Highway Carrying Bridges in New Jersey

Final Report

October 2007

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Executive Summary

In response to Governor Corzine's directive after the tragic collapse of the I-35W Bridge over the Mississippi River in Minneapolis, Minnesota, the New Jersey Department of Transportation (NJDOT) has examined the effectiveness of the State's bridge inspection program and conducted inspections of bridges with similar details to the I-35W Bridge. Based upon our review, NJDOT identified the improvements required to bring all of the State's structurally deficient and functionally obsolete bridges to a state of good repair and outlined a Capital Investment Analysis to reach that goal.

The State's bridge inspection program is in compliance with the National Bridge Inspection Standards (NBIS). New Jersey's inspection personnel are more highly qualified than required by NBIS and perform more thorough inspections than typically conducted elsewhere. As such, our bridge inspection program has safely maintained our bridge infrastructure.

We have re-inspected all of our steel deck truss structures over the past several weeks, as this was the type structure on the I-35W Bridge in Minnesota. We are also re-inspecting our welded steel box structures since the I-35W truss consisted of welded steel boxes. The inspection of the welded steel boxes will be completed by year's end. Once the actual cause of the collapse of the I-35W Bridge is determined through forensic analysis, we will determine if further bridge inspections are warranted. Further, we have also worked to ensure that the bridge inspection reports and data are up-to-date and accurate, as it relates to localities, bi-state authorities and other entities.

We have identified our Capital Investment Analysis for utilizing our bridge funds cost-effectively. The Capital Investment Analysis would utilize NJDOT's Bridge Management System to determine priorities and invest resources using a mix of bridge programs designed to both repair the bridges that have reached the end of their service lives and reduce the number of bridges that reach the state where replacement/reconstruction is the only viable option (Fix It First).

We recommend the following actions in order to preserve both the safety and functionality of the State's bridges as a vital part of our transportation network.

- Increase the State bridge funding (for NJDOT, Orphan, DEP and NJ TRANSIT bridges) to $659 million annually to substantially reduce the current backlog of structurally deficient bridges.
- Increase funding to local governments by $25 million annually in order to address the current backlog of structurally deficient bridges in the first instance.
- Develop a robust capital investment analysis to address deficient bridge backlog at the Turnpike, Parkway and the Atlantic City Expressway.
- Maintain the level of funding for the NJDOT's bridge and culvert inspection programs.
- Initiate a program to inventory, determine jurisdiction and inspect the County/Municipally owned culverts.
- Continue to enhance and develop the NJDOT's Bridge Management System.

I. Introduction

Following the loss of life during the catastrophic collapse of the Silver Bridge over the Ohio River between Ohio and West Virginia in 1967, the United States Congress passed a law mandating regular safety inspection of the nation's bridges. In 1969, the National Bridge Inspection Standards (NBIS) were added to the Code of Federal Regulations (23CFR650) mandating that all of the nation's highway carrying bridges over 20 feet long be inspected at a cycle of not more than two years. The NBIS also specifies requirements for the State bridge inspection organization, inspection personnel, inspection procedures, and data inventory. The New Jersey Department of Transportation instituted the mandated bridge safety inspection program starting in 1971. New Jersey's inspection requirements exceed the minimum standards set in the NBIS to reduce the risk that undetected deterioration of our bridges would impact the safety of the traveling public and the loss of valuable infrastructure.

As a result of the recent failure of the I-35W Bridge over the Mississippi River in Minneapolis, Minnesota, there is a heightened awareness of the need to conduct regular comprehensive bridge safety inspections and to make any repairs necessary to assure that the State's transportation system remains safe. In addition, this tragedy has also focused attention on the need to maintain our bridges in a state of good repair in order that they can continue to fulfill their purpose in the State's transportation network and promote the economy of New Jersey.

The purpose of this report is to identify the current condition and inspection status of all the highway carrying bridges in New Jersey. In addition, information on steel deck truss bridges, welded steel box structures and fracture critical bridges is provided since the I-35W Bridge that failed was a fracture critical steel deck truss bridge with welded steel box beams. Further, this report identifies the funding needs to bring the structurally deficient (SD) and functionally obsolete (FO) bridges to a state of good repair and provides Capital Investment Strategies to reach this goal.

The information contained in this report primarily comes from the current data in the Statewide Bridge Management System. In order to be assured that the most current data was available, all bridge owners have been requested to submit updates where necessary and the new data was input into the Bridge Management System and used as the basis for this report. Since the bridge inspection program is a continuous, ongoing program and the data is continually updated, there may be minor inconsistencies in the data due to the lag between the actual inspection and the data updates, especially for bridges not under the Department's jurisdiction. However, the overall data contained in this report gives an accurate representation of the condition of the highway carrying bridges in New Jersey.

II. Findings:
Current Bridge Condition

Total Bridge Inventory

At present, there are 6,447 highway carrying bridges over 20 feet long in New Jersey's bridge inventory. These bridges are categorized by their respective owners in Figure 1a (below):

