# PA/MA Bridges falling down

By Richard Enikeieff

# Project Goals:

Attempt to determine what factors lead up to the depreciation of bridges, and if those factors are consistent between states.

Examine the more robust PA dataset to narrow down features

Compare  two different states to see if we get a similar score and if not hypothesize why and examine the features from the other dataset.

# What we'll be covering:

Background of project

EDA

Model Selection

Conclusions

# Why Bridges?

PA and MA are among the 10 worst states for their bridge upkeep, and I personally lived next to a decaying bridge for a number of years while I lived in Pittsburgh.

# The 10 worst average sufficiency ratings in the US

The rating, which ranges from 0 to 100, measures a bridge's condition, functionality, and importance.

| State | Average sufficiency rating |
|---|---|
| Rhode Island | 71.34 |
| Hawaii | 73.56 |
| Kentucky | 75.13 |
| Arkansas | 75.62 |
| Pennsylvania | 75.86 |
| Iowa | 76.16 |
| Alaska | 76.38 |
| **Massachusetts** | **76.44** |
| North Carolina | 76.82 |
| Maine | 76.90 |

**SOURCE: U.S. Department of Transportation**

MATT ROCHELEAU/GLOBE STAFF


TUNNEL 3/4 MILE
CLEARANCE 13-6
TRUCK OVERHEIGHT
WHEN SIGNS
FLASH AHEAD

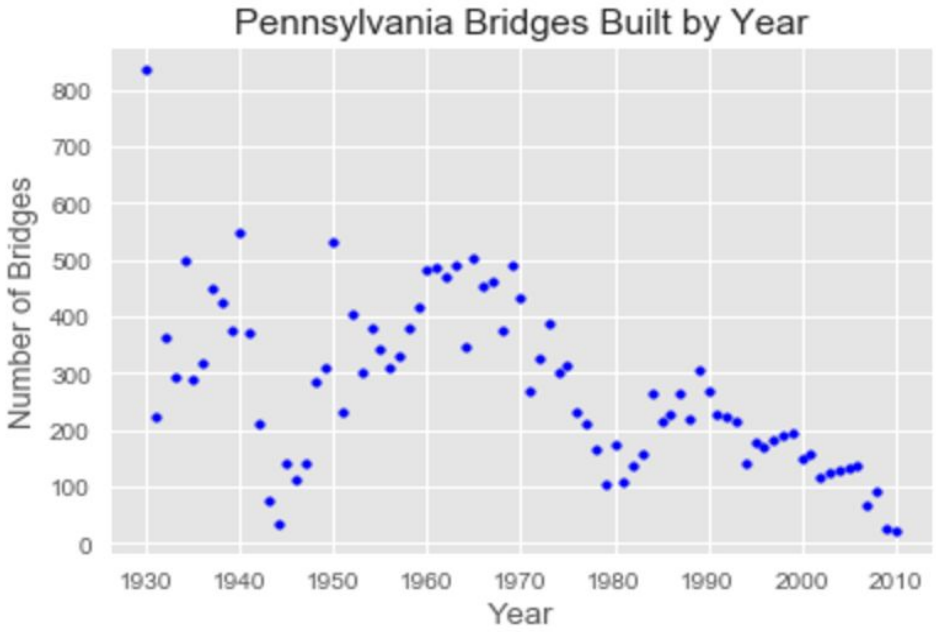
# EDA:

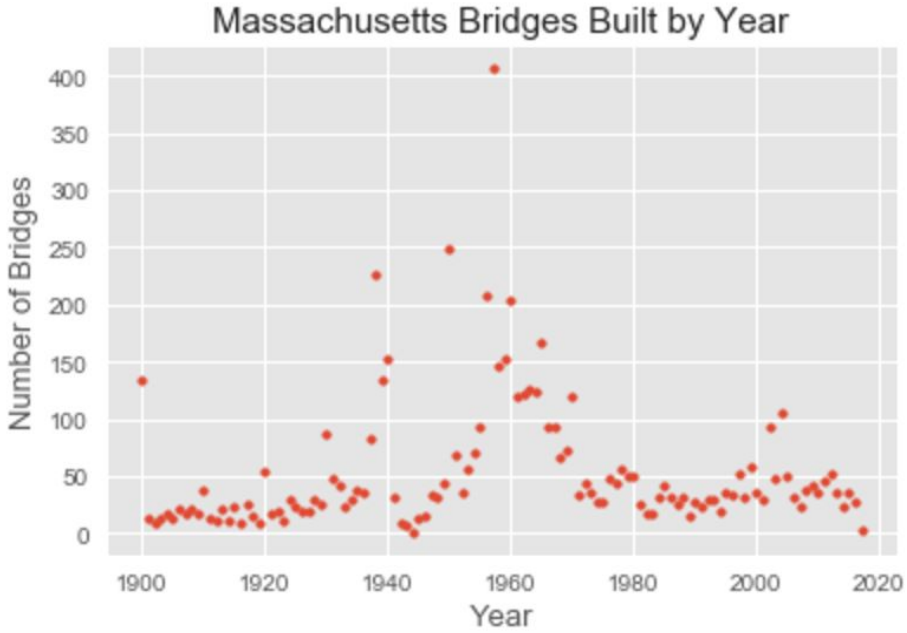
Factor Determination, and choices:

