Florida Department of Transportation

Bridge Inventory 2016 Annual Report

August 2016

Office of Maintenance

John D. Clark P.E.

Table of Contents **Page**

List of Tables **Page**

List of Figures **Page**

List of Figures **Page**

Introduction

This report on Florida's bridge inventory represents a static view, or "snapshot" of the ever- changing bridge inventory database. Presented here are various ways to view the bridge inventory that are used in the bridge management industry. The objectives of this report are to establish benchmarks of bridge inventory characteristics and conditions that can be used in the future to measure progress in managing the inventory, and to present the current state of the bridge inventory.

The Department has responsibility for inspecting and rating most of the bridges in Florida. This report divides the inventory into groups that are responsible for maintaining (preserving) the bridges. The largest group includes all bridges maintained by the Florida Department of Transportation (FDOT), divided into the seven geographic districts and the Florida's Turnpike. The next largest maintenance responsibility group is that of county governments. The FDOT hires consulting engineers to inspect and rate county bridges, while the responsibility for maintaining the bridges remains with the individual county government. The next maintenance responsibility group includes city and town governments. Like the county bridges, FDOT hires consulting engineers to inspect most of the city and town maintained bridges. Maintenance of the remainder of the inventory is done by state agencies other than the FDOT, other local agencies, the federal government, railroads, private citizens and organizations.

This report presents the bridge inventory by various characteristics (number of bridges, age, structure types, and deck areas) and conditions (overall structural condition, structurally deficient bridges, posted and closed bridges, and functionally obsolete bridges). Also included for comparison are relative construction costs of bridges by structure type.

Number of Bridges

Currently there are 12,262 bridge-structures accounted for in the Florida DOT Bridge Management System. The FDOT has maintenance responsibility for 6,836 of the bridges, or 55.75%. County governments maintain 3,894 bridges (31.76%), city and towns maintain 1,238 bridges (10.1%), with the remaining 294 bridges (2.4%) maintained by others (see Figures 1 & 2).

The 6,836 bridges maintained by FDOT are divided by district and shown in Figures 3 & 4. District 2 has the most bridges, with 1,233 (18.04%), followed by District 5 (1033 bridges – 15.11%), District 1 (931 bridges – 13.62%), District 3 (816 bridges – 11.94%), District 4 (766 bridges - 11.21%), Turnpike District (741 bridges – 10.84%), District 7 (705 bridges – 10.31%), and District 6 (611 bridges – 8.94%). The number of bridges shown includes the 116 bridges maintained by the Dade County Expressway Authority (MDX) and 296 bridges maintained by the Orlando Orange County Expressway Authority (OOCEA).

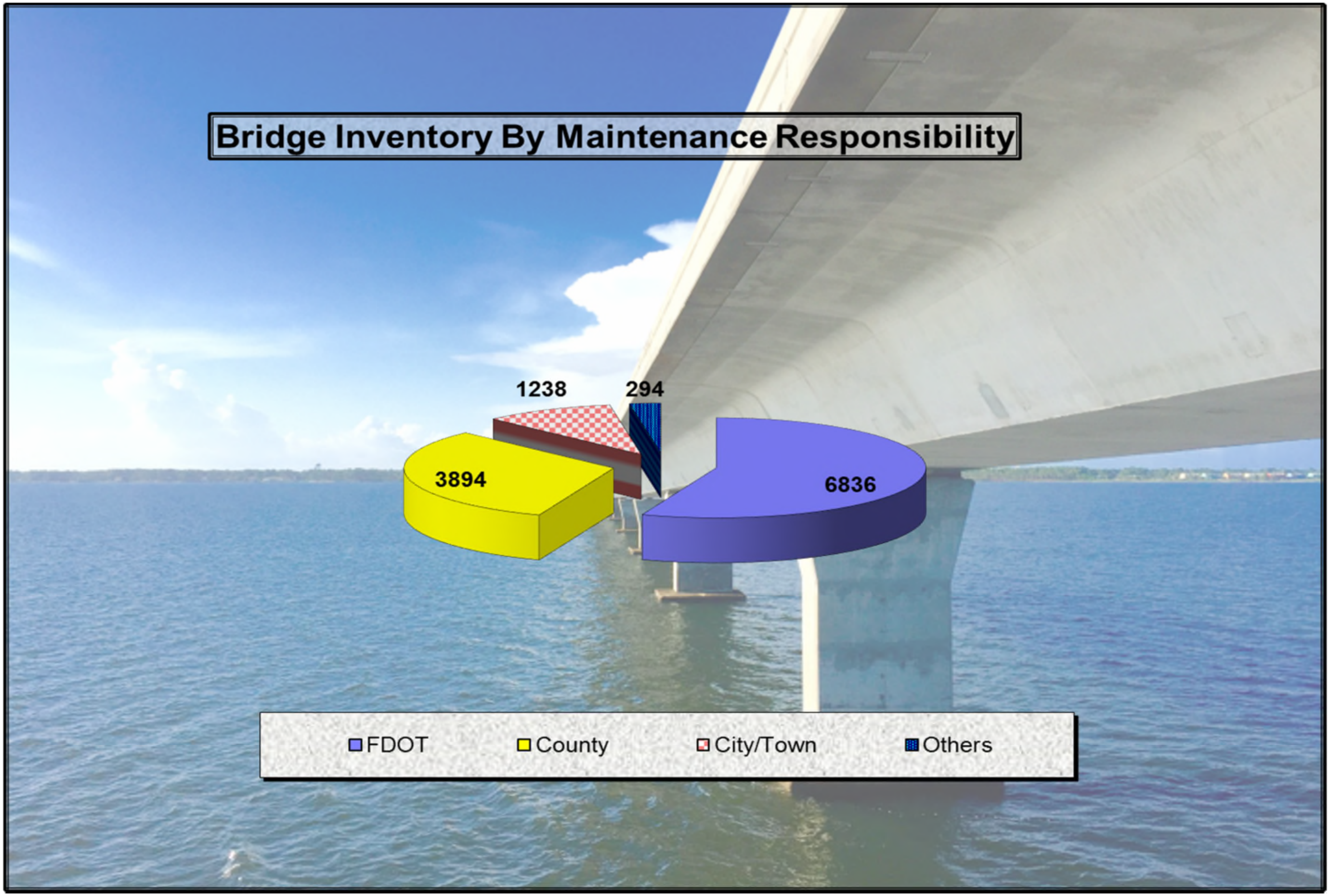


Figure 1

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

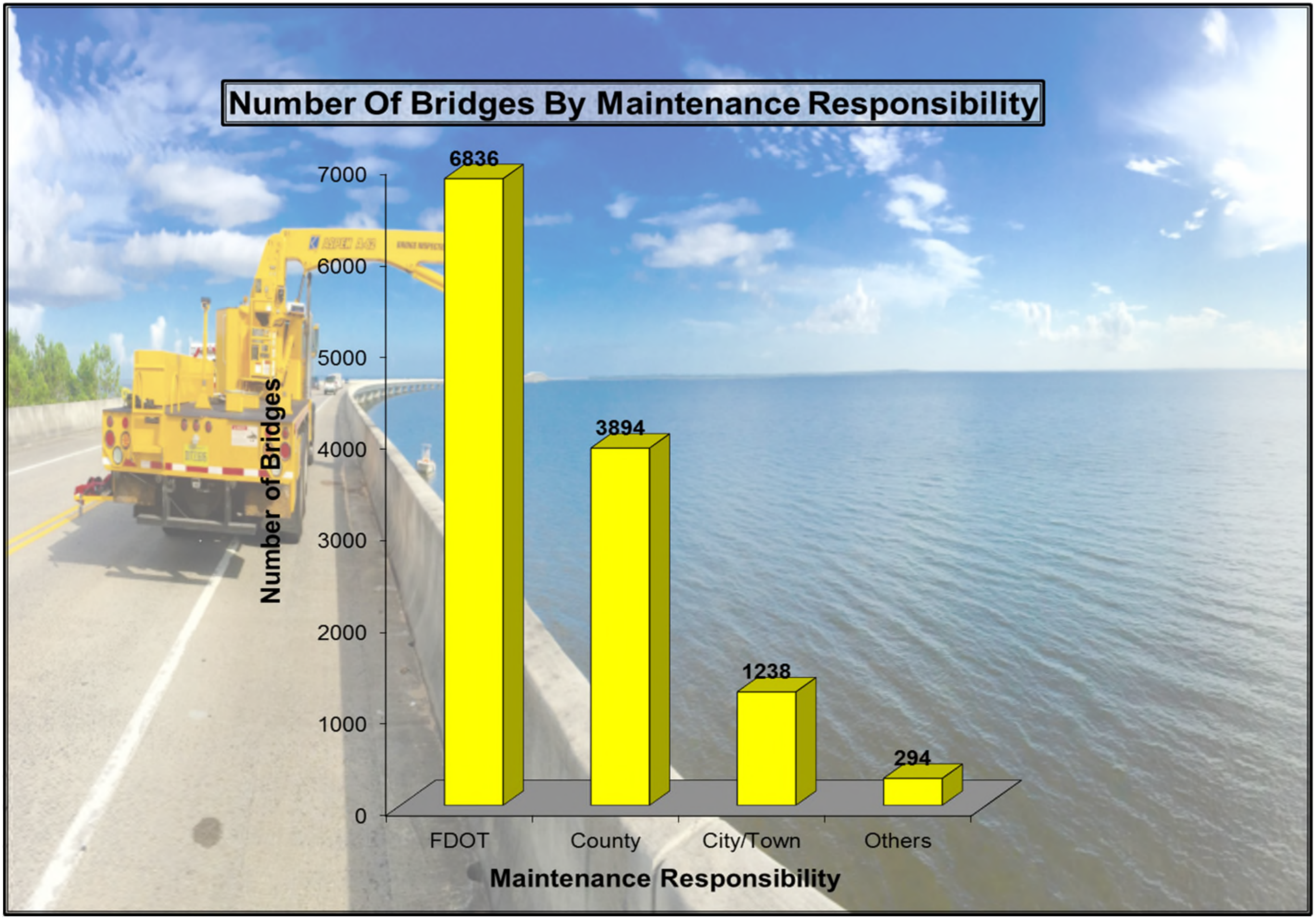


Figure 2

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

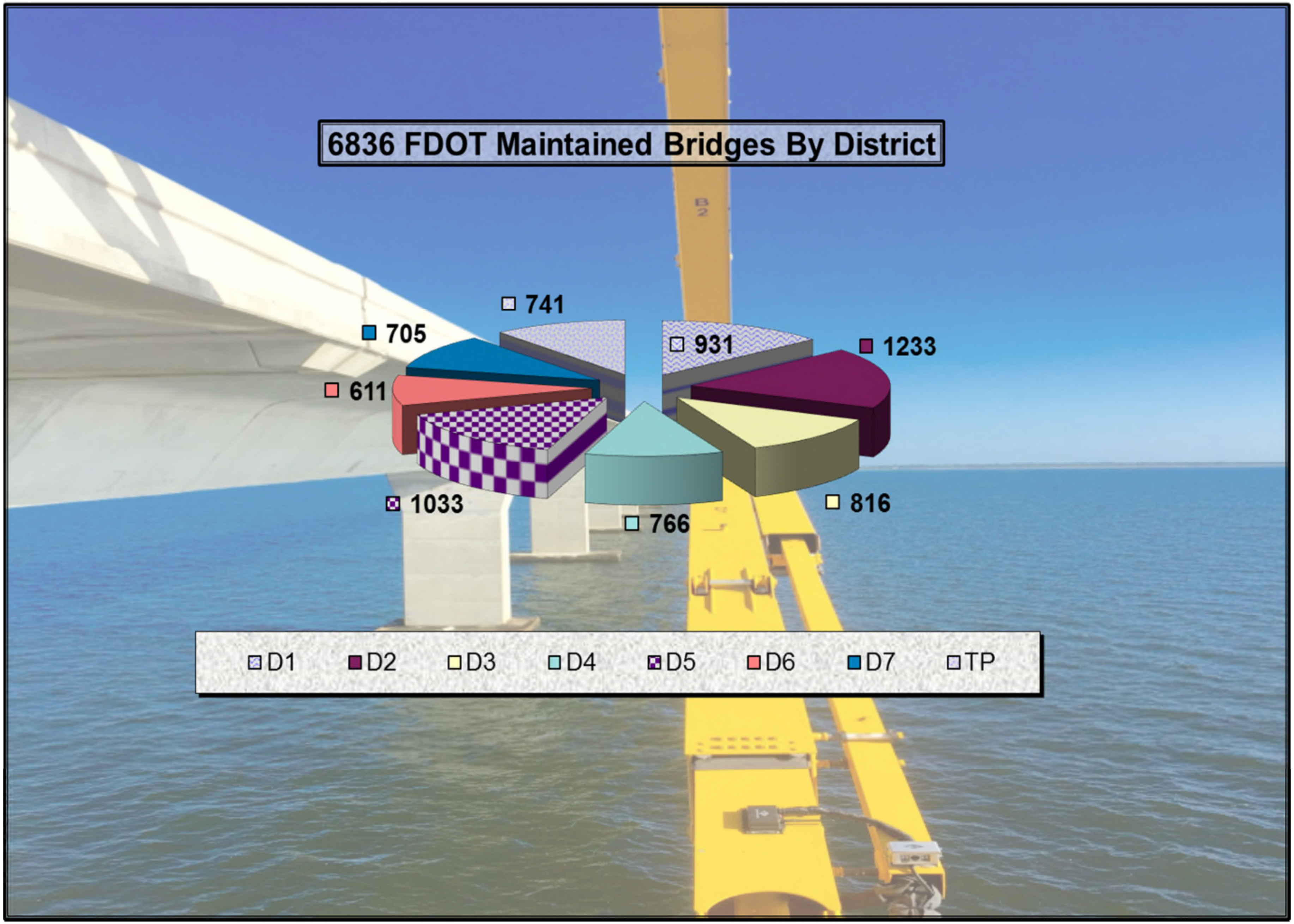

6836 FDOT Maintained Bridges By District
741
705
611
931
1233
1033
766
816
D1
D2
D3
D4
D5
D6
D7
TP

Figure 3

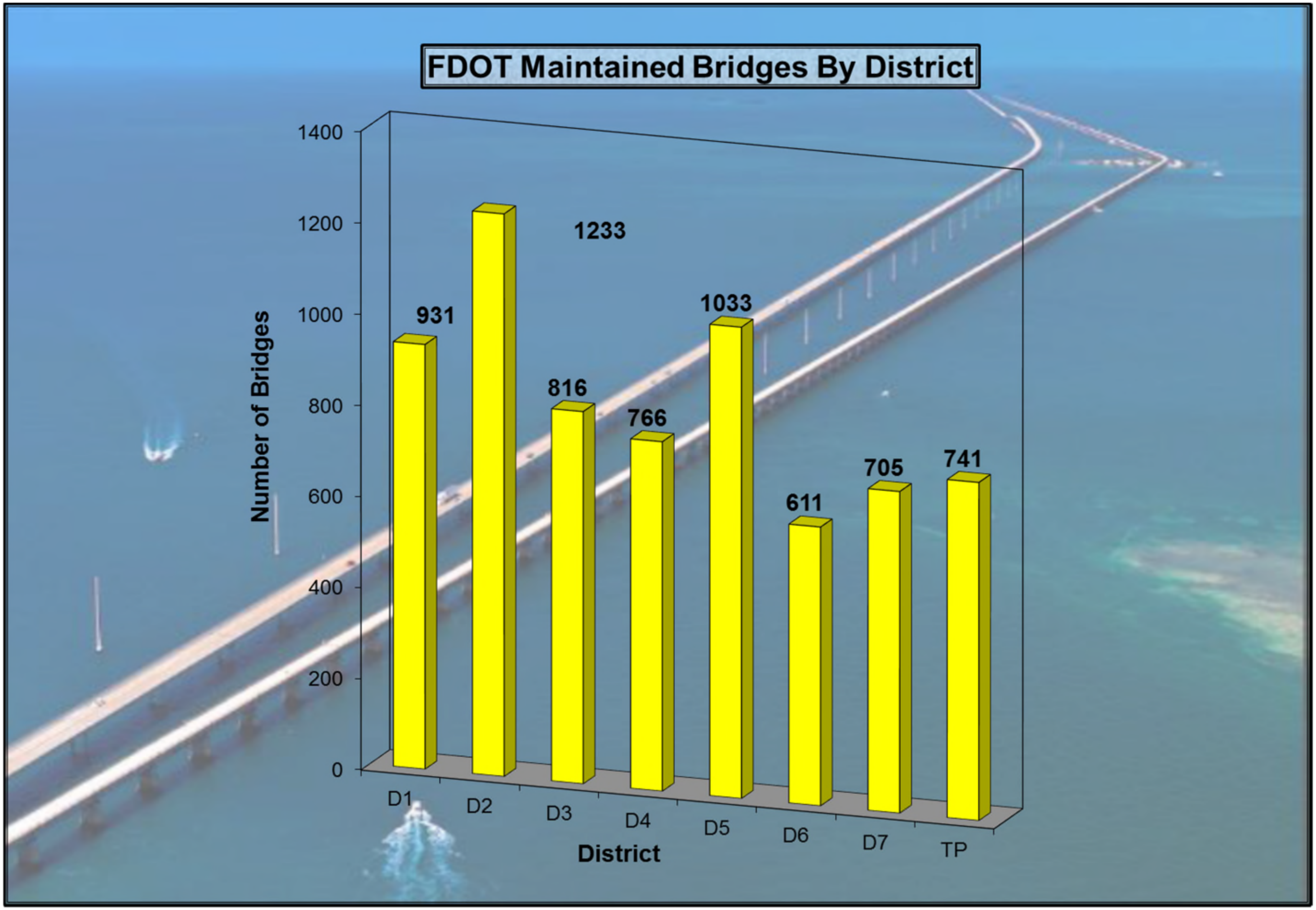


Figure 4

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

Age of Bridges

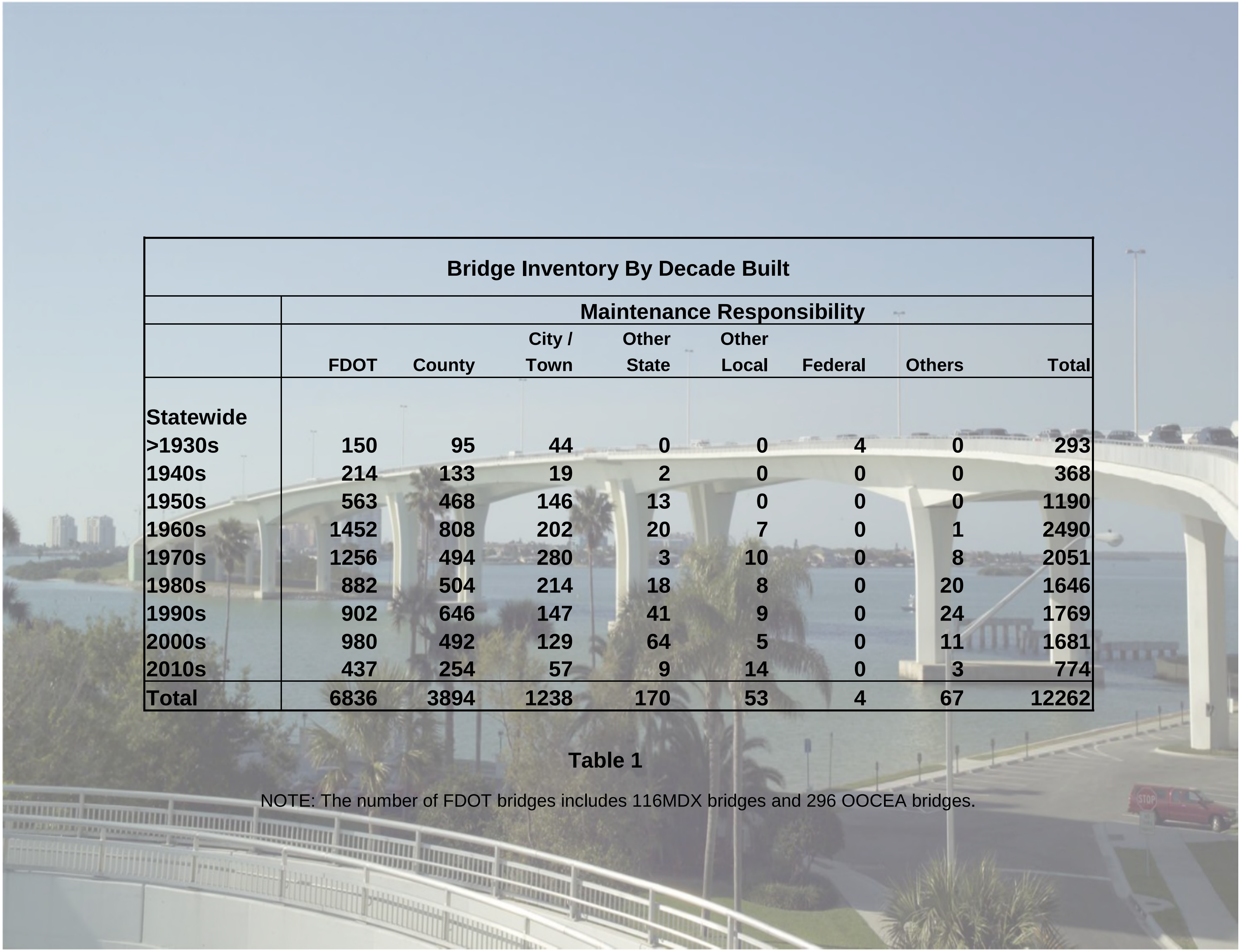
While the industry is now designing bridges to last for 75 years, most bridges built in the past were designed for a service life of 50 years. Looking at bridge age is the most common and simplest method of forecasting long-term budget requirements. This might lead one to conclude that bridges constructed before 1960 are at the end of the service life. Fortunately, advances in material science, design practices, and construction methods, along with a generally favorable climate, inspection and maintenance practices have contributed in many bridges functioning well past their original design life, despite the tremendous growth in traffic volume over the years. The strategy of bridge maintenance is to leverage these advances using an aggressive maintenance program to extend the useful life of the bridges, thereby minimizing the need to replace a large number of bridges within a short time period (see Table 1).

For the 6,836 bridges maintained by FDOT, approximately 13.56% were constructed prior to 1960, about 39.61% were constructed in the 1960's and 1970's, with the remaining 46.83% having been built since 1980 (see Figure 5).

Similar results can be seen with the statewide bridge inventory of county government maintained bridges with 17.87% constructed prior to 1960, 33.44% constructed in the 1960's and 1970's, and 48.69% since 1980 (see Figure 6).

The city and town maintained bridges are very similar as well, with 16.88% constructed prior to 1960, 38.93% constructed in the 1960's and 1970's, and 44.18% since 1980 (see Figure 7).

An examination of the distribution of the decade of construction by FDOT District, for the 6,836 FDOT maintained bridges show that the older bridge populations are concentrated in the rural and older urban areas, as one would expect (see Tables 2 & 3). The percentage of District bridge inventories built prior to the 1960's are as follows: District 2 – 21.01%, District 1 – 22.66%, District 3 – 16.79%, District 5 – 9.39%, District 7 – 10.07%, District 4 – 6.14%, District 6 – 9.82%, and the Turnpike District – 6.07%. While expansion and growth in South Florida has led to relatively younger bridge inventories for Districts 4 & 6, and the Turnpike, one would anticipate that the older bridge inventories, especially in Districts 1 and 2, would require a larger share of resources as their bridges reach the end of their service life. See Figure 8 for a graphic comparison of the FDOT Districts.



Bridge Inventory By Decade Built								
	Maintenance Responsibility							
	FDOT	County	City / Town	Other State	Other Local	Federal	Others	Total
Statewide								
>1930s	150	95	44	0	0	4	0	293
1940s	214	133	19	2	0	0	0	368
1950s	563	468	146	13	0	0	0	1190
1960s	1452	808	202	20	7	0	1	2490
1970s	1256	494	280	3	10	0	8	2051
1980s	882	504	214	18	8	0	20	1646
1990s	902	646	147	41	9	0	24	1769
2000s	980	492	129	64	5	0	11	1681
2010s	437	254	57	9	14	0	3	774
Total	6836	3894	1238	170	53	4	67	12262