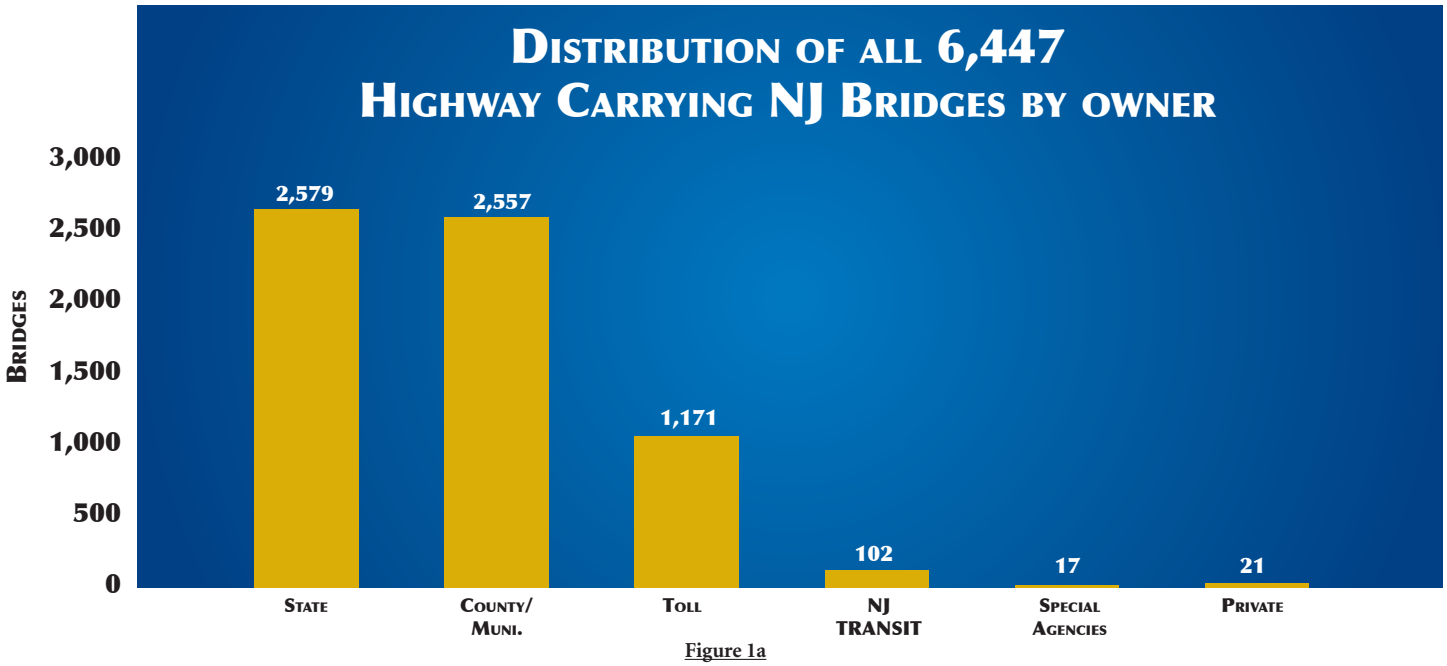


Figure 1a

Shown below is a chart depicting the area of bridges included in the bridge owner categories respectively (Figure 1b):

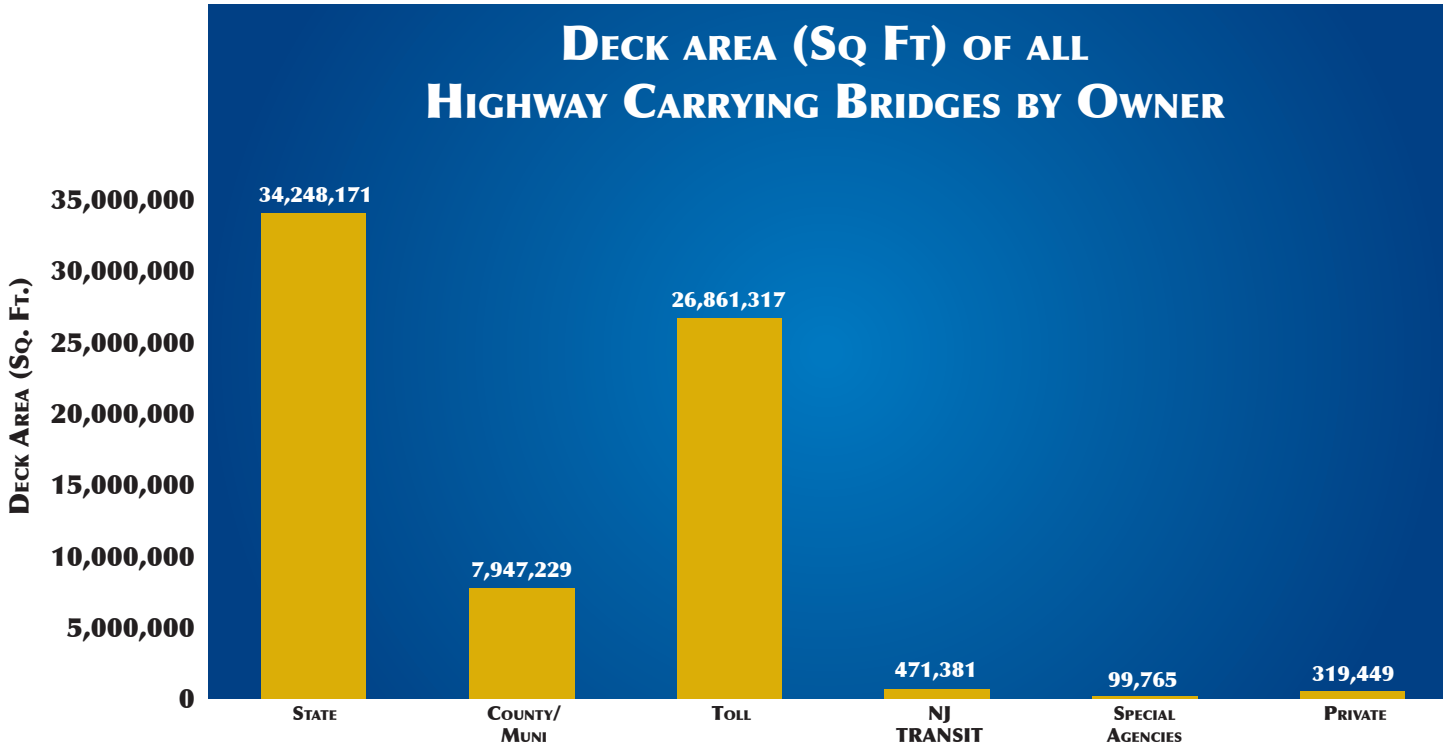


Figure 1b

Age of Bridges

The following figures show the bridge age distribution by individual bridge owner (Figure 2) and the age distribution of all bridges in the state (Figure 3):