PA Factors: Lat/Lon, average daily traffic, city code, covered, caretaker, deck area/width, main material, main span material and type, design, material for the bridge, length, historical significance, year built/reconstructed, state/local, structural rating, flood inspection and the nbi rating

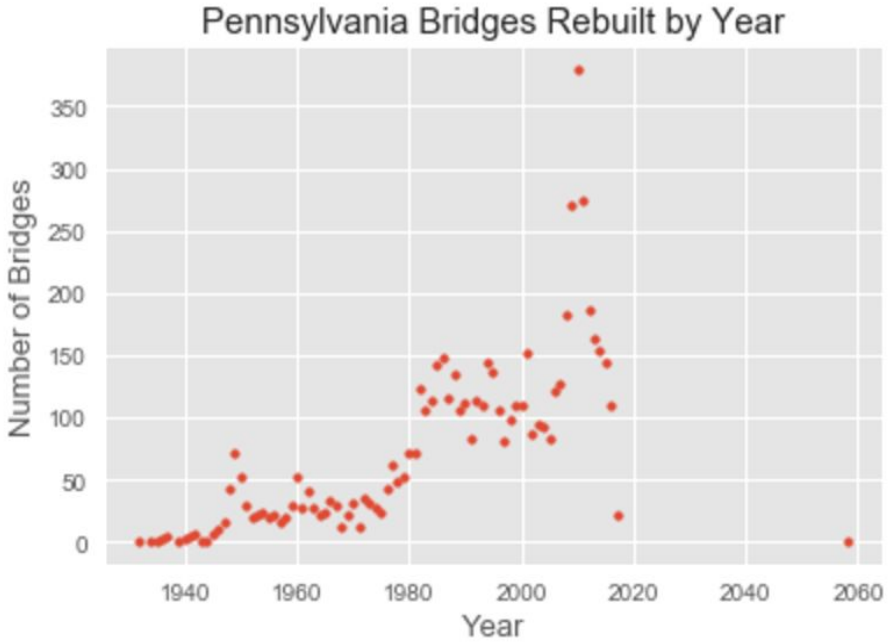
MA Factors: Latitude, Longitude, Structure Material, Structure_Type, Bridge_Owner, Year Built, Year reconstructed, Structure Length, Structurally Deficient, Structure Category