Table 1

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

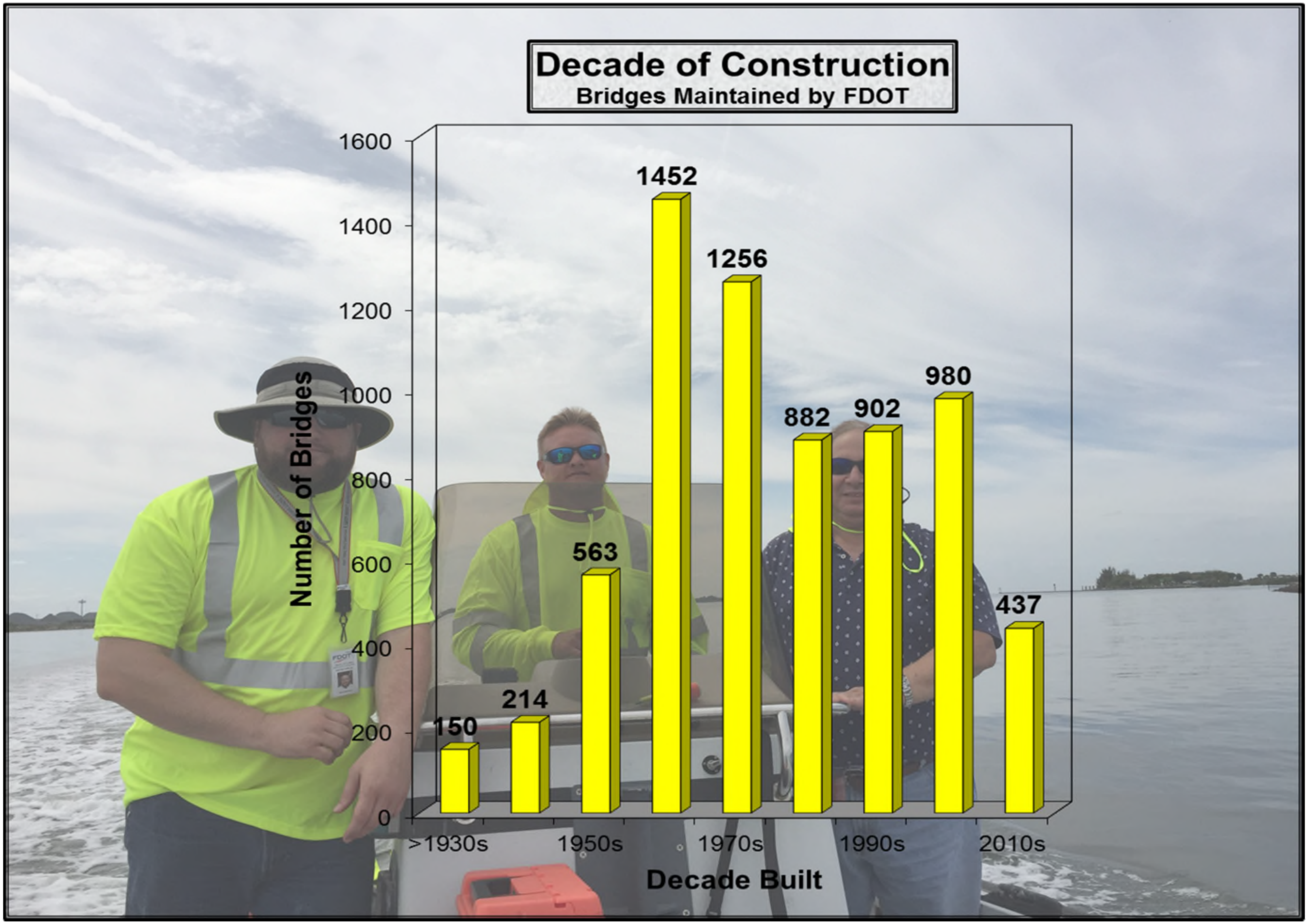


Figure 5

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

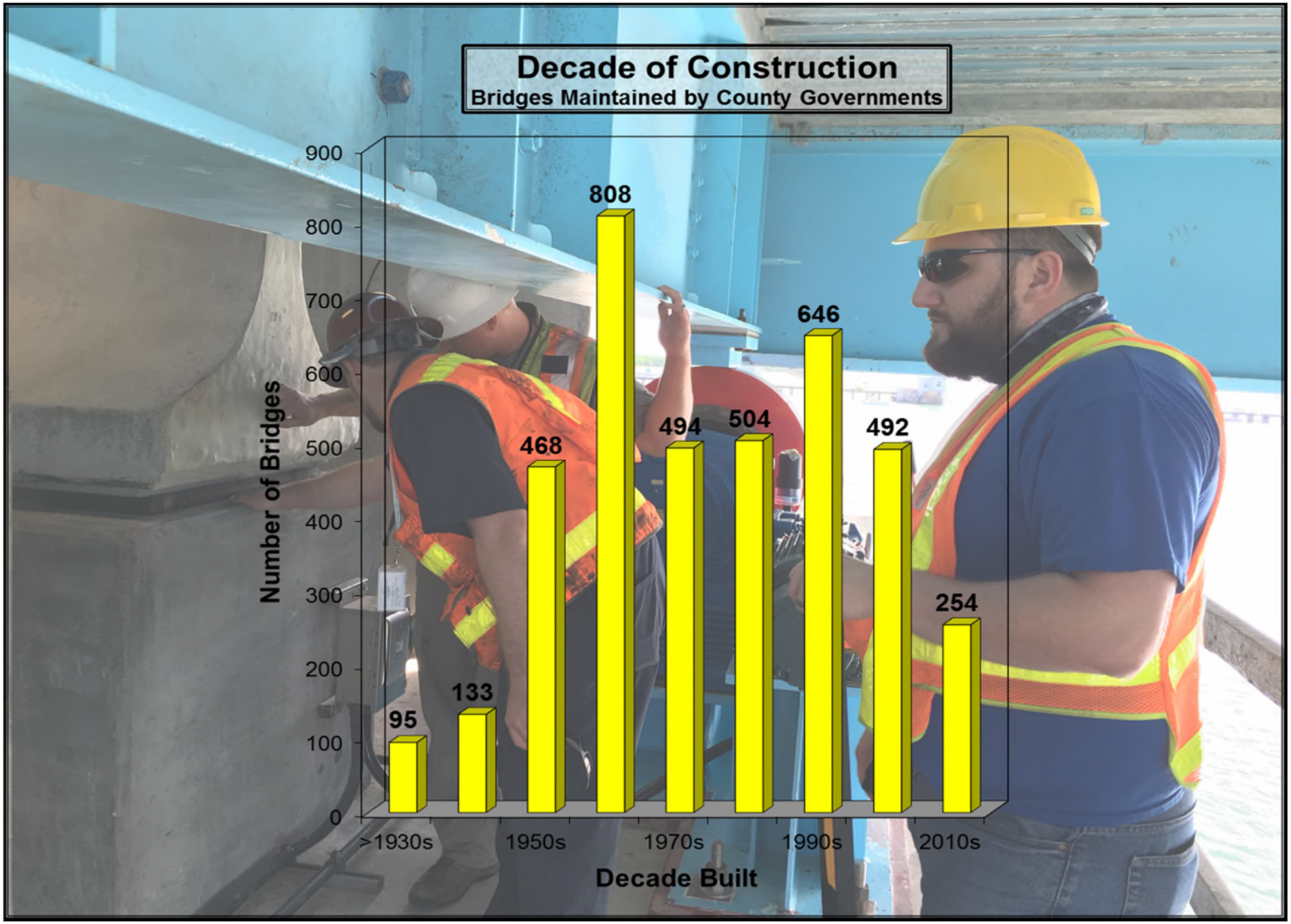


Figure 6

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

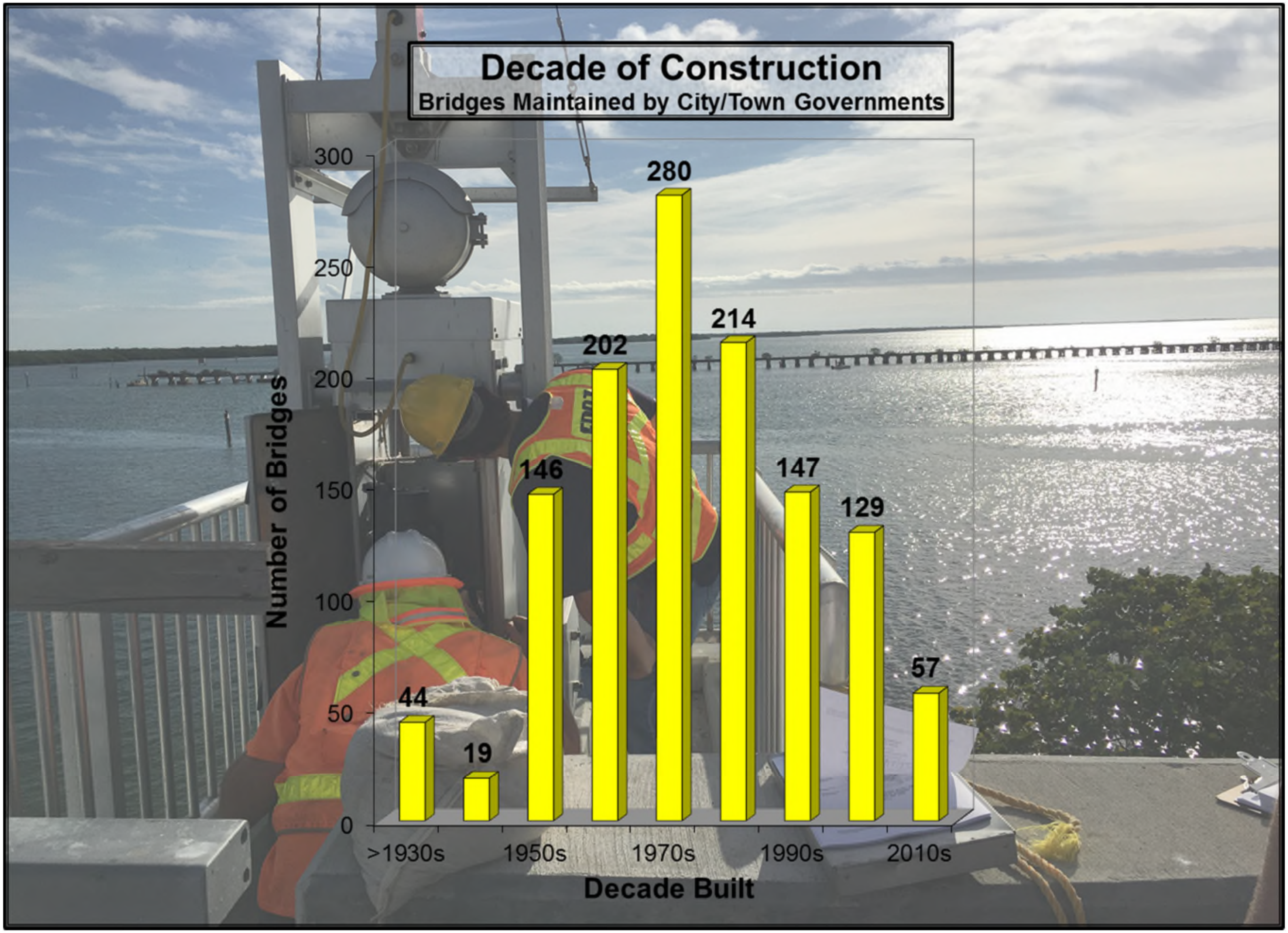


Figure 7

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

Bridge Inventory — 2016 Annual Report

Bridge Inventory by Decade Built (Districts 1 thru 4)																
	Maintenance Responsibility								Maintenance Responsibility							
	FDOT	County	City/Town	Other State	Other Local	Federal	Others	Total	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total
	District 1								District 3							
>1930s	23	10	5	0	0	0	0	38	10	25	0	0	0	0	0	35
1940s	61	24	1	1	0	0	0	87	55	33	2	1	0	0	0	91
1950s	127	101	13	2	0	0	0	243	72	142	5	0	0	0	0	219
1960s	113	213	36	5	6	0	0	373	110	166	5	6	0	0	0	287
1970s	155	135	86	0	3	0	0	379	286	91	9	3	2	0	0	391
1980s	176	139	48	2	5	0	0	370	58	70	9	14	0	0	1	152
1990s	137	130	26	6	8	0	0	307	103	193	11	28	0	0	0	335
2000s	97	101	20	4	0	0	0	222	68	157	10	49	1	0	0	285
2010s	42	62	11	3	1	0	0	119	54	76	2	5	0	0	0	137
Total	931	915	246	23	23	0	0	2138	816	953	53	106	3	0	1	1932
	District 2								District 4							
>1930s	54	16	6	0	0	0	0	76	5	5	6	0	0	0	0	16
1940s	61	52	3	0	0	0	0	116	4	3	4	0	0	0	0	11
1950s	144	118	34	5	0	0	0	301	38	37	59	6	0	0	0	140
1960s	418	96	37	1	0	0	0	552	73	69	58	4	1	0	0	205
1970s	193	40	32	0	0	0	1	266	155	75	67	0	0	0	0	297
1980s	44	47	28	0	0	0	0	119	228	73	53	1	0	0	0	355
1990s	99	48	21	2	0	0	0	170	96	105	17	1	0	0	0	219
2000s	147	51	37	3	0	0	1	239	125	65	17	3	0	0	0	210
2010s	73	23	5	0	0	0	0	101	42	28	14	0	0	0	0	84
Total	1233	491	203	11	0	0	2	1940	766	460	295	15	1	0	0	1537

Table 2

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

Bridge Inventory by Decade Built (Districts 5 thru 8)

	Maintenance Responsibility								Maintenance Responsibility							
	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total
	District 5								District 7							
>1930s	25	10	3	0	0	0	0	38	29	10	14	0	0	0	0	53
1940s	13	10	2	0	0	0	0	25	10	4	3	0	0	0	0	17
1950s	59	27	5	0	0	0	0	91	32	19	18	0	0	0	0	69
1960s	277	62	11	1	0	0	1	352	114	105	37	1	0	0	0	257
1970s	121	35	47	0	0	0	7	210	111	86	23	0	5	0	0	225
1980s	79	78	39	1	0	0	19	216	168	71	20	0	3	0	0	262
1990s	152	66	27	3	0	0	24	272	64	90	35	0	1	0	0	190
2000s	234	57	23	5	2	0	9	330	122	38	14	0	2	0	1	177
2010s	73	38	17	0	8	0	3	139	55	14	6	0	1	0	0	76
Total	1033	383	174	10	10	0	63	1673	705	437	170	1	12	0	1	1326
	District 6								Turnpike							
>1930s	4	19	10	0	0	4	0	37	0	0	0	0	0	0	0	0
1940s	10	7	4	0	0	0	0	21	0	0	0	0	0	0	0	0
1950s	46	24	12	0	0	0	0	82	45	0	0	0	0	0	0	45
1960s	225	97	18	2	0	0	0	342	122	0	0	0	0	0	0	122
1970s	77	32	16	0	0	0	0	125	158	0	0	0	0	0	0	158
1980s	64	26	17	0	0	0	0	107	65	0	0	0	0	0	0	65
1990s	48	14	10	1	0	0	0	73	203	0	0	0	0	0	0	203
2000s	73	23	8	0	0	0	0	104	114	0	0	0	0	0	0	114
2010s	64	13	2	1	4	0	0	84	34	0	0	0	0	0	0	34
Total	611	255	97	4	4	4	0	975	741	0	0	0	0	0	0	741

Table 3

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

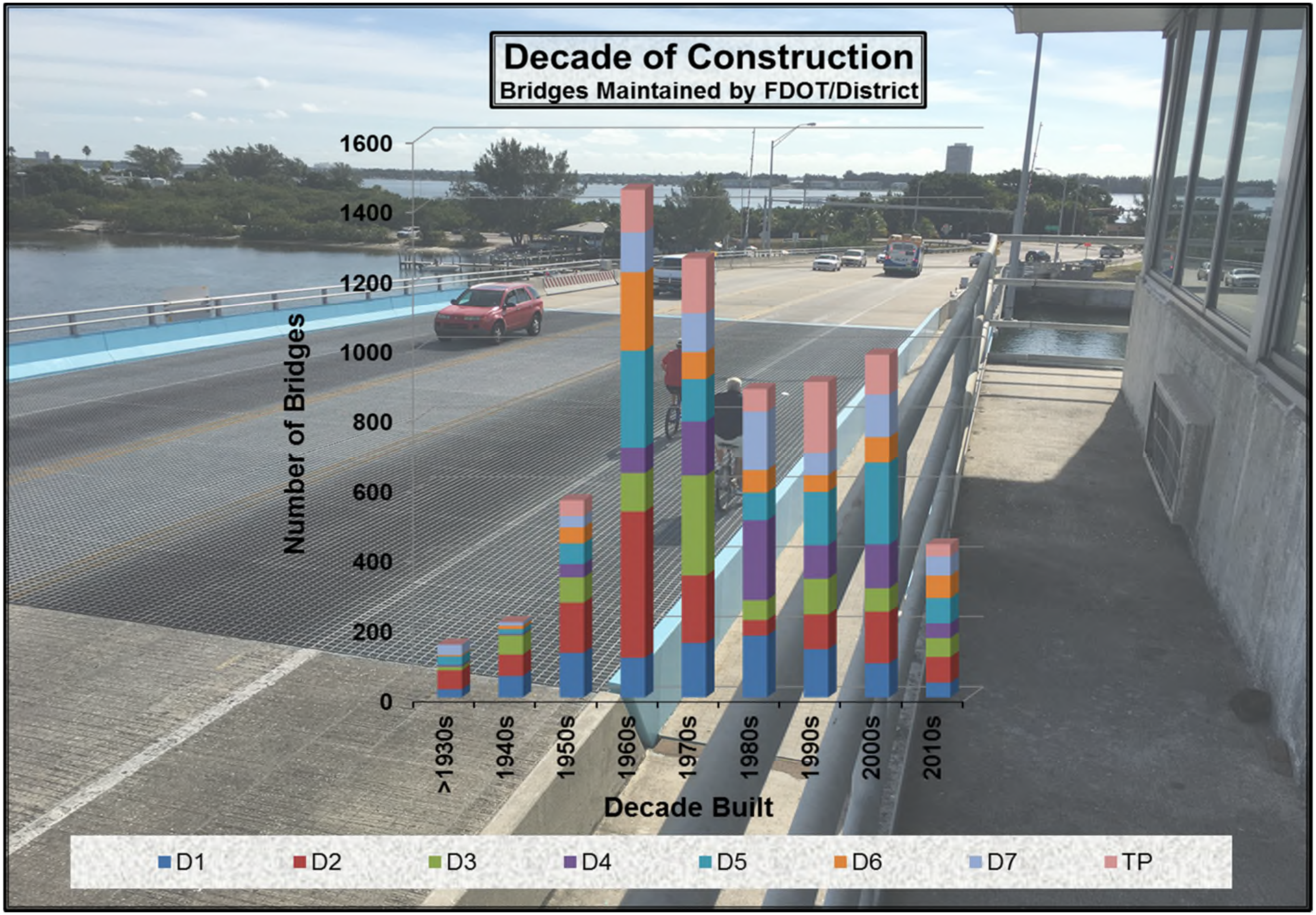


Figure 8

NOTE: The number of FDOT bridges includes 116MDX bridges and 296 OOCEA bridges.

Types of Bridge Superstructures

With the exception of historic, gateway, or "signature" bridges, the type of bridge superstructure is generally of little interest to most people. However, the superstructure type is the most common method used by bridge engineers to categorize bridges. Superstructures are the unsupported component of a bridge that carries the intended loads across the span opening. Superstructure types are generally described by their structural configuration along with their material of construction. As a result, superstructure types can accurately define a bridge's service life, performance, and maintainability. In the broadest sense there are three types of structural configurations for categorizing bridge superstructures. These are shells, which would include the arch culvert superstructure type. The second category is plates including slabs, orthotropic plates, and box culverts. Also included in the plate category is a special type of plate, called a beam. Superstructure types for a beam would include girders, boxes, and movable superstructure spans. The third category is the truss. The material of construction is generally concrete, steel, or timber. For recording purposes these superstructure and material types have been reduced to twelve specific categories with a thirteenth (other) category for unusual and seldom used superstructure types (see Table 4).

Slabs

These would include both Reinforced Concrete Slabs and Prestressed Concrete Slabs. These superstructure types are characterized by having a generally constant, rectangular cross-section using concrete as the main building component.

Slab bridges maintained by the state represent 16.28% of the total inventory. Similarly, slab bridges maintained by counties are 35.64%, and by cities and towns are 53.80%.

Beams and Girders

Most of the bridges in Florida can be considered as beam or girder bridges. These superstructure types are composed of either singular or groups of individual linear elements positioned either in the direction of traffic or transverse to the direction of traffic. The categories used for this type include Reinforced Concrete Beam, Prestressed Concrete Beam, Steel Beam, Timber Beam, Reinforced Concrete Box, Prestressed Concrete Box, Steel Box, and Movable Spans. Beam and Girder type bridges comprise 62.24% of the state maintained inventory, 33.87% of the county bridges, and 25.44% of the city/town bridges.

Trusses

The members of a truss work in either tension or compression. Bending is assumed not to occur in this type of bridge superstructure. The external loads from the deck and traffic are applied only at the joints of a truss.

At present 0.04% of the state maintained bridges use truss superstructures. Likewise, 0.36% of the county bridges and 0.16% of the city/town bridges use trusses.

Culverts

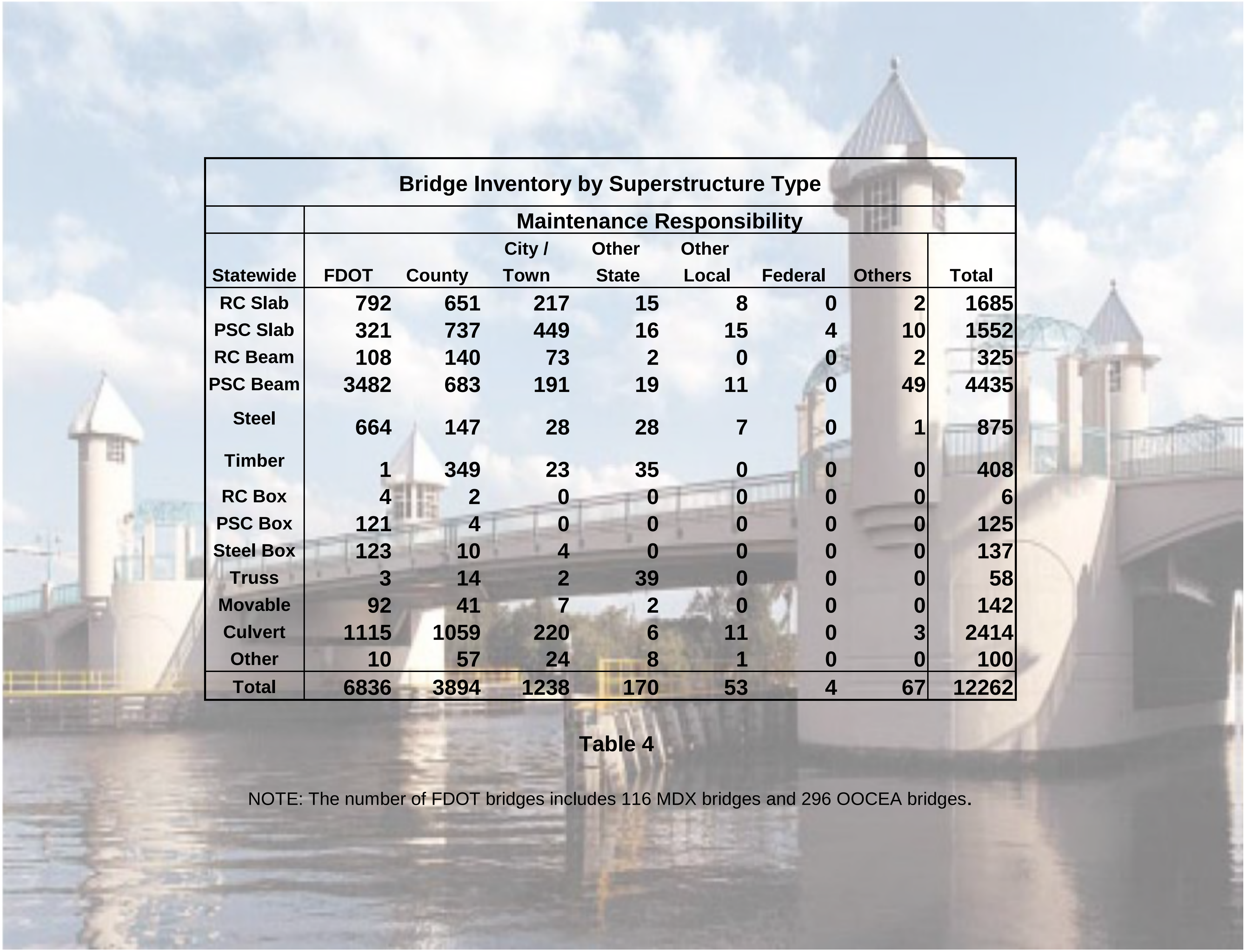
A culvert is typically a buried drainage structure. When the overall opening of the culvert is at least 20 feet it is considered a bridge by the Federal Government, and hence is treated like a bridge for inspection and maintenance purposes. Culverts represent 16.31% of the state maintained bridges. County inventories include 27.20% culverts, and city/towns include 17.77% culverts.

Movables

The general classification known as movable bridge includes the specific superstructure type describing the way it moves. This could be either a bascule, swing, or lift bridge. The movable bridge can either stand alone, or include fixed approach spans. Movable bridges represent 1.35% of the total state bridge inventory. County inventories include 1.05% movables, and city/towns include 0.57% movable bridges.

Figures

Figures 9 through 12 present graphic views of Table 4, which shows superstructure type by maintenance responsibility.



Bridge Inventory by Superstructure Type								
	Maintenance Responsibility							
Statewide	FDOT	County	City / Town	Other State	Other Local	Federal	Others	Total
RC Slab	792	651	217	15	8	0	2	1685
PSC Slab	321	737	449	16	15	4	10	1552
RC Beam	108	140	73	2	0	0	2	325
PSC Beam	3482	683	191	19	11	0	49	4435
Steel	664	147	28	28	7	0	1	875
Timber	1	349	23	35	0	0	0	408
RC Box	4	2	0	0	0	0	0	6
PSC Box	121	4	0	0	0	0	0	125
Steel Box	123	10	4	0	0	0	0	137
Truss	3	14	2	39	0	0	0	58
Movable	92	41	7	2	0	0	0	142
Culvert	1115	1059	220	6	11	0	3	2414
Other	10	57	24	8	1	0	0	100
Total	6836	3894	1238	170	53	4	67	12262

Table 4

NOTE: The number of FDOT bridges includes 116 MDX bridges and 296 OOCEA bridges.

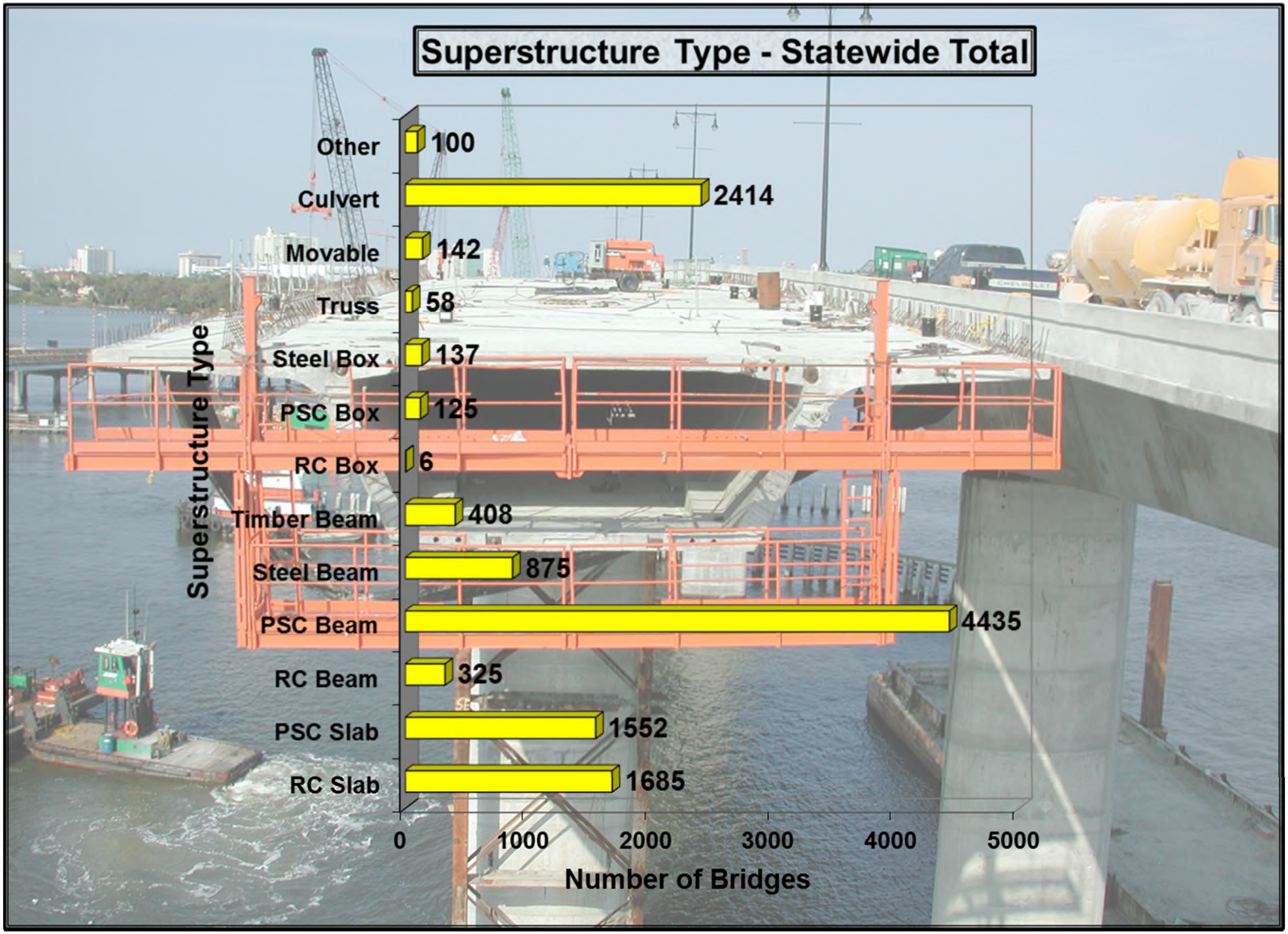

Superstructure Type - Statewide Total
Superstructure Type
Other 100
Culvert 2414
Movable 142
Truss 58
Steel Box 137
PSC Box 125
RC Box 6
Timber Beam 408
Steel Beam 875
PSC Beam 4435
RC Beam 325
PSC Slab 1552
RC Slab 1685
0
1000
2000
3000
4000
5000
Number of Bridges

