M E M O R A N D U M

To: Mayor and Council Members

From: Richard Mendoza, Director, Public Works Department

Date: February 24, 2022

Subject: State of City of Austin Bridges

The Public Works Department is pleased to provide the attached report which describes the current state of Austin's bridges along with our current maintenance and capital needs. The City of Austin has 452 major bridges including many large culverts spanning 20 feet or greater. Additionally, we have approximately 800 smaller bridges and low water crossings with spans of less than 20 feet.

The Texas Department of Transportation (TxDOT) inspects all our major bridges with spans 20 feet or greater every two years. TxDOT then forwards these bridge inspection reports to the City of Austin, Public Works Department. These reports include a Sufficiency Rating (SR) for each bridge from 0 to 100 which is an assessment of the primary bridge components and recommendations for repairs and maintenance. Public Works currently budgets approximately $1.3 million dollars annually for these repairs.

The average Sufficiency (SR) Rating for Austin's 452 rated major bridges is 83 (Very Good) on a scale from 0-100. There are currently no city bridges rated in poor or worse condition (SR <50), and only 45 bridges are in Fair (SR 50 - 59) to Satisfactory (SR 60 - 69) condition. The remaining are all rated in Good, Very Good, or Excellent condition with SRs at or above 70. Many of the lower rated bridges have recently received significant maintenance or repairs and over half of the structures in Fair condition have received at least some level of maintenance in the last 10 years. However, the following five bridges have been identified as requiring major rehabilitation or replacement, they include:

1. Redbud Trail/Emmett Shelton bridge over Lady Bird Lake
2. Barton Springs Road bridge over Barton Creek
3. Delwau Lane bridge over Boggy Creek
4. William Cannon Drive Railroad Overpass
5. Slaughter Lane Railroad Overpass

The average age of our 452 major bridges is 44 years and 29% (129) are past their anticipated design life of 50 years. These older bridges are included in our asset management plan and are currently performing well with routine maintenance and repair. However, it is important to note that with increasing age and ever-increasing traffic levels and loadings these bridges will experience an accelerated rate of deterioration to the point of needing rehabilitation or replacement. They will then need to be incorporated into our capital improvements program (CIP) at which time funding will need to be identified from capital bond programs and/or infrastructure grants.

The current $1.3M annual bridge maintenance budget is used to address maintenance and repair needs

as identified in the bi-annual TxDOT bridge inspection reports. This includes work such as surface repairs, joint seal replacement, guardrail repairs, and vegetative and debris removal. This work is currently being accomplished with a combination of in-house staff and contractors. We are anticipating this need to grow as our bridges age and are planning for a dedicated bridge maintenance crew and additional contract authority in our FY23 budget proposal.

The smaller bridges (less than 20 feet span) which total approximately 800 are an emerging issue. These are primarily pipe and box culvert construction. Public Works now has a location map of these smaller bridges and water crossings. These structures are not included in the biannual TxDOT bridge inspection program and must be inspected by the city. Public Works is currently conducting a condition assessment and inventory for these structures and the final report is expected by Summer 2022. Our department routinely collaborates with Watershed Protection Department to control over-vegetation, sedimentation, and debris build-up within these structures.

In summary, having all of Austin's major bridge structures in Fair or better condition represents a successful bridge management program. However, we must sustain our current annual bridge maintenance program and plan for future replacement and rehabilitation capital reinvestments to protect these critical infrastructure assets.

Please feel free to contact me if you have any questions or need more information on this matter.

CC: Spencer Cronk, City Manager
Gina Fiandaca, Assistant City Manager

Attachment

City of Austin
Street & Bridge Operations

State of Bridges Report
2022

Butterfly Bridge at 2nd Street over Shoal Creek

1. Introduction

The following report describes the state of bridges in the City of Austin. The report includes a brief summary of the condition and age of all bridges and also discusses the needs and funding requirements to maintain Austin's bridge inventory.

