Transportation Planning in the Face of Extreme Weather and Climate Impacts

2017 Resiliency Peer Exchange on Extreme Weather and Climate Impacts

November 6th and 7th, 2017
Washington DC

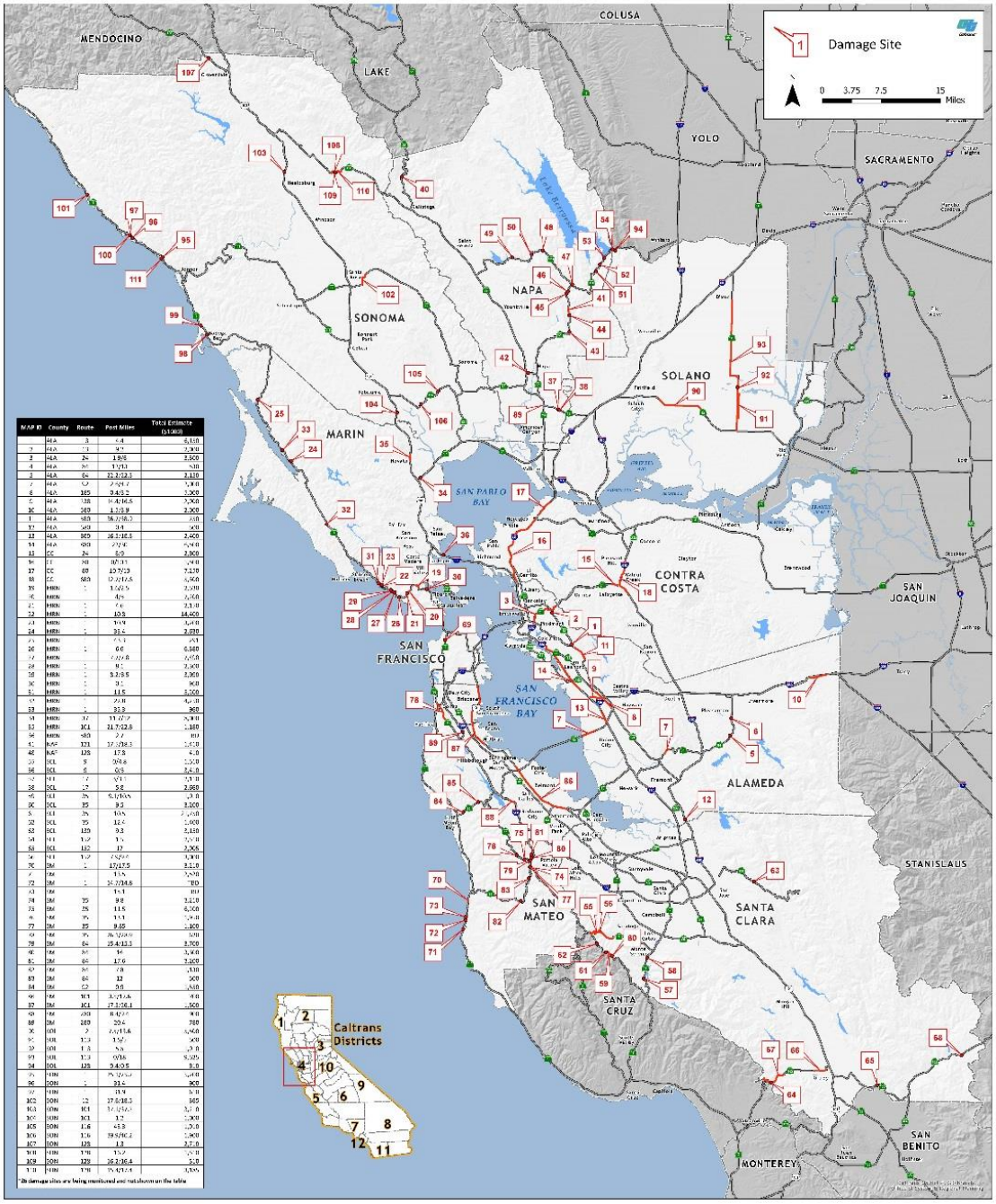
Chris Schmidt

Division Chief
Division of Transportation Planning

Caltrans

BAY AREA STORM DAMAGE SITES 2017

110 Locations and Over $250 Million to Date



MAP ID	County	Route	Post Miles	Total Estimate ($1000)
	MEN	1	0.4	6,100
2	MEN	1	9.4	3,300
3	MEN	24	1.8/6	3,500
4	MEN	37	1.7/3.1	500
5	MEN	80	12.2/12.3	3,120
6	MEN	101	2.4/4.2	3,300
8	MEN	101	9.4/9.5	3,300
9	MEN	116	16.4/16.5	3,300
10	MEN	580	1.2/3.9	3,300
11	MEN	580	16.7/16.9	500
12	MEN	580	0.4	500
13	MEN	580	16.2/16.5	2,400
14	MEN	580	17/19	5,500
15	CC	24	0.9	3,300
16	CC	80	10/11	2,500
17	CC	80	10.7/13	7,250
18	CC	580	12.2/12.5	5,500
19	MEN	:	1.5/2.5	2,200
20	MEN	:	4/5	3,300
21	MEN	:	7.6	3,300
22	MEN	:	10.3	14,400
23	MEN	:	10.9	3,300
24	MEN	:	11.4	2,200
25	MEN	:	11.3	500
26	MEN	:	0.6	6,380
27	MEN	:	7.2/7.8	2,500
28	MEN	:	8.1	2,300
29	MEN	:	9.2/9.5	2,300
30	MEN	:	0.1	900
31	MEN	:	11.5	3,500
32	MEN	:	20.8	4,200
33	MEN	:	21.9	900
34	MEN	37	11.7/12	5,300
35	MEN	101	21.7/22.8	2,400
36	MEN	580	2.2	800
37	NAP	121	17.7/18.3	2,500
38	NAP	128	17.8	6,0
39	SCL	9	0/0.6	1,500
40	SCL	9	0/1	3,600
41	SCL	17	0/1	3,300
42	SCL	17	5.8	2,900
43	SCL	35	6.1/6.5	500
44	SCL	35	9.2	3,300
45	SCL	35	10.5	2,400
46	SCL	35	12.4	1,900
47	SCL	129	0.2	2,100
48	SCL	152	1.5	2,300
49	SCL	152	17	3,005
50	SCL	152	23/25	3,300
51	SM	1	17/17.5	2,100
52	SM	1	19.5	3,500
53	SM	1	24.7/24.8	700
54	SM	35	0.2	900
55	SM	35	3.1	3,100
56	SM	35	11.5	6,300
57	SM	35	13.1	2,400
58	SM	35	9.85	1,800
59	SM	35	26.7/26.9	500
60	SM	84	15.4/15.5	3,700
61	SM	84	16	3,400
62	SM	84	17.6	3,200
63	SM	84	2.8	1,100
64	SM	84	12	500
65	SM	92	0.8	1,500
66	SM	101	3.7/3.8	900
67	SM	101	17.2/18.1	1,500
68	SM	101	0.2/0.7	900
69	SM	280	20.4	700
70	SON	1	7.7/13.6	1,400
71	SON	12	1.7/2	500
72	SON	12	5.8	1,0
73	SON	101	0/0.6	9,500
74	SON	121	9.4/10.6	8,0
75	SON	1	24.7/25.3	1,4
76	SON	1	33.4	900
77	SON	1	0.9	1,0
78	SON	12	17.0/18.3	900
79	SON	101	31.7/34.7	3,0
80	SON	101	1.2	1,200
81	SON	116	4.8.3	1,0
82	SON	116	19.5/19.2	1,900
83	SON	121	1.3	3,7,0
84	SON	121	13.7	1,0
85	SON	121	16.2/16.4	5,0
86	SON	121	19.4/19.6	3,5