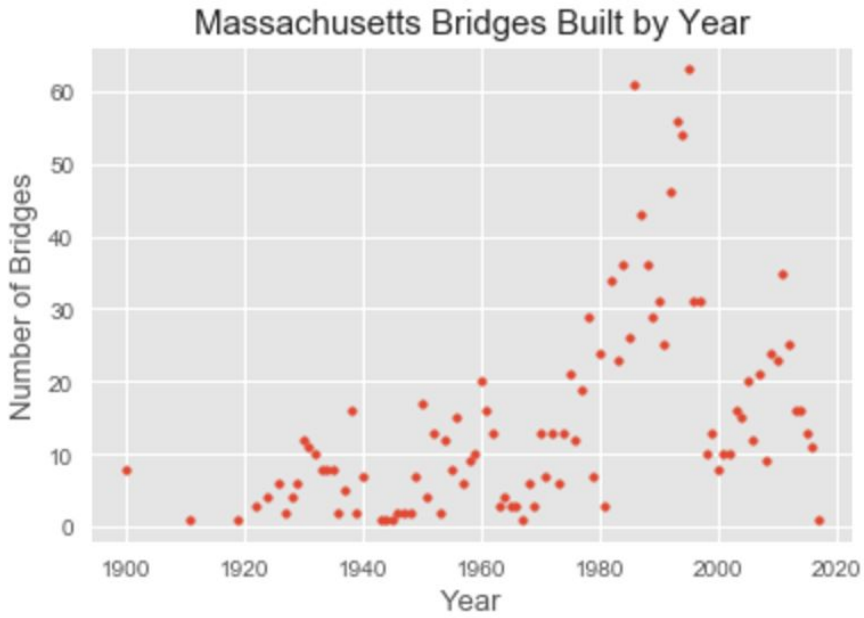
# Year Built Comparisons



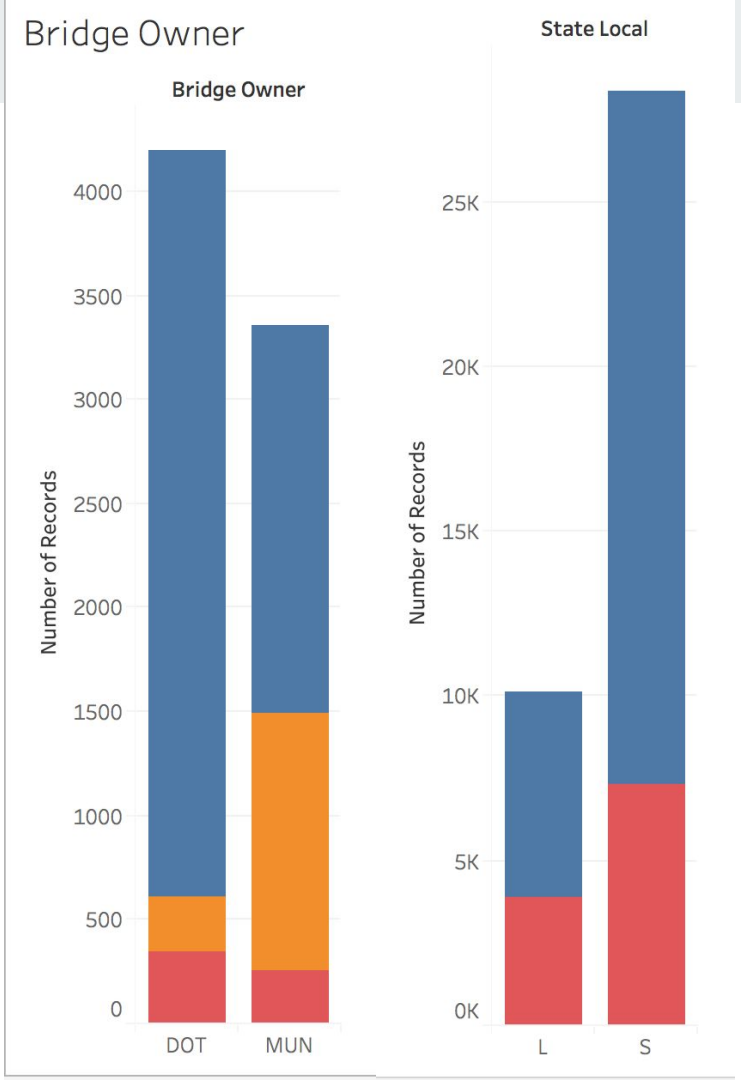