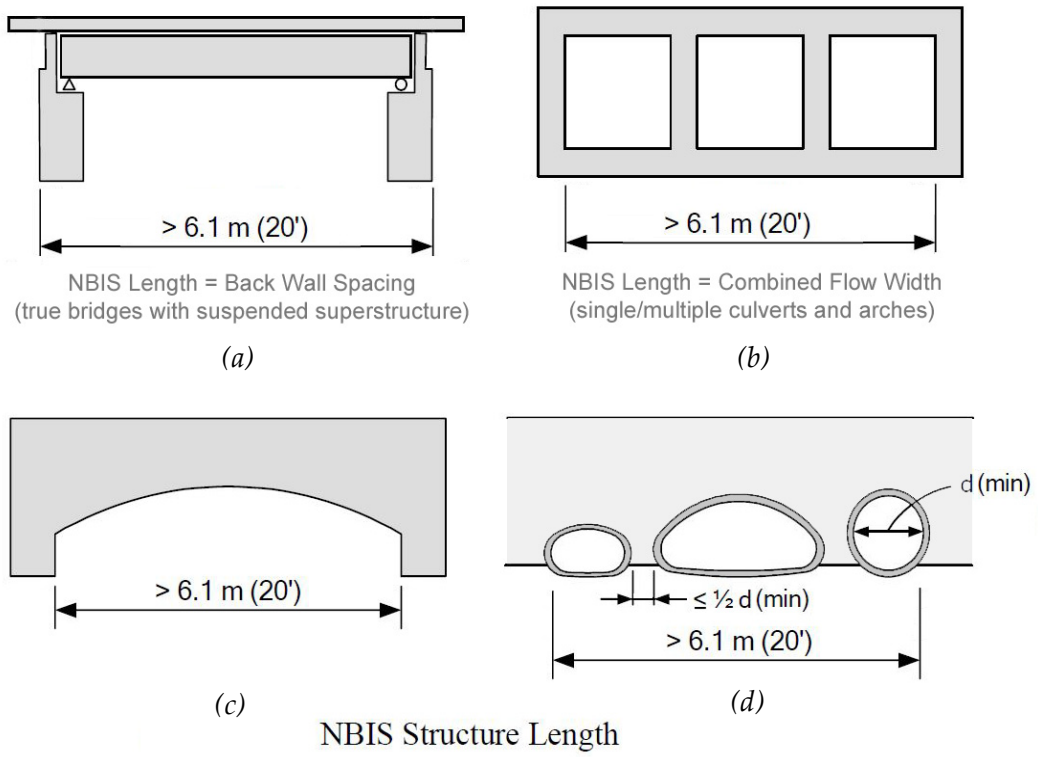
The City of Austin has 452 major bridges (including large culverts) with 20-foot span or longer. Additionally, there are about 800 more locations where water crosses the right of way under small bridges or in culverts and pipes with spans less than 20 foot.

The approximate replacement value of Austin's bridge inventory of 2.2 million square feet of bridge deck is about $2 Billion. The average Sufficiency Rating (SR) for Austin's 452 rated bridges is 83 (very good) on a scale from 0-100. This indicator represents the nationally established criteria by the Federal Highway Administration (FHWA) for the National Bridge Inspection System (NBIS) for rating and reporting bridge condition information to the Federal government. In general, Austin's bridges are in very good condition currently requiring mostly routine repairs and preventative maintenance.

The Texas Department of Transportation (TxDOT) regulated consultants inspect all bridges (with spans equal or over 20') once every two years. The digital records and data are forwarded to the City of Austin, Public Works Department, Street & Bridge Operations. These reports include the Sufficiency Rating for each bridge, assessments of the primary bridge components, and possible recommendations for repairs and maintenance.

The Sufficiency Rating (SR) as defined by NBIS is not just a simple measure of bridge safety only. This rating includes a variety of other criteria such as not meeting current standards for deck width, railing types, approach design, etc. Bridges that do not completely comply with today's more rigorous standards are technically categorized as "obsolete". A fair amount of obsolescence in structures built 40 or more years ago should be expected and may be acceptable for a while. Alternatively, a bridge with serious structural problems would be technically categorized as "deficient".

The NBIS requires all structures that are 20 feet and longer in length as defined by Figures 1(a)-(d) to be inspected at least bi-annually. A few may require more frequent inspection depending upon condition. Some structures may need special inspections such as underwater or fracture critical inspections. In Texas these inspections are all performed by highly trained and qualified TxDOT approved bridge inspectors. TxDOT gathers this federally mandated information for the entire state to assure consistency across the numerous agencies and jurisdictions involved.

