Analysis of NBI Data for California Bridges

Rosa Vasconez, Emily Yu

California State Polytechnic University, Pomona

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What is the NBI?

- National Bridge Inventory (NBI)
  - A database compiled by the Federal Highway Administration (FHWA)
  - Used to analyzed the conditions of all the bridges and tunnels in the United States

Research Objective

- Understand the National Bridge Inventory and its resources and limitations
- Retrieve relevant data to the bridge population in California
- Analyze data to get information on bridge performance and properties

Methodology

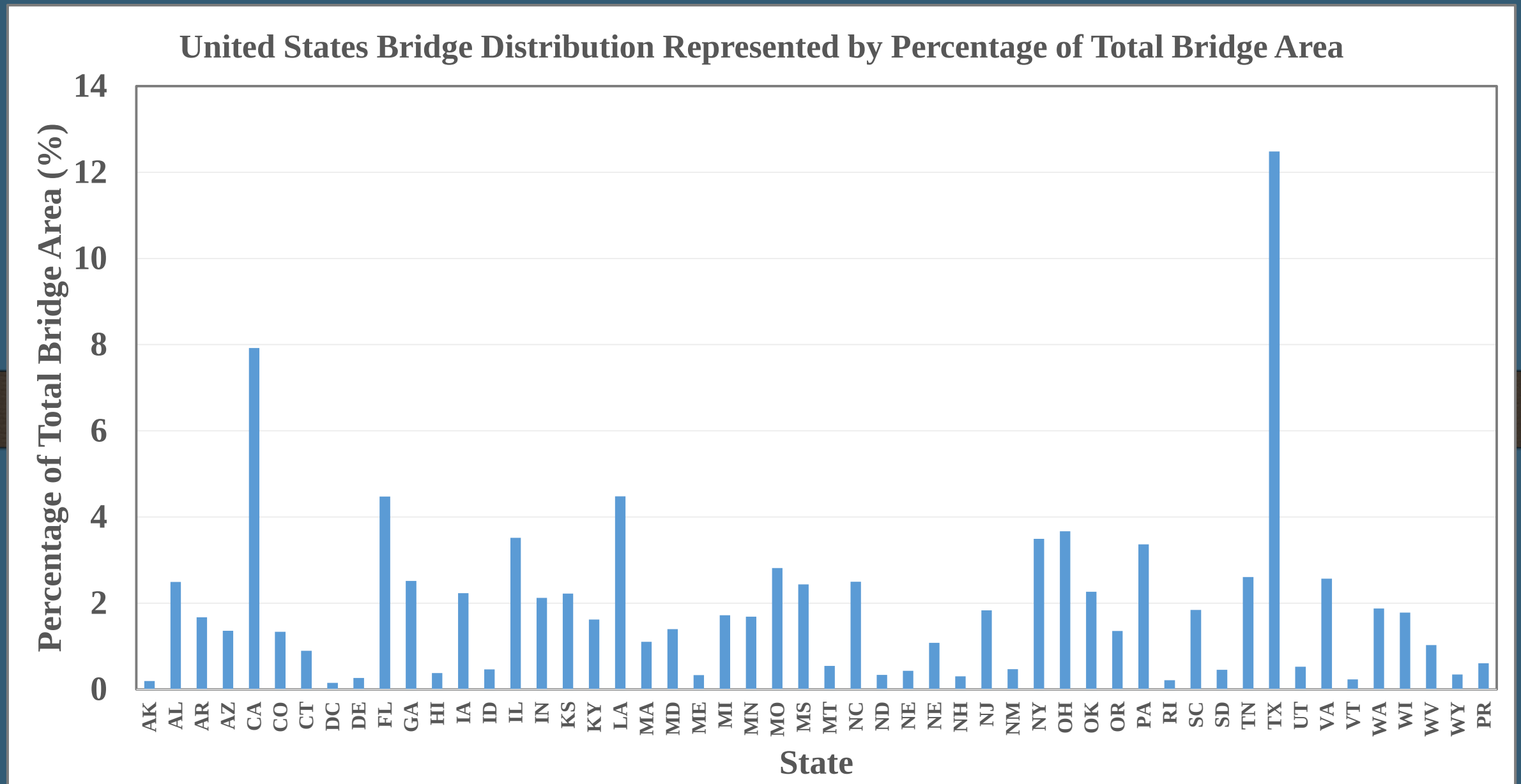
- Analyze data from the National Bridge Inventory and the National Bridges website
  - NBI information taken from "Frequently Requested Charts"
    - Information deciphered from ASCII files
  - National Bridges website: database that extracts information from the NBI ASCII file
    - Provides informative data about specific counties

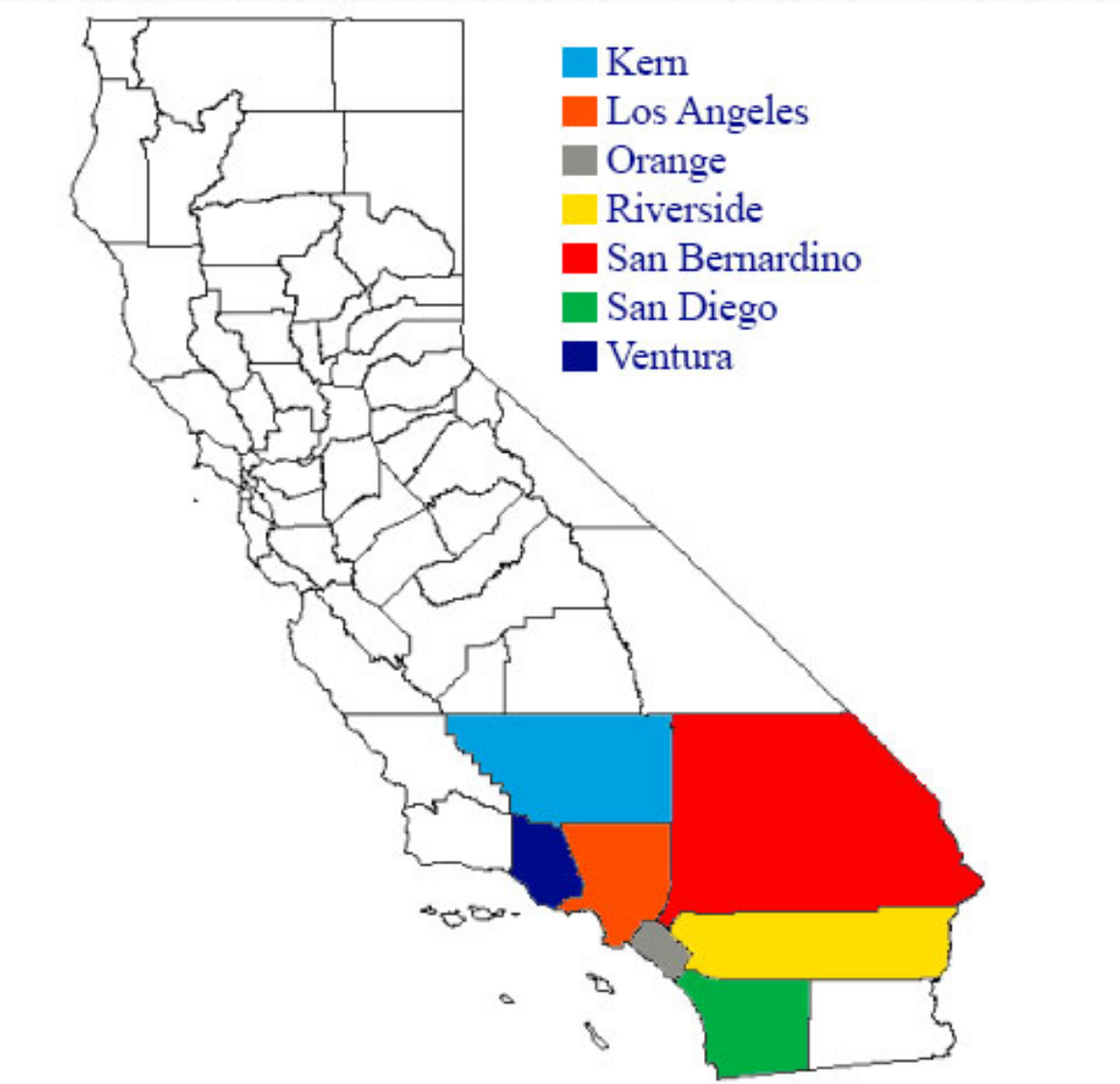
Research Parameters

- Material Composition
- Wearing Surface and Deck Protection
- Age
- Functional System
- Structural Status
- Average Daily Traffic (ADT)
- Ownership
- Federal aid and Non-federal aid bridge distribution

Results

- Information on the performance of the bridge population of California in terms of strength and serviceability
- Correlation of bridge performance with geographic location, material type, traffic volume and age

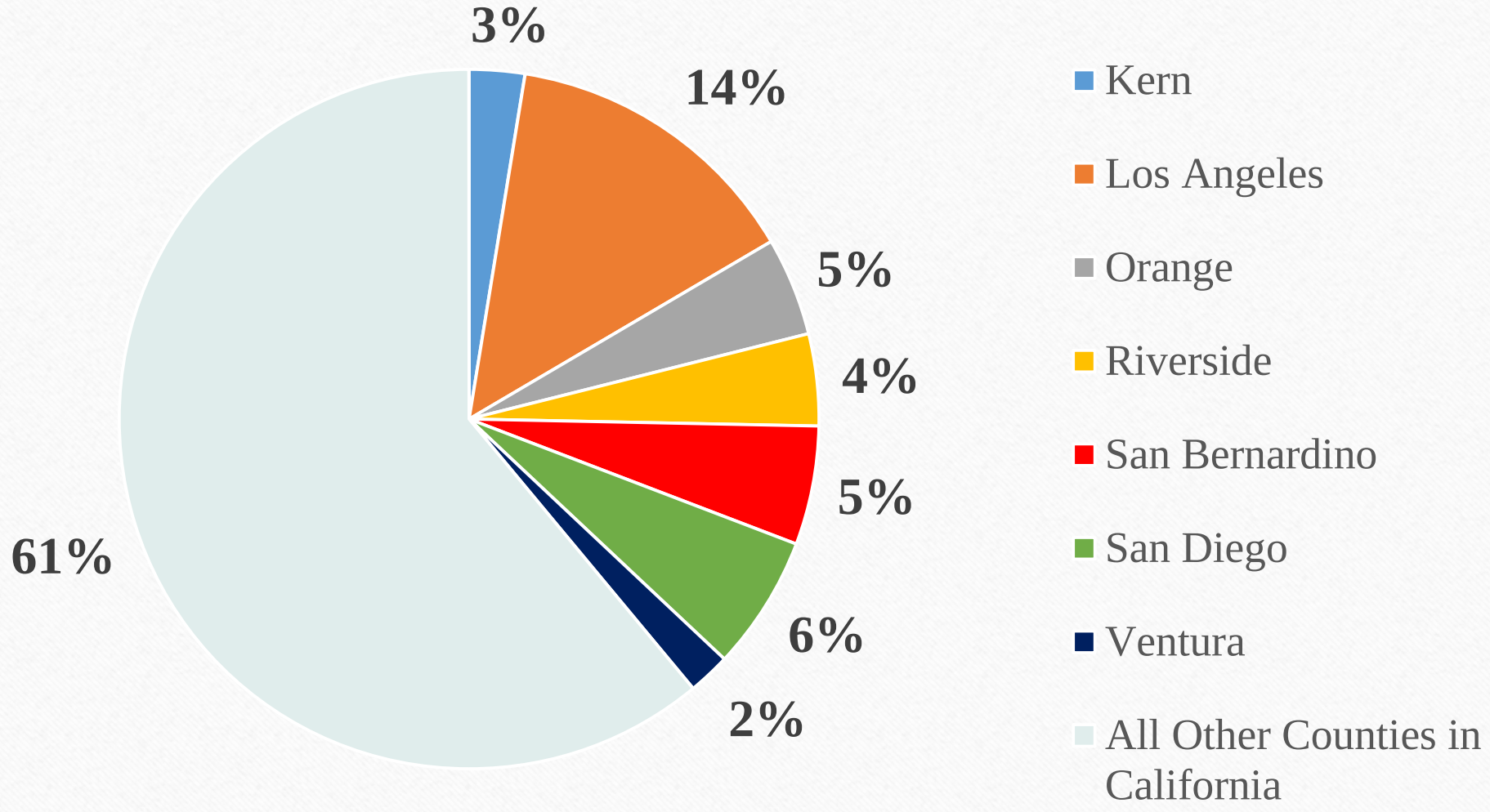

United States Bridge Distribution Represented by Percentage of Total Bridge Area
Percentage of Total Bridge Area (%)
0
2
4
6
8
10
12
14
AK AL AR AZ CA CO CT DC DE FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NE NH NJ NM NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY PR
State



