# High-Speed Rail

## International, USA and California

*NORTHWEST CORRIDOR RAIL SUMMIT*

*By*

*Hon. Rod Diridon Sr.*

*Chair*
*Intercity and High Speed Rail Committee*
*American Public Transit Association*

*Member/Chair Emeritus*
*California High Speed Rail Authority Board*

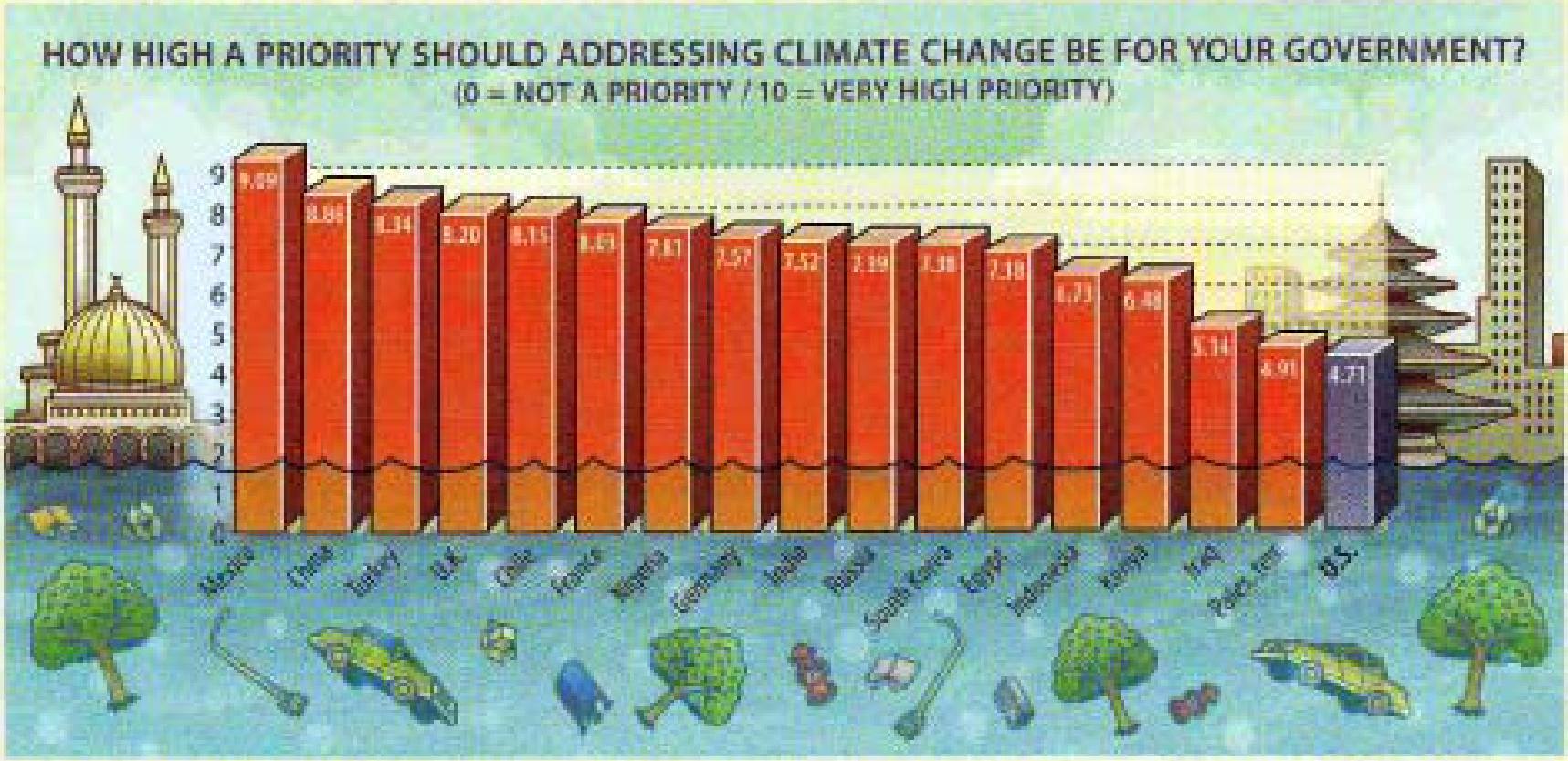
* *

Created by Mineta Transportation Institute

MTI

# WHAT, US WORRY?

U.S. representatives to the United Nations climate-change conference in Copenhagen may want to go incognito. It now appears unlikely that the Senate will pass a strong climate-protection bill in time for the pivotal December summit. Moreover, the slacker mentality that grips Congress extends to the general populace: A survey of 19 countries by the University of Maryland's Program on International Policy Attitudes finds that Americans rank dead last when it comes to backing action on climate change. Most other nations show strong popular support for tough government action. Despite Britain's already substantial efforts, 77 percent of Britons think their government should do even more. At the opposite end of the spectrum, only the residents of the Palestinian territories and Iraq are as lackadaisical as us. —*Paul Rauber*



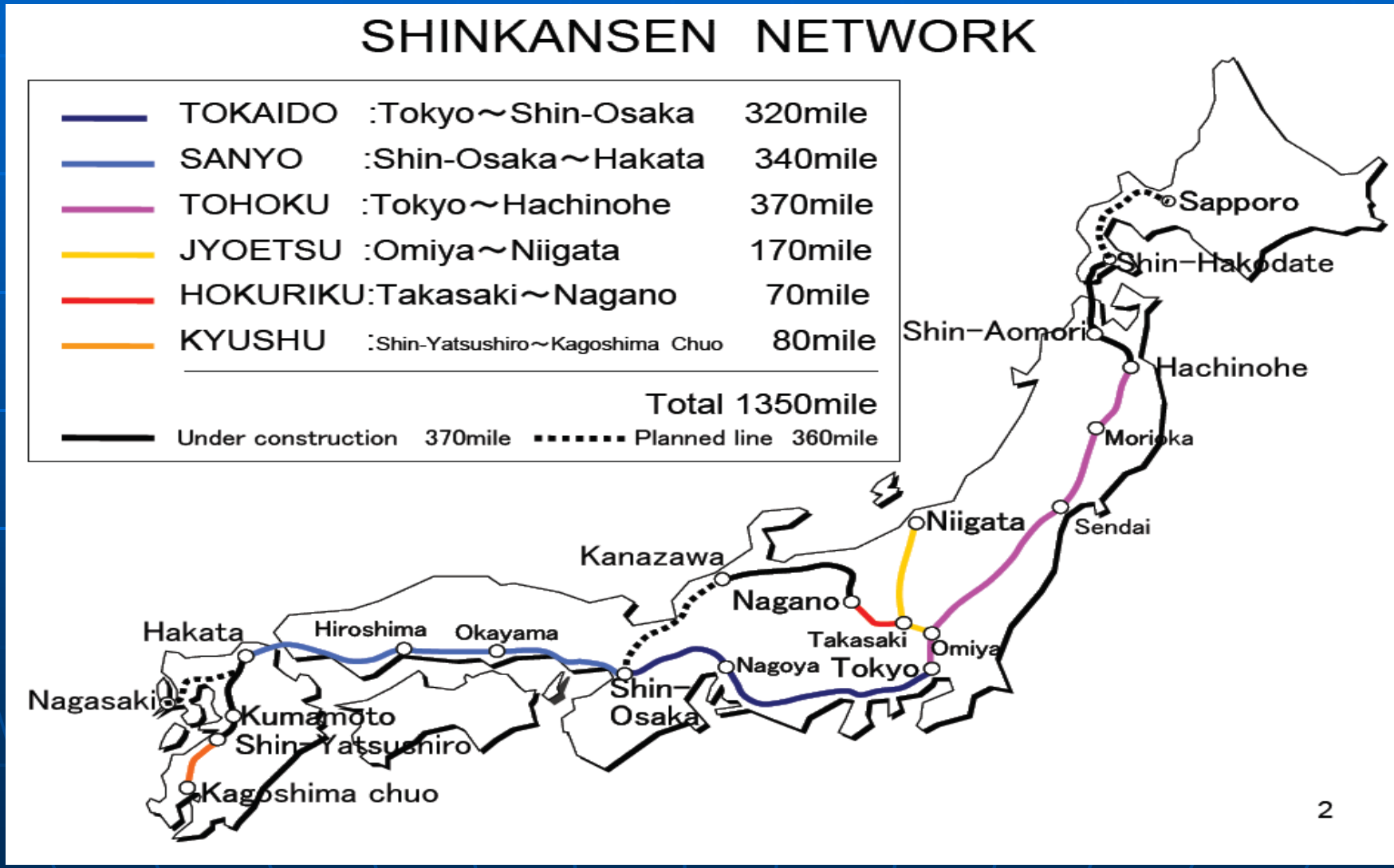
# High Speed Rail System in Asian Countries

- Korea: KTX
- Japan : Shinkansen
- Taiwan: HSR 700T
- China: CRH Systems

# High Speed Rail in Japan
# Shinkansen System

- Opened in 1964
- Total Service Mileage: 1,350 miles
- Operated by 4 Japan Railway Companies
- Total Fleet approx. 4,000 cars
- Max. 12 Trains during peak hour
- 300 km/h operation

# High Speed Rail in Japan
# Route Map




Sapporo
Hakodate
Aomori
Hachinohe
Akita
Morioka
Shinjo
Yamagata
Fukushima
Niigata
Nagano
Kanazawa
Takasaki
Omiya
Tokyo
Nagoya
Okayama
Osaka
Hakata
Nagasaki
Kagoshima
Japan

# High Speed Rail in Japan

- Shinkansen System: The most frequent service in the world.
- Helped local cities to grow.
- Initial construction cost paid off in 7 years of revenue service.
- Show competitiveness to airlines up to around 600 miles distance.

