Genesee-Finger Lakes Regional Bridge Network Needs Assessment and Investment Strategy

prepared for

Genesee Transportation Council

prepared by

Cambridge Systematics, Inc.

GENESEE TRANSPORTATION COUNCIL

February 2015

GTC's Commitment to the Public

The Genesee Transportation Council assures that no person shall, on the grounds of race, color, national origin, disability, age, gender, or income status, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity. GTC further assures every effort will be made to ensure nondiscrimination in all of its programs and activities, whether those programs and activities are Federally funded or not.

En Español

El Consejo Genesee del Transporte asegura completa implementación del Título VI de la Ley de Derechos Civiles de 1964, que prohibe la discriminación por motivo de raza, color de piel, origen nacional, edad, género, discapacidad, o estado de ingresos, en la provisión de beneficios y servicios que sean resultado de programas y actividades que reciban asistencia financiera Federal.

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Key Findings

As in other parts of the country, the poor conditions of bridges in the region have drawn their share of attention…if not resources.

- Within the last five years, several bridges crossing the Erie Canal in Wayne County were **closed abruptly** as inspections revealed that **the structures could no longer support the current posted weight limits.**
- The right hand lanes of the Irondequoit Bay Bridge (NYS Route 104) were **closed and overweight and oversized trucks were banned for nearly six months** between October 2013 and March 2014 after a routine inspection.
- The Chili Avenue (New York State Route 33A) bridge over the Erie Canal connecting the City of Rochester and the Town of Gates was **closed temporarily on May 6, 2014 for emergency repairs** due to issues discovered while preventive maintenance was being performed; **the bridge carries over 16,000 vehicles per day.**
- **In the time it took to complete this initiative – approximately five months – seven bridges were closed or had weight restrictions put in place.**

"[The legislature is] very concerned about the aging bridge infrastructure …[and is] working to engage state stakeholders to address problems related to restriction of movement of automotive traffic, commercial truck traffic, emergency equipment and agricultural equipment."

– Orleans County Legislature, April 22, 2014

Due to the lack of adequate funding, the Genesee Transportation Council commissioned this analysis to determine the long-term consequences of underinvestment and what would be possible with adequate financial support.

Project Objectives

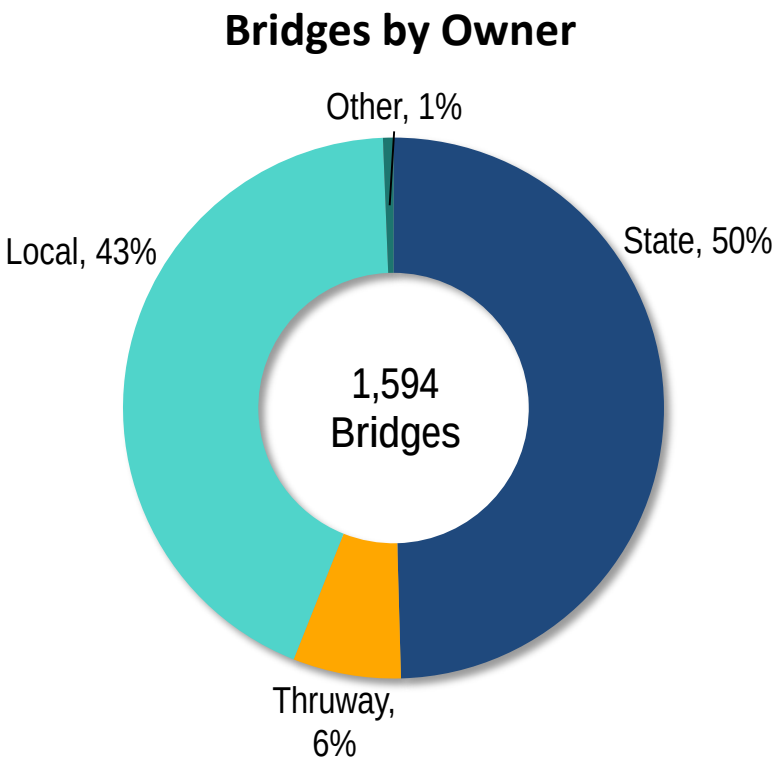
The purpose of this initiative was to develop a regional strategy and associated guidance for transportation agencies in the nine-county Genesee-Finger Lakes Region to consider when identifying requisite funding for bridge preservation and maintenance as part of their capital improvement program development activities.

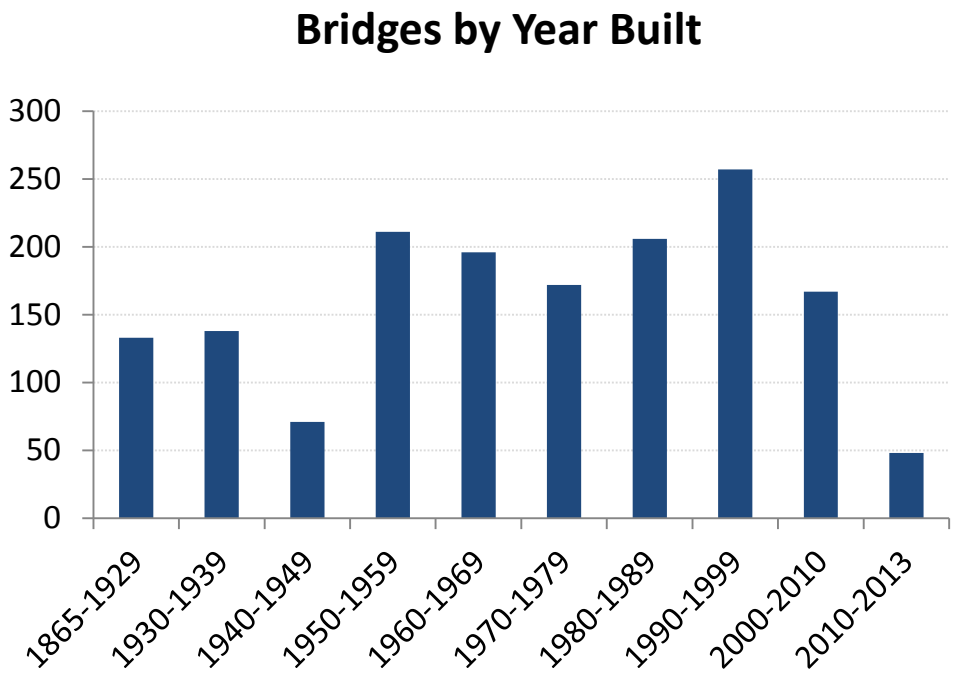
The Genesee Transportation Council (GTC) commissioned Cambridge Systematics (CS) to:

- Conduct a network level analysis to better understand how future bridge conditions (on a systemwide basis) will be affected under various levels of funding, as well as the funding necessary to meet performance targets; and
- Create two tools to support more informed investment decisions to maximize the limited revenues expected to be available.

Disclaimer: The future network condition and levels of investments presented in this document are based on judgments and assumptions using the most accurate and recent data available. Actual results may differ and findings should be used for planning purposes only with ongoing investigation and assessment necessary. The findings are not intended nor should they be construed to constitute a guarantee of any kind.

There are 1,594 bridges in the Genesee Finger Lakes Region.





