

# “Structural and Functional Characteristics of Decommissioned Bridges”

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# Objectives

- To examine the the life span of bridges vs. material/design type, traffic volumes, etc.
- To quantify the age, condition, and functional status of bridges at the time they were replaced
- To develop insight into the reasons that bridges are replaced and the expected service life of structures of various material/design types
- To provide knowledge for engineers involved with bridge preservation policy, bridge management, and life cycle cost analysis of bridges.



# Questions About Decommissioned Bridges

- Where?
- Owned/maintained by?
- Type, material, size?
- Age when replaced?
- Functional class of highway?
- Why were they replaced?
  - What was their condition when they were replaced?
  - Were they structurally deficient or functionally obsolete?



# Studying a Population of Decommissioned Bridges

- Identify a significant number of bridges that have been taken out of service (and probably replaced)
- Determine what year they were decommissioned, and
- Having completed steps (1) and (2), historical data from the NBI can be used
  - To answer the other aspects of the “what” question
  - To provide clues that help answer the “why” question



# This Study

- Resources:
  - Historical NBI data – available for Years 1984 to 2009
  - Bridge Portal – interface with LTBP database
- Study focus:
  - 1992 to 2009
  - Identified 20645 bridges in 42 states that were replaced during that time span
  - Culverts excluded



# A Caveat

Reliance on NBI data should be tempered with understanding that some NBI data may be in error. For instance:

- Found a NJ DOT owned bridge located in Angola
- Age data obtained from the NBI can be problematic
  - Results included some bridges that were replaced before they were originally built
  - In one case 288 years earlier; in two others over 1000 years earlier

Therefore, I eliminated some bridges with obvious age errors, but really don't know the extent of any other

# Replaced Bridges by State

State	# Replaced	State	# Replaced	State	# Replaced	State	# Replaced
AL	74	IL	2	NV	35	TN	1443
AK	4	IN	2258	NH	137	TX	2487
AZ	317	IA	86	NJ	555	UT	32
AR	45	KS	1732	NM	1	VT	184
CT	164	LA	1324	NY	2459	VA	80
DE	44	ME	245	ND	218	WA	36
DC	2	MD	323	OH	21	WV	351
FL	4	MI	1176	OR	37	WI	24
GA	118	MS	392	PA	1106		
HI	20	MT	414	RI	33		
ID	1	NE	1764	SD	471		