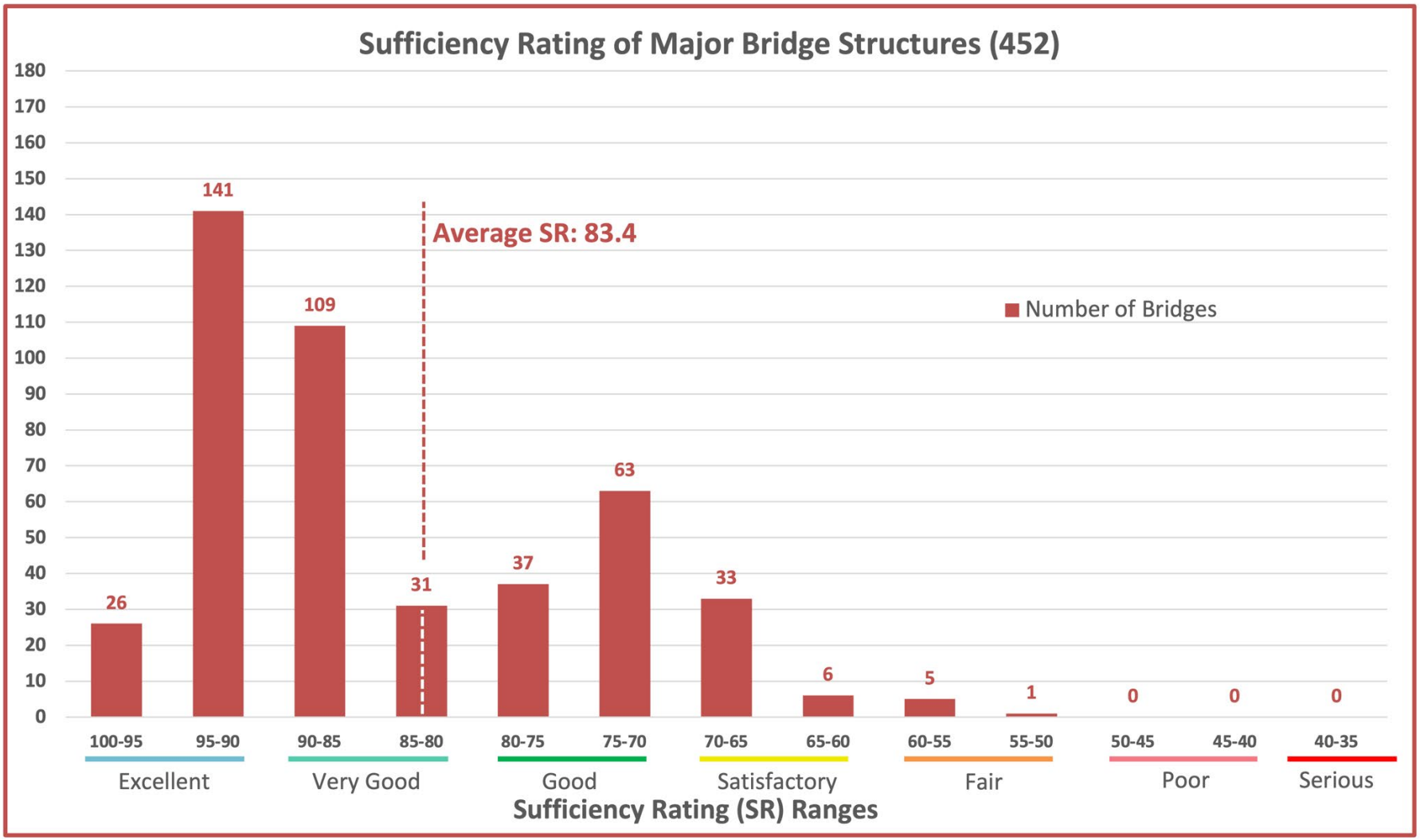


Figures 1. NBIS Bridge Structures of 20' and Greater (inspected by TxDOT)

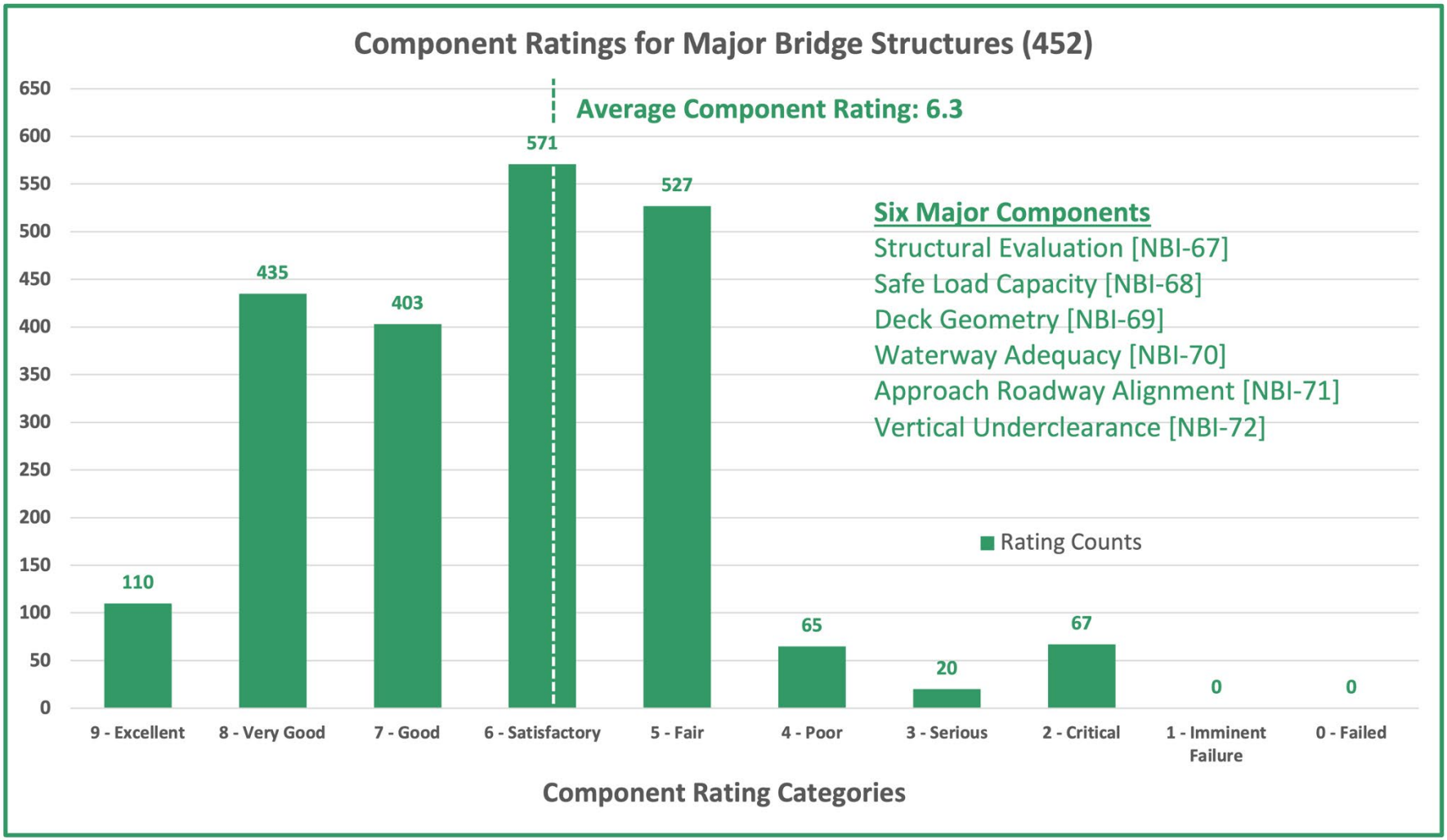
2. Condition Ratings, Age, and Functionality