# High Speed Rail in Japan
# New Train set N700 Series

# High Speed Rail in Korea
# KTX

- Korean High Speed Rail:

- Between Seoul and Busan
  - TGV based design.
  - Total 46 train sets:
    - 12 trains by Alstom
    - 34 trains by Hyundai-Rotem
    - Max Speed: 300 km/h


Seoul
Chonan
Taejon
Taegu
Kyongju
Pusan
Korea

# High Speed Rail in Korea
# Original KTX

- First KTX by Alstom Design

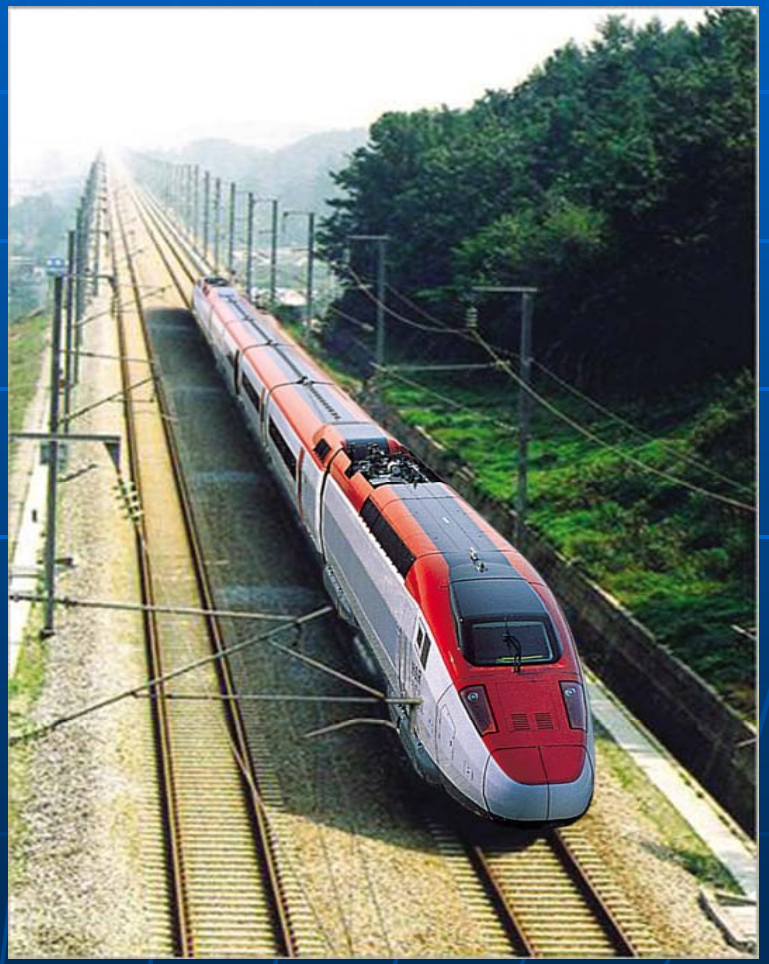
# High Speed Rail in Korea

- New Vehicle Development by Korean Car Builder, Hyundai-Rotem

- KTX-350
  - Max. Speed: 350 km/h

Prototype car under running test.

# High Speed Rail in Korea
# New KTX-350

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# High Speed Rail in Taiwan

- Opened: January 5, 2007
- Total length: 345 km
- Max Speed: 300 km/h
- 12 car trains, total 30 train sets

# High Speed Rail in Taiwan
# Route Map


Created by Mineta Transportation Institute

# High Speed Rail in Taiwan
# HSR 700T Series


Created by Mineta Transportation Institute

# High Speed Rail in China

- Mid to Long Range Rail Transportation Improvement Plan is on-going.

  200 – 250 km/h Lines: Mostly dedicated for passenger services.

  350 km/h Lines: Dedicated for passenger services

# High Speed Rail in China Route Map


Created by Mineta Transportation Institute


Harbin
Shenyang
Beijing
Tianjin
Jinan
Xian
Zhengzhou
Xuzhou
Nanjing
Shanghai
Wuhan
Changsha
Zhuzhou
Taipei
Kaohsiung
Guangzhou
Shenzen
China

# High Speed Rail System in China
# CRH-1 by Bombardier

# High Speed Rail System in China
# CRH-2 by Kawasaki


Created by Mineta Transportation Institute

# High Speed Rail in China
# CRH-3 by Siemens

# High Speed Rail in China
# CRH-5 by Alstom


CRH
和谐号

# High Speed Rail Systems in Asian Countries

- Long term commitment by government for infrastructure development
- Environmentally friendly system
- Higher passenger carrying capacity than any other transportation modes
- Economical growth of local cities along line

# European HSR

**Major players:**

- Spain
- France
- Germany
- Italy

**Other countries with HSR:**

- Holland
- Belgium
- England

| | | | |
|---|---|---|---|
| Units: | 200 kph | - | 125 mph |
| | 250 kph | - | 155 mph |
| | 300 kph | - | 186 mph |
| | 350 kph | - | 217 mph |


Legend: (05/2008)
320 - 350 km/h
300 km/h
250 km/h
200 - 230 km/h
< 200 km/h
Sundsvall
Tampere
Lahti
Turku
Helsinki
Sankt-Peterburg
Bergen
Oslo
Uppsala
Stockholm
Tallinn
Stavanger
Linköping
Moskva
Kristiansand
Göteborg
Riga
Glasgow
Smolensk
Arhus
Malmö
Kobenhavn
Vilnius
Belfast
Kaliningrad
Minsk
Br'ansk
Dublin
Manchester
Liverpool
Leeds
Gdansk
Kursk
Cork
Hamburg
Bremen
Poznan
Warzawa
Char'kov
Birmingham
Amsterdam
Berlin
Kijev
Bristol
Rotterdam
Hannover
Dnepropetrovsk
Doneck
London
Antwerpen
Leipzig
Wroclaw
Essen
Bruxelles
Dresden
Katowice
L'vov
Rostov
Köln
Lille
Liège
Praha
Ostrava
Krakow
Le Havre
Frankfurt
Nürnberg
Rouen
Mannheim
Brno
Brest
Stuttgart
Paris
Strasbourg
Bratislava
Kisin'ov
Odessa
Rennes
Le Mans
München
Wien
Budapest
Cluj-Napoca
Nantes
Dijon
Salzburg
Innsbruck
Basel
Graz
Tours
Bern
Zürich
Brasov
Sevastopol
Genève
Ljubljana
Zagreb
Lyon
Constanta
Bucuresti
Torino
Milano
Verona
Clermont-
Ferrand
Venezia
Beograd
Bordeaux
Varna
Genova
Bologna
Sarajevo
Vigo
Bilbao
Montpellier
Split
Sofija
Toulouse
Firenze
Istanbul
Porto
Huesca
Marseille
Nice
Skopje
Ankara
Valladolid
Zaragossa
Roma
Thessaloniki
Barcelona
Tirane
Eskisehir
Madrid
Napoli
Bari
Lissboa
Toledo
Konya
Adana
Valencia
Izmir
Athinai
Sevilla
Cordoba
Alicante
Palermo
Cadiz
Malaga
Catania


Oulu
Oslo
Tampere
Helsinki
St Petersburg
Turku
Tallin
Stockholm
Göteborg
Riga
Vilnius
Moskva
Gdansk
København
Glasgow
Edinburgh
Dublin
Hamburg
Amsterdam
Berlin
Minsk
Bristol
London
Hannover
Poznan
Warszawa
Brux
Köln
Praha
Katowice
Kiev
Luxe
Nürnberg
Paris
Strasbg
Wien
Nantes
München
Zürich
Krakow
Chisinau
Ljubljana
Lyon
Milano
Zagreb
Bordeaux
Torino
Bologna
Beograd
Sarajevo
Coruña
Vitoria
Toulouse
Nice
Bucuresti
Marseille
Sofia
Vigo
Zaragoza
Roma
Istanbul
Porto
Valladolid
Barcelona
Madrid
Napoli
Ankara
Sivas
Bursa
Valencia
Konya
Kayseri
Lisboa
Sevilla
Alicante
Malaga