# Bridges Replaced

## Range:

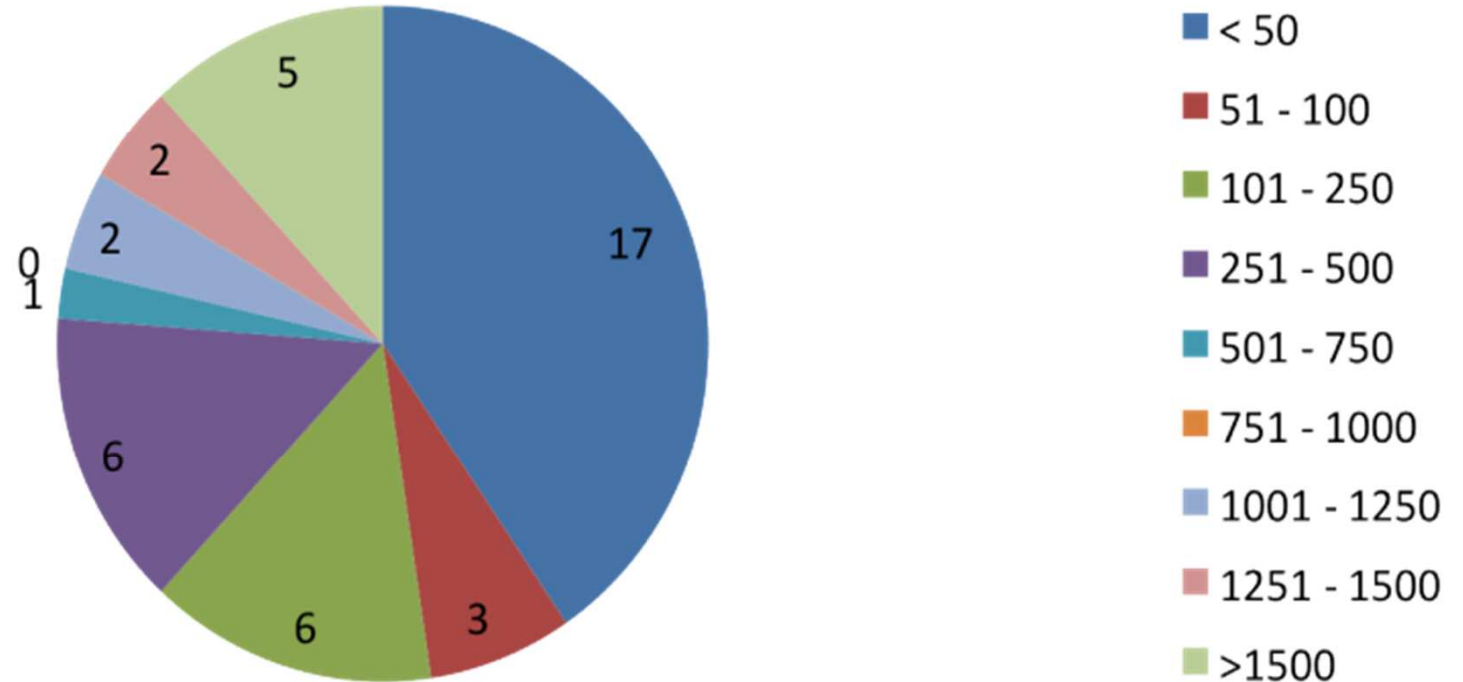
Min 1

Max 2524

Mean # = 504

Median # = 130

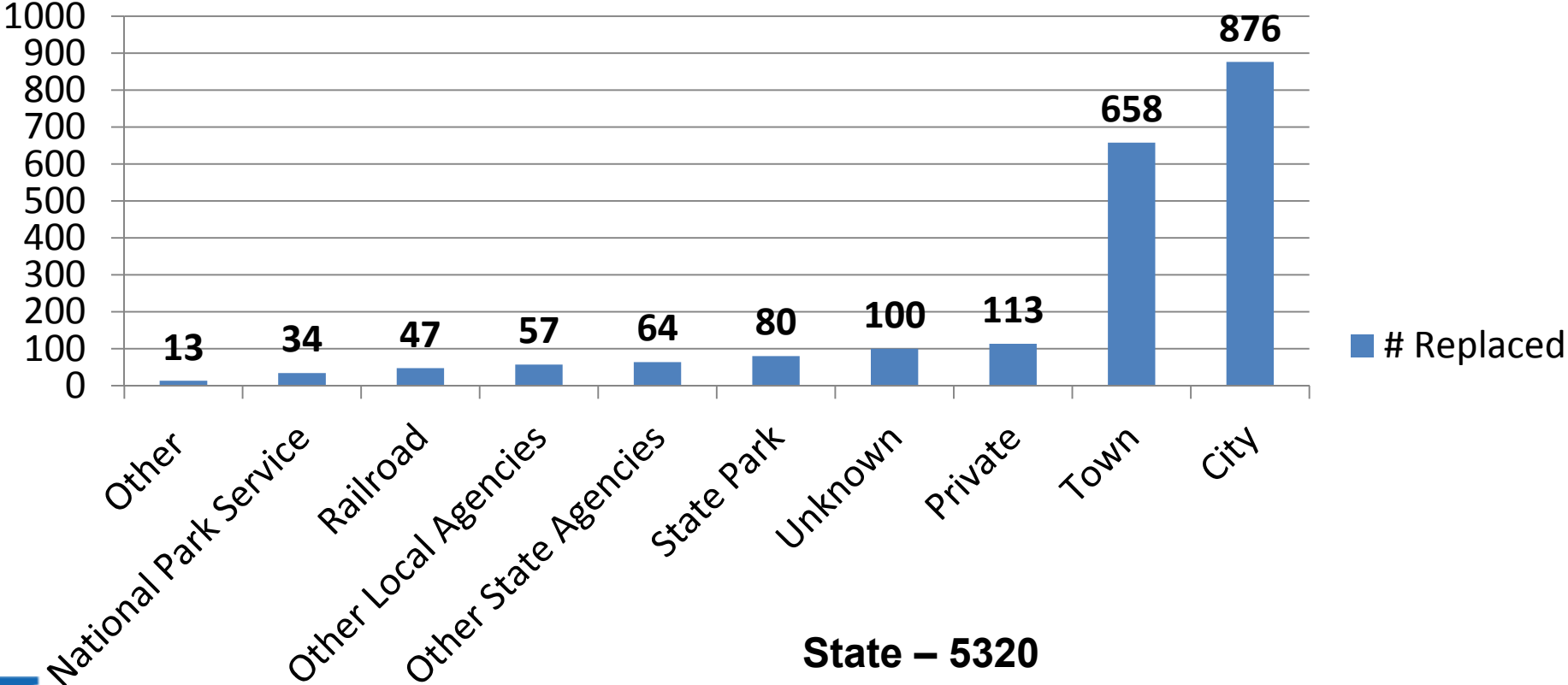
## # of States





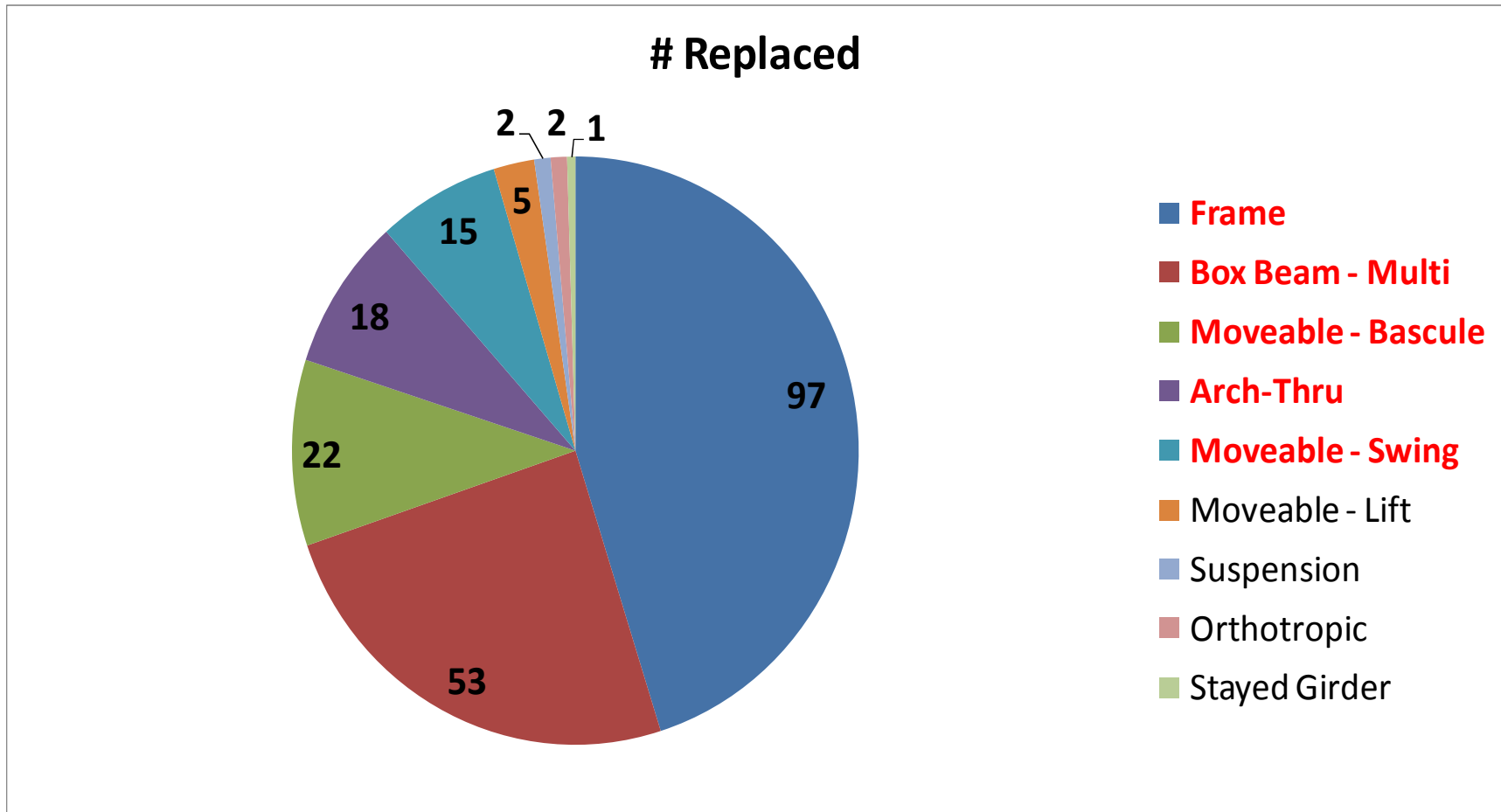