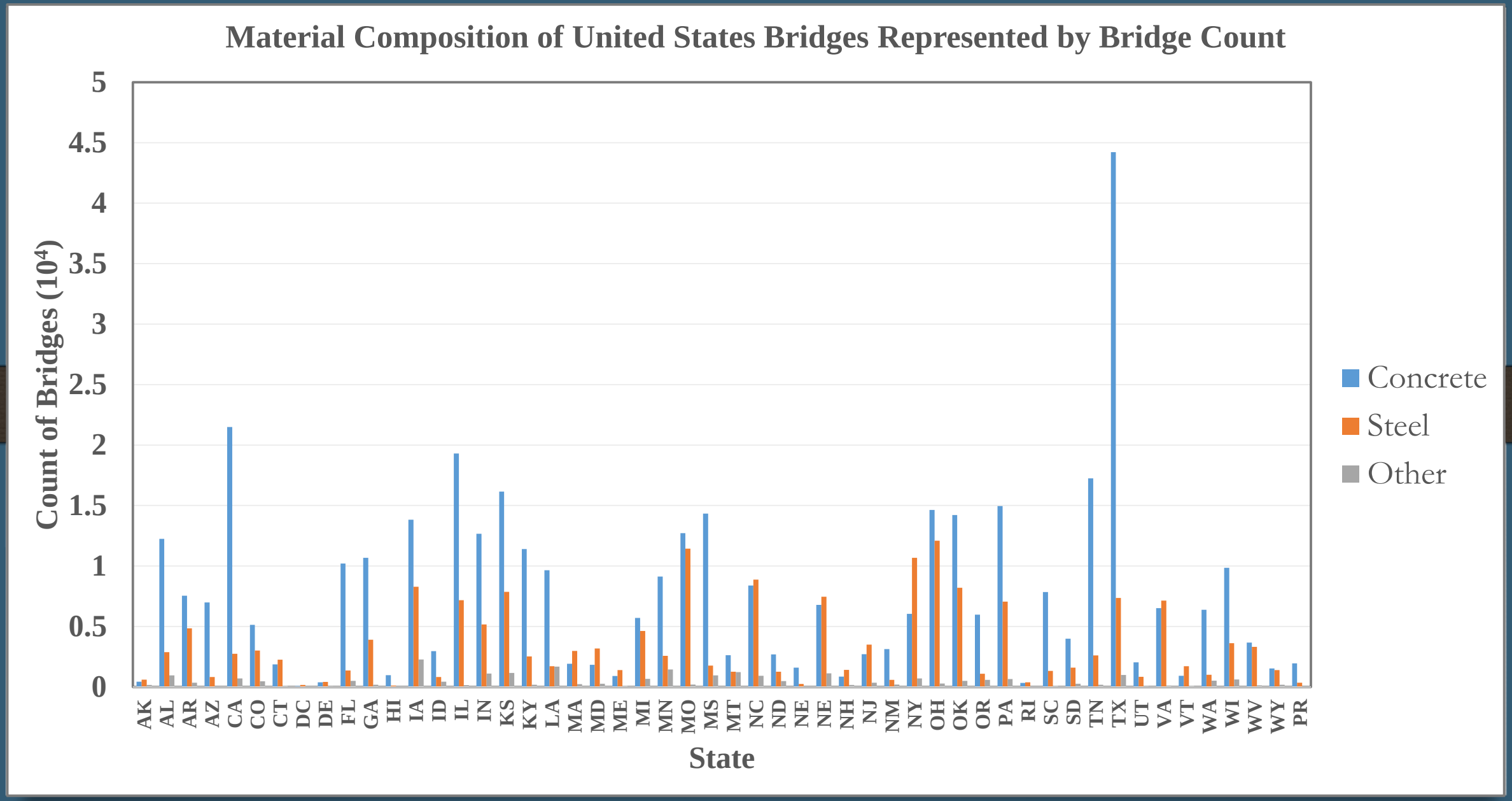
Southern California Counties

- 25, 406 bridges in California
- 38% are in Southern California

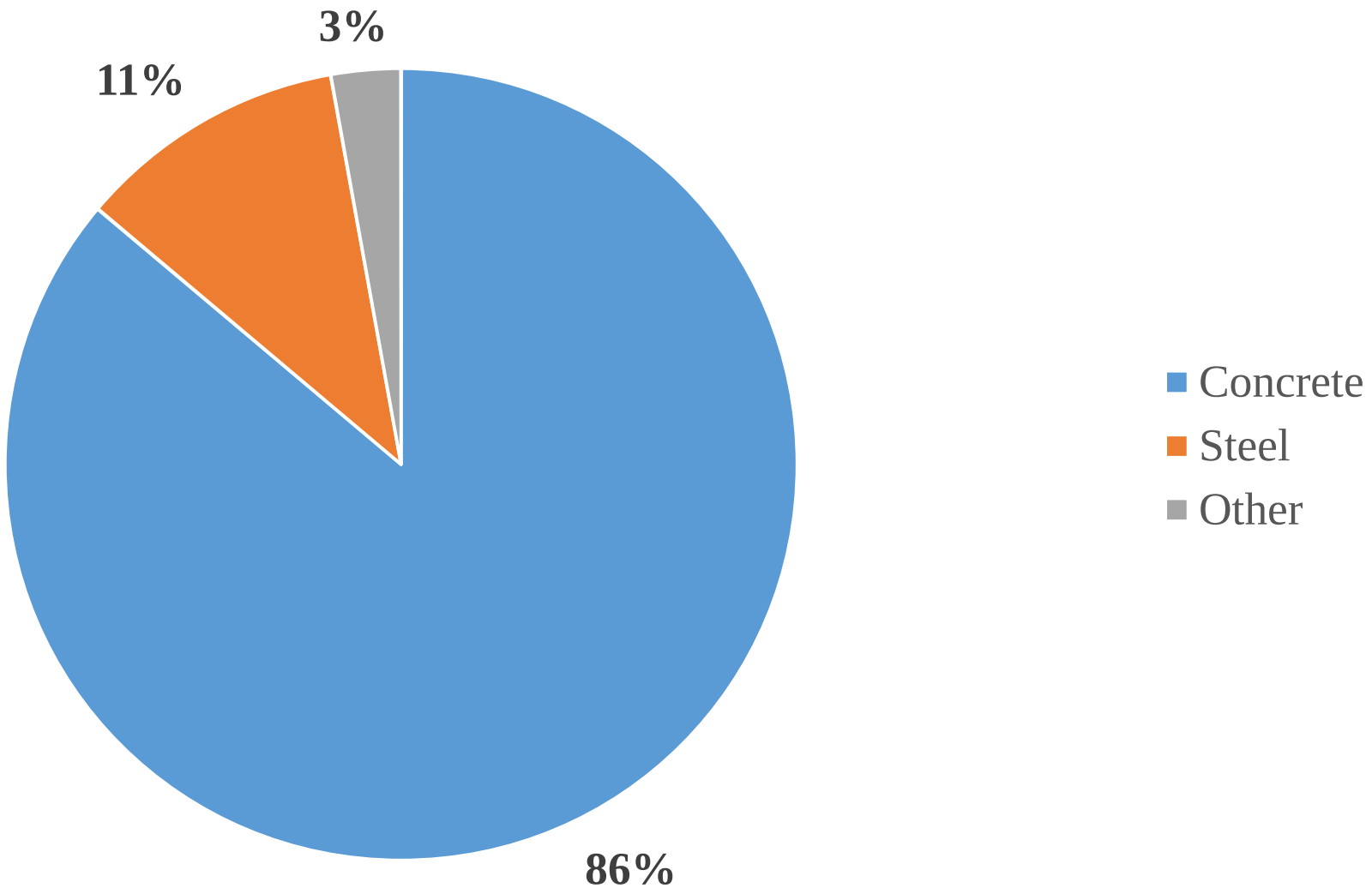
Distribution of California Bridges (Bridge Count)



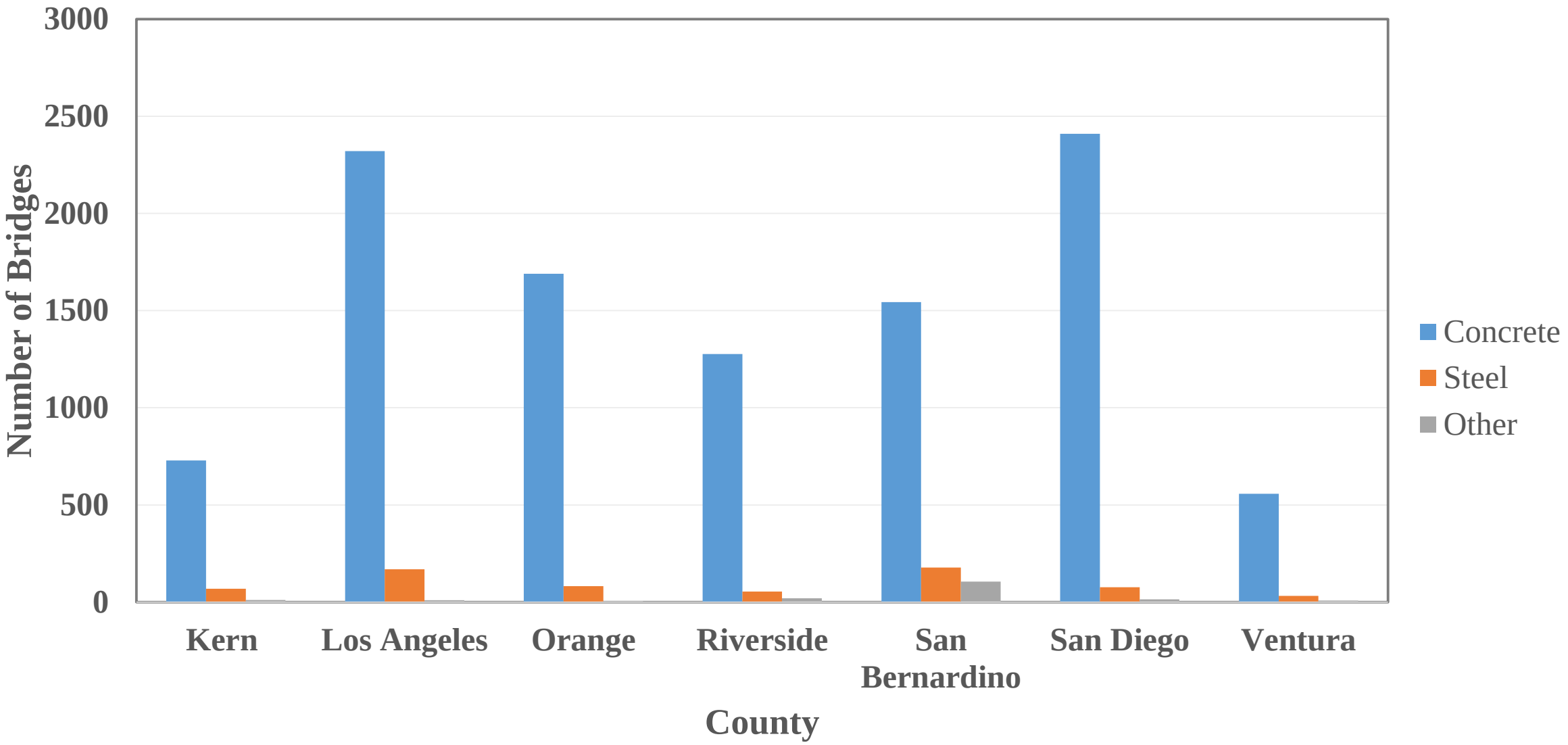
Material Composition


Material Composition of United States Bridges Represented by Bridge Count
Count of Bridges (10^4)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
AK AL AR AZ CA CO CT DC DE FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NE NH NJ NM NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY PR
State
Concrete
Steel
Other