Source: National Bridge Inventory (NBI), 2013. The NBI database is based on data submitted by the New York State Department of Transportation (NYSDOT) to the Federal Highway Administration (FHWA) as part of the Federally-required national bridge inspection program. The NBI database is a collection of information covering all of the nation's bridges over 20 feet in length that carry public roads, including Interstate Highways, U.S. highways, state and local roads, as well as publicly-accessible bridges on Federal lands. States are required to submit a summary analysis of the number, location, and general condition of the bridges in their states on an annual basis.

Note: The term "bridges" means all public structures that are 20 feet or longer and carry motor vehicles.

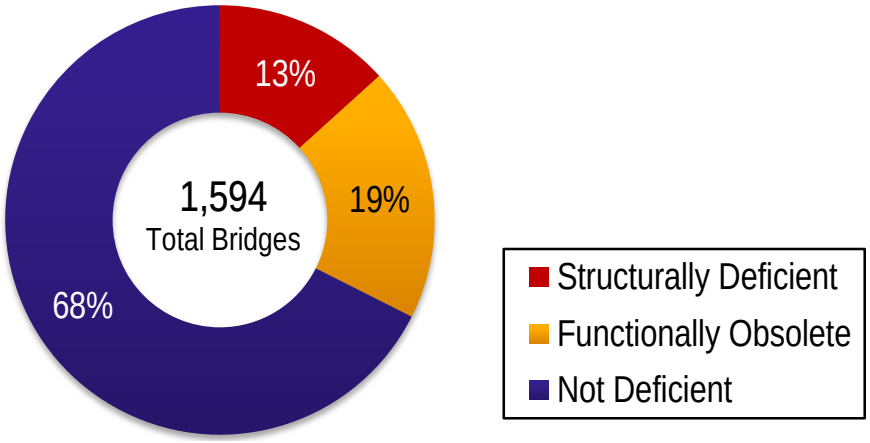
1.4 million vehicles per day travel over bridges that require significant maintenance or repair and the situation will worsen unless investment increases.

Measured in terms of users (vehicles per day):

- Structurally Deficient bridges carry 1.4 million vehicles per day.
- Functionally Obsolete bridges carry 4.3 million vehicles per day.
- Bridges that are neither Structurally Deficient nor Functionally Obsolete carry approximately 7.9 million vehicles per day.

Measured in terms of assets (individual bridges):

- Approximately one-third of the region's bridges are Structurally Deficient or Functionally Obsolete.



Per Federal Standards, bridge condition is assessed in these terms:

Structurally Deficient. Describes the condition of a bridge and its elements at the point when the bridge requires significant maintenance and repairs to remain in service. The classification of a bridge as "Structurally Deficient" does not imply that it is unsafe for travel.

Functionally Obsolete. Describes a bridge that is no longer by design functionally adequate for its purposes (for example due to lack of compliance with current bridge design standards such as lane widths, shoulder widths, vertical/horizontal clearances), although the bridge is structurally sound and safe for all vehicles.

Three future scenarios were analyzed based on varying levels of investment: Maintain Existing Conditions, Achieve a State of Good Repair, and Manage Declining Assets.

- Maintain Existing Conditions. The objective of this scenario is to calculate the funding level needed to maintain the existing network condition in the most cost-effective manner. This should not be interpreted as implying that stakeholders in the Region are satisfied with the existing conditions.
- Achieve a State of Good Repair. The objective of this scenario is to calculate the funding needed to achieve the maximum performance level at which maintenance needs are cost-effectively addressed as intended in a bridge's life-cycle. Economic optimization analyses determine the maximum performance level relative to life-cycle costs to users and transportation agencies (i.e., benefit-cost ratio greater than 1).
- Manage Declining Assets. The objective of this scenario is to calculate the maximum performance level that could be achieved based on the funding expected to be available for bridge investment in the Region. The average annual investment level projected in the Region from 2014 through 2017 from Federal, state, and local funds is $37 million (in 2014 dollars). For this scenario, it is assumed that this level of investment will remain flat in the future (i.e., will not keep up with projected rates of inflation for materials and labor).

Future bridge network conditions were forecasted using the National Bridge Investment Analysis System (NBIAS) and the Pontis tool.

NBIAS, developed by Cambridge Systematics, Inc. and others for the Federal Highway Administration (FHWA); and Pontis, developed by Cambridge Systematics and others for the American Association of State Highway and Transportation Officials (AASHTO), are tools designed to calculate cost-effective maintenance costs by generating an optimal set of preservation actions for bridge elements based on life-cycle user and agency costs, and engineering standards that are used to determine bridge maintenance needs.

In this analysis, NBIAS was used to forecast future bridge conditions and Pontis was used to forecast conditions of culverts over 20 feet in length.

Future deficiencies were evaluated from the perspectives of both customers and the agencies responsible for ensuring bridges are safe and well-maintained.

A total of eight measures were selected to evaluate the future performance and associated funding needs of the Regional bridge network.

Performance Measures

- Number of regional bridges that are not classified as Structurally Deficient or Functionally Obsolete.
- Number of regional bridges that are not classified as Structurally Deficient.
- Number of state bridges that are not classified as Structurally Deficient or Functionally Obsolete.
- Number of local bridges that are not classified as Structurally Deficient or Functionally Obsolete.
- Percent of regional Average Annual Daily Traffic (AADT) on bridges that are not classified as Structurally Deficient or Functionally Obsolete.
- Percent of regional AADT on bridges that are not classified as Structurally Deficient.
- Percent of regional truck AADT on bridges that are not classified as Structurally Deficient or Functionally Obsolete.
- Percent of total deck area of bridges on the National Highway System that are not classified as Structurally Deficient (forthcoming federal requirement).

To achieve a State of Good Repair in 10 years (by 2025), the Region would need to double its current investment in bridges.

$75 million *(2014 dollars)*

To achieve a State of Good Repair by 2025.

$31 million *(2014 dollars)*

To maintain current number of bridges that are neither Structurally Deficient nor Functionally Obsolete through 2025.

$22 to $24 million *(2014 dollars)*

To maintain the current level of regional traffic crossing bridges that are neither Structurally Deficient nor Functionally Obsolete through 2025.

	Today		Maintain Existing Conditions	Achieve a State of Good Repair		Manage Declining Assets[1]	
Performance Measure	Current Average Investment (annual $ in millions)	Existing Condition	Invest (annual $ in millions)	Invest (annual $ in millions)	Condition	Invest (annual $ in millions)	Condition
# Regional bridges not Structurally Deficient or Functionally Obsolete	$37	1,077	$31	$75	1,210	$28	1,033
# Regional bridges not Structurally Deficient	$37	1,382	$75	$75	1,382	$28	1,254
# State bridges not Structurally Deficient or Functionally Obsolete	$27	554	$15	$55	693	$20	617
# Local bridges not Structurally Deficient or Functionally Obsolete	$10	523	$20	$20	519	$8	432
% Deck Area on NHS not Structurally Deficient		90%	$21	$30	92%		
% Regional AADT on bridges not Structurally Deficient or Functionally Obsolete	$37	58%	$22	$75	73%	$28	61%
% Regional AADT on bridges not Structurally Deficient	$37	89%	$68	$75	90%	$28	79%
% Regional truck AADT on bridges not Structurally Deficient or Functionally Obsolete	$37	61%	$24	$75	75%	$28	63%

(1) Assumes continuation of current average investment in year of expenditure dollars, equivalent as investing $28 million per year in the region today: $20 million per year in the state-owned network and $8 million in the locally owned network.

