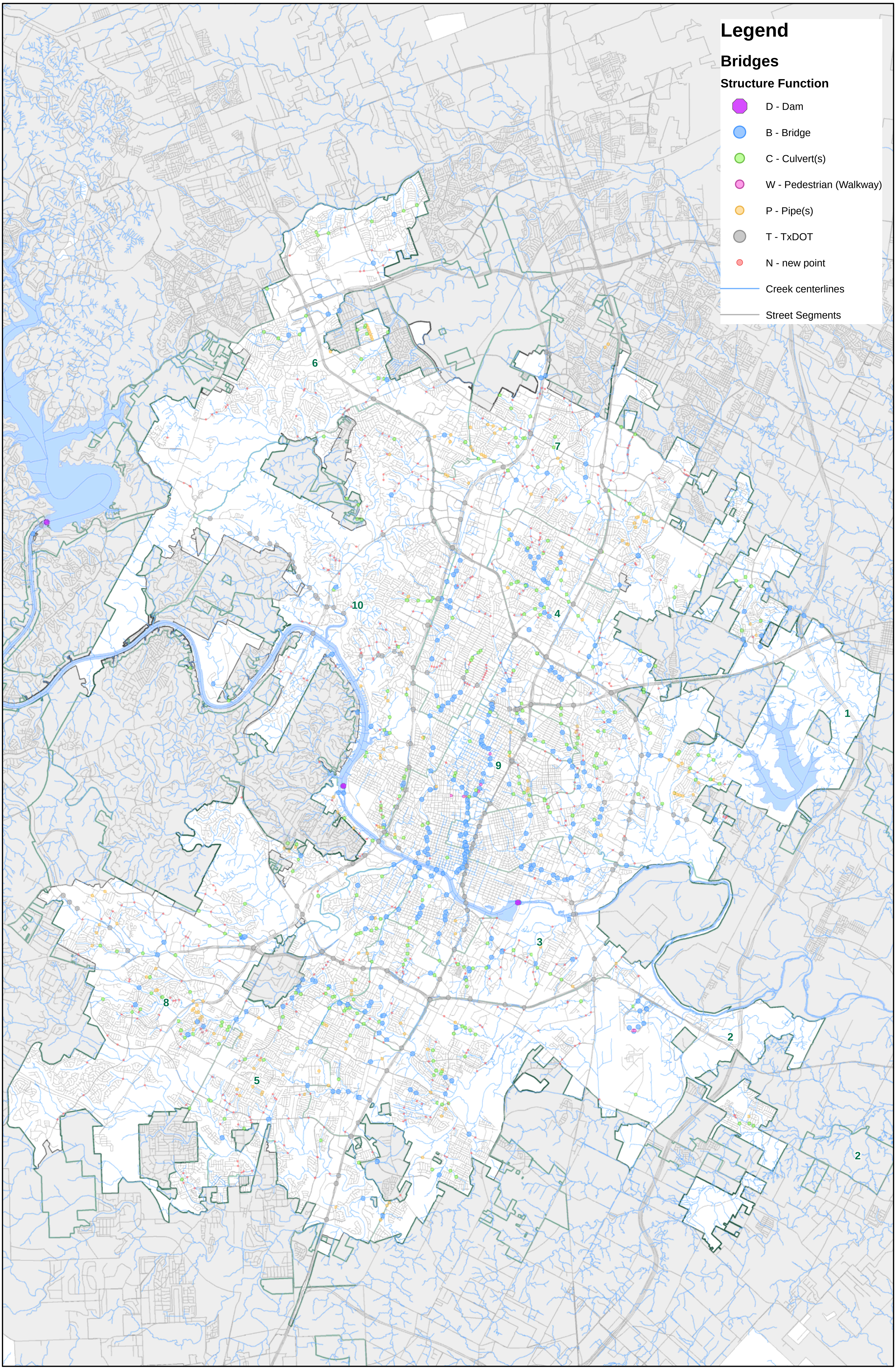
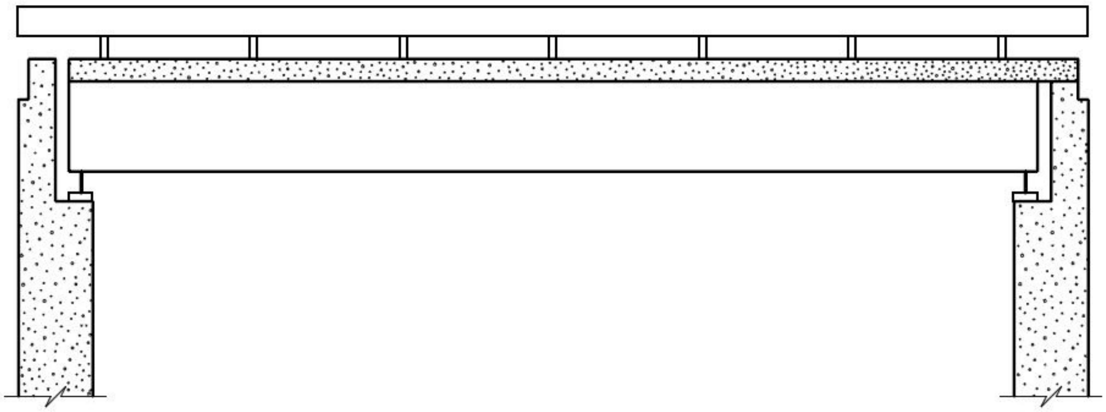
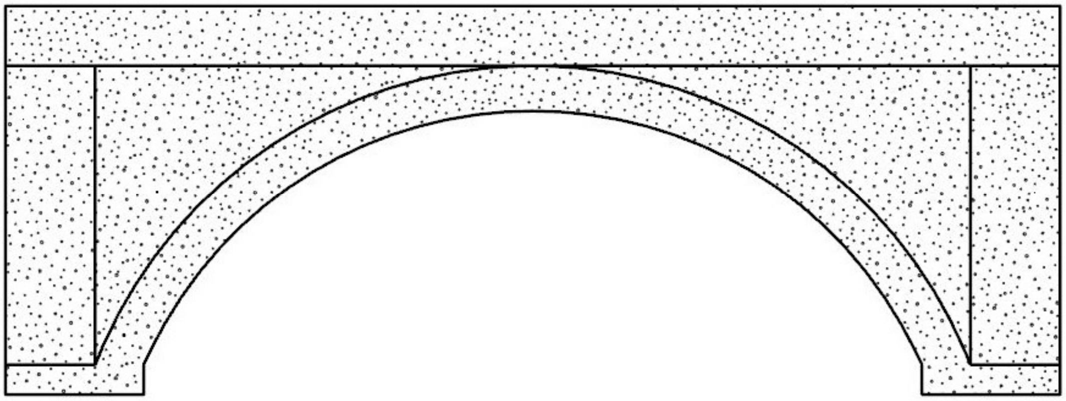
City of Austin - Bridges and Culverts