*26 damage sites are being monitored and not shown on the table

Climate Change Impacts

Climate Change Impacts


MUD CREEK SLIDE
(MON PM 8.8)

Climate Change Legislation

Senate Bill 1

- Support planning actions at local and regional levels that advance climate change adaptation efforts on the transportation system.
- $20 Million over 3 years

Senate Bill 2800

- Climate Safe Infrastructure Working Group to integrate climate change impacts into state infrastructure engineering

Senate Bill 246

- Established Integrated Climate Adaptation and Resiliency Program

Coordination for Climate Change

- Caltrans
- Community
- Local & Regional Government
- Research Universities
- Non-Government Agencies
- Regulatory Agencies

Plan for Improved Agency Partnering

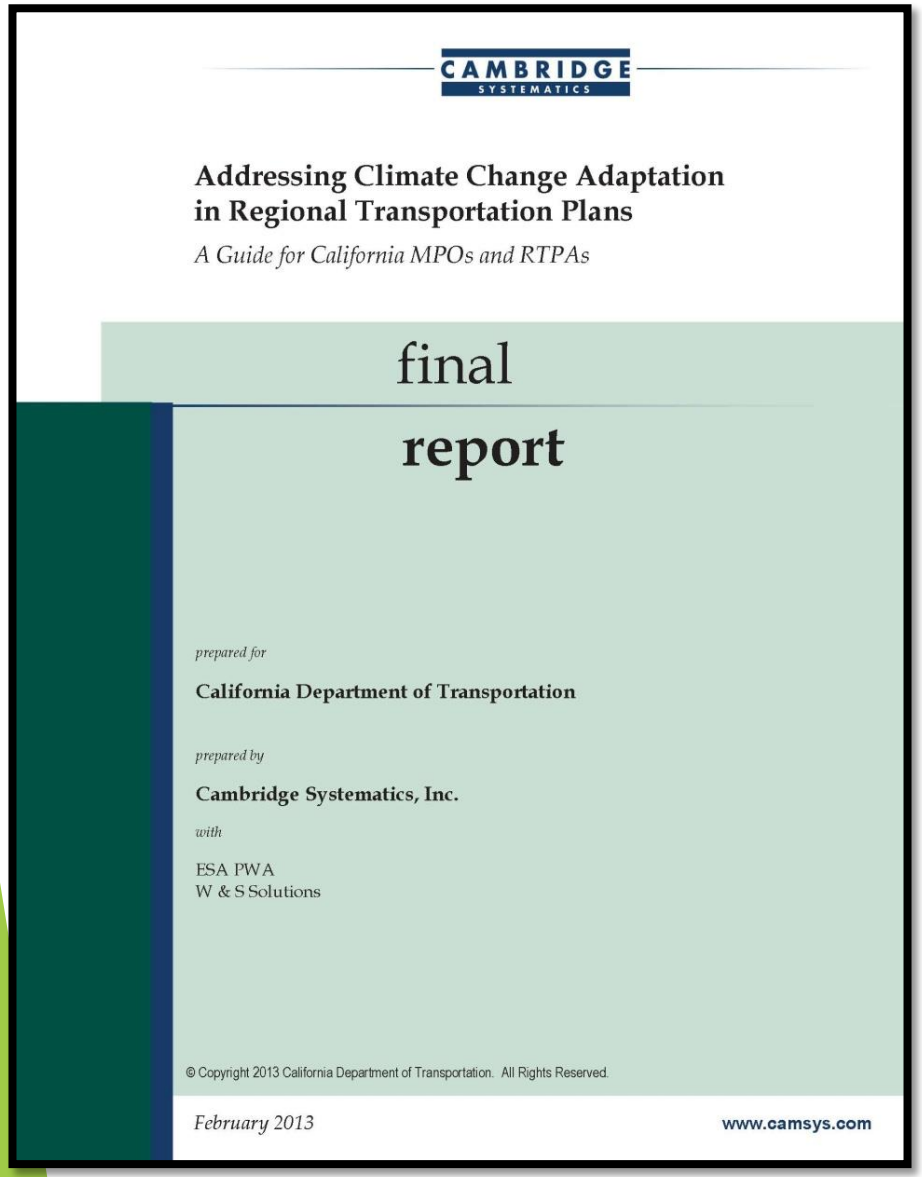
Caltrans & California Coastal Commission

Prepared by the Integrated Planning Team

December 21, 2016

First Edition

Caltrans' Climate Change Guidance


CAMBRIDGE SYSTEMATICS

Addressing Climate Change Adaptation in Regional Transportation Plans

A Guide for California MPOs and RTPAs

final

report

prepared for

California Department of Transportation

prepared by

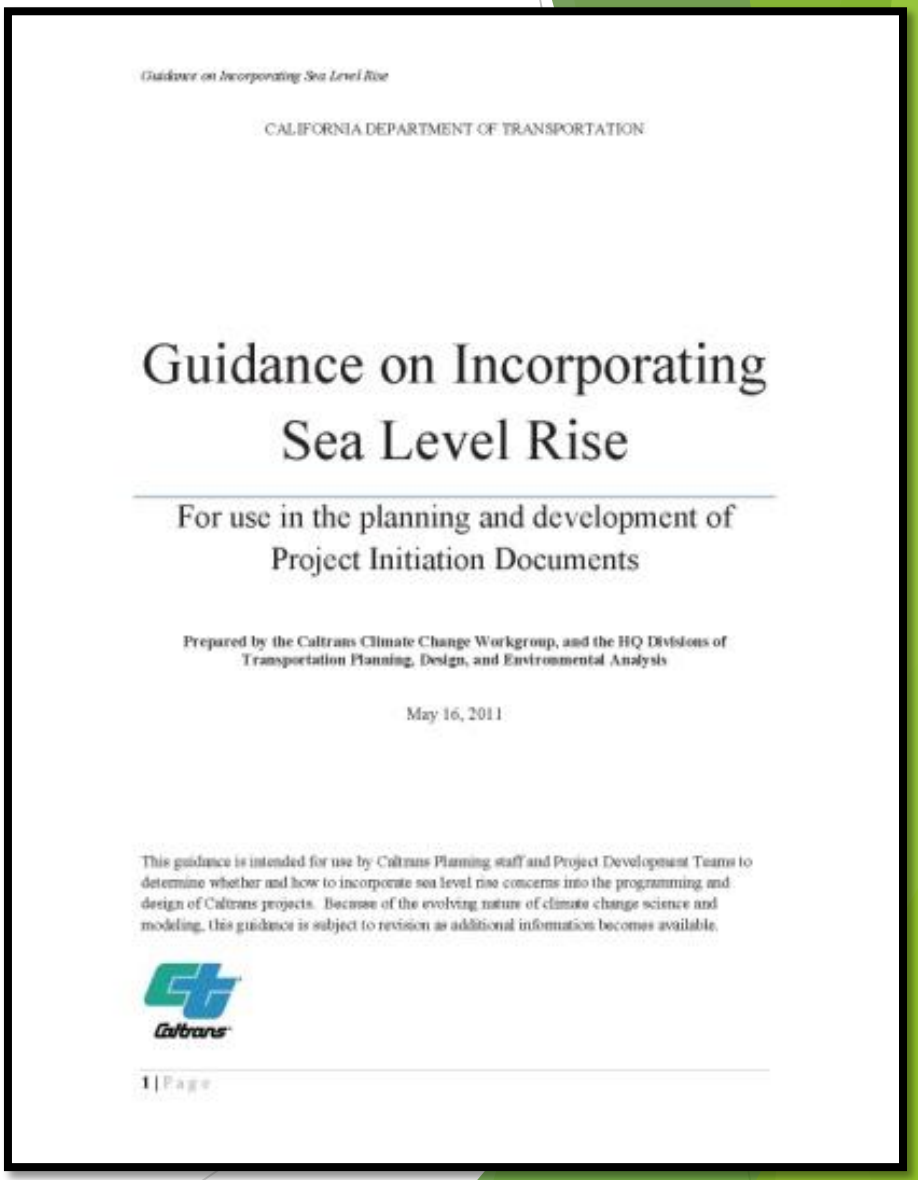
Cambridge Systematics, Inc.

with

ESA PWA
W & S Solutions

February 2013

www.camsys.com



CALIFORNIA DEPARTMENT OF TRANSPORTATION

Guidance on Incorporating Sea Level Rise

For use in the planning and development of Project Initiation Documents

Prepared by the Caltrans Climate Change Workgroup, and the HQ Divisions of Transportation Planning, Design, and Environmental Analysis

May 16, 2011

This guidance is intended for use by Caltrans Planning staff and Project Development Teams to determine whether and how to incorporate sea level rise concerns into the programming and design of Caltrans projects. Because of the evolving nature of climate change science and modeling, this guidance is subject to revision as additional information becomes available.