To attain a State of Good Repair, the Region would need to increase investments in bridges by 60 percent between now and 2040.

$59 million *(2014 dollars)*
To achieve a State of Good Repair by 2040.

$31 million *(2014 dollars)*
To maintain current number of bridges that are neither Structurally Deficient nor Functionally Obsolete.

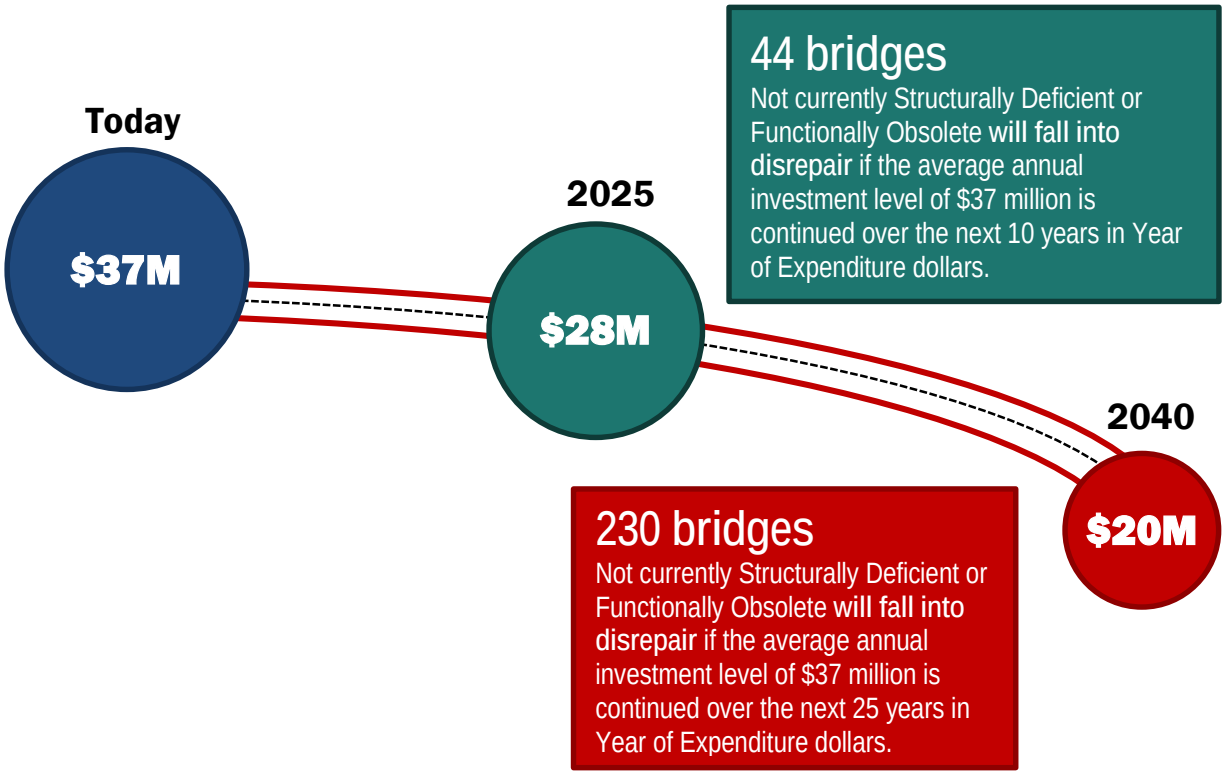
$21 to $23 million *(2014 dollars)*
To maintain the current level of regional traffic crossing bridges that are neither Structurally Deficient nor Functionally Obsolete through 2040.

	Today		Maintain Existing Conditions	Achieve a State of Good Repair		Manage Declining Assets[1]	
Performance Measure	Average Current Investment (annual $ in millions)	Existing Condition	Invest (annual $ in millions)	Invest (annual $ in millions)	Condition	Invest (annual $ in millions)	Condition
# Regional bridges not Structurally Deficient or Functionally Obsolete	$37	1,077	$31	$59	1,217	$20	847
# Regional bridges not Structurally Deficient	$37	1,382	$55	$59	1,386	$20	1,022
# State bridges not Structurally Deficient or Functionally Obsolete	$27	554	$17	$44	693	$15	503
# Local bridges not Structurally Deficient or Functionally Obsolete	$10	523	$15	$15	519	$5	359
% Deck Area on NHS not Structurally Deficient		90%	$19	$22	93%		
% Regional AADT on bridges not Structurally Deficient or Functionally Obsolete	$37	58%	$23	$59	77%	$20	54%
% Regional AADT on bridges not Structurally Deficient	$37	89%	$56	$59	90%	$20	70%
% Regional truck AADT on bridges not Structurally Deficient or Functionally Obsolete	$37	61%	$21	$59	78%	$20	59%

(1) Assumes continuation of average current investment in year of expenditure dollars, equivalent as investing $20 million today in the region, $15 million in the state-owned network, and $5 million in the locally owned network.

Inflation will impact our purchasing power if the annual investment level projected for the Region remains at $37 million in Year of Expenditure dollars.

- The annual investment level projected for the Region from 2014 through 2017 is $37 million (2014 dollars). The number of bridges not Structurally Deficient or Functionally Obsolete will drop from 1,077 today to around 1,033 in 2025 and 847 in 2040 if future annual investments remain at $37 million in Year of Expenditure dollars. Put another way, the number of bridges that will fall into disrepair will increase 44 percent from 517 today to 747 in 2040.