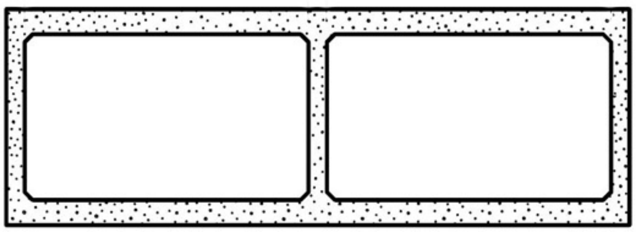


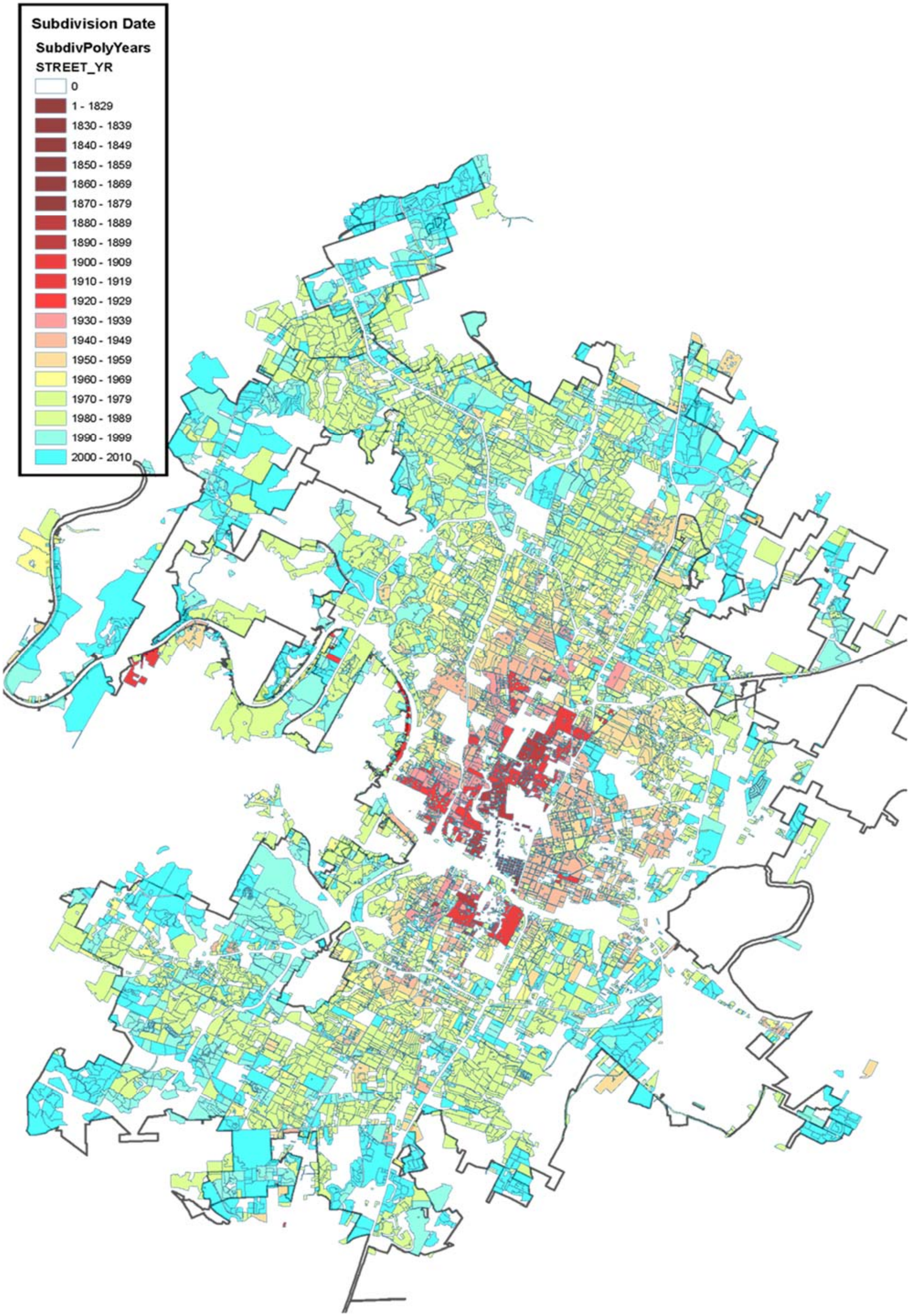
Critical Infrastructure Assessment 2017

Bridges







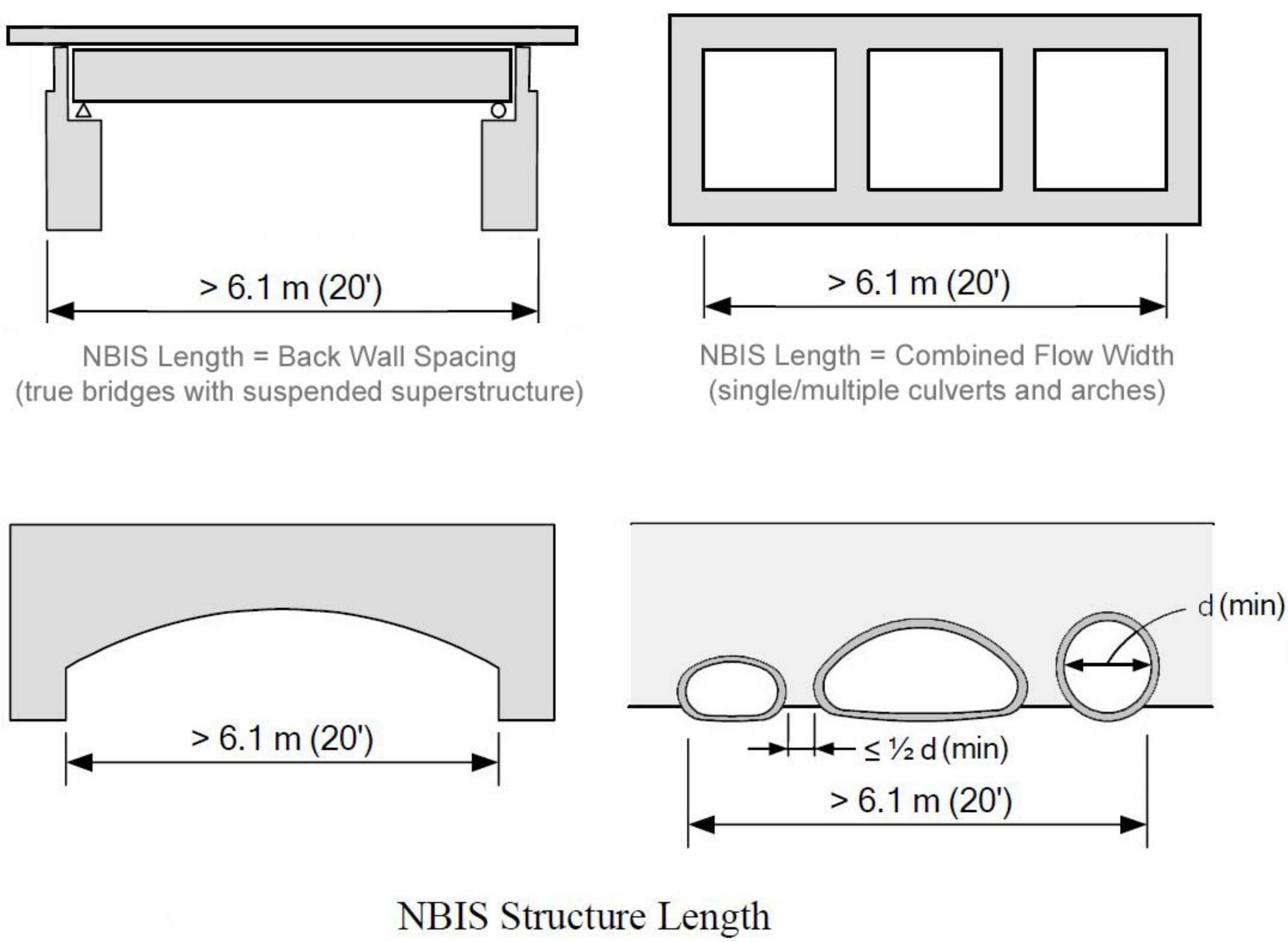

Subdivision Date
SubdivPolyYears
STREET_YR
0
1 - 1829
1830 - 1839
1840 - 1849
1850 - 1859
1860 - 1869
1870 - 1879
1880 - 1889
1890 - 1899
1900 - 1909
1910 - 1919
1920 - 1929
1930 - 1939
1940 - 1949
1950 - 1959
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - 2010

Introduction

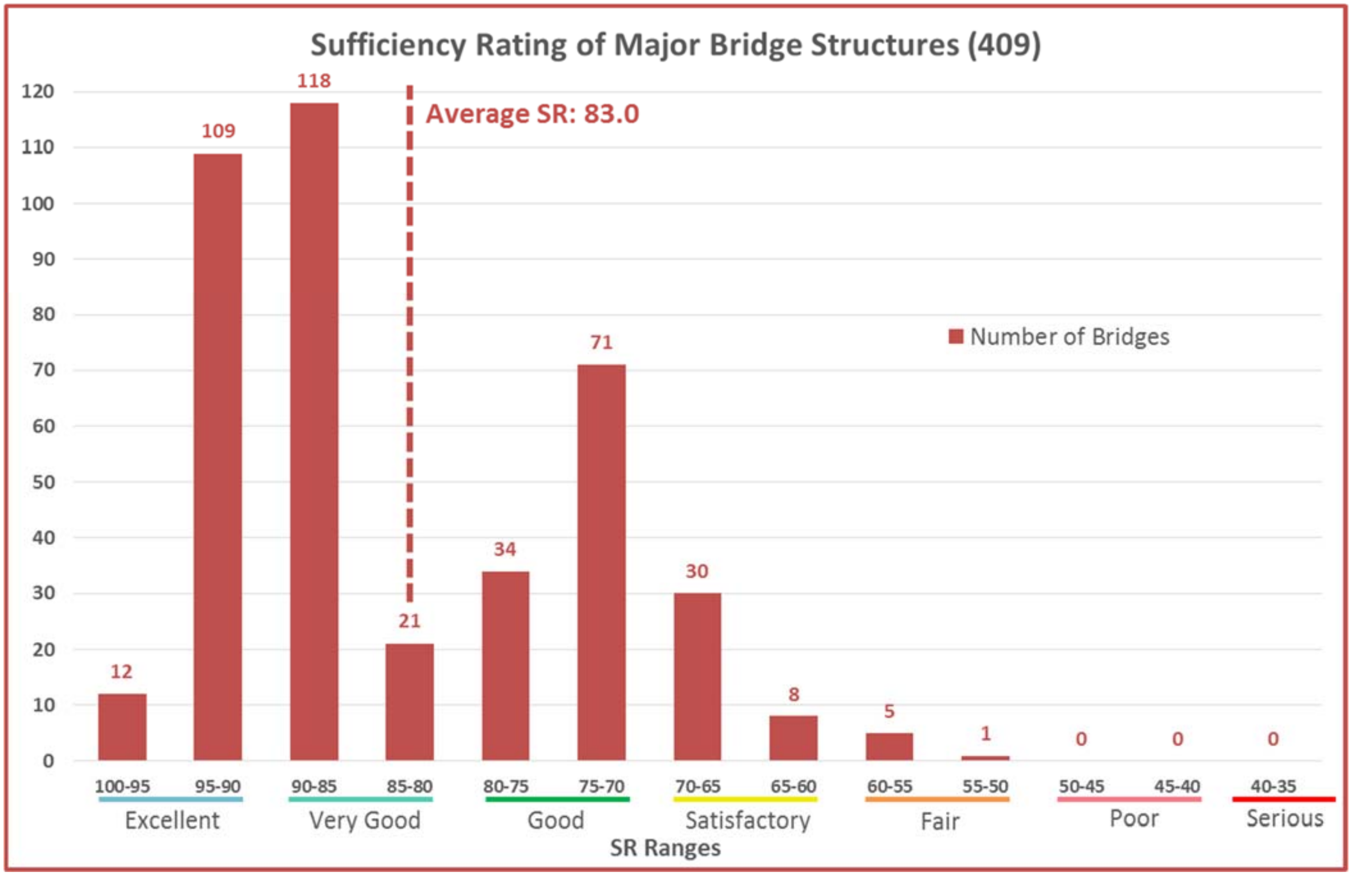
The approximate replacement value of Austin’s bridge inventory of 2.25 Million square feet of bridge deck is about $900 Million. The average Sufficiency Rating (SR) for Austin’s 427 rated bridges (spans greater than 20 feet) is 83 (Very Good) on a scale from 0-100. This represents the nationally established criteria 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 and mostly require only routine repairs and preventative maintenance.

