# PA/MA Bridges falling down

By Richard Enikeieff

# Project Goals:

Attempt to determine what factors lead up to the depreciation of bridges

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

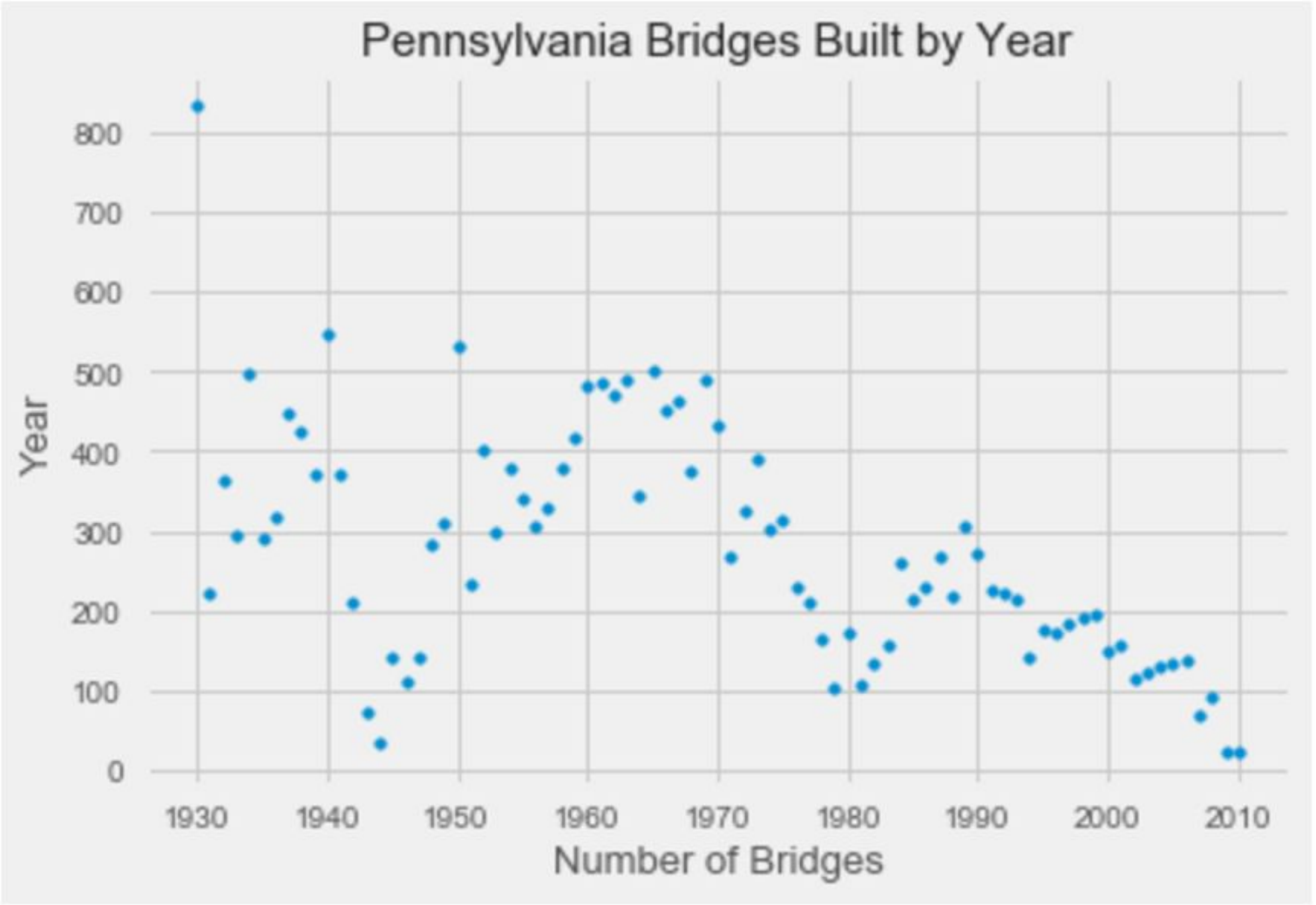
# EDA:

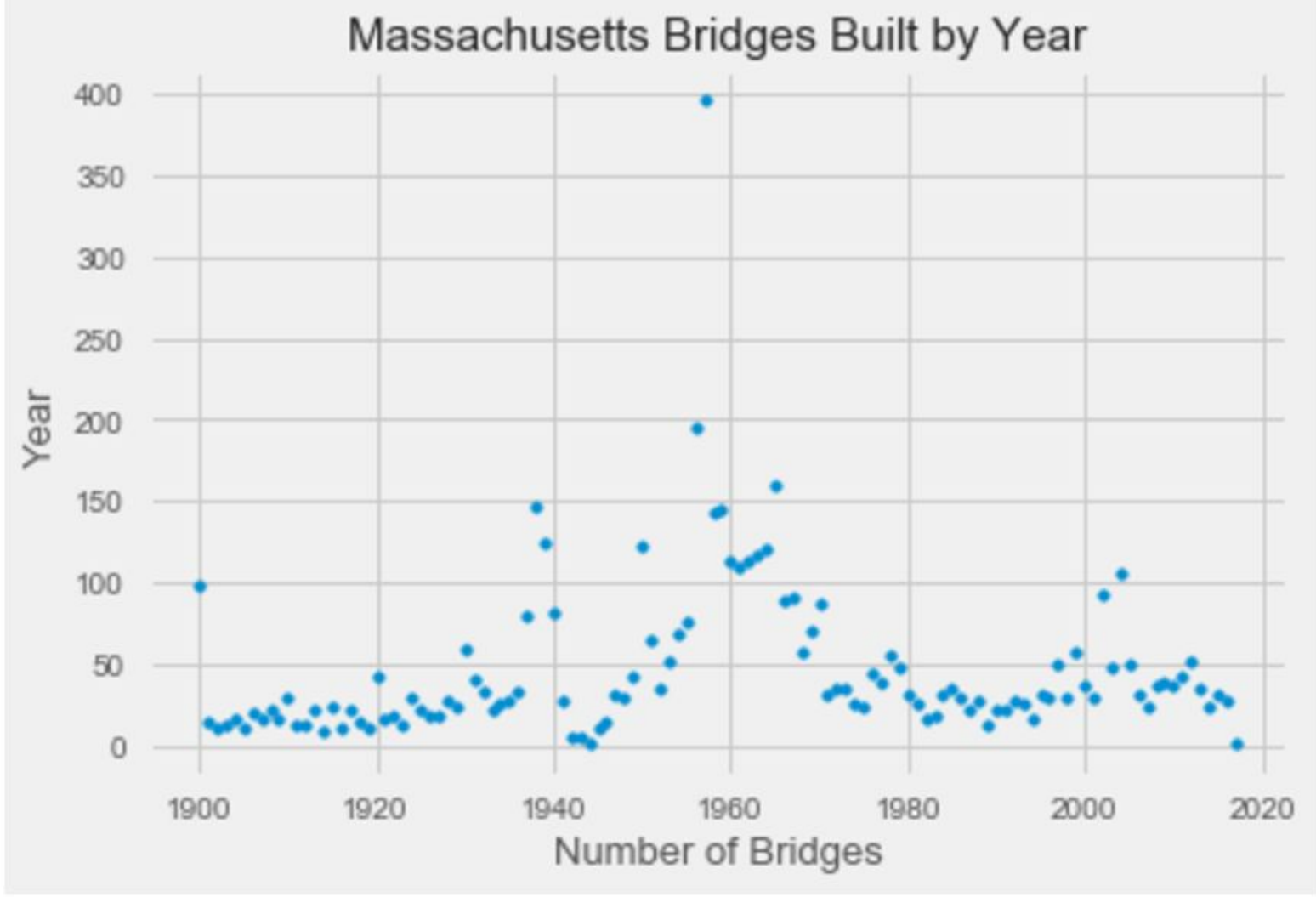
Factor Determination, and choices:

PA Factors:

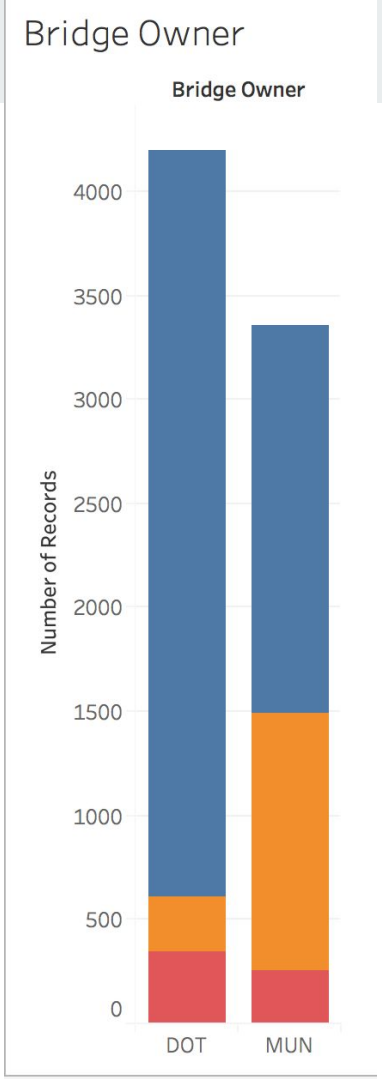
'X','Y','CTY_CODE','ADTTOTAL','BRIDGE_ID','COVERED_BRIDGE','CUSTODIAN','DECK_AREA','DECK WIDTH', 'DEPT_MAIN_MATERIAL_TYPE' , 'DEPT_MAIN_PHYSICAL_TYPE', 'DESIGNMAIN', 'HISTSIGN', 'LENGTH', 'MATERIALMAIN', 'NBI_RATING', 'STATE_LOCAL', 'STRRATING', 'YEARBUILT', 'YEARRECON', 'FLOOD_INSP', 'KIND_HWY'