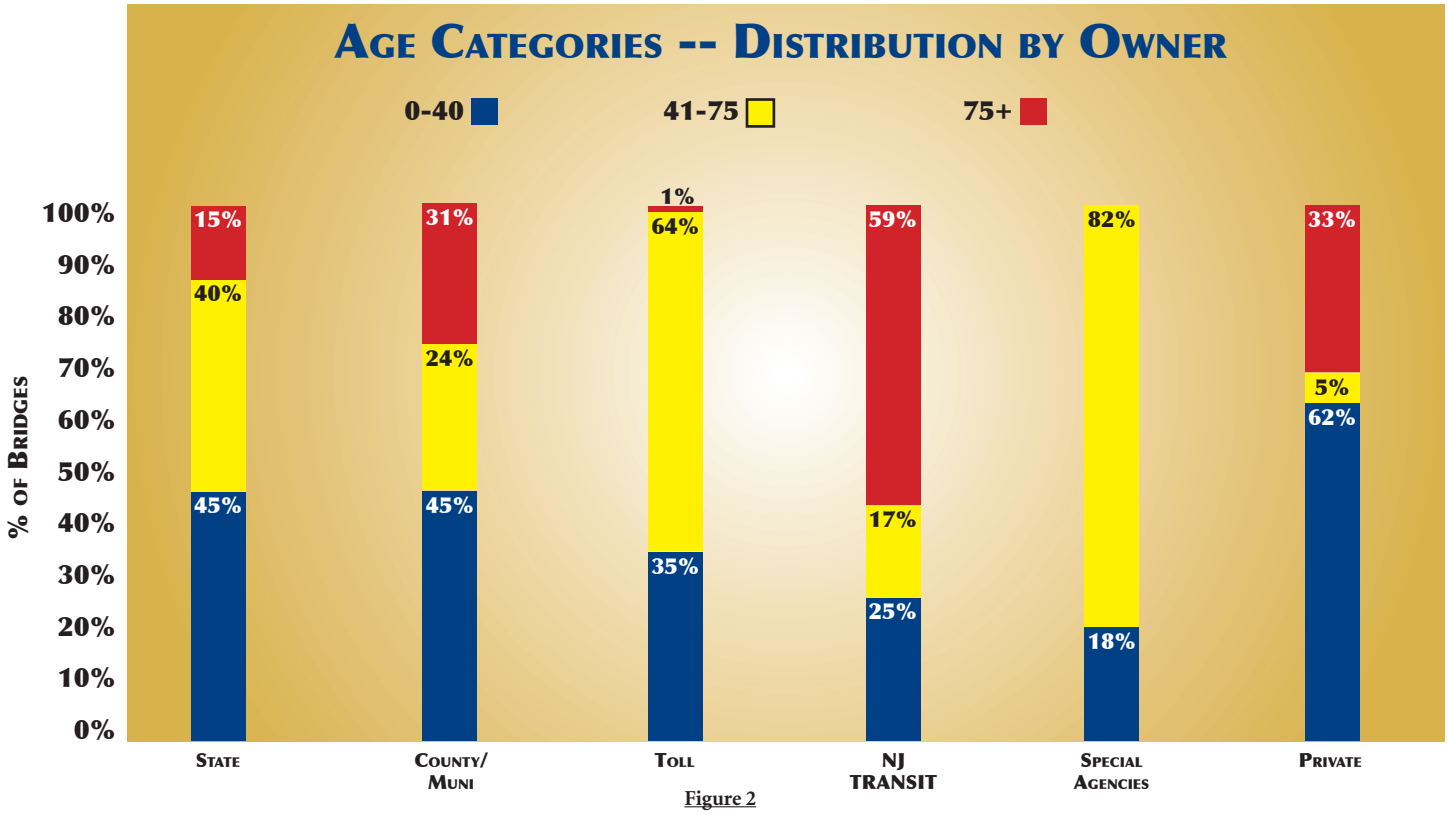


Figure 2

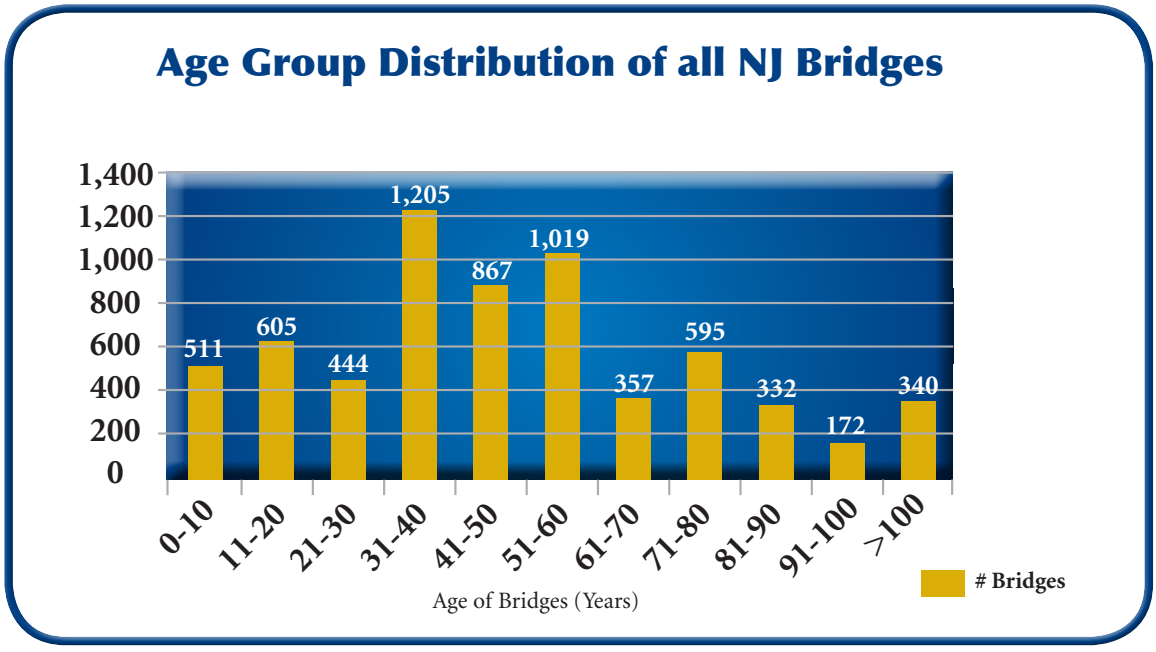


Figure 3

NOTES:

- The average design life expectancy of a new bridge is 75 years. At present, 15 percent of State, 31 percent of County/Municipal, 59 percent of NJ TRANSIT and 38 percent of Private bridges are older than 75 years.
- The average age of the bridges in New Jersey is 49 years.

Condition Statistics

Of all the bridges in New Jersey, Figure 4 (below) depicts the percentage of bridges that are not deficient (neither structurally deficient nor functionally obsolete), structurally deficient, and functionally obsolete:

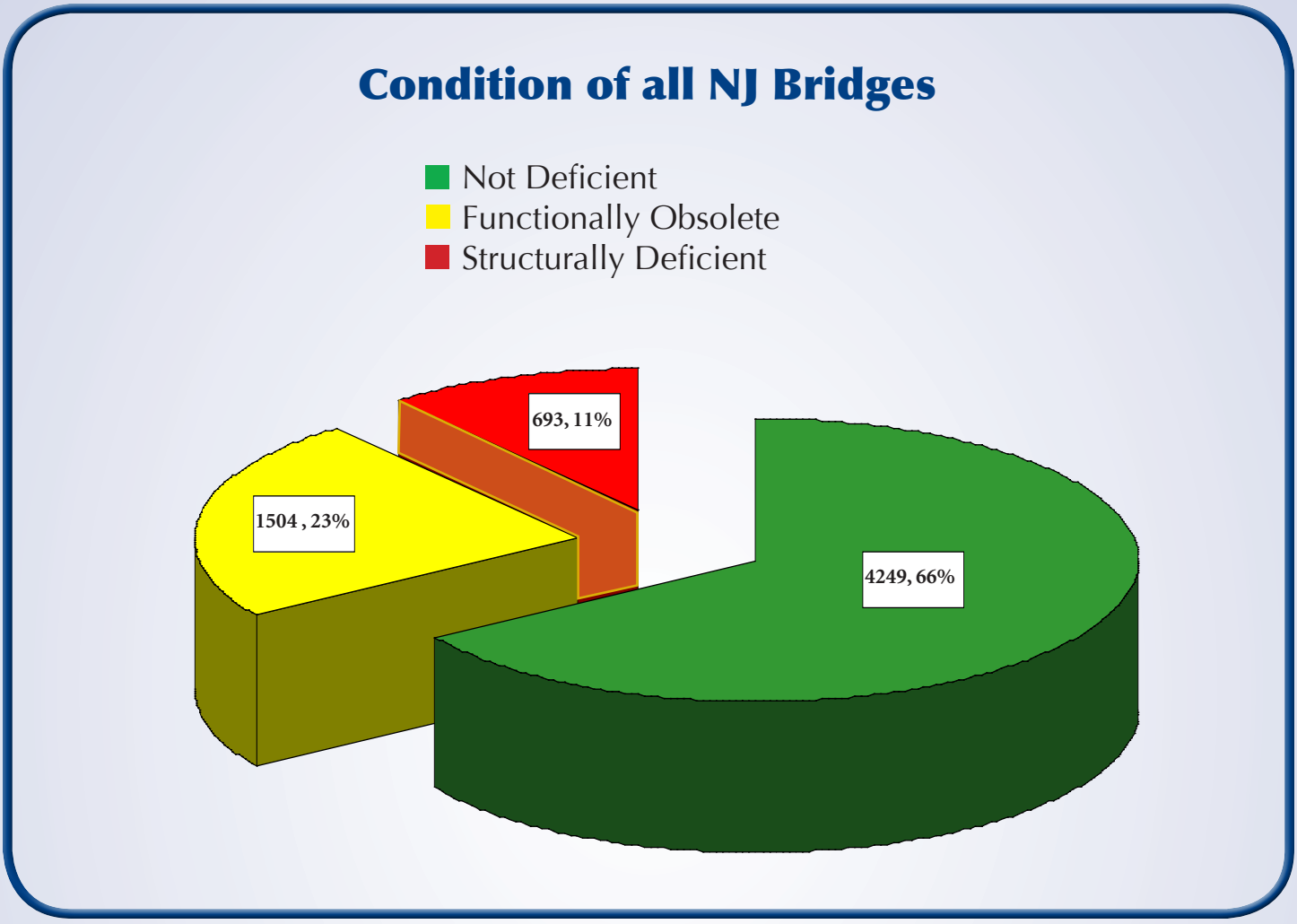


Figure 4

It is important to note that a bridge is considered to be structurally deficient if the deck, superstructure and/or substructure are deteriorated. Additionally, a bridge is considered to be functionally obsolete if the structure contains sub-standard geometrical features, such as narrow lanes, narrow shoulders (or lack of shoulder), poor approach roadway alignment, or inadequate vertical under-clearance. However, a bridge classified as structurally deficient or functionally obsolete does not mean that it is unsafe for use.

Figure 5 (below) is a further breakdown of the bridges shown in Figure 4, showing the current percentages of not deficient, structurally deficient and functionally obsolete bridges in New Jersey by each bridge owner:

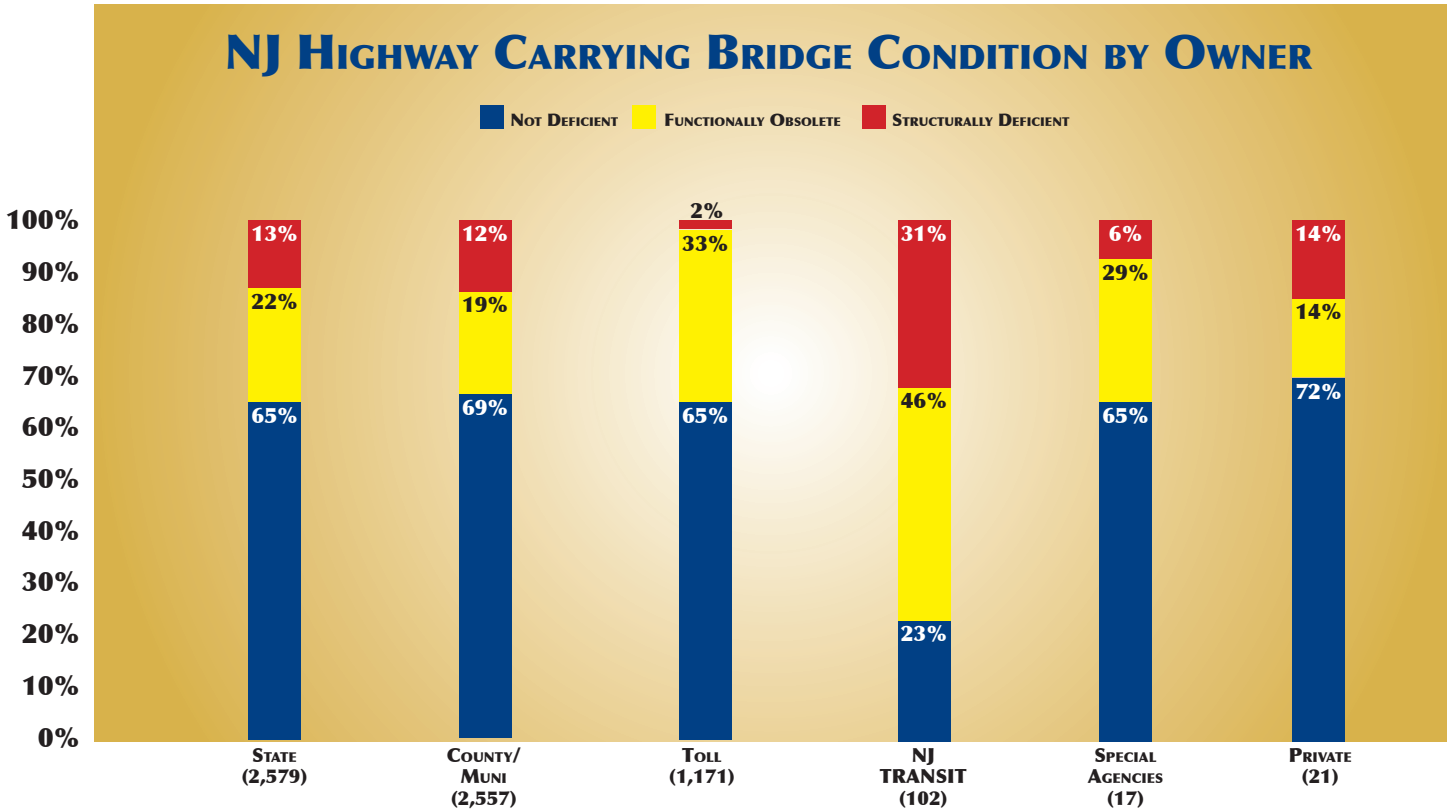


Figure 5

Additional Bridge Findings

In addition to the regular biennial bridge safety inspections, the National Bridge Inspection Standards (NBIS) also mandate that additional types of inspections and other information be retained. Some of the additional information is as follows:

- There are 631 fracture critical (non-redundant) bridges in New Jersey (220 State, 39 NJ TRANSIT, 266 County/Municipal, 100 Toll, and 6 Private). Of the fracture critical bridges, 220 are structurally deficient (35 percent), 152 are functionally obsolete (24 percent) and 259 are not deficient (41 percent). These bridges are constructed in a manner in which the failure of a single member could result in the collapse of the entire bridge or a significant portion of the bridge. Fracture critical bridges are generally constructed with steel tension members that have welded, riveted or bolted connections. The Pulaski Skyway is an example of a riveted fracture critical bridge. Fracture critical bridges must be more rigorously inspected than other bridges which lack such critical members.

- There are 276 bridges in New Jersey that are required to have safety inspections at a more frequent cycle than the every two years as required by NBIS (70 State, 13 NJ TRANSIT, 183 County/Municipal, 4 Toll and 6 Private). These bridges are required to have interim (more frequent) inspections of the structural members where deterioration could potentially cause a loss of load-carrying capacity.

- There are 467 scour critical bridges in New Jersey (169 State, 294 County/Municipal and four Other). Scour critical bridges have a potential for damage due to the erosion of streambed material during severe floods that could cause damage. The scour critical bridges are monitored during periods of severe flooding to ensure that they have not sustained any damage. In addition, these bridges receive special inspections following severe flooding to assure that no damage has occurred and to identify the need to repair any damage that may have been sustained.

- There are 381 load posted bridges — 217 of which are required to be posted due to low load carrying capacity. Load posted bridges have restrictions which limit the weights of trucks using the bridges. Four State-owned bridges are currently load posted (Pulaski Skyway/Passaic River, Pulaski Skyway/Hackensack River, Route 52/Rainbow Thorofare and Route 52/Elbow Thorofare).

The following bridge inspection information is provided as attachments to this report:

- Attachment #1—NJ Highway Carrying Bridge Condition Inventory. The data report indicates the Category Owner, Maintenance (Responsibility), Route, Structure Number, (Bridge) Name, (Date of) Last Inspection, Open/Closed Status, Deficient or Obsolete, and Sufficiency Rating for every bridge in New Jersey.

- Attachment #2—A list of all structurally deficient bridges in New Jersey. The data report indicates the Category Owner, Maintenance (Responsibility), Route, Structure Number, (Bridge) Name, Date of Last Inspection, Sufficiency Rating and Interim Inspection (Required) for every bridge in New Jersey.

- Attachment #3 – A compilation of the Bridge Capital Investment Analysis and resource needs from New Jersey and Bi-State Authorities.

Bridge Inspection Program

The State's bridge inspection program remains in compliance with the National Bridge Inspection Standards, and the high quality inspections that are performed have insured against bridge failures such as the tragedy recently suffered in Minnesota. New Jersey's investment in our bridge inspection program is one of the highest nationwide on a per bridge basis.

The cost is high for a number of reasons, including the high cost of labor in New Jersey, the high cost of traffic control due to our congested roads, more thorough inspection performance and the utilization of higher quality inspection staff. The following table shows the annual average bridge inspection costs:

Bridge Owner	Annual Average Cost
State (incl. Orphans, DEP & NJ Transit)	$ 12.0 million
County/Municipal	$ 6.0 million
Major Toll Authorities (NJTPK, GSP & ACE)	$ 4.8 million
Total*	**$ 21.8 million**

***Does not include the costs to inspect culverts, sign structures or other structures; nor does it include costs incurred by bi-state and other New Jersey authorities.**

We feel that the cost of a high quality inspection program is justified by providing for the identification of deterioration at a point where it can be repaired before it results in the loss of use of our highway system and the potential loss of life that could result.

Culvert Inspection Program

NBIS does not include culverts or small bridges less than 20 feet in length, however, the NJDOT has a culvert inspection program for bridges from five feet to 20 feet long. These structures are inspected on a four year cycle (whereas the large bridges are inspected every two years). NJDOT maintains a database for the State owned culverts. The County/Municipally owned culverts are not currently inspected regularly. While some counties maintain complete inventories and inspect culverts routinely, others do not.

Currently there is no State or Federal requirement for a statewide inspection program for the County/Municipal owned culverts. We feel it is necessary that a program be initiated at the State level to implement a complete inventory, jurisdiction determination and inspection of all the County/Municipal owned culverts and that the culverts be included in future Capital Investment Analyses. The Commissioner of Transportation met with the County Engineers on August 29, 2007 and announced that the Department would fund inspections of County/Municipal culverts. In addition, the Commissioner agreed that the Department would work in partnership with the local governments to develop a culvert inventory system.

III. Current Bridge Capital Investment Levels and Condition

Levels of capital investment for bridge maintenance and reconstruction vary substantially by individual owner and historical information for many bridge owners is currently not available. Assuming that capital investment statewide over the past seven years has remained somewhat consistent between owners, the following assumptions can be made about the adequacy of current funding levels.

- The overall condition of bridges in New Jersey continues to decline based on current investment/ funding levels.

- While the overall number of structurally deficient/ functionally obsolete bridges has decreased slightly over the past seven years, the overall square foot area of bridges that are structurally deficient/ functionally obsolete has increased over the past seven years (see figures 6a and 6b).

- At current funding levels the numbers and square foot area for bridges that are structurally deficient/ functionally obsolete will continue to increase for the following owners: State, Toll Authorities and NJ TRANSIT.