# Comparison by reconstruction year

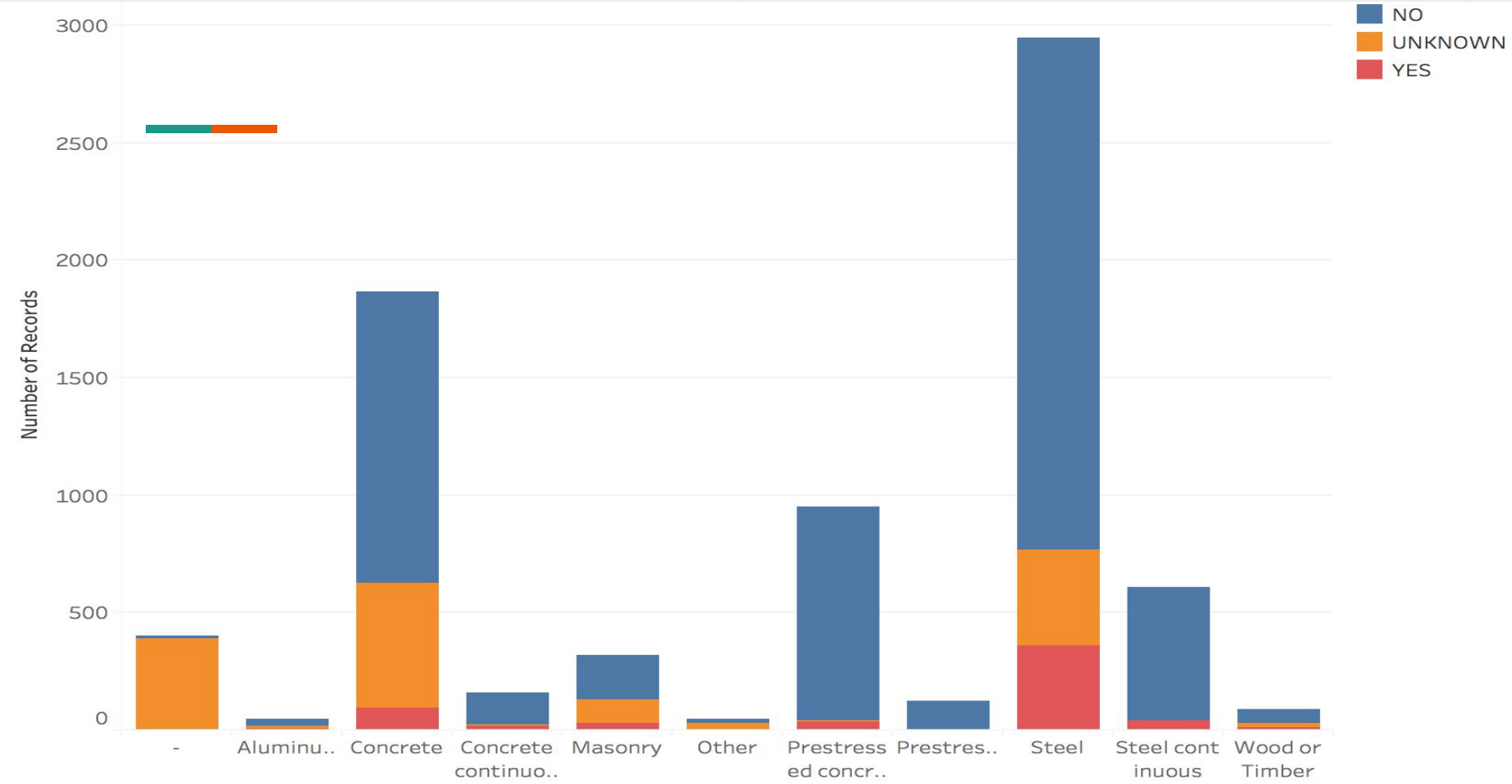


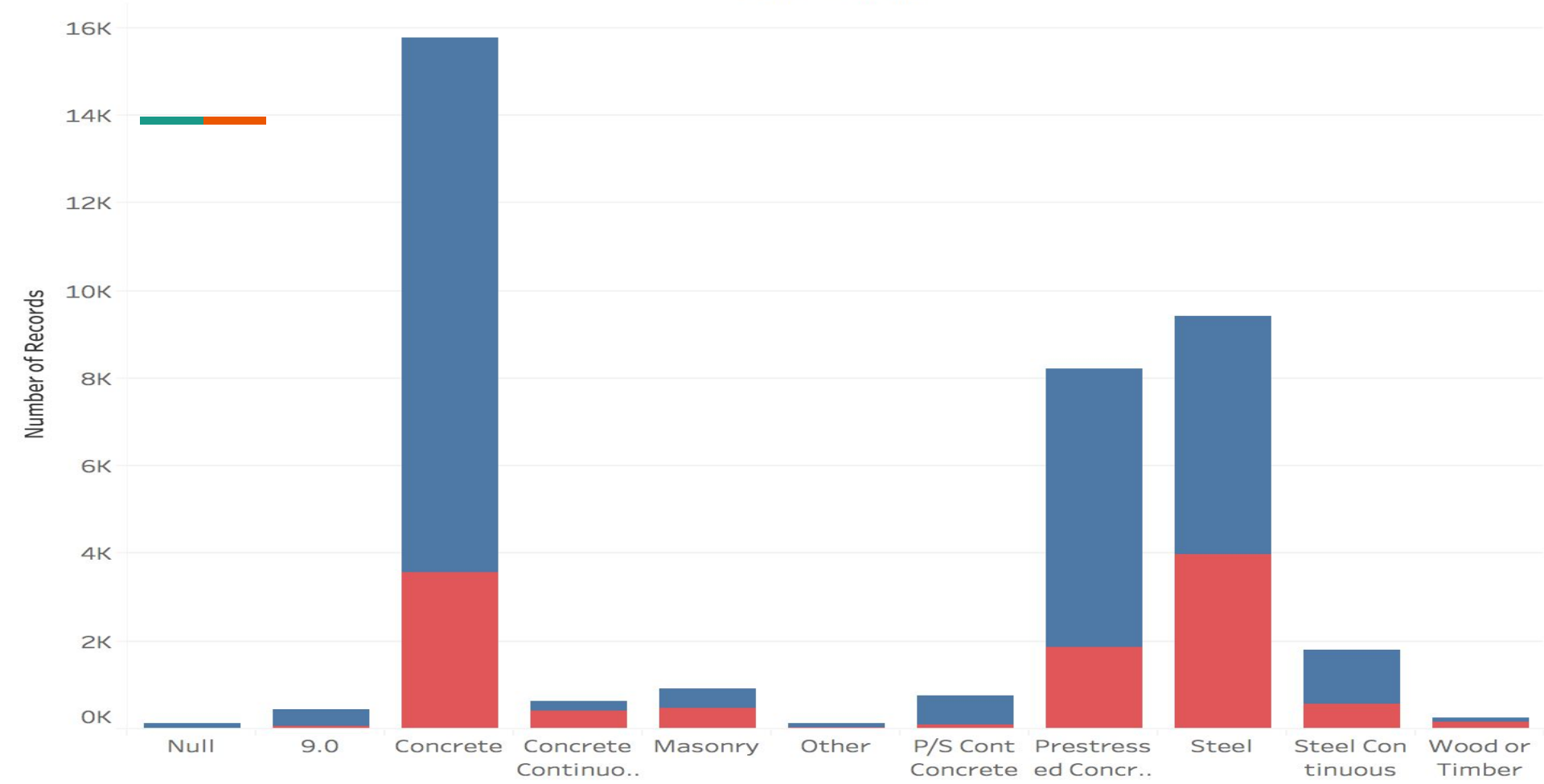