# Owner

# Replaced

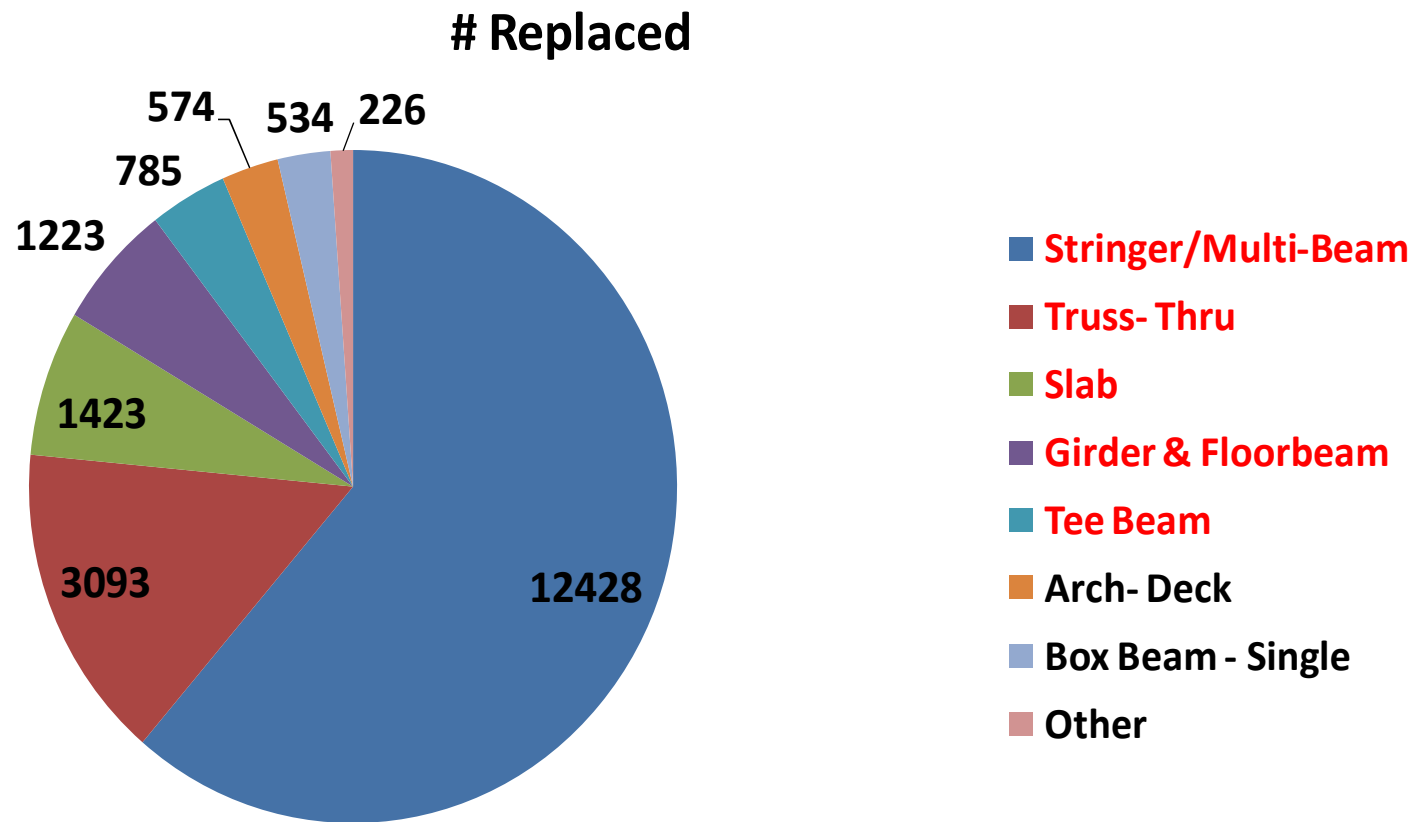


**State – 5320**  
**County - 12860**

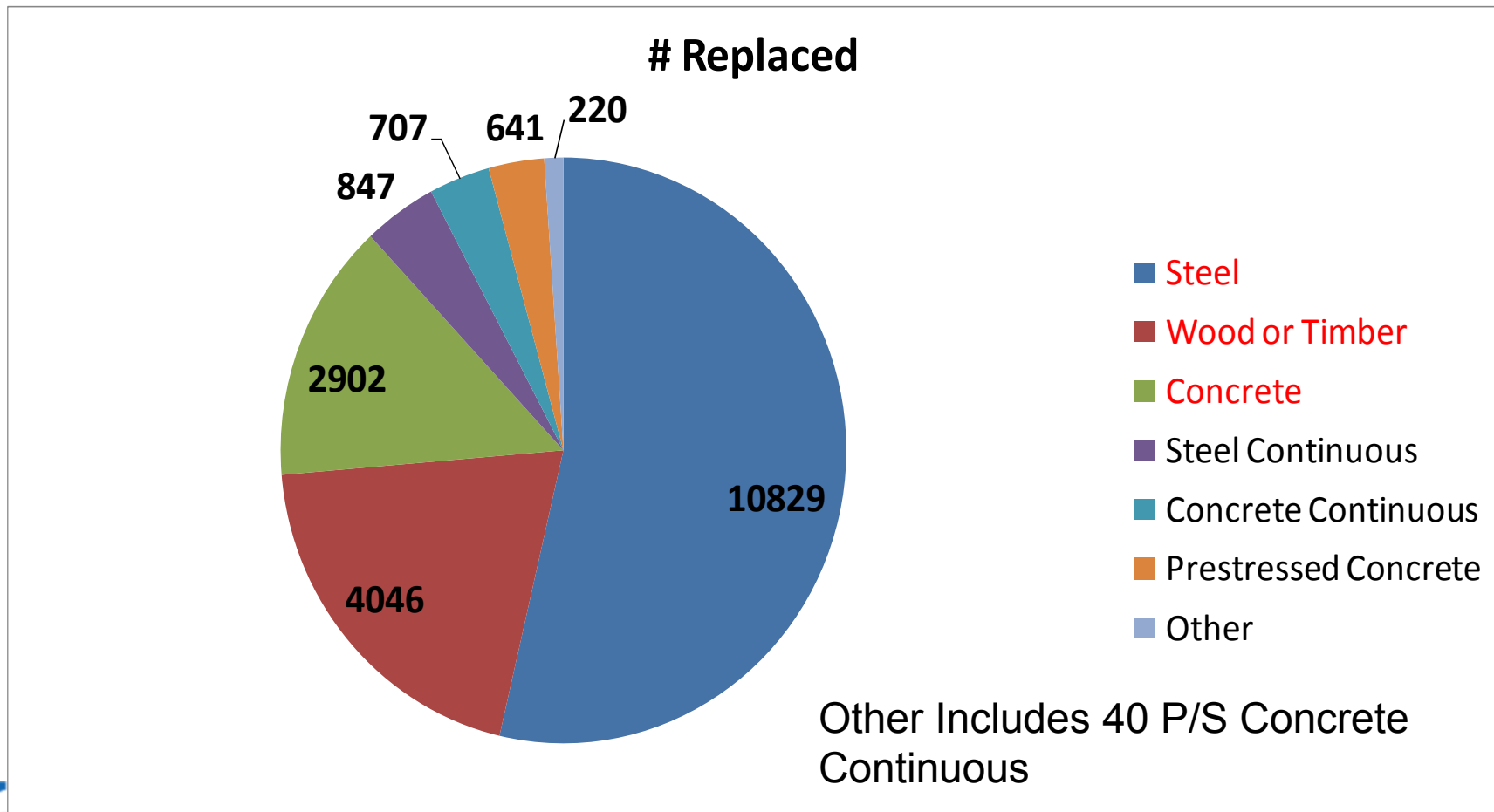
# Type of Main Span



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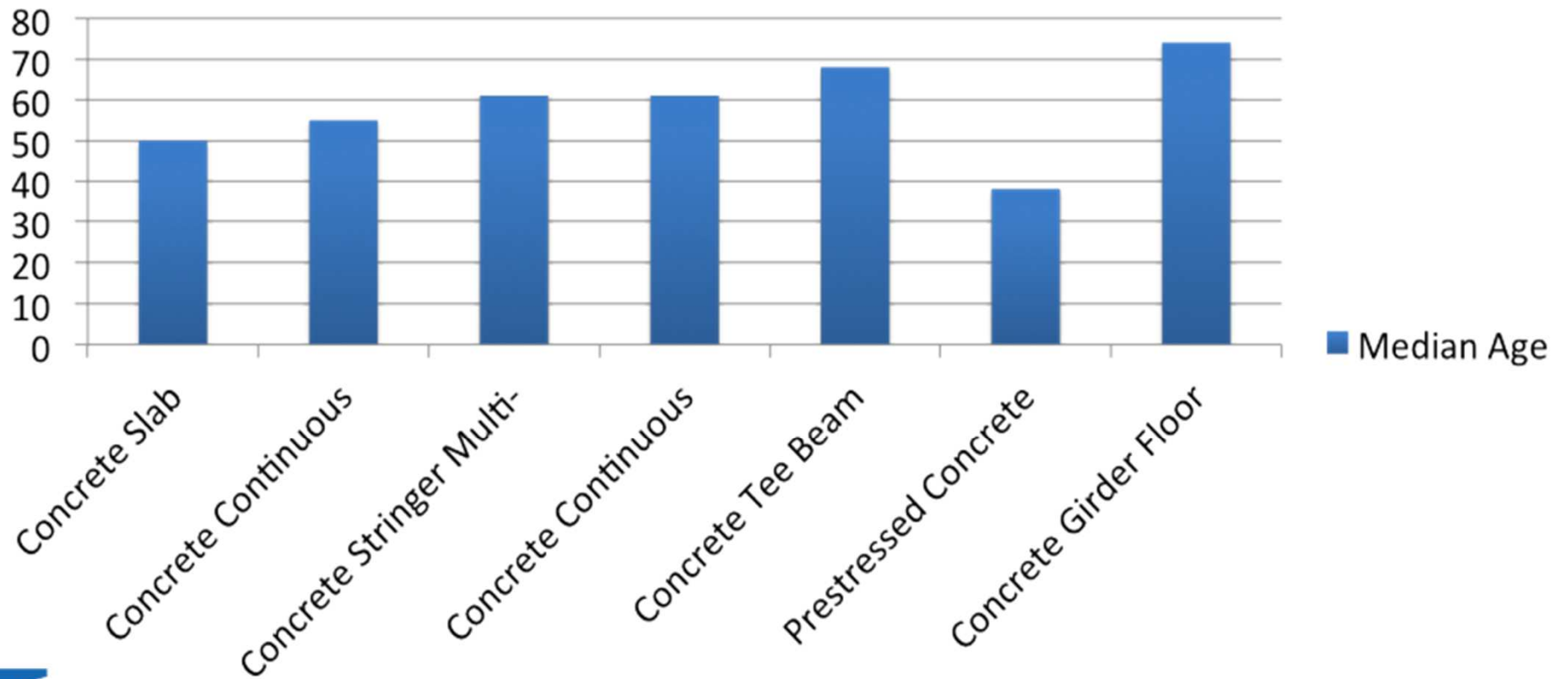