Caltrans

Adaptation Steps

CALTRANS CLIMATE CHANGE

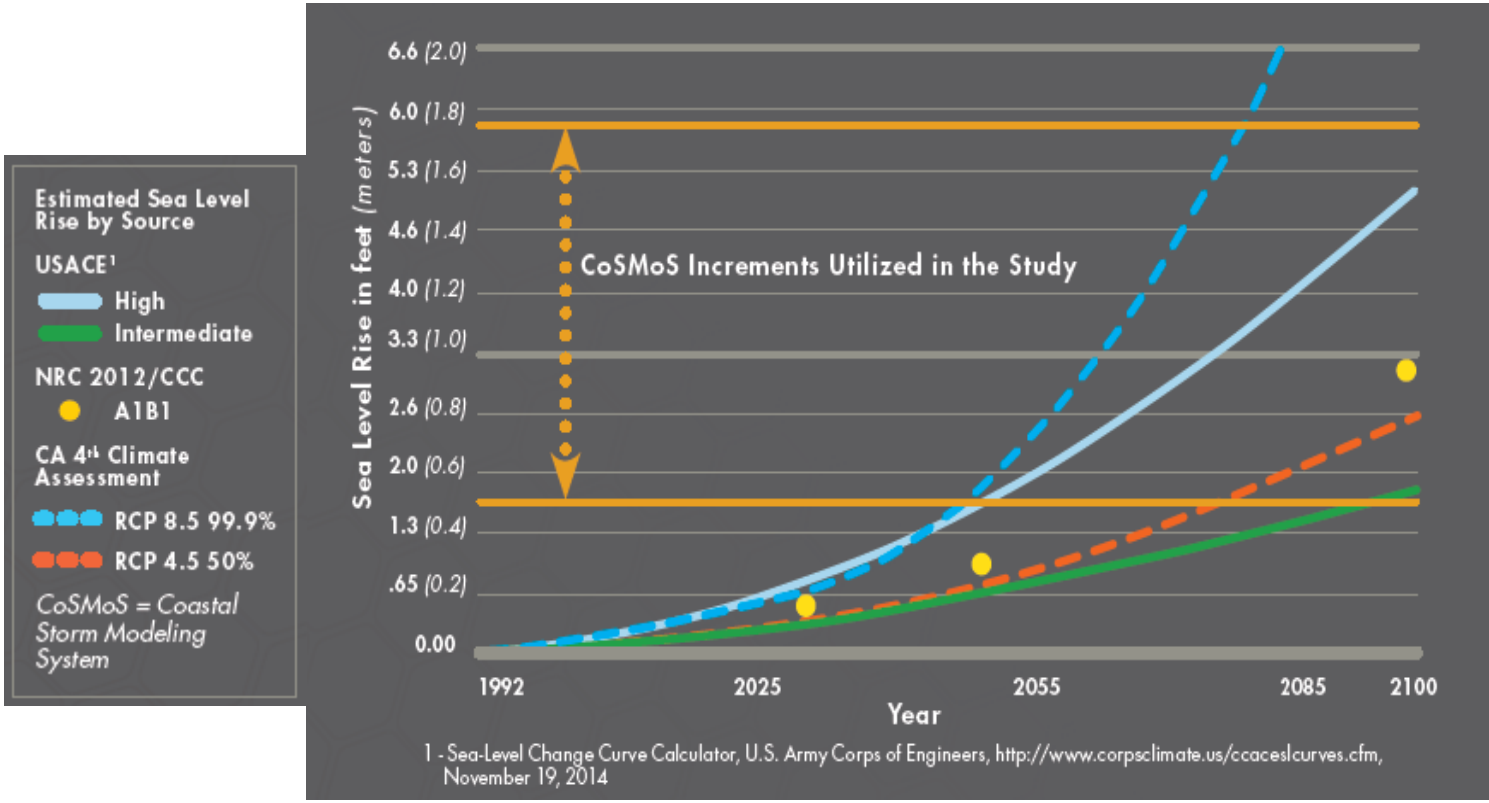
VULNERABILITY ASSESSMENT

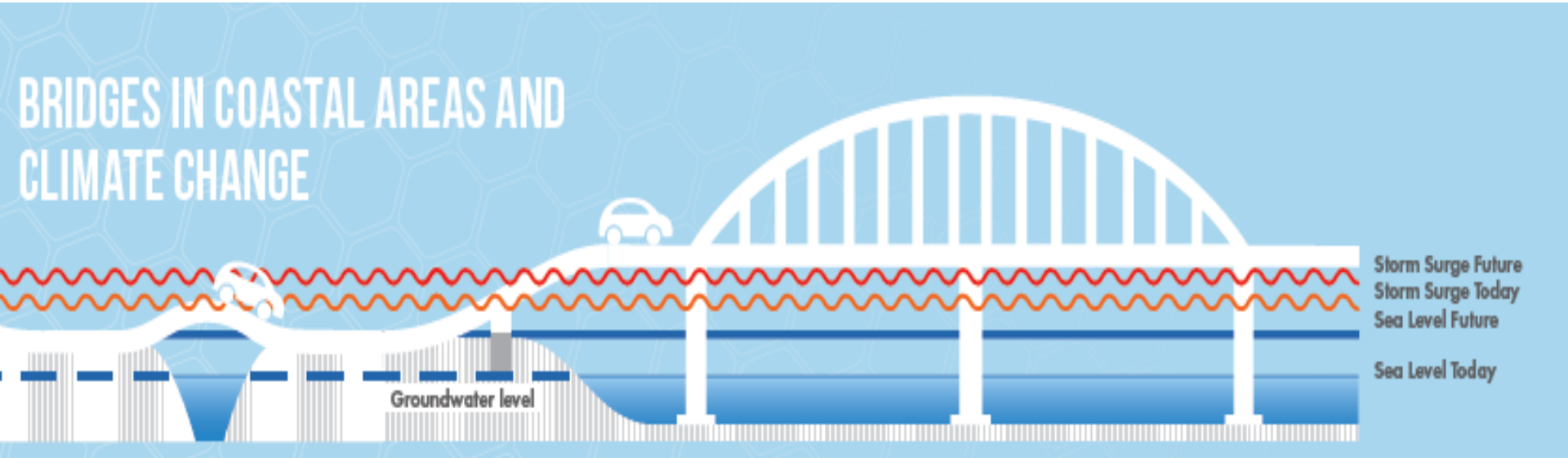
DISTRICT 4

2017

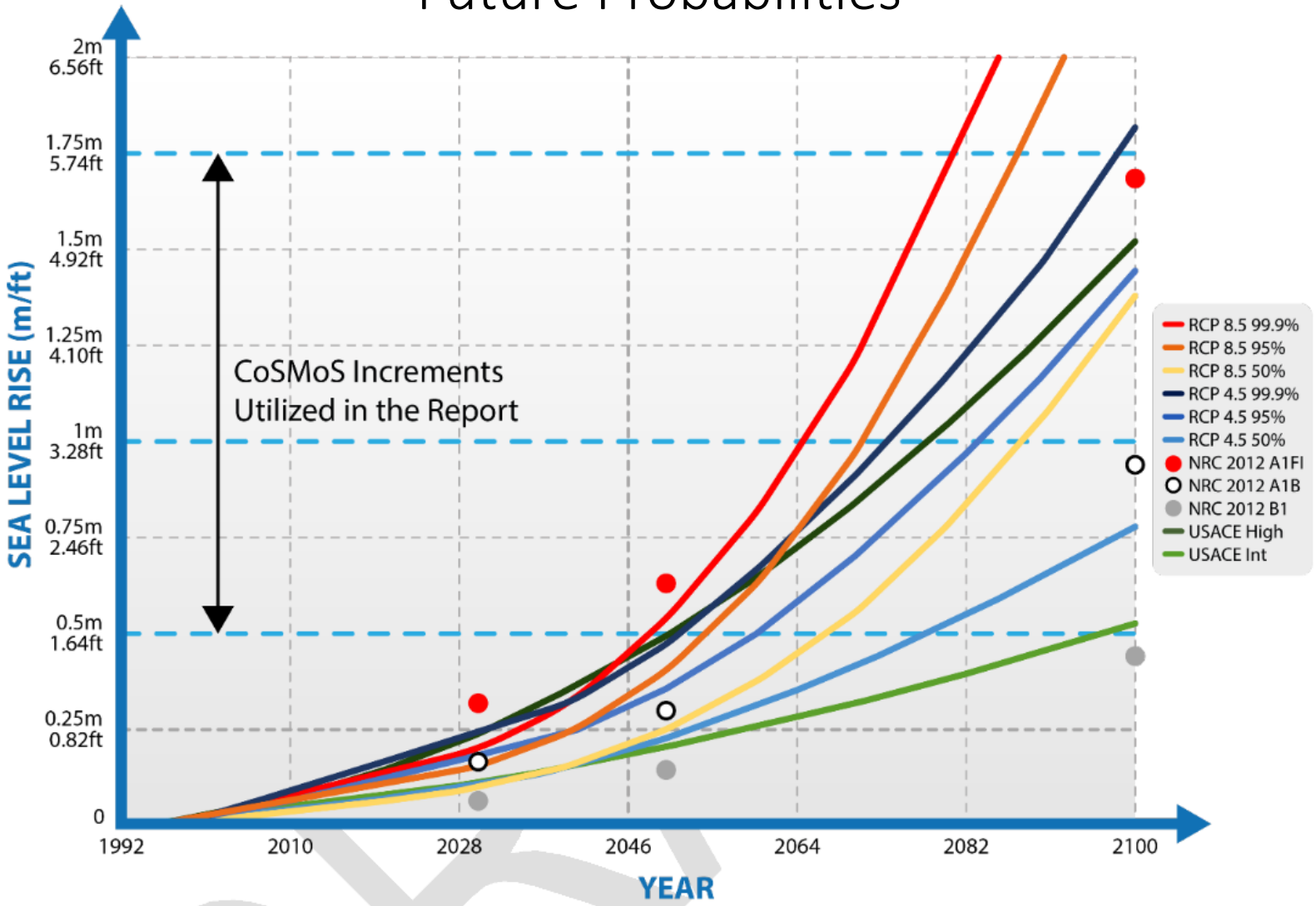
Caltrans | WSP | PARSONS BRINCKERHOFF

Sea Level Rise Impacts





Planning Before Emergencies – Vulnerability Assessment Future Probabilities



Notes:

Data represented are averaged from six gauges, except for B1 and A1FI which are estimates developed using only one gauge. All