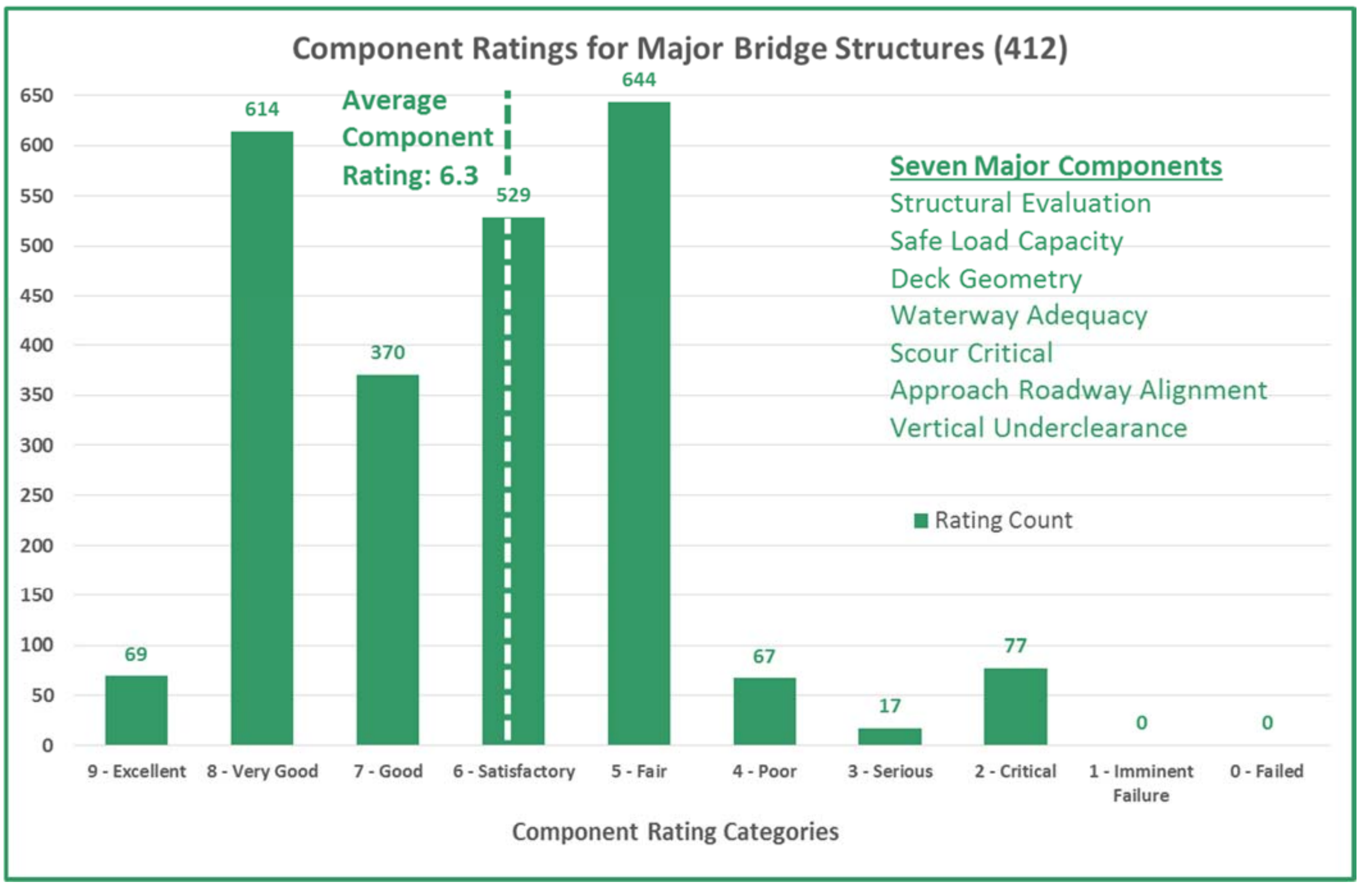
The Sufficiency Rating (SR) as defined by National Bridge Inspection System (NBIS) is not just a simple measure of bridge safety only. These ratings include a variety of other criteria such as not meeting current standards for deck width, railing types, approach design, etc. Bridges that do not completely comply with today’s more rigorous standards are technically called Obsolete. A fair amount of obsolescence in structures built 40 or more years ago should be expected and is normally acceptable.

The NBIS requires all structures that are 20 feet and longer in length as defined below to be inspected at least bi-annually. A few may require more frequent inspection depending upon condition and 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 inspectors. TxDOT gathers this federally mandated information for the entire state to assure consistency across the numerous agencies and jurisdictions involved.



Figures 1a-d: NBIS Bridge Structures of 20’ and Greater (inspected by TxDOT)

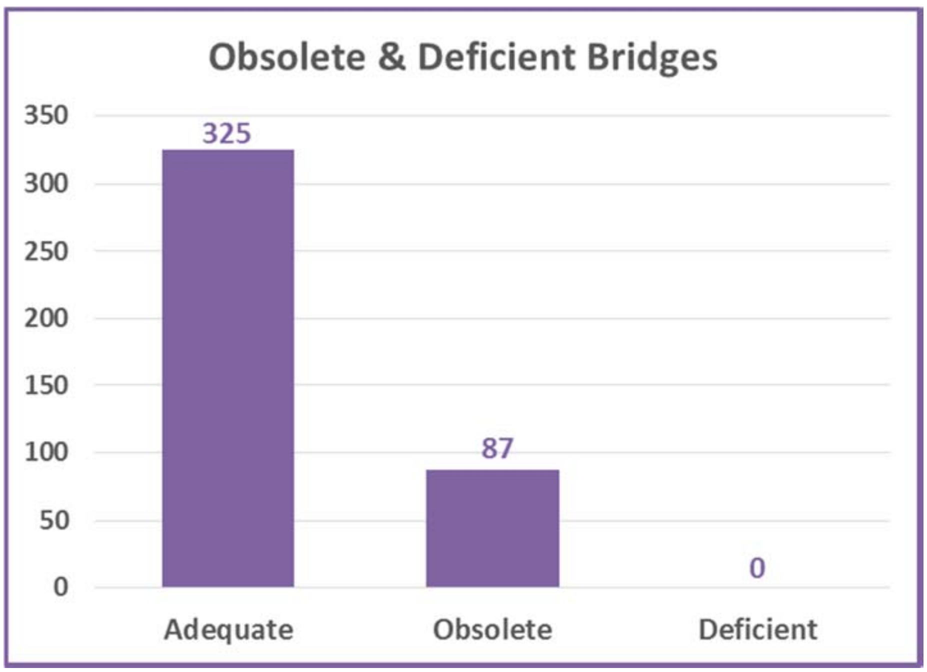

Sufficiency Rating of Major Bridge Structures (409)
Average SR: 83.0
Number of Bridges
12
109
118
21
34
71
30
8
5
1
0
0
0
100-95
95-90
90-85
85-80
80-75
75-70
70-65
65-60
60-55
55-50
50-45
45-40
40-35
Excellent
Very Good
Good
Satisfactory
Fair
Poor
Serious
SR Ranges


Component Ratings for Major Bridge Structures (412)
Average Component Rating: 6.3
Seven Major Components
Structural Evaluation
Safe Load Capacity
Deck Geometry
Waterway Adequacy
Scour Critical
Approach Roadway Alignment
Vertical Underclearance
Rating Count
69
614
370
529
644
67
17
77
0
0
9 - Excellent
8 - Very Good
7 - Good
6 - Satisfactory
5 - Fair
4 - Poor
3 - Serious
2 - Critical
1 - Imminent Failure
0 - Failed
Component Rating Categories

General Bridge Conditions

There are currently no bridges rated in Poor or Serious condition (<50) and only 6 bridges in Fair condition (50-60). The rest are all rated in Satisfactory or better condition with an SR at or above 60. And none are considered Deficient. Many of the lower rated bridges have received maintenance in our annual bridge maintenance contract, our CIP program, or are proposed for replacement in the near future. More than half of the structures in Fair or Satisfactory condition have received some type of maintenance in the last 10 years. A listing of our 44 lowest rated structures having a sufficiency rating below 70 (Good) is included for reference at the end of this document in Appendix A. In summary, having all of Austin's structures in Satisfactory or better condition represents a successful management program and protection of these valuable and critical infrastructure assets.

It should be noted that there is a clear trend in the age of our structures. Almost 30% of the inventory or 117 of these 412 bridges are past their currently accepted design life of 50 years. Fortunately, most of them are still performing quite well. But with increasing age and increasing traffic levels and loadings, these bridges will experience a faster rate of deterioration and eventually need more maintenance and rehabilitation. A long term plan for funding replacement structures must also be considered.

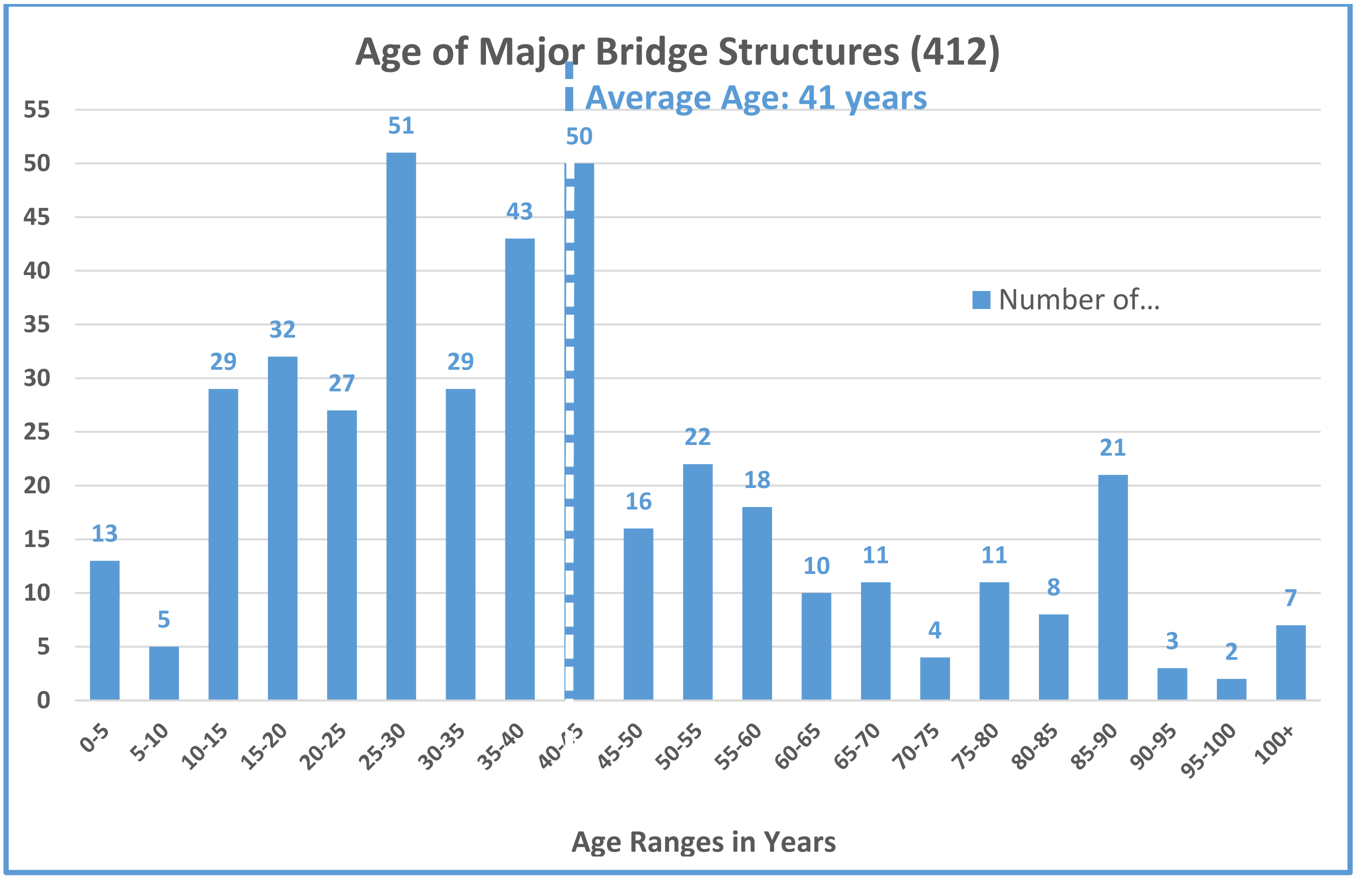


Bridges with Load Posting Limits

In the most recent inspection reports we have from the summer of 2016, TxDOT asked that we load post two bridges where the structure requires a load limit lower than the maximum legal allowable loading:

- 4th over Waller Creek
- Circle S over Boggy Creek

The structure over Waller Creek at 4th Street is an old bridge in downtown that Capital Metro Transit Authority is going to replace to support their Red Line light rail service. Circle S over Boggy Creek is a very old bridge that had abutment support problems until we added a straddle bent. Additionally, the very old reinforced concrete deck is now considered to have a restricted load carrying capacity. This indicates that we should enforce a load posting restriction.



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 managed its bridge inventory through the Street and Bridge district supervisors on a repair as needed basis. This method had no systematic ability to forecast future rehabilitation or replacement needs or schedule preventive maintenance which would extend the useful life of these structures. The purpose of a BMIS is to transform bridge management from the reactive mode to a proactive one. We have detailed inspection files on each bridge with biannual ratings back to 1988. The data in these files is currently being used to determine maintenance priorities. A formal BMIS database system will be selected and recommended for purchase in 2019.

This BMIS will allow us to better manage our infrastructure assets and move from being reactive to being proactive. The BMIS will allow for modeling, analysis, and planning for this aging infrastructure. Our future bridge needs can then be more accurately forecast and projected for both maintenance, rehabilitation, and long term capital planning and budgeting for bridge replacements.

Maintenance, Rehabilitation, and Replacement

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 (CIP) and TxDOT Off-System Bridge Program. In 2003 we established a steady budget for bridge maintenance from the Transportation Fund. Since then we have steadily contracted for repairs and preventative maintenance on 10 to 12 bridges each year.

Pedestrian Bridges

In addition to the above list the City is also responsible for maintaining pedestrian bridges and structures that are part of the Mobility Trail system. The following lists the pedestrian structures that are in immediate need of major rehabilitation or replacement:

Deficient Pedestrian Bridges

- Landon Lane at Lee Elementary
- 49th Street at Woodview over Shoal Creek
- Bethune Avenue
- Pecan Grove Road at Alameda Drive
- 2 bridges on Johnson Creek Mobility Trail
- Sparks at 31st Street
- Barton Parkway

Other Structures in the Right of Way

In addition to the bridge structures the City is also responsible for maintenance of retaining walls, special structures, guardrails, and embankments next to roadways and trails. There are currently needs identified for major maintenance along the Shoal Creek Trail and locations along roadways such as Hart Street. Recently constructed trails and structures like The Boardwalk and the Southern Walnut Creek Trails include over a mile of elevated structures and multiple pedestrian bridges within each system. Substantial facilities like these and others will require budgeting of adequate funding for future maintenance and repairs.

Capital Program Needs

Two projects stand out as critical needs in this area: the Emmett Shelton Bridge on Redbud Trail over the Lady Bird Lake and the William Cannon Drive MSE Walls.

The Emmett Shelton Bridge is critical to Austin because of the Ullrich Water Treatment Plant and our agreement with the City of Westlake. All heavy truck traffic must use this bridge to service the Ullrich plant. The bridge was studied in 1997 by CFX Engineering to determine its capacity for handling this continued heavy truck traffic, the construction traffic for the Ullrich expansion projects, and its remaining life in general. A structural enhancement project in 1998 was executed to give us about another 10 years; however, this period has elapsed. The structure is due for replacement as a critical link across the river serving both Austin and Westlake. The preliminary estimate for this project is $50 Million.

The William Cannon Drive mechanically stabilized earth (MSE) walls have been a concern since their construction in the 1980s. Excessive movement in the panels was noted right after completion and has been monitored over the years. The situation stabilized for about 20 years, but began moving and failing again a few years ago. The overpass roadway started cracking severely and required major repairs. The design is being funded by 2006 and 2010 bond funding, but construction will have to be funded by a new bond program. The preliminary estimates for these projects are $5 Million for the west end and $5 Million east end.

Other bridge projects that are being recommended over the next 5 years are Barton Springs Rd Bridge over Barton Creek ($9 M), Delwau Lane Bridge over Boggy Creek ($5 M), Slaughter Ln MSE Walls ($7.3 M), Riverside Drive Retaining Wall ($1.5 M), and continued miscellaneous Minor Bridge & Culvert funding for smaller structures ($5 M).

Emerging Issue – Maintenance of Culverts and Small Structures

There are about 1,100 smaller structures (less than 20') without inspection records and condition assessments. 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 like to experience severe flood damage and the consequence of any failure is 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 only have locations and limited information on all of the smaller bridge, culvert, and pipe structures. Although much less critical, we will establish a routine inspection of these minor structures as well. This will allow us to maintain a comprehensive inventory, condition assessment, and ratings for all of 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 additional set of smaller bridges and drainage crossings will have to be inspected by City staff because they are not included in TxDOT inspections. We intend to initiate and complete this initial condition assessment and data collection over the next three years.

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 will clean debris out the culverts to assure drainage flow and maintain vegetation control in the culvert entrance and exit areas.

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 all of 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 (guardrailing), 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 large bridges over 20 feet in length on a two cycle.

Typical Data Needed for Most Small Structures

Structure:

- location,
- structure type [B, C, P],
- street/facility carried,
- feature crossed,
- year built,
- last repaired/rehab,
- pipe length,
- skew,
- paved width,
- flow width

Images:

- side-oblique of full site (1),
- both sides (2),
- roadway, both directions looking toward crossing (2),
- any special/unusual detail pictures

Pipe(s):

- type,
- material,
- size,
- dimensions/spacing,
- number of pipes,
- condition

Additional Data Needed for Some Small Structures (as appropriate)

Slope Protection/Riprap:

- protection – type, material, dimensions/area, condition

Headwall(s):

- pipe end and protection – type, material, dimensions, condition

Railing:

- guardrailing,
- parapet walls,
- bridge railing – type, material, dimensions, condition

Safety End Treatments:

- turn downs,
- special end treatments – type, material, dimensions, condition

Signs:

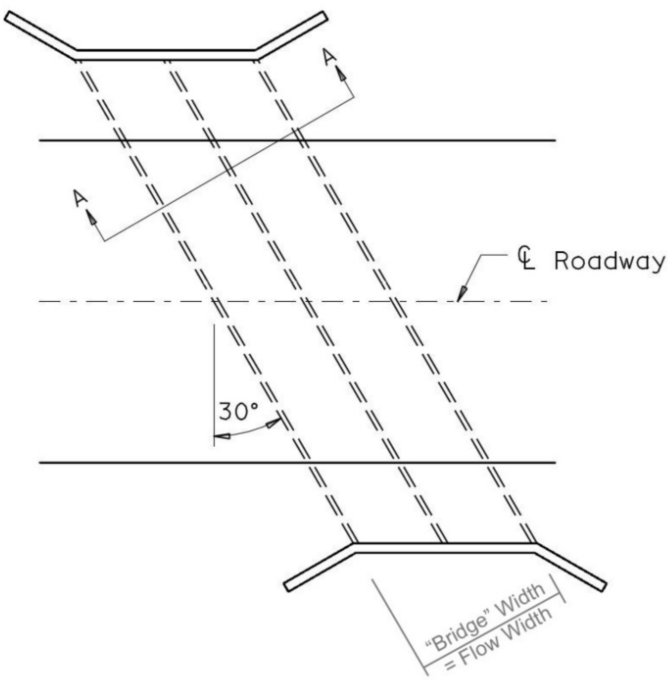
- bridge corners,
- edge markers – sign designation, size, sign mount, condition

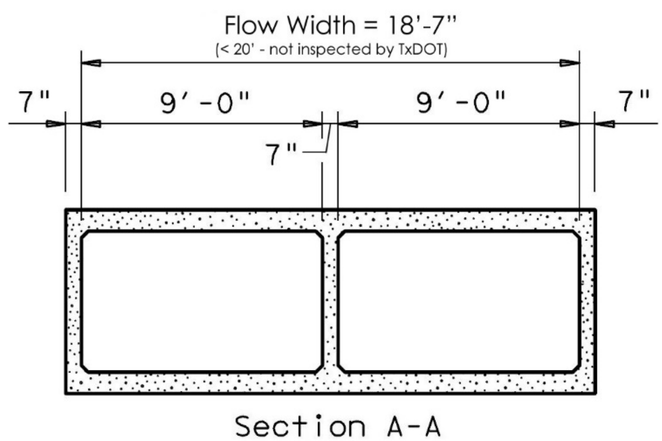
Typical Box Large Culvert Structures

(Inspected by TxDOT as NBIS bridges)

Typical Small Box Culvert Structures

(Not currently inspected as NBIS bridges)





Figures 2a, 2b: Small Structures of Less than 20' combined flow width are not inspected by TxDOT and reported to the National Bridge Inventory System (NBIS)


04/06/2012

Typical Small Pipe Culvert Crossing Structures

Standard 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.

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.

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.