Figure 9

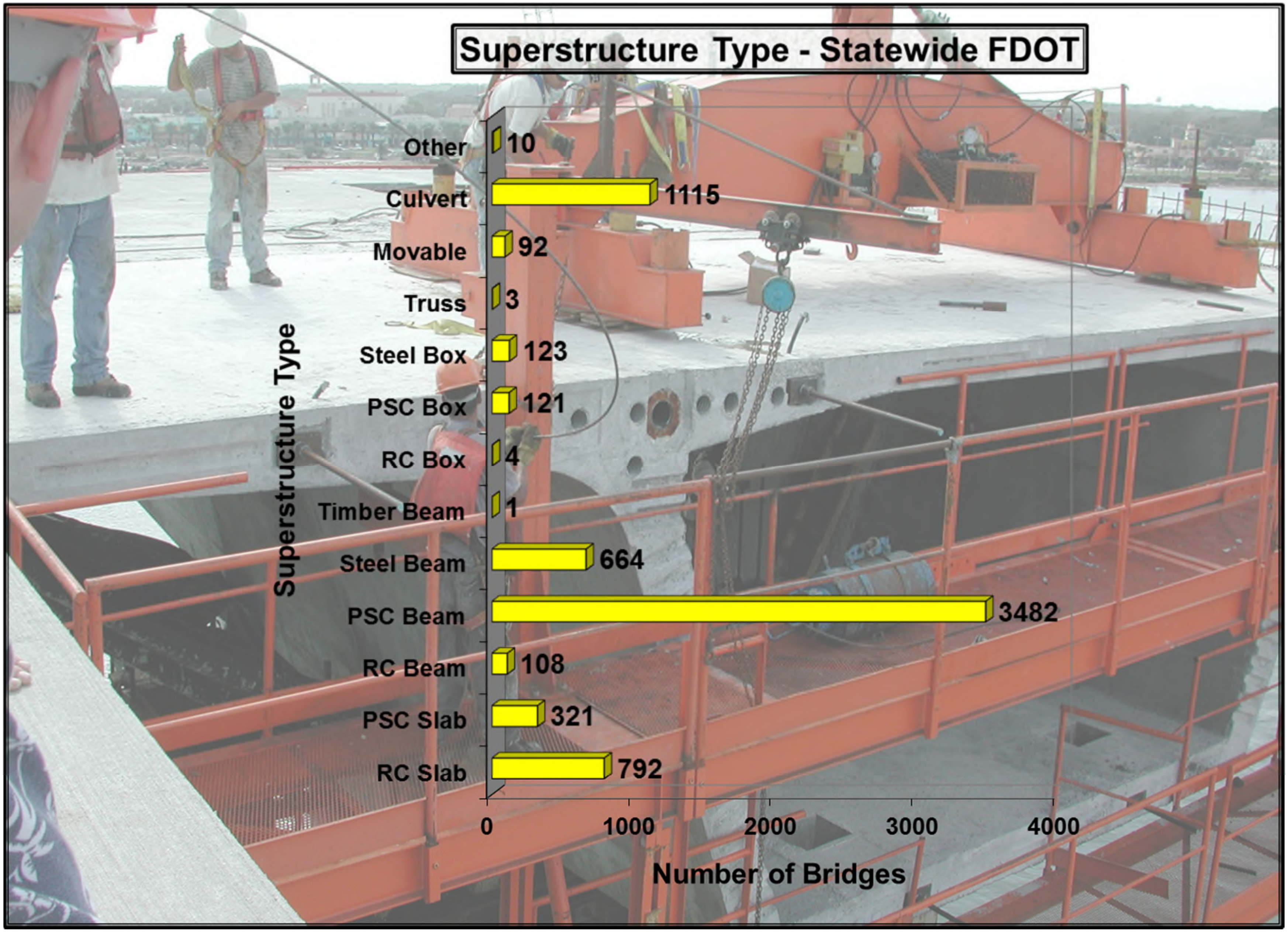

Superstructure Type - Statewide FDOT
Superstructure Type
Other
10
Culvert
1115
Movable
92
Truss
3
Steel Box
123
PSC Box
121
RC Box
4
Timber Beam
1
Steel Beam
664
PSC Beam
3482
RC Beam
108
PSC Slab
321
RC Slab
792
0
1000
2000
3000
4000
Number of Bridges

Figure 10

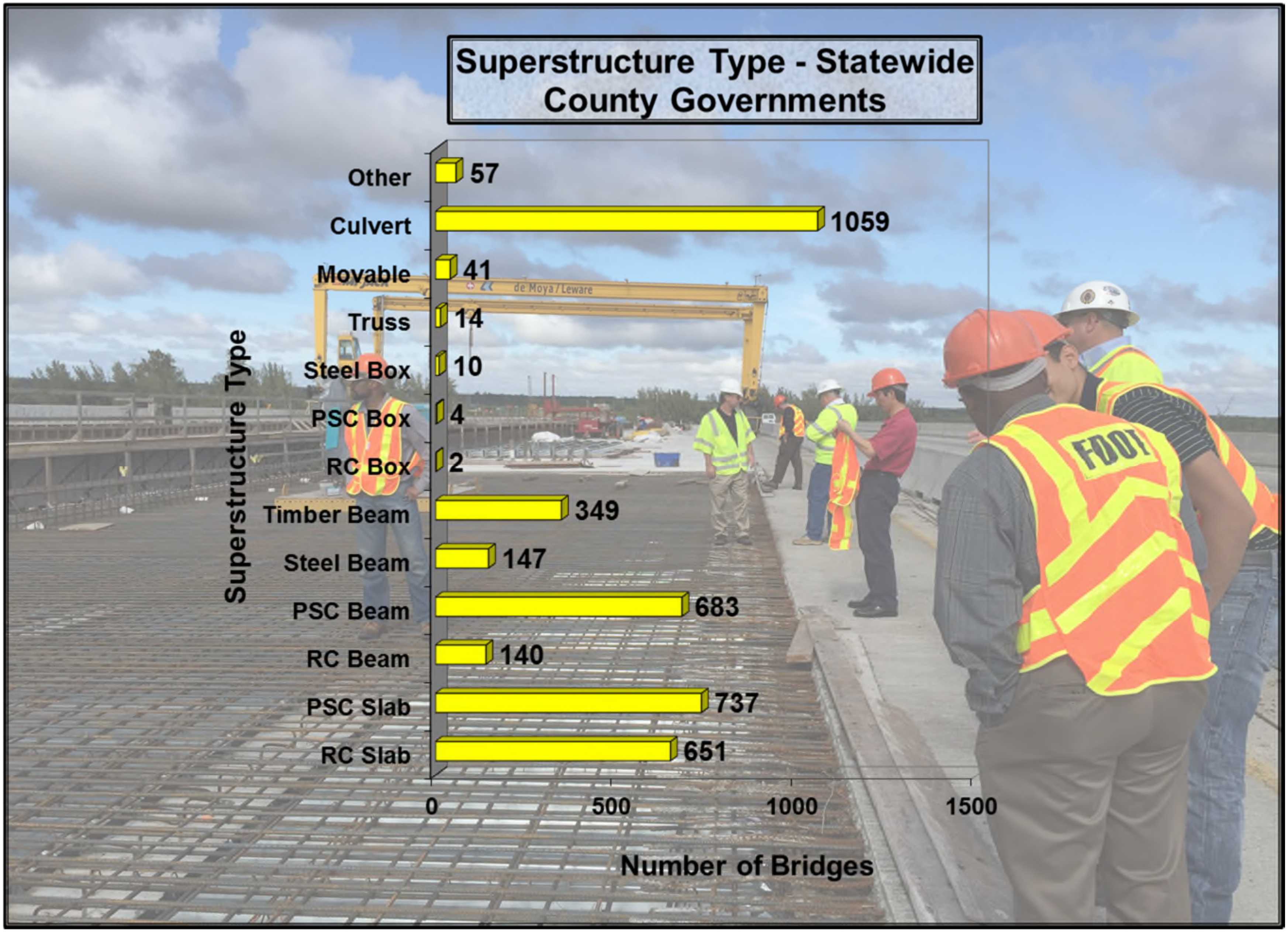

Superstructure Type - Statewide
County Governments
Superstructure Type
Other
Culvert
Movable
Truss
Steel Box
PSC Box
RC Box
Timber Beam
Steel Beam
PSC Beam
RC Beam
PSC Slab
RC Slab
57
1059
41
14
10
4
2
349
147
683
140
737
651
0
500
1000
1500
Number of Bridges
FDOT

Figure 11

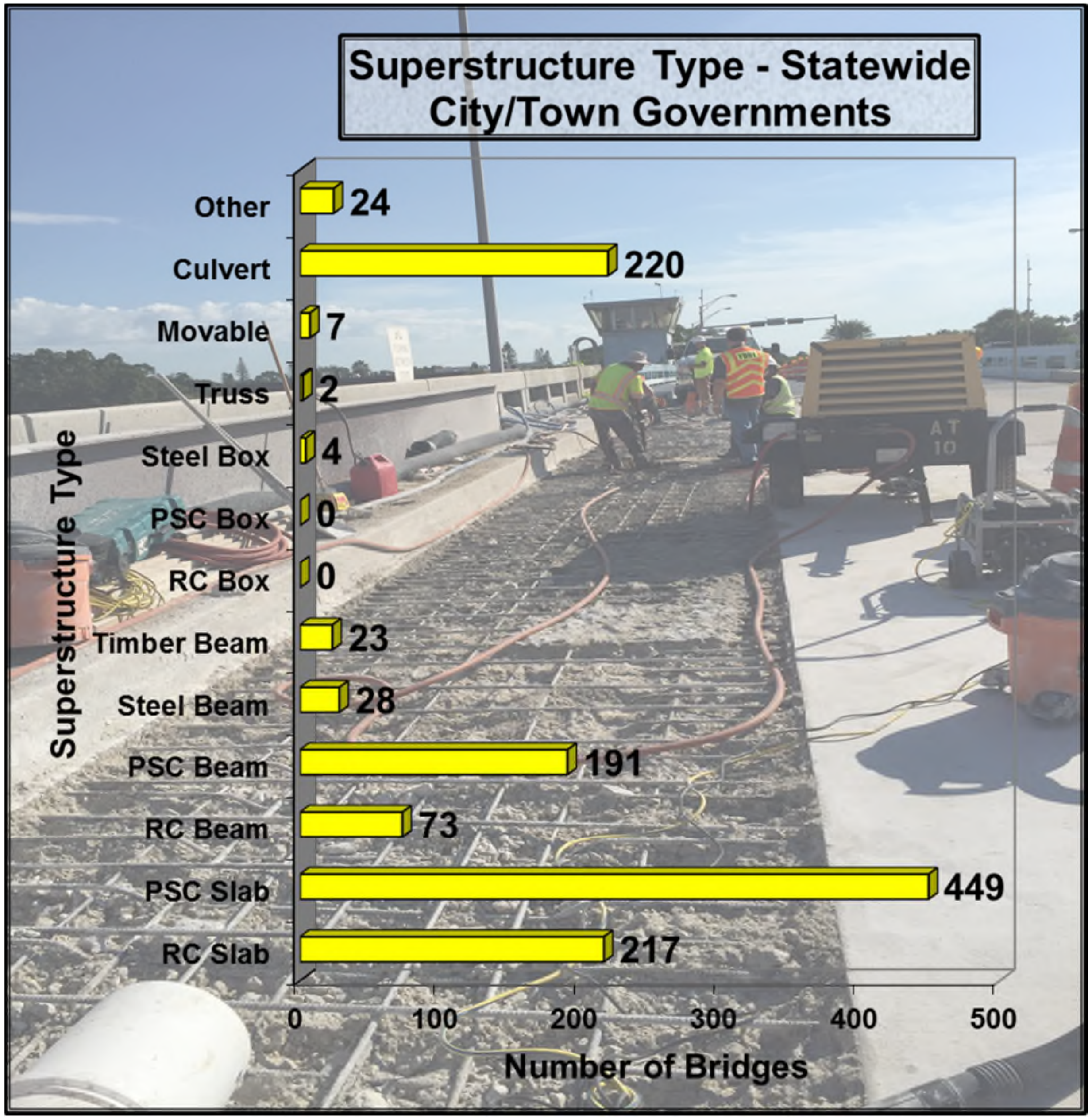

Superstructure Type - Statewide
City/Town Governments
Other
Culvert
Movable
Truss
Steel Box
PSC Box
RC Box
Timber Beam
Steel Beam
PSC Beam
RC Beam
PSC Slab
RC Slab
24
220
7
2
4
0
0
23
28
191
73
449
217
Superstructure Type
0
100
200
300
400
500
Number of Bridges

Figure 12

Deck Area of the Bridge Inventory

Most bridges are one-of-a-kind structures. However, to simplify categorizing and evaluation, a method often used to compare bridges relies on the area of the deck or riding surface. Rather than listing bridges individually, this method groups bridges in ranges based on total deck area. Table 5 presents these deck area ranges by maintenance responsibility.

FDOT Bridges Statewide

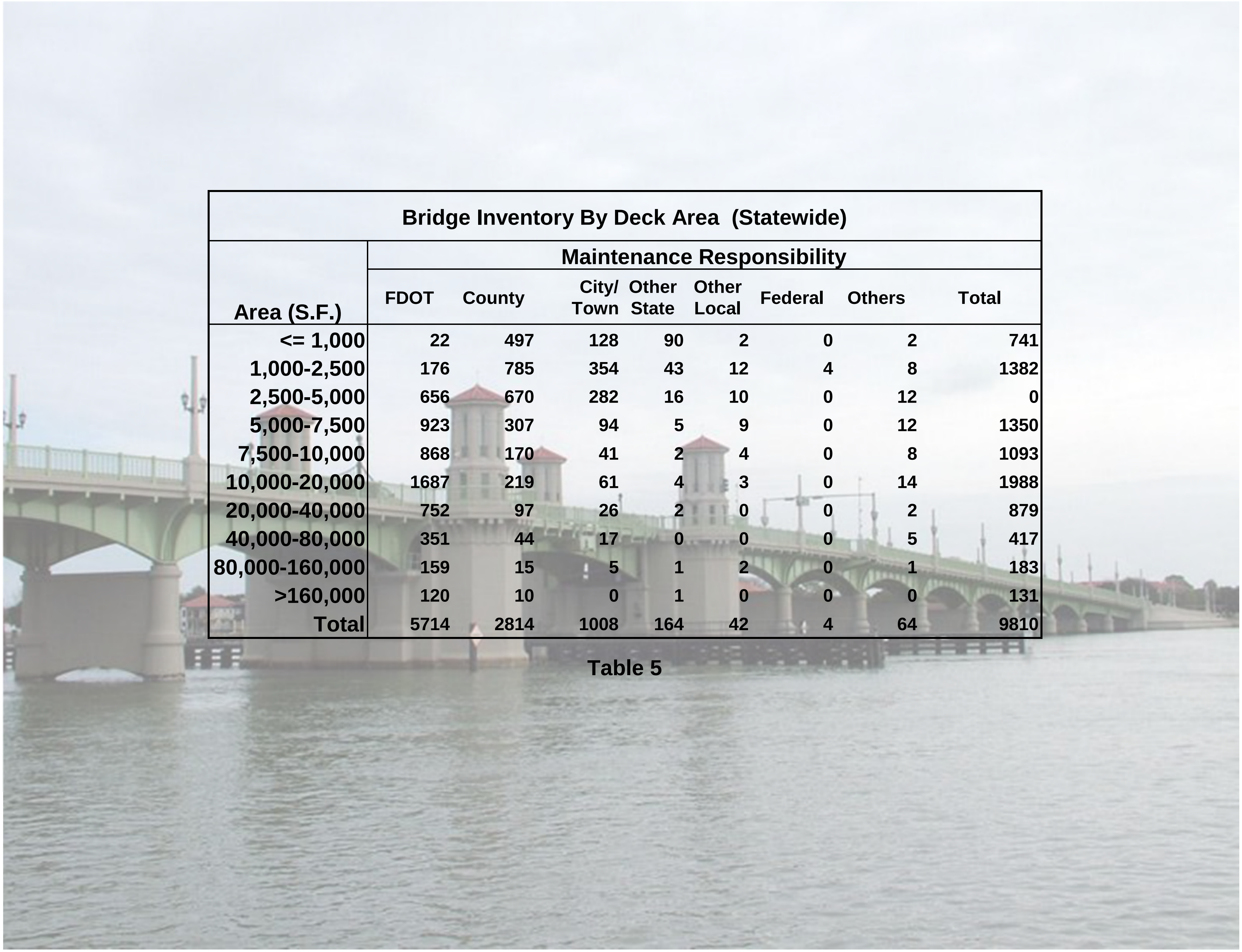
Figure 13 presents the 5,714 FDOT bridges grouped by the deck area ranges (culverts and other miscellaneous structures are not included in this group). The range with the largest number of bridges is the 10,000 to 20,000 square foot range, with 1,687 bridges, 29.52% of the total. 14.95% of the FDOT bridges fall into the 0 to 5,000 square foot range; 31.34% are in the 5,000 to 10,000 square foot range; and 24.19% of the bridges have deck areas greater than 20,000 square feet.

County and City/Town Bridges

As one might expect, bridges maintained by county governments are generally smaller than those maintained by FDOT. The statewide county maintenance responsibility group has 69.37% of their bridges under 5,000 square feet; with 16.95% between 5,000 and 10,000 square feet; 7.78% between 10,000 to 20,000 square feet; and only 5.90% over 20,000 square feet (see Figure 14). The results for the City/Town and Others groups are similar; with 75.79% of these bridges less than 5,000 square feet (see Figure 15 & 16).

FDOT Bridges by District

Tables 6 and 7 present the statewide data sorted by district. Figure 17 allows graphic comparison between the districts for the FDOT maintained bridges. For example, 30.26% of the District 1 bridges are less than 5,000 square feet and only 14.77% of their bridges are over 20,000 square feet. In contrast, only 13.91% of District 4 bridges are less than 5,000 square feet, while 34.30% are over 20,000 square feet.



Bridge Inventory By Deck Area (Statewide)								
	Maintenance Responsibility							
Area (S.F.)	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total
<= 1,000	22	497	128	90	2	0	2	741
1,000-2,500	176	785	354	43	12	4	8	1382
2,500-5,000	656	670	282	16	10	0	12	0
5,000-7,500	923	307	94	5	9	0	12	1350
7,500-10,000	868	170	41	2	4	0	8	1093
10,000-20,000	1687	219	61	4	3	0	14	1988
20,000-40,000	752	97	26	2	0	0	2	879
40,000-80,000	351	44	17	0	0	0	5	417
80,000-160,000	159	15	5	1	2	0	1	183
>160,000	120	10	0	1	0	0	0	131
Total	5714	2814	1008	164	42	4	64	9810

Table 5

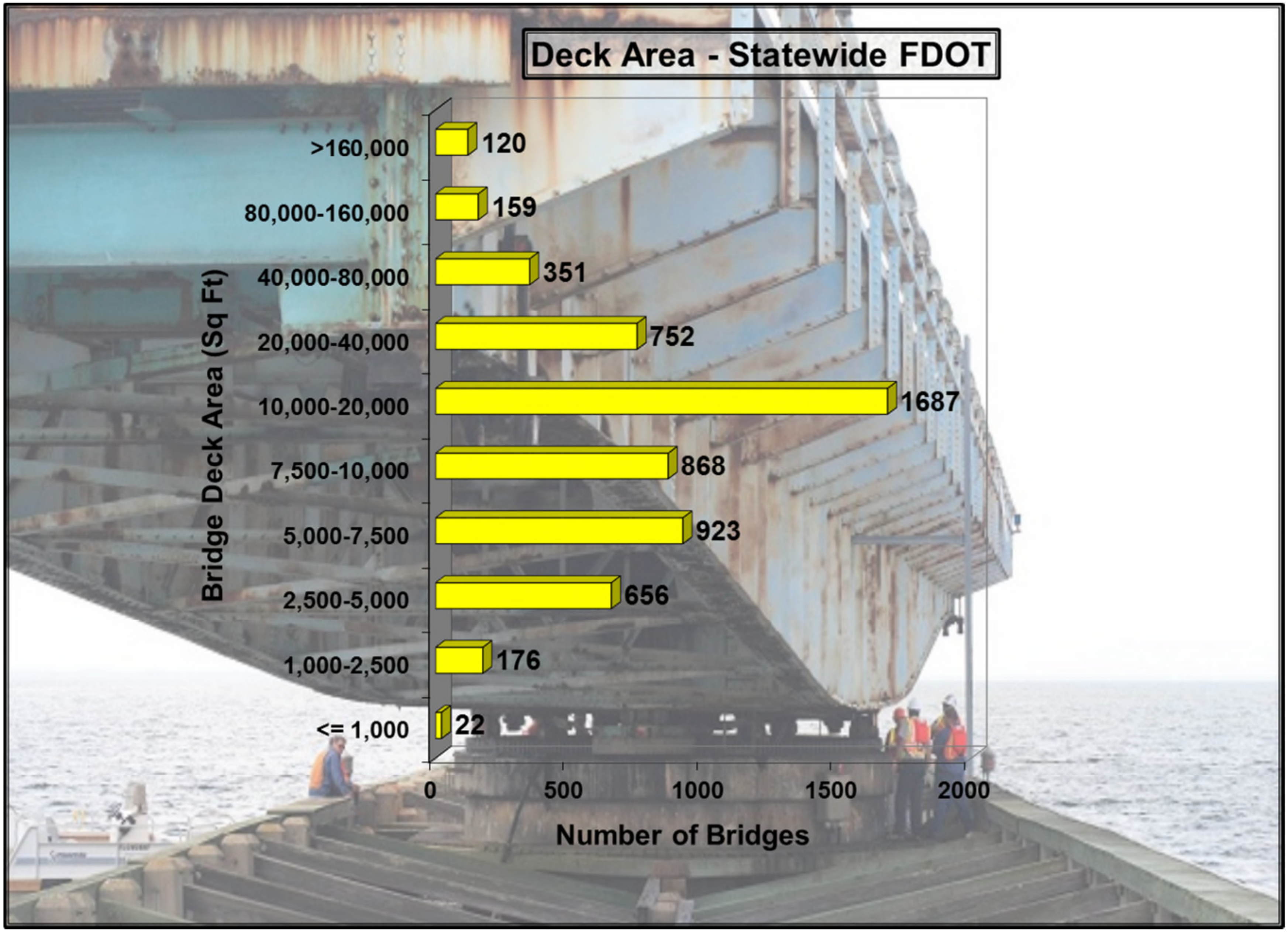

Deck Area - Statewide FDOT
Bridge Deck Area (Sq Ft)
>160,000
80,000-160,000
40,000-80,000
20,000-40,000
10,000-20,000
7,500-10,000
5,000-7,500
2,500-5,000
1,000-2,500
<= 1,000
120
159
351
752
1687
868
923
656
176
22
0
500
1000
1500
2000
Number of Bridges

Figure 13

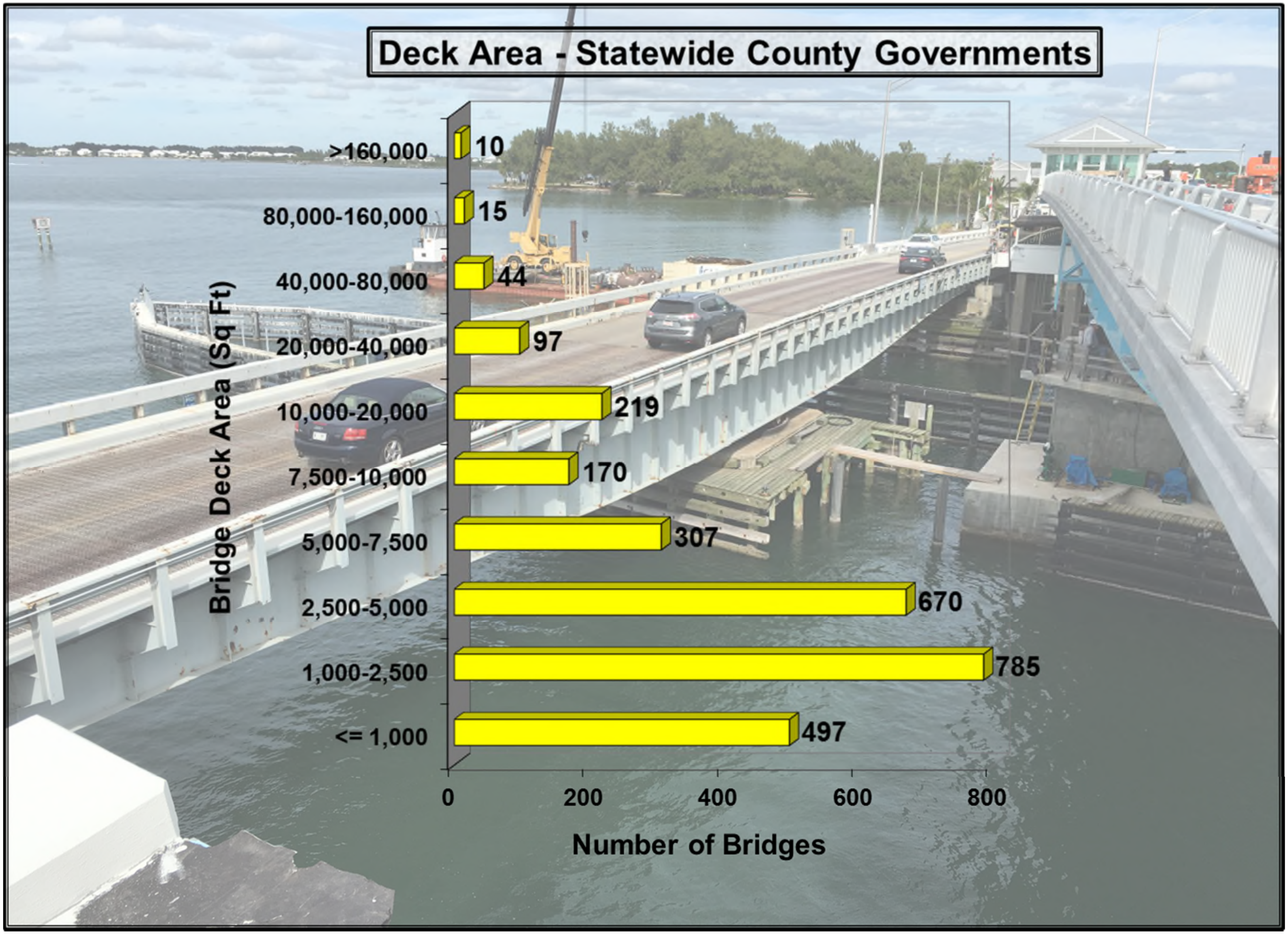
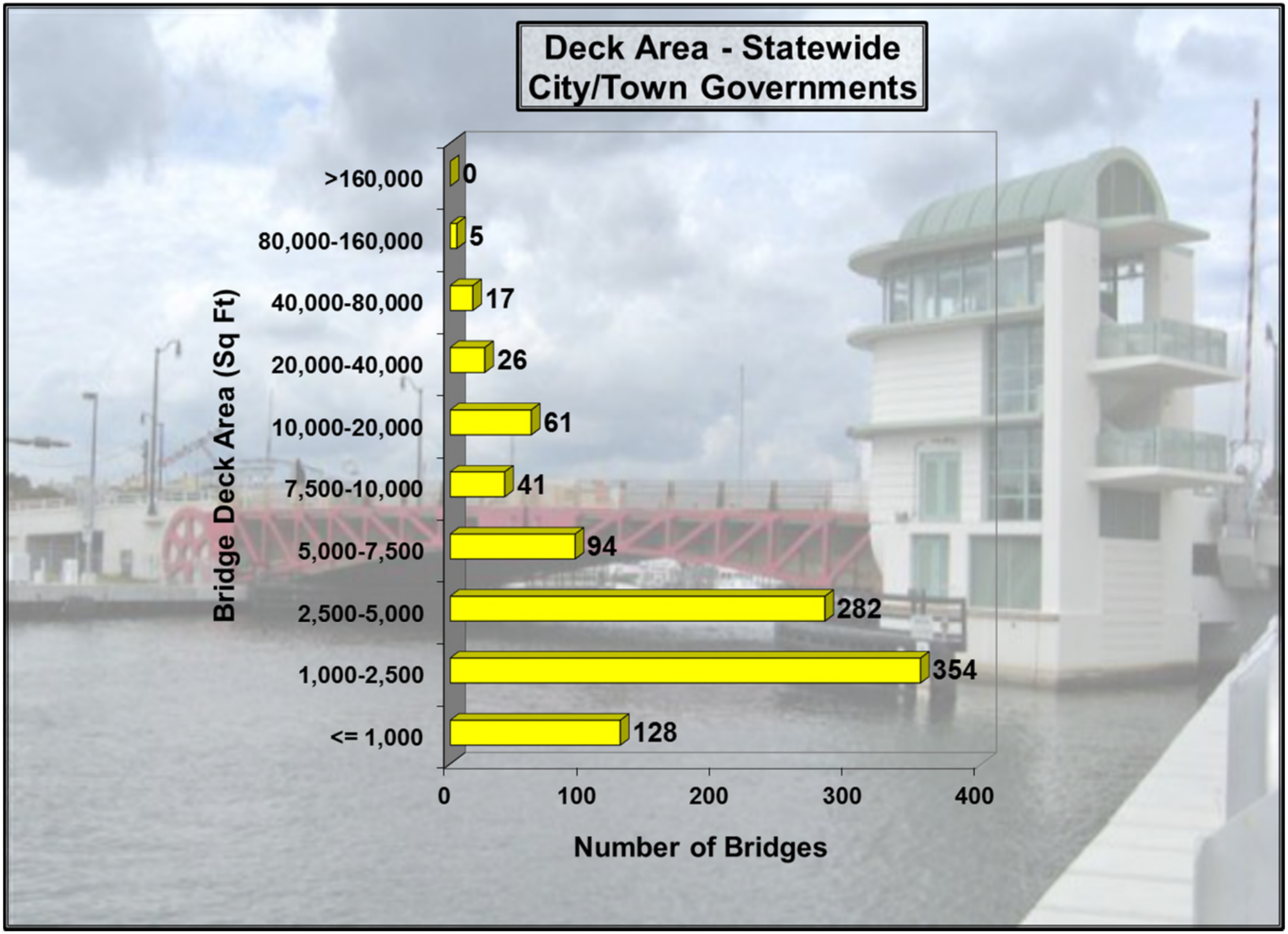
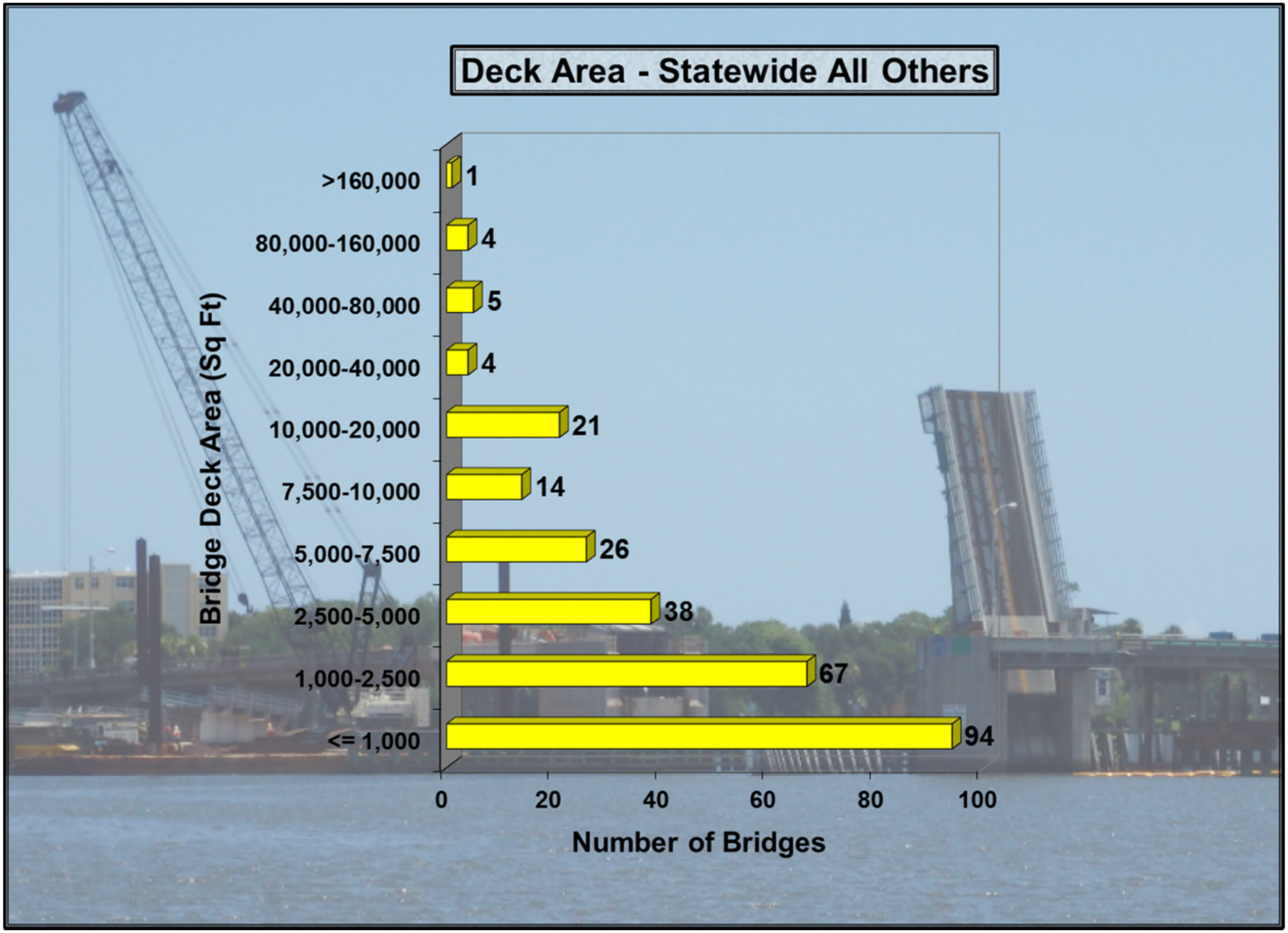