SLR scenarios are estimates based upon existing datasets and a number of assumptions given vertical land movement and rates of SLR. Each dataset has been manipulated to a base year of 1992 for comparison.

Fig. 7

STORM SURGE EXAMPLE

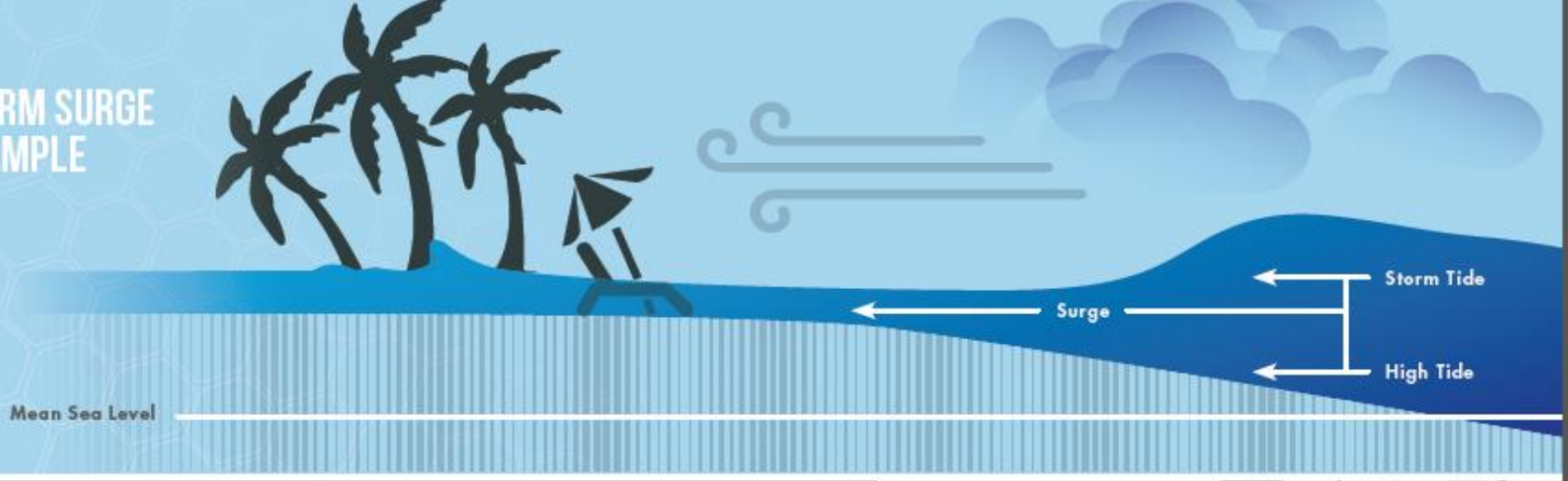


Fig.8

ROADS EXPOSED TO HIGHER RISK OF SEA LEVEL RISE

STORM SURGE

Roads at Risk of Flooding Due to Sea Level Rise and Storm Surge, San Francisco Bay Area. 3.28 ft (1 meter) Sea Level Rise 100-year Storm Surge