Material Composition of California Bridges



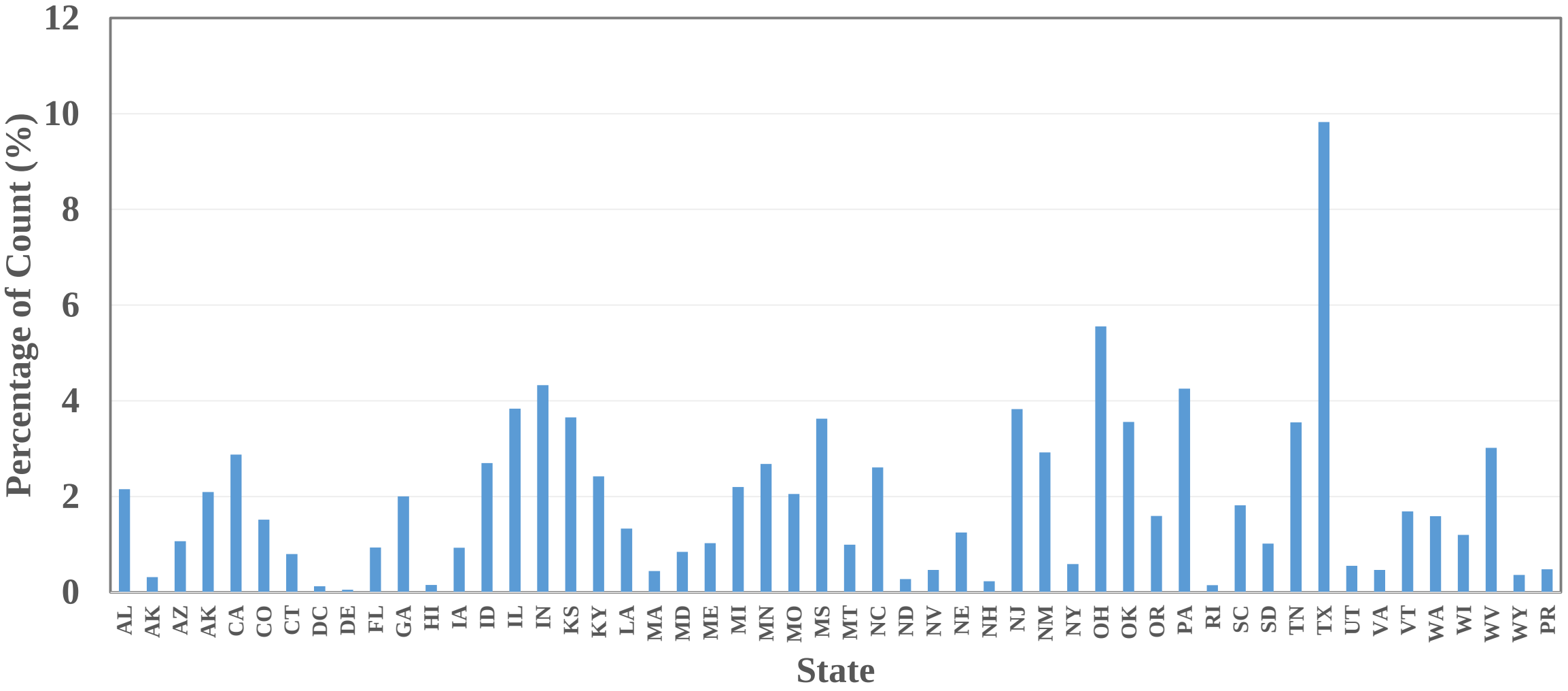
Material Composition of Southern California County Bridges



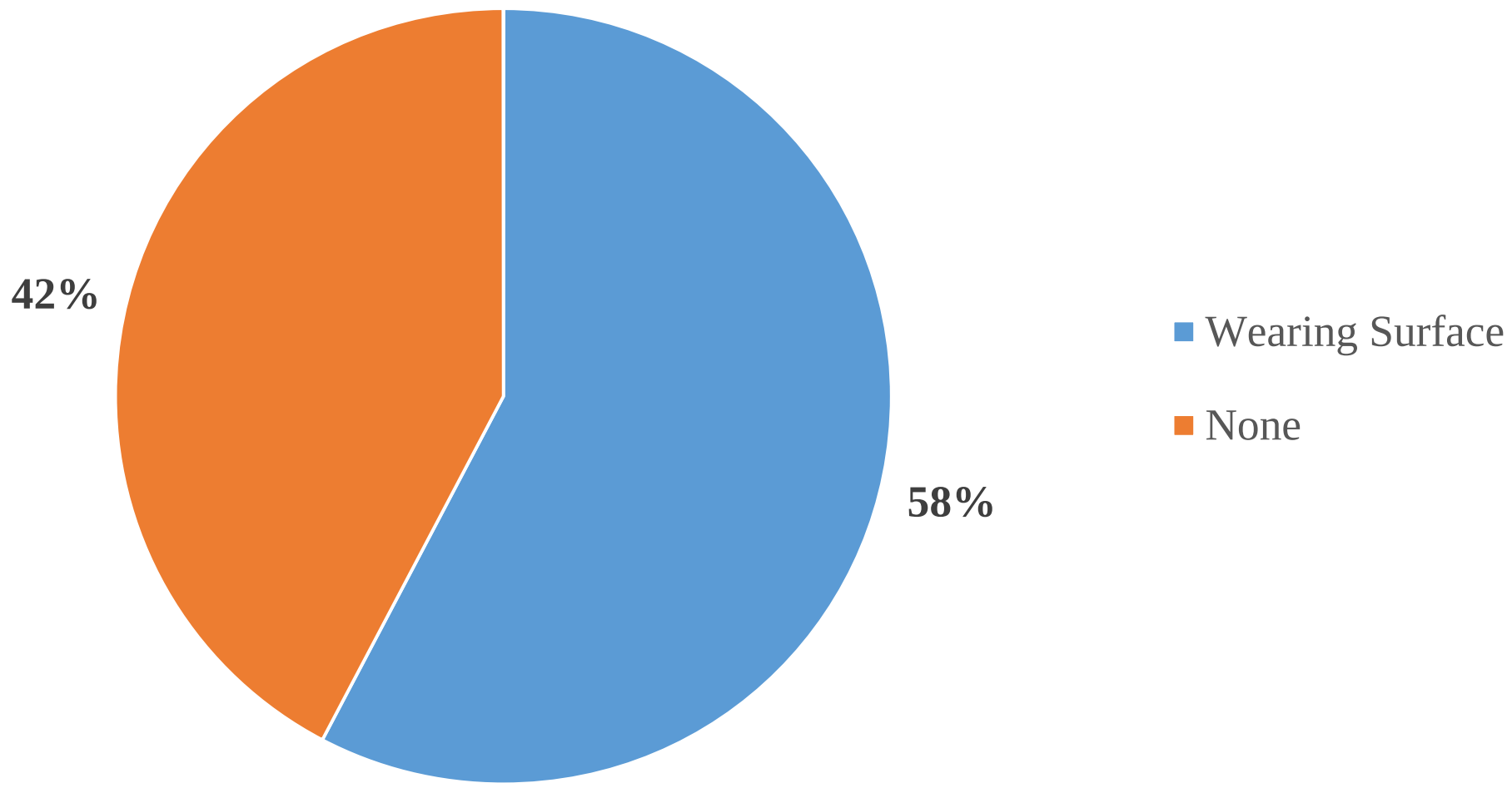
Wearing Surface and Deck Protection

Provide protection from environmental and external factors

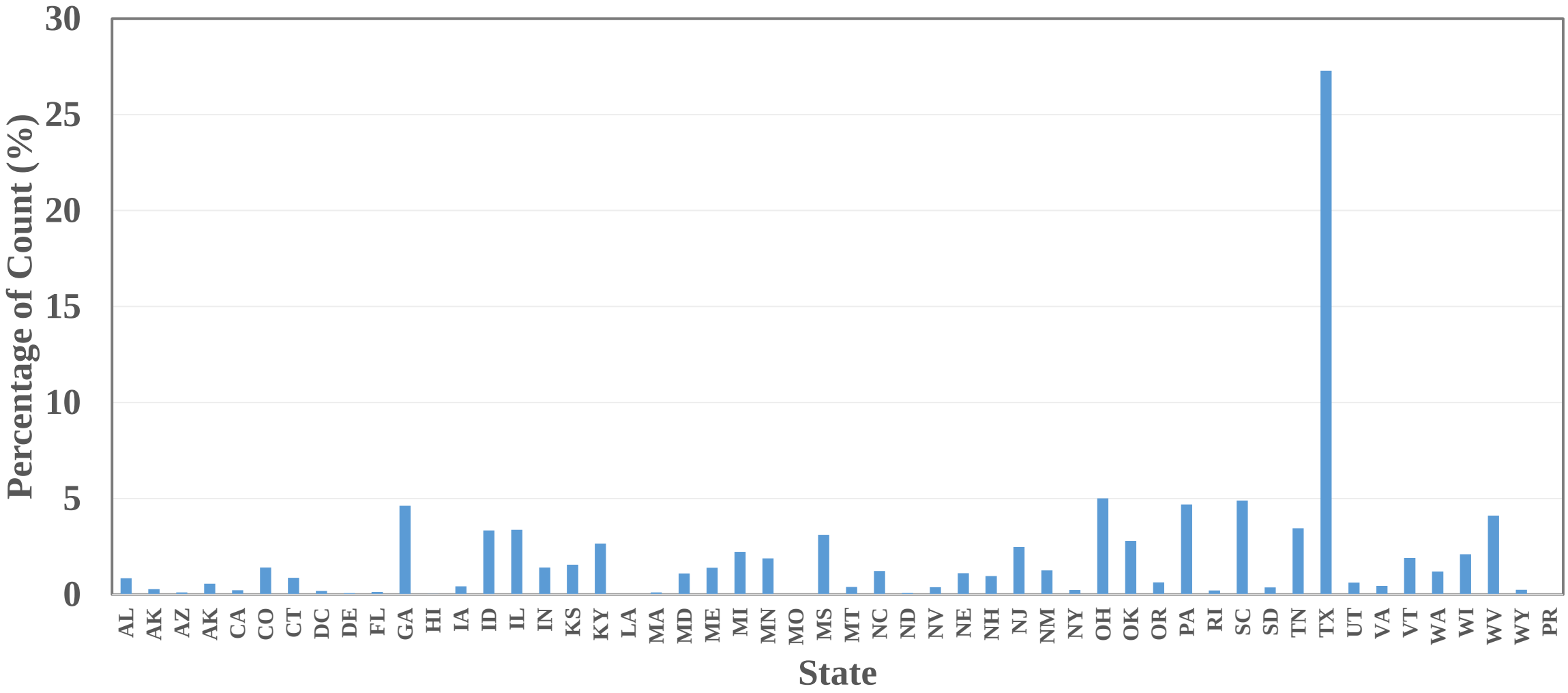
Wearing Surfaces of United States Bridges Represented in Percentage of Total Count