Deck Area - Statewide County Governments
>160,000
80,000-160,000
40,000-80,000
20,000-40,000
10,000-20,000
7,500-10,000
5,000-7,500
2,500-5,000
1,000-2,500
<= 1,000
10
15
44
97
219
170
307
670
785
497
Bridge Deck Area (Sq Ft)
0
200
400
600
800
Number of Bridges

Figure 14



Deck Area - Statewide
City/Town Governments
Bridge Deck Area (Sq Ft)
>160,000
80,000-160,000
40,000-80,000
20,000-40,000
10,000-20,000
7,500-10,000
5,000-7,500
2,500-5,000
1,000-2,500
<= 1,000
0
5
17
26
61
41
94
282
354
128
0
100
200
300
400
Number of Bridges

Figure 15



Deck Area - Statewide All Others
Bridge Deck Area (Sq Ft)
>160,000
80,000-160,000
40,000-80,000
20,000-40,000
10,000-20,000
7,500-10,000
5,000-7,500
2,500-5,000
1,000-2,500
<= 1,000
1
4
5
4
21
14
26
38
67
94
0
20
40
60
80
100
Number of Bridges

Figure 16

Bridge Inventory By Deck Area (Districts 1 Thru 4)

	Maintenance Responsibility								Maintenance Responsibility							
	FDOT	County	City/ Town	Other State	Other Local	Feder- al	Others	Total	FDOT	County	City/ Town	Other State	Other Local	Feder- al	Others	Total
	District 1								District 3							
<= 1,000	8	104	26	4	0	0	0	142	1	240	8	74	1	0	0	324
1,000-2,500	76	205	60	6	10	0	0	357	13	216	12	24	0	0	0	265
2,500-5,000	129	167	75	5	9	0	0	385	60	128	9	4	0	0	0	201
5,000-7,500	120	56	26	1	3	0	0	206	108	53	3	1	0	0	0	165
7,500-10,000	96	33	5	1	0	0	0	135	101	24	0	1	0	0	0	126
10,000-	171	37	8	2	0	0	0	218	166	24	2	0	0	0	0	192
20,000-	57	17	0	2	0	0	0	76	60	11	1	0	0	0	0	72
40,000-	25	7	0	0	0	0	0	32	34	3	2	0	0	0	0	39
80,000-	9	5	0	0	0	0	0	14	19	3	1	0	2	0	0	25
>160,000	13	1	0	1	0	0	0	15	24	0	0	0	0	0	0	24
Total	704	632	200	22	22	0	0	1580	586	702	38	104	3	0	0	1433
	District 2								District 4							
<= 1,000	6	58	14	9	0	0	0	87	0	13	45	0	1	0	0	59
1,000-2,500	21	61	60	2	0	0	0	144	21	111	112	6	0	0	0	250
2,500-5,000	104	64	29	0	0	0	0	197	80	136	87	7	0	0	0	310
5,000-7,500	167	27	12	0	0	0	0	206	64	66	14	2	0	0	0	146
7,500-10,000	169	12	14	0	0	0	0	195	57	25	7	0	0	0	0	89
10,000-	274	12	9	0	0	0	2	297	255	51	12	0	0	0	0	318
20,000-	92	6	5	0	0	0	0	103	148	25	5	0	0	0	0	178
40,000-	50	2	5	0	0	0	0	57	66	7	1	0	0	0	0	74
80,000-	36	1	1	0	0	0	0	38	20	2	0	0	0	0	0	22
>160,000	20	1	0	0	0	0	0	21	15	1	0	0	0	0	0	16
Total	939	244	149	11	0	0	2	1345	726	437	283	15	1	0	0	1462

Table 6

Bridge Inventory By Deck Area (Districts 5 Thru 8)

	Maintenance Responsibility								Maintenance Responsibility							
	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total
	District 5								District 7							
<= 1,000	2	21	13	3	0	0	2	41	3	43	17	0	0	0	0	63
1,000-2,500	16	50	40	3	0	0	8	117	13	74	39	0	2	0	0	128
2,500-5,000	89	62	29	0	0	0	12	192	30	50	22	0	0	0	0	102
5,000-7,500	173	28	17	1	0	0	12	231	68	42	9	0	4	0	0	123
7,500-10,000	154	33	8	0	1	0	8	204	103	25	3	0	3	0	0	134
10,000-20,000	251	36	20	1	1	0	12	321	192	40	5	0	1	0	0	238
20,000-40,000	108	16	3	0	0	0	2	129	108	12	8	0	0	0	0	128
40,000-80,000	40	8	5	0	0	0	5	58	56	10	2	0	0	0	0	68
80,000-160,000	23	1	2	0	0	0	1	27	19	1	1	1	0	0	0	22
>160,000	13	0	0	0	0	0	0	13	14	3	0	0	0	0	0	17
Total	869	255	137	8	2	0	62	1333	606	300	106	1	10	0	0	1023
	District 6								Turnpike							
<= 1,000	2	18	5	0	0	0	0	25	0	0	0	0	0	0	0	0
1,000-2,500	11	68	31	2	0	4	0	116	5	0	0	0	0	0	0	5
2,500-5,000	63	63	31	0	1	0	0	158	101	0	0	0	0	0	0	101
5,000-7,500	70	35	13	0	2	0	0	120	153	0	0	0	0	0	0	153
7,500-10,000	69	18	4	0	0	0	0	91	119	0	0	0	0	0	0	119
10,000-20,000	172	19	5	1	1	0	0	198	206	0	0	0	0	0	0	206
20,000-40,000	123	10	4	0	0	0	0	137	56	0	0	0	0	0	0	56
40,000-80,000	52	7	2	0	0	0	0	61	28	0	0	0	0	0	0	28
80,000-160,000	27	2	0	0	0	0	0	29	6	0	0	0	0	0	0	6
>160,000	16	4	0	0	0	0	0	20	5	0	0	0	0	0	0	5
Total	605	244	95	3	4	4	0	955	679	0	0	0	0	0	0	679

Table 7

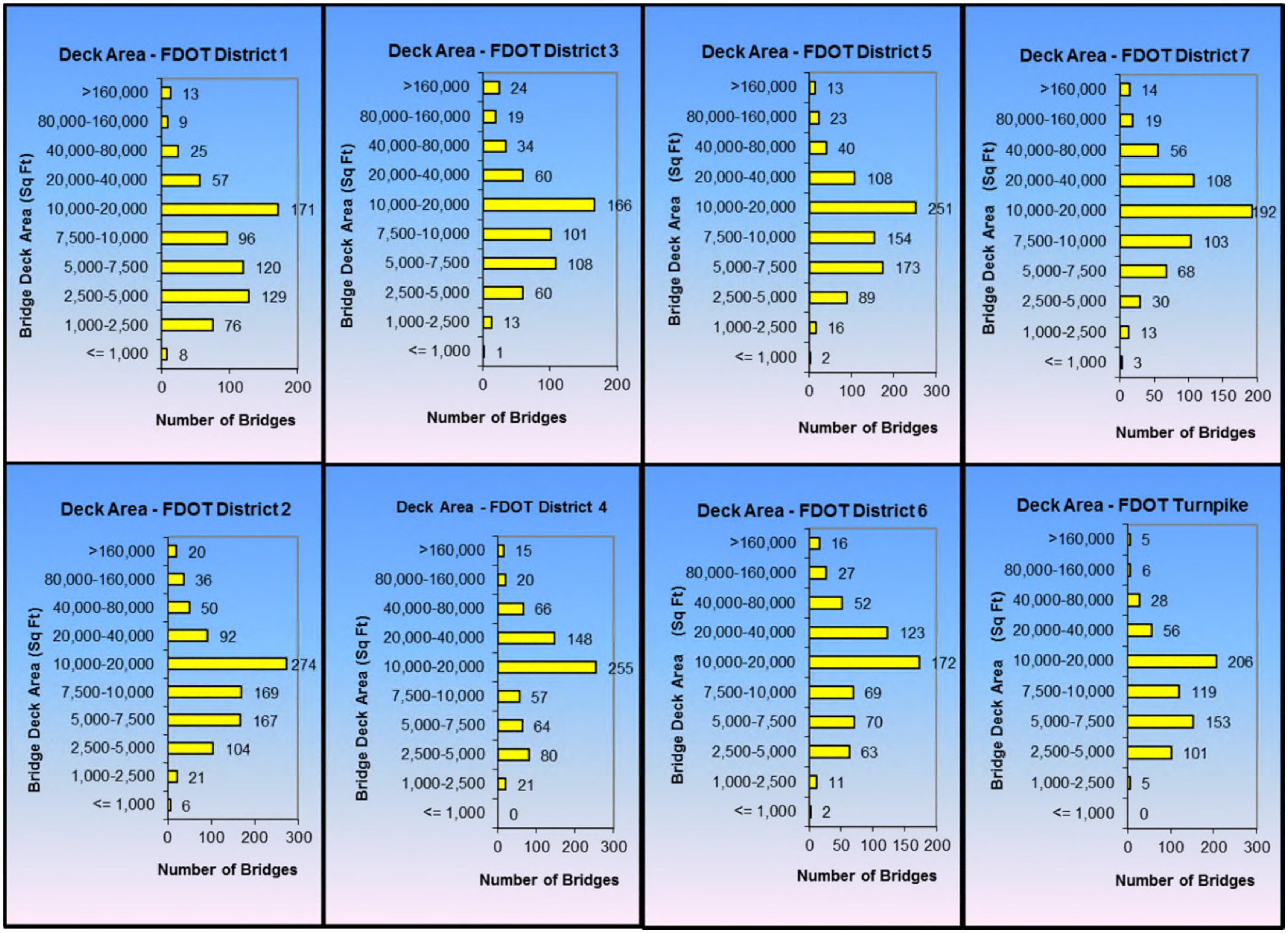

Deck Area - FDOT District 1
>160,000 13
80,000-160,000 9
40,000-80,000 25
20,000-40,000 57
10,000-20,000 171
7,500-10,000 96
5,000-7,500 120
2,500-5,000 129
1,000-2,500 76
<= 1,000 8
0 100 200
Number of Bridges
Bridge Deck Area (Sq Ft)
Deck Area - FDOT District 3
>160,000 24
80,000-160,000 19
40,000-80,000 34
20,000-40,000 60
10,000-20,000 166
7,500-10,000 101
5,000-7,500 108
2,500-5,000 60
1,000-2,500 13
<= 1,000 1
0 100 200
Number of Bridges
Bridge Deck Area (Sq Ft)
Deck Area - FDOT District 5
>160,000 13
80,000-160,000 23
40,000-80,000 40
20,000-40,000 108
10,000-20,000 251
7,500-10,000 154
5,000-7,500 173
2,500-5,000 89
1,000-2,500 16
<= 1,000 2
0 100 200 300
Number of Bridges
Bridge Deck Area (Sq Ft)
Deck Area - FDOT District 7
>160,000 14
80,000-160,000 19
40,000-80,000 56
20,000-40,000 108
10,000-20,000 192
7,500-10,000 103
5,000-7,500 68
2,500-5,000 30
1,000-2,500 13
<= 1,000 3
0 50 100 150 200
Number of Bridges
Bridge Deck Area (Sq Ft)
Deck Area - FDOT District 2
>160,000 20
80,000-160,000 36
40,000-80,000 50
20,000-40,000 92
10,000-20,000 274
7,500-10,000 169
5,000-7,500 167
2,500-5,000 104
1,000-2,500 21
<= 1,000 6
0 100 200 300
Number of Bridges
Bridge Deck Area (Sq Ft)
Deck Area - FDOT District 4
>160,000 15
80,000-160,000 20
40,000-80,000 66
20,000-40,000 148
10,000-20,000 255
7,500-10,000 57
5,000-7,500 64
2,500-5,000 80
1,000-2,500 21
<= 1,000 0
0 100 200 300
Number of Bridges
Bridge Deck Area (Sq Ft)
Deck Area - FDOT District 6
>160,000 16
80,000-160,000 27
40,000-80,000 52
20,000-40,000 123
10,000-20,000 172
7,500-10,000 69
5,000-7,500 70
2,500-5,000 63
1,000-2,500 11
<= 1,000 2
0 50 100 150 200
Number of Bridges
Bridge Deck Area (Sq Ft)
Deck Area - FDOT Turnpike
>160,000 5
80,000-160,000 6
40,000-80,000 28
20,000-40,000 56
10,000-20,000 206
7,500-10,000 119
5,000-7,500 153
2,500-5,000 101
1,000-2,500 5
<= 1,000 0
0 100 200 300
Number of Bridges
Bridge Deck Area (Sq Ft)

Figure 17

Overall Structural Condition

The performance of maintenance and repair activities in a timely manner keeps bridges in good condition, avoids more expensive repair or replacement costs in the future, and ensures that the bridges are safe for use by the public. The identification of bridge work needs generally begins with the bridge inspection. Like most states, Florida's bridge inspection program began in the late 1960's. Since then, much has been learned in the field of bridge inspection. Areas of emphasis have changed and expanded as new problems became apparent, as newer bridge types became more common, and as these newer bridges aged enough to require corrective actions. Guidelines for inspection condition rating have evolved to increase uniformity and consistency of inspections. Today's program is large in scope, well organized, and professionally managed. Data collected from bridge inspections is critical input into a variety of analyses and decisions within the FDOT to determine the most cost effective mix of preventive maintenance, routine maintenance, repair, rehabilitation, replacement, and other actions over the life of the bridges.

Bridges generally consist of three components: the deck or riding surface; the superstructure for supporting the deck; and the substructure which functions to transfer the superstructure loads to the ground. Bridge inspectors assign a numerical condition rating to each of the components, from 0 being the worst to 9 being the best. The Overall Condition Rating for a bridge represents the component with the lowest rating. The ratings are divided into four categories. They are Excellent = 8 to 9; Good = 6 to 7; Fair = 5; and Poor = 4 or less. Bridge culverts use the same scale, except there is only one overall component. Grouping the bridges as excellent, good, fair, or poor, as described above, and presenting them by maintenance responsibility and FDOT District a view of the overall condition of Florida's bridges is obtained. (see Table 8)

Figure 18 shows, for each of the maintenance responsibility groups, the percentage of bridges in excellent, good, fair, and poor condition. Approximately 95.39% of the FDOT maintained bridges are in excellent or good condition. However, the number drops to 85.21% for County bridges, 88.05% for City/Town bridges, and 85.37% for Other Agency bridges. Figures 19 and 20 provide similar views of the FDOT maintained bridges, by district. An alternative view of the data is presented in Figures 21, 22, and 23, for each of the three maintenance groups.

Figure 24 is provided to show a general graphical view of the location of state maintained bridges within the state based on condition category.

Overall Structural Condition

Maintenance Responsibility

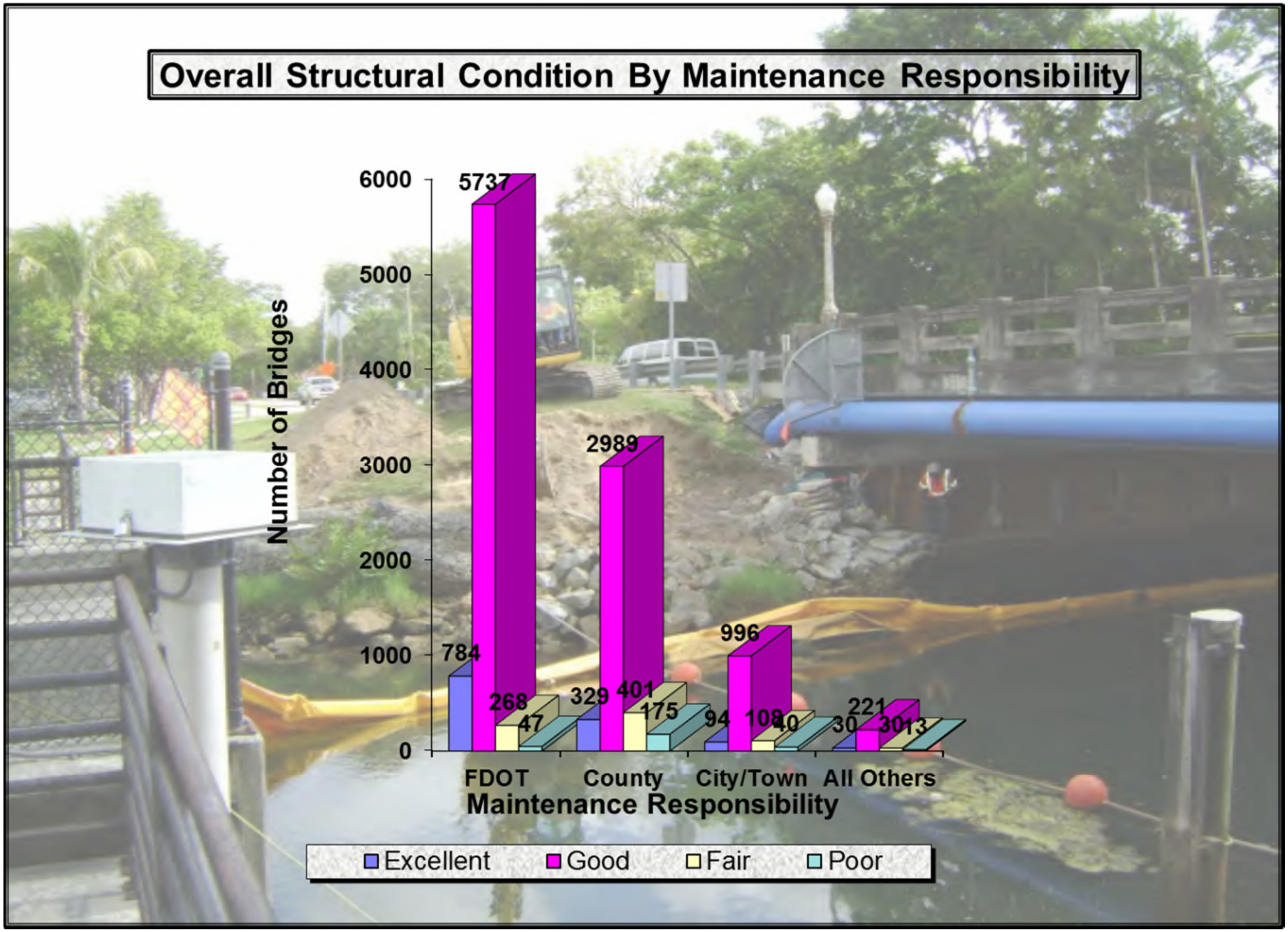
	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total
District 1								
Excellent	66	75	19	3	0	0	0	163
Good	840	784	221	17	23	0	0	1885
Fair	25	47	4	2	0	0	0	78
Poor	0	9	2	1	0	0	0	12
Total	931	915	246	23	23	0	0	2138
District 2								
Excellent	72	35	10	0	0	0	0	117
Good	1097	315	156	5	0	0	1	1574
Fair	51	92	26	4	0	0	0	173
Poor	13	49	11	2	0	0	1	76
Total	1233	491	203	11	0	0	2	1940
District 3								
Excellent	23	41	1	2	0	0	0	67
Good	720	651	41	81	2	0	1	1496
Fair	59	180	8	19	1	0	0	267
Poor	14	81	3	4	0	0	0	102
Total	816	953	53	106	3	0	1	1932
District 4								
Excellent	138	70	22	3	0	0	0	233
Good	589	364	220	10	1	0	0	1184
Fair	30	21	49	2	0	0	0	102
Poor	9	5	4	0	0	0	0	18
Total	766	460	295	15	1	0	0	1537

Maintenance Responsibility

	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total
District 5								
Excellent	147	60	20	0	8	0	6	241
Good	831	293	144	7	2	0	56	1333
Fair	50	18	4	1	0	0	1	74
Poor	5	12	6	2	0	0	0	25
Total	1033	383	174	10	10	0	63	1673
District 6								
Excellent	160	26	10	0	4	0	0	200
Good	425	198	75	3	0	4	0	705
Fair	22	23	6	0	0	0	0	51
Poor	4	8	6	1	0	0	0	19
Total	611	255	97	4	4	4	0	975
District 7								
Excellent	100	22	12	0	3	0	1	138
Good	580	384	139	0	8	0	0	1111
Fair	23	20	11	0	0	0	0	54
Poor	2	11	8	1	1	0	0	23
Total	705	437	170	1	12	0	1	1326
Turnpike								
Excellent	78	0	0	0	0	0	0	78
Good	655	0	0	0	0	0	0	655
Fair	8	0	0	0	0	0	0	8
Poor	0	0	0	0	0	0	0	0
Total	741	0	0	0	0	0	0	741
Statewide								
Excellent	784	329	94	8	15	0	7	1237
Good	5737	2989	996	123	36	4	58	9943
Fair	268	401	108	28	1	0	1	807
Poor	47	175	40	11	1	0	1	275
Total	6836	3894	1238	170	53	4	67	12262

NOTE: The number of FDOT bridges includes 116 MDX bridges and 296 OOCEA bridges.