FLOODED BAYSHORE ROAD HIGHWAY 37

FLOODED BRIDGE ACCESS I-80 IN OAKLAND

ERODING COASTAL ROAD HIGHWAY 1 AT GLEASON BEACH

Fig. 9

INCREASED LIKELIHOOD OF WILDFIRES

HWY 29

HWY 128

I-505

HWY 130

Levels of Concern

- VERY HIGH
- HIGH
- MEDIUM
- Exposed Roadway

2025

2055

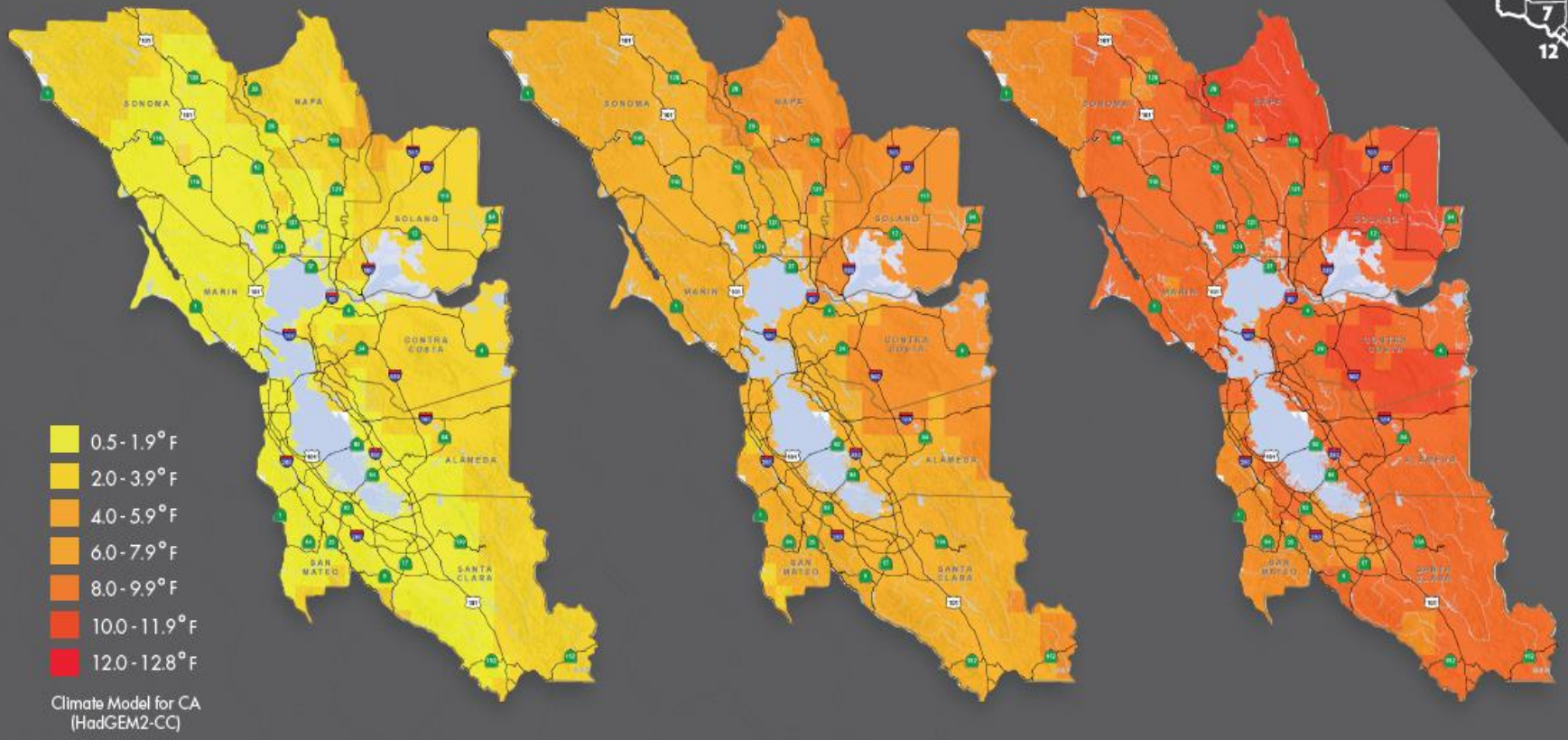
2085

Increased Likelihood of Caltrans State Highway System Exposed to Wildfires within District 4 in Future Years

Fig.1

CHANGE IN AVERAGE MAXIMUM TEMPERATURE

A REQUIRED MEASURE FOR PAVEMENT DESIGN



2025 REPRESENTATIVE CONCENTRATION PATHWAYS (RCP) 8.5, 50TH PERCENTILE[1]

2055 REPRESENTATIVE CONCENTRATION PATHWAYS (RCP) 8.5, 50TH PERCENTILE[1]

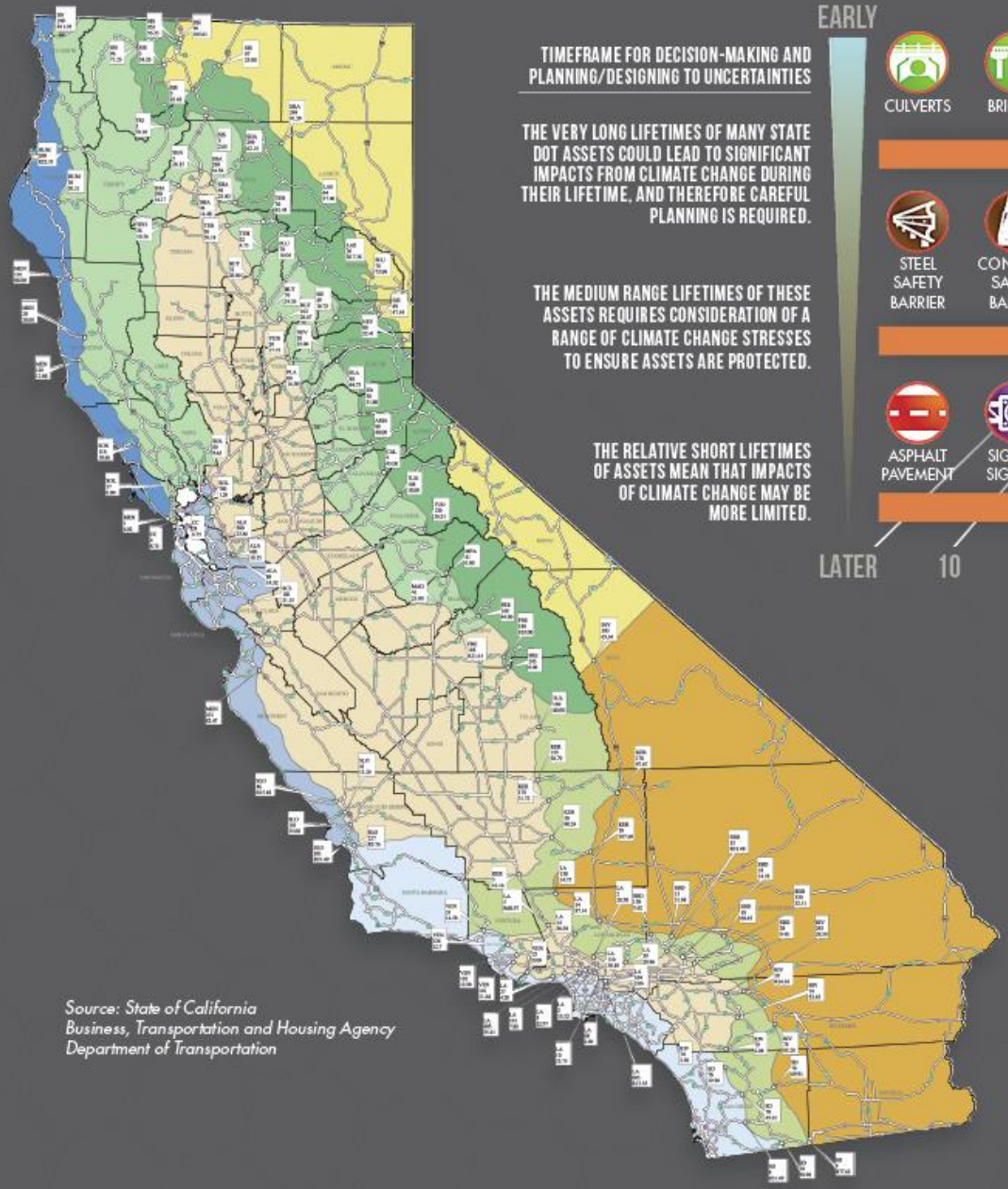
2085 REPRESENTATIVE CONCENTRATION PATHWAYS (RCP) 8.5, 50TH PERCENTILE[1]

Change in Average 7-day Maximum Temperature, Worst Case Scenario for Future Greenhouse Gas Emission Concentrations, 2025, 2055, and 2085

Caltrans Transpotation Asset Vulnerability Study, District 4. Caltrans No. 74A0737. Climate data provided by the Scripps Institution of Oceanography. The data shown were generated by downscaling global climate outputs using the Localized Constructed Analogs (LOCA) technique.