Europe 2008


Oulu
Tampere
Helsinki
St Petersburg
Turku
Tallin
Oslo
Stockholm
Göteborg
Riga
Glasgow
Edinburgh
Vilnius
Moskva
København
Gdansk
Dublin
Minsk
Hamburg
Amsterdam
Berlin
Hannover
Poznan
Warszawa
Bristol
London
Brux
Köln
Praha
Katowice
Krakow
Kiev
Lux
Ruhr
Nürnberg
Paris
Strasbg
Wien
Bratislava
Budapest
München
Nantes
Zürich
Krakow
Chisinau
Ljubljana
Lyon
Milano
Zagreb
Bordeaux
Torino
Bologna
Beograd
Sarajevo
Bucuresti
Toulouse
Coruña
Vitoria
Nice
Marseille
Sofia
Pristina
Vigo
Zaragoza
Podgorica
Skopje
Roma
Tirana
Istanbul
Porto
Valladolid
Barcelona
Madrid
Napoli
Thessaloniki
Ankara
Sivas
Bursa
Valencia
Lisboa
Sevilla
Alicante
Izmir
Konya
Kayseri
Malaga
Athinai

Europe 2025


# RENFE Spain

## 1st HSR 1992

- **Lines built :**

| | Distance | Trip time | old alignment |
|---|---|---|---|
| • Madrid - Seville: | 472 km | 2hr 15min | 6 hr |
| • Madrid - Barcelona: | 635 km | 2hr 38min | 7 hr |
| • Madrid – Valladolid: | 180 km | 1hr | |
| • Cordoba - Malaga: | 170 km | 1hr | |

- **Under construction**
  - Barcelona Perpignan (French border) 340 km

# Spain: Rolling Stock for >= 300 kph

AVE S 100 →


← AVE S 102

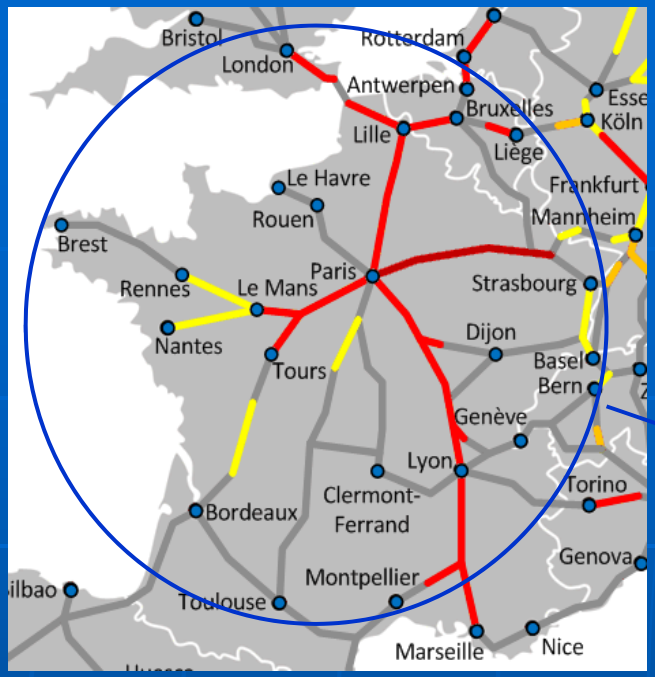
AVE S 103
(ICE-3) →

# Spain: Rolling Stock

## >= 300 kph only

| Type | Design | Vmax | Trains | In Service |
|---|---|---|---|---|
| AVE S 100 | Alstom (TGV) | 300 kph | 18 | 1992 |
| AVE S 102 | Talgo/ Bombardier | 330 kph | 46 | 2001 |
| AVE S 103 | Siemens (ICE-3) | 350 kph | 26 | 2007 |

- Total of **90 trains** capable of running at 300 kph and more.
- **1500 km** high speed tracks in service (2007).
- Planned **2230 km** in service by **2010.**
- HSR separated from existing tracks due to gauge difference. (1435mm instead of 1668mm)




# SNCF France

## 1st HSR 1981

Approximately 3 hrs travel time

| | Distance | Trip time | old |
|---|---|---|---|
| **Lines built : alignment** | | | |
| • Paris - Lyon: | 427 km | 2hr | 3hr 50min |
| • Paris - Tours: | 282 km | 1hr 10min | 2hr 15min |
| • Paris - Calais: | 329 km | 1hr 30min | 3hr |
| • Lyon - Marseille: | 251 km | 1hr 40min | 3hr |
| • Paris - Metz: | 300 km | 1hr 25min | 2hr 45min |
| • Paris - London: | (480 km) | 2hr 15min | 6hr 30min |
| • London – Bruxelles | (~350 km) | 2hr | 5hr |
| **Under construction** | | | |
| • Dijon – Mulhouse | 425km | (2012) | |
| • Metz – Strasbourg | 96 km | (2014) | |
| • Tours – Bordeaux | 303 km | (2015) | |

# France: Rolling Stock for >= 300 kph


TGV - PSE

TGV- Atlantique/Réseau


Thalys fist generation
= TGV Réseau

Designed for international service to Belgium and the Netherlands (Brussels Amsterdam)

# France: Rolling Stock for >= 300 kph

**TGV-2N**

**TGV – EST**

Designed to travel also in Germany and Switzerland on regular tracks

# France: Speed records

- **Long distance**: 1067 km in 3hr 29min → average speed 305 kph! (TGV Réseau: Calais to Marseille May 26; 2001)
- **Top speed:** 574.8 kph (April 3rd; 2007)

**Train-Consist:**

•Two TGV-EST locomotives and two powered Jacobs bogies (AGV).

•12 powered axles of 16 total

•Total power 20 MW!

# Next Generation TGV = AGV

- Major differences:
  - Distributed power (EMU rather than locomotive design)
  - Powered Jacobs-Bogie
  - Reduced axle load
  - Permanent magnet motors (synchronous motors)
  - Improved aero-dynamics
  - More passenger space (no locomotive)

# France Rolling Stock > 300 kph

| Type | Design | Vmax [kph] | Trains | In Service |
|---|---|---|---|---|
| TGV-PSE | Alstom | 270 to 300 | > 100 | 1982 |
| TGV-Atlantique | Alstom | 300 to 320 | > 100 | 1989 |
| TGV-Réseau | Alstom | 320 | 80 | 1995 |
| TGV-Douplex | Alstom | 320 to 350 | ~ 150 | 1996 |
| TGV-EST | Alstom | 320 later 350 | ~ 10 | 2007 |
| Thalys PBA | Alstom | 320 | 10 | 1995 |
| Thalys PBKA | Alstom | 320 | 17 | 1997 |
| Eurostar | Alstom | 300 | 38 | 1993 |
| AGV | Alstom | 360 | 1 Test train | 2008 |

# SNCF France

- More than **500 trains** capable of running at 300 kph and more
- Some of the trains are owned by neighboring countries
- International service
- More than **1500 km** high speed tracks
- Another ~ **900 km** under construction
- HSR sections separated from existing tracks
- All trains capable of running on existing tracks


# DB Germany

## 1st HSR 1991

Most HSR lines are operated at 250 kph

Only lines with max speed 300 kph are listed here

- **Lines built :**
  - Frankfurt - Köln: 177 km
  - Ingolstadt - Nürnberg: 89 km
- **Under construction**
  - Ebensfeld – Erfurt: 122 km
  - München-Leibzig-Berlin planned opening 2017

# Frankfurt - Köln

- High speed trains only
- Grades up to 4%
- Follows the topography
- Ballast less trac
- 300 kph;  IC3

# Germany: Rolling Stock

| Type | Design | Vmax | Trains | In Service |
|---|---|---|---|---|
| ICE-1 | Siemens | 280 kph | 60 | 1982 |
| ICE-2 | Siemens | 280 kph | 44 | 1989 |
| ICE-3 | Siemens | 330 kph | 72 | 2000 |


ICE-2

ICE-3

# Peculiarities of German HSR

- High population density between major cities
- German legal system allows private persons to challenge the proposed alignment
- More effort is put into upgrading existing alignments than new lines
- Upgraded alignments typically allow less than 250 kph due to geographical constraints
- Freight and slower passenger trains run on the same alignment


# FS Italy

## 1st HSR 2005 (300kph)

Italy has an extensive alignment of 200+ kph. It had trains running at 200 to 250 kph starting in the 1970ies.

| **Lines built :** | **Distance** | **Trip time** | **note** |
|---|---|---|---|
| • Roma - Napoli: | 200 km | 1hr 30min | 25 kV |
| • Turin - Novara: | 84 km | | 25 kV |
| • Milano – Treviglio: | 24 km | | 3 kVdc |
| • Padua - Mestre: | 24 km | | 3 kVdc |