Table 8



Overall Structural Condition By Maintenance Responsibility
Number of Bridges
6000
5000
4000
3000
2000
1000
0
5737
784
268
47
2989
329
401
175
996
94
108
40
221
30
30
13
FDOT
County
City/Town
All Others
Maintenance Responsibility
Excellent
Good
Fair
Poor

Figure 18

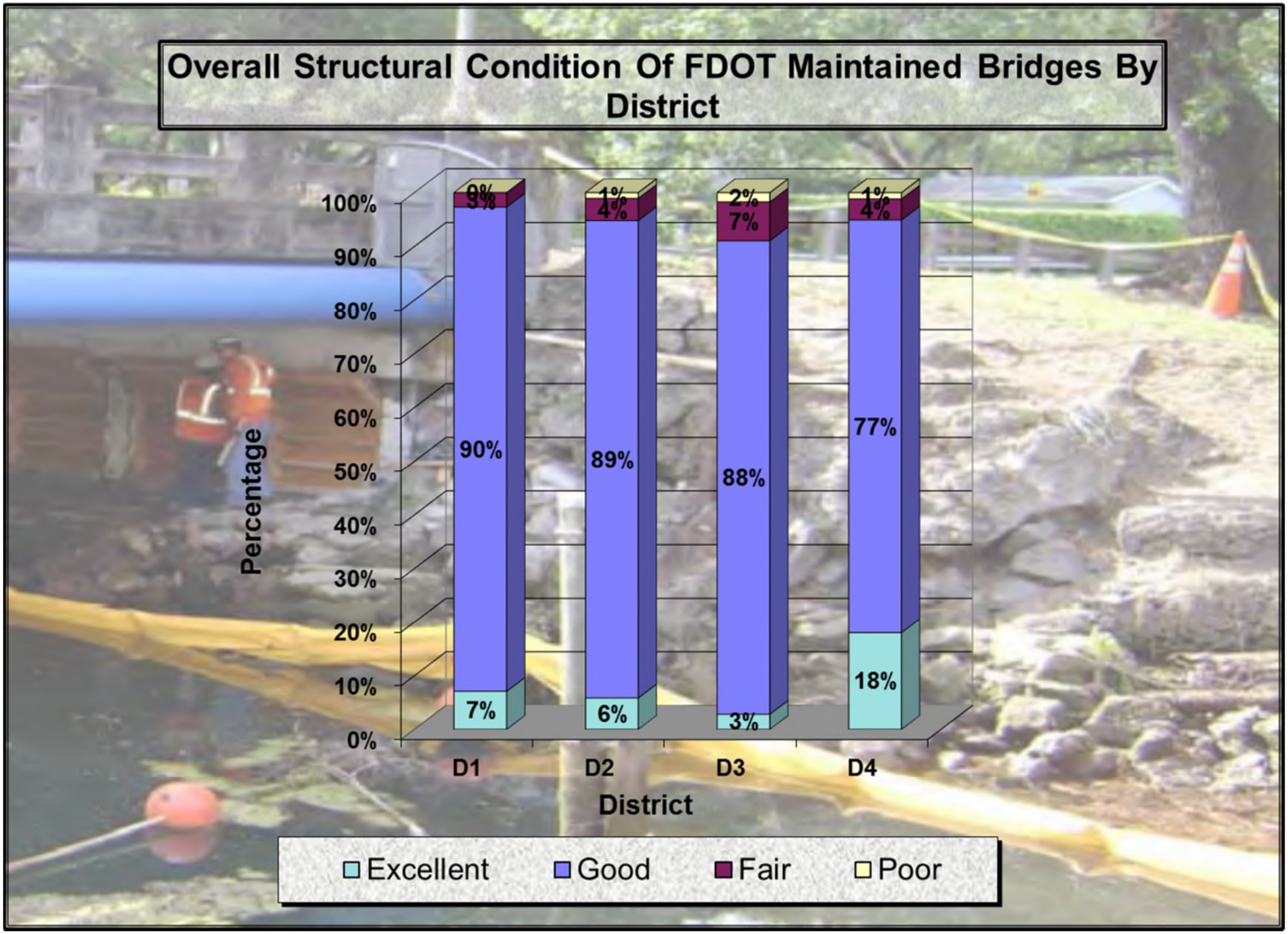

Overall Structural Condition Of FDOT Maintained Bridges By District
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
D1
D2
D3
D4
District
0%
3%
90%
7%
1%
4%
89%
6%
2%
7%
88%
3%
1%
4%
77%
18%
Excellent
Good
Fair
Poor

Figure 19

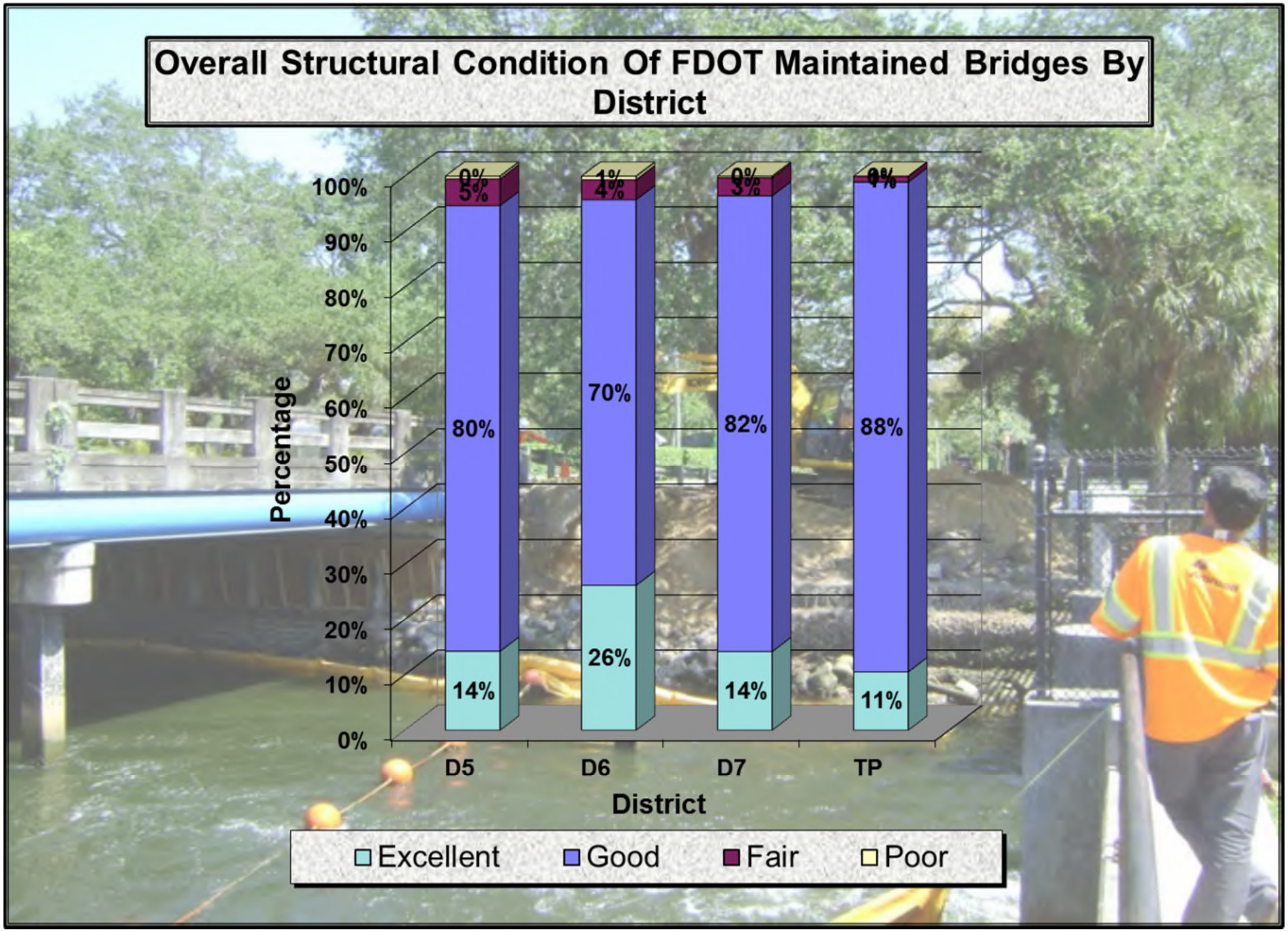

Overall Structural Condition Of FDOT Maintained Bridges By District
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
5%
80%
14%
1%
4%
70%
26%
0%
3%
82%
14%
88%
11%
D5
D6
D7
TP
District
Excellent
Good
Fair
Poor

Figure 20

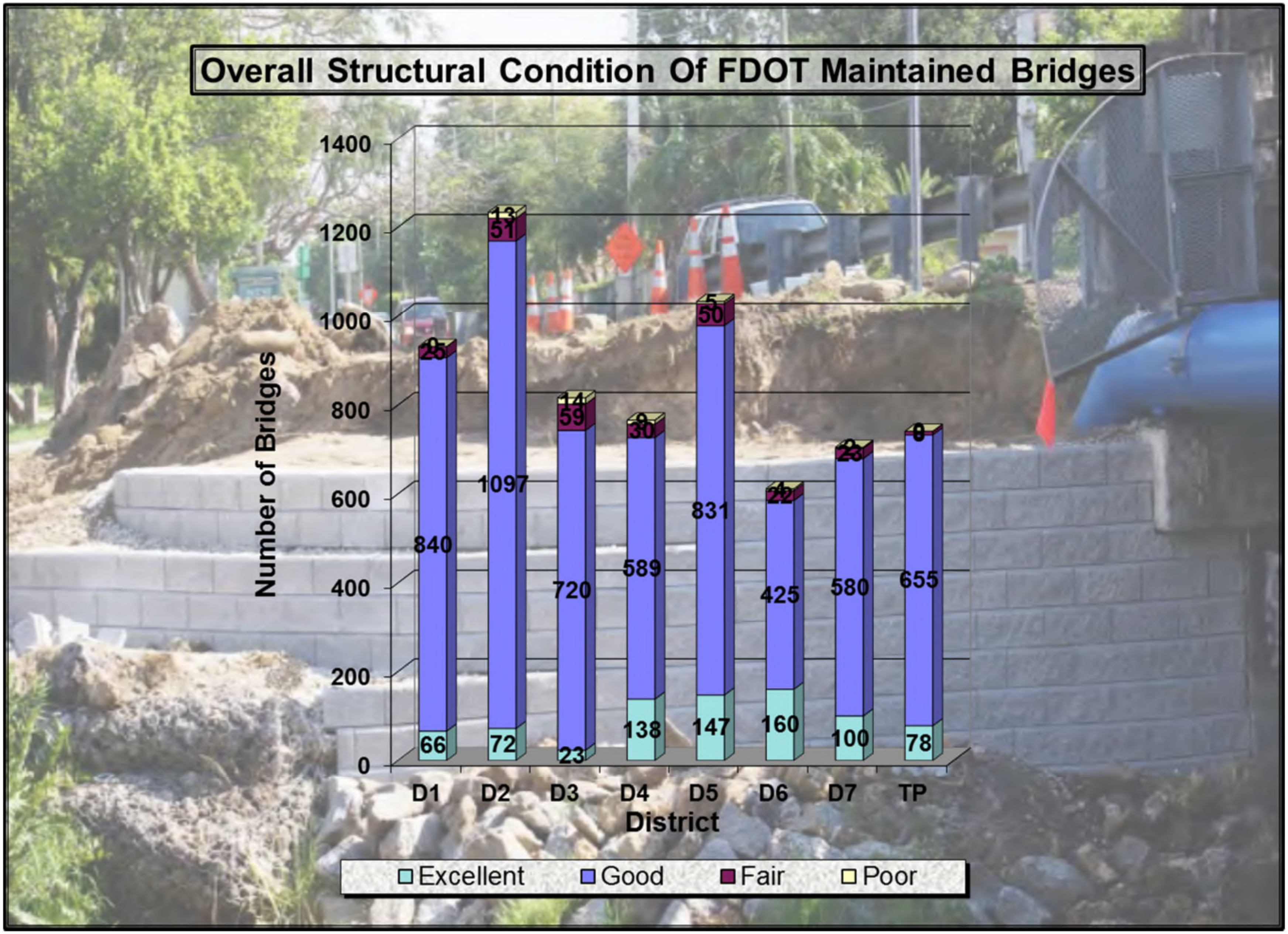

Overall Structural Condition Of FDOT Maintained Bridges
Number of Bridges
1400
1200
1000
800
600
400
200
0
District
D1
D2
D3
D4
D5
D6
D7
TP
66
840
25
72
1097
51
13
23
720
59
14
138
589
30
9
147
831
50
5
160
425
22
4
100
580
23
2
78
655
Excellent
Good
Fair
Poor

Figure 21

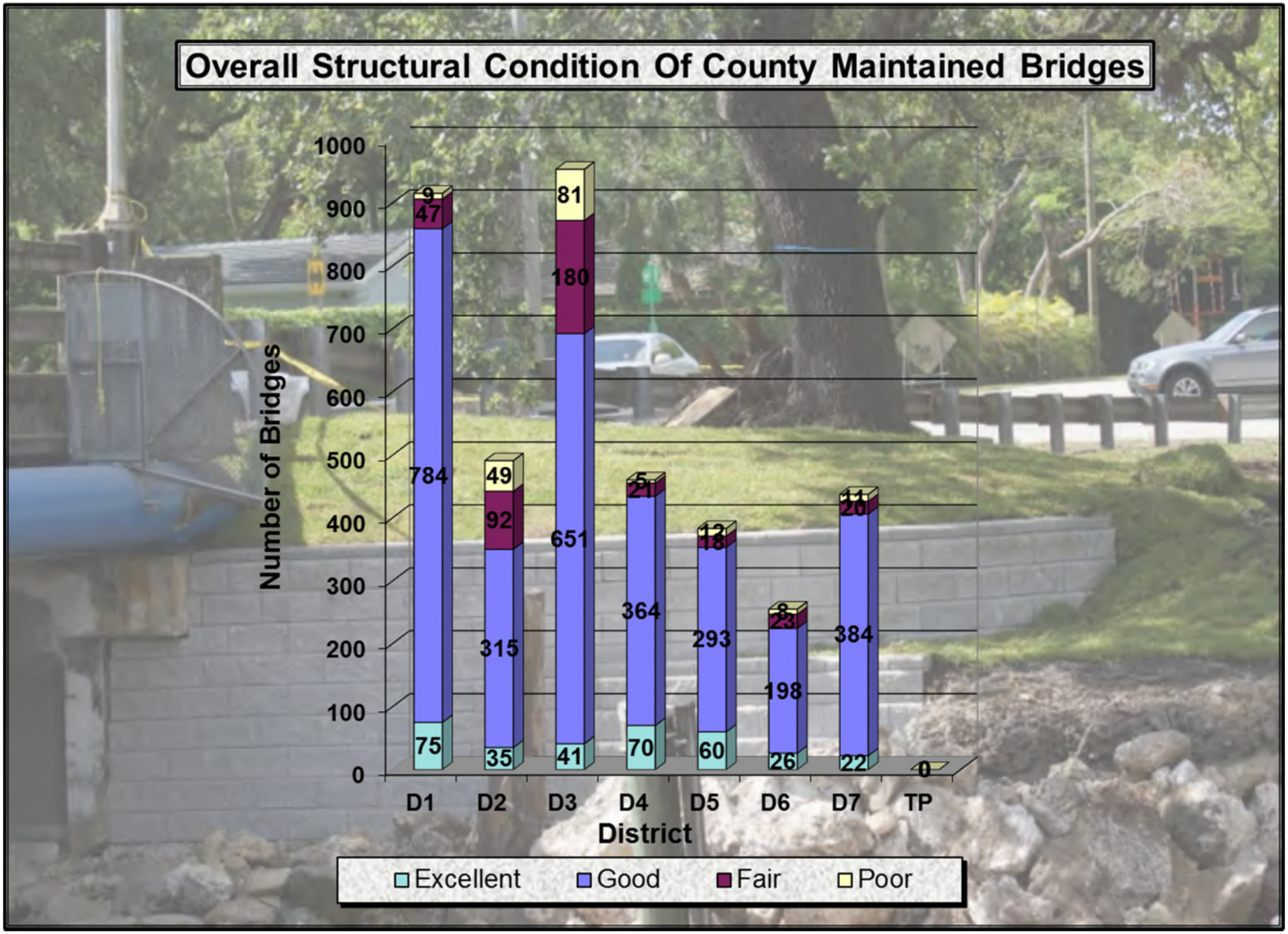

Overall Structural Condition Of County Maintained Bridges
Number of Bridges
1000
900
800
700
600
500
400
300
200
100
0
D1
D2
D3
D4
D5
D6
D7
TP
District
Excellent
Good
Fair
Poor
9
47
784
75
49
92
315
35
81
180
651
41
5
21
364
70
12
18
293
60
8
23
198
26
11
20
384
22
0

Figure 22

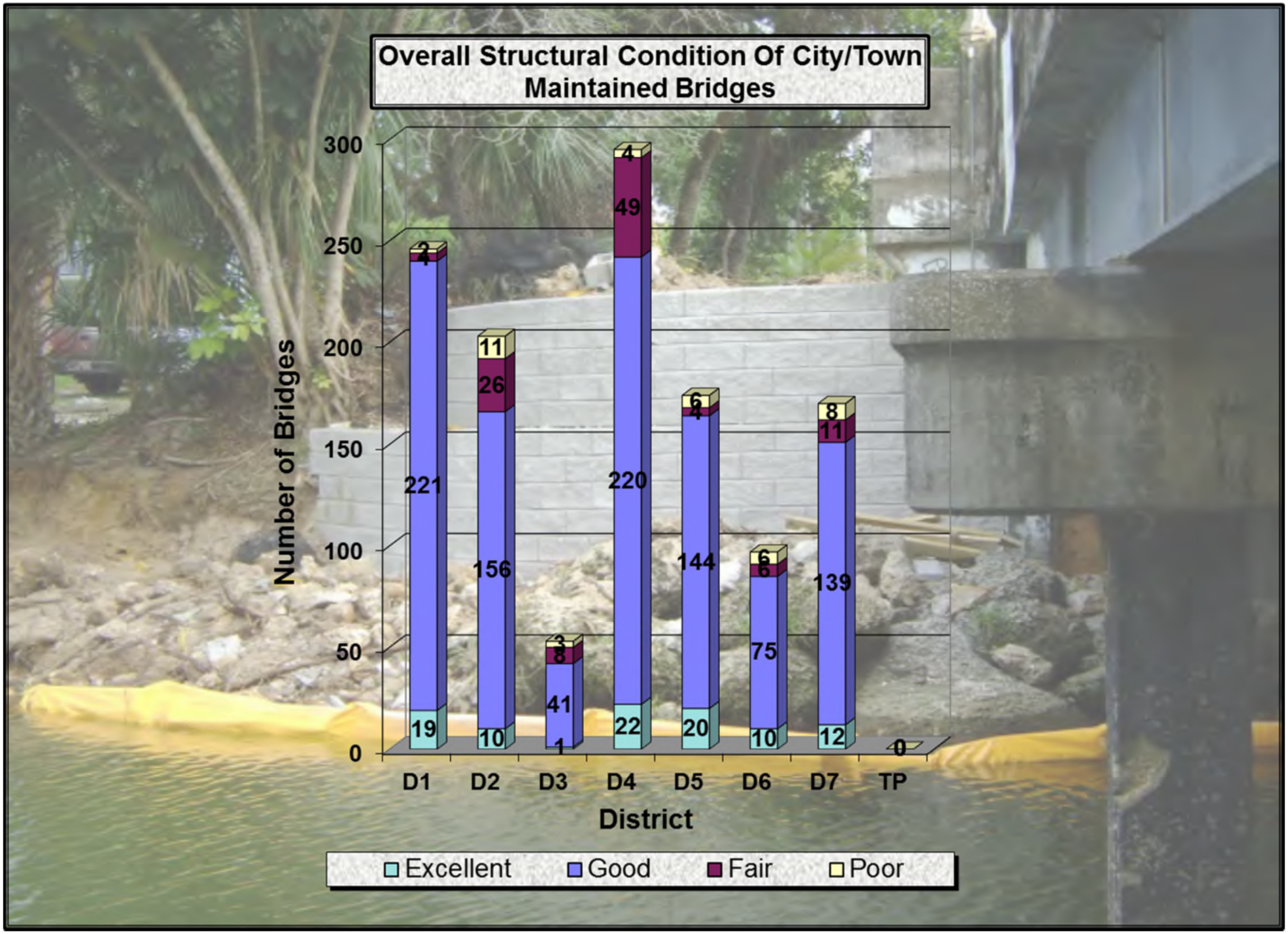

Overall Structural Condition Of City/Town Maintained Bridges
Number of Bridges
300
250
200
150
100
50
0
D1
D2
D3
D4
D5
D6
D7
TP
District
2
4
221
19
11
26
156
10
3
8
41
1
4
49
220
22
6
4
144
20
6
6
75
10
8
11
139
12
0
Excellent
Good
Fair
Poor

Figure 23

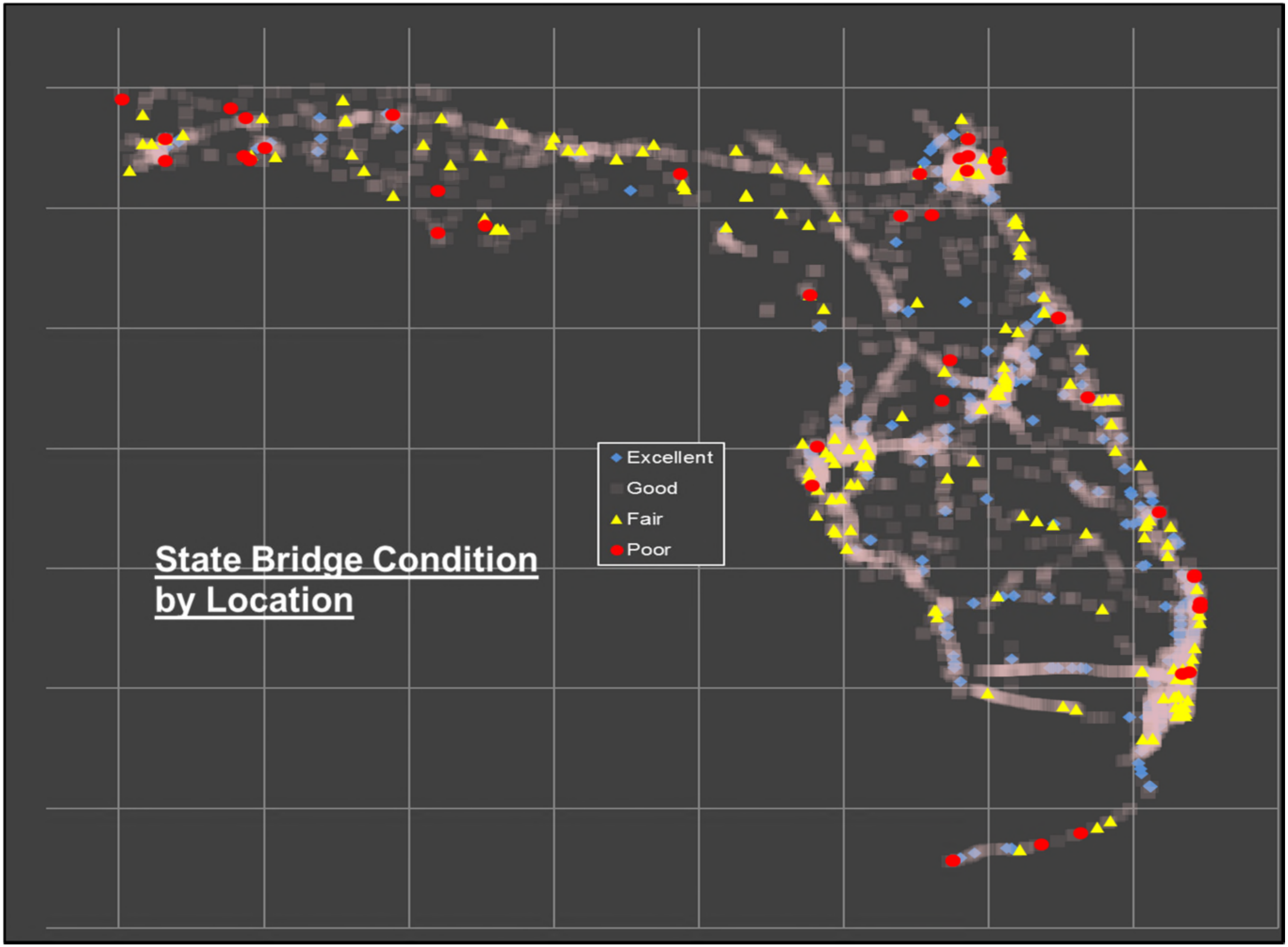
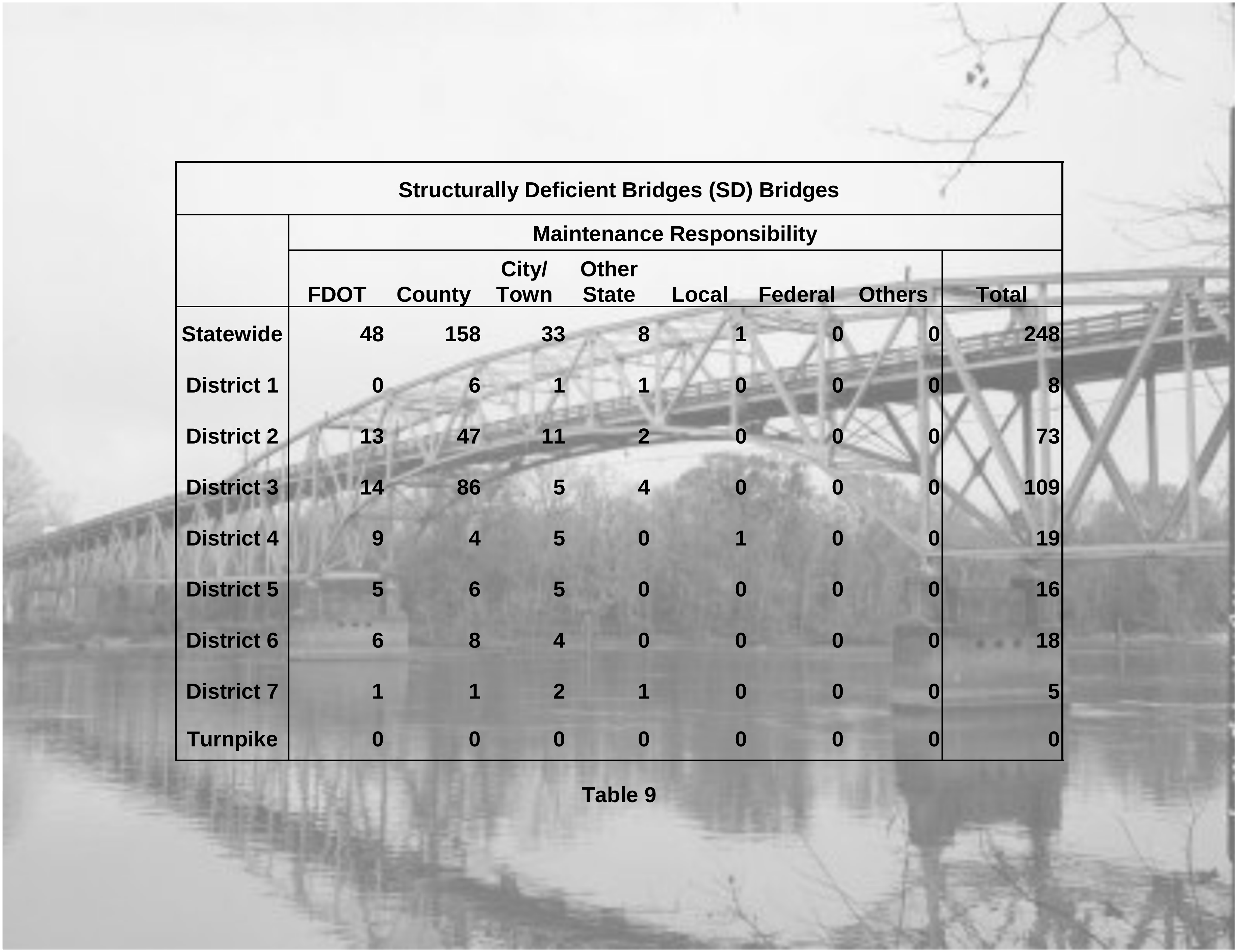

State Bridge Condition
by Location
Excellent
Good
Fair
Poor

Figure 24

Structurally Deficient Bridges

The FDOT follows the Federal Highway Administration's (FHWA) definition to identify structurally deficient bridges. A bridge can have structural deterioration but not be considered structurally deficient, mostly due to the material safety factors and conservatism inherent in bridge design practices. The FHWA defines a structurally deficient bridge to have a poor (numerical rating of 4), or worse, condition rating for the deck, superstructure, or substructure component, or culvert. Additionally, if the bridge is considered intolerable with regards to its ability to carry legal loads or its serviceability during floods, it is also considered to be structurally deficient. FDOT's work program requires that structurally deficient bridges, once identified, have corrective actions (repair or replacement) initiated within six years. Structurally deficient bridges are not considered unsafe for public use unless the bridge is also closed.

There are currently 248 structurally deficient bridges in Florida, with over 63.71% having county maintenance responsibility. Forty-eight (19.35%) of the structurally deficient bridges are maintained by FDOT (see Figure 25). Refer to Figure 26 for a presentation of structurally deficient bridges, by district, for each of the maintenance responsibility groups. Over 84.18% of the County Government maintained structurally deficient bridges are concentrated within District 2 and 3. Over 63.64% of the City/Town maintained structurally deficient bridges are concentrated within Districts 2, 3, and 4.



