

# San Francisco Bay Bridge

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# Presentation Overview

- History
- Recent Problems
- Alternative Routes



# About the Bay Bridge



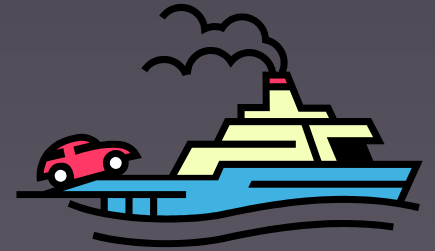
- Built in 1936
- Length: 8.4 miles
- Made up of two suspension bridges
  - Meet in the middle of the San Francisco Bay at Yerba Buena Island
- Double-deck bridge
- Average daily traffic: 280,000 vehicles
- Connects San Francisco with Oakland
- Cost: \$4



# History of the Bay Bridge



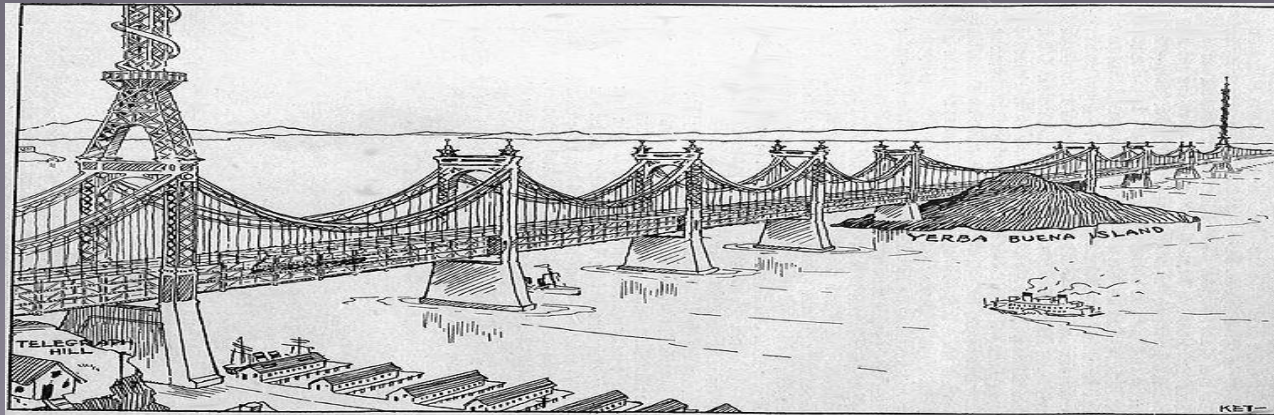
# Before the Bridge



- Ferries carried 46 million people between San Francisco and Oakland yearly
- An underwater tunnel was considered
  - Rejected because it would not be big enough to handle the auto traffic
- Mass production of the automobile called for bridge to be built

# Construction of the Bridge

- Took 3 years to build
- Opened November 12, 1936
- Cost \$77 million
- Originally:
  - 6 lanes of traffic on upper level
  - Truck traffic and railway cars on lower level