Appendix A

Listing of 44 Lowest Rated Bridge Structures with Sufficiency Ratings (SR) below 70

No.	Street Carried	Feature Crossed	Location	SR
1	E 5th St EB	Waller Creek	0.10 mi E of Red River St	52.1
2	S 1st Street	Williamson Creek	0.9 mi S of SH 71	57.8
3	S 1st Street	Williamson Creek	1.0 mi S of SH 71 (Ben White Blvd)	58.2
4	E Riverside Dr	Country Club Creek Branch	3.7 mi E of Loop 275	58.4
5	Vertex Blvd	Onion Creek	2.7 mi E of IH 35	58.7
6	S Pleasant Valley Rd	Colorado River - Longhorn Dam	0.14 mi S of Cesar Chavez St	58.8
7	N Lamar Blvd	Shoal Creek	0.10 mi S of W 15th St	60.2
8	Circle S Rd	Boggy Creek	0.90 mi S of William Cannon Dr	60.8
9	S 1st Street	Williamson Creek	1.15 mi S of SH 71	61.6
10	Baythorne Dr	Onion Creek	2.7 mi W of IH 35	61.9
11	E Riverside Dr	Willow Creek	1.9 mi E of Loop 275	62.8
12	W Stassney Ln	Williamson Creek Branch	0.8 mi W of S 1st St	63.1
13	E Stassney Lane	Williamson Creek	0.25 mi E of IH 35	63.7
14	Pleasant Valley Rd	Williamson Creek	0.1 mi N of William Cannon Dr	64.0
15	E 7th St EB	Tillery St & CMTA Rail	1.6 mi E of IH 35	65.1
16	E 7th St WB	Tillery St & CMTA Rail	1.6 mi E of IH 35	65.1
17	E Riverside Dr	Blunn Creek	0.30 mi W of IH 35	65.5
18	W 15th St	Shoal Creek/Lamar Pkwy	0.20 mi W of West Ave	65.6
19	W 45th St	Shoal Creek	0.5 mi W of Burnet Rd	65.7
20	Slaughter Ln	Slaughter Creek Tributary	0.14 mi W of Brodie Ln	66.0
21	S Congress Ave	Lady Bird Lake	0.1 mi S of Cesar Chavez St	66.1
22	Redbud Trail	Colorado River Relief	0.30 mi W of Lake Austin Blvd	66.3
23	E 45th St	Waller Creek	1.9 mi W of Airport Blvd	66.8
24	Cameron Rd	Little Walnut Creek Branch	0.50 mi N of US 183	66.8
25	S 1st St	Boggy Creek	1.0 mi S of William Cannon Dr	66.9
26	Redbud Trail	Colorado River	0.20 mi W of Lake Austin Blvd	67.1
27	Barton Springs Rd	Barton Creek	0.70 mi E of Loop 1 (MoPac)	67.3
28	E 15th St	Waller Creek	0.27 mi E of Congress Ave	67.7
29	Metric Blvd	Walnut Creek	0.70 mi S of Parmer Ln	67.8
30	E Riverside Dr EB	Country Club Creek	1.4 mi E of IH 35	67.9
31	E Riverside Dr WB	Country Club Creek	1.4 mi E of IH 35	67.9
32	E Stassney Lane	Draw	2.2 mi SE of IH 35	67.9
33	E Stassney Lane	Draw	2.8 mi E of IH 35	67.9
34	Manchaca Rd	Williamson Creek	0.70 mi S of US 290	68.0
35	Old San Antonio Rd	Slaughter Creek	0.20 mi W of IH 35	68.3
36	Manor Rd	Little Walnut Creek	0.5 mi W of US 183	68.6
37	Payton Gin Rd	Little Walnut Creek	0.1 mi W of Lamar Blvd	68.7
38	Gracy Farms Ln	Branch Walnut Creek	0.35 mi E of Burnet Rd	68.7
39	S 1st St	E Bouldin Creek	0.5 mi S of Barton Springs Rd	69.0
40	W 51st St	Waller Creek	0.40 mi E of Lamar Blvd	69.1
41	Mt Bonnell Rd	Dry Creek	0.4 mi S of FM 2222	69.1
42	S 1st St	E Bouldin Creek	0.1 mi S of Barton Springs Rd	69.7
43	Walnut Creek Cross	Walnut Creek Branch	0.02 mi W of Park 35 Cir	69.8
44	W Oltorf St	W Bouldin Creek	0.15 mi E of S Lamar Blvd	69.9

Background

Mechanically Stabilized Earth (MSE) walls were developed as an extremely efficient technology for bridge embankments. They are still widely in use today. The William Cannon Drive Overpass embankment was placed during the first generation of MSE wall designs in 1983. William Cannon Drive is a major 6-lane divided arterial roadway. And as such, it is a critical roadway network asset serving south Austin.

The west end of this large overpass structure exhibited movement immediately after its initial construction. Several experts were consulted for an evaluation of the situation at that time. Minor construction quality issues and marginal materials seemed to be the cause of these early concerns. Ultimately, the City decided to monitor the situation rather than reject the work entirely. The situation did stabilize and showed no significant movement for about 10 years.

Near the end of the 1990s movement was realized again by large cracks appearing in the roadway above. The MSE walls on both sides of the west approach embankment to the bridge have experienced movement and deflections that has caused noticeable separation between the sidewalk and the street. This movement has also triggered voids and major cracking in the roadway surface. So, after 20 years of monitoring and growing concerns over its condition, a recommendation and design was requested for the permanent repair of the west end.

A substantial amount of geotechnical and background information was gathered for the design of the MSE walls on the west end of the William Cannon Overpass. This culminated in the preparation of an engineering report of findings and recommendations prepared by Dannenbaum Engineering Corporation in 2003. Full construction plans for both ends are also available.

The design that was tentatively selected for the west end of this overpass in 2003 was to extend the bridge for an additional span to lower the necessary height of the remaining MSE walls. However, we were not able to pursue this alternative at that time due to its very high cost. Other options such as soil nails and other geotechnical solutions were eliminated at that time due to feasibility concerns. Fortunately, it has come to our attention that a lot has changed in the industry since then. Numerous MSE walls of this generation have been repaired using several newer and more cost-effective techniques. For example, soil nailing technologies and equipment have advanced tremendously during this period. For this reason we want to reconsider all currently feasible options for the safe, efficient, timely, and cost-effective repair of this overpass embankment.

We are now requesting recommendations and design for the east end of the overpass since the east end was similarly constructed. We now know that there were minor flaws in the industry's design practices for the first generation of these walls which further compounded our construction issues. If a more practical, beneficial, and affordable repair method can be developed; we will recommend constructing repairs to the west end using the same method. Overall, it seems prudent to retrofit both ends to assure the overpass and bridge remain stable, safe, and reliable for their remaining service life of 50 or more years.

Alternative Solutions

We want to consider several alternatives with the ultimate objective of a balance of safety, reliability, minimizing citizen disruption to the degree possible, and cost. The current options appear to be

1) Entirely Reconstruct the MSE Walls
2) Extend the Bridge to Replace Distressed MSE Walls
3) External Soldier Piles/Walls
4) GeoPiers/Stiffen Soil Mass and Foundation Soils
5) Soil Nailing

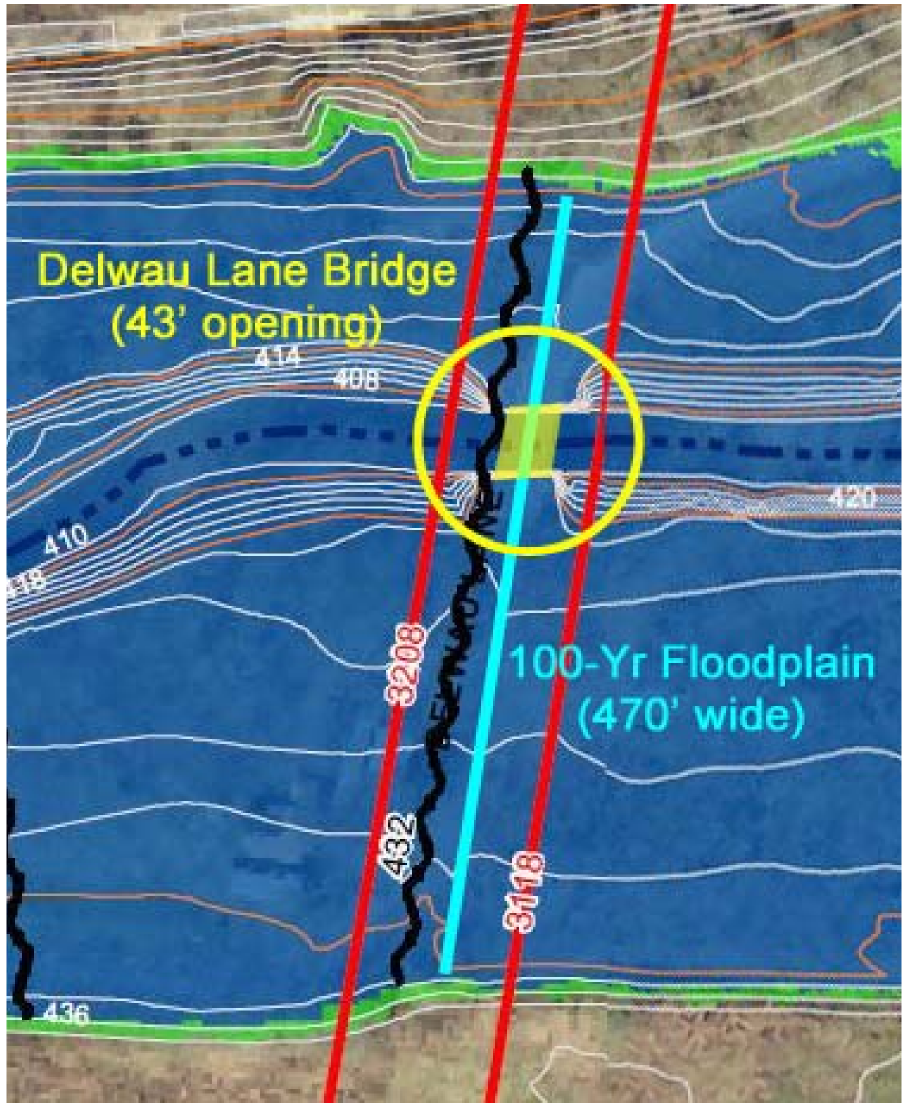
However, any other appropriate solutions should be investigated and considered at the consulting engineer's discretion. As stated before, we want to reconsider options that were previously eliminated as infeasible in the 2003 recommendations.