# Bridge Ownership

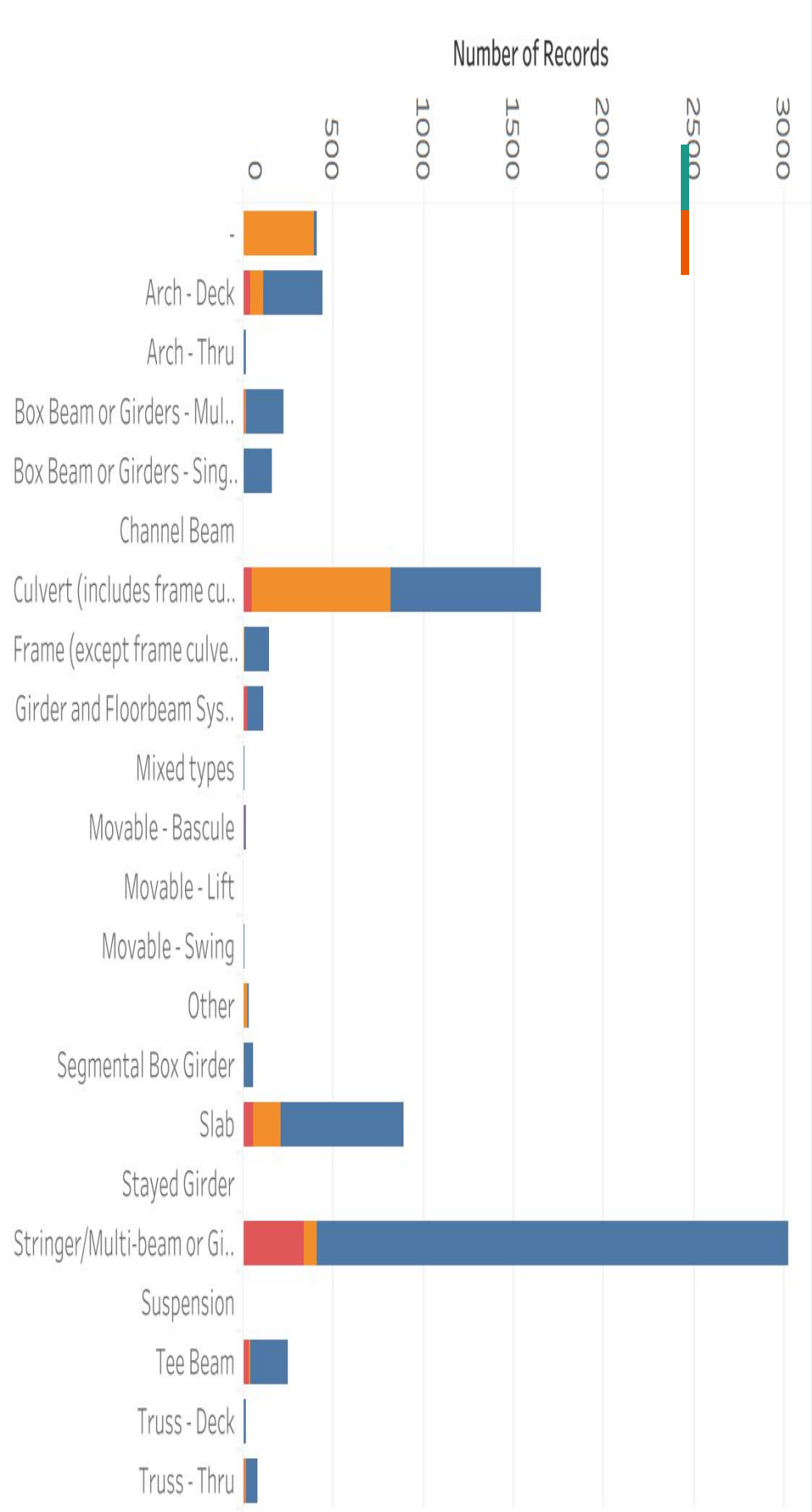
Significant difference in ownership for PA vs MA