Structurally Deficient Bridges (SD) Bridges								
	Maintenance Responsibility							
	FDOT	County	City/ Town	Other State	Local	Federal	Others	Total
Statewide	48	158	33	8	1	0	0	248
District 1	0	6	1	1	0	0	0	8
District 2	13	47	11	2	0	0	0	73
District 3	14	86	5	4	0	0	0	109
District 4	9	4	5	0	1	0	0	19
District 5	5	6	5	0	0	0	0	16
District 6	6	8	4	0	0	0	0	18
District 7	1	1	2	1	0	0	0	5
Turnpike	0	0	0	0	0	0	0	0

Table 9

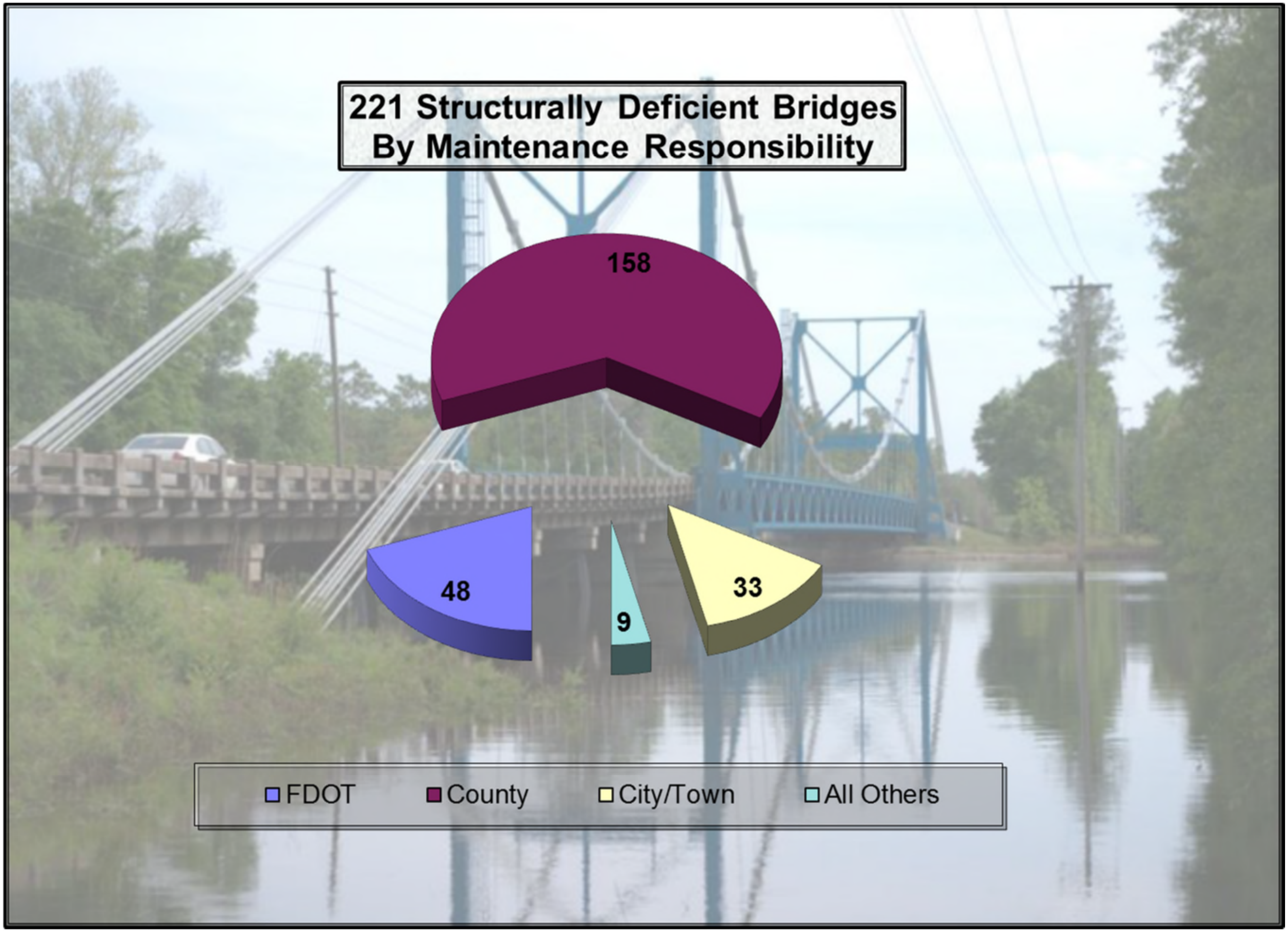

221 Structurally Deficient Bridges
By Maintenance Responsibility
158
48
9
33
FDOT
County
City/Town
All Others

Figure 25

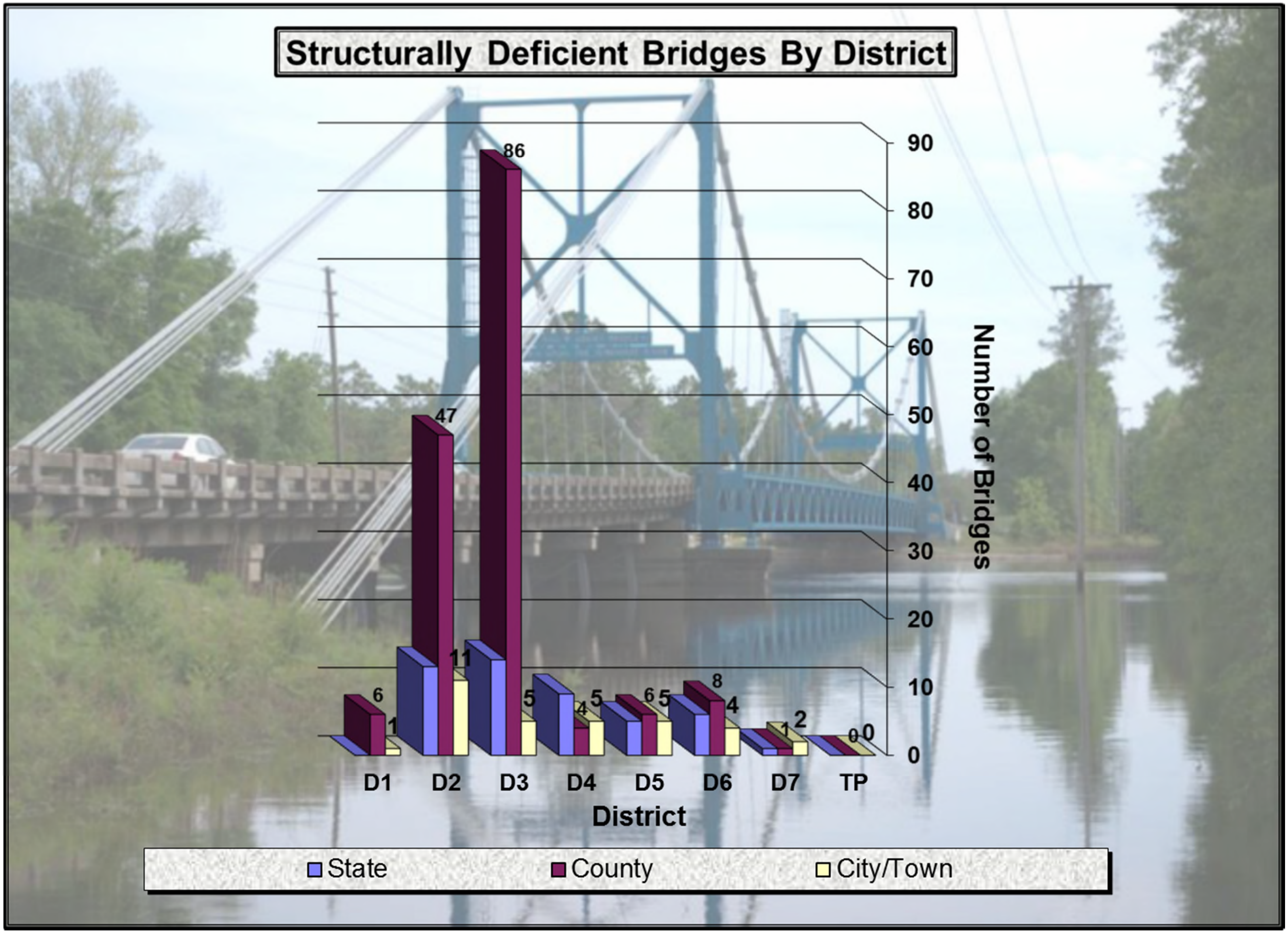

Structurally Deficient Bridges By District
90
80
70
60
50
40
30
20
10
0
Number of Bridges
6
1
47
11
86
5
4
5
6
5
8
4
1
2
0
0
D1
D2
D3
D4
D5
D6
D7
TP
District
State
County
City/Town

Figure 26

Posted and Closed Bridges

The operational status of a bridge indicates whether the bridge is unrestricted or open to all traffic, closed to all traffic, or posted for some sort of traffic restriction. Posting restrictions generally refer to gross vehicular weights of truck traffic. The needs to post weight restrictions at on bridges are generally caused by the inability of individual bridge members to adequately carry the applied legal loads. The inability to carry the applied legal loads can be the result of either advanced structural deterioration that results in a loss of material strength, obsolete member proportions, or a combination of these two factors. Older bridges were typically designed for smaller loads than today's standards would require, and as a result, the member sizes are often smaller in relation to what would be designed today. Like structurally deficient bridges, posted bridges receive the highest priority in the FDOT bridge construction program. Construction to replace the bridge or rehabilitation to strengthen the bridge must be initiated within six years from the time the posting requirement is first determined.

Table 10 presents the number of posted and closed bridges by maintenance responsibility group, for each of the districts. There are currently 718 posted or closed bridges in Florida, with County Governments having maintenance responsibility for over 76.46% of the total. City and Town Governments are responsible for the maintenance of over 17.69% of the total, while the FDOT is responsible for only 7 of the 718 bridges (0.97%) (see Figure 27). The number of posted County bridges (549 bridges) is much greater than the number of structurally deficient County bridges (158), which indicated that the majority of County bridge posting restrictions are caused by obsolete design, rather than advanced structural deterioration (see Figure 28).

Of the 7 posted or closed bridges maintained by the FDOT, Districts 1, 4, and Turnpike had none, and Districts 2 and 7 constituted 57.14% of the posted or closed bridges (see Figure 29). Three Hundred and Ninety Seven (72.31%) of the posted or closed bridges maintained by County Governments are concentrated within Districts 2 and 3 (see Figure 30). Seventy-one (55.91%) of the posted or closed bridges maintained by City/Town Governments are concentrated within Districts 2 and 4 (see Figure 31). Statewide, 66.16% of all posted or closed bridges are within the boundaries of Districts 2 and 3.

Posted and Closed Bridges

	Maintenance Responsibility								Maintenance Responsibility							
	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total
	District 1								District 5							
Posted	0	82	17	2	0	0	0	101	0	20	20	3	0	0	0	43
Closed	0	1	0	1	0	0	0	2	1	0	1	0	0	0	0	2
Total	0	83	17	3	0	0	0	103	1	20	21	3	0	0	0	45
	District 2								District 6							
Posted	2	91	37	5	0	0	0	135	0	16	3	0	0	0	0	19
Closed	0	4	1	1	0	0	0	6	1	4	2	0	0	0	0	7
Total	2	95	38	6	0	0	0	141	1	20	5	0	0	0	0	26
	District 3								District 7							
Posted	0	294	8	21	0	0	0	323	0	8	3	0	0	0	0	11
Closed	1	8	2	0	0	0	0	11	2	0	0	0	0	0	0	2
Total	1	302	10	21	0	0	0	334	2	8	3	0	0	0	0	13
	District 4								Turnpike							
Posted	0	21	33	1	0	0	0	55	0	0	0	0	0	0	0	0
Closed	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Total	0	21	33	1	1	0	0	56	0	0	0	0	0	0	0	0

	FDOT	County	City/ Town	Other State	Other Local	Federal	Others	Total
	Statewide							
Posted	2	532	121	32	0	0	0	687
Closed	5	17	6	2	1	0	0	31
Total	7	549	127	34	1	0	0	718

Table 10

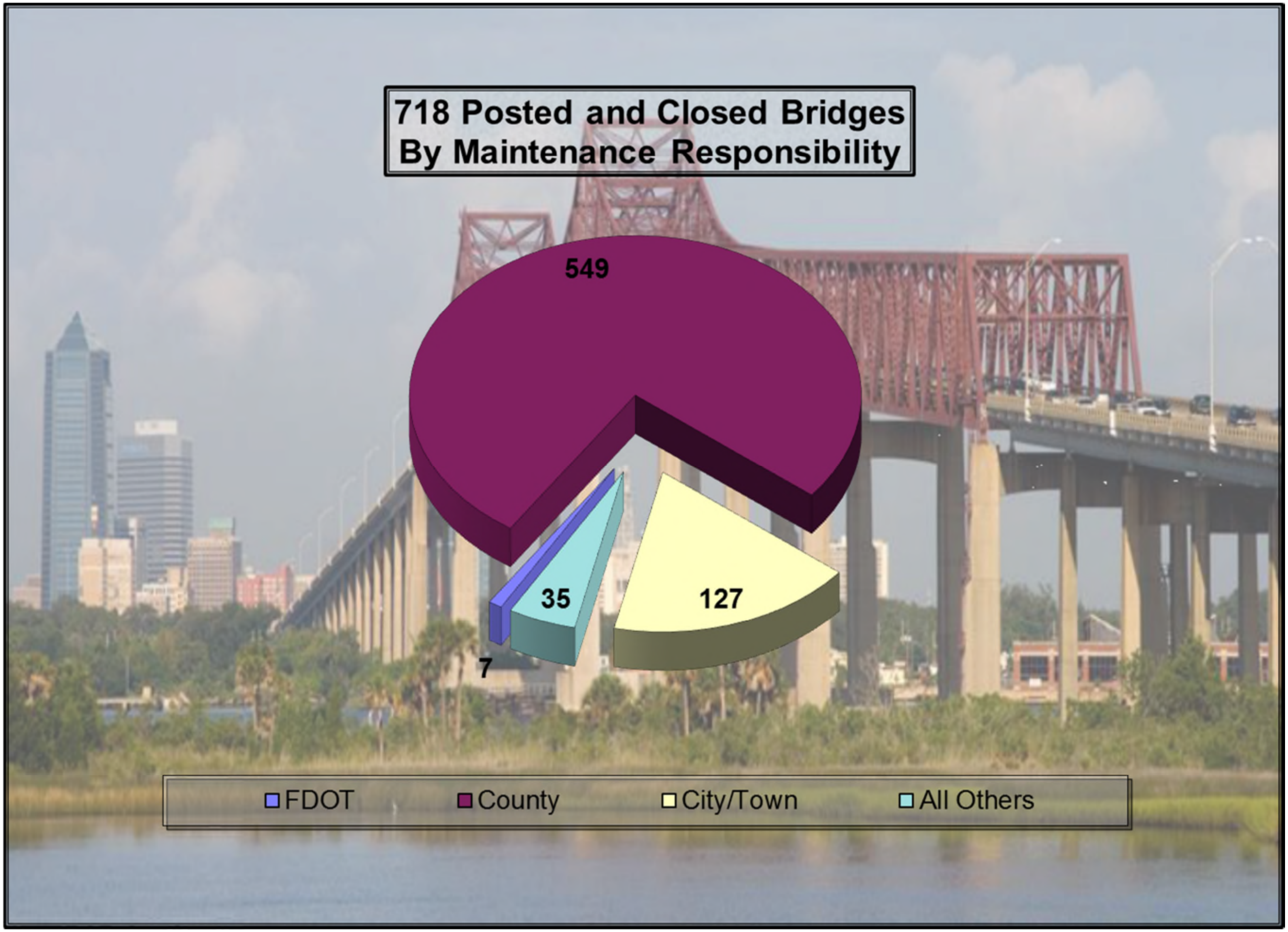

718 Posted and Closed Bridges
By Maintenance Responsibility
549
35
127
7
FDOT
County
City/Town
All Others

Figure 27

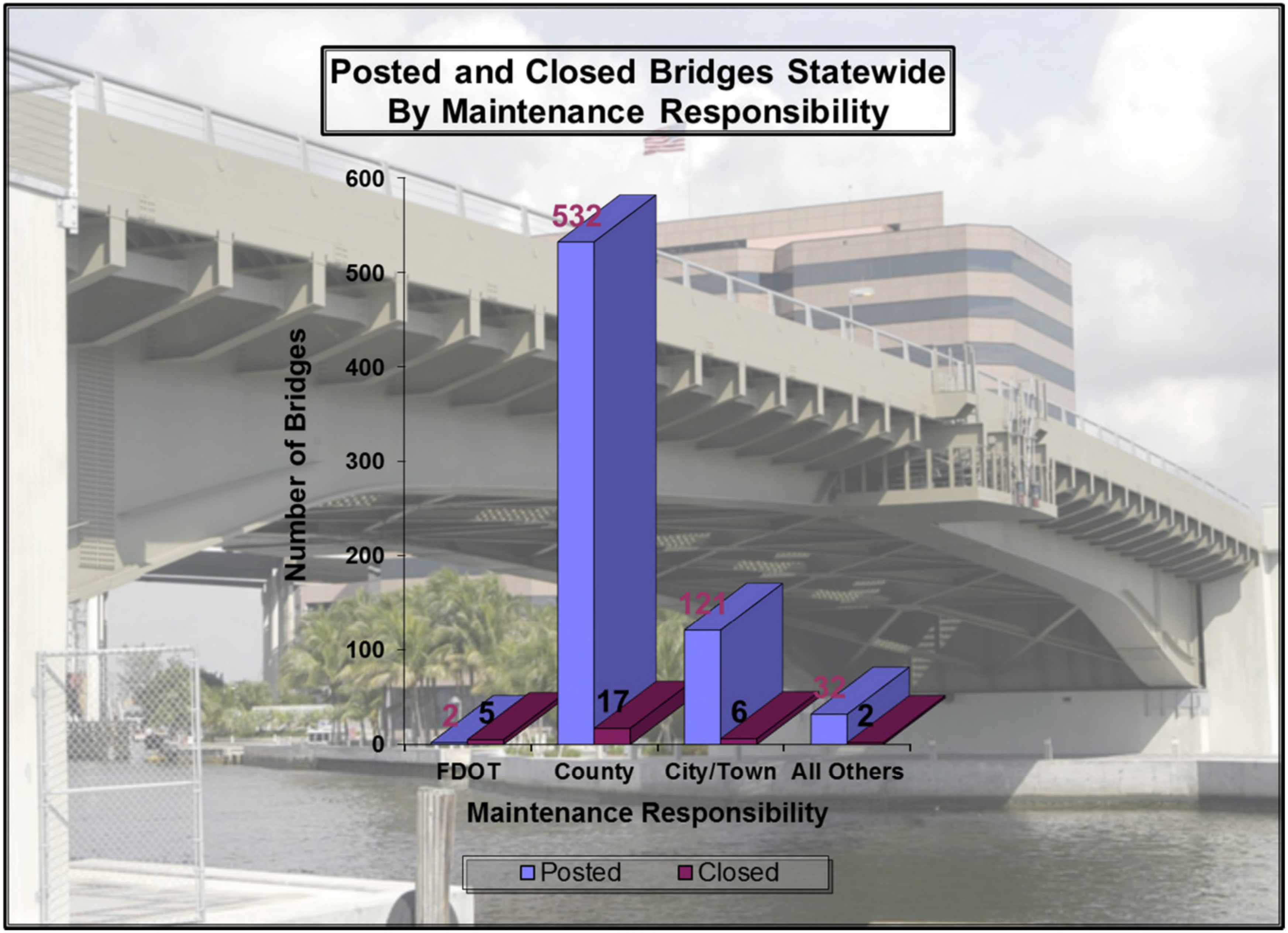

Posted and Closed Bridges Statewide
By Maintenance Responsibility
Number of Bridges
600
500
400
300
200
100
0
532
17
121
6
32
2
2
5
FDOT
County
City/Town
All Others
Maintenance Responsibility
Posted
Closed

Figure 28

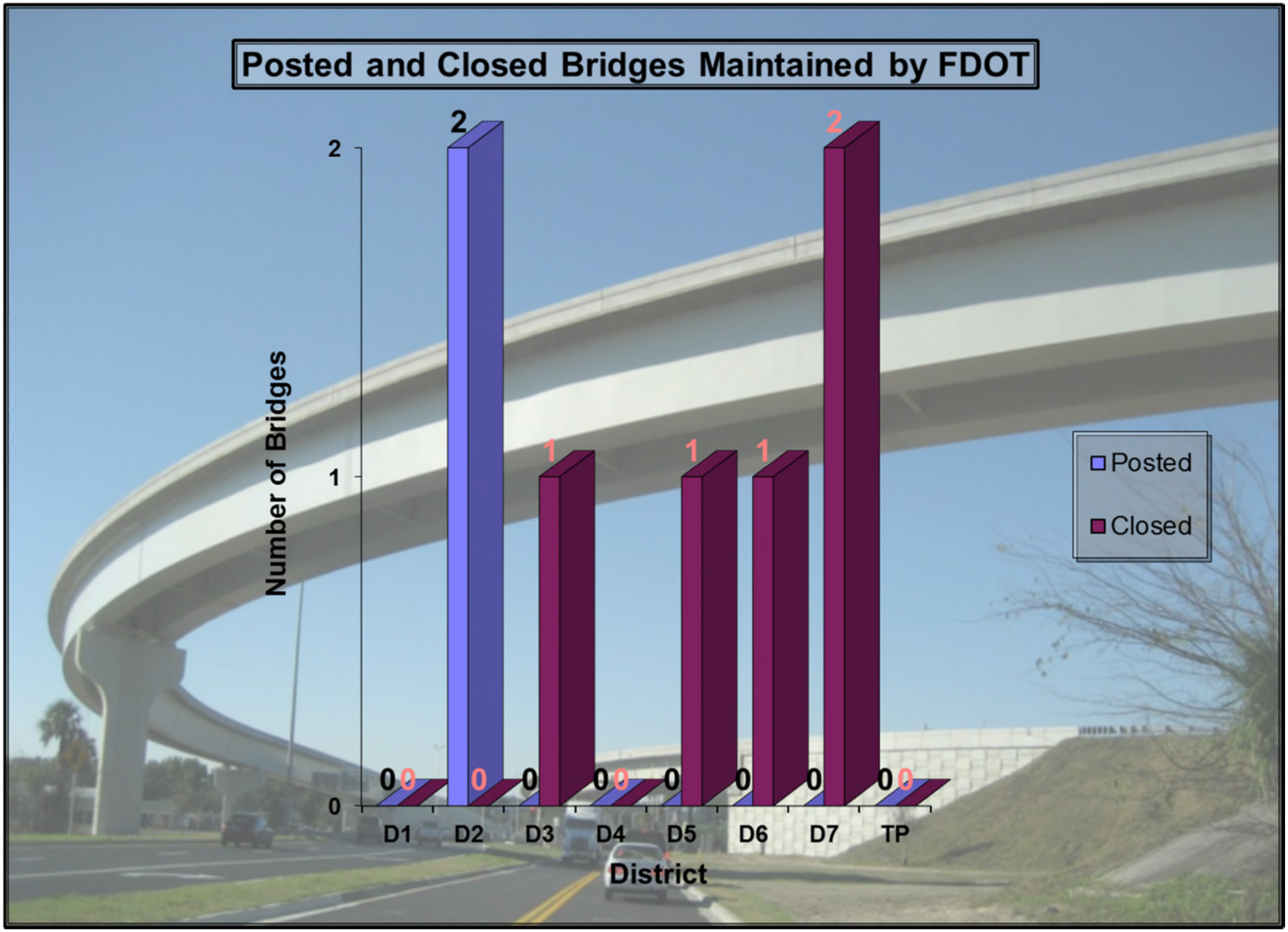

Posted and Closed Bridges Maintained by FDOT
Number of Bridges
2
1
0
2
0
0
1
0
0
0
1
0
1
0
2
0
0
D1
D2
D3
D4
D5
D6
D7
TP
District
Posted
Closed

Figure 29

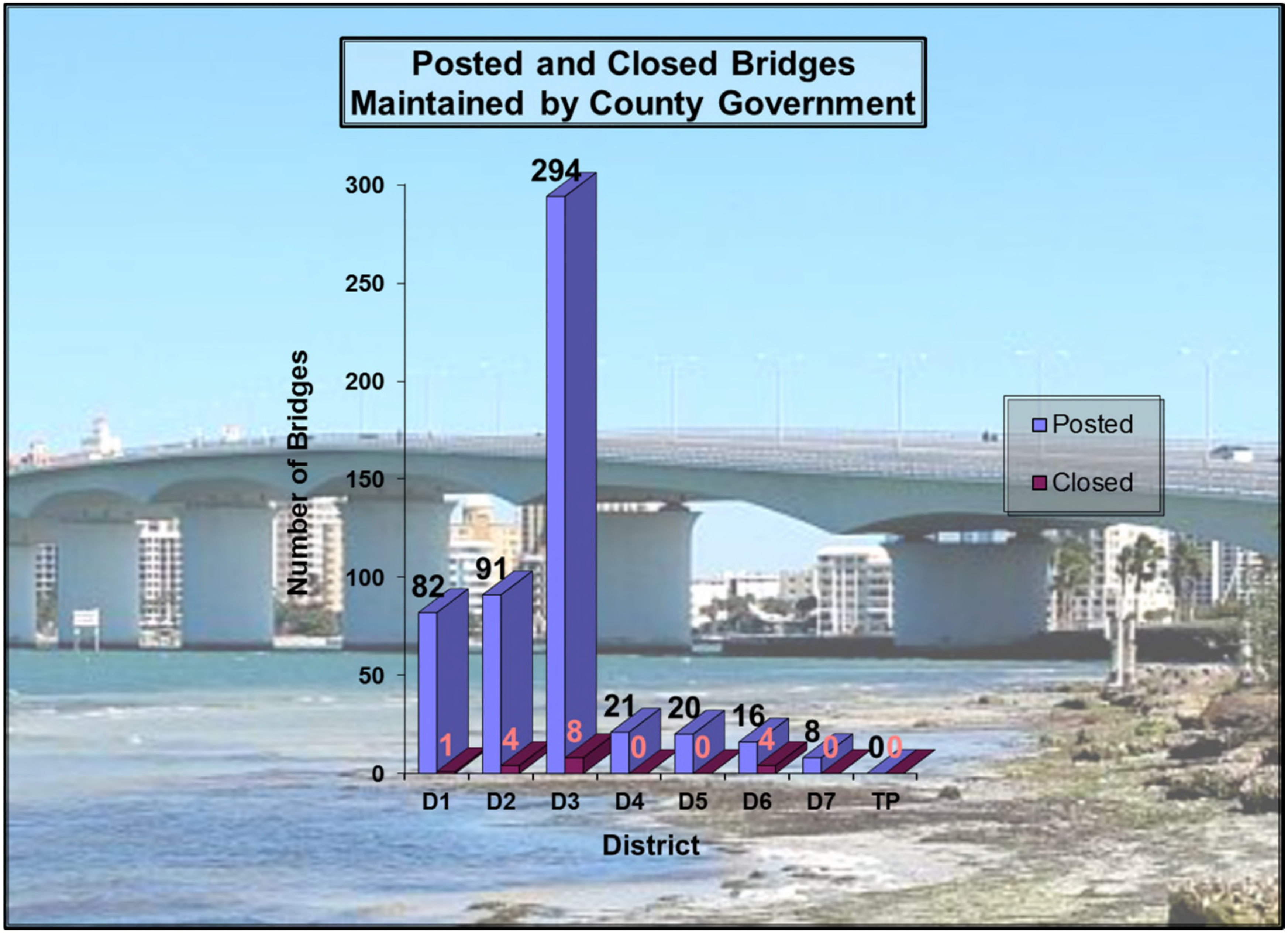

Posted and Closed Bridges
Maintained by County Government
Number of Bridges
300
250
200
150
100
50
0
82
91
294
21
20
16
8
0
1
4
8
0
0
4
0
0
D1
D2
D3
D4
D5
D6
D7
TP
District
Posted
Closed