Concerns About Other MSE Wall Locations

We only have a few walls that were similarly designed and constructed like those at the William Cannon overpass and most are not as large or as critical. However, since the Slaughter Lane overpass is very similar, it too should be analyzed and considered for rehabilitation. Fortunately, this may be the only other major structure of this type on our arterial roadway network.

Furthermore, embankment wall technology has improved a lot since the early 1980s. Specifically, changes have since been made to the design standards for MSE walls which have corrected these problems. TxDOT has experienced similar issues and is still retrofitting some of their older walls today. Regardless, there are new MSE walls all over the Austin area on IH-35, US 183, US 290, MoPac, and Hwy 71. However, these new retaining walls and embankments are far superior and constructed much more conservatively and reliably than the older walls.

Delwau Lane Bridge over S Boggy Creek

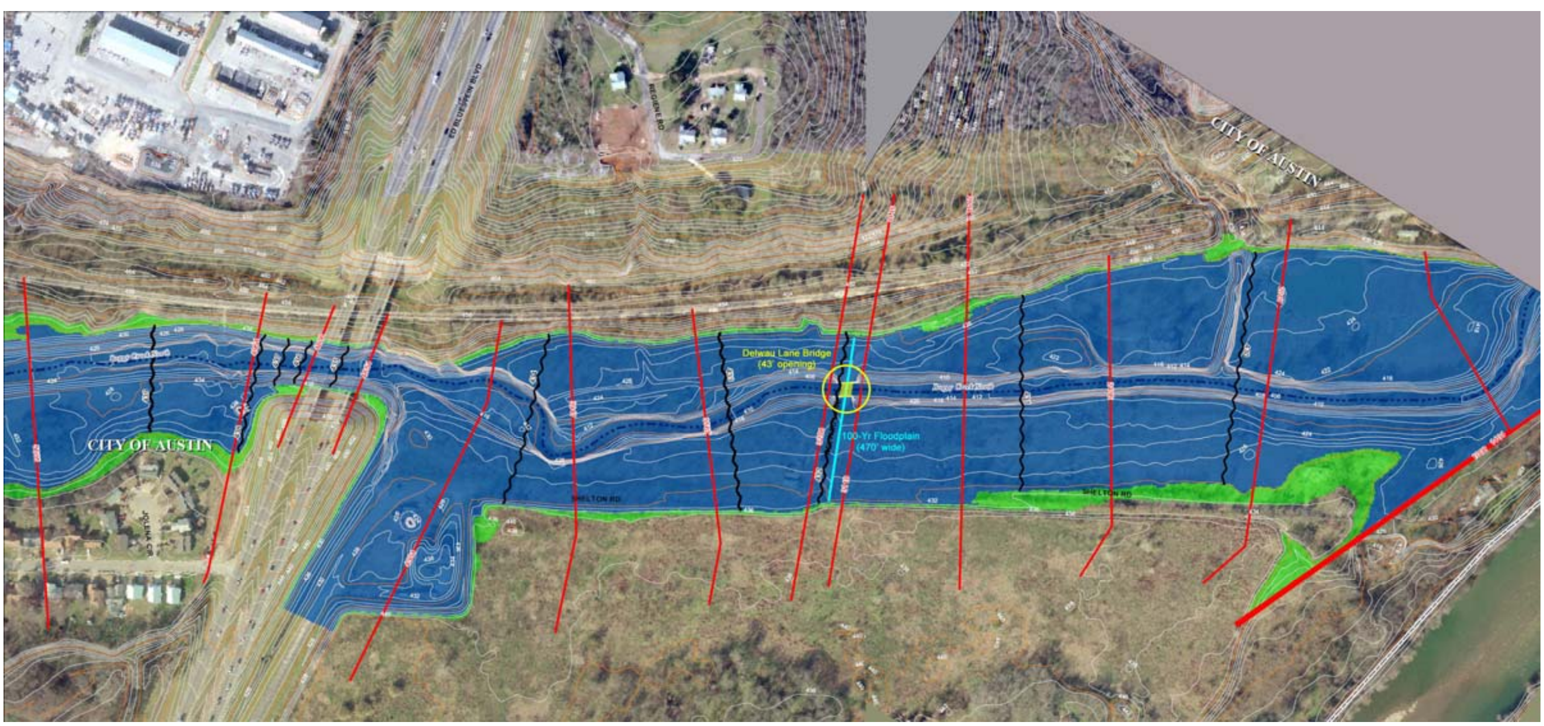


Current Bridge:

43’ waterway opening

30’ wide deck

100 Yr Floodplain: 470’ wide




07/19/2006

07/19/2006

07/19/2006

06/27/2006

06/27/2006

Delwau Lane Bridge over S Boggy Creek

October 1998 Flood Damage

Delwau Lane Bridge over S Boggy Creek

August 1999 Flood Damage & Massive Voids






Delwau Lane Bridge over S Boggy Creek

July 2006 Abutment Undermining & Repairs after June Flood

Delwau Lane Bridge over S Boggy Creek

July 2006 Abutment Undermining & Repairs after June Flood (cont'd)

Delwau Lane Bridge over S Boggy Creek

January 2007 Flood Damage

Delwau Lane Bridge over S Boggy Creek

2008 Northeast Bank Scouring after High Flow Event

2010 Additional Northeast Bank Scouring after High Flow Event

Delwau Lane Bridge over S Boggy Creek

May 2015 Flood Damage & Concrete Abutment Fill

April 2016 Flood Damage & Mortared Rubble Repair

Condition Report on the Emmett Shelton Bridge on Redbud Trail over Lady Bird Lake

Street & Bridge Operations
September 28, 2017

Background

- o The Emmett Shelton Bridges on Redbud Trail over Lady Bird Lake were originally built in 1948 making the structures 68 years old. There are actually two separate bridges. A 400 foot bridge spanning from the Austin side on the East bank to Redbud Isle and a 100 foot bridge to the West bank on the Westlake Hills side.

- The structure is used by more than 13,000 vehicles per day as a critical commuter link between Austin and Westlake Hills. And, a primary problem with these obsolete structures at this point is that they are too narrow for current traffic volumes.
- The bridges are critical to the servicing and operation of the Ullrich WTP facility because of truck traffic restrictions and concerns with all other routes out of the plant. All other routes have been well studied, considered, and ultimately rejected over the years.
- Interlocal Agreement (Resolution 871005-02) with Westlake Hills was executed on October 5, 1987 calling for the City of Austin to set aside $4 Million from a proposed 1989 bond election for roadway and bridge improvements on Redbud Trail serving the Ullrich WTP. In the event the citizens of Austin rejected such a program, the two cities would re-evaluate the situation and potential sources of funding. However, no bond election was held which made the specific language ineffectual. Thus, the intent and need remains to negotiate a new resolution to these issues.
- The bridges also have very narrow, substandard sidewalks serving as the Western end of the Lance Armstrong Bikeway (LAB) and are the only pedestrian and bike route to the popular parks destination Redbud Isle.

Design Issues

- Many bridges constructed in this era were only designed for the lighter truck loadings of that era and a 50 year design life. And, trucks in the 1940s were about half the weight of today's trucks. Therefore, these structures have seen more than twice the design loadings they were designed for and; therefore, they are well beyond the anticipated design life of these highly used bridges.
- The Ullrich WTP traffic has further and substantially increased the truck loadings beyond normally expected traffic and well beyond designed loadings. There were 13 sludge and chemical trucks per day weighing between 70,000 and 77,000 lbs gross in 1996. The 6 year plant expansion project added construction traffic and increased the operational trucking demands with the increased Ullrich WTP capacity.

Bridge Condition

- Bi-annual inspections by professional engineers are done for the Fed's National Bridge Inventory System (NBIS) through TxDOT's Bridge Inspection and Appraisal Program (BRINSAP). These inspections are done by highly trained engineers that meet TxDOT's stringent requirements for bridge experience.
- A thorough and rigorous analysis and load testing by CFX Engineering in 1997 was consistent with an all-time low SR of 36.4 (out of 100) and established a limited remaining useful life. No recent or further special testing, inspections, or analysis have been done beyond the CFX Engineering study referenced below under possible safety concerns and the normal TxDOT inspections.
- The last TxDOT inspection was done in 2010 and resulted in a Sufficiency Rating (SR) of 67.0 which is a rating of "Fair". And, TxDOT ratings have been consistently around 67 since our rehabilitation project was completed in 1999. Despite this seemingly acceptable rating, we are concerned that the somewhat cursory visual inspections performed are highly overrating the structural capacity of this bridge (see last three points under Safety Concerns section). The interim enhancements designed by CFX and made in 1999 were only intended to extend the usable life of the structure until we could plan to replace the bridge in about 2006 contingent upon availability of capital funding.

Safety Concerns

- The two bridges on Redbud Trail collectively known as the Emmett Shelton Bridge are still considered safe at this time and remain open to all legal truck loads. However, the bridges are relatively old and the exact end of their life cycle is impossible to predict with precision. Therefore, bridge inspections have been conservative to assure that the existing structures are performing well enough to keep them open with confidence.
- Exact prediction of when a bridge may reach the end of its useful life is impossible, however, a very detailed analysis and actual load testing by CFX Engineering lead by Dr. Ramon Carrasquillo of the University of Texas was performed in an attempt to predict the best possible estimate of the remaining service life (RSL).
- The CFX report showed that this structure was already very close to the end of its useful life in 1997 before the Ullrich WTP expansion construction project. Therefore, the bridge deck was structurally modified in late 1998 to enhance its load carrying capacity. The theoretical "grace" period of another 8 years calculated by CFX expired in 2008.
- This bridge may become critically and structurally deficient over the next few years and is at high risk of steel girders reaching their fatigue failure life (too many millions of loadings). We will attempt to monitor the bridge closely recognizing that these types of failures can be very serious and require quick remedial action without much warning. Fortunately, this structure has redundant girders meaning that a sudden catastrophic collapse as seen elsewhere in the nation is extremely unlikely.
- Severe load restrictions, limited number of allowable truck loadings per day, lengthy detours and closures are a distinct possibility if any excessive distresses or damages are noted over the next few years.
- Furthermore, a previous study done for the LCRA as a tabletop study of a "rain bomb" event showed that the Redbud trail Bridge would be about 6" under water in a 100-year flood event and possibly could stay out of service for up to 3 days during such events. This period could even be longer if severe scouring were to compromise the stability of the bridge foundations as a result of flood waters or LCRA flood water releases.