Figures 2 shows the SR of all major bridges on a scale from 0-100. There are currently no bridges rated in Poor or worse condition (SR < 50), only 6 bridges in Fair condition (SR 50 - 59), and 39 bridges in Satisfactory condition (SR 60 - 69). The rest are all rated in Good, Very Good, or Excellent condition with an SR at or above 70. The average SR for Austin's 452 rated major bridges is 83 (Very Good).

Also, major bridges are evaluated in relation to the level of service using key individual components: structural evaluation, deck geometry, vertical under clearances, safe load capacity, waterway adequacy, and approach roadway alignment. Figure 3 presents the evaluation ratings on a scale of 0 to 9 for all individual components of 452 major bridges. There are 152 individual components in Critical to Poor condition (ratings of 2, 3, or 4) which require repairs and maintenance. Fortunately, all the other 2,046 individually rated components are in Fair to Excellent condition (ratings > 5). The overall average component rating for all rated items is 6.3 (Satisfactory).



Figures 2. Sufficiency Ratings (SR) of all major bridges



Figures 3. Summary of the key individual component ratings for all major bridges

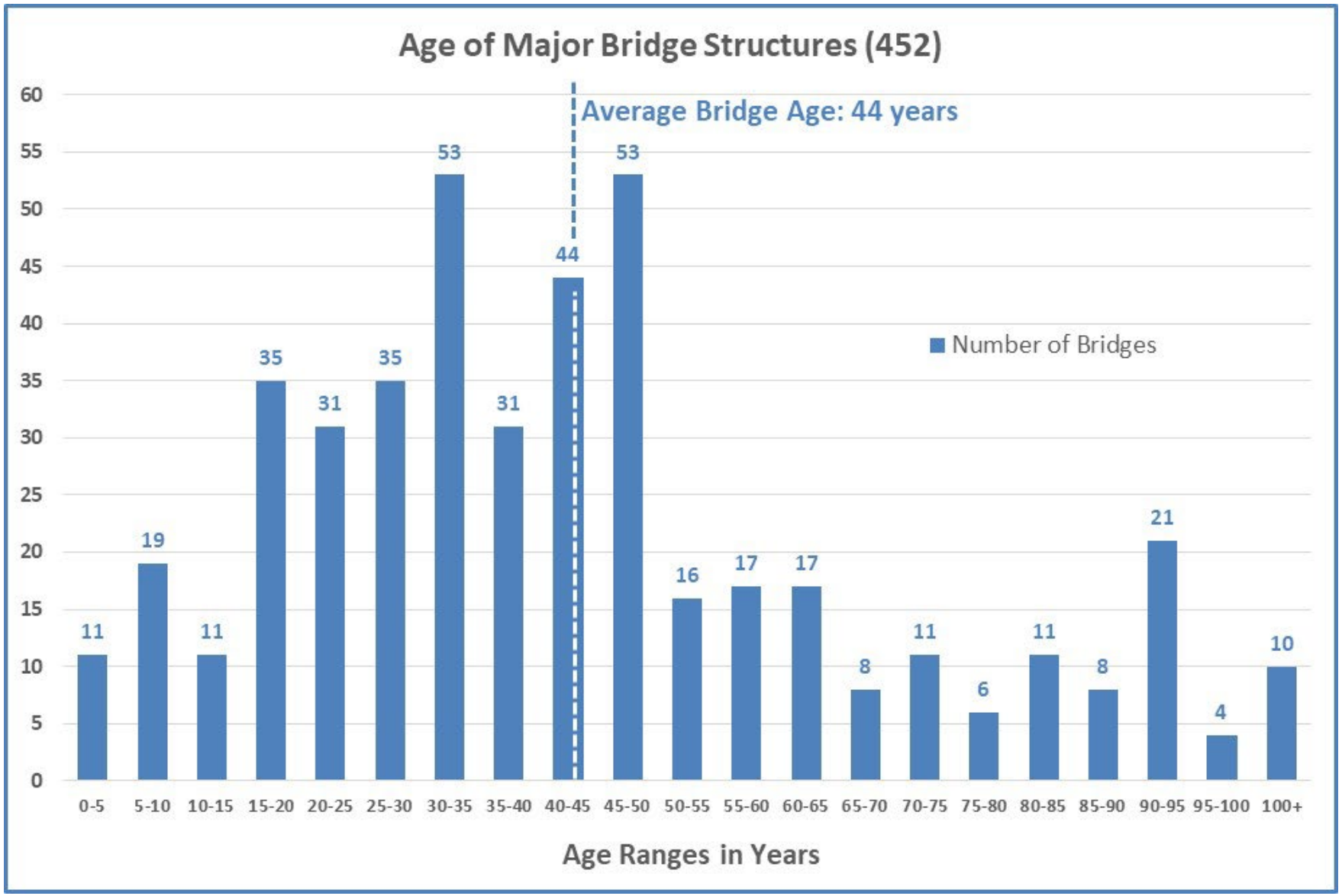
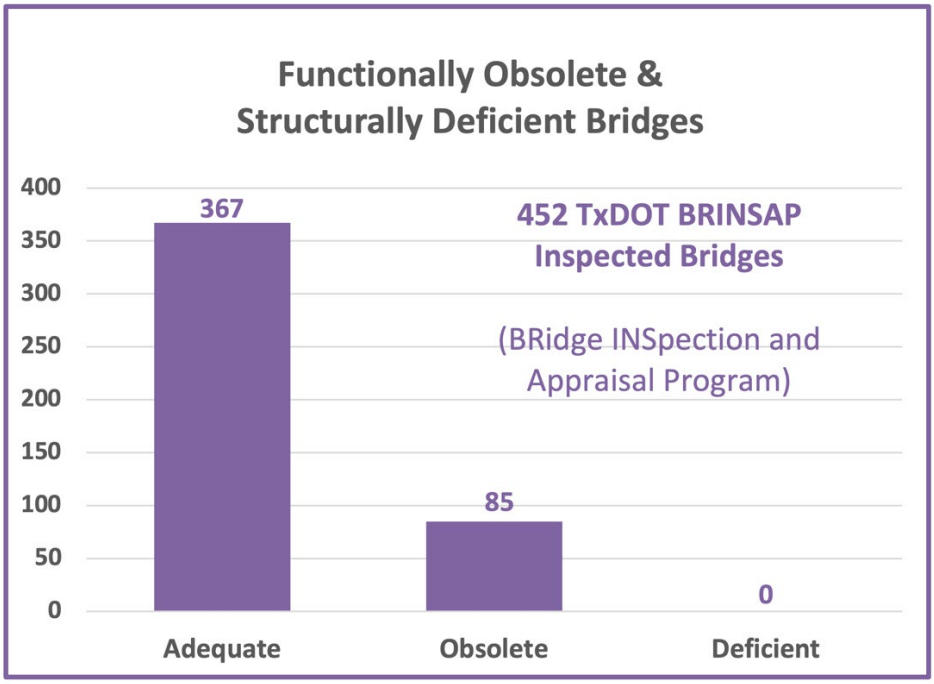

Age of Major Bridge Structures (452)
Average Bridge Age: 44 years
Number of Bridges
60
55
50
45
40
35
30
25
20
15
10
5
0
11
19
11
35
31
35
53
31
44
53
16
17
17
8
11
6
11
8
21
4
10
0-5
5-10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
80-85
85-90
90-95
95-100
100+
Age Ranges in Years

Figure 4 presents the ages for all major bridges. The average age of our major bridge inventory is 44 years old. Furthermore, 129 of these structures (29%) are past their anticipated design life of 50 years. It should be noted that there is a clear trend in the older age of our structures. Fortunately, many of them are still performing quite well, but with increasing age and ever-increasing traffic levels and loadings these bridges will experience an accelerating rate of deterioration and will soon need rehabilitation or replacement.

Another factor that comes with age is the potential for obsolescence. Bridges can be inadequate by either structural deficiency or functional obsolescence. While load-carrying capacity is evaluated for structurally deficient classification, the aspect of meeting our present-day needs based on current standards is considered for functional obsolescence. Almost a full 30% of our bridges were built 50 or more years ago and initially met much older standards and expectations for lane widths, number of lanes, shoulders, sidewalks, and railing types. As such they often have narrow or no roadway shoulders, narrow sidewalks, sidewalks on only one side, no bike lanes, and substandard railings. Figure 5 indicates that there are 85 functionally obsolete and no structurally deficient bridges.