- **Under construction**
  - Milano - Bologna - Firenze

# Italy: Rolling Stock

| Type | Design | Vmax | Trains | In Service |
|---|---|---|---|---|
| ETR 500 (P) | Ansaldo/Bombardier | 300 kph | 60 | 1982 |

# Benefits of HSR in Europe

- Appeals to travelers
  - Cost efficient
  - Competitive with air travel for trip times < 4 hours
  - City center to City center travel
  - More reliable
  - More flexible
  - More room for traveler
  - Conveniences (Bar, Restaurant)
- Environmental benefit
  - At 300kph 3 times more energy efficient than flying
  - Independent of the type of primary energy source
  - Less carbon pollution (TGV is practically carbon free)
  - Economic development near stations
  - Reduces congestions on roads an airports

# Development Trends in Europe

- Network projects replace single-lines projects
- International system compatibility (clearance, weight, voltage, train protection, ticketing)
- Operation on existing tracks to connect city centers
- Speeds up to 350 kph on new lines
- Connect major cities in less than 4 hrs
- Compete with airlines (50% of the market, if trip time is less than 4 hours)
- Replace night trains

# New TGV lines outside Asia and Europe

- **America**
  - Argentina: Buenos-Aires à Cordoba (710km; Trip time 14hrs now - planned < 3 hrs)
- **Africa**
  - Morocco: Casablanca-Tanger (2013)
- Mexico

# Congressionally Designated Steel Wheel on Rail Systems

| System | Total Cost |
|---|---|
| New York (Empire) | $1.5 |
| Pennsylvania (Keystone) | $1.3 |
| New England Rail | $2.8 |
| Southeast High Speed Rail | $4.9 |
| South Central Corridor | $2.9 |
| Florida High Speed Rail | $14.4 |
| Midwest Regional Rail | $8.6 |
| Ohio-Cleveland Hub | $3.9 |
| California High Speed Rail | $33.0 |
| Pacific Northwest | $2.4 |
| Gulf Coast | $5.2 |
| Total Costs | $80.9 |

(All costs in 2007$ Billions)

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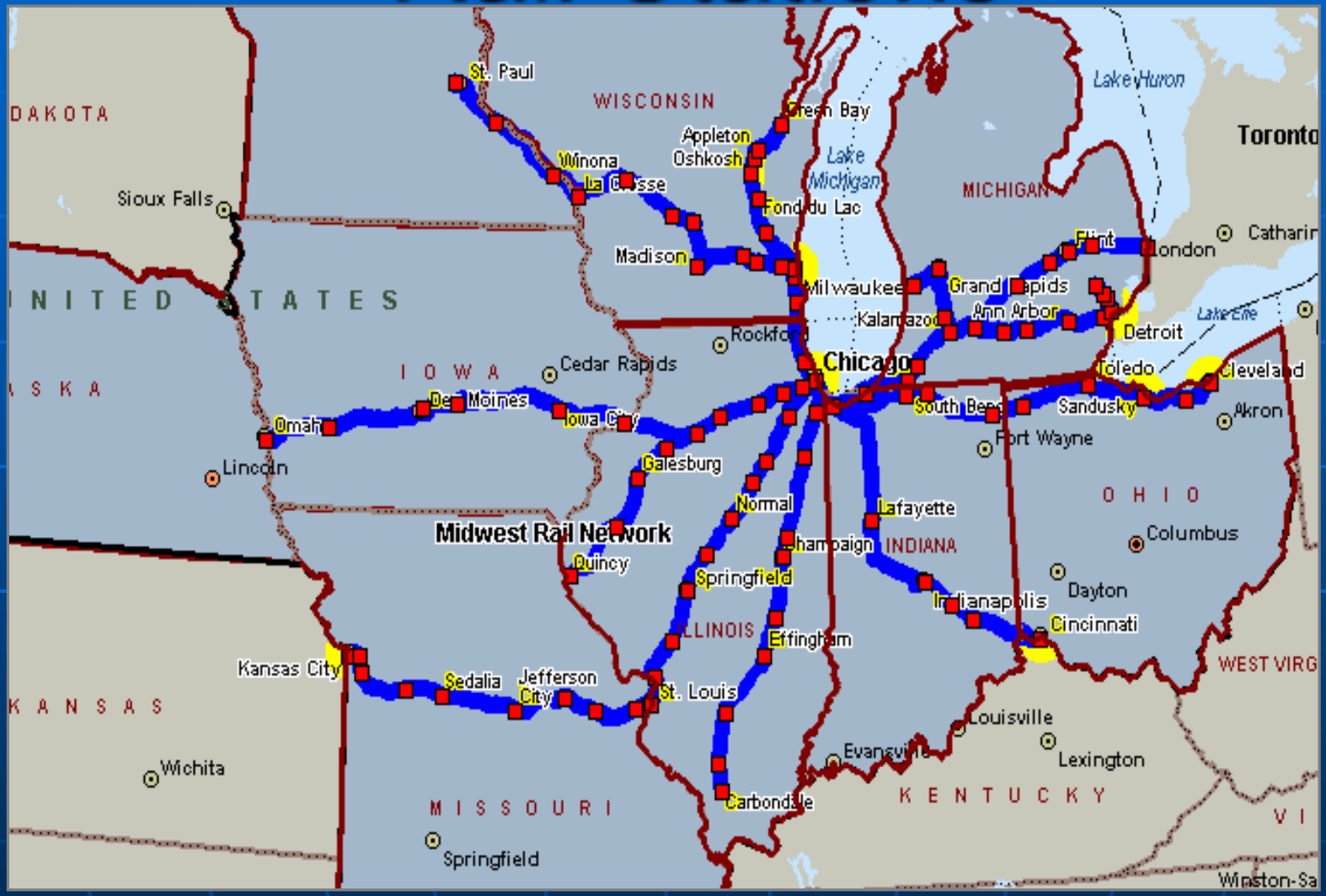
# Intermediate and High Speed Rail Corridor Designations


Created by Mineta Transportation Institute

# Midwest Regional Rail: 100 Rail Stations

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# California High-Speed Rail Authority

- Authorized by legislation in 1996
- Nine-member authority board - five appointed by Governor, two by State Senate, two by State Assembly
- Budget expended in state/federal funds to date, $70M
- Program level Environmental Clearance certified on July 9, 2008

# CHSRA Fiscal Summary

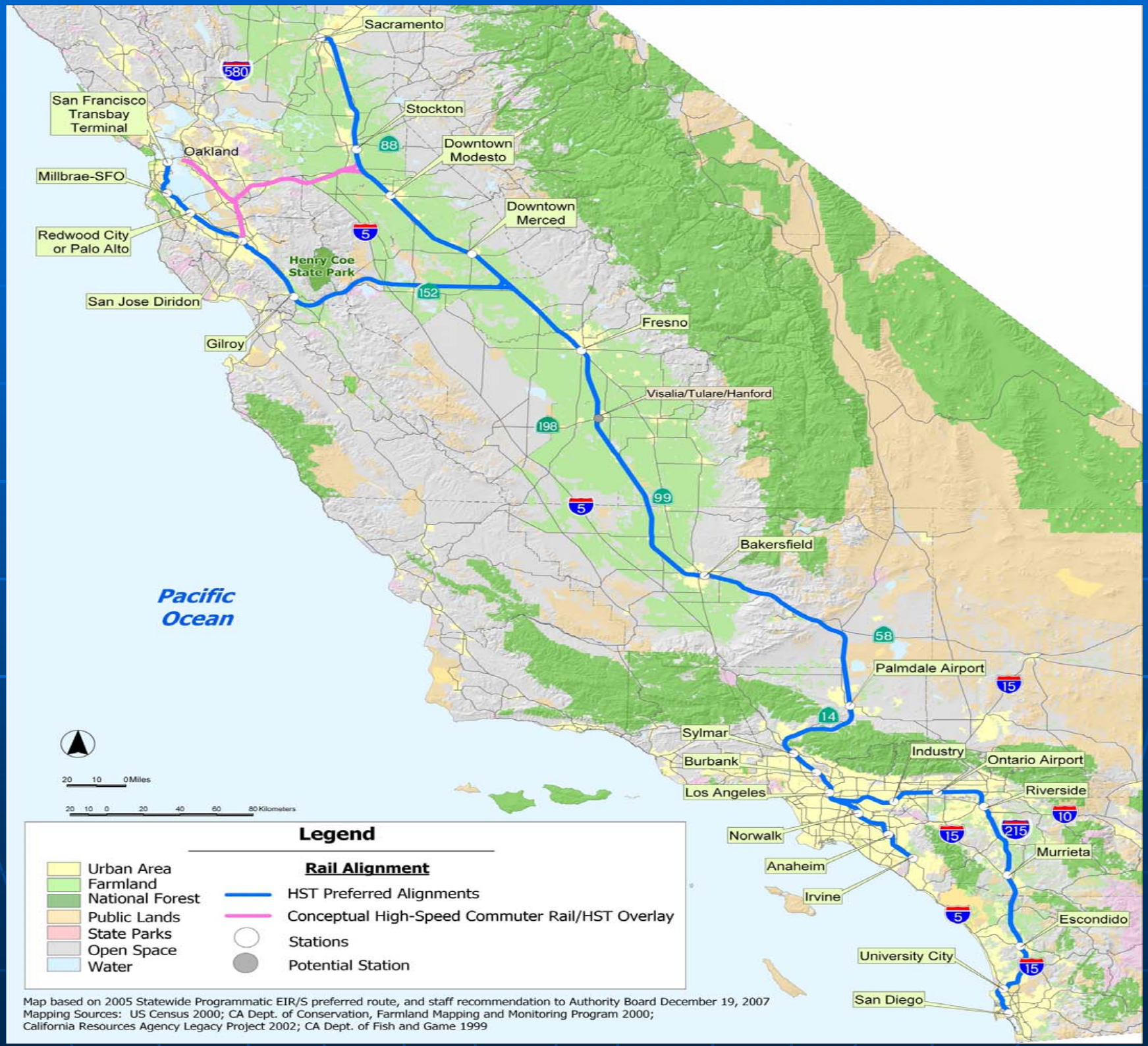
- Operations and business plans were developed by Charles River Associates in 2001 and confirmed and expanded upon by Cambridge Systematics in 2008
- Expected performance of the starter line from Anaheim via Los Angeles, the Central Valley, Gilroy, San Jose, to San Francisco:
  - Completion – 2018-2020
  - Ridership – 55 million per year
  - Gross revenue - $2.4B
  - Net after O and M - $1.1B
- Design, construction and rolling stock
  - Federal - $12 to $16B
  - State - $9 B
  - Public/private partnership - $6.5 to $7.5B
  - Local cost sharing - $2 to $3 B