# Main Span Material



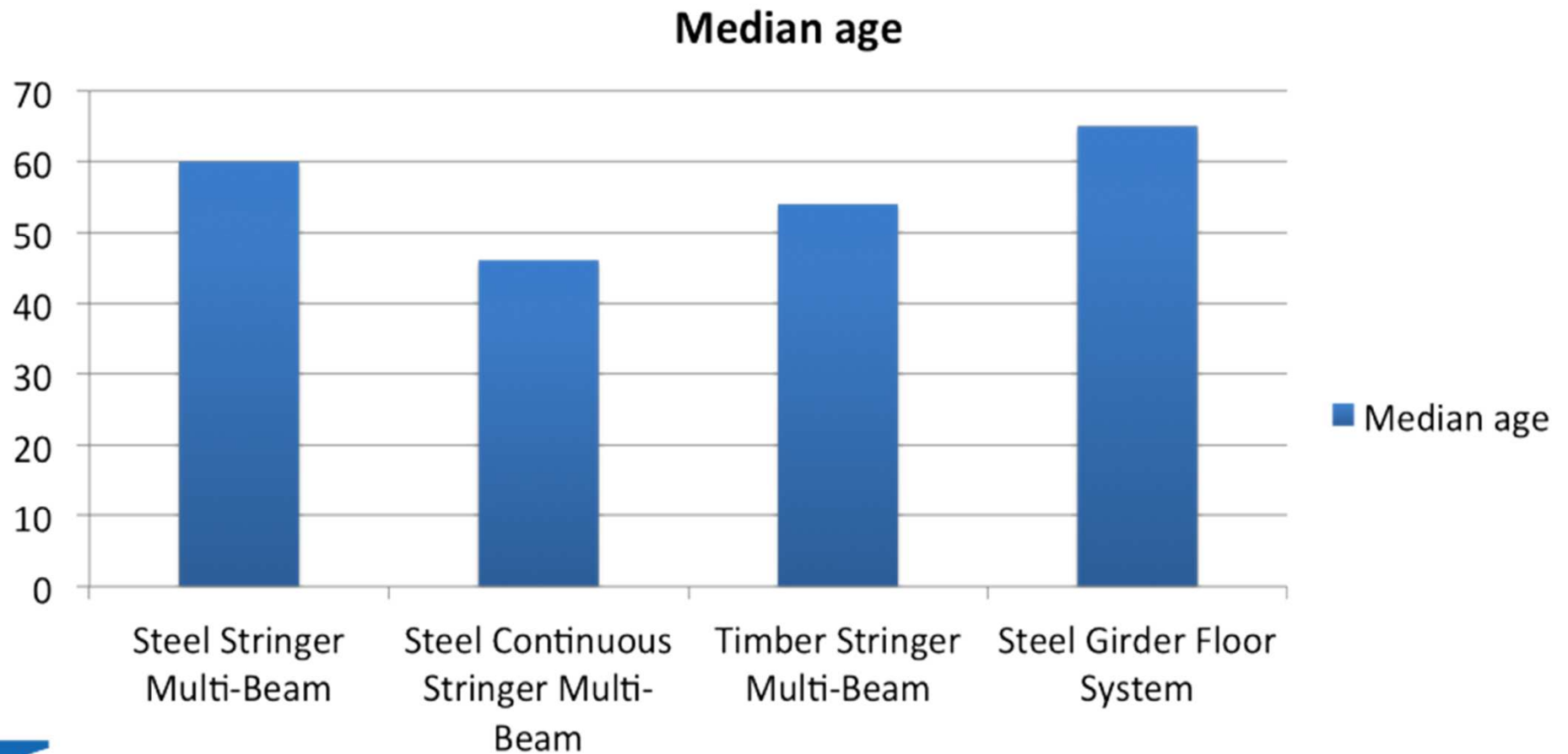
# Structure Type/Material vs. Median

Age  
Median Age



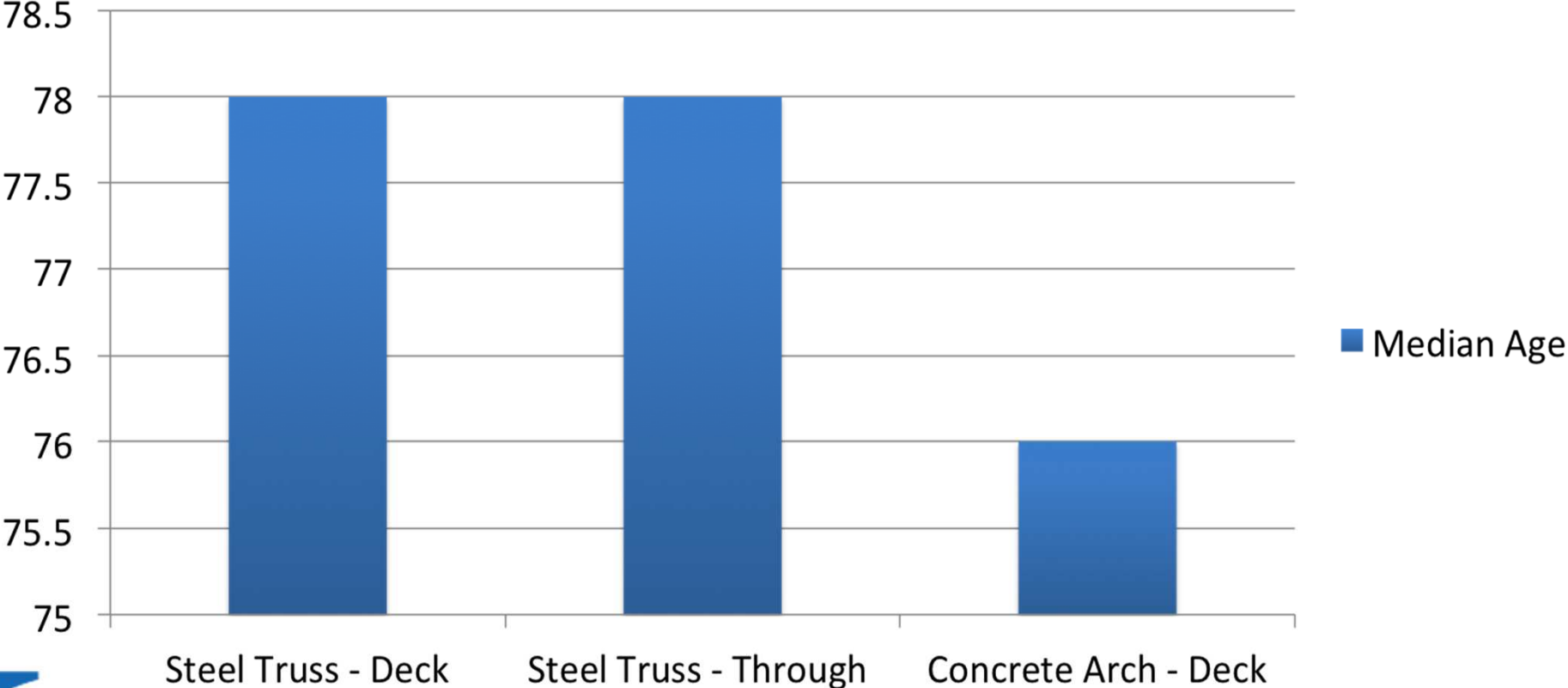


# Structure Type/Material vs. Median Age



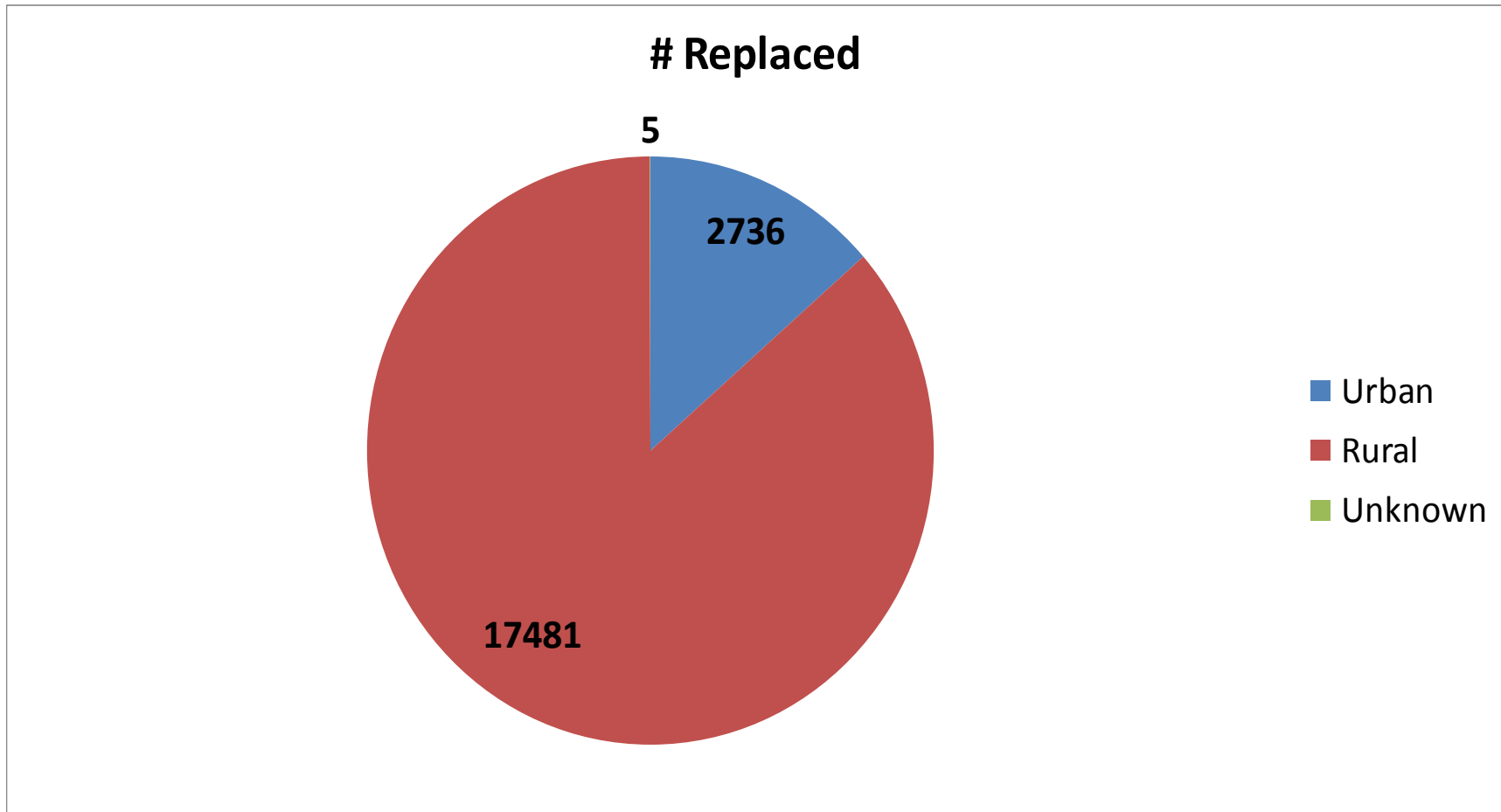
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Age  
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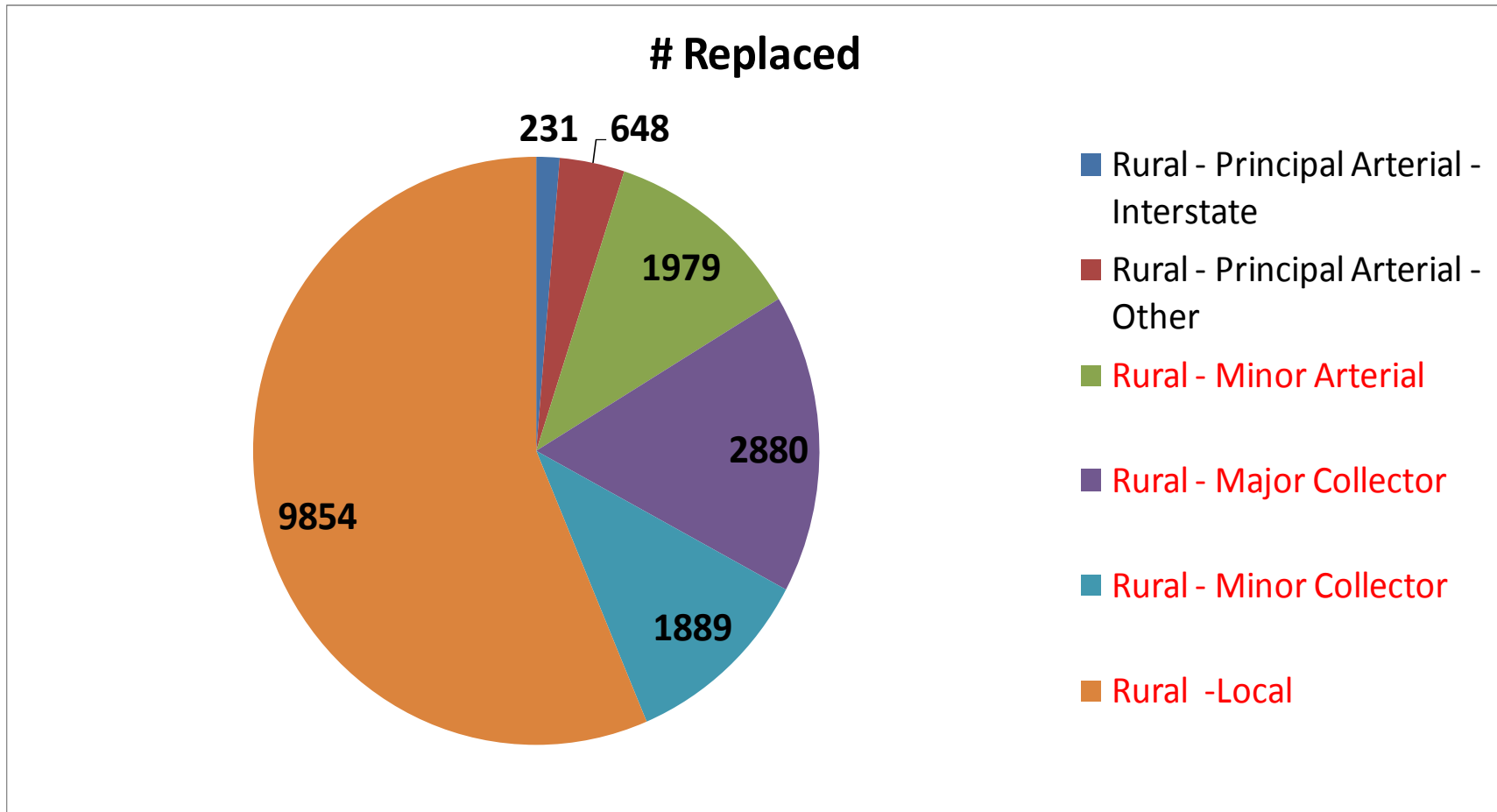