In summary, keeping Austin's structures in good or better condition is important to protect these valuable and critical infrastructure assets. A long-term plan for funding replacement of these structures must also be considered.



3. Maintenance, Rehabilitation, and Replacement Needs

3.1 Capital Program Needs

The following section highlights the bridge structures that are in immediate need of major rehabilitation or complete replacement in the next 5 years. The map in Figure 6 shows the location of these bridges with the City Council Districts.

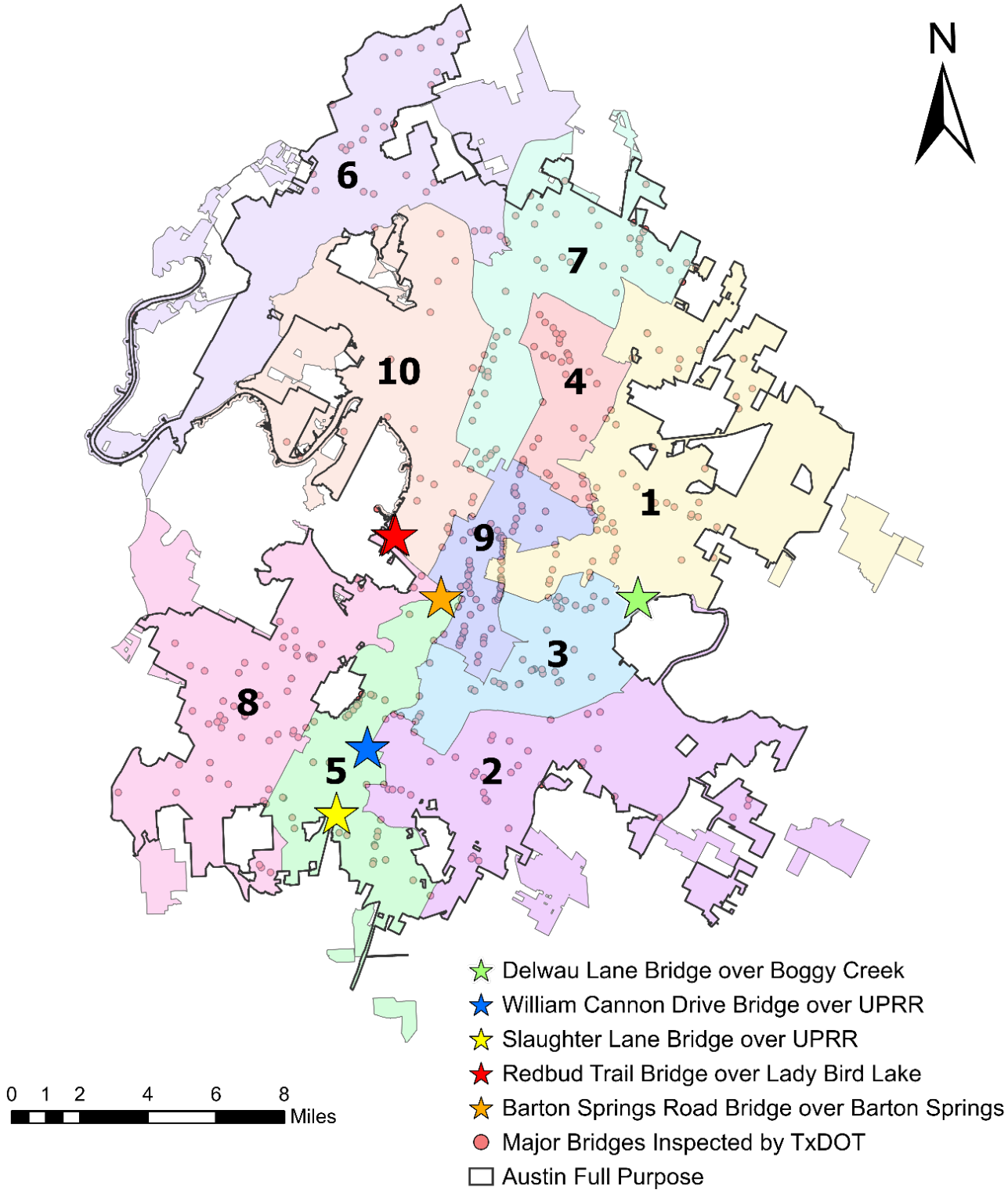
Delwau Lane Bridge over Boggy Creek – project estimate: $12M – Bridge has been damaged in a number of flood events and has repeatedly required major repairs. However, what is really needed is complete replacement with a longer span structure. The existing short span structure creates a bottle neck in the Boggy Creek flow very close to the Colorado River. A much longer span structure is required to properly address the necessary volume of water under the bridge and avoid scouring.

William Cannon Drive Bridge over UPRR – project estimate: $6M – Mechanically Stabilized Earth Walls (MSE) at both ends of the bridge are experiencing structural problems and need to be replaced. The preliminary engineering phase for the east side of the structure was completed in August 2018. The PER recommended in place rehabilitation of the MSE wall sections and provided options and preliminary cost estimates. We received additional funding to complete the design phase. Final design should be completed late Spring/early Summer 2022. However, construction funding has not been identified at this time.