Fig. 2

CALTRANS PAVEMENT REGIONS

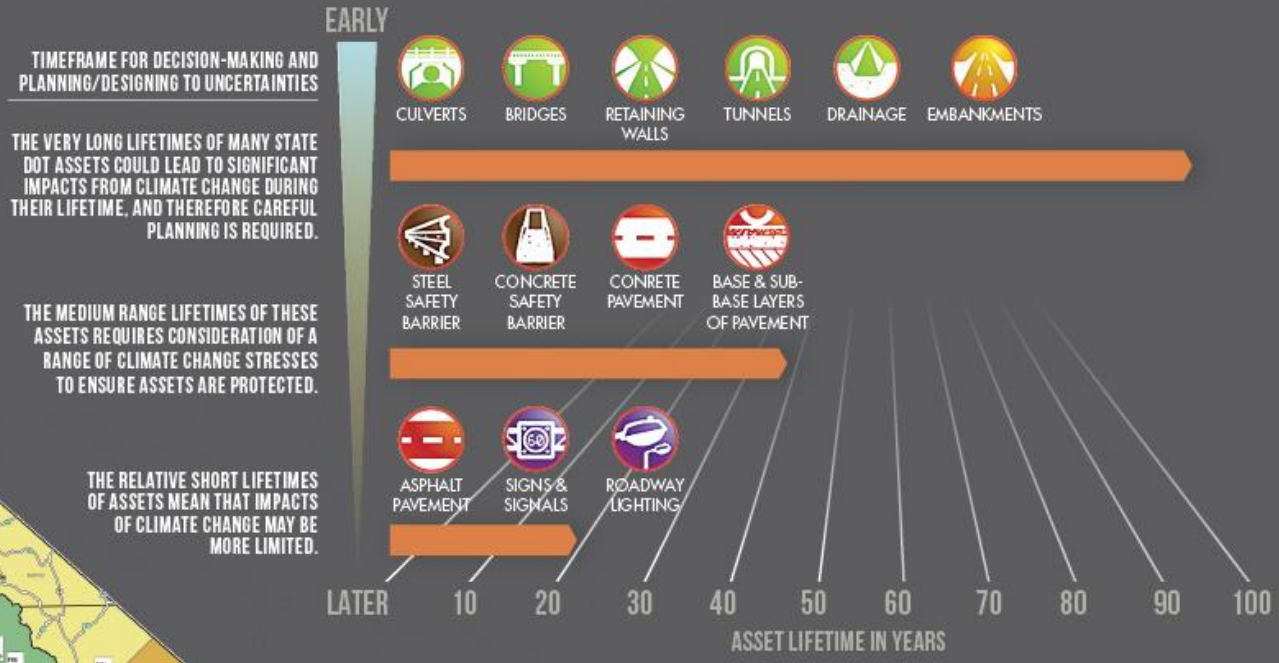


Source: State of California
Business, Transportation and Housing Agency
Department of Transportation

Fig. 3

TIMEFRAME FOR DECISION MAKING

TRANSPORTATION INFRASTRUCTURE ASSETS



THE DESIGN LIFE (OR "USEFUL LIFE") OF TRANSPORTATION INFRASTRUCTURE IS THE ESTIMATED REMAINING TIME THAT AN ASSET WILL BE IN SERVICE.

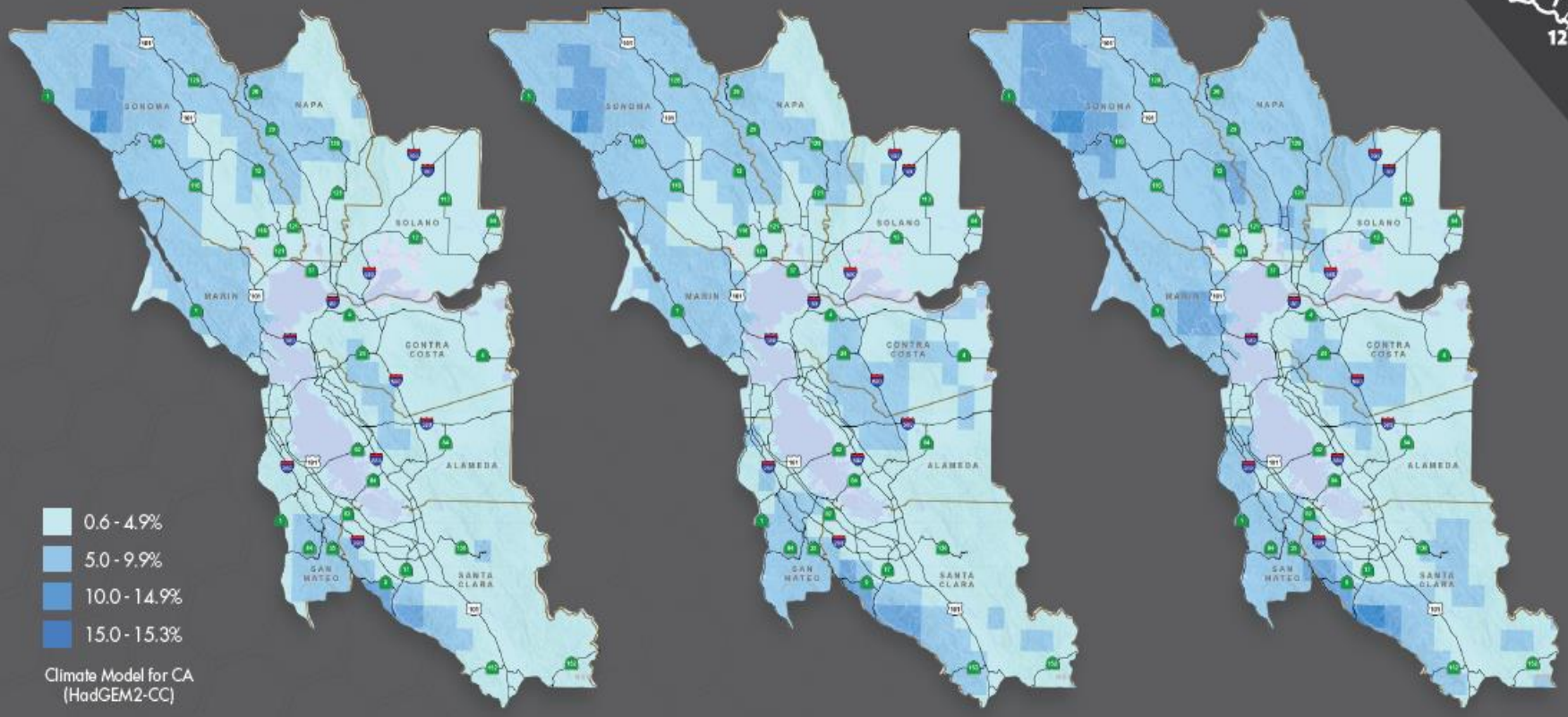
Transportation assets have differing periods of useful life once put in place. These timeframes should be a factor when planning In areas with identified climate change concerns. Roadway alignments and embankments could be in place for a century or beyond, while other assets would have a less or much less useful life.