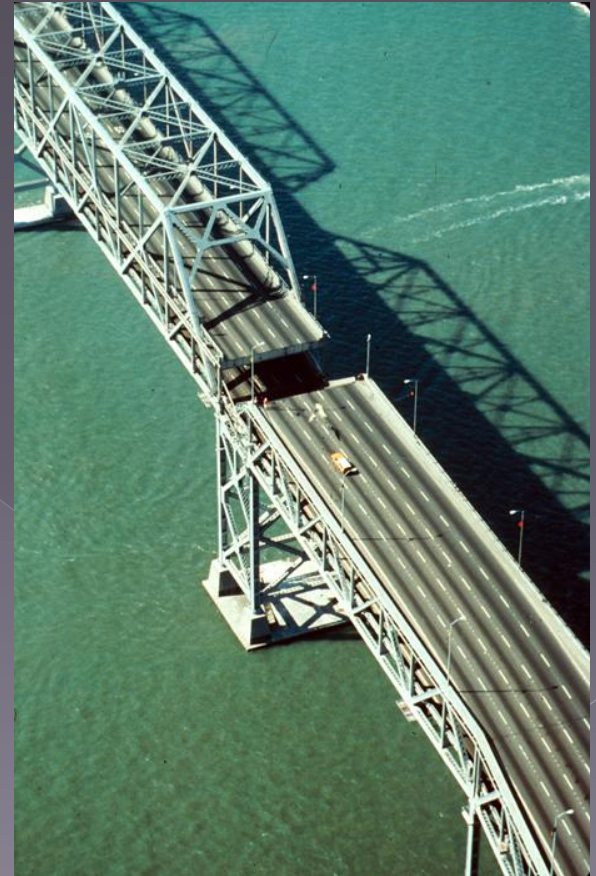
# Consequences

- 1936 – traffic on bridge exceeded expected traffic levels for 1950
  - > Tolls for bridge were lowered to attract ferry users
- 1958 – demand for bridge was so great it had to be reconfigured
- Changes:
  - > Railway system was removed
  - > Upper level: 5 lanes of traffic going East
  - > Lower level: 5 lanes of traffic going West



# Loma Prieta Earthquake

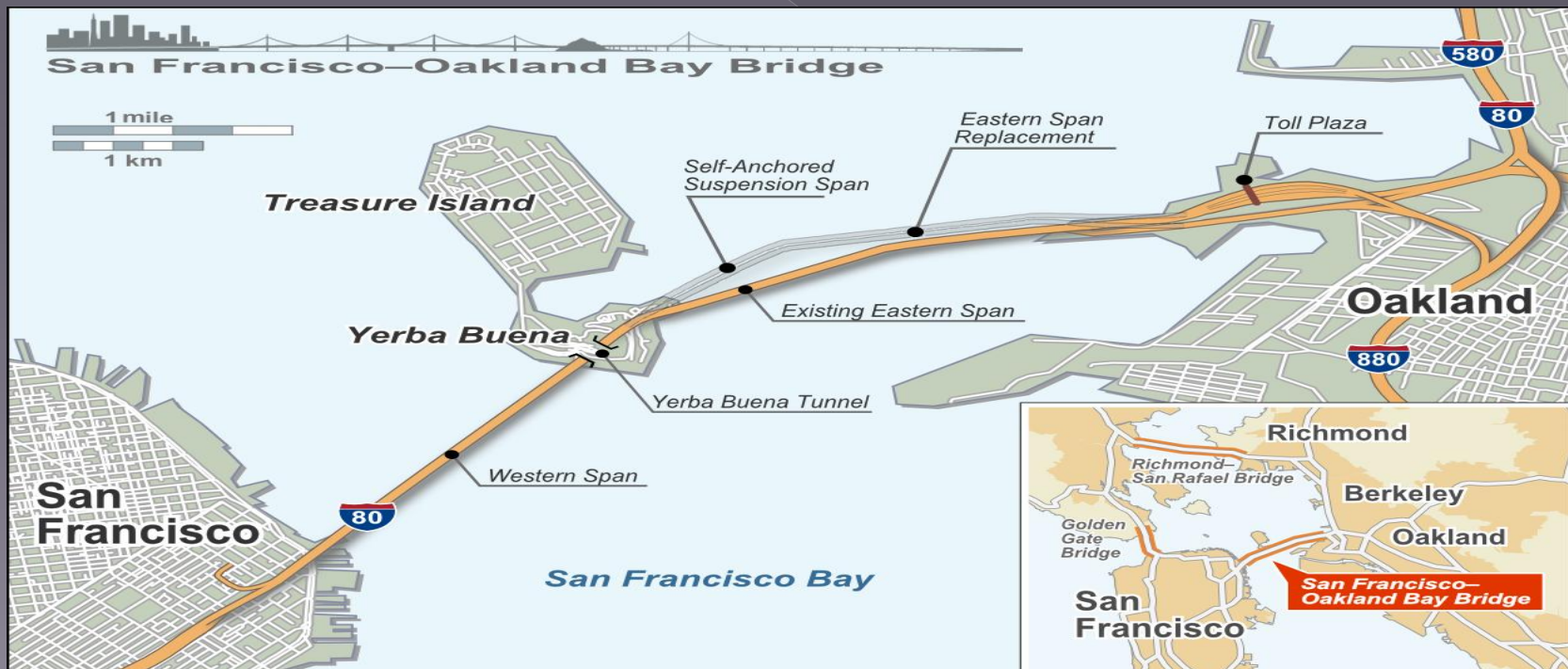
- October, 17 1989
- 7.1 Magnitude Quake
- 250 Ton section of the upper deck on the East Side collapsed
- Killed one person