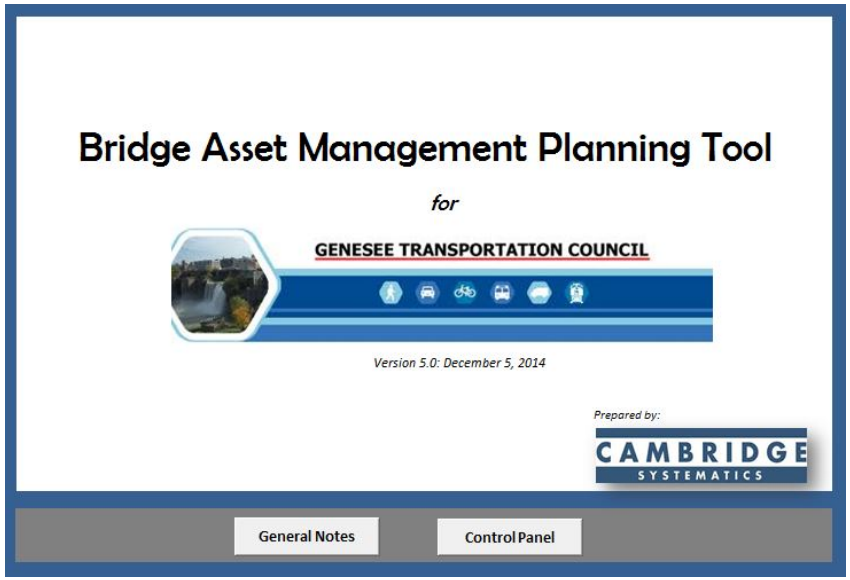


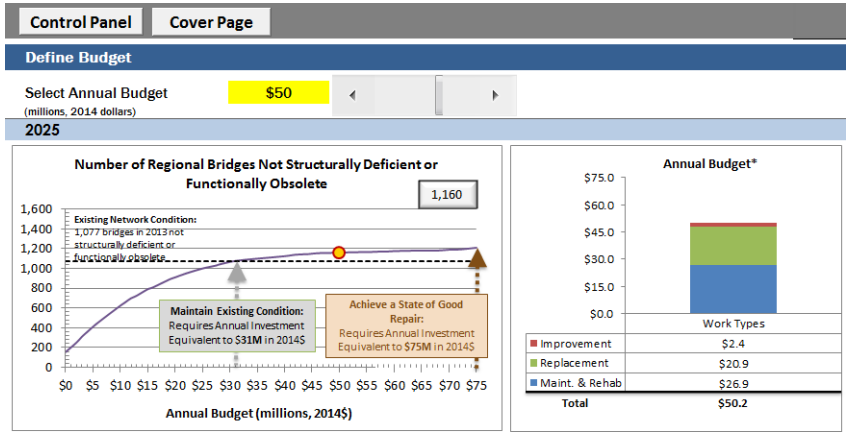
Equivalent Investment to Maintain the 2014 purchasing power of $37M			
Year	Invest (millions)	Year	Invest (millions)
2015	$38.0	2028	$53.1
2016	$39.0	2029	$54.3
2017	$40.2	2030	$55.6
2018	$41.2	2031	$56.9
2019	$42.3	2032	$58.2
2020	$43.4	2033	$59.5
2021	$44.6	2034	$60.9
2022	$45.8	2035	$62.3
2023	$47.0	2036	$63.7
2024	$48.3	2037	$65.2
2025	$49.6	2038	$66.7
2026	$50.8	2039	$68.2
2027	$51.9	2040	$69.8

(1) Assumes an annual inflation rate of 2.7 percent through 2025 and 2.3 percent thereafter through 2040. Assumptions based on New York State Department of Transportation Highway Cost Index Special Tabulations from IHS Global Insight.

A tool has been developed to identify a cost-effective balance between work types for bridges in the Region based on the amount available to be invested.

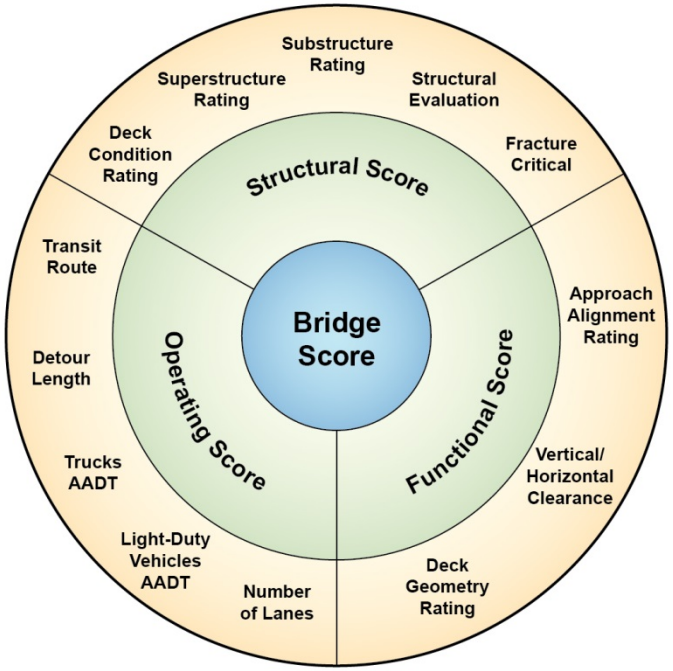
- The Bridge Asset Management Planning Tool was developed specifically for the Genesee-Finger Lakes Region to enable the Genesee Transportation Council to conduct performance-based condition assessments for two horizon years: 2025 and 2040.
- The performance-based tradeoff tool allows users to assess the system preservation needs of four different networks:
  - The region as a whole;
  - State-owned bridges;
  - Locally owned bridges; and
  - The National Highway System (NHS).
- The tool recommends how much funding should be allocated to various work types – Maintenance and Rehabilitation, Improvements, and Replacements – to maximize return on investment.
  - Work types selected by NBIAS based on long-term economic optimization models (Benefit/Cost considerations) and using New York State specific improvement costs.
- The tool uses the most recent inventory and condition data from the National Bridge Inventory.





A tool has been developed to create customized rankings of bridges and identify potential candidates for decommissioning if investment levels are not adequate to address future bridge preservation needs.

- The Bridge Prioritization Screening Tool was developed specifically for the Genesee-Finger Lakes Region to enable the Genesee Transportation Council to prioritize bridges based on various factors and provide the necessary data to assess if traffic currently using multiple bridges in close proximity to each other could be served by a single bridge if funding is insufficient to safely maintain all of the bridges currently in service.
- What does it do?
  - Rank bridges based on user-defined criteria. Bridges are scored on a scale from 0 to 100 and ranked in ascending order from the lowest numerical score to the highest. The higher the score, the more the bridge responds to the user-defined weighting of key factors such as number of vehicles carried, existing structural condition, ability to meet current geometric design standards, and whether transit vehicles use the bridge as part of their route, among others.
  - Identify bridges that could be candidates for decommissioning and specific bridges to which their traffic could be diverted. One or more bridges in close proximity to each other may need to be considered as a candidate for strategic divestment if investment in bridges drop below the level needed to maintain the current number of structures. This function of the tool provides the ability to determine if a nearby bridge could serve the needs of one or more of the bridges being considered for decommissioning, be maintained or repaired in a more cost-effective manner, and ensure connectivity across the network. Additional analysis to determine if a bridge serves a major employer, emergency management facility, or other critical civic function should be conducted as well.



Although we are making the right investments, immediate action is needed.

Insufficient funding has consequences:

- Currently, one out of three bridges in the Region is either Structurally Deficient (i.e., has elements that are in poor condition that require repair) or is Functionally Obsolete (i.e., does not meet current design standards) and the overall condition of bridges in the Region is expected to worsen as the projected investment level is unable to keep pace with future needs.
- To attain a State of Good Repair, the Region would need to increase investments in bridges by 100 percent between now and 2025 or 60 percent between now and 2040.

We're making the right investments with what we have:

- Emphasis on asset management and performance-based, data-driven capital programming has maximized our returns on investment.
- Currently, only 10 percent of traffic – both passenger and freight – travels on bridges that have elements that are in poor condition.

We need to take immediate action:

- The number of bridges that either have elements that are in poor condition or do not meet current design standards will increase 44 percent by 2040 if we don't maintain the purchasing power of our current funding level (i.e., don't increase investment to keep up with inflation).
- A robust Federal transportation program with sufficient funding and programmatic flexibility that allows the region to select bridges using its performance-based, data-driven capital programming process is needed.

Structurally-sound bridges that meet current design standards are absolutely critical to providing a safe, efficient, and reliable transportation system that supports economic development and quality of life for all.