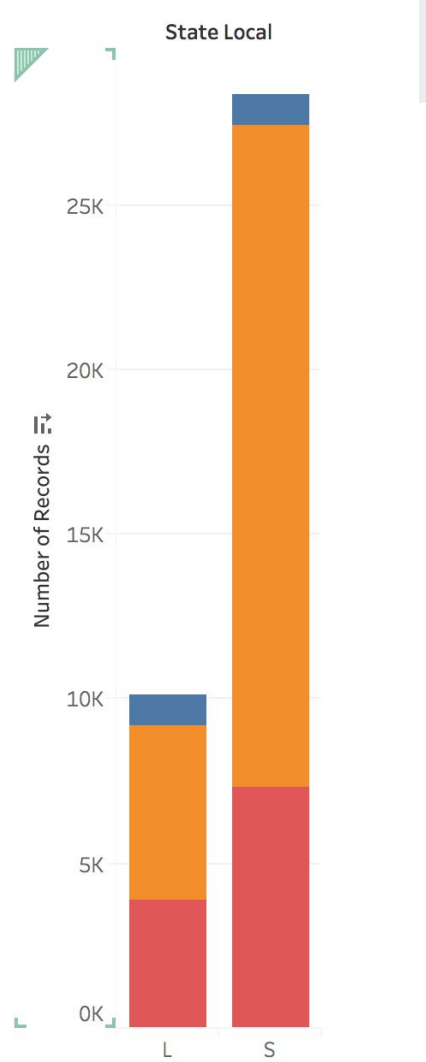
MA Factors: 'Latitude','Longitude','Structure_Material', 'Structure_Type', 'Town','Bridge_Owner', 'Bridge_Identification_Number__B','Year_Built', 'Year_Reconstructed', 'Structure_Length', 'Structurally_Deficient', 'Structure_Category'


Pennsylvania Bridges Built by Year
Year
800
700
600
500
400
300
200
100
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
Number of Bridges