# Bay Area Seismic Retrofit Project

- Result of seismic studies after Earthquake
- All four sections needed to be drastically improved
- Entirely new structures arising
- Total Cost estimated to be \$6 Billion
- Completion date slotted for late 2013



# West Approach

- One mile stretch linking Interstate 80 to Bay Bridge
- Needed to completely remove and replace original foundation
- \$429 Million
- Each section demolished and rebuilt one at a time
- Major lane reconfigurations, traffic shifts, and temporary road ways being employed during work
- Work scheduled at off-peak hours (weekends and nights)



# West Span

- San Francisco to Yerba Buena and Treasure Islands
- Resurfacing of bridge deck
- Steel added to suspension rails or rails were replaced
- 17 million tons of new steel brought in
- All work done at night to minimize impact on traffic



# Self-Anchored Suspension Span (SAS)

- Part of the new East Span
- Single Suspension Tower designed to withstand major earthquake
- Side-by-Side Decks
- Estimated completion date is late 2013





# Skyway

- Between SAS and Oakland touchdown
- Longest Portion of new East Span 1.2 miles
- Five Lanes, 10 foot shoulders to keep traffic moving



# Oakland Touchdown

- Will connect Interstate 80 in Oakland to the new East Span
- Involves building two new roadway sections
  - > New westbound lanes connecting the East Span
  - > New eastbound lanes coming off the bridge to Interstate 80
- Traffic will shift to new westbound lanes first
  - > Demolition of old westbound lanes will allow for connection of the new eastbound lanes coming off the bridge



## Oakland Touchdown

When completed, this section of the bridge will connect the Skyway to Interstate 80 in Oakland. Work involves building two roadway sections and a new electrical substation, in addition to extensive relocation of underground utilities.

# Yerba Buena Island Transition Structure

- Will connect the Yerba Buena Island to SAS
- Connecting side-by-side East Span decks to upper and lower decks of YBI tunnel and West Span decks
- Traffic shifted to a temporary detour that connects East Span to the tunnel
- Movements and building of new sections and detours closed the entire bridge labor day weekend 2007



# Recent Problems and Repairs

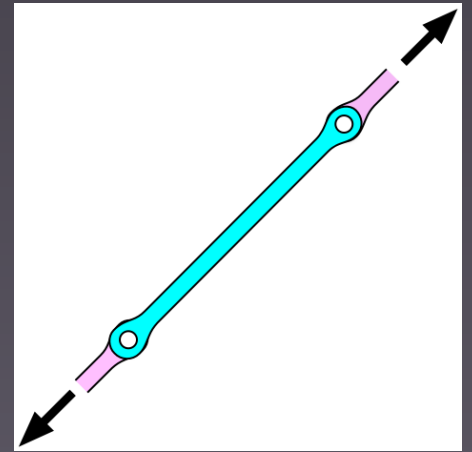




# Recent Problems

## ● Labor Day Weekend 2009

- During closure for retrofitting, major crack found in an eyebar (see picture)
- CalTrans created new materials and repaired bridge
- Was not inspected by Federal Highway Administration, but state inspection reports were used



# Recent Problems Cont.

## ● October 27, 2009

- 5,000 lbs of metal came crashing down on rush hour traffic
- Falling debris hit cars, but no injuries/deaths
- The falling pieces were the same ones repaired over Labor Day Weekend
- Closure lasted for roughly 6 days