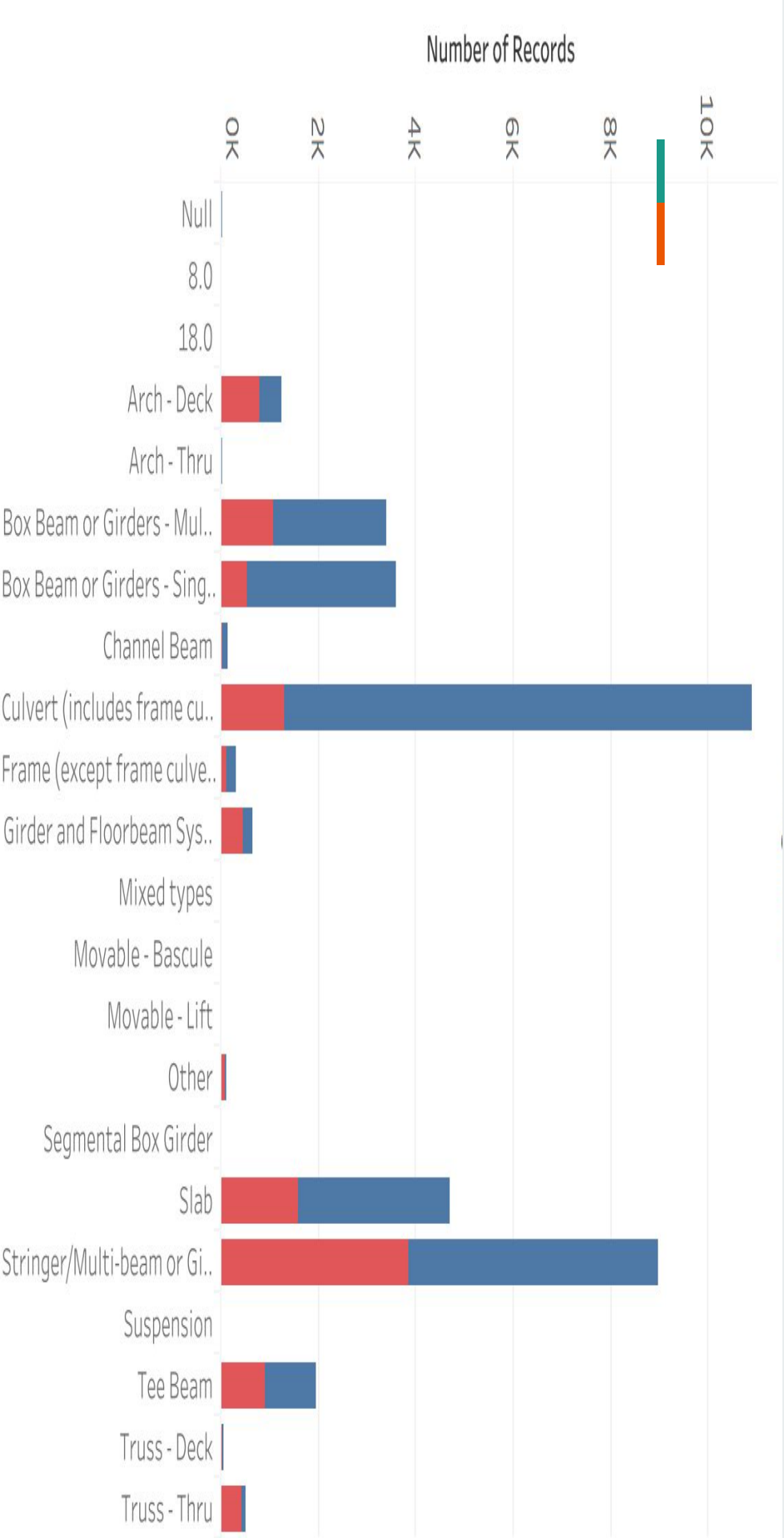





Sum of Number of Records for each Structure Material. Color shows details about Structurally Deficient.