- North Coast
- Central Coast
- Inland Valley
- Low Mountain
- High Mountain
- Desert
- High Desert
- South Coast
- South Mountain

Note: Markers indicate County/Route/Post Mile of State Hwys. at region boundaries. When there is no marker, the region follows a county boundary.

Fig. 4

CHANGE IN 100-YEAR STORM PRECIPITATION DEPTH



2025 RCP 8.5, 50TH PERCENTILE

2055 RCP 8.5, 50TH PERCENTILE

2085 RCP 8.5, 50TH PERCENTILE

Percent Change in 100-year Storm Precipitation Depth, Worst Case Scenario for Future Greenhouse Gas Emission Concentrations, Caltrans District 4, 2025, 2055, and 2085

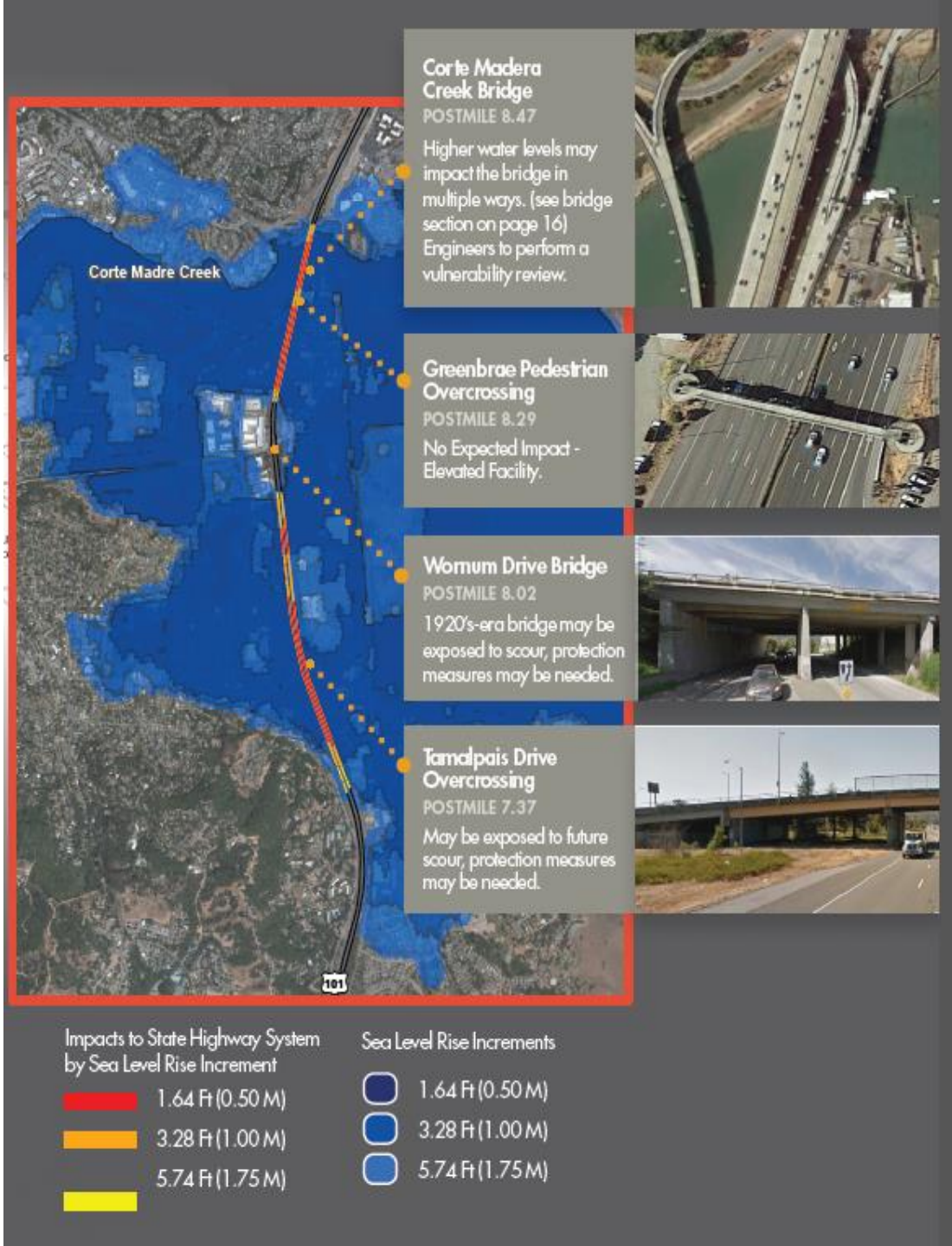
District Adaptation Reports

Asset-level assessments

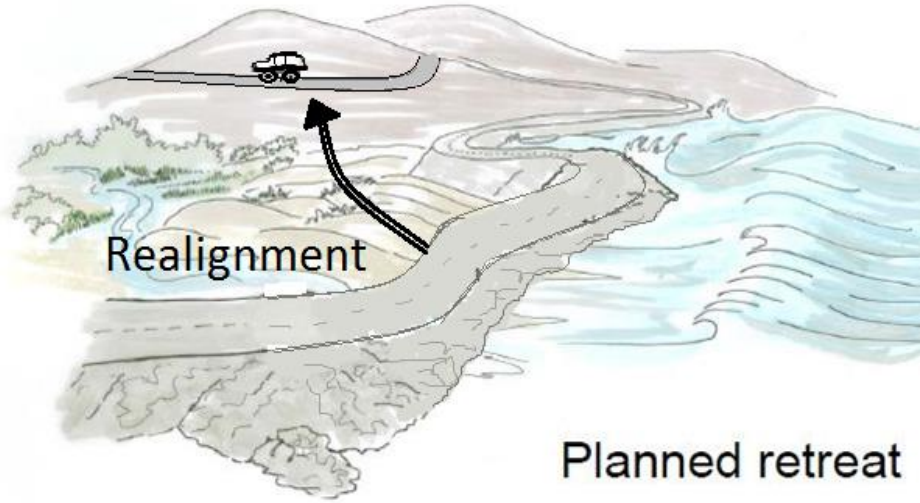
- "What would it take" approach
- Develop Facility Management Plans'