# Urban vs. Rural Bridges Replaced

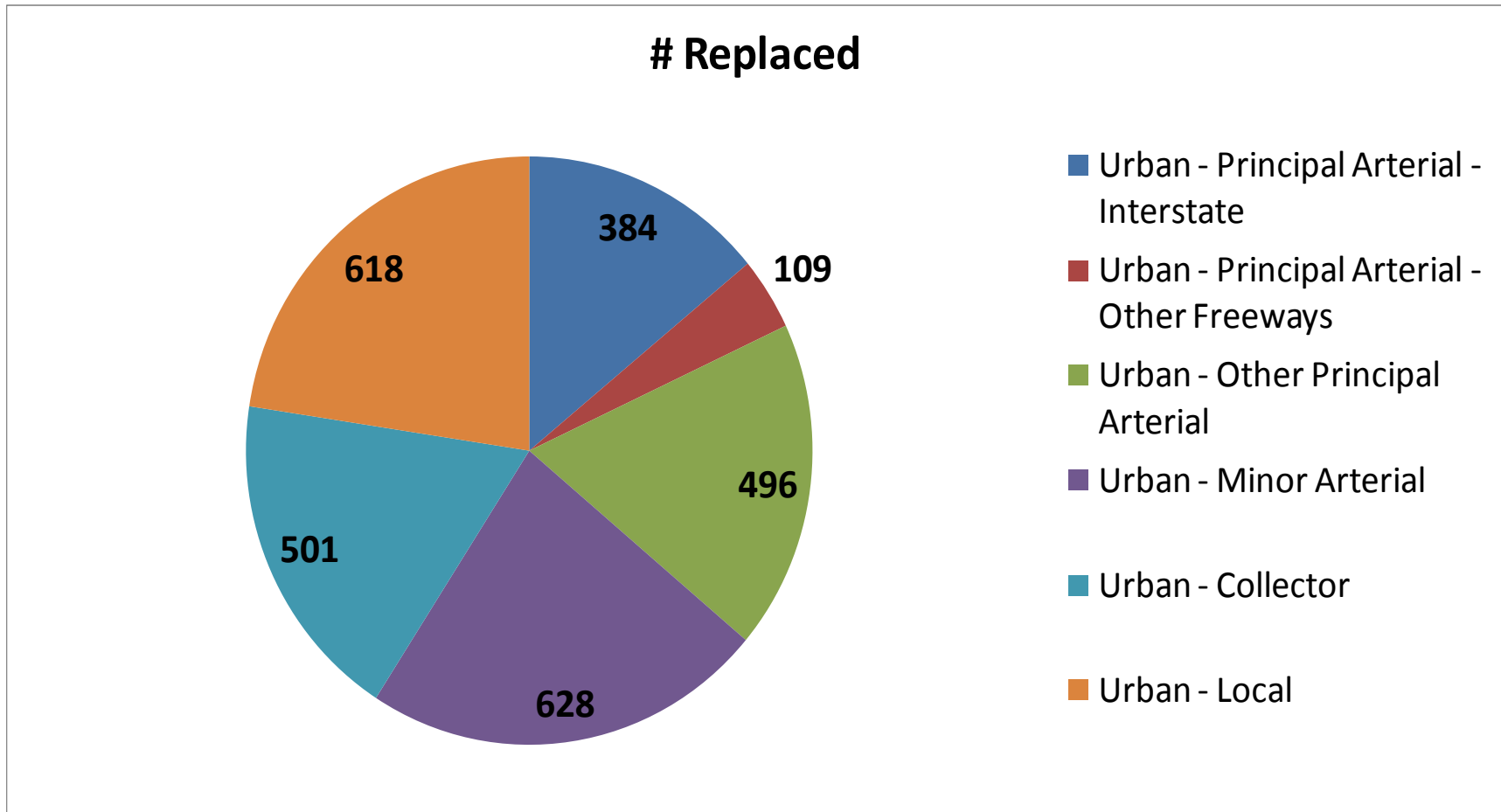




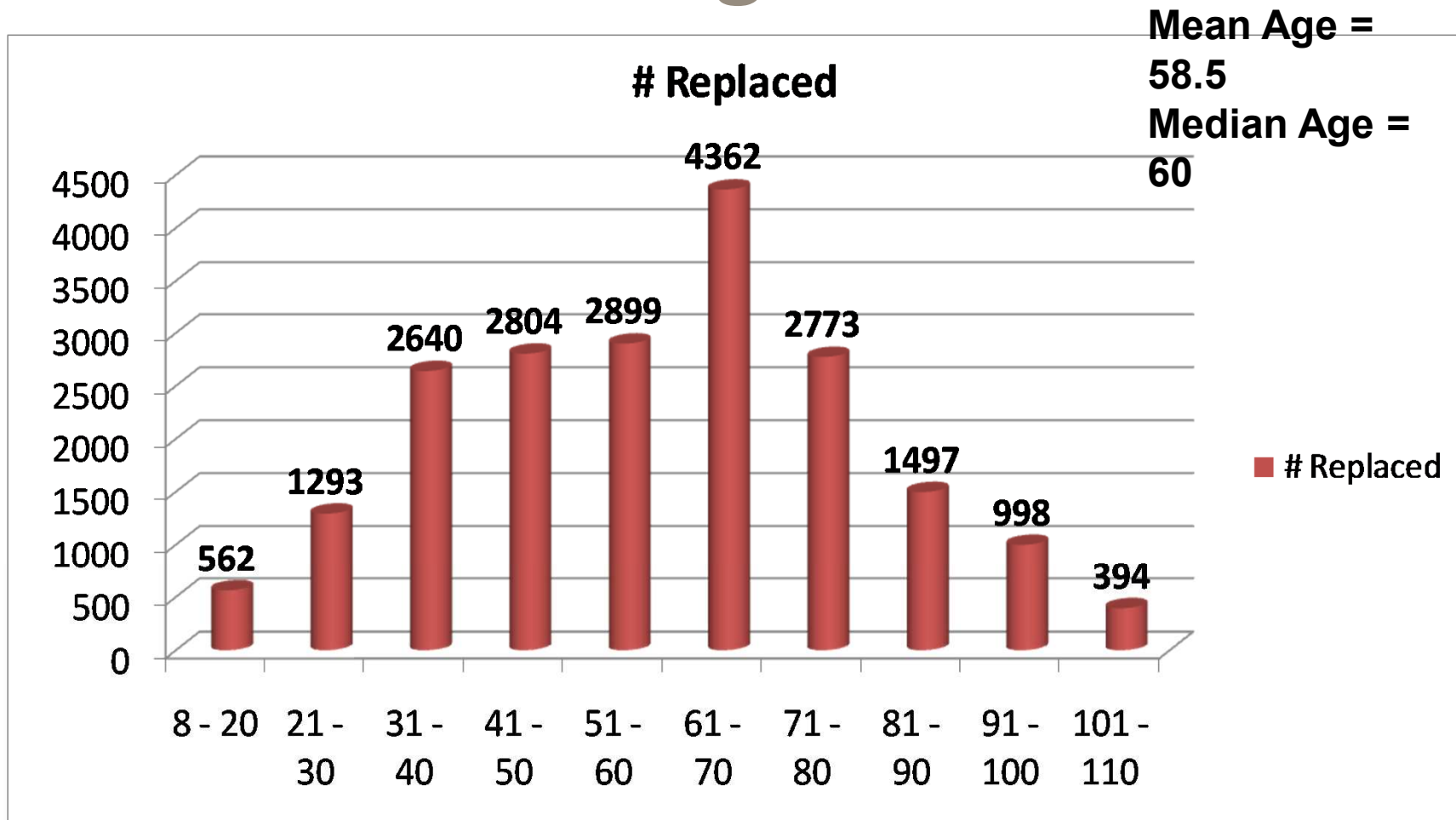
# Rural Bridges Replaced



# Urban Bridges Replaced



# Age

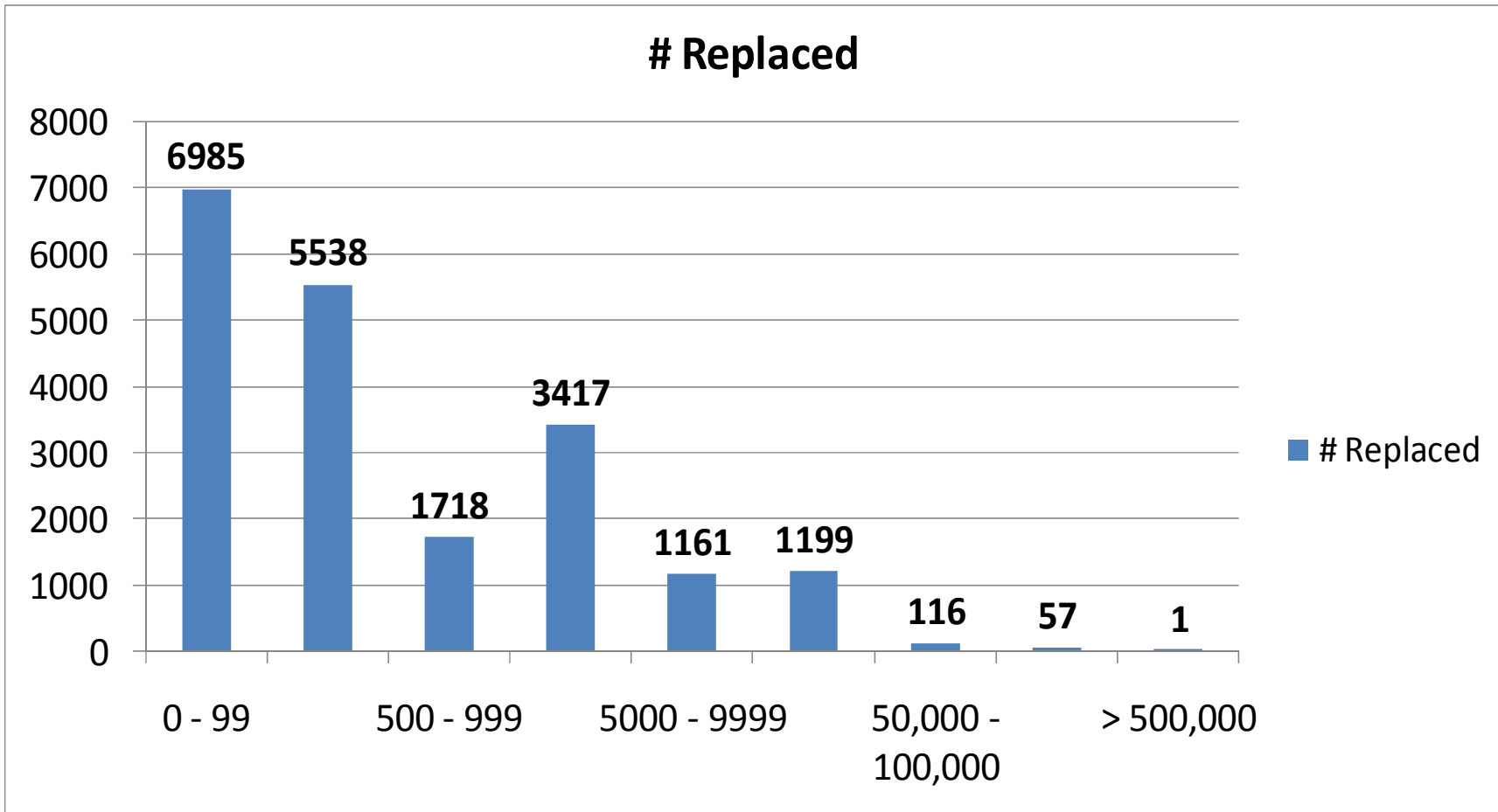




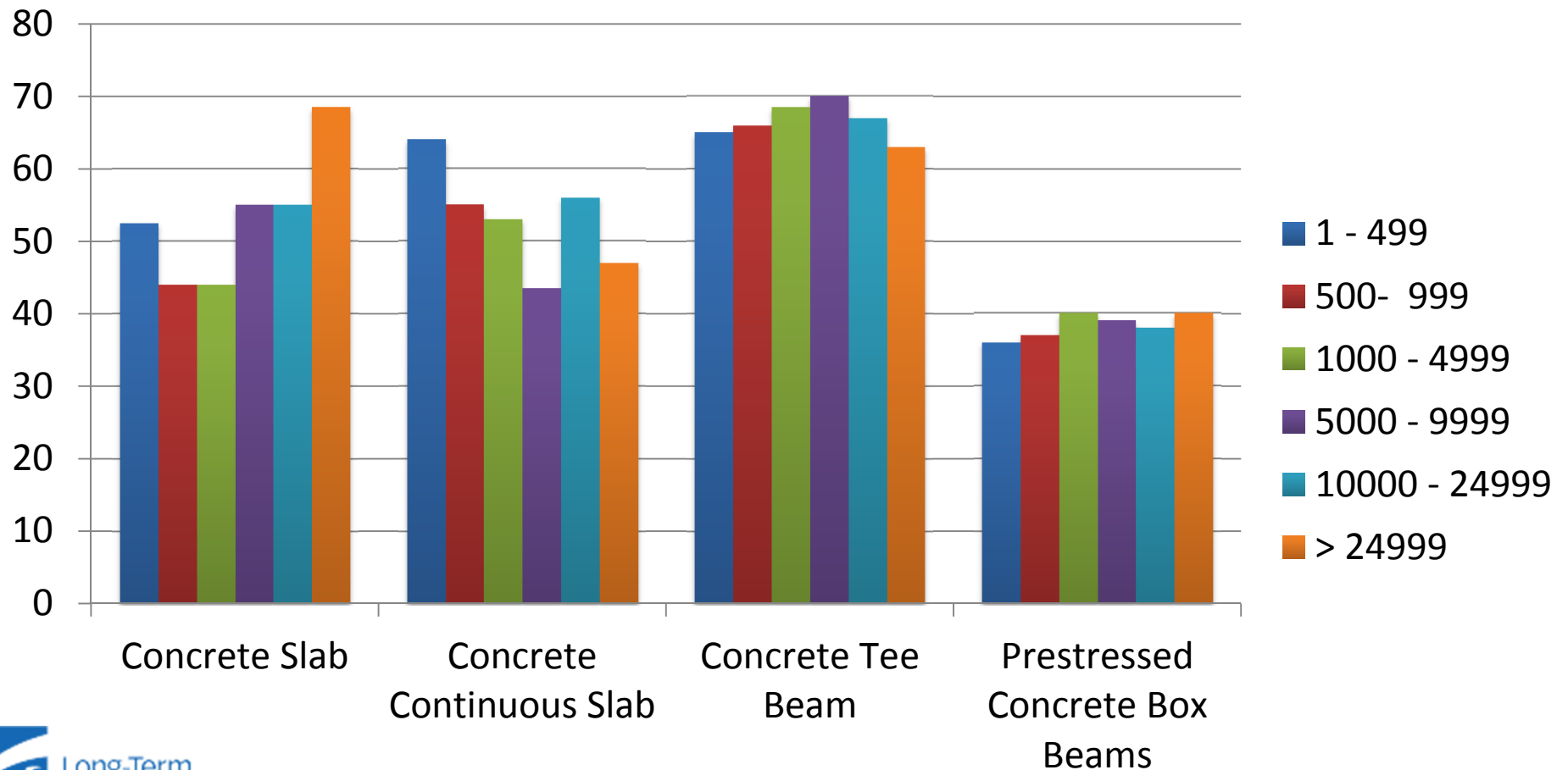
# Age by Material Type

Material	Range	Mean	Median
Concrete	8 - 110	61.1	64
Steel	8 - 110	62.8	64
P/S Concrete	8 - 80	39.3	37