Appendix:
Performance Curves

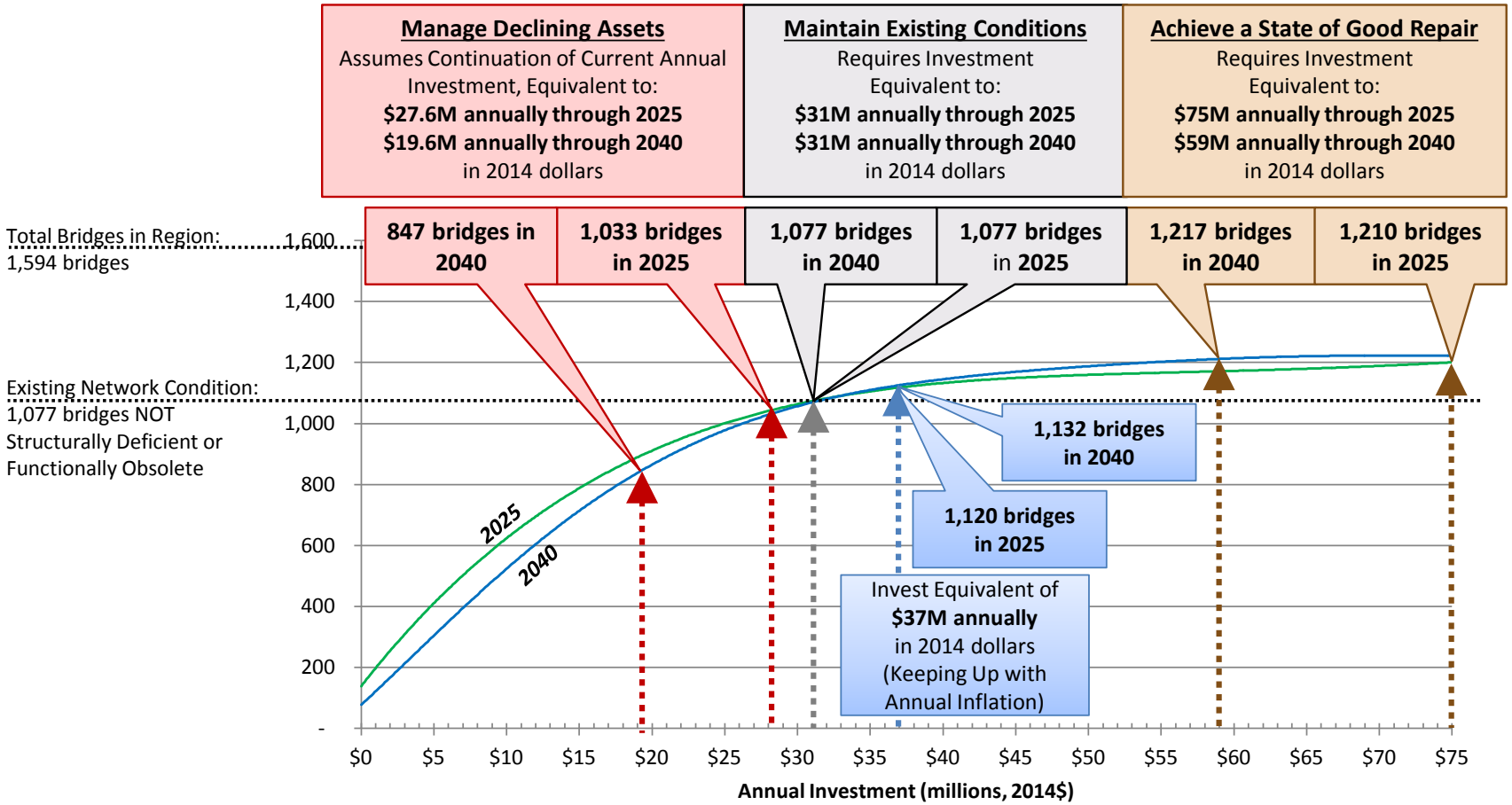
How to read the performance curves.

The performance curves in this section tie performance (vertical or Y-axis) to annual investment level (horizontal or X-axis). The 2025 and 2040 curves, represented by green and blue lines, respectively, represent the results at the end of each horizon year. Each graph has two dotted horizontal lines. The lower one depicts the existing network condition and the higher one depicts the total number of bridges in the region.

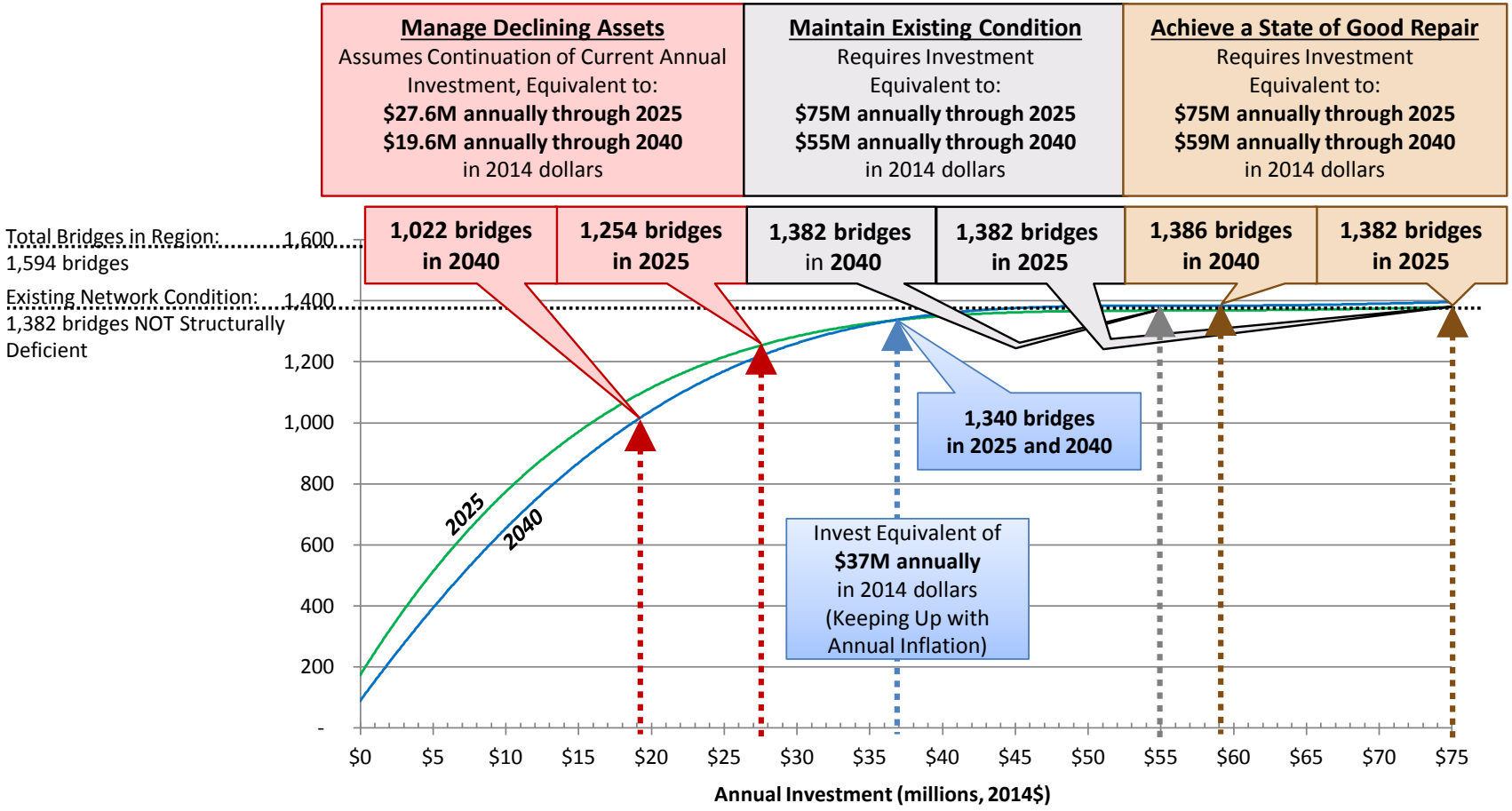
The figure below shows the performance curve of the projected number of the bridges that will not be Structurally Deficient or Functionally Obsolete in 2025 and 2040. The Y-axis ranges from 0 to 1,594 (the total number of bridges in the region). Currently, 1,077 bridges in the region are not Structurally Deficient or Functionally Obsolete (i.e., 517 bridges are either Structurally Deficient or Functionally Obsolete). The 2025 and 2040 curves show the condition that could be achieved in 2025 and 2040 for different annual budget scenarios. Moving from left to right along the curves, the number of bridges not Structurally Deficient or Functionally Obsolete increases as higher annual budgets are committed.