16K
14K
12K
10K
8K
6K
4K
2K
0K
Number of Records
Null
9.0
Concrete
Concrete Continuo..
Masonry
Other
P/S Cont Concrete
Prestressed Concr..
Steel
Steel Continuous
Wood or Timber


Number of Records
0
500
1000
1500
2000
2500
3000
-
Arch - Deck
Arch - Thru
Box Beam or Girders - Mul..
Box Beam or Girders - Sing..
Channel Beam
Culvert (includes frame cu..
Frame (except frame culve..
Girder and Floorbeam Sys..
Mixed types
Movable - Bascule
Movable - Lift
Movable - Swing
Other
Segmental Box Girder
Slab
Stayed Girder
Stringer/Multi-beam or Gi..
Suspension
Tee Beam
Truss - Deck
Truss - Thru


Number of Records
0K
2K
4K
6K
8K
10K
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Arch - Deck
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Channel Beam
Culvert (includes frame cu..
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Girder and Floorbeam Sys..
Mixed types
Movable - Bascule
Movable - Lift
Other
Segmental Box Girder
Slab
Stringer/Multi-beam or Gi..
Suspension
Tee Beam
Truss - Deck
Truss - Thru

# Model Selection:

Random Forests:

.90 PA1 Score, AUC_ROC: .96

.90 MA Score,  AUC_ROC: .8

.82 PA2 Score, AUC_ROC: .9

# PA Feature Importance

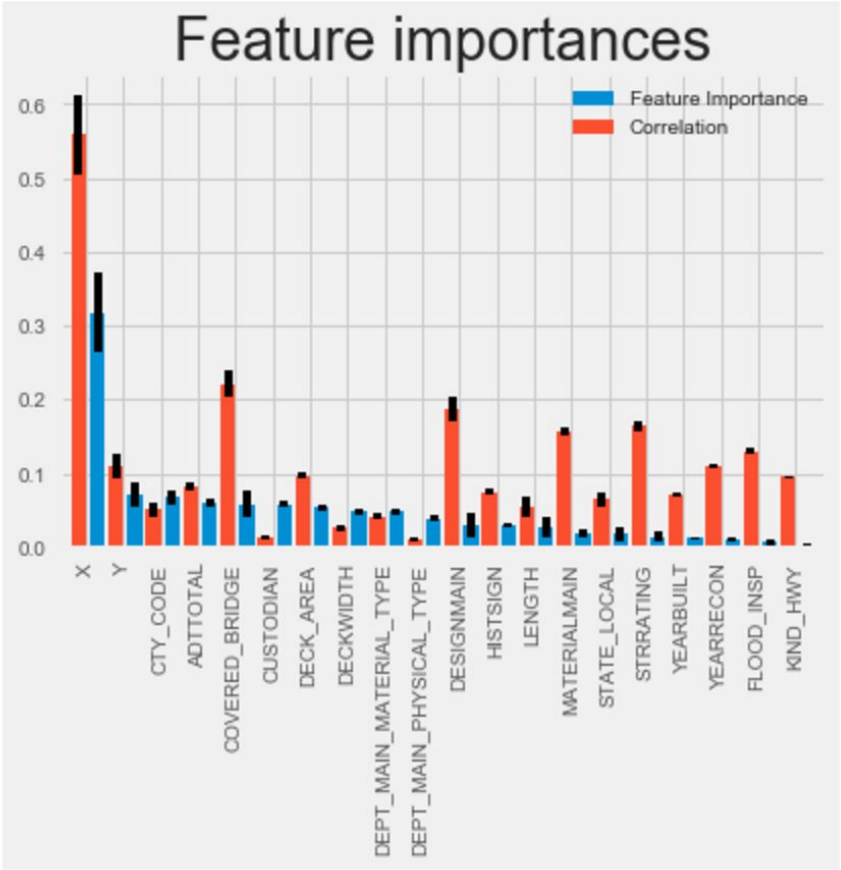
Latitude

Longitude

City Code

Average Daily Traffic

Covered Bridge

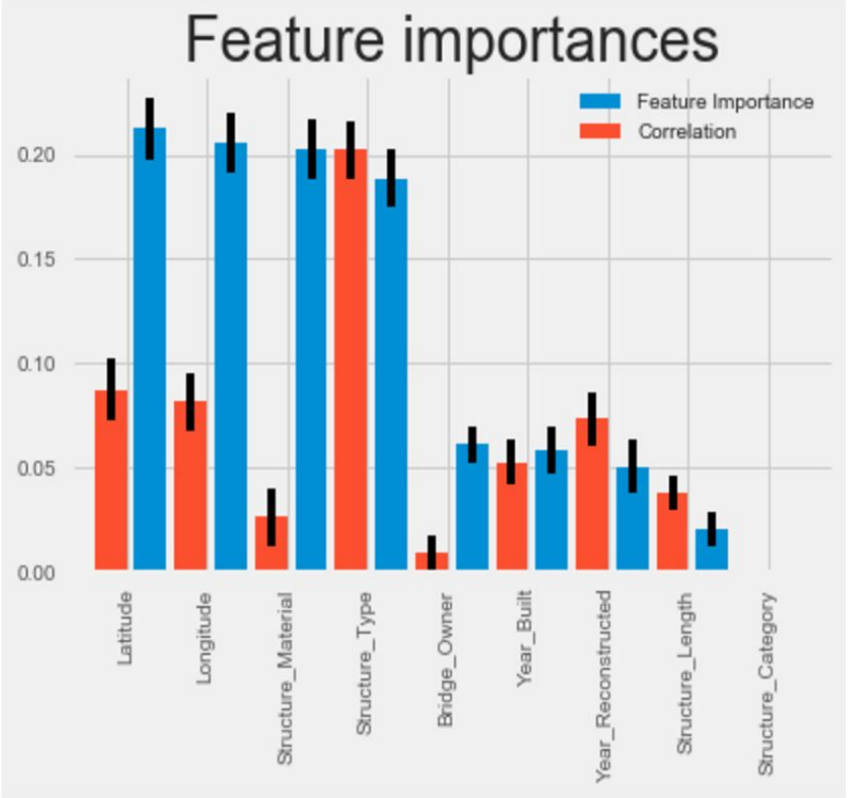


# MA Feature Importance

Geography

Material

Type



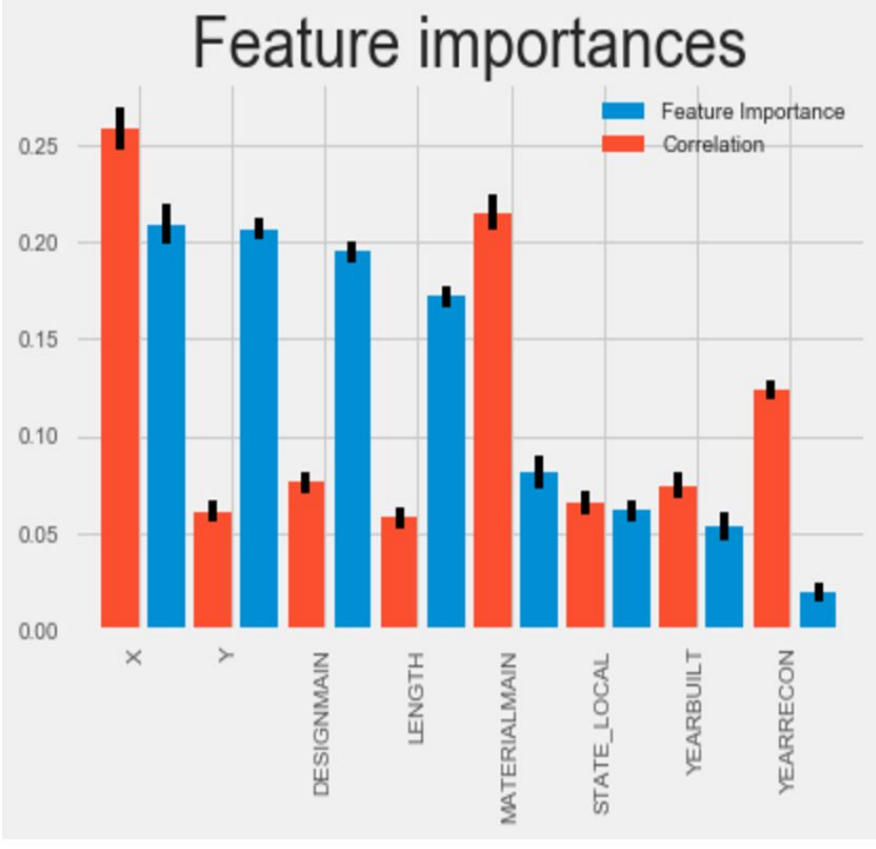
# PA 2 Feature Importance

Location

Material

Design

Length



# Conclusion:

Depending on the model we are 80-90% confident that these features can lead to the process of depreciation.

Future Goals: attempt to determine why similar features were more important depending on the state, look further into the discrepancy between scores. While all bridges will become decrepit eventually, analyzing contributing features could possibly prolong their lifespans, and reduce the need for repairs.

# Questions?