# ADT

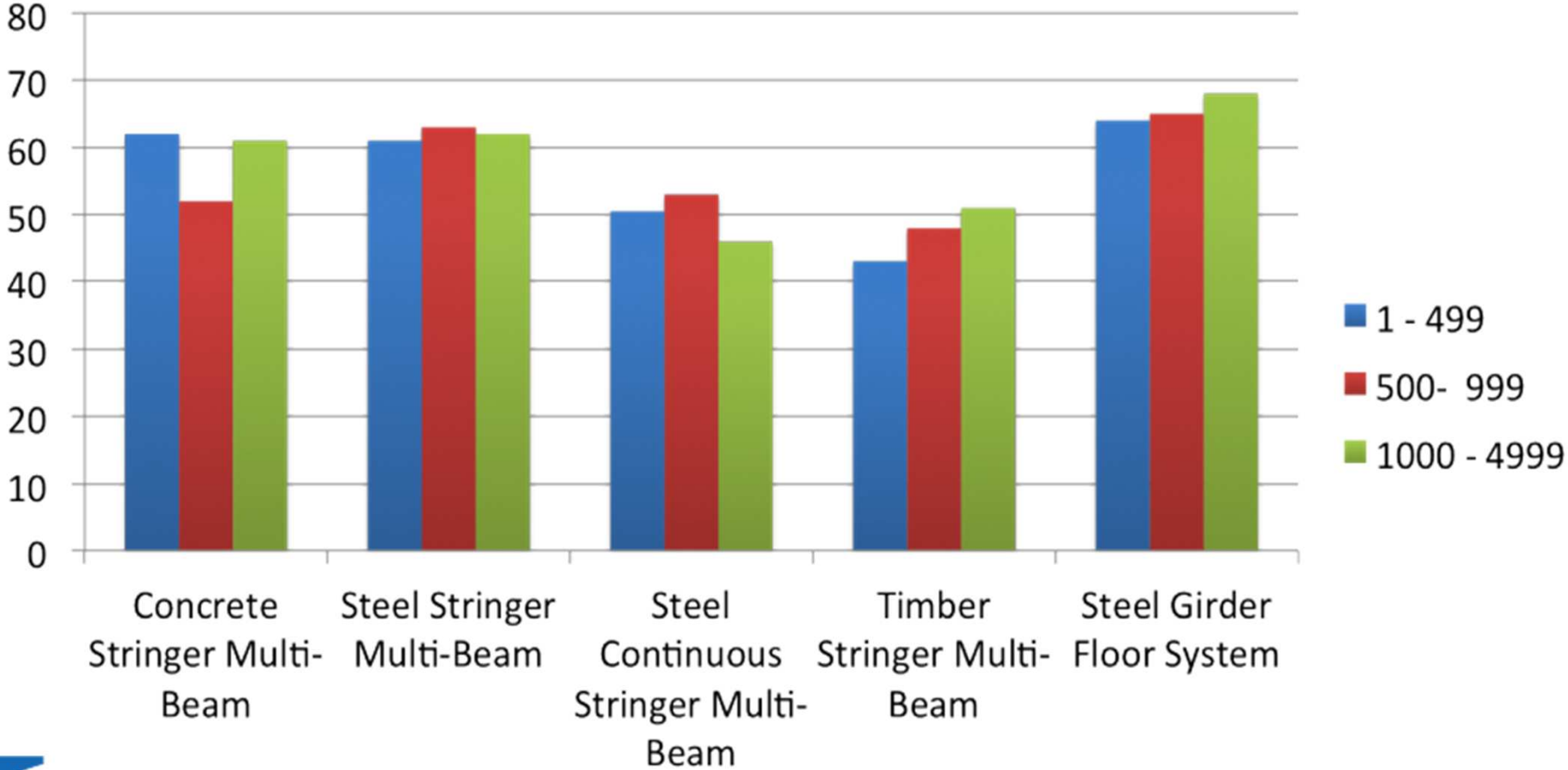


# Median Age vs ADT





# Median Age vs ADT





# Conclusions

- Sample Population – 20,222 bridges (no culverts)
- 86 % Rural
- Rural bridges – 56% local & 22% minor
- Urban bridges – 14% Interstate, 22% Principal Arterial
- Ownership – 26% State, 64% County
- ADT
  - 62% < 500
  - 25% 501 – 1000
  - .01 % > 50,000



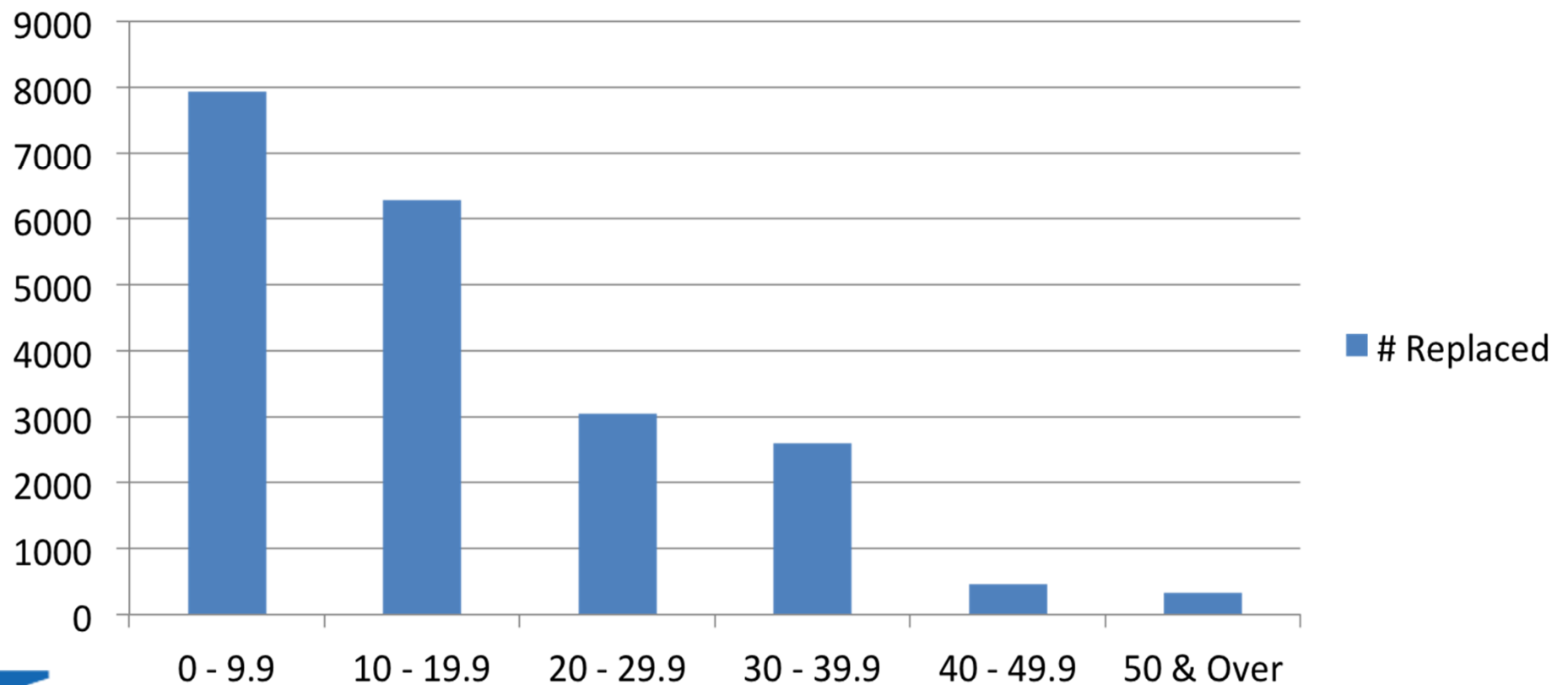


# Conclusions

- Main Span Type
  - Girder/Girder-Floorbeam
  - Thru truss
  - Slabs, tee beams
- Main Span Material
  - Simple span steel beam bridges - >50%
- Age when replaced – fairly normal distribution
- Age when replaced vs. traffic volumes – direct correlation not evident