Where the horizontal line that represents "Existing Network Condition" intersects with the 2025 and 2040 curves, that point indicates the annual budget level required to maintain the existing network condition. To achieve a State of Good Repair by 2040, an annual investment of $59 million through 2040 is required. To achieve the State of Good Repair by 2025, an annual investment of $75 million is required. The Manage Declining Asset arrows indicate the projected condition if the current level of investments were to be continued in year of expenditure dollars. According to the analysis, by 2040 the number of bridges not Structurally Deficient or Functionally Obsolete will drop from 1,077 today to 847.

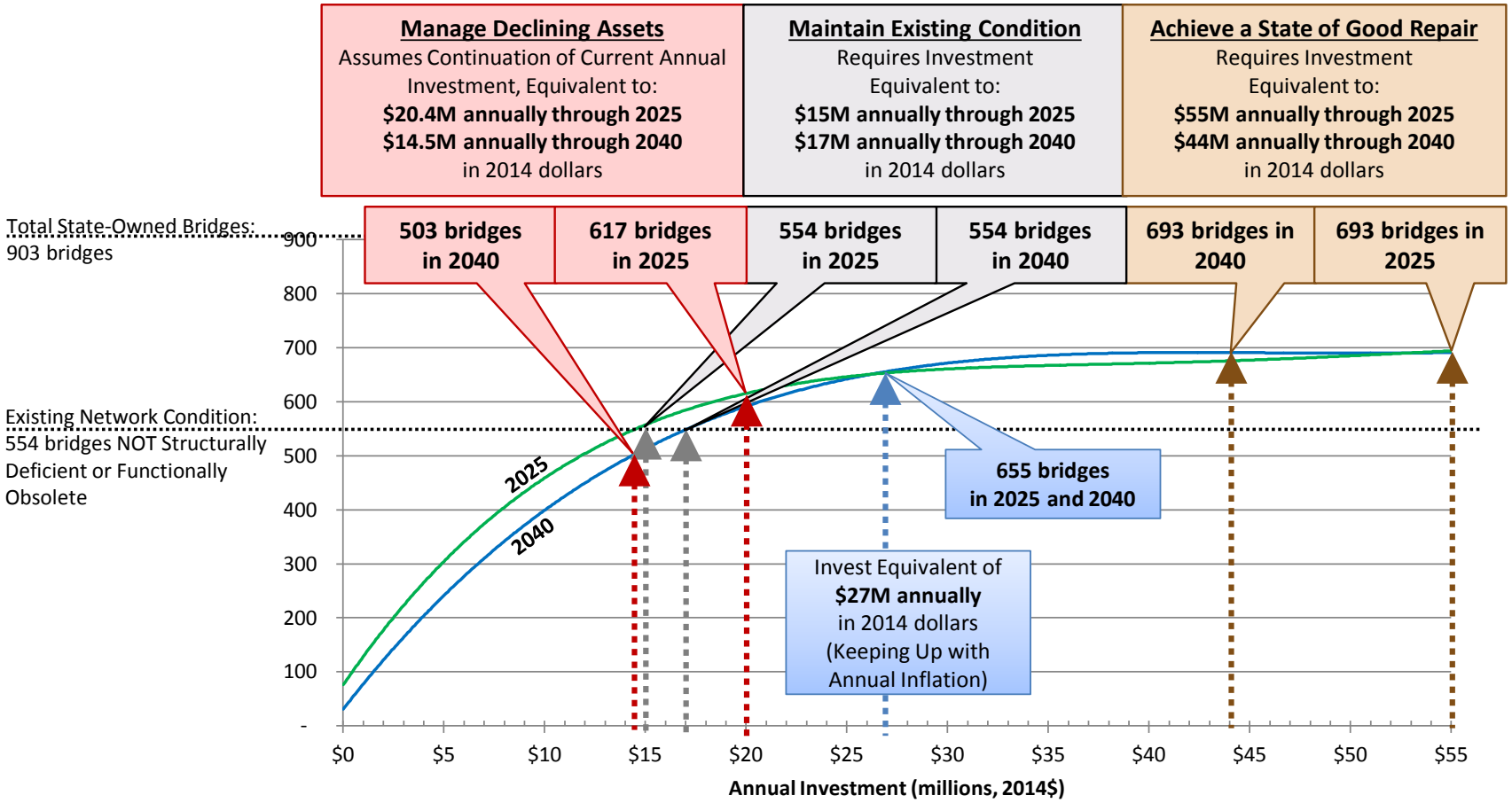
Number of regional bridges that are not classified as Structurally Deficient or Functionally Obsolete.