Transporation Impacts for Flood Drill

Lake	Crossing	Top of Bridge/ Rdwy or Dam Spwy Elev. (feet msl)	Flood Crest (feet msl)	Depth of Water Above/Below (feet)	Time below Water (days)
Lake Travis	Downstream of Starcke Dam	738.0	725	-13.0	N/A
	Upstream of Mansfield Dam	714.5	722	7.5	3 days
Lake Austin	RR 620	650.0	512.8	-137.2	N/A
	Low Water Crossing	500.7	511.24	10.5	+30 days
	SH 360	536.5	495.67	-40.8	N/A
	Upstream of Tom Miller Dam	492.8	492.8	0.0	N/A
Town Lake	Redbud Trail	445	445.6	0.6	3 days
	Mopac	485	444.1	-40.9	N/A
	Lamar	450	441.3	-8.7	N/A
	S 1st	446	440.6	-5.4	N/A
	Congress	450	440.5	-9.5	N/A
	IH 35 Frontage Road	454	439.8	-14.2	N/A
	IH 35 Mainlanes	458	439.8	-18.2	N/A
	Longhorn Dam	472.5	438.6	-33.9	N/A
Travis	US 183(SB)	459	436.8	-22.2	N/A
	US 183(NB)	453.3	436.8	-16.5	N/A
	FM 973	416	415.8	-0.2	2.5 days

Estimated time under water does not imply that the bridge will not be damage or out of service longer
The positive depth of water gives the depth over the approach roadway or bridge deck.
Bridges also may be cut off due to storm drains backing up and are not accounted for in this table.

Proposed Bridge

- A single long-span bridge has been proposed as a replacement for the two bridge set-up. Major roadway geometry changes to Redbud Trail have also been proposed to benefit our Ullrich WTP truck traffic and all users.
- A 10 foot wide sidewalk and bike path has also been proposed as part of this structure to extend the LAB and usable sidewalk along Lake Austin Blvd to Redbud Isle.
- The proposed bridge is also intended to drastically improve the alignment of the bridge approach roadway on Redbud Trail by smoothing out the tight curves at the west end of the existing bridge. This can be seen in the image of the proposed roadway (green lines) and bridge alignment (red lines) on the following page. There have been numerous complaints and many documented accidents in the tight S-curves and at the “kink” in the road at the west end of the bridge. These both represent severely obsolete roadway geometries which are considered intolerable in modern roadway design.
- The sharp curves on the west approach are made worse by the rather steep slope of the roadway approaching the bridge from the west descending from the top of the bluff down to the existing bridge crossing level. In recognition of this fact, the proposed bridge is also intended to improve the vertical profile of this crossing by raising the elevation of the entire bridge by about 25 feet. This allows for making the approach roadways less steep, improves use by City of Austin sludge trucks, and places the bridge deck entirely above of all predictable flood events.

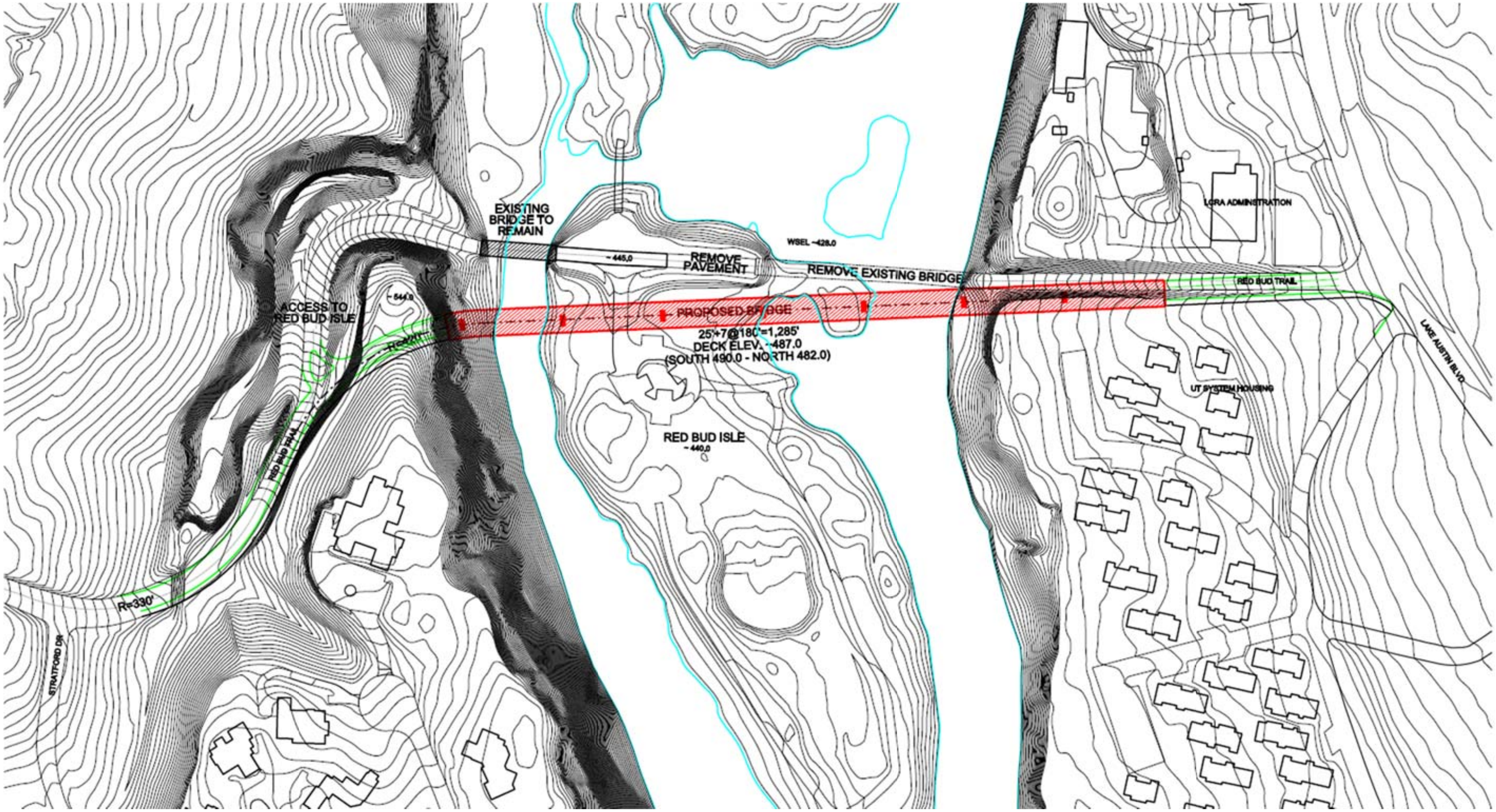
Bridge Replacement Justification

The Emmett Shelton Bridge on Redbud Trail over Lady Bird Lake is a critical link between Austin and Westlake Hills and is now 68 years old. The bridge is critical for servicing and operating the City of Austin Ullrich Water Treatment Plant facility. Many bridges constructed in this era were designed for the much lighter truck loadings of that time and a 50 year design life. The Ullrich WTP traffic has substantially increased the truck loadings beyond the normally expected traffic and well beyond these design expectations – possibly more than twice the anticipated design loadings and well beyond its anticipated design life.

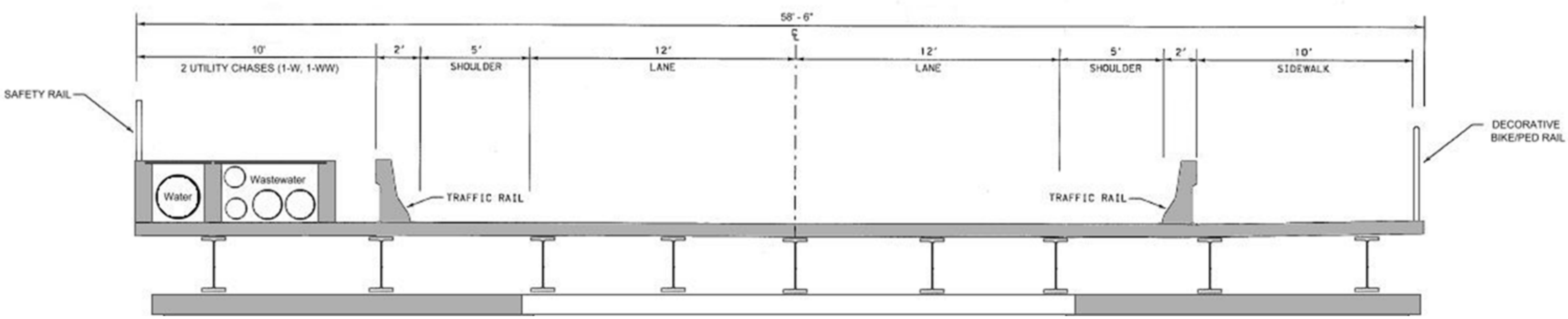
The exact prediction of when a bridge will begin to fail is impossible, so a cautious approach must be taken to bridge replacement. Bridge inspections will continue to assure that the bridge is performing adequately to keep open with confidence, but caution is advised. A very detailed analysis and load testing by CFX Engineering and lead by Dr. Ramon Carrascillo of the University of Texas was performed in 1997 to predict an estimate of the bridge’s remaining service life (RSL). The CFX report showed that this structure was very close to the end of its useful design life at that time. As a result, the bridge deck was structurally modified to enhance its load carrying capacity to theoretically increase the bridge’s RSL another 8 to 10 years and through the planned Ullrich WTP expansion project. Although substantial safety factors are used in the design of bridges, we need to push forward now with the renewal of this structure.