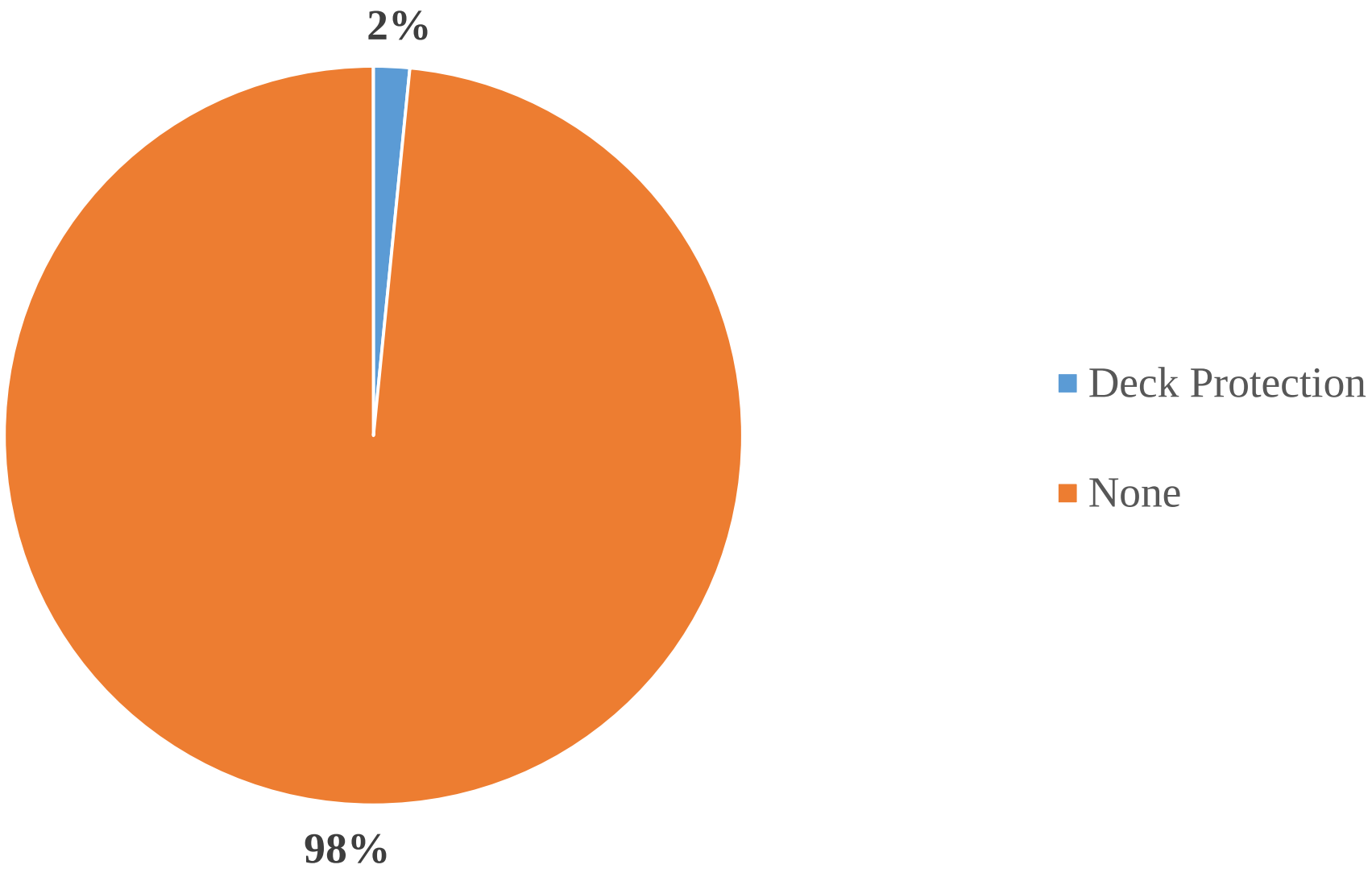
California Bridges with Wearing Surfaces



Deck Protection of United States Bridges Represented in Percentage of Total Bridge Count



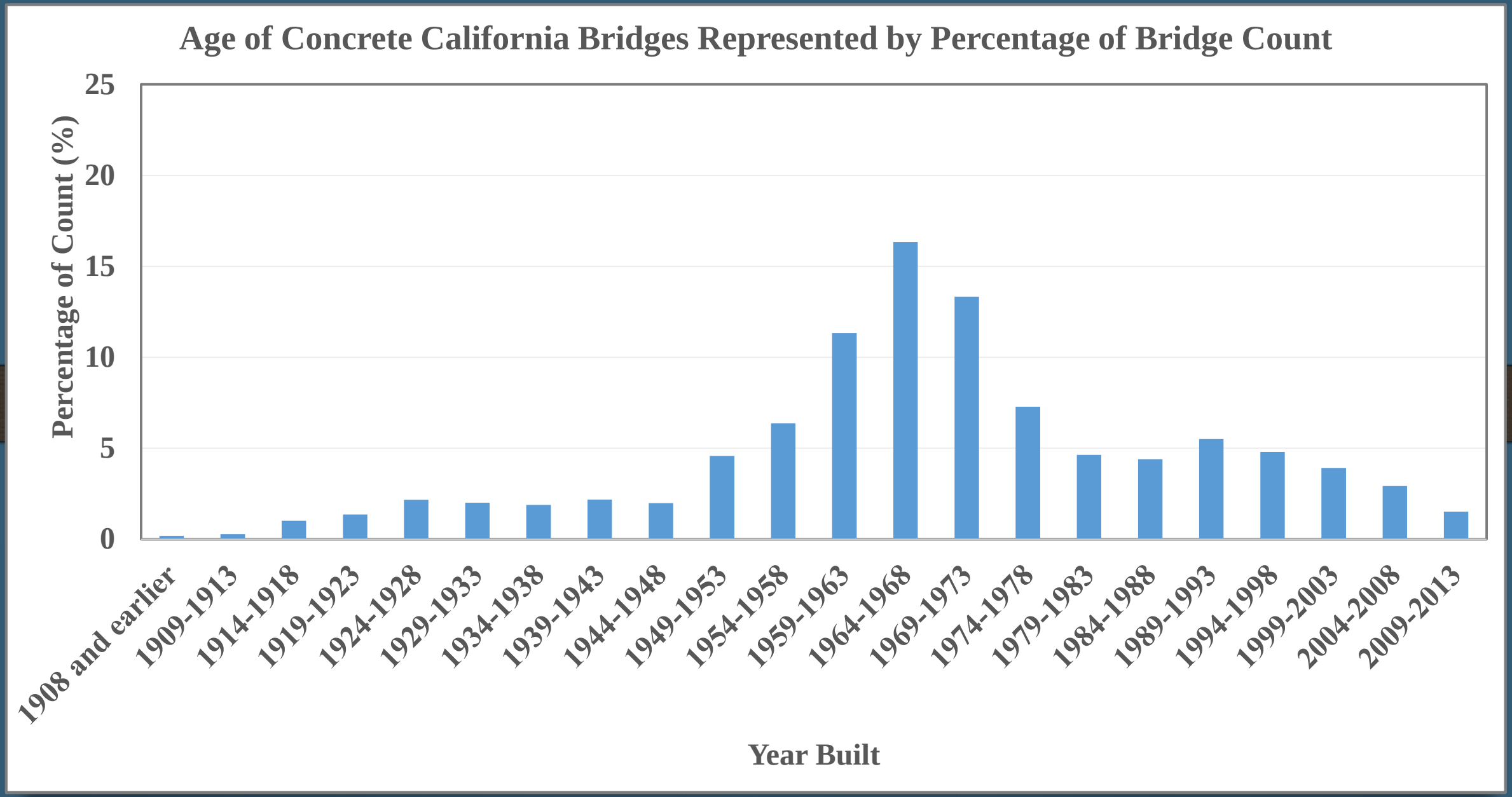
California Bridges with Deck Protection



Age

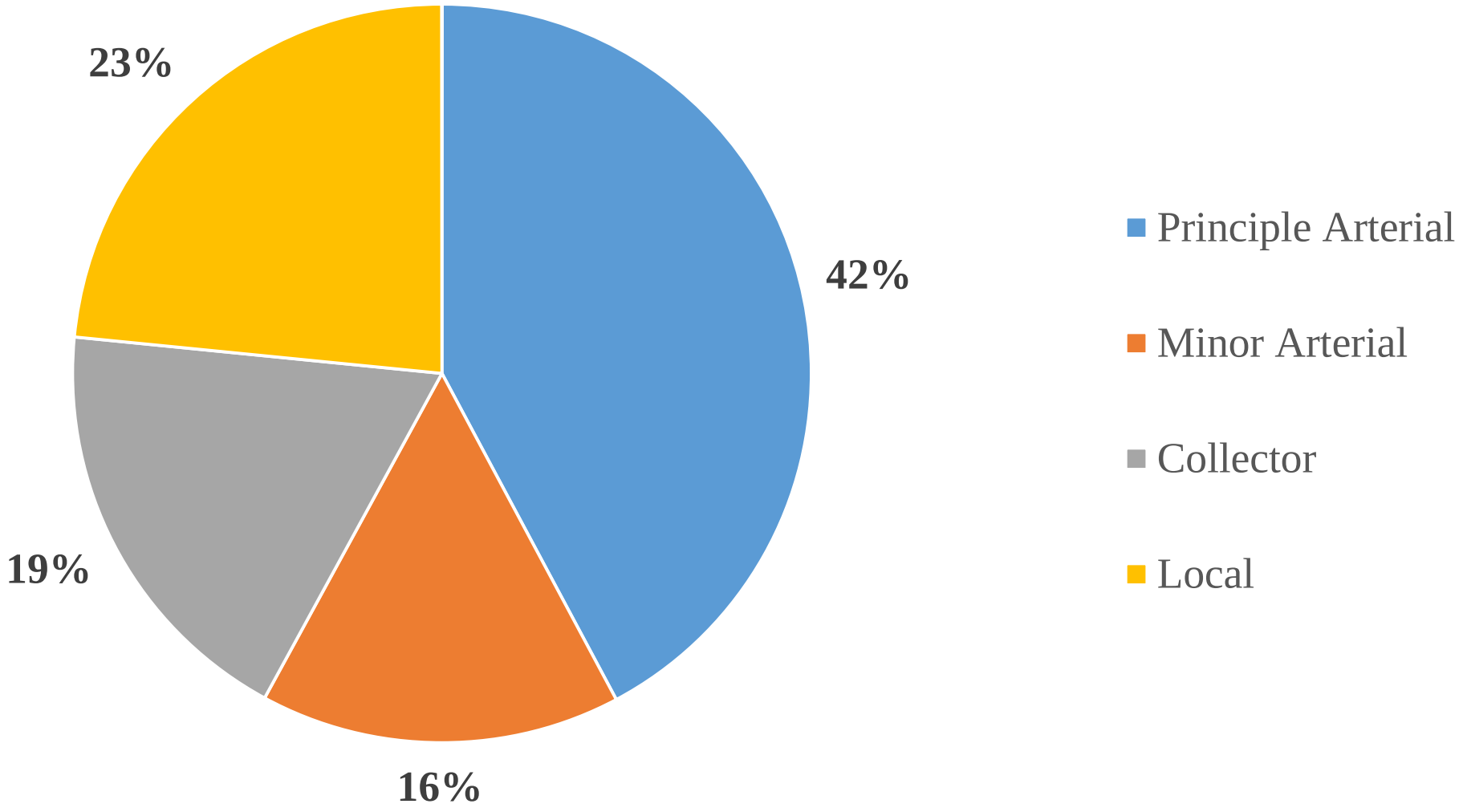
Life expectancy of bridges is 70 years old.