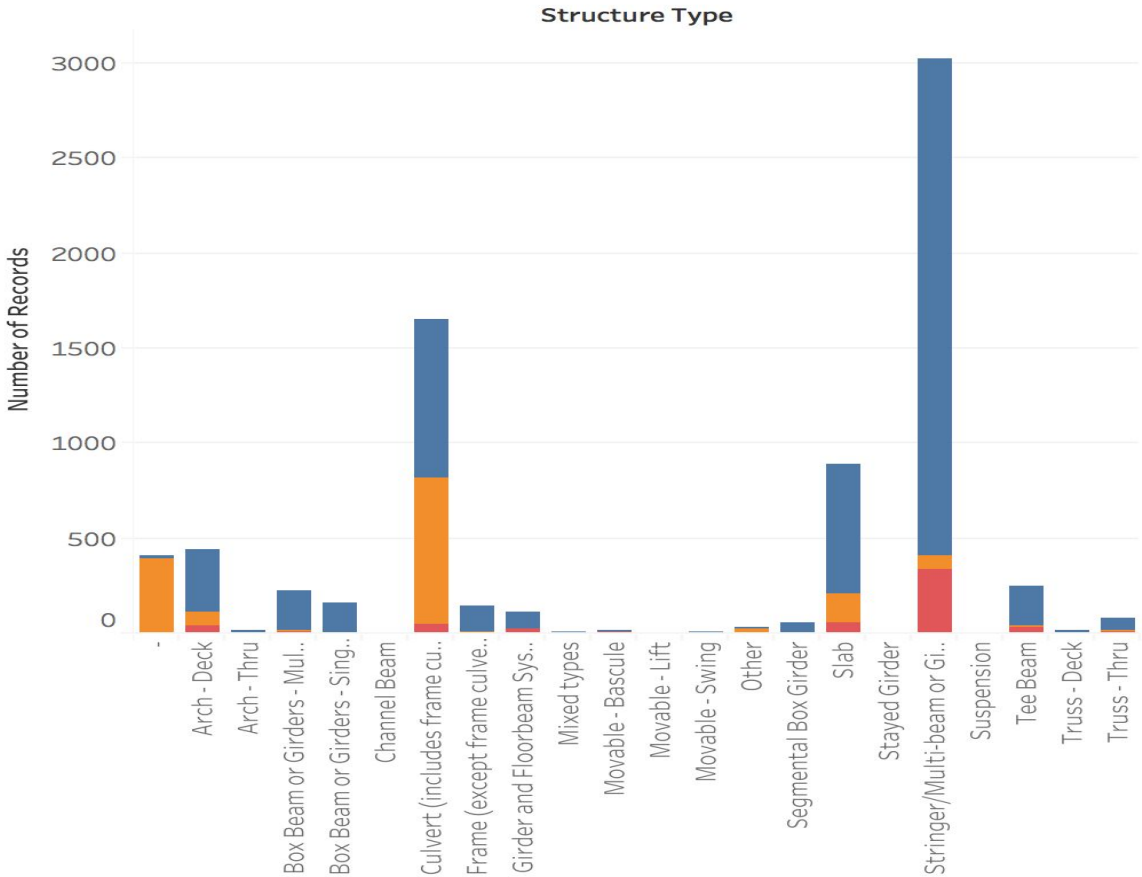

Massachusetts Bridges Built by Year
Year
400
350
300
250
200
150
100
50
0
1900
1920
1940
1960
1980
2000
2020
Number of Bridges

# Bridge Ownership



# Types


Structure Type
Number of Records
3000
2500
2000
1500
1000
500
0
-
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