- The number of County/Municipally owned structurally deficient and functionally obsolete bridges has been reduced slightly over the past seven years. This reduction is primarily the result of work accomplished through the Bridge Bond Act of 1999. Local governments have an unexpended balance of approximately $63 million from this Act that can be used for structurally deficient bridges under their jurisdiction. However, it is likely that other funding sources will be required to prevent increases in the number of structurally deficient and functionally obsolete county/municipal bridges.

Of all the bridges in New Jersey, Figure 6a (below) depicts the number of bridges that are structurally deficient and functionally obsolete showing the trend from 2000 to 2007.

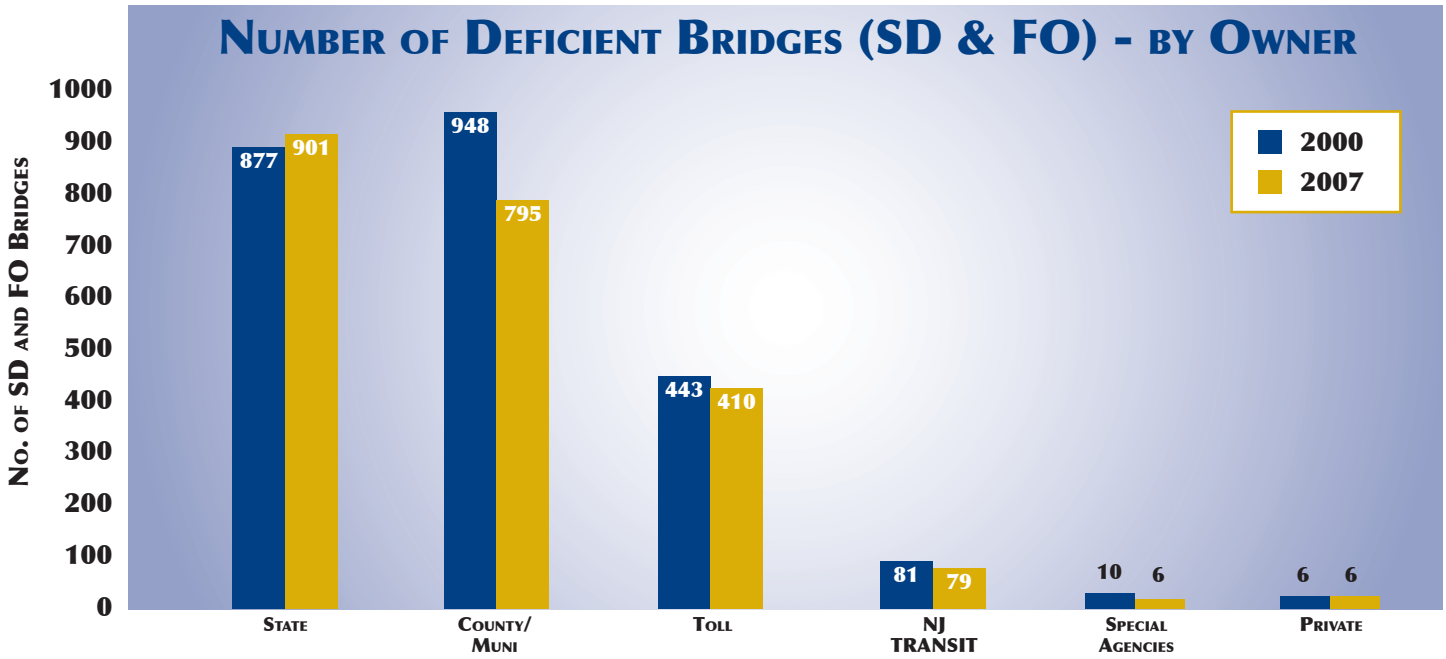


Figure 6a

Of all the bridges in New Jersey, Figure 6b (below) depicts the total square foot deck areas of bridges that are structurally deficient and functionally obsolete showing the trend from 2000 to 2007:

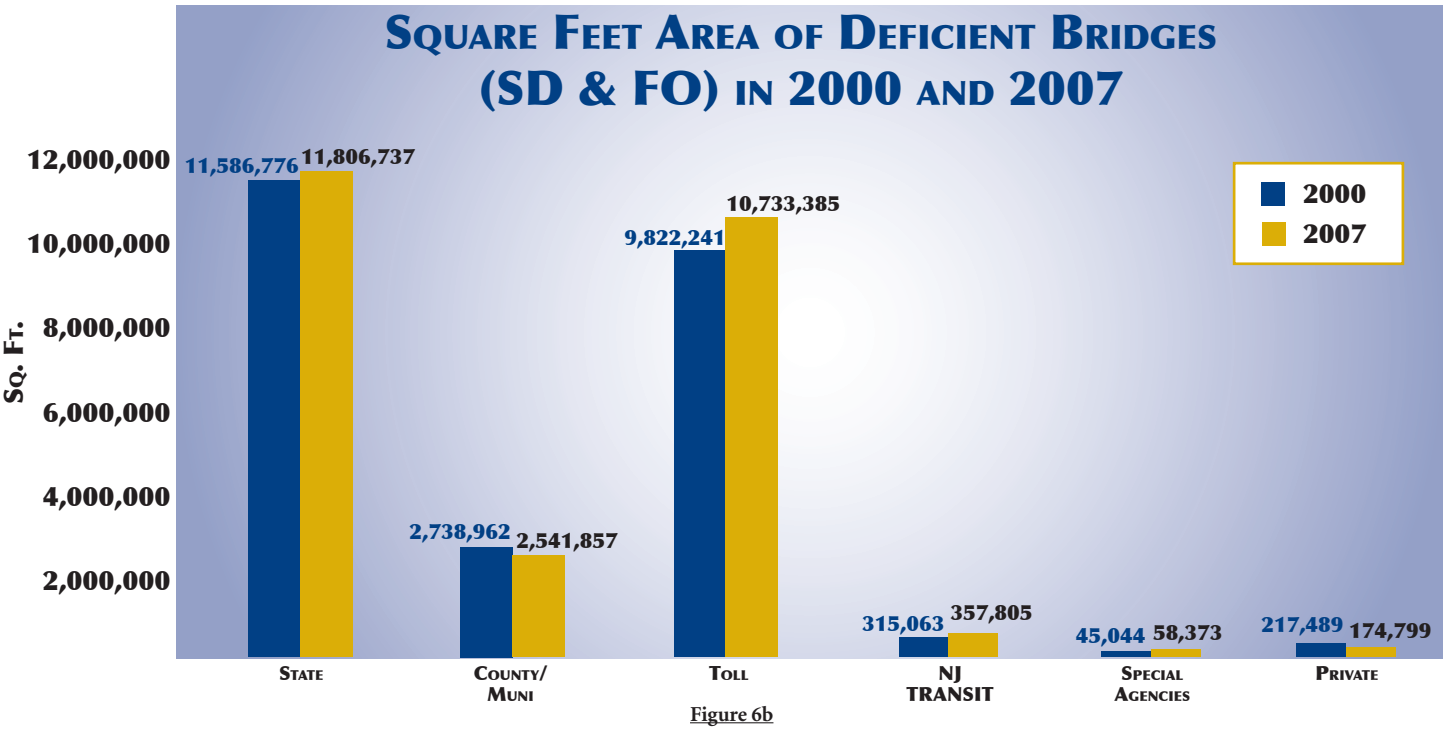


Figure 6b

As can be seen, based on the current statewide investment levels for bridges the overall condition of bridges will continue to decline. Of major concern is the investment levels for State-owned, Toll Authority and NJ TRANSIT bridges, as the capital resources have not kept pace with the rate of deterioration. While there has been a small overall improvement in county owned bridges, there is still a great variation between individual counties, and the condition of some county bridges continue to show a significant decline.

IV. Bridge Capital Investment Needs

The current bridge needs identified to eliminate the structurally deficient and functionally obsolete highway carrying bridges for the various bridge owners is shown in the following chart:

Bridge Owner	Bridge Needs Backlog ($ M)
State (includes Orphan & DEP bridges)	$ 7,824
County/Municipal	$ 1,583
Toll Authorities	$ 3,850
NJ TRANSIT	$ 176
Special Agencies	$ 7
Private	$ 140
Total Needs	**$ 13,580**

While it is difficult to accurately predict the future condition and deterioration of each of the other owner's bridges at this time, it is reasonable to assume that a proportional future investment will be required for each of these categories.

Tables showing the bridge needs by category of bridge owner follow:

STATE	To Eliminate Structurally Deficient & Func. Obs. ($ M)
NJDOT	$ 7,661
Orphan	$ 160
DEP Parks	$ 3
NJ TRANSIT*	$ 176
Total	**$ 8,000**

***Does not include costs for the NJ TRANSIT owned railroad carrying structures.**

COUNTY/MUNICIPAL	To Eliminate Structurally Deficient & Func. Obs.($ M)
Atlantic County	$ 84
Bergen County	$ 67
Burlington County	$ 88
Camden County	$ 14
Cape May County	$ 65
Cumberland County	$ 4
Essex County	$ 100
Gloucester County	$ 31
Hudson County	$ 188
Hunterdon County	$ 74
Mercer County	$ 25
Middlesex County	$ 37
Monmouth County	$ 278
Morris County	$ 108
Ocean County	$ 5
Passaic County	$ 97
Salem County	$ 54
Somerset County	$ 85
Sussex County	$ 123
Union County	$ 28
Warren County	$ 29
Total	**$ 1,583**

NOTE: The costs shown include all municipally-owned bridges in each County.

TOLL AUTHORITY	To Eliminate Structurally Deficient & Func. Obs. ($ M)
Burlington County Bridge Commission	$ 109
Delaware River & Bay Authority	$ 275*
Delaware River Joint Toll Bridge Commission	$ 446*
Cape May County Bridge Commission	$ 200
Delaware River Port Authority	$ 794*
NJ Turnpike (including GSP)	$ 1,688
Port Authority of NY and NJ	$ 312
South Jersey Transportation Authority (ACE)	$ 26
Total	**$ 3,850**

***Represents planned capital investment needs**

SPECIAL AGENCY	To Eliminate Structurally Deficient & Func. Obs. ($ M)
New Jersey Sports & Exposition Authority	$ 1.5*
Palisades Interstate Park Commission	$ 5.6
Total	**$ 7.1**

***Represents planned capital investment needs**

PRIVATE	To Eliminate Structurally Deficient & Func. Obs. ($ M)
Beesley's Point Bridge Company	$ 140.0
Margate Bridge Commission	$ 0.2
Total	**$ 140.2**

This summary identifies the anticipated investments needed to replace, repair, preserve and maintain bridges (greater than 20 feet long) for each of the counties listed. The investment needs to replace or repair any bridge that is considered to be structurally deficient or functionally obsolete, and/or the capital investment for preservation and maintenance of bridges over the next five to ten years is shown. The costs of routine maintenance activities are not included.

V. Bridge Capital Investment Analysis

Overview

While NJDOT oversees the Federal NBIS bridge inspection program for all New Jersey bridges, the operation, maintenance and overall safety of those bridges fall under the jurisdiction of the individual owner. The financial responsibility to operate and maintain those bridges also falls under the individual owner. Bridges that fall under State, County or Toll Authority jurisdiction comprise the bulk of New Jersey's bridges, and all of these entities rely on State and/or Federal funds to help support their bridge programs. The following will discuss individual investment analyses for State, County and Toll Agencies to remove bridges that are structurally deficient/functionally obsolete.

State Bridges

Included under State bridges are NJDOT owned, NJDEP owned, NJ TRANSIT owned (highway carrying bridges only) and Orphan bridges for which NJDOT is responsible. It should be noted that NJDOT currently programs replacement/ rehabilitation of NJ TRANSIT highway carrying bridges in its annual capital program

Based on past funding constraints, the cost to remove the backlog of structurally deficient/functionally obsolete state bridges has reached approximately $8 billion.

