets and Roads Requirements



## Highway Performance Monitoring System (HPMS)

*Requirement: Provide updated HPMS information to MTC/Caltrans*

1. Pavement condition:
  - Collected by MTC
  - StreetSaver data
- 2.. Roadway Inventory:
  - Collected by Caltrans
  - Geospatial & roadway attributes data

# Local Streets and Roads Requirements



## Highway Performance Monitoring System (HPMS)

*Requirement: Provide updated HPMS information to MTC/Caltrans*

### 3. Traffic counts:

- National Highway System (NHS) – primarily Interstate & principal arterials (Caltrans)
- Non-NHS – minor arterials & collectors (Local jurisdictions)
  - MTC compiles local data
  - Annual survey, sent March/April
  - OBAG 2 recipients must participate in survey throughout OBAG 2 (starting 2017)



# OBAG 2 LSR Compliance Schedule

Year	OBAG 2 Funding	Local Streets and Roads Requirements	
2017	Year 1 (FY18) – funding priority for ongoing programs, planning, PE for capital projects	Winter – Update pavement database Spring – Annual HPMS survey (1/5) Summer – 2018 Needs Assessment	<u>Ongoing</u> Maintain certified PMP
2018	Years 2 (FY19) through 5 (FY22) – all projects eligible for programming	Winter – Update pavement database Spring – Annual HPMS survey (2/5)	
2019		Winter – Update pavement database Spring – Annual HPMS survey (3/5) Summer – 2020 Needs Assessment	
2020	Subject to annual capacity, annual obligation plan	Winter – Update pavement database Spring – Annual HPMS survey (4/5)	
2021	CMAAs and MTC work to program evenly through year 5	Winter – Update pavement database Spring – Annual HPMS survey (5/5) Summer – 2022 Needs Assessment	

# OBAG 2 Contact Information

## OBAG 2 County Programs:

County Congestion Management Agencies (CMAs)

<http://mtc.ca.gov/about-mtc/what-mtc/partner-agencies/congestion-management-agencies>

## OBAG 2 Program Management:

Mallory Atkinson

[matkinson@mtc.ca.gov](mailto:matkinson@mtc.ca.gov)

(415) 778-6793