However, accounting for external and environmental factors, life expectancy is 50 years old.


Age of Concrete California Bridges Represented by Percentage of Bridge Count
Percentage of Count (%)
25
20
15
10
5
0
1908 and earlier
1909-1913
1914-1918
1919-1923
1924-1928
1929-1933
1934-1938
1939-1943
1944-1948
1949-1953
1954-1958
1959-1963
1964-1968
1969-1973
1974-1978
1979-1983
1984-1988
1989-1993
1994-1998
1999-2003
2004-2008
2009-2013
Year Built

Functional System

Functional Systems of California Bridges



Structural Status

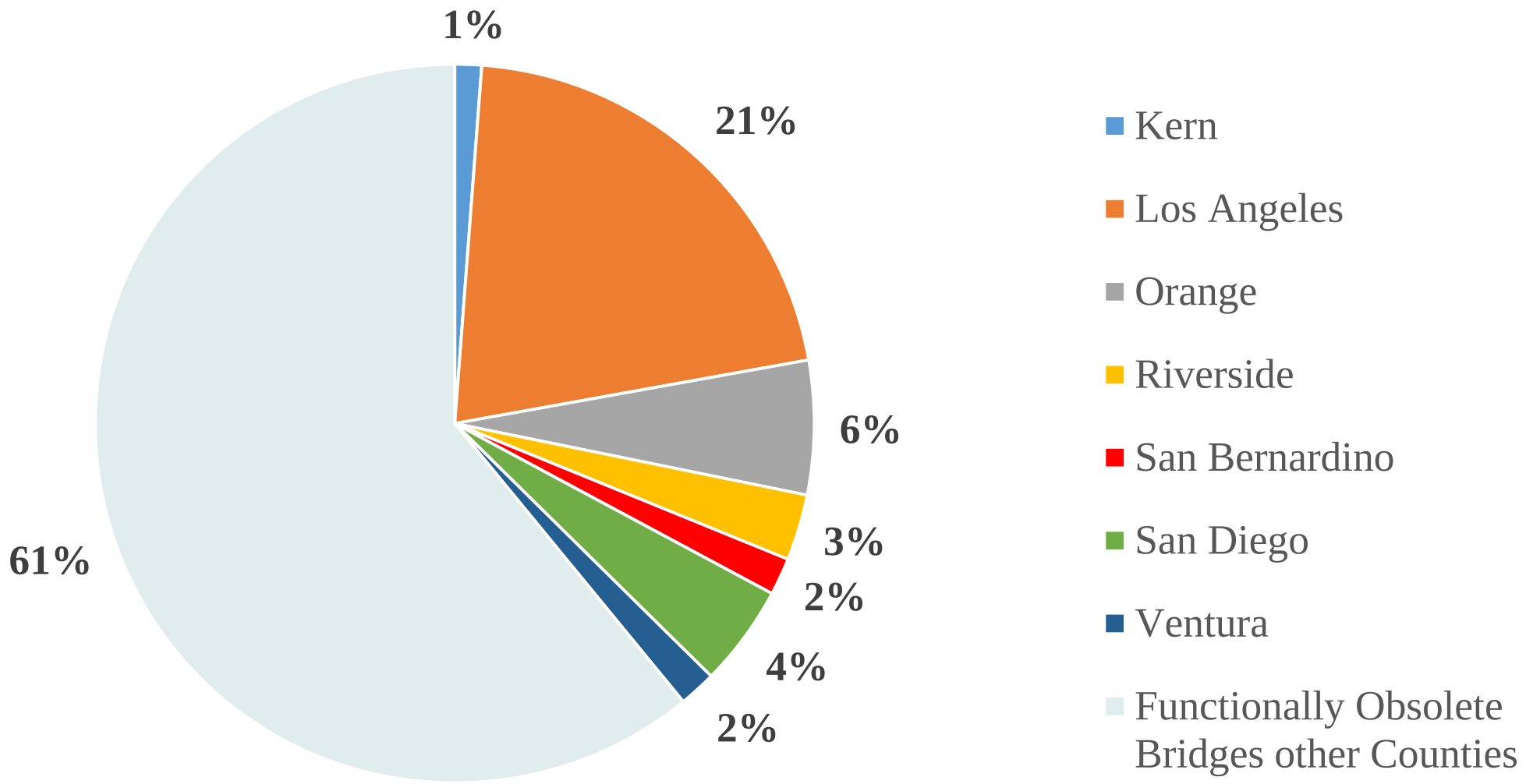
Functionally Obsolete:

- The design of the bridge is no longer functionally adequate for its task
- Does not accommodate traffic flow or vertical clearance is restrictive
- Does not meet safety regulations

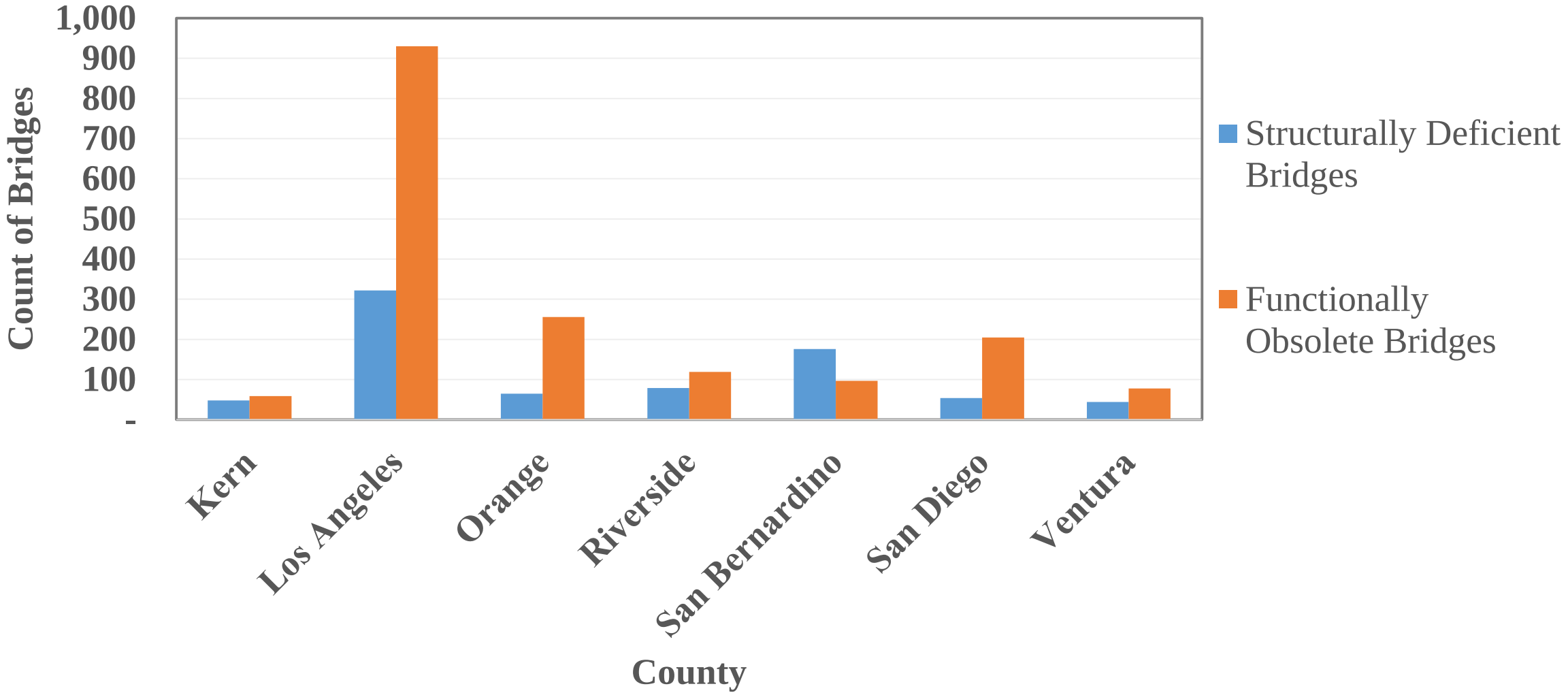
Structurally Deficient:

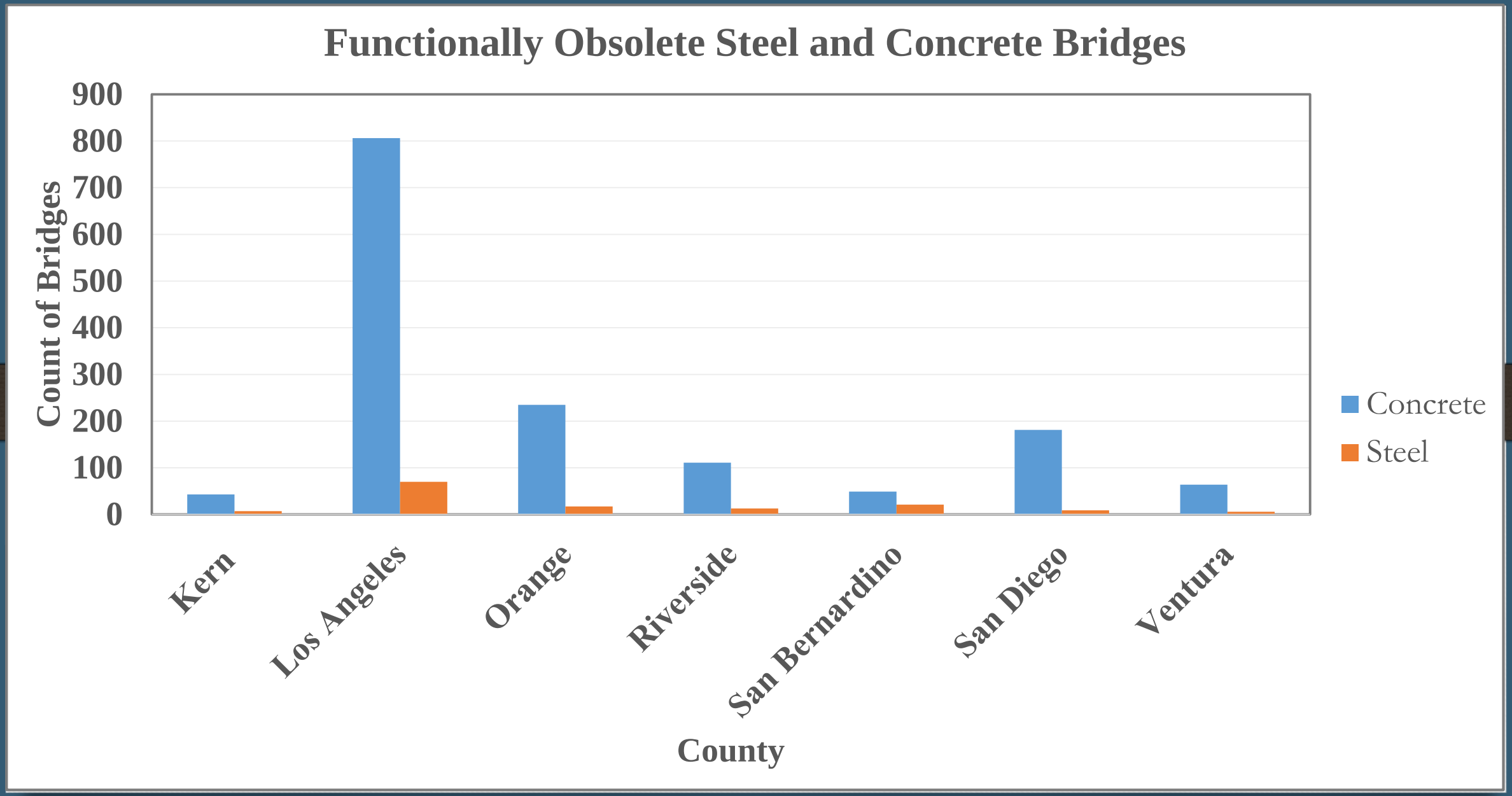
- The bridge is in need of maintenance
- There are flaws in the structure and the bridge needs repair
- Minor concrete cracks in bridge

Functionally Obsolete Bridges in California



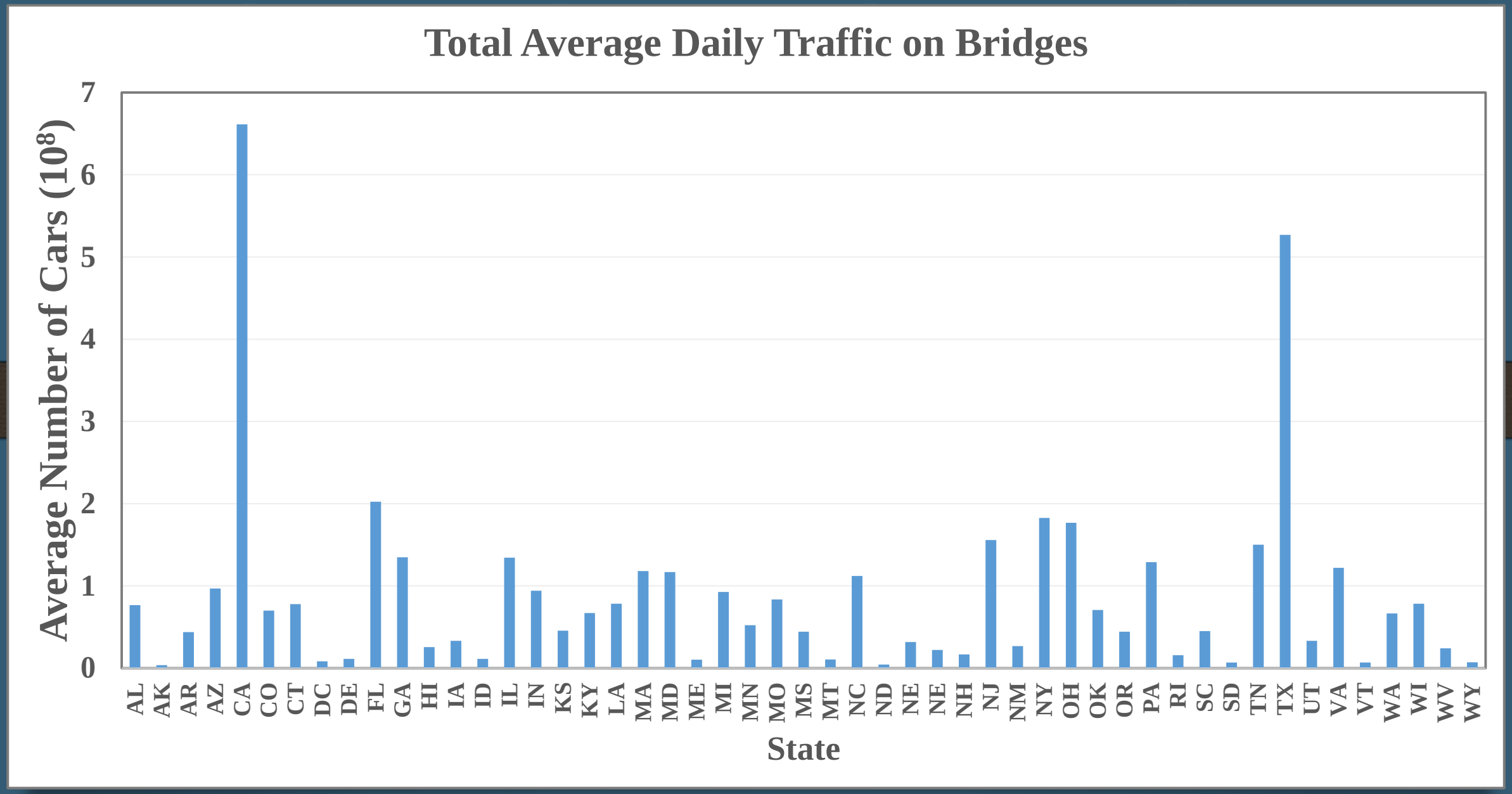
Southern California Structurally Deficient and Functionally Obsolete Bridges Represented by Count of Bridges




Functionally Obsolete Steel and Concrete Bridges
Count of Bridges
900
800
700
600
500
400
300
200
100
0
Kern
Los Angeles
Orange
Riverside
San Bernardino
San Diego
Ventura
County
Concrete
Steel

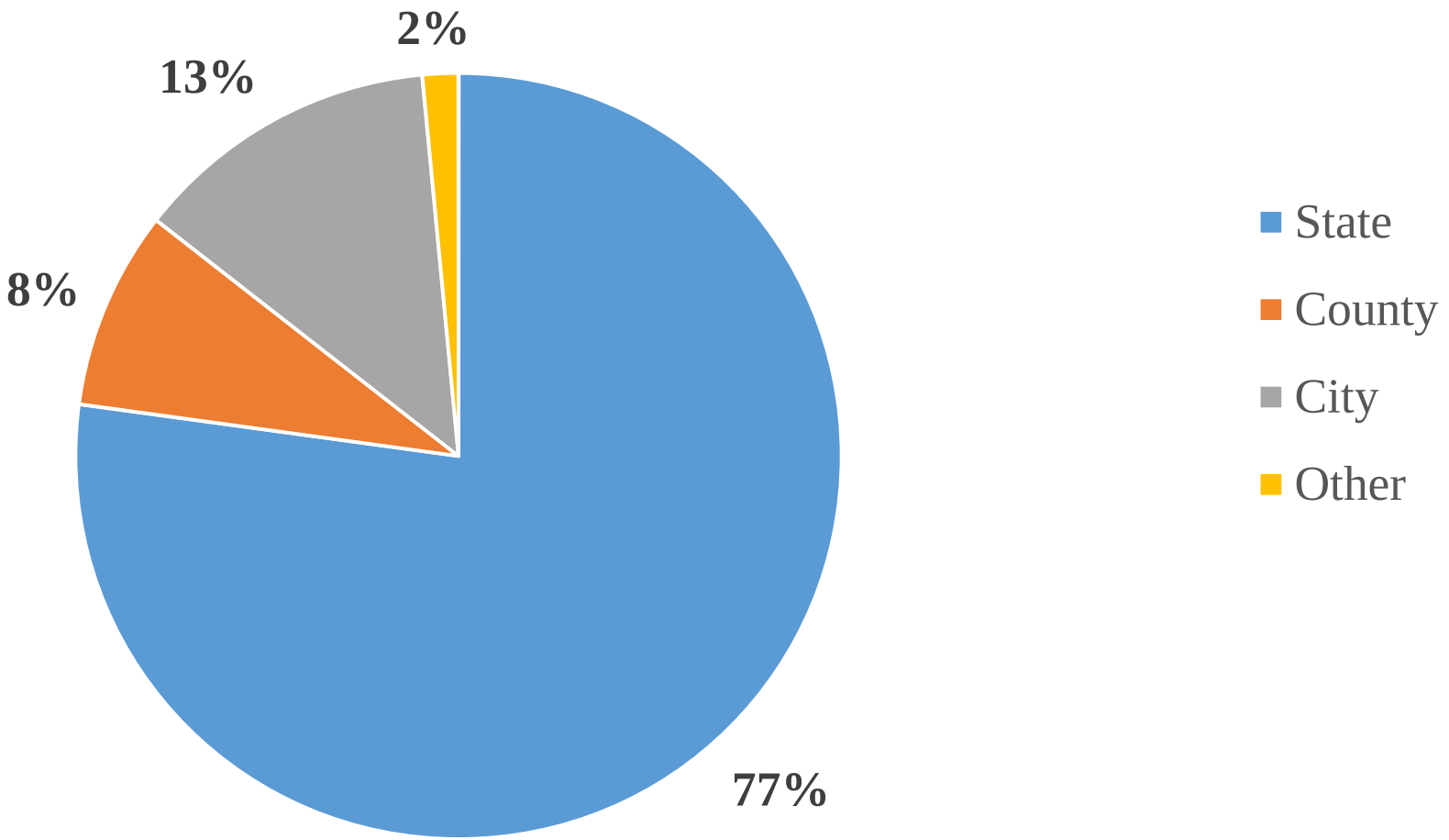
Average Daily Traffic on Bridges

Total traffic averaged over 365 days.