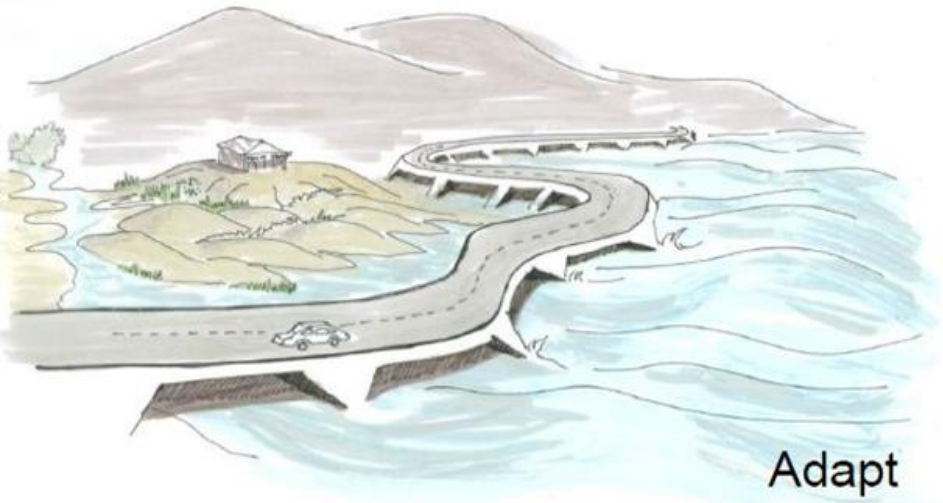
Local and Regional Coordination

- Develop complementary practices



Project Options

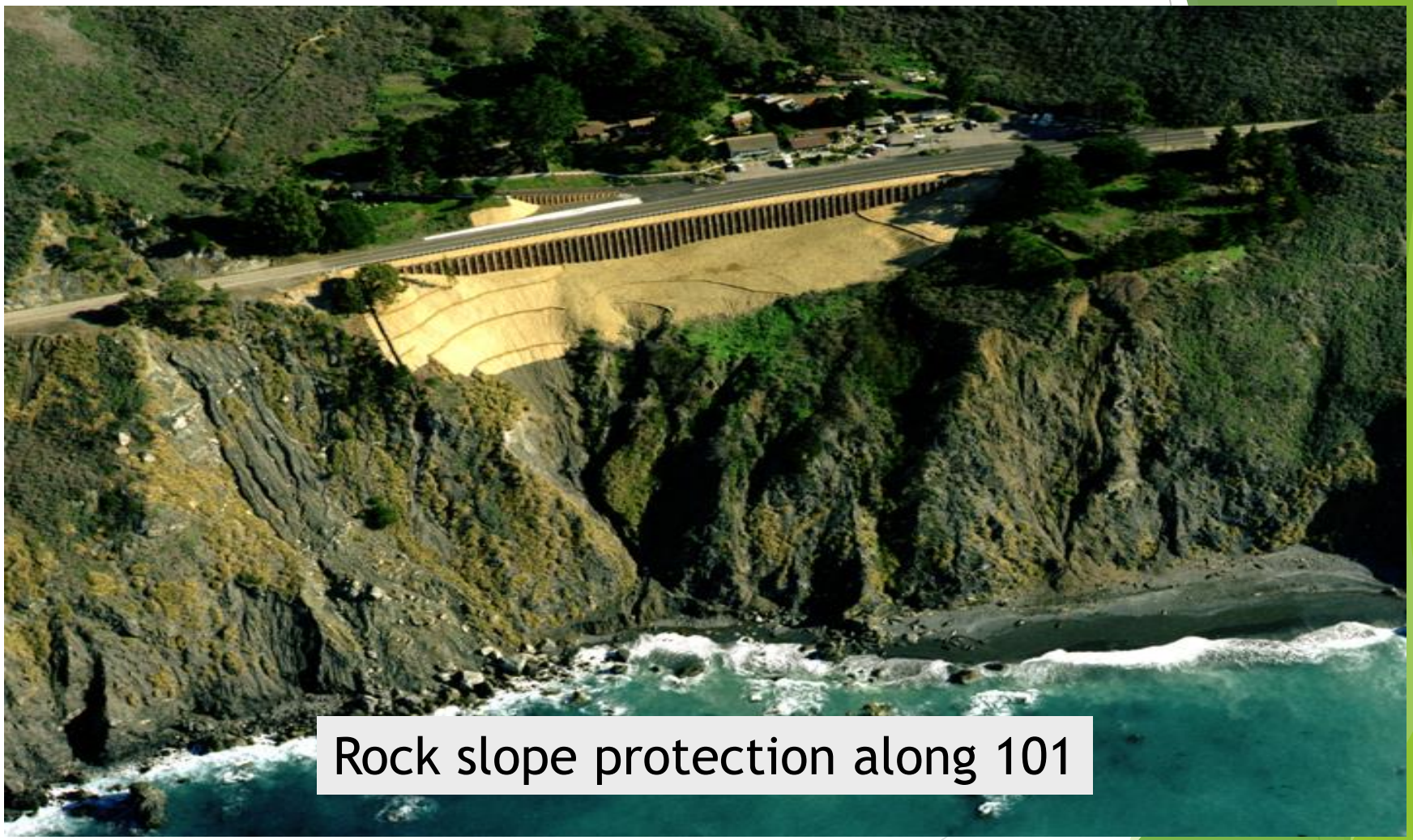




Representative Damages

Major erosion event along 101

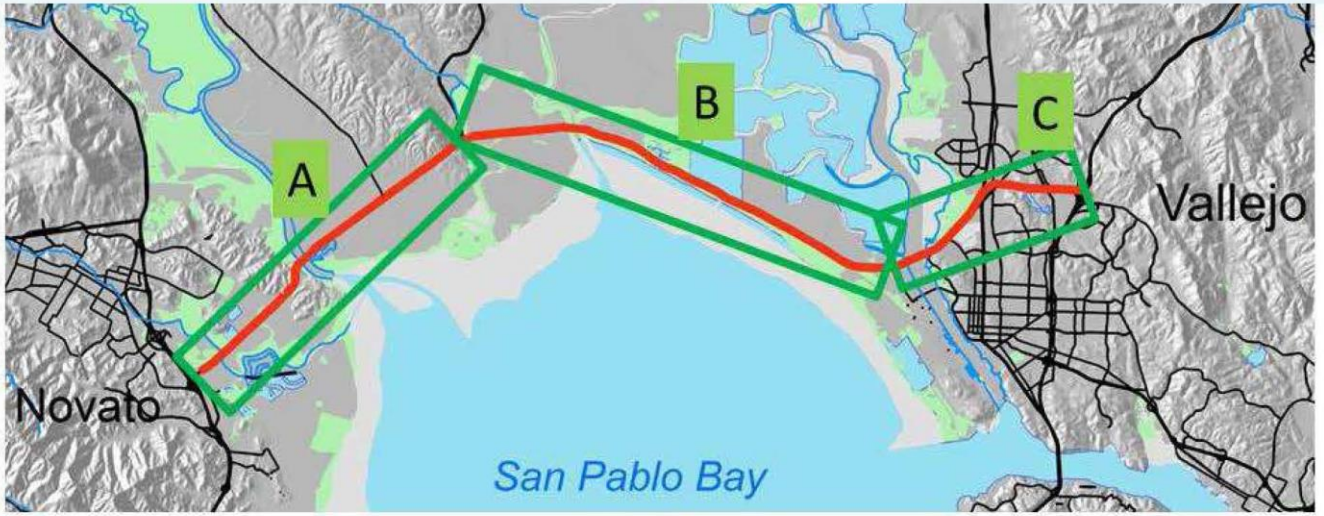
Defend



Rock slope protection along 101

State Route 37 Corridor Segments

- Segment A – freeway/expressway between SR 101 and SR 121 - (4-lanes)
- Segment B – freeway/expressway between SR 121 and Mare Island (highest immediate risk of seal level rise) – (2-lanes and 4-lanes segments)
- Segment C – freeway between Mare Island and Interstate 80 - (4-lanes)



Representative Damages

SR 37 Looking North Aerial at Freeway, Basins, and Novato Creek Bridges January 2017

Flooding and SLR Solutions

Near-term to Long-term Solutions

Drainage Improvements

Shoreline Improvements

Levee Improvements

Raise Roadway

Natural Adaptation Solutions

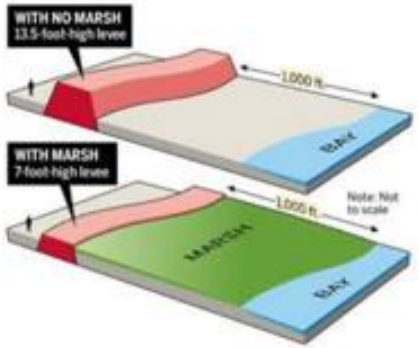
Scale of Action

Small-scale Wetland Restoration

- Mitigate impacts of roadway widening
- Moderate wave attenuation
- Minor habitat improvements

Living Levee (mild, natural slope)

- Allows for habitat transition
- Reduces wave runup
- Lessen or eliminate need for armoring



Elevate Roadway on Causeway

- Increase hydrological connectivity
- Restore large contiguous parcels
- Help meet bay-wide environmental goals
- Moderate wave attenuation


Climate Risk
Environment Impacts
Risk Management Plan
Facility Traits
Community Context

THANK YOU

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