## ● The S-Curve

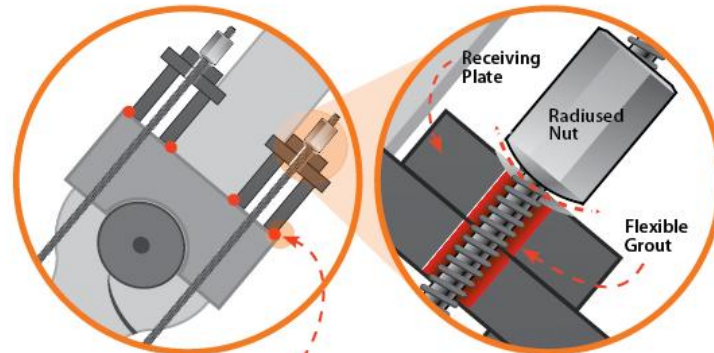
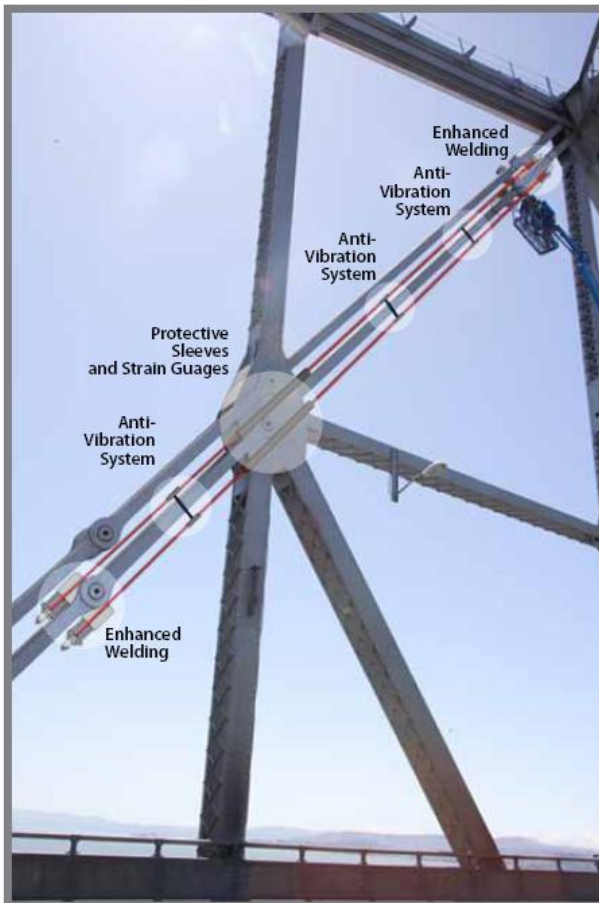
- Curvy temporary section with more than 50 accidents (1 fatal) in two months

# Repairs

- ◎ Failures attributed to design affects
  - > Tight and lack of secure attachment of components
- ◎ Repairs took a while, and hit a few snags
- ◎ Modifications
  - > Structural welding, addition of structural components, monitors, and protective measures
- ◎ Opening postponed until November 2, 2009

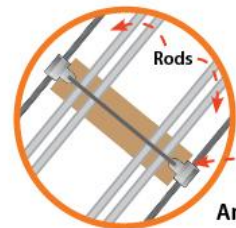
# Repairs

## ENHANCEMENTS TO EYEBAR REPAIR SYSTEM

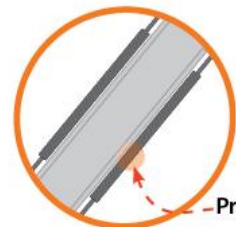


Enhanced Welding

Radiused Nut Allows for Rotation



Anti-Vibration System



Protective Sleeves



# Affects of Recent Problems

- Shut down main link of Bay Bridge – rerouting roughly 280,000 daily users
- Disrupted regional businesses
- Workers stayed home, flocked to public transportation, or were stuck in horrible traffic on alternate routes

## Alternate Routes



# Commuter's Alternative Routes

- Golden Gate Bridge

- > Approx. 30 mi away from Bay Bridge
- > Very congested
- > Can add over an hour onto commute
- > Cost: \$6



- San Mateo Bridge

- > Experiences 40% more traffic than usual
- > Approx. 40 miles from Bay Bridge
- > Can add half an hour – hour onto commute
- > Cost: \$4

# Alternative Routes Cont.

## ◉ San Rafael Bridge

- Approx. 20 mi from Bay Bridge
- Can add up to 40 minutes onto commute
- Cost: \$4



## ◉ Ferries

- Runs 12-13 times per weekday
- Trips take 35-45 minutes between Oakland and San Francisco
- Cost: \$12.50 round trip



# Alternative Routes Cont.

## ◎ BART – Bay Area Rapid Transit

- Subway system
- Deal with overflow conditions
  - Ran extra trains and longer hours
  - When Bay Bridge is closed, ridership can increase up to 49%
- Set ridership record on Sept 8<sup>th</sup> while bridge was closed
  - 437,000 people
  - Most people in 37 year history of BART
- Cost: Varies depending on destination
  - \$6.20 to cross San Francisco Bay



# Conclusion

- Seismic Retrofitting Project still ongoing
- Alternative routes remain congested when Bay Bridge is closed
- Recent repairs have been successful but problems reflect growing concern about bridges, and the American transportation infrastructure, today.