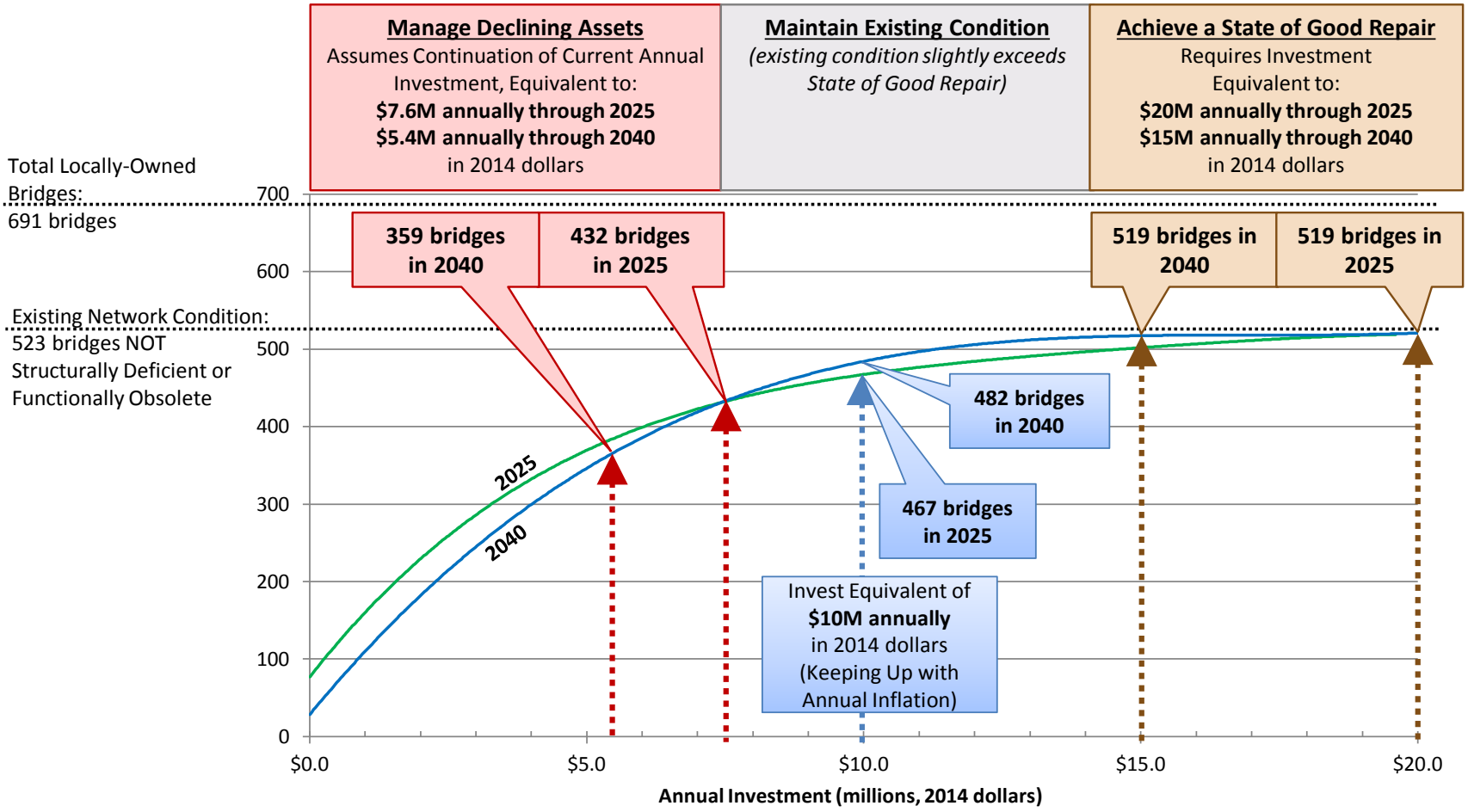
Number of regional bridges that are not classified as Structurally Deficient.



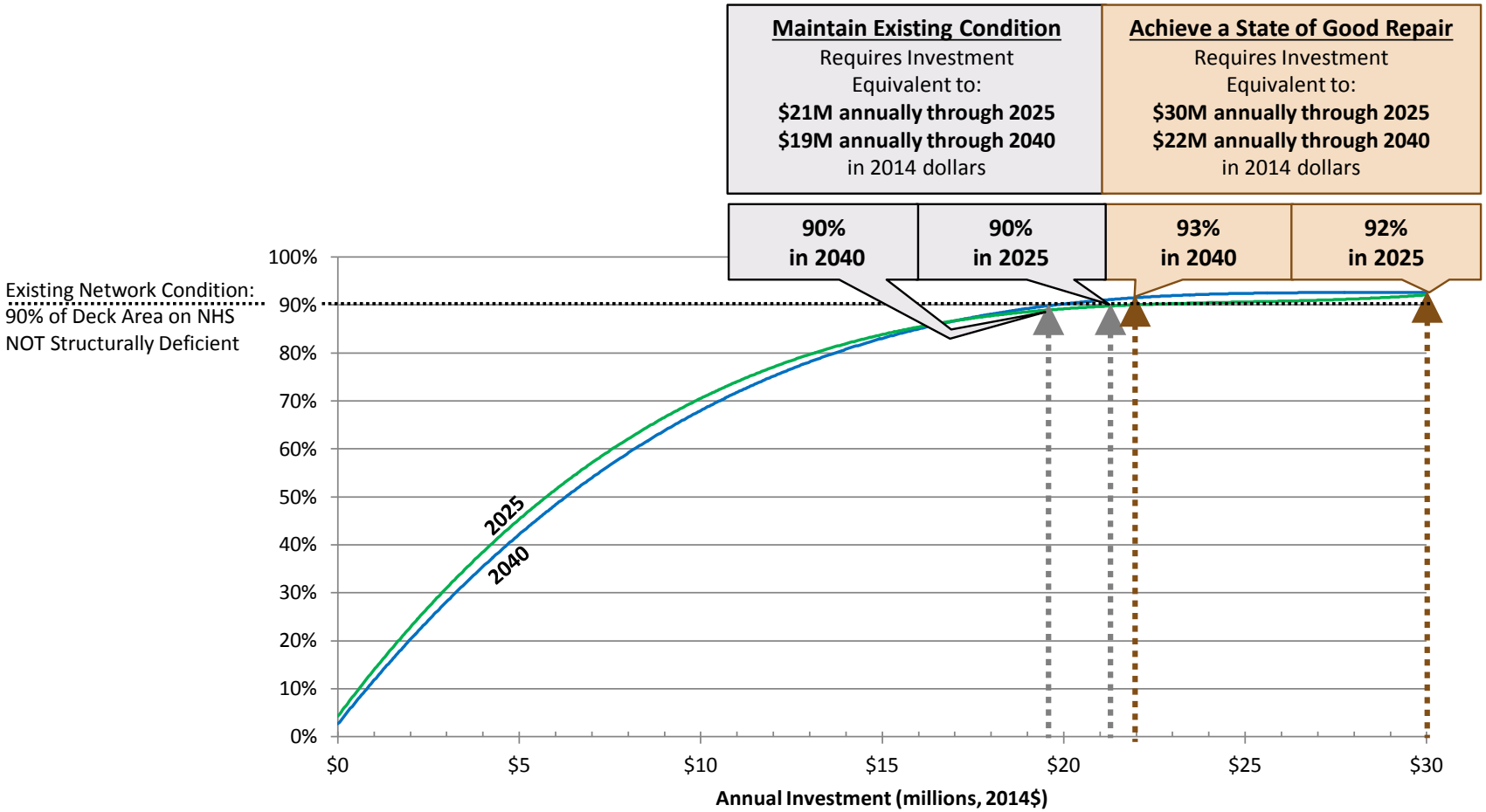
Number of state bridges that are not classified as Structurally Deficient or Functionally Obsolete.