Slaughter Lane Bridge over UPRR – project estimate: $6M – same problems and situation as the William Cannon Drive Bridge MSE walls above. No funding for design or construction of the Slaughter Lane Overpass has been identified yet.

Redbud Trail Bridge over Lady Bird Lake – project estimate: $54M – The two bridge structures in this location are now 74 years old and well beyond their life span. The structures need to be replaced. The preliminary engineering phase is complete and final design phase is about to begin. Funding for the design and construction phases was secured in the 2018 bond program. The 30% design is complete, and 60% design documents are due in April 2022.

Barton Springs Road Bridge over Barton Springs – project estimate: $36M – This structure is old, obsolete, and requires major rehabilitation at a minimum and potentially complete replacement. The preliminary engineering phase is underway. Additional funding for design and construction phases is needed. The Bridge Conceptual Engineering Report (BCER) will be the next major deliverable. Completion of the BCER is expected in summer 2023.



Figures 6. Major bridges in immediate need of rehabilitation or replacement

3.2 Maintenance of Major Bridges

We are very fortunate in that there are no bridges that currently have an SR rating in the poor range. All structures previously rated poor have been improved by our Capital Improvements Program, other contracted projects, or Street & Bridge Operations maintenance crews. Many of the lower rated bridges have received maintenance in our annual bridge maintenance contract, our CIP program, or are proposed for future replacement. More than half of the structures in Fair condition have received some type of maintenance in the last 10 years. In 2003 we established a steady budget for bridge maintenance from the Transportation Fund. Since then, we have steadily performed repairs and preventative maintenance on 4 to 6 bridges each year under bridge maintenance contract.

3.2.1 Bridge Management Information System

The Bridge Management Information System (BMIS) mission is to "Improve organized knowledge of the condition of our bridge system which can be used to prioritize or optimize a plan for bridges needing preventive or repair maintenance, rehabilitation, or replacement in order to keep the City of Austin's bridges in a good serviceable condition for the traveling public."

In the past the city has managed its bridge inventory through the Street and Bridge Operations district supervisors on a "repair as needed" basis. However, this method has no systematic ability to forecast future rehabilitation or replacement needs or schedule preventive maintenance which will extend the useful life of these structures. We do have detailed inspection files on each bridge with biannual ratings back to 1988. The data in these files is currently being used to manually determine maintenance priorities. However, a BMIS will allow for an efficient and optimized decision-making process. Another key benefit of having a BMIS will be to transform bridge management from a reactive mode to a proactive one. A formal BMIS database system has yet to be evaluated and implemented.

Acquiring a BMIS will greatly bolster our capability to effectively manage our structural assets. The system will allow for modeling, analysis, and planning for this aging infrastructure. Future bridge needs can then be more accurately forecast and projected for maintenance, rehabilitation, and replacement via long-term capital planning and robust annual maintenance budgeting.

3.3 Maintenance of Smaller Culvert Structures

There are about 800 smaller structures (less than 20'). These are typically pipes and smaller culverts that allow drainage water to cross under the roadway. Fortunately, these smaller structures represent a much lower risk than larger bridge structures. They are less likely to experience severe flood damage and the consequences of any failure are much lower. Historically, a relatively small Minor Bridge and Culvert capital program has been used to address the more substantial problems that occasionally occur with these smaller structures.

While we have detailed condition reports on all major structures, we now also have an inventory, locations, and inspection information on the smaller bridge, culvert, and pipe structures. Although much less critical, we will establish a routine inspection cycle for these minor structures as well. This will allow us to maintain a comprehensive inventory, condition assessment, and ratings for all our transportation structures.

Street and Bridge Operations has developed a map of all bridges and culverts where water crosses the right of way in GIS. This set of smaller bridges and drainage crossings are inspected by the city because they are not included in TxDOT inspections.

3.3.1 Shared Maintenance Responsibility

These smaller culvert crossing structures within the right of way are both part of the roadway and at the same time part of the drainage infrastructure. PWD will maintain the structural integrity of the culvert or pipe itself including headwalls, railing, and pavement. Watershed Protection Department will clean debris out the culverts to assure drainage flow and maintain vegetation control around the culvert entrance and exit areas and in drainage ditches.

3.3.2 Small Bridge & Culvert Structures – Description of Inventory Elements

Small pipes and culverts crossing the right of way have far fewer elements than typical bridge structures and are much less complicated. Minimal attributes will be required for data collection of all the simple pipe and box culverts. The following pictures of some pipe crossings show how few attributes are needed to adequately describe and characterize these simple structures.

These small structures are typically comprised of one or more buried pipes/culverts, minor safety systems (guard railing), and small entrance and exit headwalls/aprons. These structures have no decks, superstructures, substructures, or underlying channels. Conveyance of water under the roadway is entirely contained within the pipes. Also, no bridge signage, approach slabs, or any other special roadway elements are usually needed. The roadway pavement over top is typically separate and will be maintained as an integral part of the street itself. It will not be considered part of the small bridge structure – unless it has a true deck and superstructure which very few do.