# CHSRA Fiscal Summary, Cont.

- Expected performance of the 790-mile basic system connecting San Diego, Inland Empire, Los Angeles, Central Valley, Bay Area and Sacramento:
  - Completion – 2020 to 2030
  - Ridership – 93 M annually
  - Gross revenue - $3.6B
  - Net after O and M - $2.0B

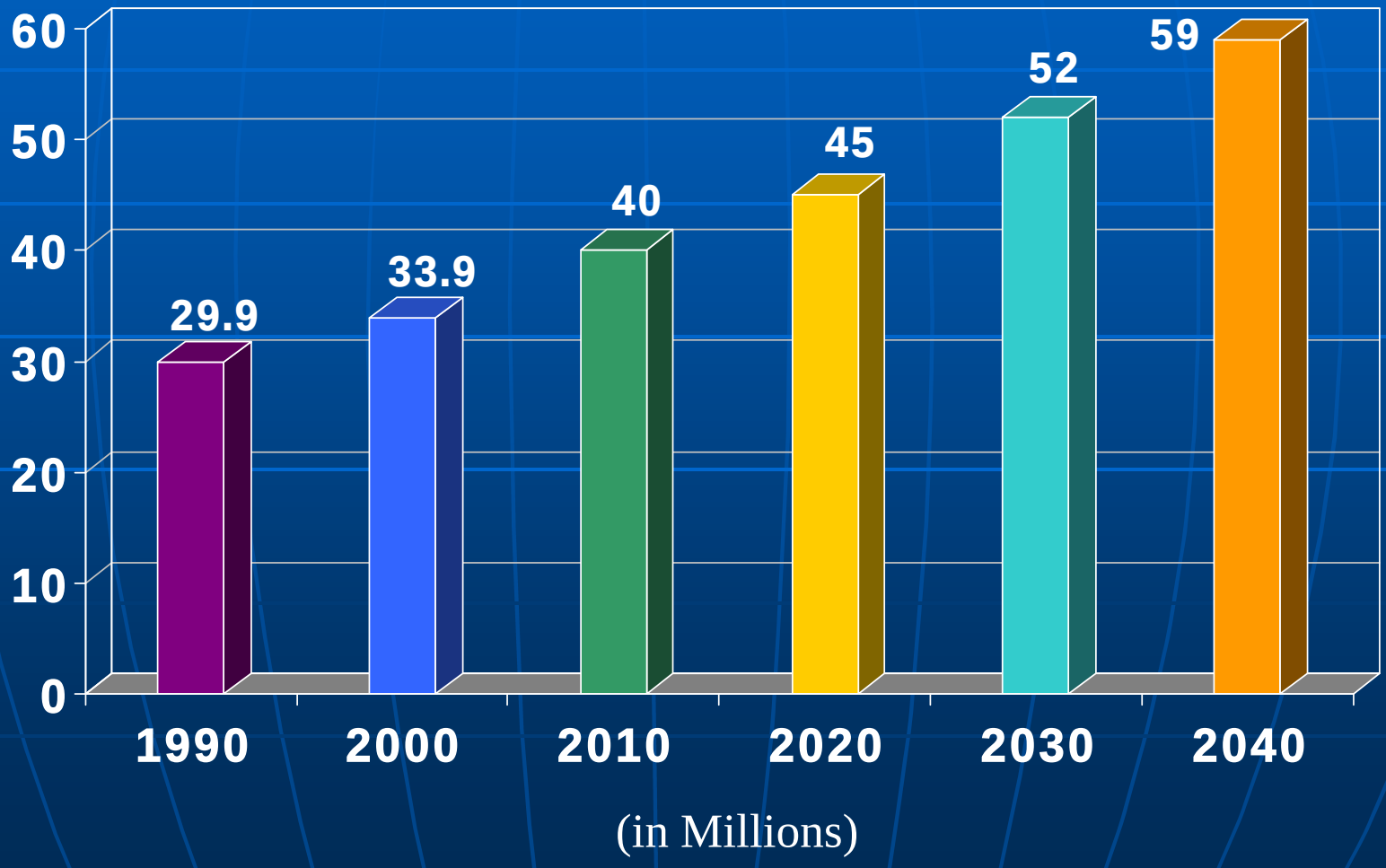
# STEEL WHEEL/STEEL RAIL HIGH SPEED GROUND TRANSPORTATON SYSTEMS

Created by Mineta Transportation Institute




Map based on 2005 Statewide Programmatic EIR/S preferred route, and staff recommendation to Authority Board December 19, 2007
Mapping Sources: US Census 2000; CA Dept. of Conservation, Farmland Mapping and Monitoring Program 2000;
California Resources Agency Legacy Project 2002; CA Dept. of Fish and Game 1999

# California's Existing & Projected Population




Sources: 1990 and 2000 - U.S. Census Bureau; Projections - CA Dept. of Finance, 1998