# Inventory Rating (Metric Tons)

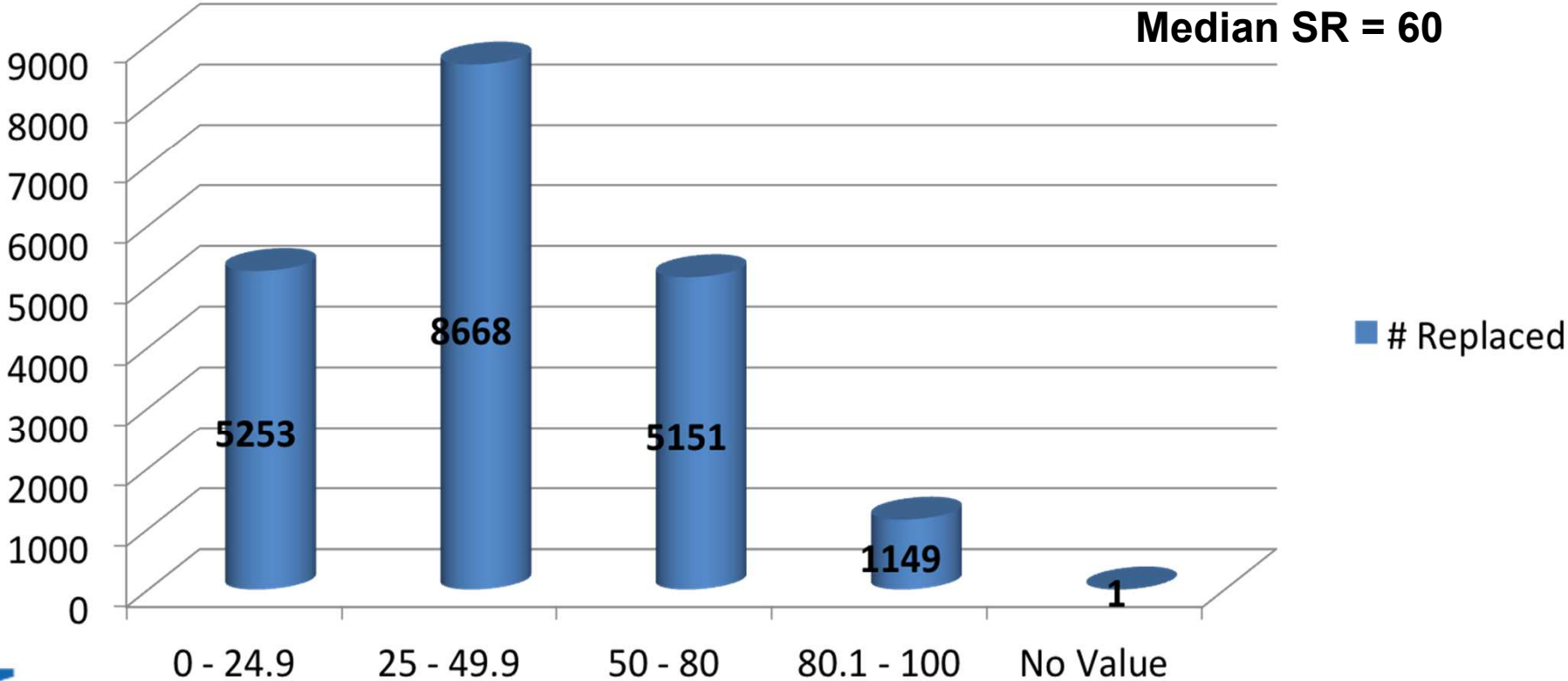
# Replaced



# Sufficiency Rating

# Replaced

Mean SR = 58.4  
Median SR = 60





# Structural Deficiency

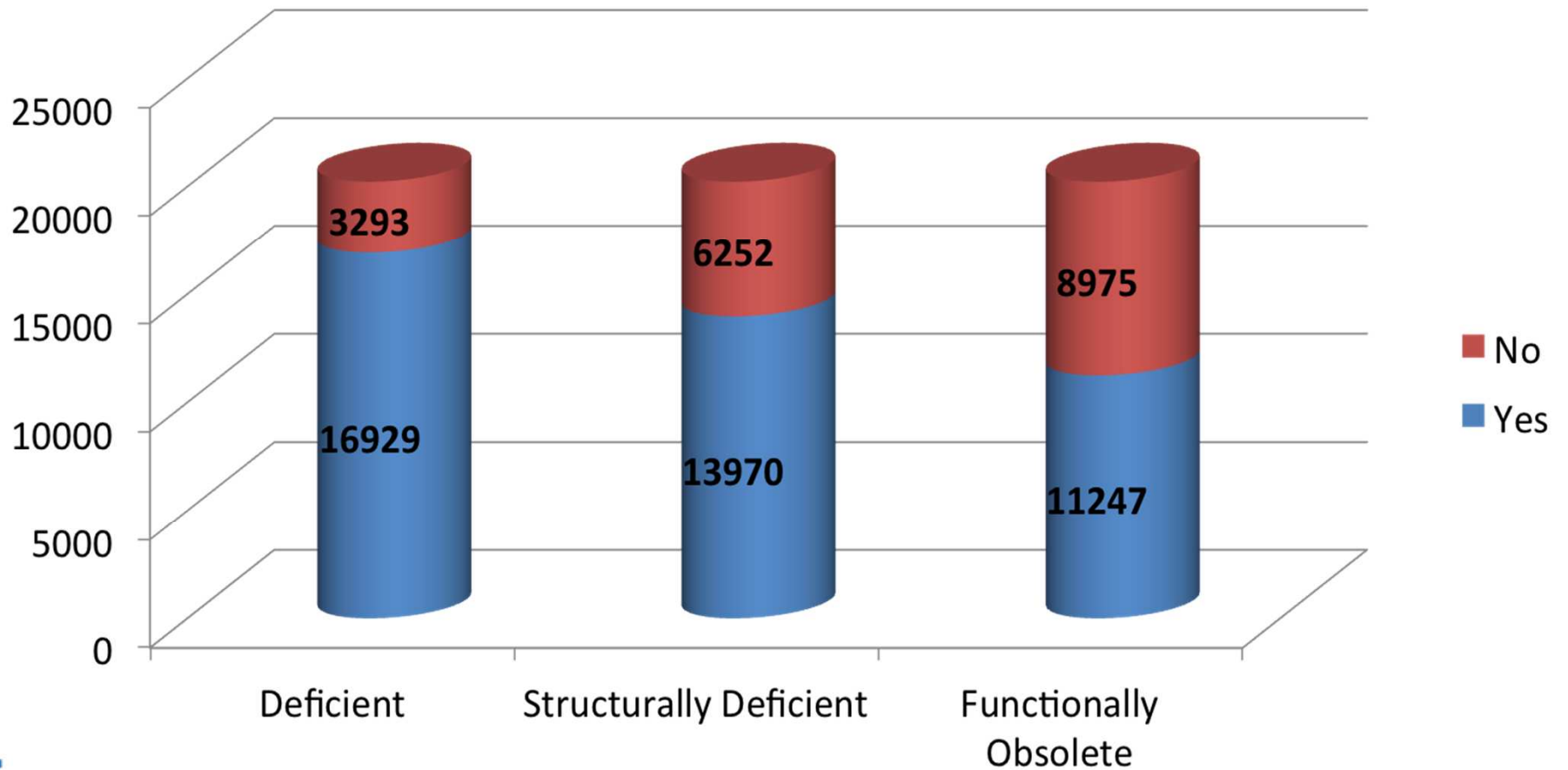
- **Structurally Deficient (SD)** - A highway bridge is classified as structurally deficient if one of the following is rated in "poor" condition or worse (4, 3, 2, 1, or 0 on the NBI rating scale
  - Item 58 - Deck,
  - Item 59 – Superstructure,
  - Item 60 – Substructure or
  - Item 62 – Culvert
- Or,
  - Item 67 – Structural Evaluation Appraisal is coded 2, 1, or 0)
  - Item 71 - Waterway adequacy for the feature below the bridge is coded 2 or below



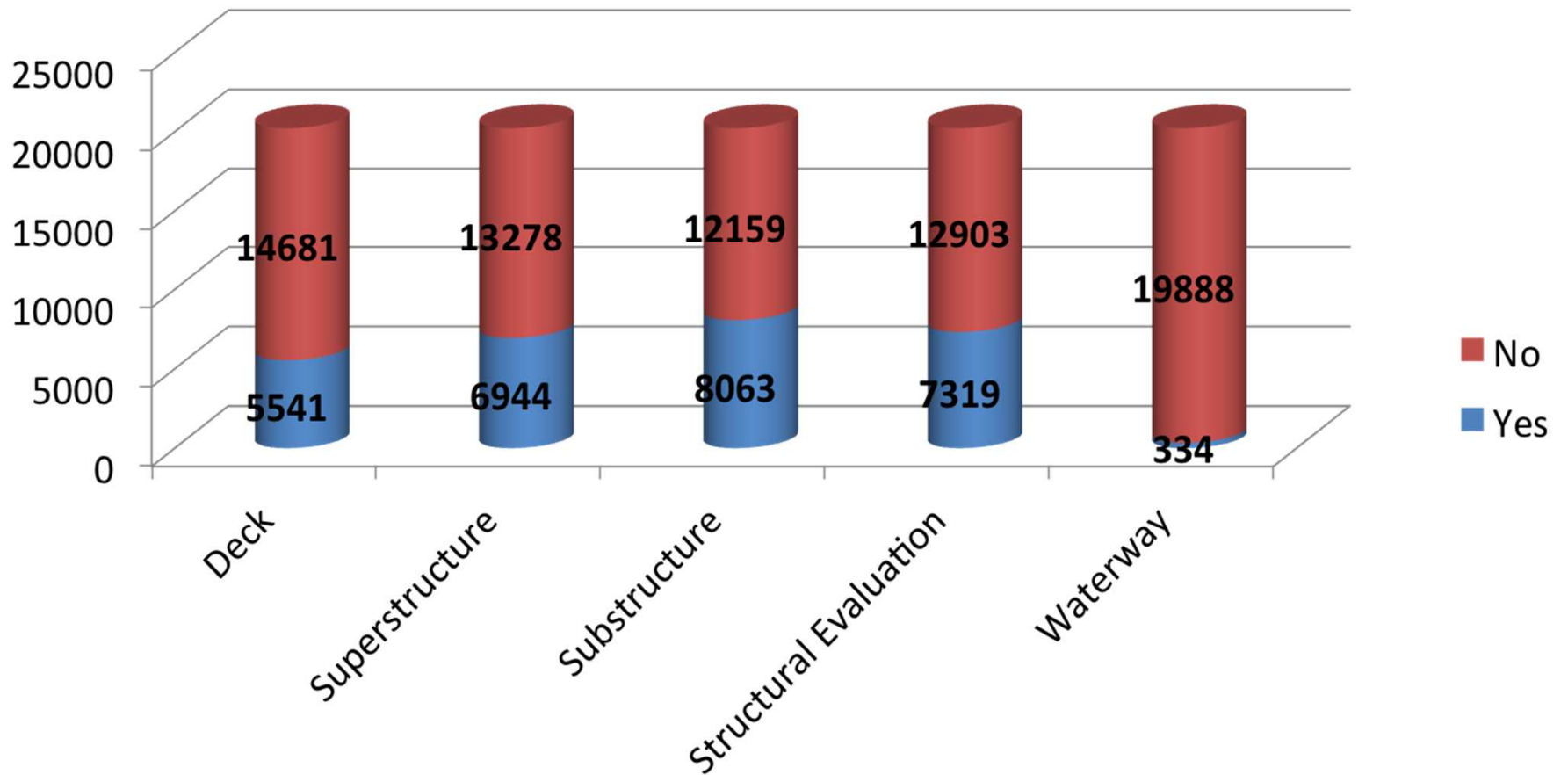
# Functional Obsolescence

- **Functionally Obsolete (FO)** - Highway bridges classified as functionally obsolete are NOT structurally deficient; classification as Functional Obsolete would be triggered by a **code of 3 or lower**, meaning basically intolerable and requiring high priority for correction, for
  - Item 68 – Deck Geometry Appraisal,
  - Item 69 – Underclearances – Vertical & Horizontal, or
  - Item 72 – Approach Roadway Appraisal;
- Or if
  - Item 67 - Structural Evaluation Appraisal or
  - Item 71 – Waterway Adequacy Appraisal are coded 3.