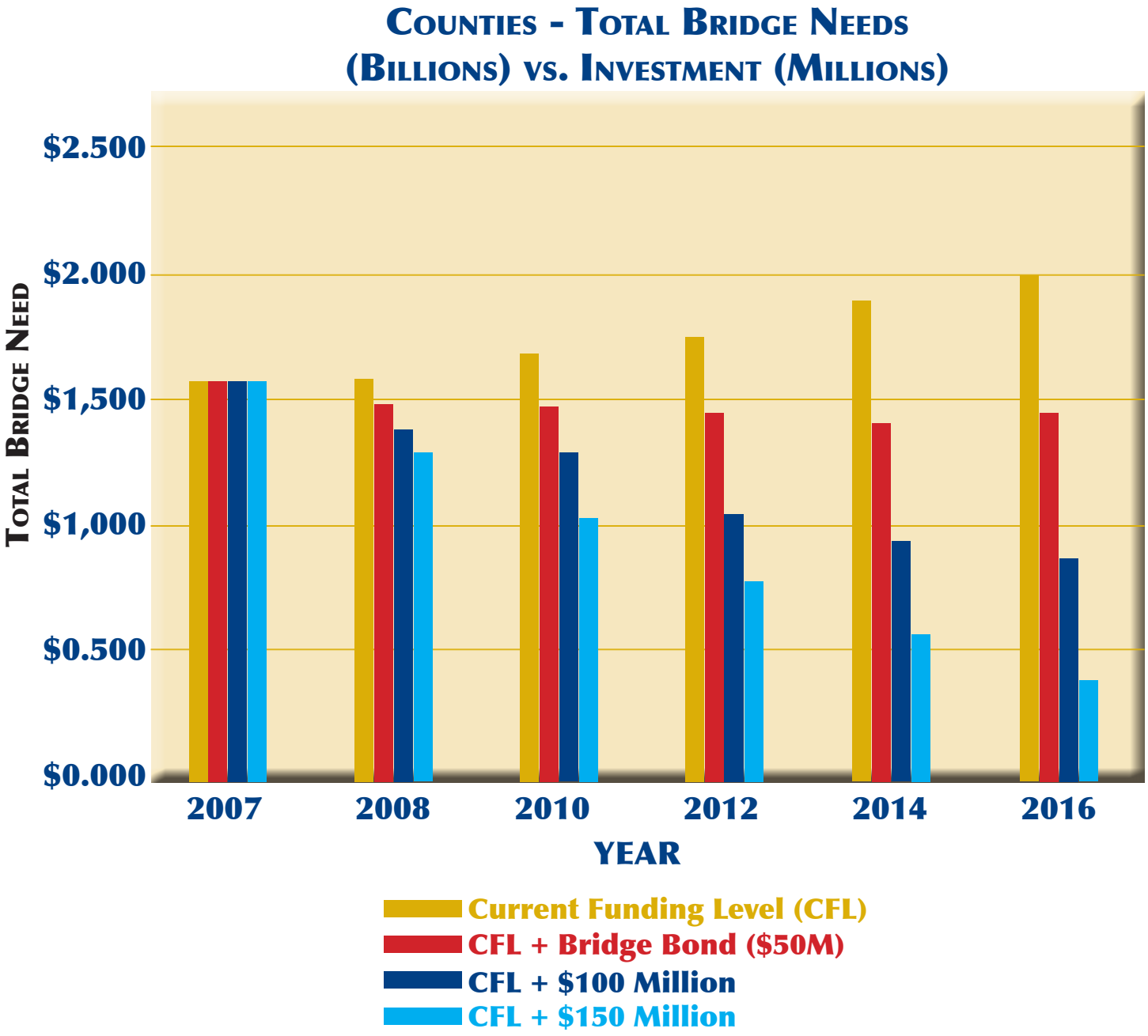
The Fiscal Year 2008 Capital Program has increased available resources for bridges to $509 million. Of this amount, $406 million is earmarked for the State owned bridges. This amount does not even allow NJDOT to keep pace with the current rate of deterioration. In order to substantially reduce the current backlog over the next 10 years and to considerably limit other bridges from becoming structurally deficient, the funding must be increased from $509 million to $800 million annually.

Obviously, this number is staggering and perhaps unattainable based on the State's fiscal constraints. Another challenge NJDOT and the Toll Authorities are faced with is High Cost Bridges like the Whitpenn Bridge and the Pulaski Skyway; rehabilitation or replacement of these structures range from $100 million to over a billion dollars per project.

Therefore, it is recommended that the State prioritize its investments in an effort to eliminate the backlog of structurally deficient bridges in order to prevent bridge collapse. Functional obsolesce is important but a bridge's structural integrity determines whether it stands or falls. Also, the Department can focus its efforts to limiting other bridges from becoming structurally deficient to the maximum extent possible. To that end, it is recommend that the State invest $659 million or $150 million more annually to substantially reduce the current backlog of structurally deficient bridges. In the event that additional resources become available, the Department can begin to address functionally obsolete bridges as well.

County owned Bridges

Local governments own 2,557 bridges, of which 795 are structurally deficient and functionally obsolete. NJDOT allocates through the Transportation Trust Fund and federal transportation programs approximately $85 million annually to local governments for bridge repair and/or replacement. In addition, Counties have an unexpended balance of approximately $63 million from the 1999 Bridge Bond Act that can be used for structurally deficient bridges under their jurisdiction. The current backlog to remove structurally deficient/functionally obsolete bridges on the county/local level is estimated to be $1.6 billion. It is recommended that local governments prioritize funding to substantially reduce the current back log of structurally deficient bridges in the first instance. Doing so would require funding to local governments be increased by $25 million annually, or $1.1 billion over ten years.



Toll Authority Bridges

Toll Authority bridges consist of the following authorities and commissions, which collect toll revenues to support operation and maintenance of their facilities.

- Burlington County Bridge Commission
- Cape May County Bridge Commission
- Delaware River & Bay Authority
- Delaware River Joint Toll Bridge Commission
- Delaware River Port Authority
- NJ Turnpike Authority (including GSP)
- Port Authority of NY and NJ
- South Jersey Transportation Authority (ACE)

Based on information supplied by the authorities, the total investment needed to eliminate the structurally deficient/functionally obsolete bridges is estimated to be $3.85 billion. Some of the authorities lack sufficient revenues to bond for their bridge repair needs. To ensure the continued safety of the bridges on these roadways, we must develop a robust capital investment analysis.

VI. Recommendations

As a result of the analysis conducted in the generation of this report, we recommend the following actions:

- Increase the State bridge funding (for NJDOT, Orphan, DEP and NJ TRANSIT bridges) to $659 million annually to substantially reduce the current backlog of structurally deficient bridges over a 10 year period.
- Increase funding to local governments by $25 million annually so that the current backlog of structurally deficient bridges are substantially reduced over a 10 year period.
- Maintain the level of funding for the bridge inspection program mandated under the National Bridge Inspection Standards and the NJDOT owned culvert inspection program.
- Initiate a program to inventory, identify jurisdiction and inspect the County/Municipally owned culverts as a NJDOT inspection program in order to provide a means to identify needs and to maintain the safety of the roads in the State.
- Continue to enhance and develop the NJDOT's Bridge Management System to provide a means to objectively and effectively manage the Department's various bridge Capital Investment Analyses.

The implementation of these recommendations will assure that the State's transportation infrastructure will continue to effectively and safely meet the economic needs of the residents of New Jersey in the future.