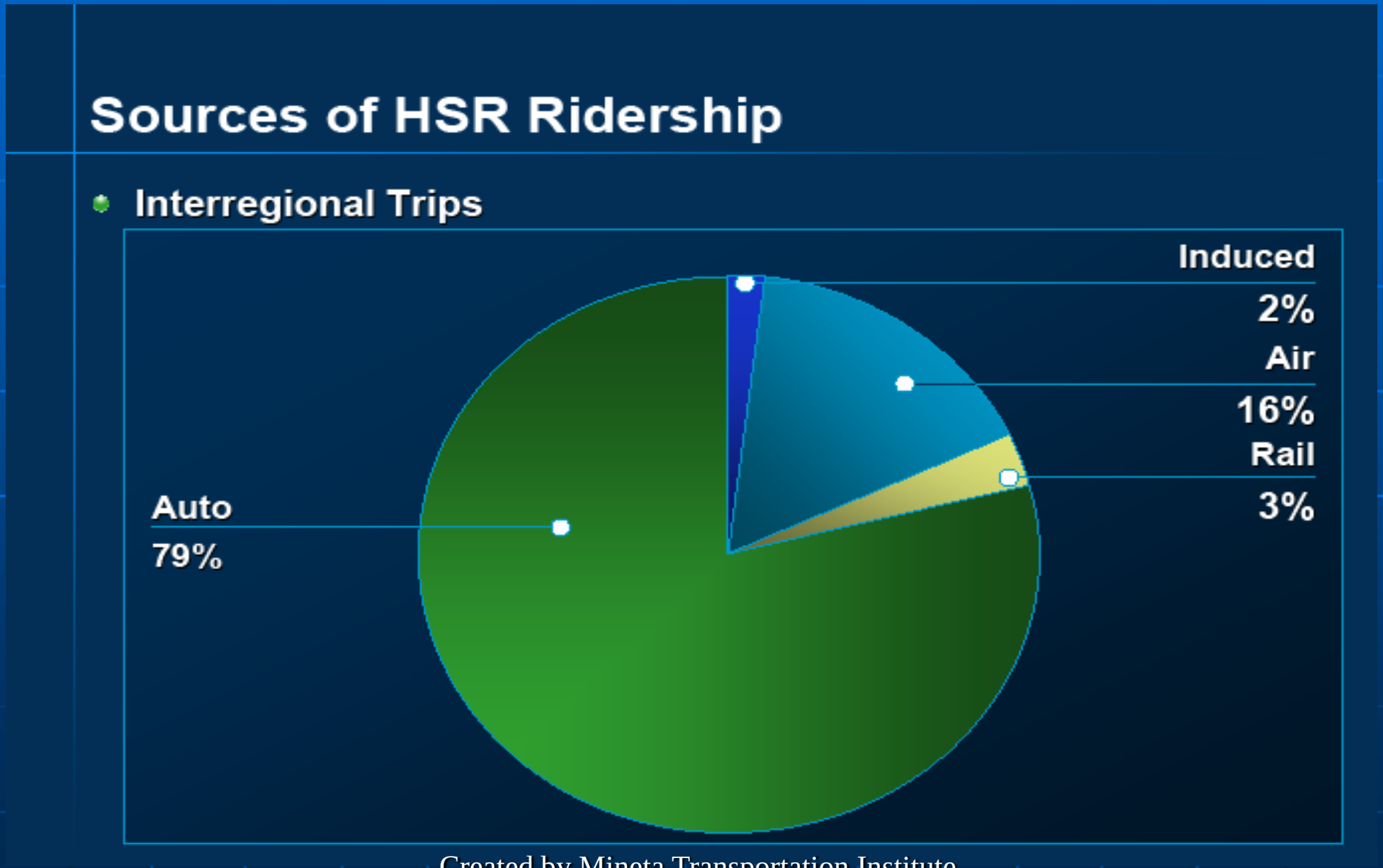
# HIGH-SPEED TRAIN TRAVEL TIMES

- High-speed trains will provide Californians with safe, predictable, consistent and competitive region-to-region transportation.

| Travel Time (Hrs:Min) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Los Angeles | San Francisco | San Jose | San Diego | Sacramento | Fresno | Bakersfield | Riverside | Anaheim |
| Los Angeles | N/A | 2:38 | 2:09 | 1:18 | 2:11 | 1:24 | 0:54 | 0:33 | 0:20 |
| San Francisco | 2:38 | N/A | 0:30 | 3:56 | 1:06 | 1:20 | 1:51 | 3:10 | 2:57 |
| San Jose | 2:09 | 0:30 | N/A | 3:27 | 0:52 | 0:51 | 1:21 | 2:41 | 2:28 |
| San Diego | 1:18 | 3:56 | 3:27 | N/A | 3:29 | 2:42 | 2:12 | 0:48 | N/A |
| Sacramento | 2:11 | 1:06 | 0:52 | 3:29 | N/A | 0:53 | 1:23 | 2:43 | 2:37 |
| Fresno | 1:24 | 1:20 | 0:51 | 2:42 | 0:53 | N/A | 0:37 | 1:56 | 1:43 |
| Bakersfield | 0:54 | 1:51 | 1:21 | 2:12 | 1:23 | 0:37 | N/A | 1:26 | 1:13 |
| Riverside | 0:33 | 3:10 | 2:41 | 0:48 | 2:43 | 1:56 | 1:26 | N/A | N/A |
| Anaheim | 0:20 | 2:57 | 2:28 | N/A | 2:37 | 1:43 | 1:13 | N/A | N/A |

*Optimal Express Trip Times between City Pairs (220 mph [350 kph] maximum speed)*

# Sources of HSR Ridership
## (Interregional Trips)

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# BENEFITS OF HIGH-SPEED TRAINS

- A new mode of transportation that would increase connectivity and accessibility to existing transportation systems, air transportation, and underserved inland populations such as the Central Valley.
- Safer, more reliable than highway or air travel.
- Quick, predictable travel times that would be sustainable over time.
- Lower passenger costs than air or auto travel.
- Would provide additional capacity for future generations.
- Decreased energy consumption, reduced air pollution, and reduced reliance on petroleum.
- Would cost 2 to 3 times less and have fewer environmental impacts than expanding highways and airports to meet future demands.
- Environmental impacts are minimized with most alignments within or adjacent to existing rail or highway right-of-way.

# California's 2050 population estimated at 60M+ Alternatives to meet that need:

| **Key variables** | **Highway/Airport Alternatives:**<br>**3,000 added lanes/miles of freeway and 2 new international airports** | **California High Speed Rail Alternative:**<br>**790 miles of California High Speed Rail** |
|---|---|---|
| Cost | $100 Billion | $40 Billion |
| Capacity beyond 2050 | None | Adequate until 2100 |
| Energy | 22 million barrels of petroleum per year more than HSR | Electric power:<br>1/5 the energy of a car,<br>1/3 energy of a plane per seat/mile |
| Pollution | Creates 18 billion more pounds per year of $CO_2$ than HSR | Base Case |
| Safety | 43,000 people killed and hundreds of thousands injured on US highways in 2007 | No fatalities in 45 years of Japanese Shenkansen and more than 25 years of French TGV |

# ECONOMIC BENEFITS

Like past major infrastructure projects – California's water, university and highway systems – the high-speed train system would be an economic stimulant and smart investment in California's infrastructure.

- Creating 160,000 construction-related jobs.
- A high-speed train system is forecast to improve California's economy, resulting in an additional 450,000 new permanent jobs by 2035.
- Cost benefit analysis based upon "investment grade" ridership forecasts concluded that the high-speed train system benefits would be more than two times its cost.

# California High-Speed Train Project

FLY CALIFORNIA
Without ever leaving the ground.

790 Miles Long

26 Stations

150 Miles of Bridges, Viaducts, and Elevated Structures





35 Miles of Tunnels

610 Grade Separations

510,000 Square Yards of Retaining Walls

110 Power Supply, Switching and Paralleling Sub-Stations

STATISTICS
Statistics

# California High-Speed Train Project

FLYCALIFORNIA
Without ever leaving the ground.