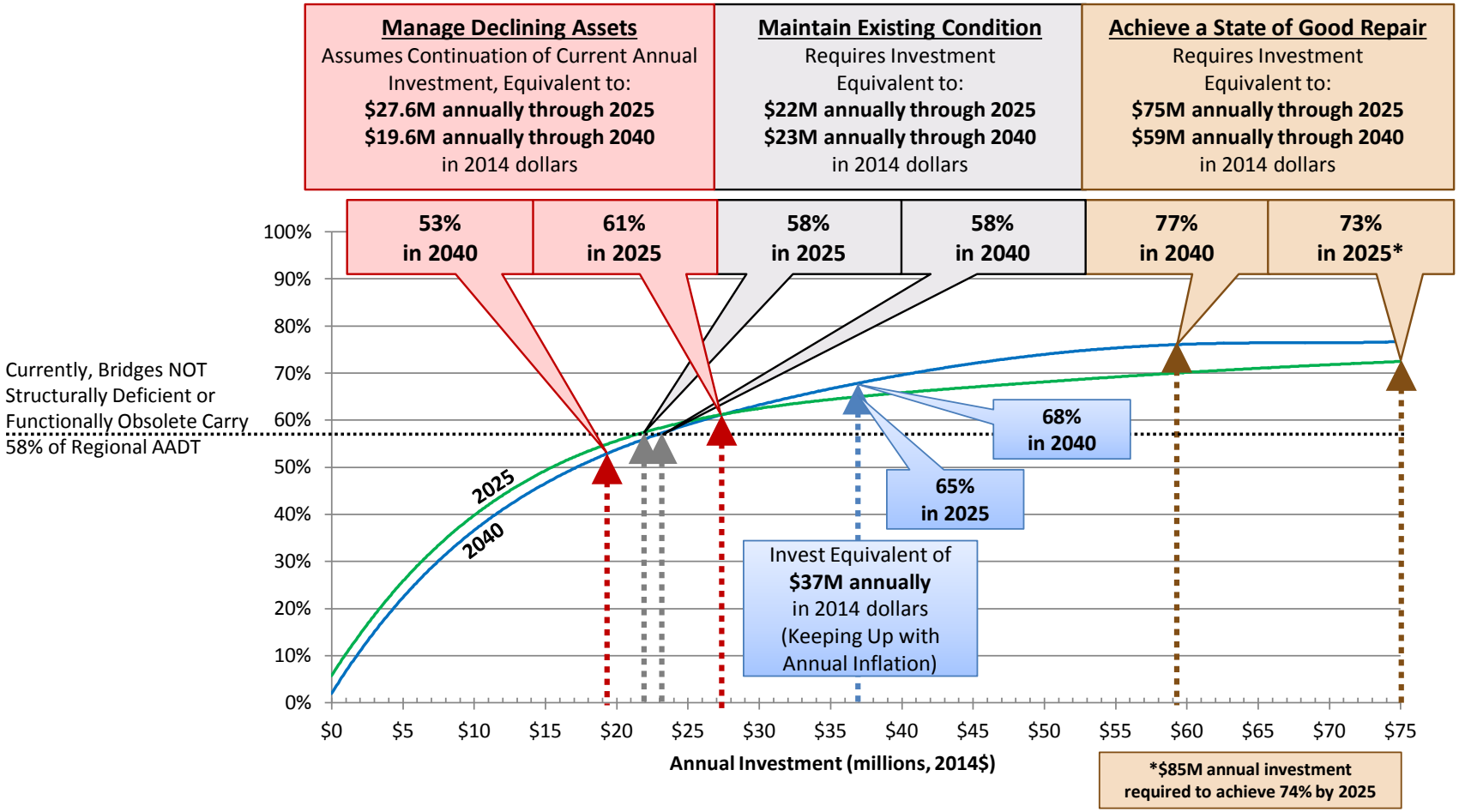
Number of local bridges that are not classified as Structurally Deficient or Functionally Obsolete.



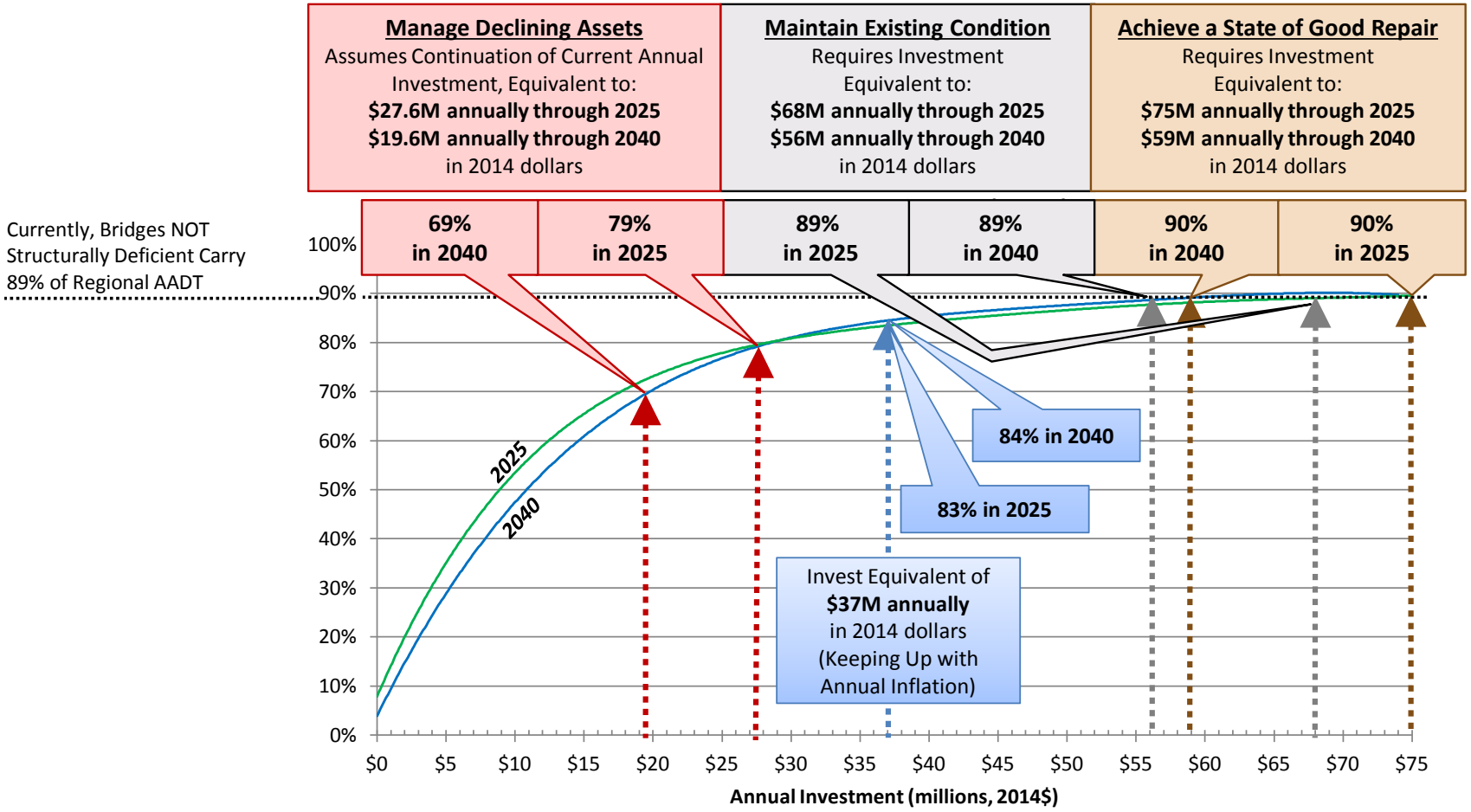
Percent of total deck area of bridges on the National Highway System that are not classified as Structurally Deficient.



Percent of regional AADT on bridges that are not classified as Structurally Deficient or Functionally Obsolete.



Percent of regional AADT on bridges that are not classified as Structurally Deficient.



Percent of regional truck AADT on bridges that are not classified as Structurally Deficient or Functionally Obsolete.