Figure 30

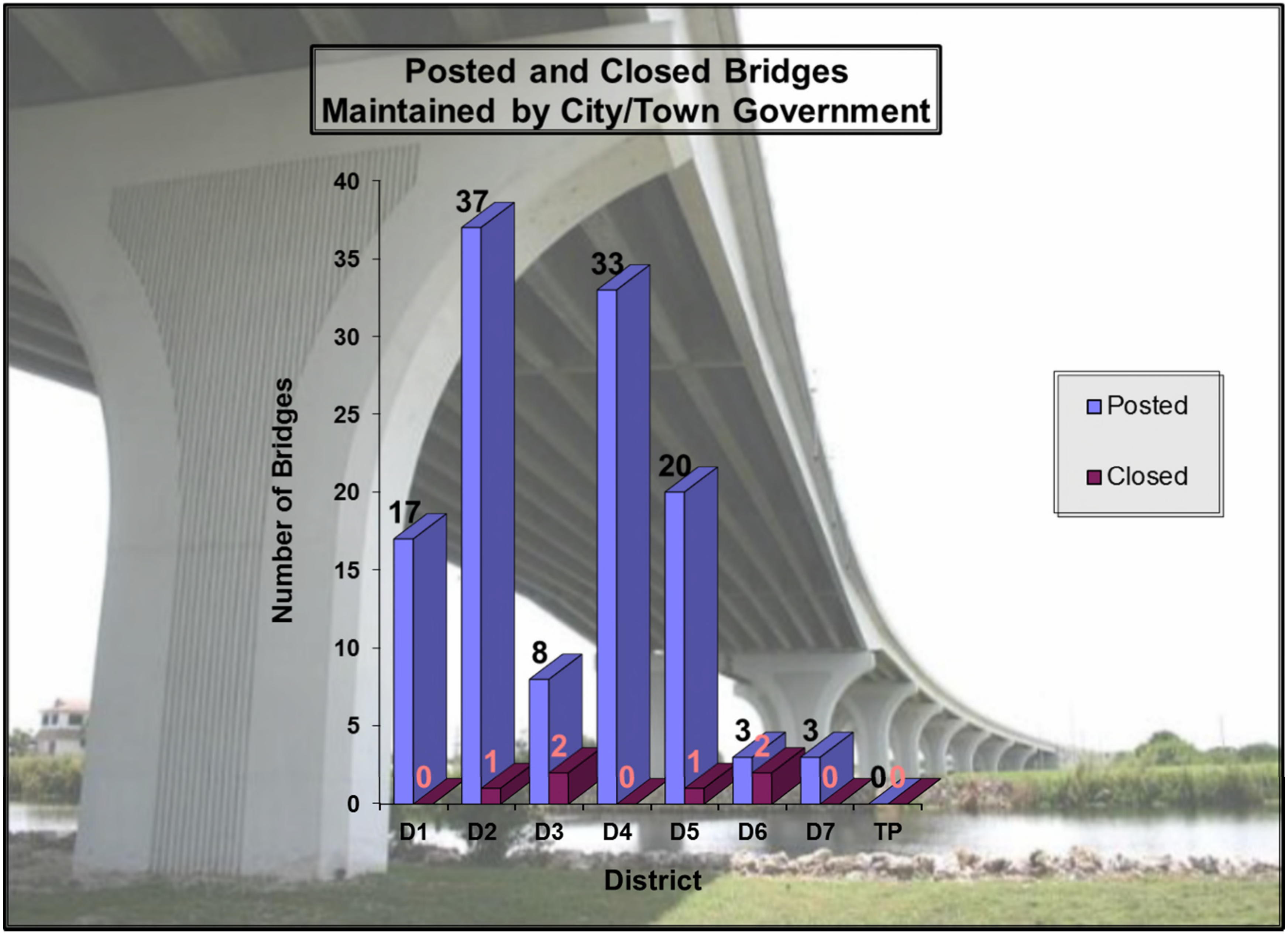
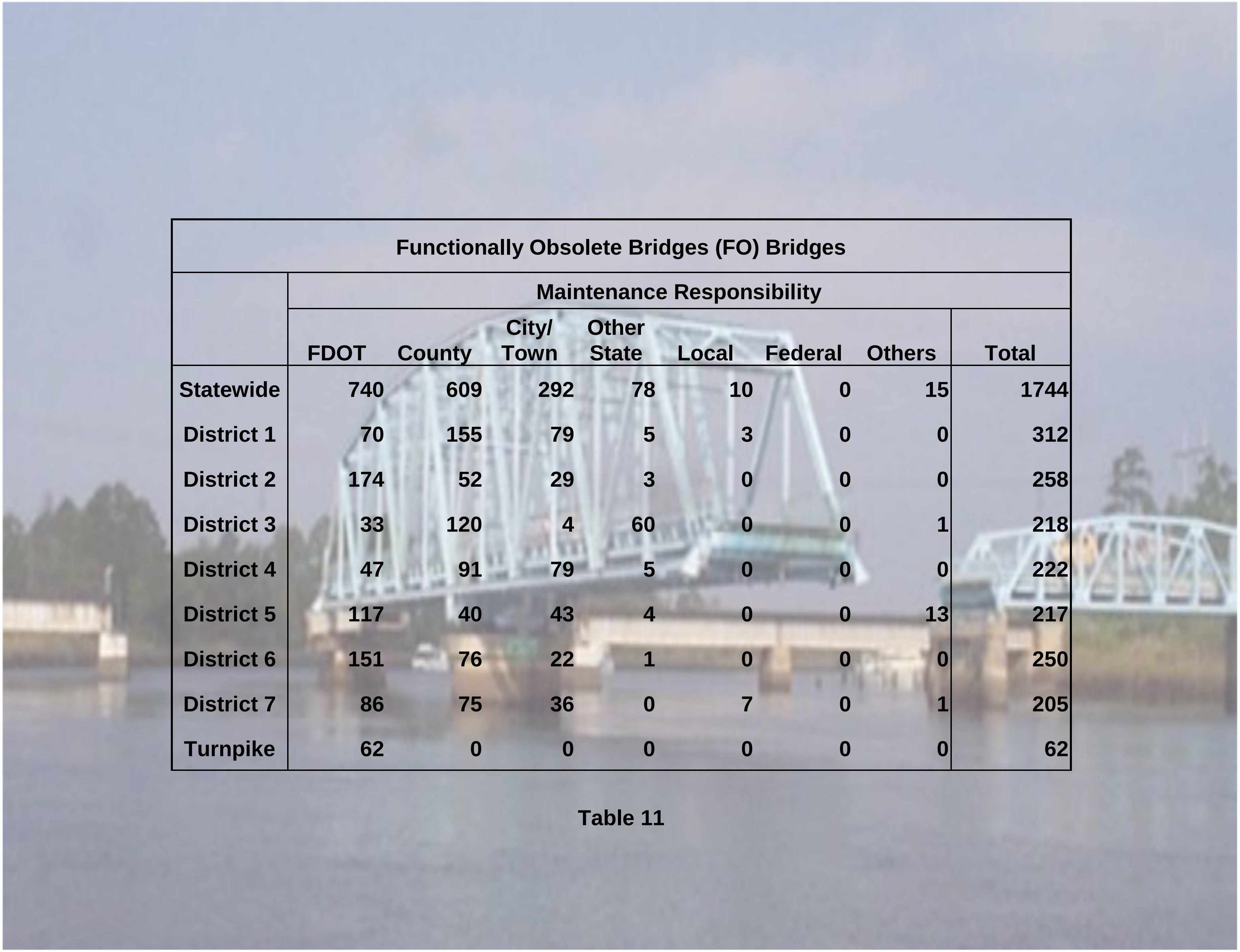

Posted and Closed Bridges
Maintained by City/Town Government
Number of Bridges
40
35
30
25
20
15
10
5
0
17
37
8
33
20
3
3
0
0
1
2
0
1
2
0
0
D1
D2
D3
D4
D5
D6
D7
TP
District
Posted
Closed

Figure 31

Functionally Obsolete Bridges

The FDOT follows the Federal Highway Administration's (FHWA) definition to identify functionally obsolete bridges. Functional obsolescence attempts to appraise the level of service a bridge provides in relation to the level of service for the highway the bridge is located on. As the level of service for the highway system changes, for example, an increase in traffic volume, a bridge can become functionally obsolete if it has geometric constraints that affect the flow of traffic on, or under, the bridge. Structural deterioration generally does not influence whether a bridge is considered functionally obsolete. Any bridge classified as structurally deficient is excluded from the functionally obsolete category. A functionally obsolete a bridge needs to have at least one of the following five criteria appraised as intolerable and requiring corrective action: 1) deck geometry (the curb-to-curb width of the bridge deck as it relates to number of traffic lanes, traffic volume, and highway classification); 2) vertical and horizontal under clearances (unrestricted clearances as related to highway classification); 3) approach roadway alignment (the inspector's subjective appraisal of the need to reduce vehicle operating speed as the bridge is approached from the highway); 4)structural evaluation (considers the numerical condition ratings for the deck, superstructure, or substructure bridge component, or for the culvert; load carrying capacity; and traffic volume); 5) waterway adequacy (the inspector's subjective appraisal of the bridge site's ability to accommodate the flow of flood water).

There are currently 1,744 functionally obsolete bridges in Florida, about 14.22% of the total. The FDOT has maintenance responsibility for over 42.43% of all functionally obsolete bridges (see Figure 32). Refer to Figure 33 for a presentation of functionally obsolete bridges, by district, for each of the three maintenance responsibility groups.



Functionally Obsolete Bridges (FO) Bridges								
	Maintenance Responsibility							
	FDOT	County	City/ Town	Other State	Local	Federal	Others	Total
Statewide	740	609	292	78	10	0	15	1744
District 1	70	155	79	5	3	0	0	312
District 2	174	52	29	3	0	0	0	258
District 3	33	120	4	60	0	0	1	218
District 4	47	91	79	5	0	0	0	222
District 5	117	40	43	4	0	0	13	217
District 6	151	76	22	1	0	0	0	250
District 7	86	75	36	0	7	0	1	205
Turnpike	62	0	0	0	0	0	0	62

Table 11

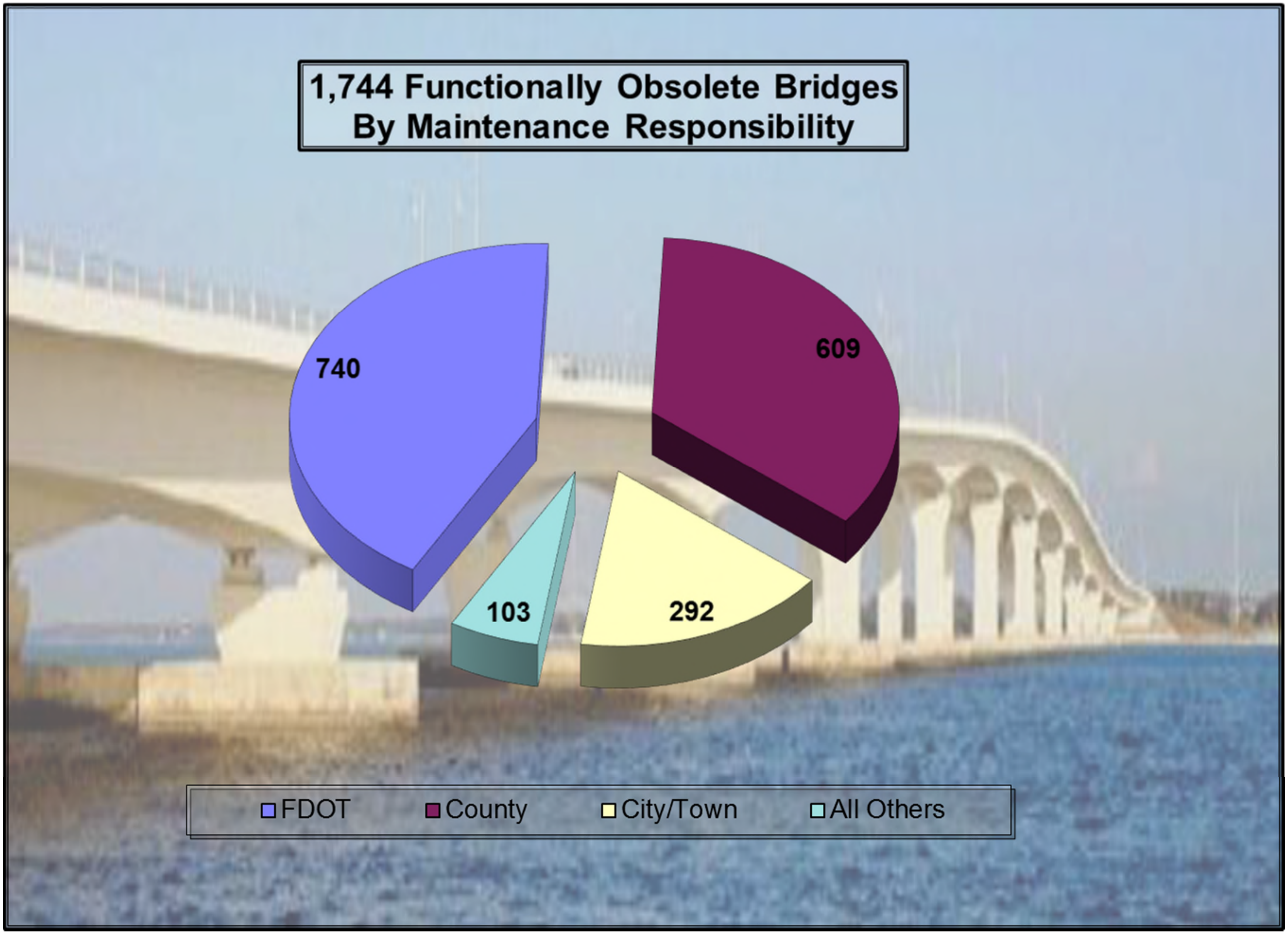

1,744 Functionally Obsolete Bridges
By Maintenance Responsibility
740
609
103
292
FDOT
County
City/Town
All Others

Figure 32

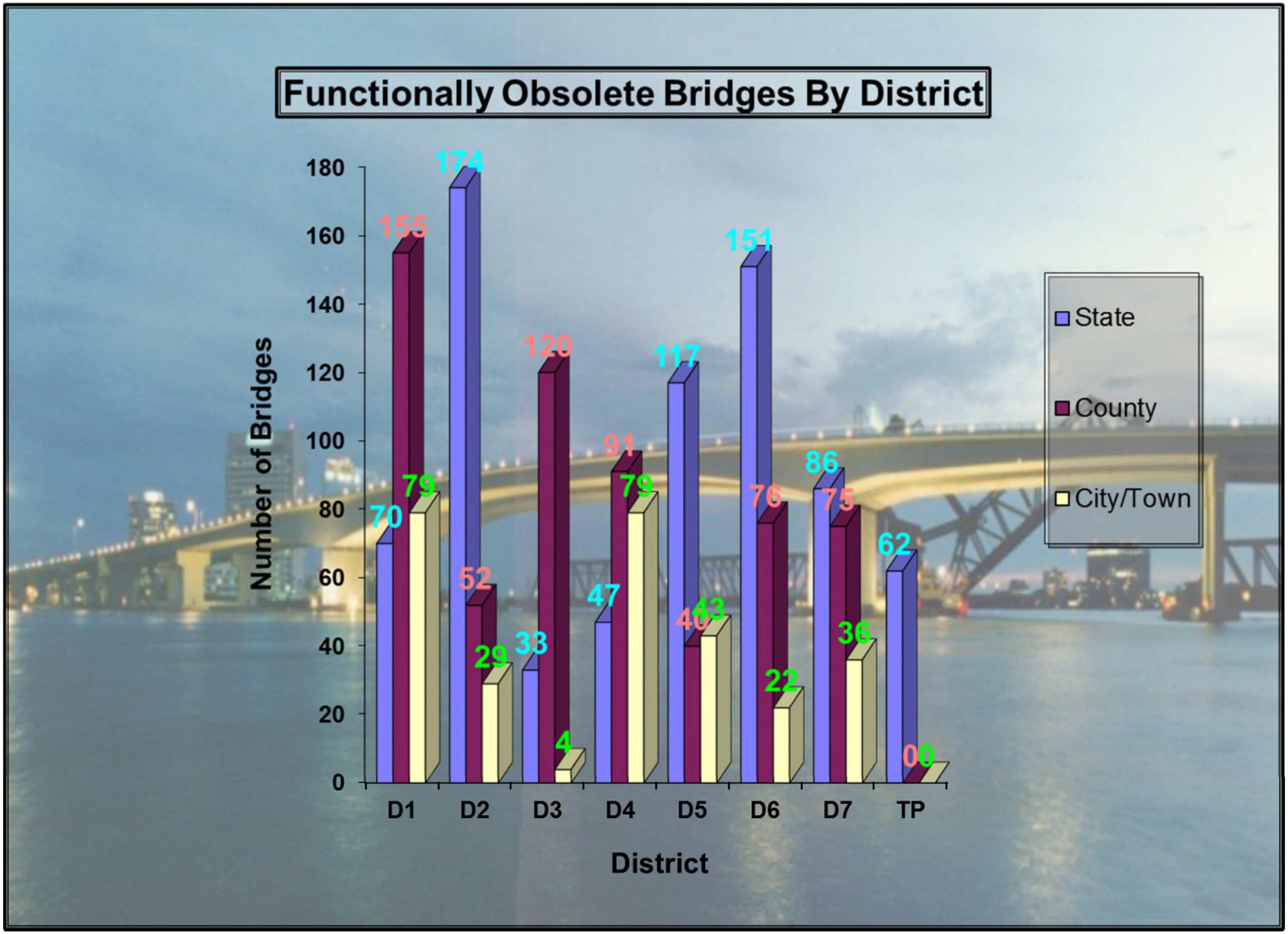

Functionally Obsolete Bridges By District
Number of Bridges
180
160
140
120
100
80
60
40
20
0
D1
D2
D3
D4
D5
D6
D7
TP
District
State
County
City/Town
70
155
79
174
52
29
33
120
4
47
91
79
117
40
43
151
76
22
86
75
36
62
0
0

Figure 33

Bridge Replacement Cost

This section provides a replacement cost estimate for the bridge inventory. As the unit cost values used in this estimate are based on very general assumptions, they should in no way be construed as adequate for estimating the cost of an individual bridge. However, as they are based on historical cost data, tempered with engineering judgment, these numbers may be useful for identifying relative trends in the distribution of the bridge inventory based on structure cost.

The estimate includes only construction of the structure. There are no values associated with R.O.W., approach work, design engineering, preliminary engineering, future maintenance and operation cost, or any other activity not associated with the actual construction of the bridge.

The bridge-structures (bridges) cost estimate is based on the present day replacement cost of the existing structure. This type of estimate is normally calculated based on the area of bridge deck (square feet) times a unit cost ($ per square foot) for the particular bridge type. The Maintenance Office uses a division of these bridge types by 13 categories based superstructure type. These categories were used to define the unit cost for the bridge types.

The basis for developing the unit costs was taken from the Bridge Development Report Cost Estimating Guide found in the LRFD (Load Resistance Factor Design) Structures Design Guidelines published by the FDOT Structures Design Office in Tallahassee. Using these numbers and engineering judgment average unit costs were developed that could be combined with the bridge data as stored in the bridge inventory database. This data base is managed by the FDOT Maintenance Office Bridge Maintenance System, also known as Pontis. The Pontis database records bridge superstructure type by two parameters. These are the superstructure design type and the (predominate) superstructure construction material. To summarize this process, average unit superstructure deck costs were derived from the structures guidelines. These numbers were then assigned to all possible combinations of 22 superstructure design types and 9 material types found in Pontis. Each of these combinations was then assigned an appropriate number from the 13 superstructure types as mentioned above. Then using the bridge in-

FDOT Bridge Deck Area (Square Feet)

	Decade Constructed									
	>1930's	1940's	1950's	1960's	1970's	1980's	1990's	2000's	2010's	Total
R/C Slab	52,006	251,804	534,003	718,152	634,075	635,505	1,680,797	1,119,806	225,264	5,851,411
P/C Slab	39,386	0	84,882	898,281	760,709	704,092	337,609	23,262	176,551	3,024,772
R/C Beam	228,675	218,657	584,757	0	0	0	0	31,402	333,599	1,397,090
P/C Beam	21,056	0	3,353,319	12,810,891	16,229,718	15,460,067	12,535,067	15,441,041	3,694,563	79,545,723
Steel Beam	462,497	210,806	2,280,228	4,782,170	7,366,689	2,868,995	3,172,459	3,655,719	952,510	25,752,072
Timber Beam	0	0	0	986	0	0	0	0	0	986
R/C Box	0	0	0	40,835	51,587	0	0	0	0	92,422
P/C Box	0	0	0	0	0	0	0	294,388	24,101	318,489
Steel Box	0	0	0	0	110,928	1,336,930	1,442,893	1,373,902	376,633	4,641,286
Truss	223,246	0	428,297	250,885	0	0	0	0	0	902,428
Movable	328,865	87,844	718,302	543,772	659,492	371,813	474,164	564,115	67,337	3,815,704
Culvert	85,958	127,705	323,062	634,768	351,481	146,042	162,610	181,880	44,741	2,058,245
Other	12,401	20,050	130,729	0	0	6,704,858	2,917,085	4,713,443	349,562	14,848,129
Total	1,454,090	916,866	8,437,577	20,680,740	26,164,681	28,228,302	22,880,263	27,398,957	6,244,861	142,406,336

Table 12

FDOT Bridge Replacement Cost ($1000's)										
	Decade Constructed									
	>1930's	1940's	1950's	1960's	1970's	1980's	1990's	2000's	2010's	Total
R/C Slab	6,241	30,492	64,695	94,468	90,816	93,404	247,023	159,759	30,224	817,123
P/C Slab	5,908	0	12,732	134,742	114,106	105,614	50,641	3,489	26,483	453,716
R/C Beam	21,724	20,772	55,552	0	0	0	0	2,983	32,891	133,923
P/C Beam	2,211	0	352,098	1,345,144	1,710,433	1,634,481	1,371,219	1,670,744	390,512	8,476,842
Steel Beam	51,658	25,126	263,604	601,973	877,058	362,892	399,251	455,561	121,160	3,158,284
Timber Beam	0	0	0	94	0	0	0	0	0	94
R/C Box	0	0	0	6,125	7,738	0	0	0	0	13,863
P/C Box	0	0	0	0	0	0	22,849	42,686	3,495	69,030
Steel Box	0	0	0	0	16,639	200,539	216,434	206,085	56,495	696,193
Truss	39,068	0	74,952	43,905	0	0	0	0	0	157,925
Movable	95,083	26,893	242,578	220,251	164,878	120,859	153,593	177,407	32,236	1,233,779
Culvert	8,166	12,132	30,691	60,303	33,391	13,874	15,448	17,279	4,250	195,533
Other	1,860	3,008	19,609	0	0	1,005,729	437,563	707,016	52,434	2,227,219
Total	231,919	118,422	1,116,512	2,507,005	3,015,061	3,537,392	2,914,022	3,443,010	750,180	17,633,524

Table 13

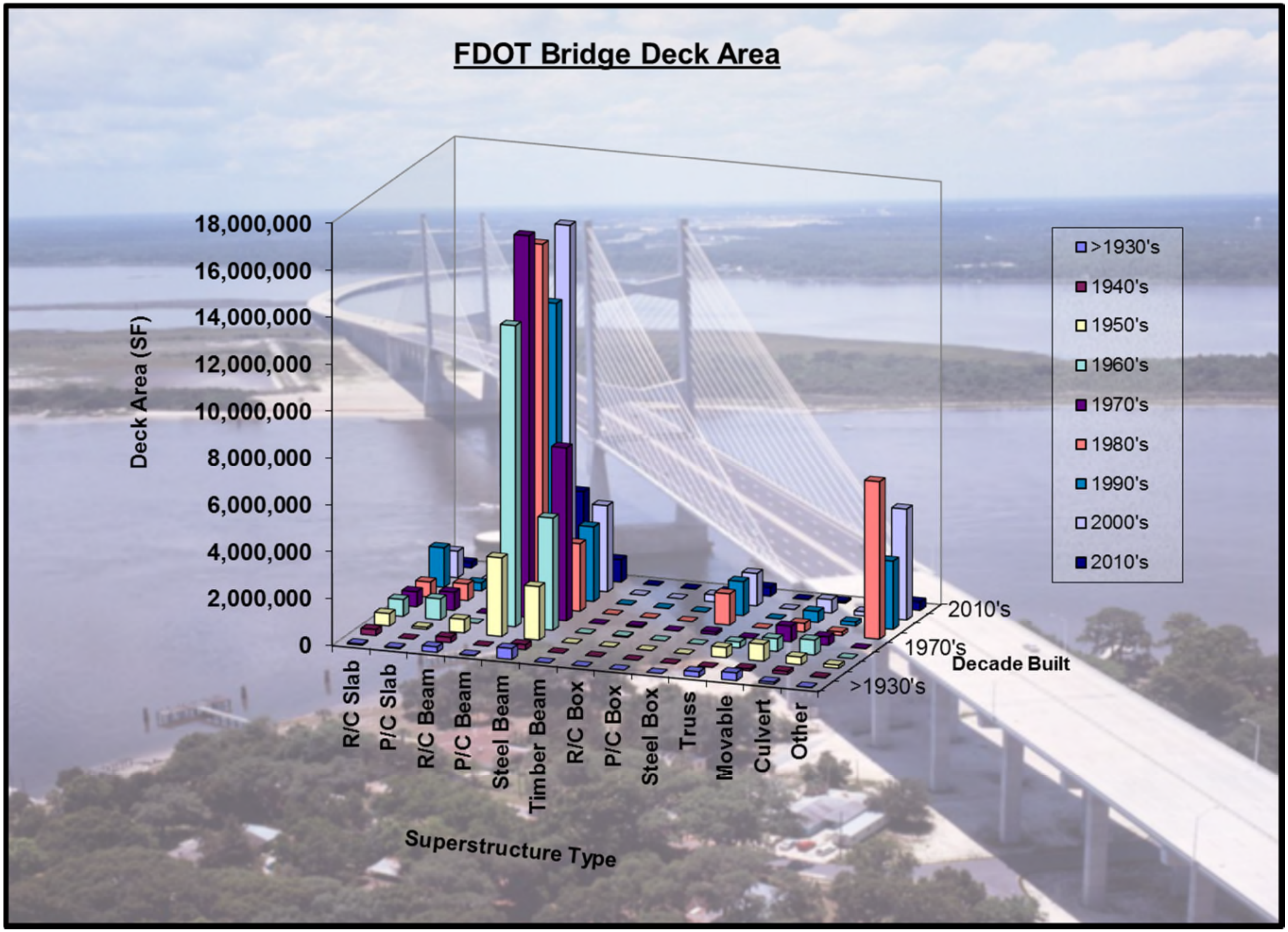

FDOT Bridge Deck Area
Deck Area (SF)
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
R/C Slab
P/C Slab
R/C Beam
P/C Beam
Steel Beam
Timber Beam
R/C Box
P/C Box
Steel Box
Truss
Movable
Culvert
Other
Superstructure Type
>1930's
1970's
2010's
Decade Built
>1930's
1940's
1950's
1960's
1970's
1980's
1990's
2000's
2010's

Figure 34

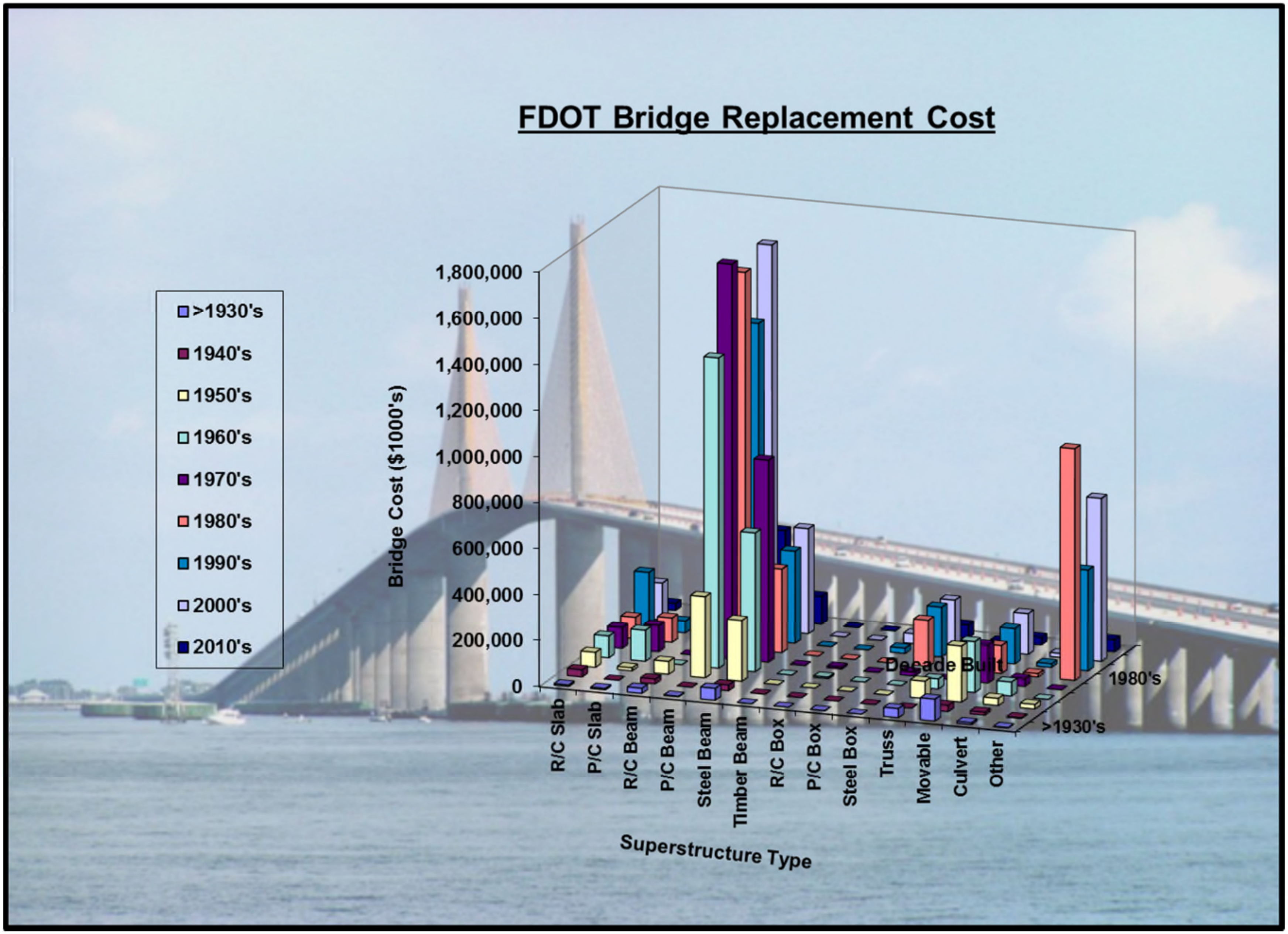
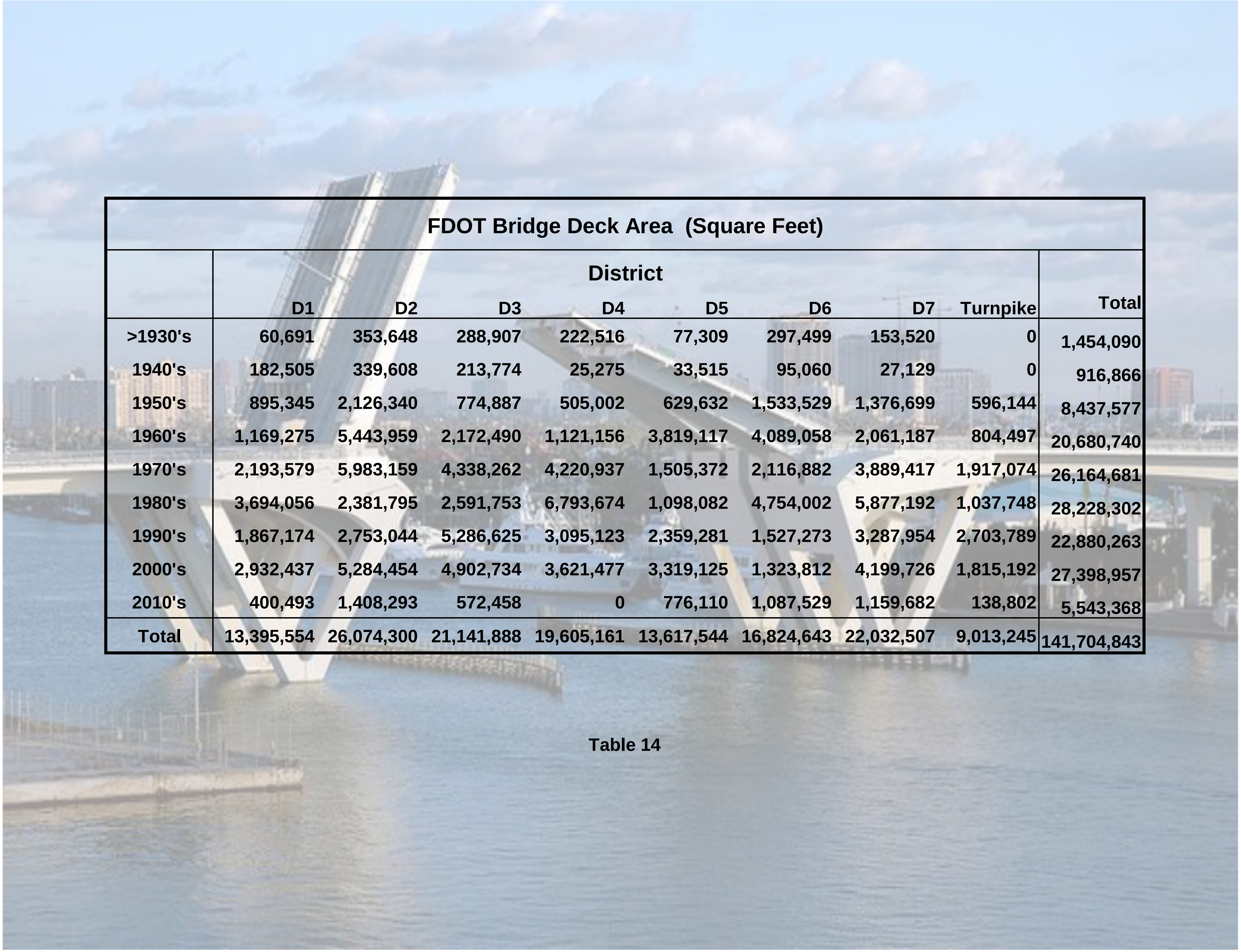