215 Million Cubic Yards of Earthwork

9.2 Million Cubic Yards of Concrete

4.5 Million Tons of Steel

1,600 Miles of Track

2,400 Miles of Electrical and Communication Cables

126,000 Construction Jobs

14,000 Operations and Maintenance Jobs

32,000 Engineering and Management Jobs

STATISTICS

## Statistics

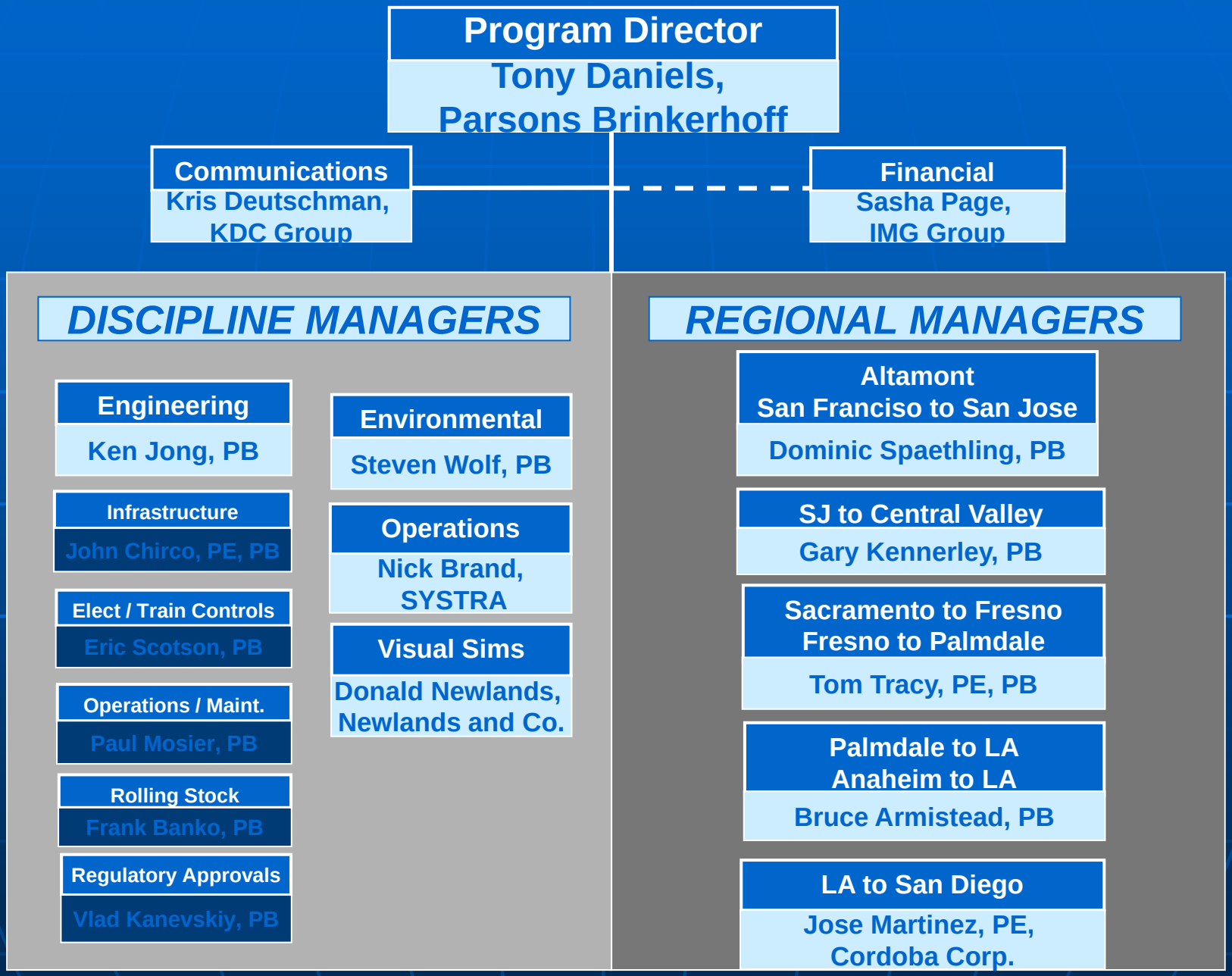
Anaheim, CA

Fresno, CA

# 90 Consultant Groups on CAHSR Project

- *Program Management:* Parsons Brinckerhoff, with SYSTRA, Cordoba, KDG Group, Cambridge Systematics & 12 specialty groups
- *Financial Planning:* IMG, Barclays, Sperry Capital
- *Regional Engineering & Environmental Work:*
  - Hatch Mott MacDonald/USR/Arup JV, with Consensus Planning Group & 9 other specialty groups
  - STV Inc., with UltraSystems Environmental, & 4 specialty groups
  - HNTB/CH2M HILL, with Arellano Associates, Katz & Associates
  - URS/HMM/Arup JV, Forhan Co., VRPA Technologies, & 5 other specialty groups
  - AECOM/CH2MHILL, with Circle Point, and 2 specialty groups
  - AECOM, with EarthTech, EDAW, Jones & Stokes, HNTB & 2 other specialty groups
  - HNTB, with AECOM, PBS&J, & 5 other specialty groups
  - Parsons, with Jones & Stokes, HDR Engineering, Circle Point, & 11 other specialty groups
- *Visual Simulation:* NC3D, and 3 specialty groups
- *Program Management Oversight:* Jacobs Engineering