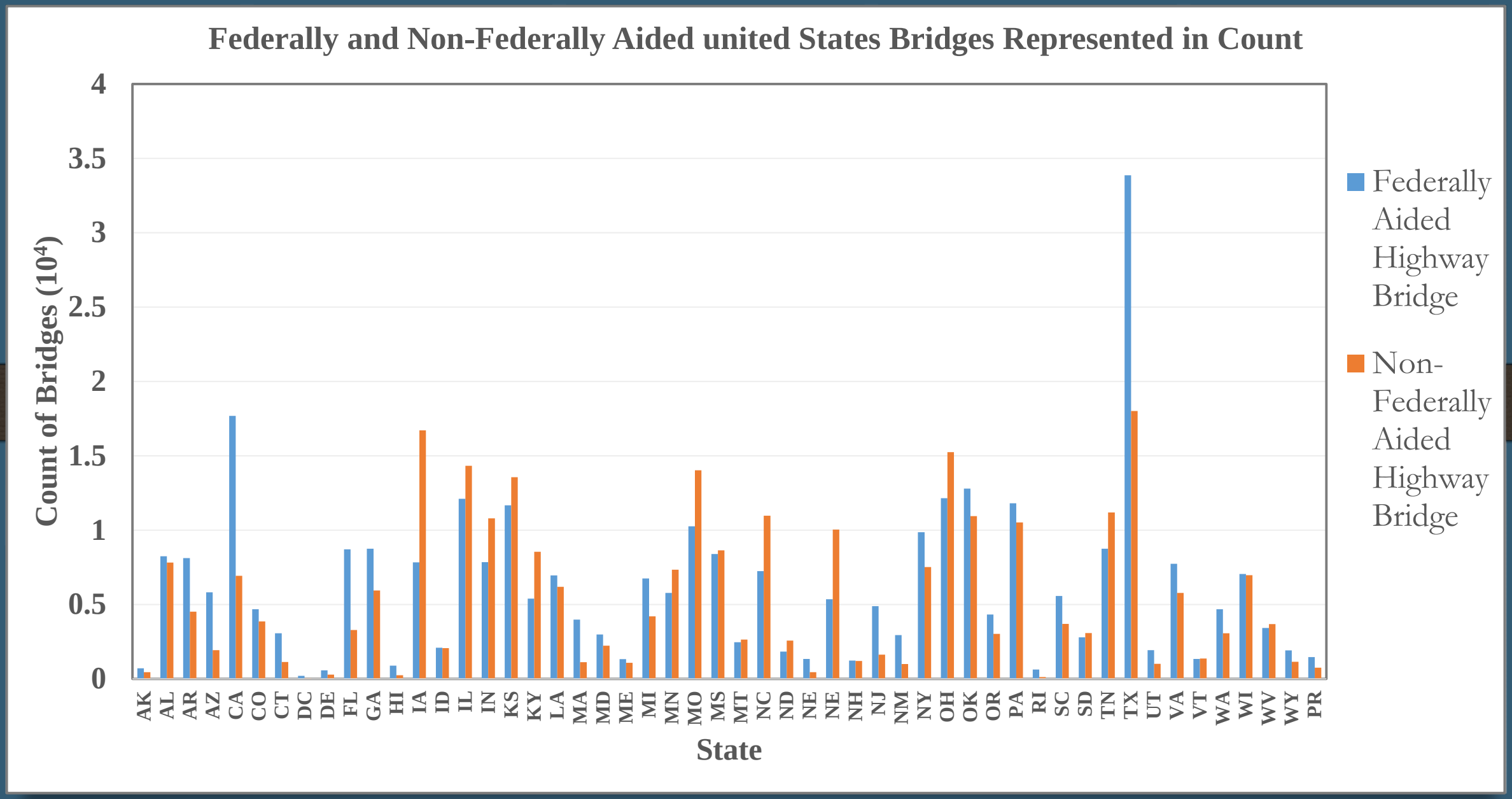

Total Average Daily Traffic on Bridges
Average Number of Cars (10^8)
0
1
2
3
4
5
6
7
AL AK AR AZ CA CO CT DC DE FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NE NH NJ NM NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY
State

Ownership

Ownership of California Bridges Represented by Percentage of Area



Federally and Non-Federally Aided Bridges

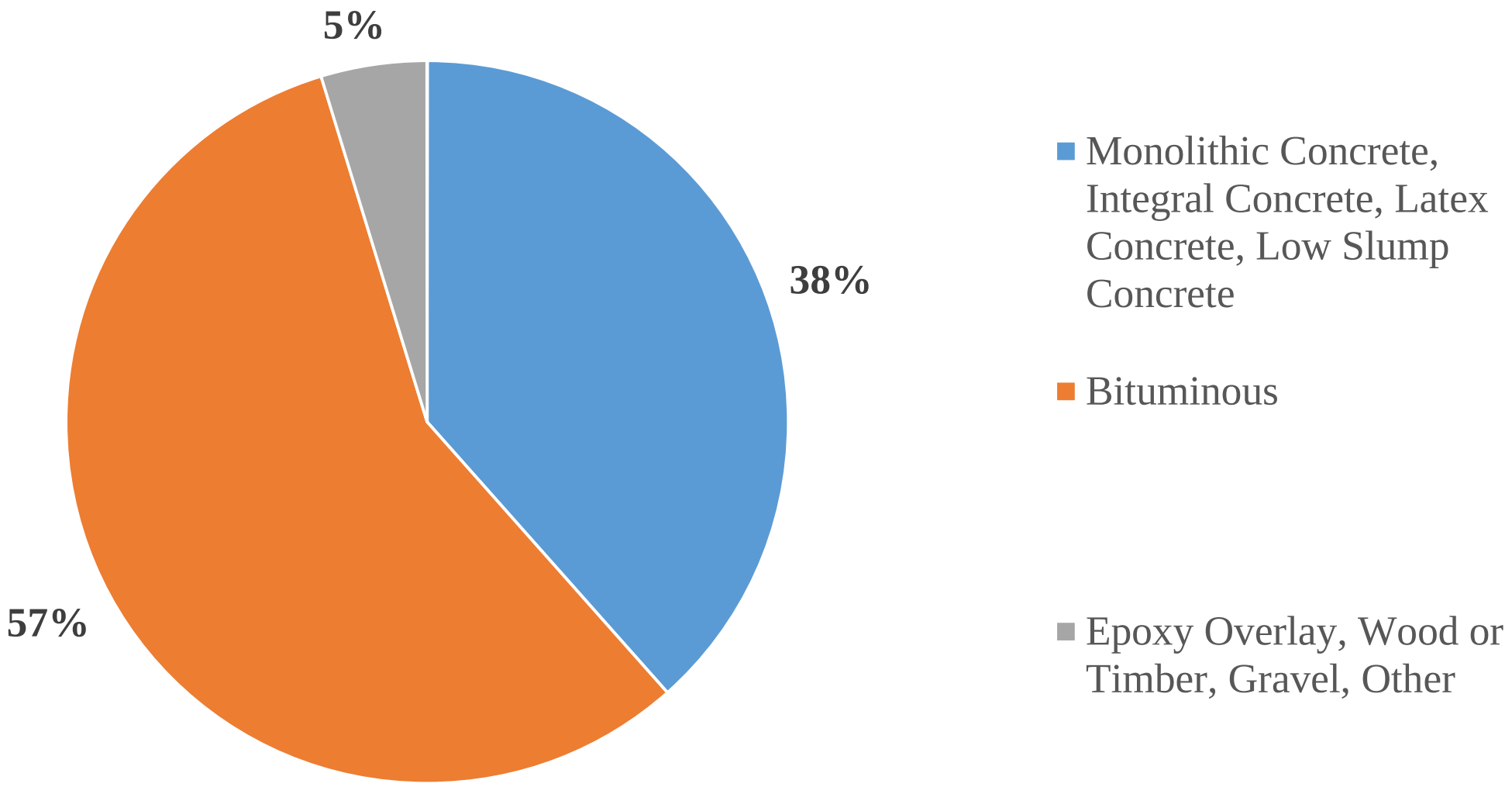

Federally and Non-Federally Aided united States Bridges Represented in Count
Count of Bridges (10^4)
4
3.5
3
2.5
2
1.5
1
0.5
0
AK AL AR AZ CA CO CT DC DE FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NE NH NJ NM NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY PR
State
Federally Aided Highway Bridge
Non-Federally Aided Highway Bridge

Conclusion

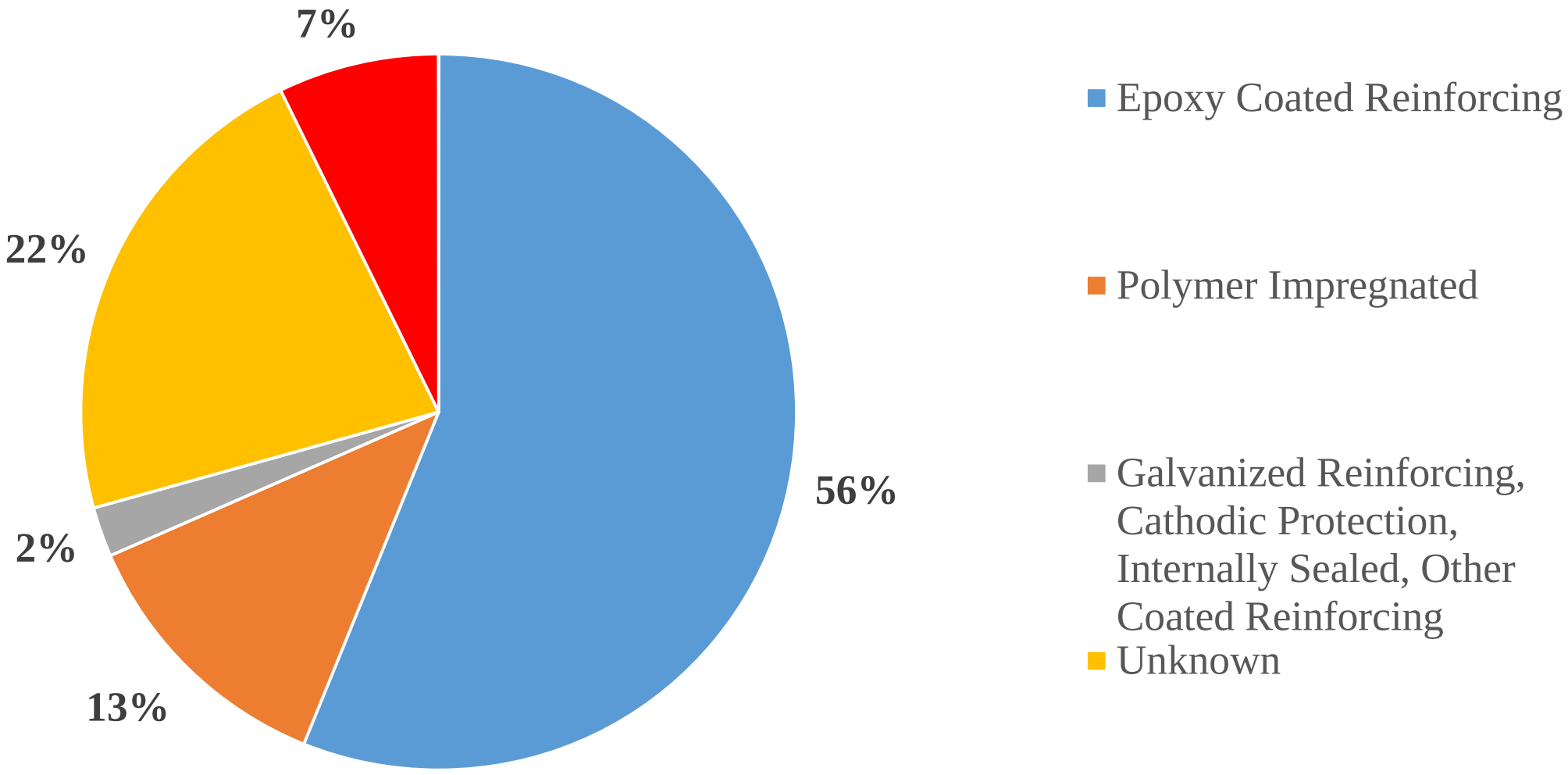
- Trends found in Research (bridge count and bridge area):
  - Geographic distribution and bridge attributes
  - Bridge condition and bridge attributes
- Majority of the information on bridges in the United States are not deciphered in ASCII files
  - HTML and Excel Format
  - NBI information limited to the tables provided on the FHWA website

Questions?