# Deficient Bridges

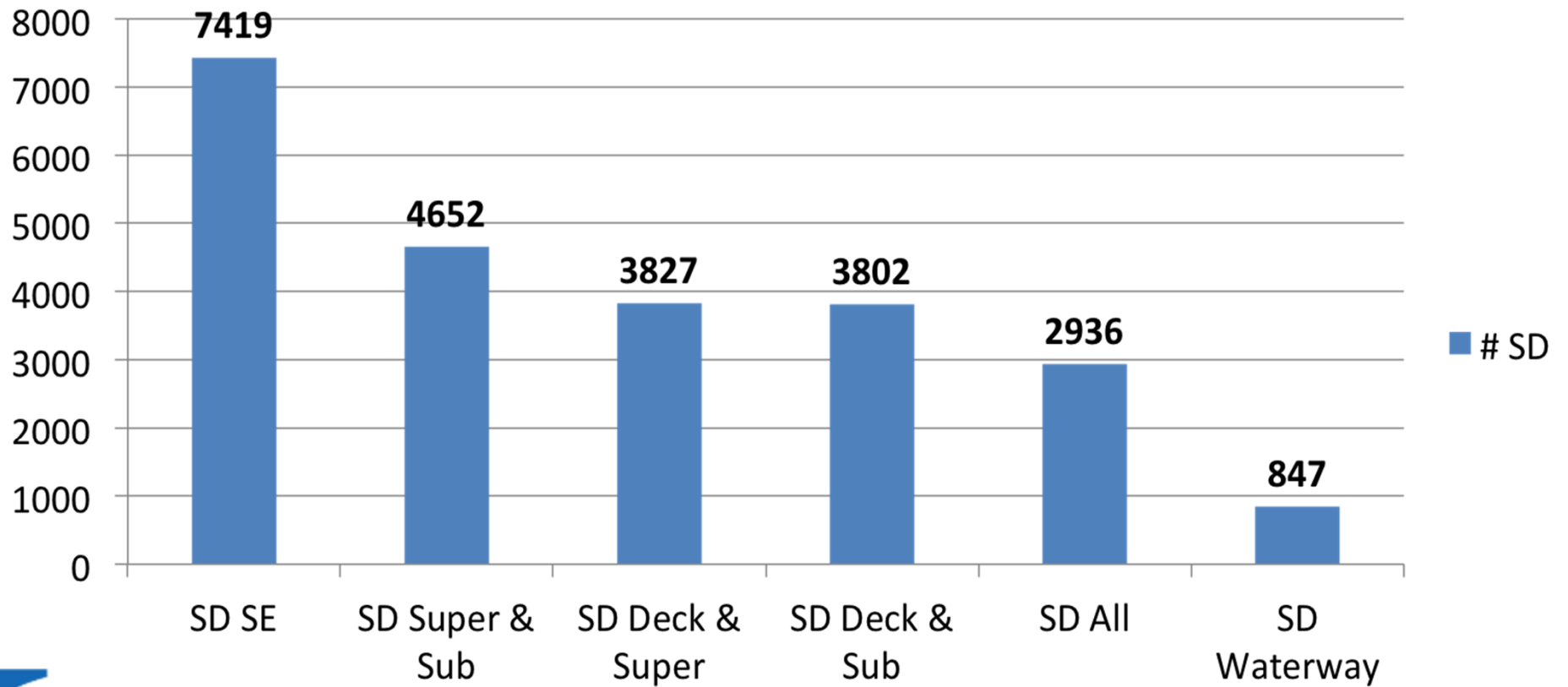


# Structural Deficiencies



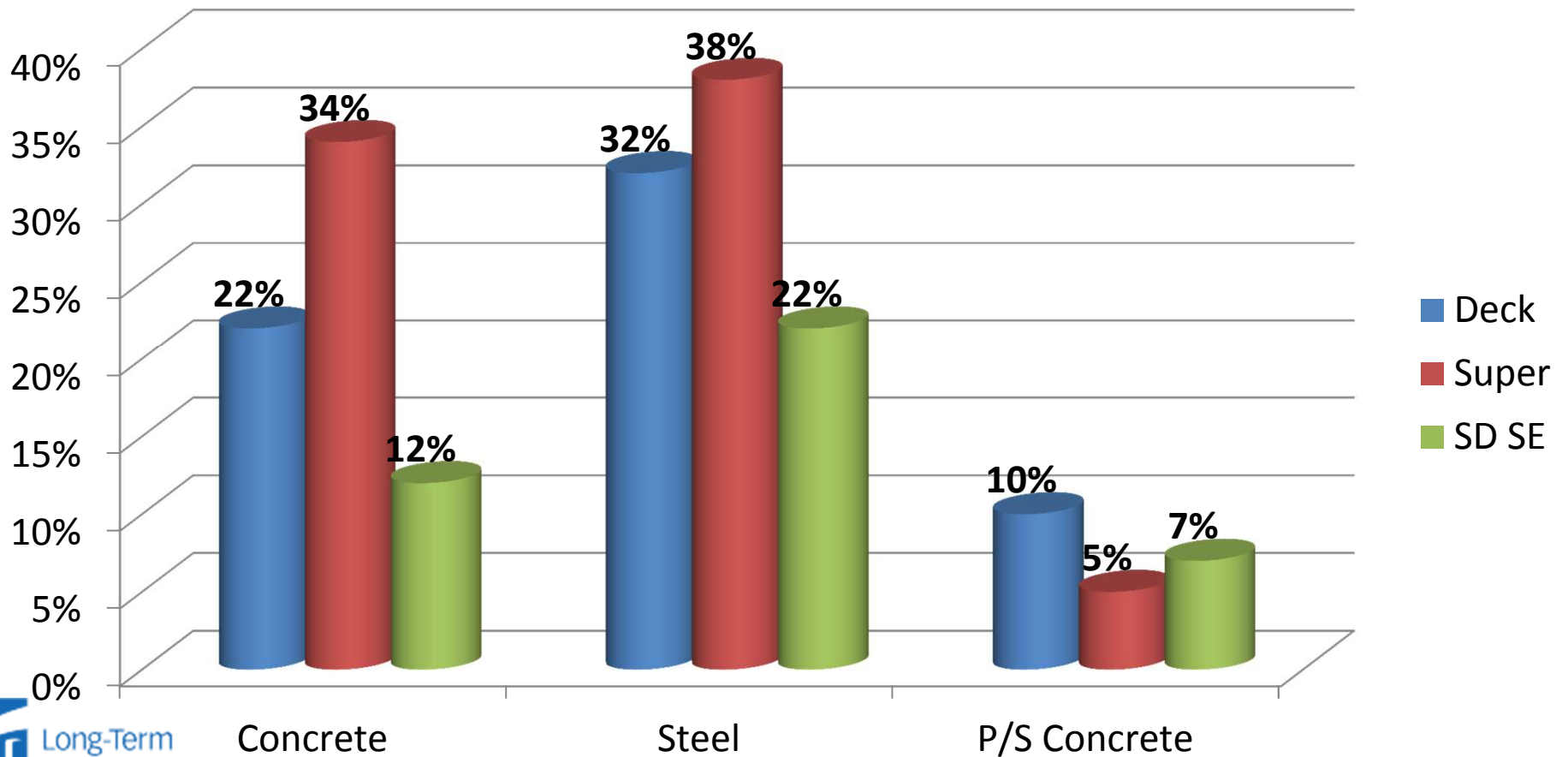
# Reasons for Rating of SD

# SD

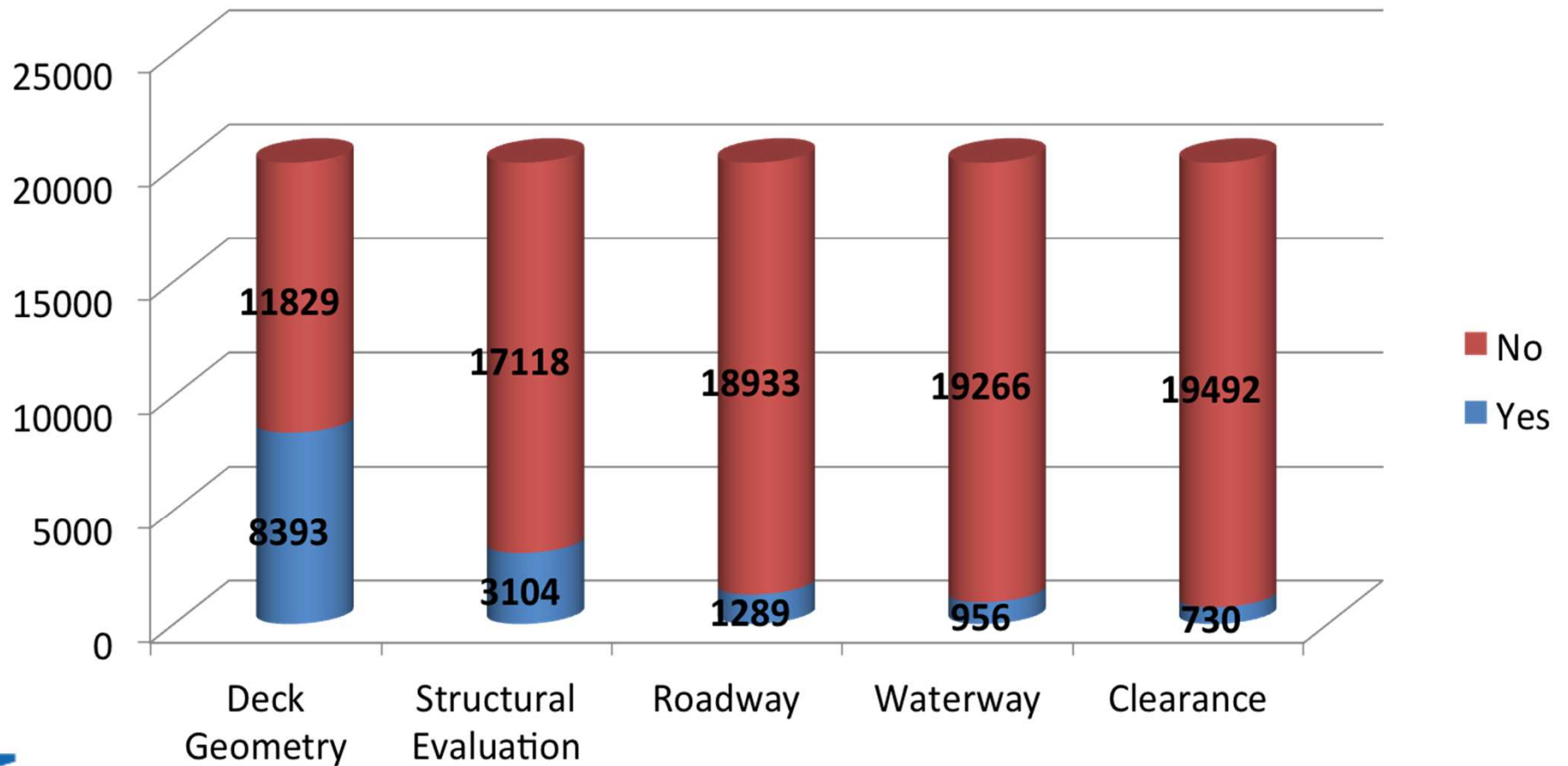




# Reasons for Rating of SD by Material



# Functionally Obsolete Characteristics





# QUESTIONS?