Alternatively, any small structures that are true bridges having suspended decks and superstructures spanning from abutments or end walls will be inspected and rated in more detail similar to the larger bridges over 20 feet in length; however, due to lower risk and criticality this will only be on a five-year cycle.

3.3.3 Examples of Typical Small Culverts

Small culverts have an opening less than 20 feet along the center of the roadway. These structures are not inspected by TxDOT and reported to the National Bridge Inventory System (NBIS). Figures 7 and 8 show the examples of typical box culverts and smaller pipe culvert crossing structures.

(a) Small Box Culvert Structures

(these are not inspected by TxDOT as NBIS bridges)

(b) Large Box Culvert Structures

Figure 7. Typical box culverts

(a) Standard Pipe Culvert Crossing in Good Condition
Small multi-pipe crossing with headwalls, guardrailing, and SETs. Abrupt roadway edge drop-off condition, although relatively shallow, warrants guardrailing protection.

(b) Non-Standard Multi-pipe Culvert Crossing – Needs Maintenance
Small, extended multi-pipe crossing with no roadway elements at all. Pipe ends are far outside the roadway clear zone. Shallow bury, small diameter pipes only create a shallow edge drop-off which does not cause a concern for the roadway.

(c) Non-Standard Pipe Culvert Crossing – Needs Improvement
Small single pipe crossing with no roadway elements at all. Pipe end is within the roadway clear zone and should probably be protected or the slope extended and improved. Deeper small diameter pipe creates an edge drop-off which may cause a concern for the roadway.

Figure 8. Typical smaller pipe culvert crossing structures

3.4 Pedestrian Bridges

In addition to the above list, Public Works is also responsible for maintaining pedestrian bridges as well as those that are part of the Mobility Trails. Examples of pedestrian bridges are presented in Figure 9.

The following lists show those pedestrian structures that are in immediate need of major rehabilitation or replacement:

- Barton Parkway
- Landon Lane at Lee Elementary
- Bethune Avenue
- 2 bridges on Johnson Creek Mobility Trail
- Sparks and 31st

Replacing a pedestrian bridge can range from $400,000 to $1,000,000, depending on span length and foundation depth.

(a) Pedestrian Bridge in Good Condition
A prefabricated steel truss frame with a concrete deck located in the J.J. Seabrook Greenbelt Trail. Replacement was completed in 2015.

(b) Pedestrian Bridge in Poor Condition
A steel truss frame with wooden planks between Sparks Avenue and 31st Street at Waller creek. Rock retaining wall was damaged due to flood events. Steel plank supports and trusses were rusted.

Figure 9. Pedestrian bridges

3.5 Other Non-Bridge Structures

In addition to bridge structures, Public Works is also responsible for maintenance of retaining walls, guardrails, railings, and embankments next to roadways and trails. There are currently identified needs for major maintenance to Shoal Creek Trail as well locations along roadways like Hart Street. The newly built trails like The Boardwalk and Southern Walnut Creek Trails include over a mile of elevated structures as well as multiple pedestrian bridges in each system that will require additional funding for maintenance and repairs. Lighting requirements and regular maintenance adds to the funding needs. There are approximately 65 miles of trail that Public Works maintains and about half of them have lighting systems. Unfortunately, the complex lighting systems on newer trails like Barton Creek Greenbelt and the Boardwalk get regularly vandalized needing frequent repairs. This drives up maintenance costs significantly.

4. Summary of Immediate Needs

There are 452 major bridge structures with spans equal or longer than 20' and about 800 smaller, shorter structures within the City of Austin right of way. We have identified needs to replace or rehabilitate bridge structures across the City as well as pedestrian bridges and retaining walls within the right of way and on the Mobility Trail System.

The original design life of the older structures is assumed to be only 40 to 50 years. Typical new bridge structures are designed and constructed for a 75-year life. And some larger bridge structures are now being designed for a 100-year life. This means that these bridge structures should be reliable and safe for 50, 75, or 100 years respectively with regular maintenance and repairs.

5. Discussion of Long-term Capital Renewal Needs

We estimate that there are $2 Billion worth of structures within the right of way. Even if we optimistically assume a full 100-year life span for all structures, on average we will need to replace 1% of our bridges every year. At today's value of our bridge infrastructure assets, we will need to spend upwards of $20 Million (1% of $2 Billion) every year to replace our oldest structures. Whereas, we have had $73 Million in dedicated bridge funding within the bond programs since 1998 which results in an average of $3 Million per year over those 24 years. Street & Bridge Operations has also allocated just over a $1 Million annual budget for the maintenance of all structures. This results in an average annual total of $4 Million per year of dedicated spending for bridges. Thus, we will soon be facing an annual bridge funding gap in the range of $16 Million per year.

This report was prepared under the direction of Pirouz Moin, P.E., Assistant Director, Public Works Department - January 27, 2022.