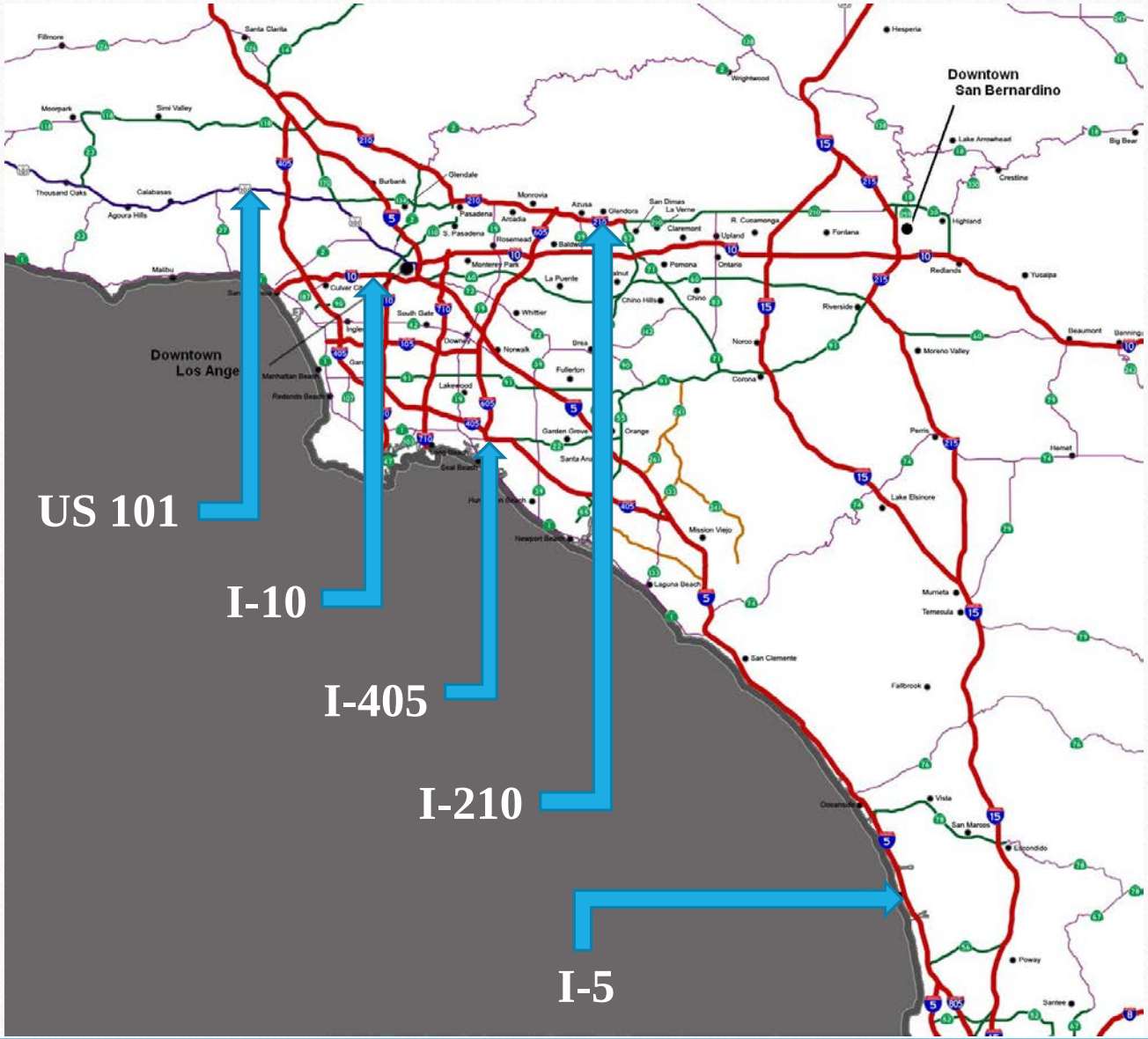
Wearing Surfaces of California Bridges



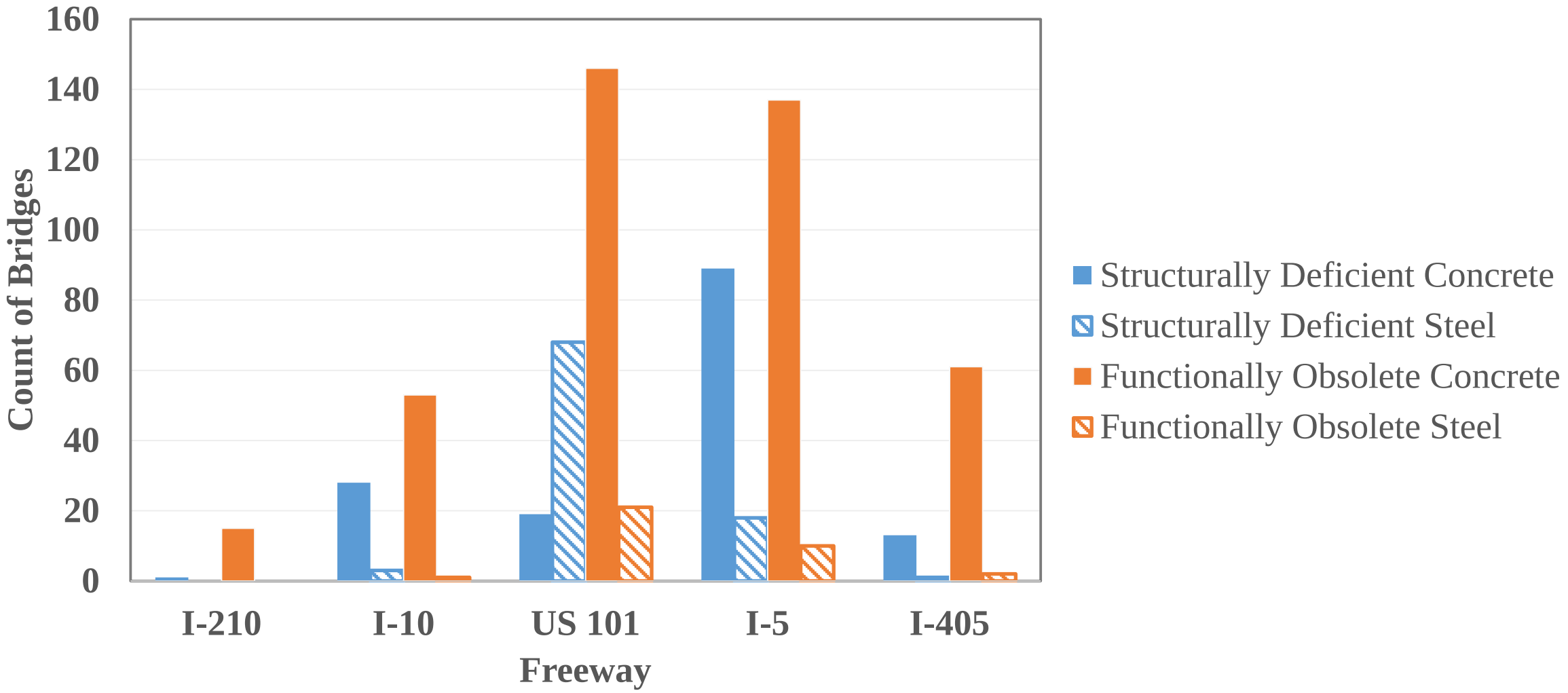
Deck Protection of California Bridges

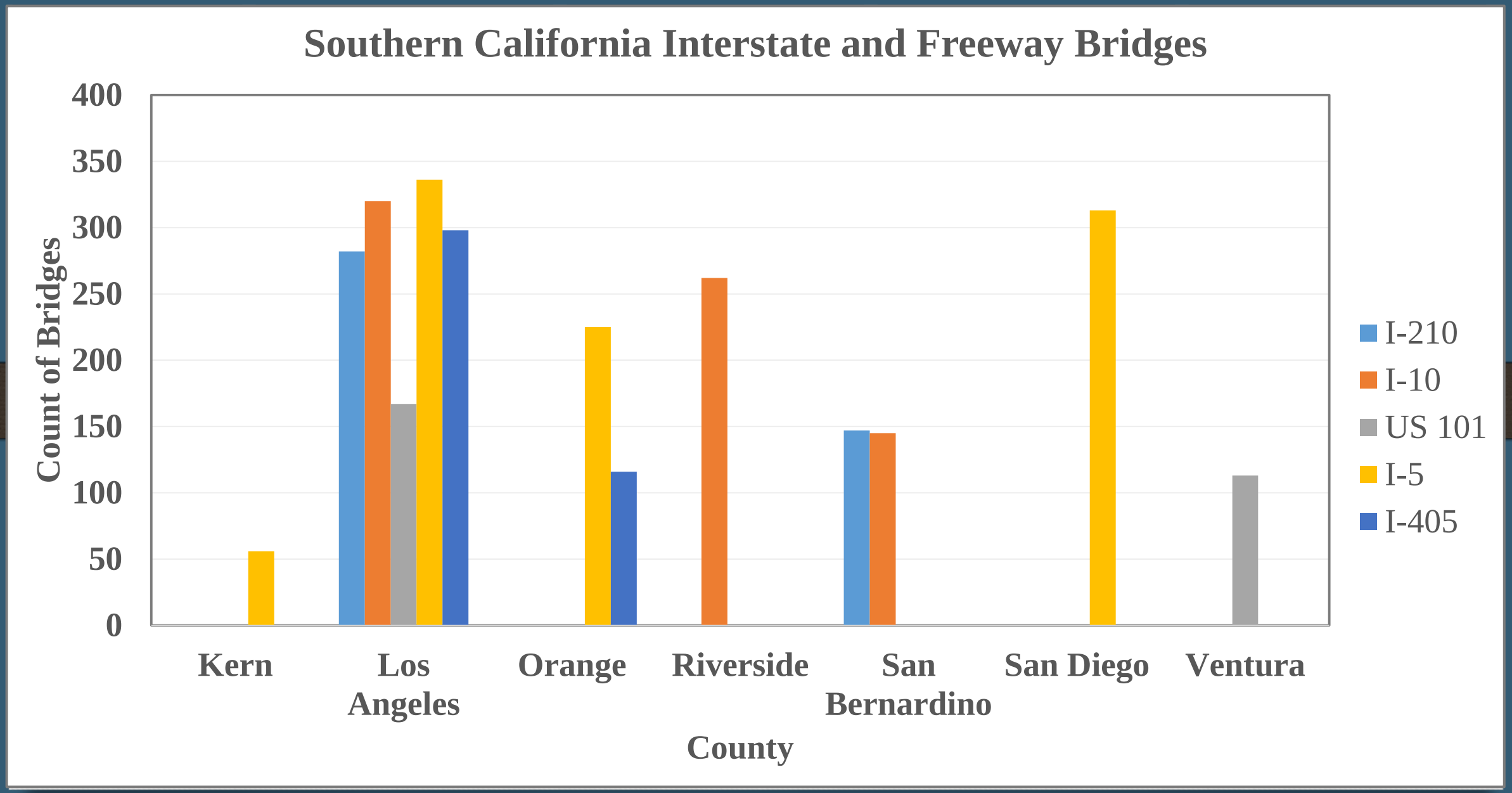


Bridges on Main Freeways in California


Downtown
San Bernardino
Downtown
Los Ange
US 101
I-10
I-405
I-210
I-5

Structurally Deficient and Functionally Obsolete Major Freeway and Interstate Bridges in Califonia Represented by Count of Bridges




Southern California Interstate and Freeway Bridges
Count of Bridges
400
350
300
250
200
150
100
50
0
Kern
Los Angeles
Orange
Riverside
San Bernardino
San Diego
Ventura
County
I-210
I-10
US 101
I-5
I-405