# PA Feature Importance

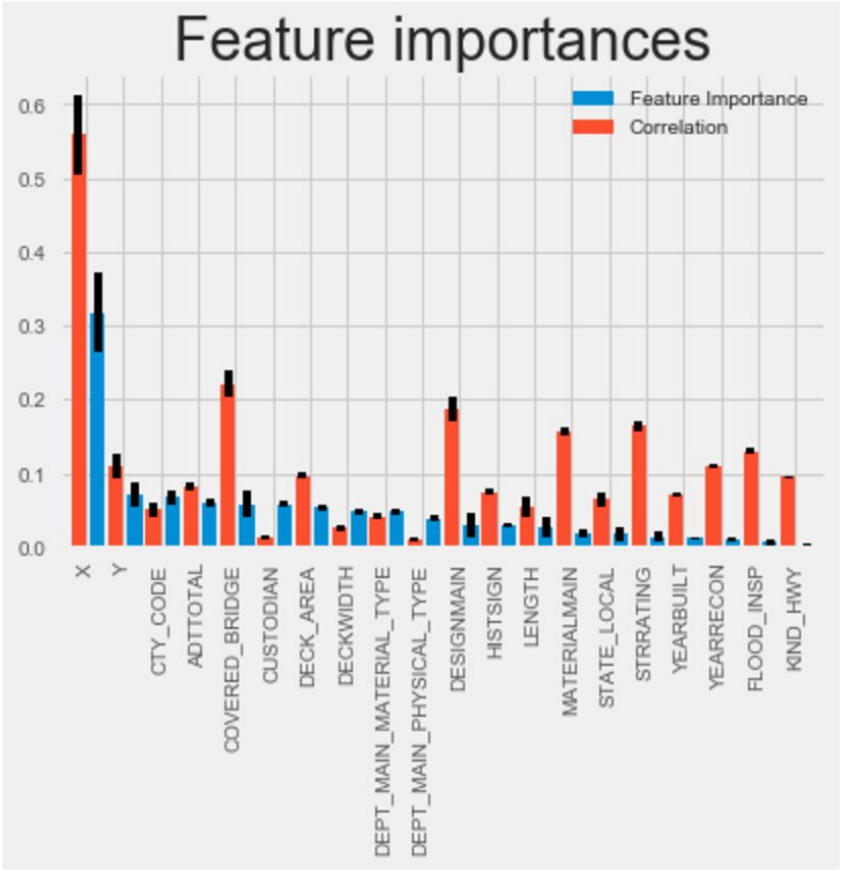
Latitude

Longitude

City Code

Average Daily Traffic

Covered Bridge

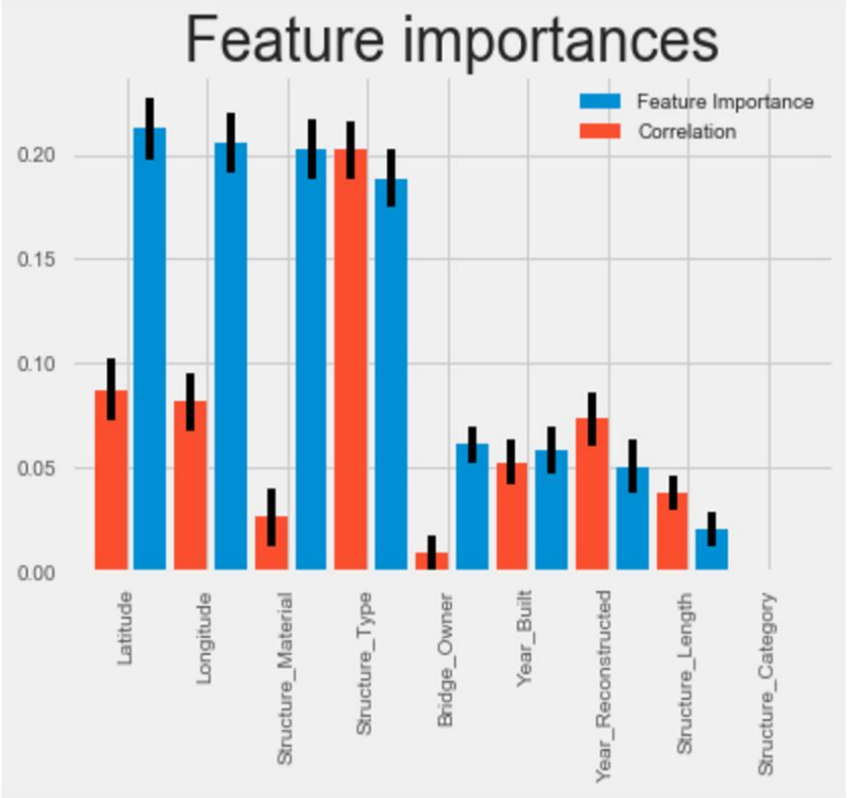


# MA Feature Importance

Geography

Material

Type



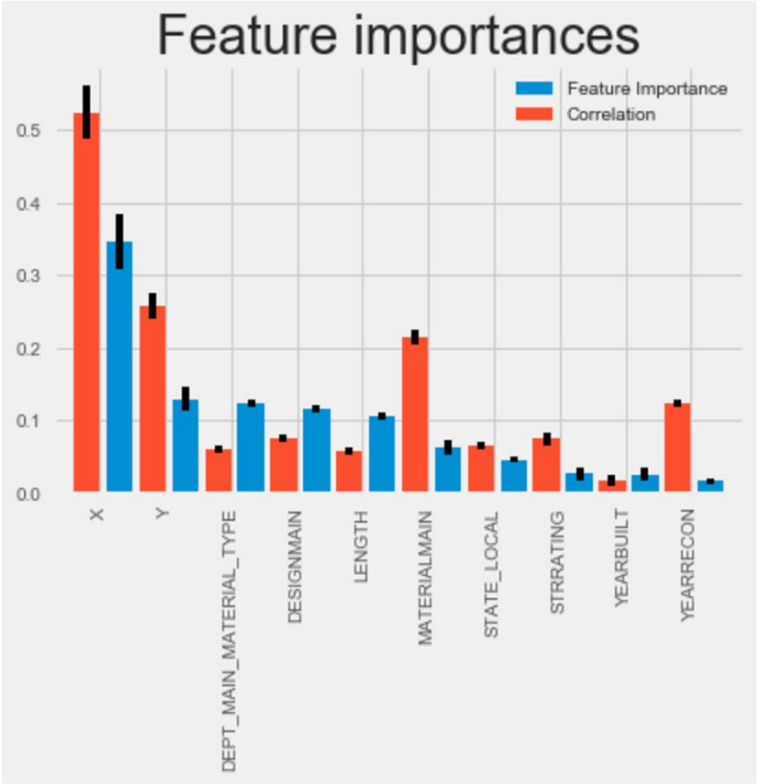
# PA 2 Feature Importance

Location

Material

Design

Length



# Model Selection:

Random Forests Best Scores:

.90 PA1 Score, AUC_ROC: .96

.90 MA Score,  AUC_ROC: .8

.85 PA2 Score, AUC_ROC: .9

# 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.