# Program Management




Created by Mineta Transportation Institute

# Program Management

**Dominic Spaethling**

**Altamont**

Brent Ogden, AECOM

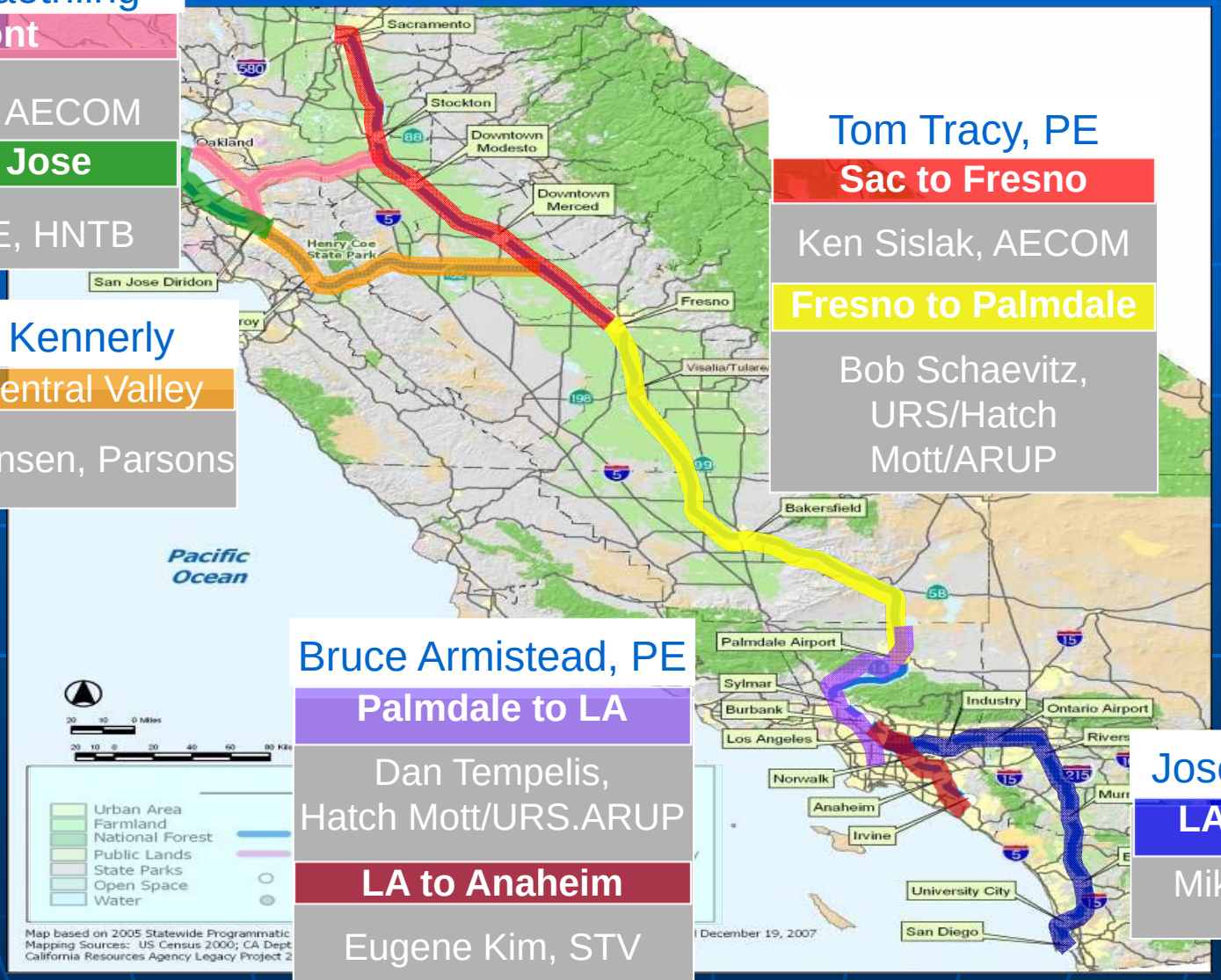
**SF to San Jose**

Tim Cobb, PE, HNTB

**Gary Kennerly**

**SJ to Central Valley**

Dave Mansen, Parsons




**Tom Tracy, PE**

**Sac to Fresno**

Ken Sislak, AECOM

**Fresno to Palmdale**

Bob Schaevitz, URS/Hatch Mott/ARUP

**Bruce Armistead, PE**

**Palmdale to LA**

Dan Tempelis, Hatch Mott/URS.ARUP

**LA to Anaheim**

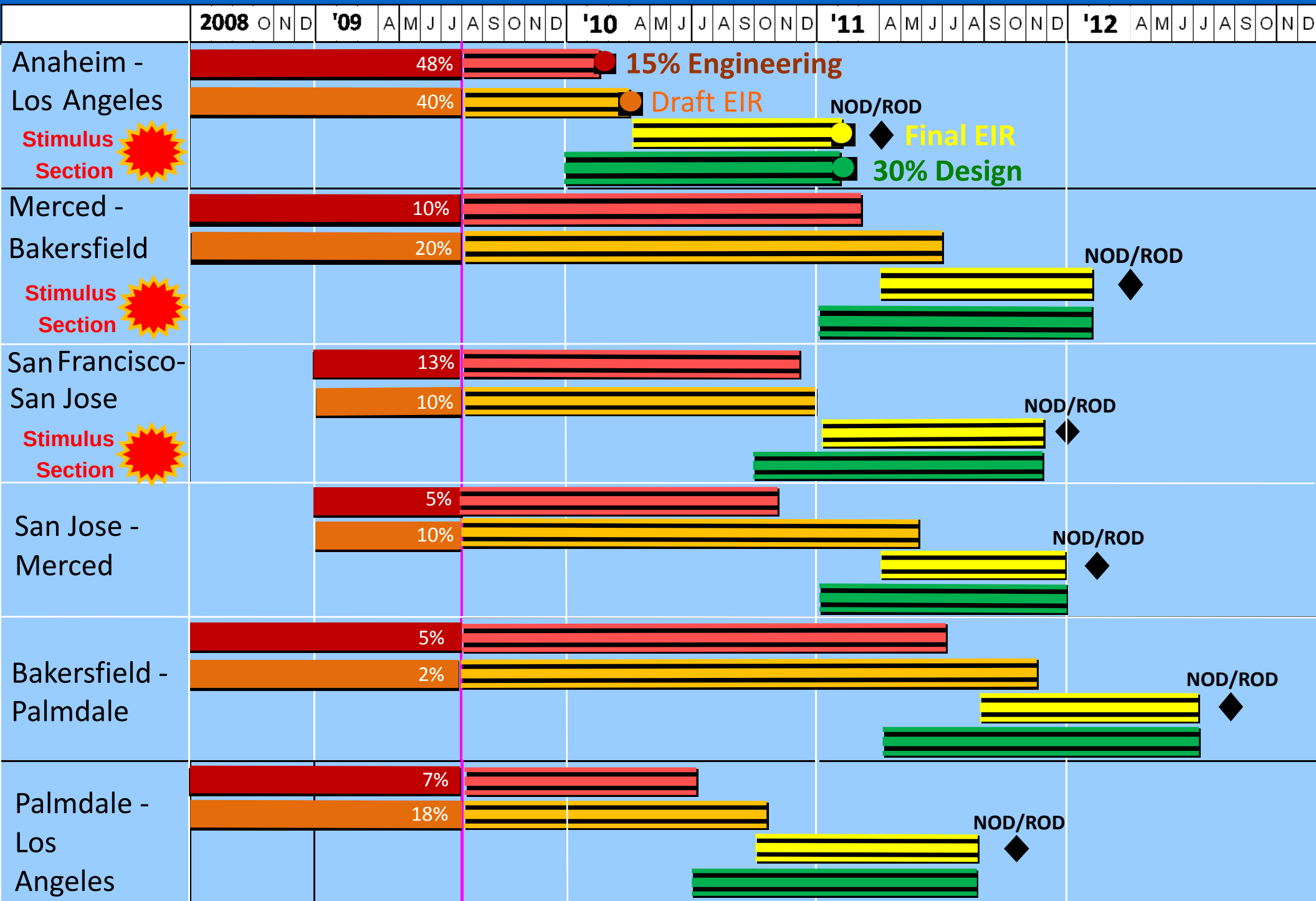
Eugene Kim, STV

**Jose Martinez, PE**

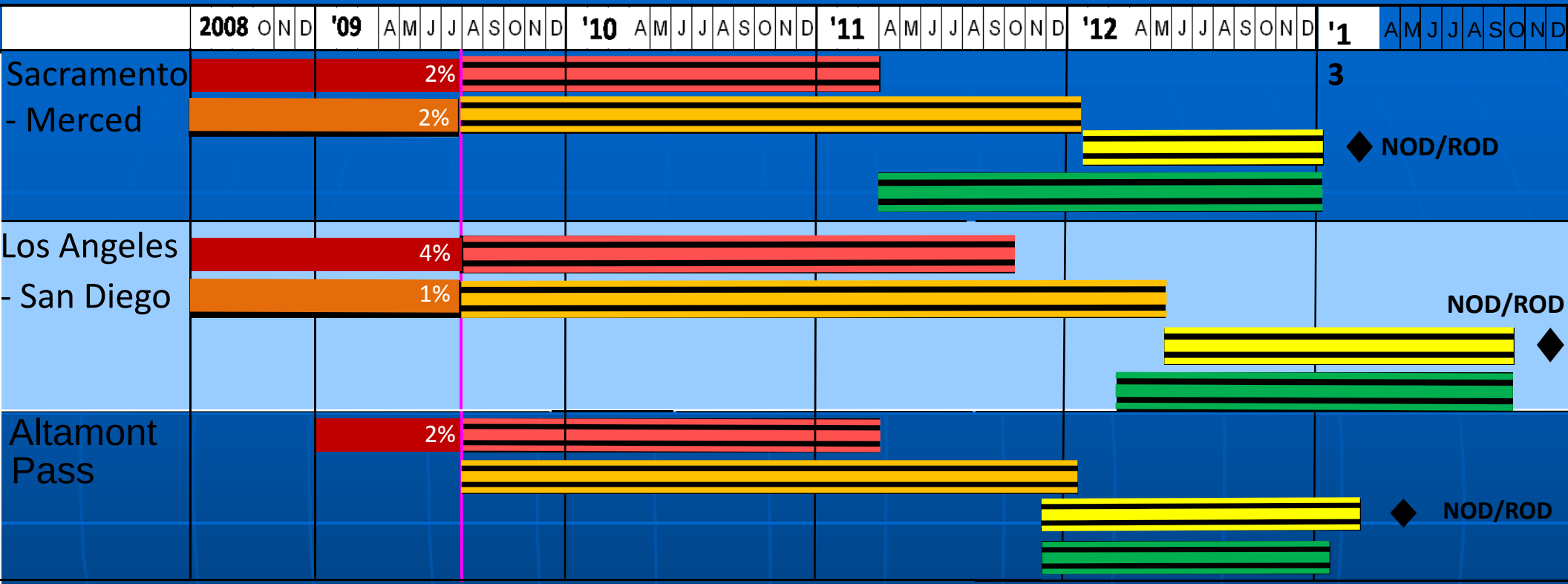
**LA to San Diego**

Mike Zdon, HNTB

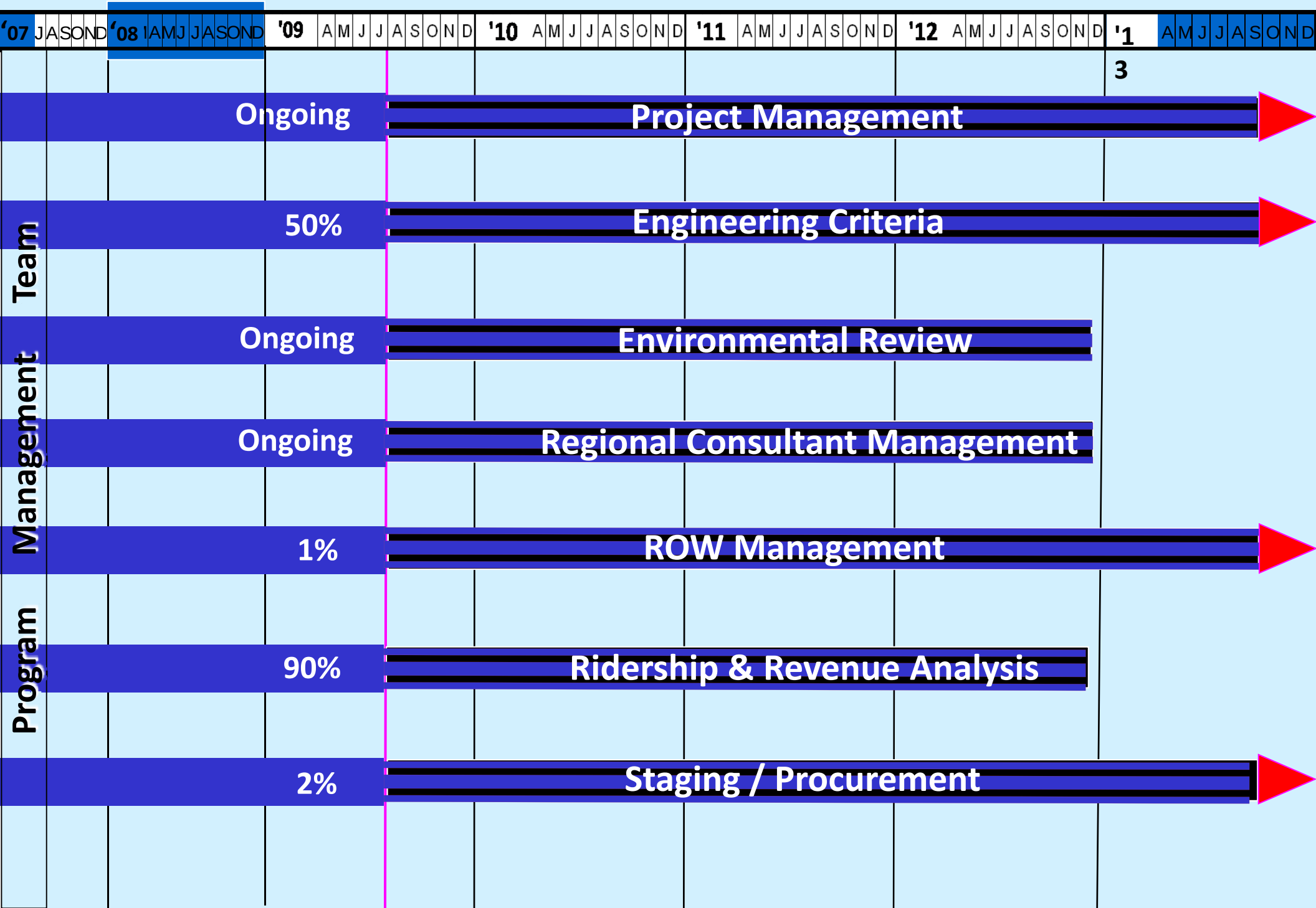
# Phase 1 Regional Teams' Progress / Plan



# Following Phase Regional Teams' Progress / Plan



# Program Management Teams' Progress / Plan



# Contact Information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