FDOT Bridge Replacement Cost
>1930's
1940's
1950's
1960's
1970's
1980's
1990's
2000's
2010's
Bridge Cost ($1000's)
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
R/C Slab
P/C Slab
R/C Beam
P/C Beam
Steel Beam
Timber Beam
R/C Box
P/C Box
Steel Box
Truss
Movable
Culvert
Other
Superstructure Type
Decade Built
1980's
>1930's

Figure 35



FDOT Bridge Deck Area (Square Feet)									
	District								
	D1	D2	D3	D4	D5	D6	D7	Turnpike	Total
>1930's	60,691	353,648	288,907	222,516	77,309	297,499	153,520	0	1,454,090
1940's	182,505	339,608	213,774	25,275	33,515	95,060	27,129	0	916,866
1950's	895,345	2,126,340	774,887	505,002	629,632	1,533,529	1,376,699	596,144	8,437,577
1960's	1,169,275	5,443,959	2,172,490	1,121,156	3,819,117	4,089,058	2,061,187	804,497	20,680,740
1970's	2,193,579	5,983,159	4,338,262	4,220,937	1,505,372	2,116,882	3,889,417	1,917,074	26,164,681
1980's	3,694,056	2,381,795	2,591,753	6,793,674	1,098,082	4,754,002	5,877,192	1,037,748	28,228,302
1990's	1,867,174	2,753,044	5,286,625	3,095,123	2,359,281	1,527,273	3,287,954	2,703,789	22,880,263
2000's	2,932,437	5,284,454	4,902,734	3,621,477	3,319,125	1,323,812	4,199,726	1,815,192	27,398,957
2010's	400,493	1,408,293	572,458	0	776,110	1,087,529	1,159,682	138,802	5,543,368
Total	13,395,554	26,074,300	21,141,888	19,605,161	13,617,544	16,824,643	22,032,507	9,013,245	141,704,843

Table 14

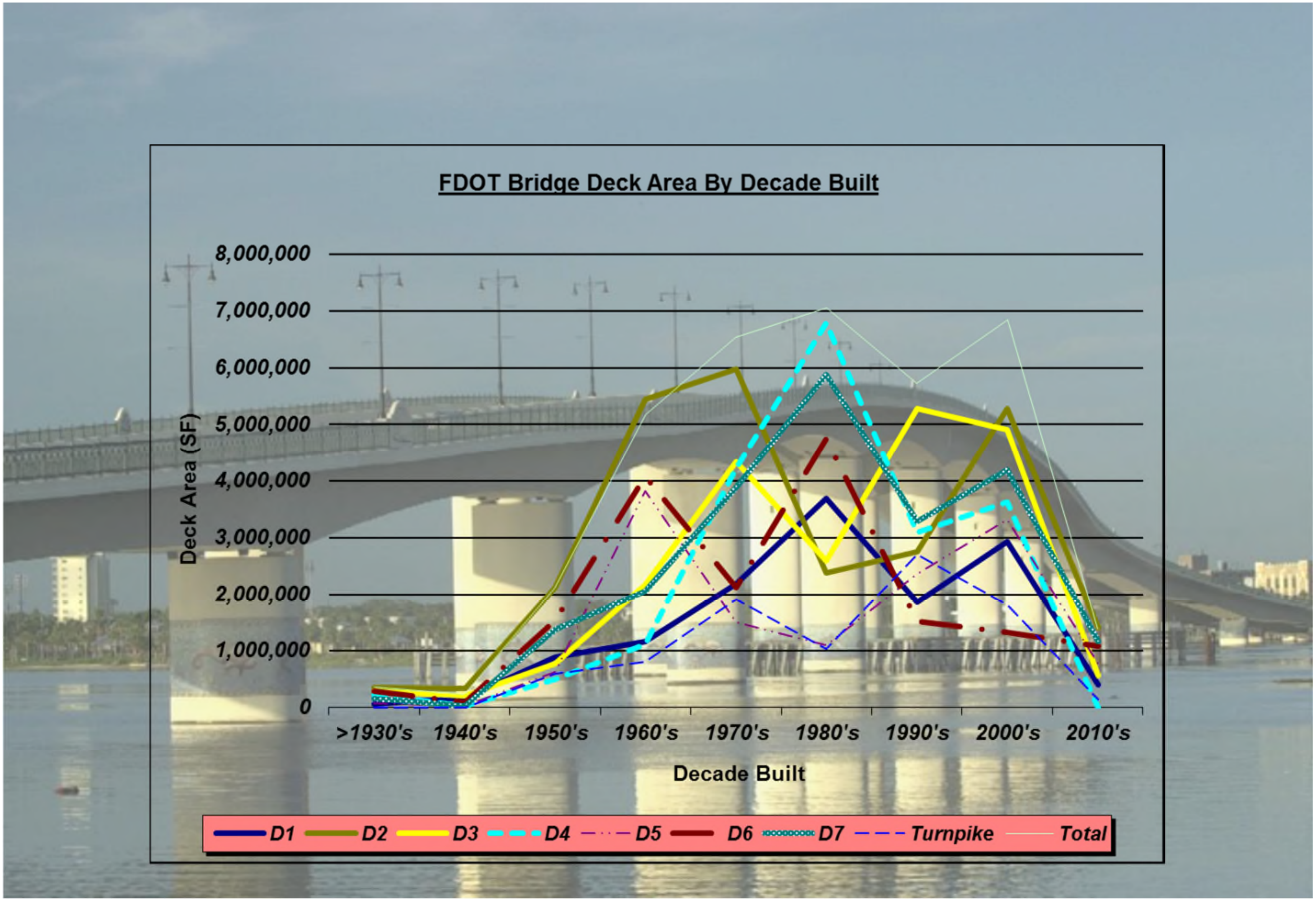
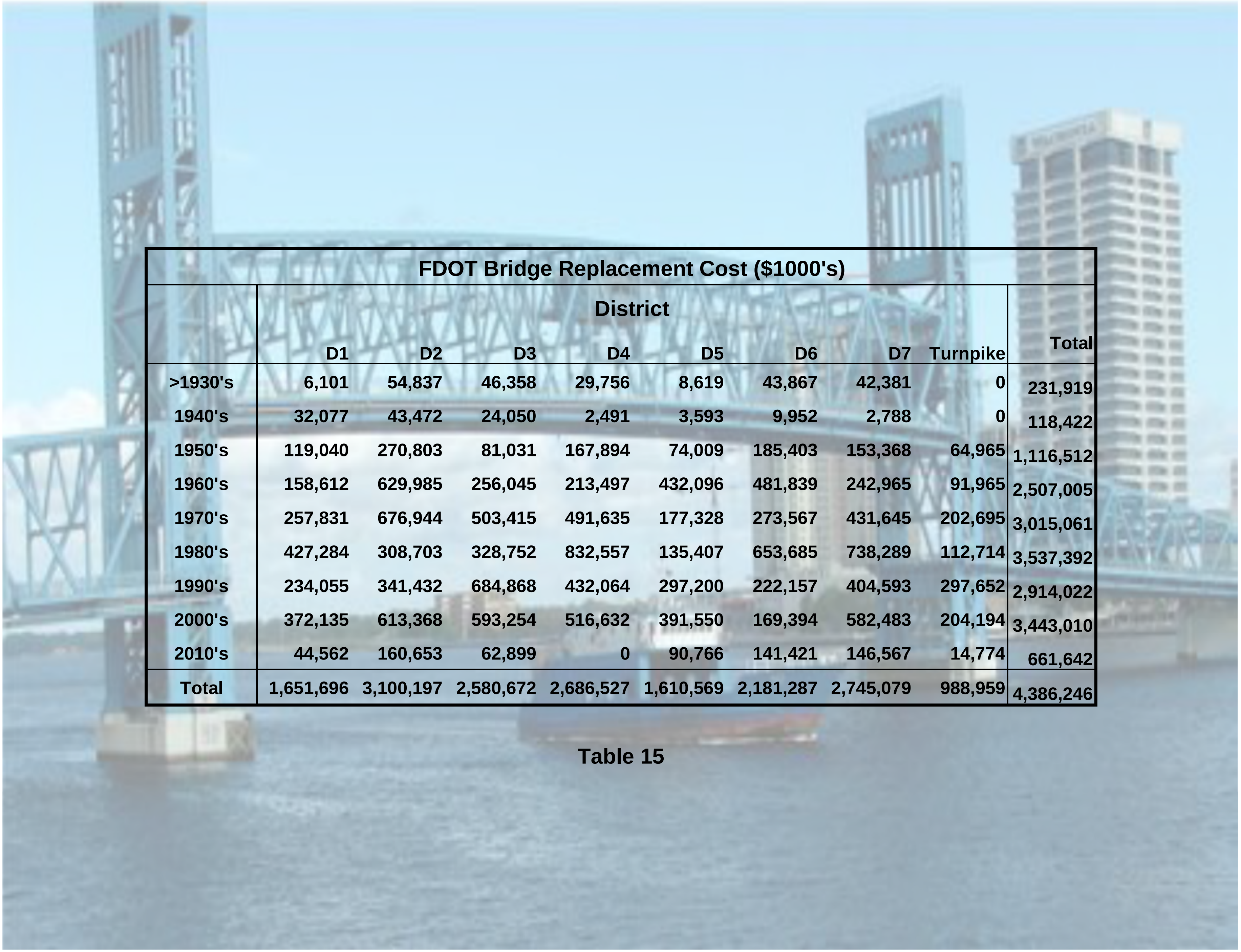

FDOT Bridge Deck Area By Decade Built
Deck Area (SF)
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
>1930's
1940's
1950's
1960's
1970's
1980's
1990's
2000's
2010's
Decade Built
D1
D2
D3
D4
D5
D6
D7
Turnpike
Total

Figure 36



FDOT Bridge Replacement Cost ($1000's)									
	District								Total
	D1	D2	D3	D4	D5	D6	D7	Turnpike	
>1930's	6,101	54,837	46,358	29,756	8,619	43,867	42,381	0	231,919
1940's	32,077	43,472	24,050	2,491	3,593	9,952	2,788	0	118,422
1950's	119,040	270,803	81,031	167,894	74,009	185,403	153,368	64,965	1,116,512
1960's	158,612	629,985	256,045	213,497	432,096	481,839	242,965	91,965	2,507,005
1970's	257,831	676,944	503,415	491,635	177,328	273,567	431,645	202,695	3,015,061
1980's	427,284	308,703	328,752	832,557	135,407	653,685	738,289	112,714	3,537,392
1990's	234,055	341,432	684,868	432,064	297,200	222,157	404,593	297,652	2,914,022
2000's	372,135	613,368	593,254	516,632	391,550	169,394	582,483	204,194	3,443,010
2010's	44,562	160,653	62,899	0	90,766	141,421	146,567	14,774	661,642
Total	1,651,696	3,100,197	2,580,672	2,686,527	1,610,569	2,181,287	2,745,079	988,959	4,386,246

Table 15

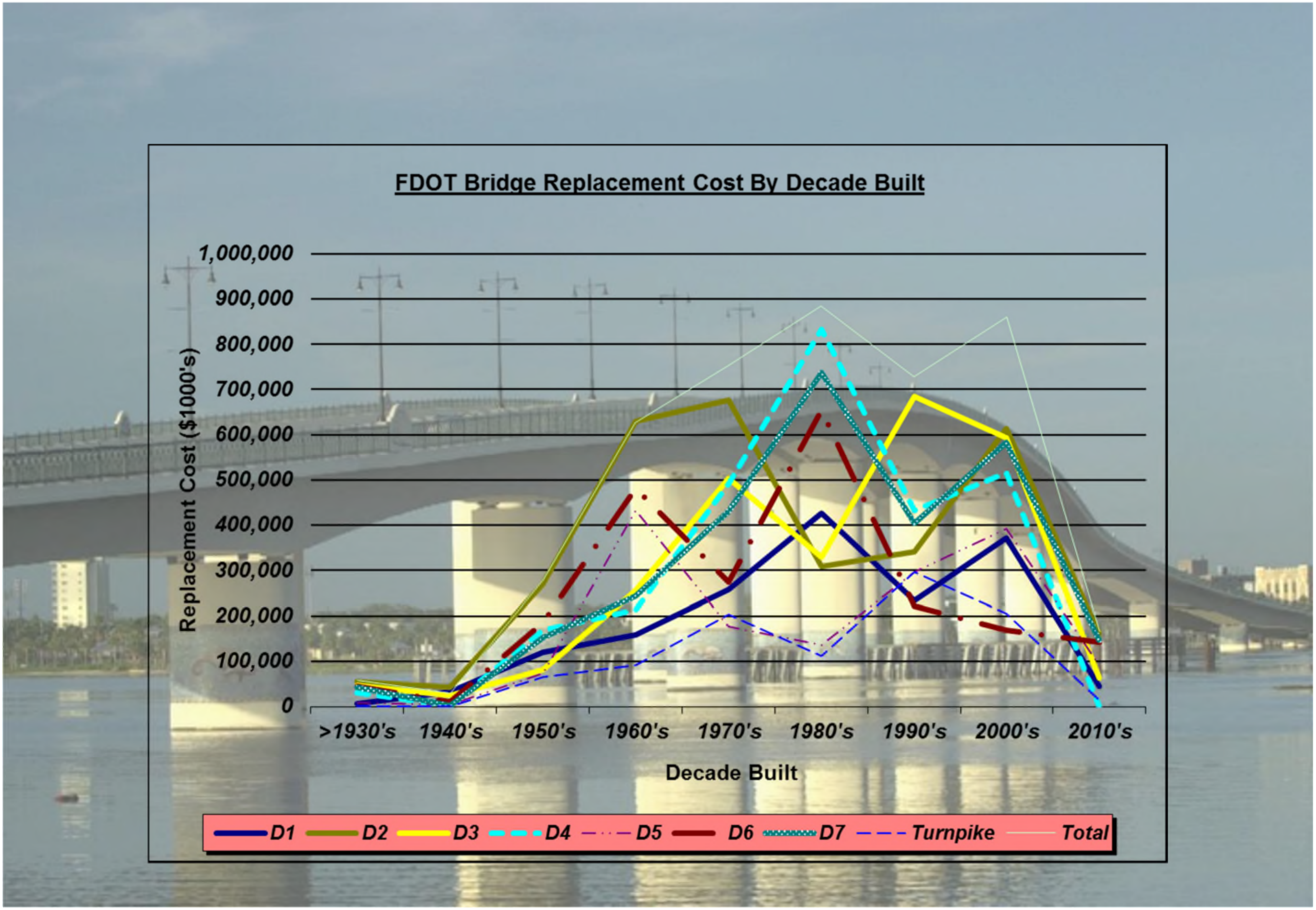
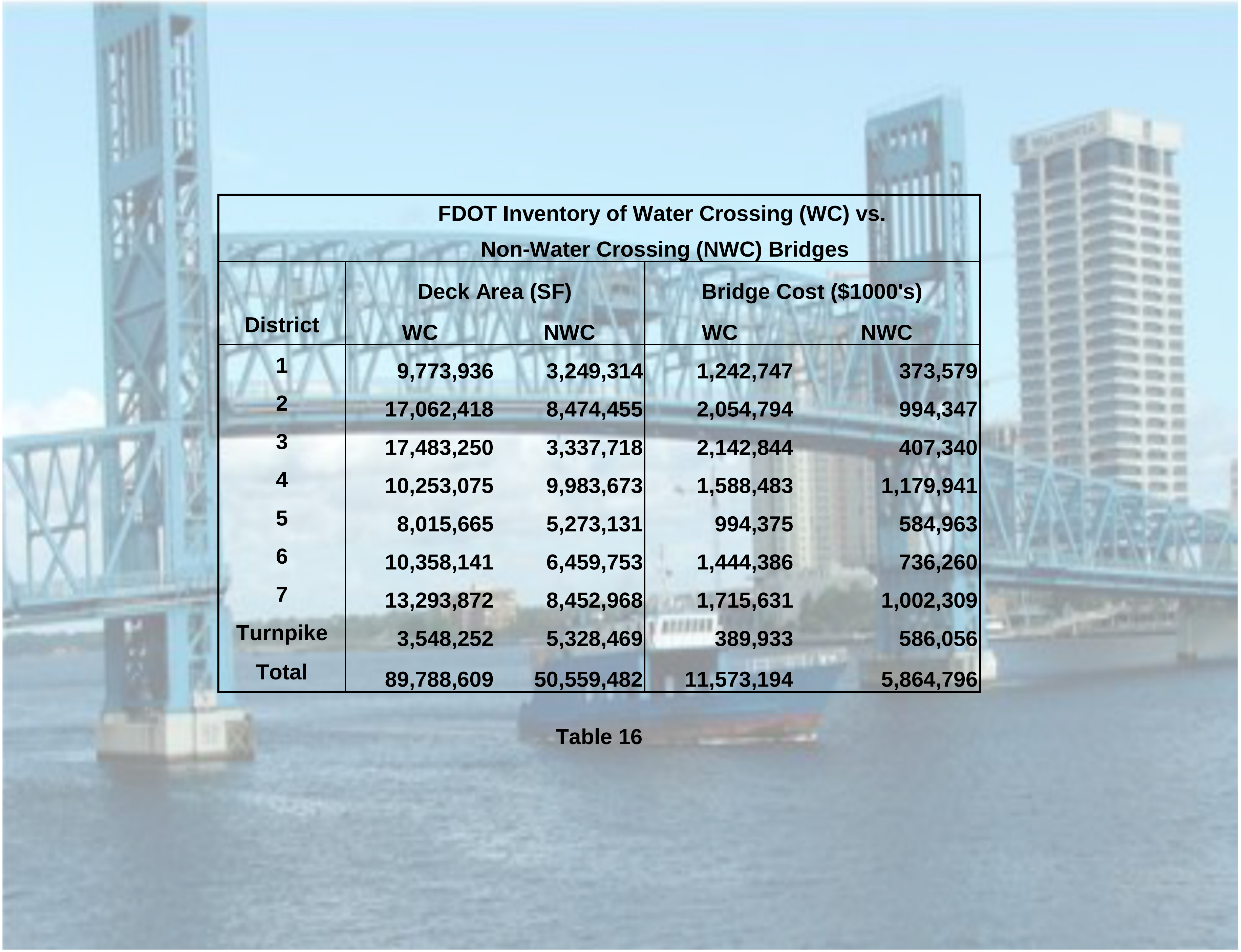

FDOT Bridge Replacement Cost By Decade Built
Replacement Cost ($1000's)
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
>1930's
1940's
1950's
1960's
1970's
1980's
1990's
2000's
2010's
Decade Built
D1
D2
D3
D4
D5
D6
D7
Turnpike
Total

Figure 37



FDOT Inventory of Water Crossing (WC) vs. Non-Water Crossing (NWC) Bridges				
District	Deck Area (SF)		Bridge Cost ($1000's)	
	WC	NWC	WC	NWC
1	9,773,936	3,249,314	1,242,747	373,579
2	17,062,418	8,474,455	2,054,794	994,347
3	17,483,250	3,337,718	2,142,844	407,340
4	10,253,075	9,983,673	1,588,483	1,179,941
5	8,015,665	5,273,131	994,375	584,963
6	10,358,141	6,459,753	1,444,386	736,260
7	13,293,872	8,452,968	1,715,631	1,002,309
Turnpike	3,548,252	5,328,469	389,933	586,056
Total	89,788,609	50,559,482	11,573,194	5,864,796

Table 16

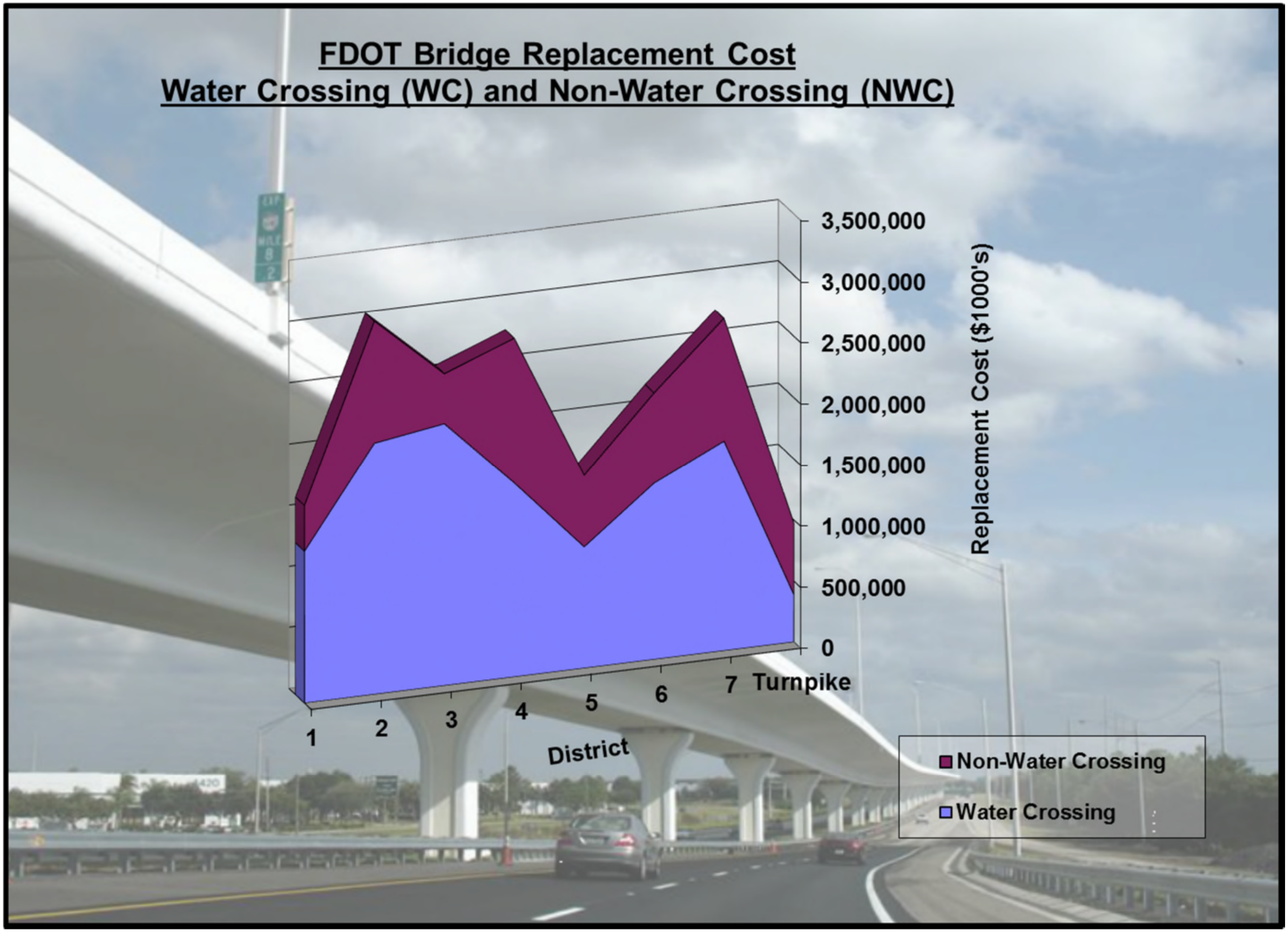

FDOT Bridge Replacement Cost
Water Crossing (WC) and Non-Water Crossing (NWC)
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Replacement Cost ($1000's)
1
2
3
4
5
6
7
Turnpike
District
Non-Water Crossing
Water Crossing

Figure 38

Conclusion

A goal of the Florida Department of Transportation is the protection of the public's investment in transportation. Bridges represent a significant portion of that investment. One of FDOT's main responsibilities is keeping the State Highway System in acceptable physical condition. To do this, FDOT resurfaces roads, repairs and replaces bridges, and performs routine maintenance activities. An awareness and understanding of the state of the bridge inventory can be used to help identify performance goals, establish resource requirements, and measure progress on meeting the above goals.

There are 12,262 bridges accounted for in Florida. The FDOT has maintenance responsibility for 6,836 of the bridges, or 55.75%. County governments maintain 3,894 bridges (31.76%), city and towns maintain 1,238 bridges (10.10%), with the remaining 294 bridges (2.40%) maintained by others. 15.10% of all bridges currently in service in Florida were constructed prior to 1960; 37.03% were constructed in the 1960's and 1970's, while the remaining 47.87% have been built since 1980. This distribution is relatively consistent for the three maintenance groups (FDOT, Counties, and City/Towns) used in this report. Bridges do not last forever. Through aggressive preventive maintenance, the strategy is to leverage advances in material science, design practices, and construction methods to extend the useful life of the bridges, thereby minimizing the need to replace a large number of bridges within a short time period. The challenge is to determine the most cost effective mix of preventive maintenance, routine maintenance, repair, rehabilitation, replacement, and other actions over the life of the bridges.

Florida's bridges are generally in good condition, with those maintained by the FDOT in better condition than those maintained by local governments or others. The most serious threat to bridges in Florida is the corrosion of steel reinforced concrete substructures in coastal regions. Much has been learned in recent years about corrosion in marine environments, affecting material specifications and design practices that helps new bridges built today. However, the older bridges in the coastal regions are beginning to require careful evaluation and extensive corrective actions. On-going research will continue to provide useful information to help meet this challenge. Other challenges include: confronting the increasingly extensive environmental and public health issues related to protective coatings for steel bridges with lead based paint; completing the statewide bridge scour evaluation program to identify scour critical bridges (bridges that could fail during floods) and to provide scour countermeasures as corrective action where required; to stay on top of movable bridge maintenance and rehabilitation; and to improve preventive maintenance on the large population (37.03% of the inventory) of bridges built during the 1960's and 1970's.

Comments on this report should be directed to:

John D. Clark, P.E.
Bridge Maintenance & Repair Engineer
Florida Department of Transportation
Office of Maintenance
605 Suwannee Street, M.S. 52
Tallahassee, FL 32399-0450

Telephone No. (850) 410-5690
Fax No. (850) 410-5511
User ID: MT954JC
E-mail: john.clark@dot.state.fl.us