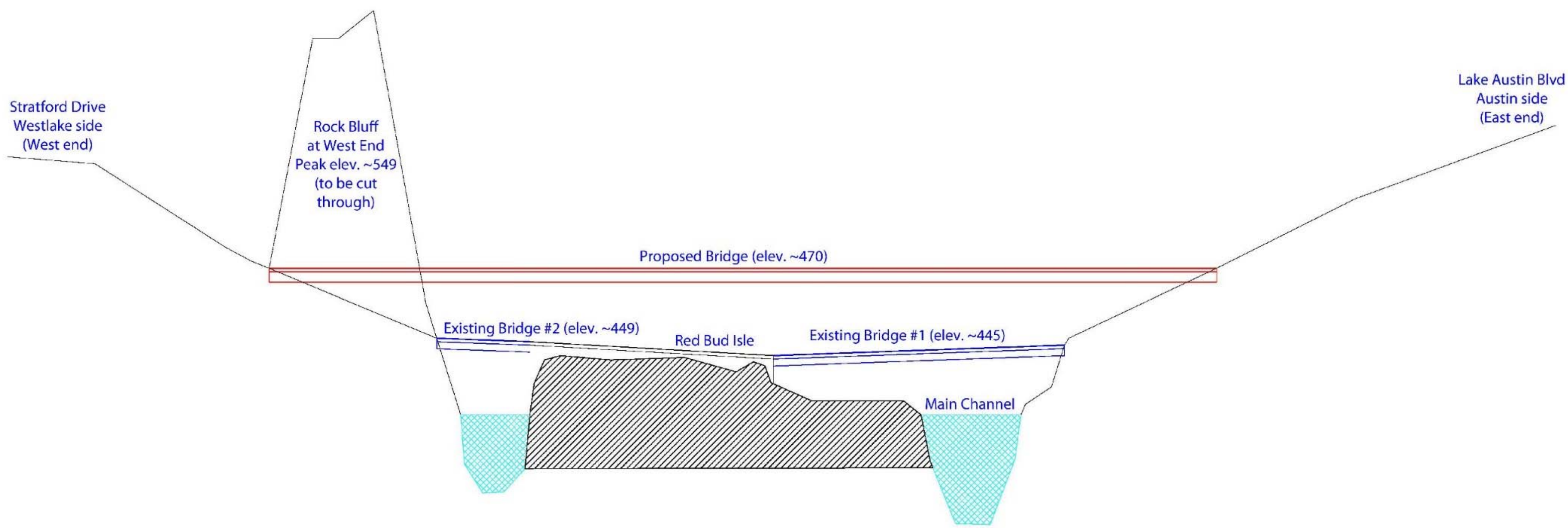
Despite the deck improvements in 1998, the bridge is still at risk of its steel girders reaching fatigue failure (too many millions of load applications) over the next few years and becoming structurally deficient. If excessive distresses or damages are noted by inspections; severe load restrictions, limited allowable truck loadings per day, and lengthy detours or even closures are a distinct possibility. Unfortunately, any such limitations on bridge loadings would also jeopardize the required daily Ullrich WTP traffic.

There are also some serious waterway related concerns for the current structure. A study done for the LCRA as a tabletop study of a “rain bomb” event showed that the Red Bud Trail Bridge would be about 6” under water in a 100-year flood event and possibly could stay out of service for up to 3 days during such events. This period could even be longer if severe scouring were to compromise the stability of the bridge foundations as a result of flood waters or LCRA flood water releases.



Red Bud Trail - Emmett Shelton Bridge





Proposed Emmett Shelton Bridge on Red Bud Trail over Lady Bird Lake & Red Bud Isle

Preliminary Planning Bridge Profile

Background

The Barton Springs Road Bridge over Barton Creek is critical to the welfare of the daily commuters because it provides connection for vehicular access to several major roads and communities. Barton Springs Road Bridge over Barton Creek is located near the intersection of Robert E Lee Road and Barton Springs Road. The bridge is obsolete and requires rehabilitation or replacement. The bridge was originally built in 1925 and was expanded on one side in 1946. The current bridge is 212' long and 58'-8" wide. Structurally it appears to be in fair condition; however, the deck width and geometry are obsolete. The bridge is currently a bottle-neck for the enhancement of all modes of travel on Barton Springs Road approaching Zilker Park from the east.

In 2011, City staff within Street and Bridges Operations Division proposed a proof of concept design that would widen the bridge deck 30 feet to accommodate 2 - 6' sidewalks, 2 - 5' bicycle lanes, 4 - 10' travel lanes and a 15' median, thus matching the new cross section of Barton Springs Road established by the reconstruction of that roadway east of Robert E Lee Rd. This proof of concept was completed in-house and was not a formal report or document that was certified by an Engineering firm. The cross section of the newer, wider Barton Springs Road to the east that was completed in mid-2003 has been a mismatch to the older roadway because of the lack of a median, substandard sidewalks, and missing bike lanes on the bridge. Successive discussions amongst City staff in the Public Works Department and Austin Transportation Department confirmed the inadequacy of these elements in addition to many other aspects of this intersection in the decade since.

The selected engineering firm will serve as the bridge designer and will present options for the rehabilitation or replacement of the bridge that shall provide safe and efficient access for people, goods, and vehicles across Barton Creek. The bridge will meet current design standards for cars, trucks, pedestrians, and bicycles, and will serve for 100 years if replaced and 40 years if rehabilitated.

Scope of the Design

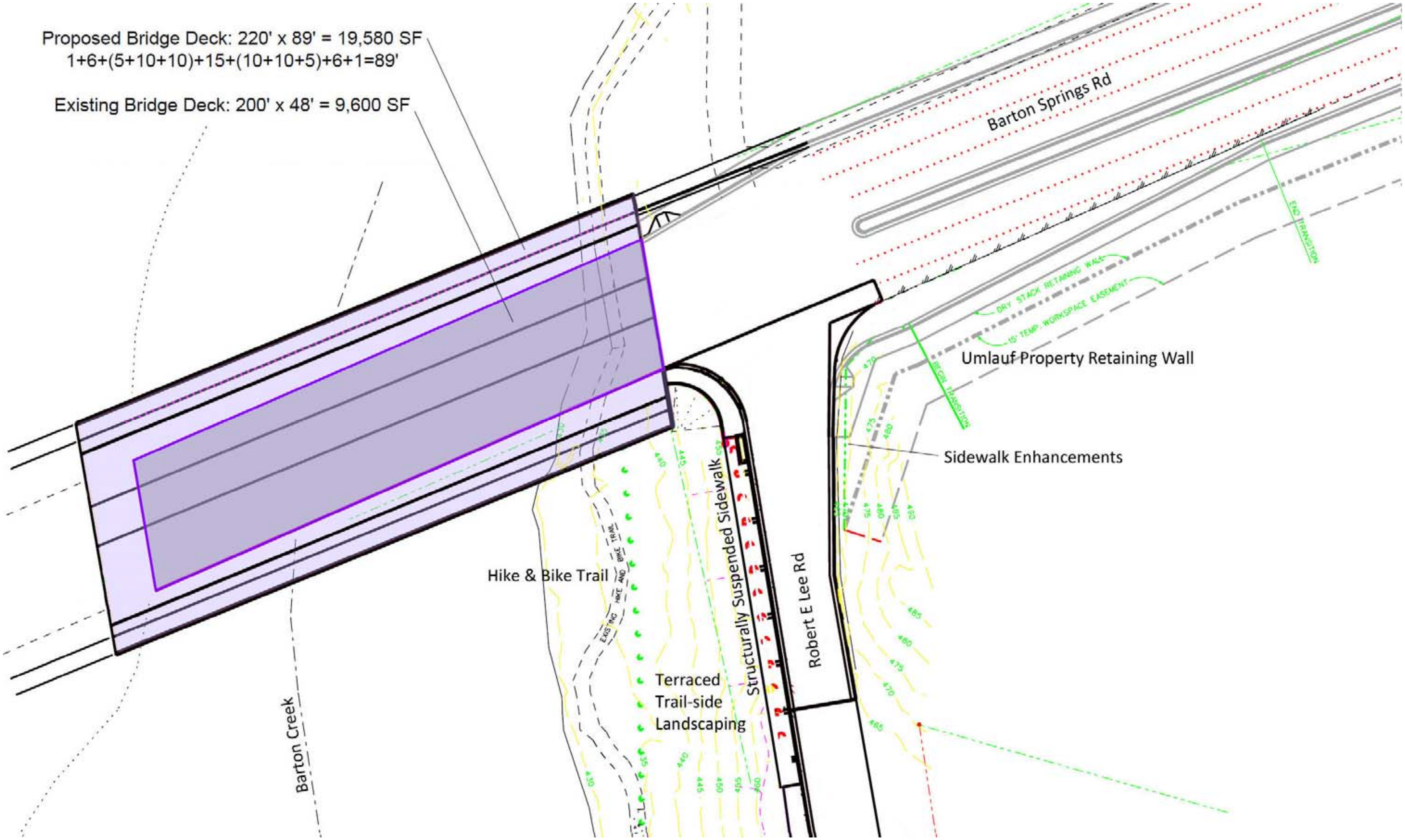
This project includes the complete replacement of the obsolete Barton Springs Road Bridge over Barton Creek located near the intersection of Robert E Lee Road. Construction of the Public Works portions of this complex project is anticipated to cost around $4 Million.

The bridge is currently a bottle-neck for the enhancement of all modes of travel on Barton Springs Road approaching Zilker Park from the east. This project would double the width of the bridge deck to accommodate 2-6' sidewalks, 2-5' bike lanes, 4-10' travel lanes and a 15' median thus matching the new cross section of Barton Springs Road established by the reconstruction of that roadway east of Robert E Lee Road.

There are a large number of interrelated improvement needs at the intersection of Barton Springs Road and Robert E Lee including:

- Fairly complex bridge geometry including an immediate adjacent "T" intersection
- Realignment of traffic lanes to match new Barton Springs cross section east of Robert E Lee
- Structural sidewalk and bridge class railing along west side of Robert E Lee
- Expansion of the bike lanes across the bridge and through the intersection
- Large retaining wall and slope stabilization along the Umlauf property
- Sidewalk connectivity on the southeast corner
- Redesign of signalized traffic intersection
- Street drainage design
- Environmental protection of Zilker Park and Barton Creek
- Protection of the creek & trailside amenities below the bridge
    - Hike & Bike Trail
    - Terraced Slopes & Plantings along the trails
    - Zilker Park Train
- Multiple public and private utilities attached to the bridge

As such, this project directly affects multiple departments: SBO, NCD, PARD, ATD, WPD, AWU, and any private utilities attached to the bridge. The Director of Public Works intends to find funding for the design of the bridge replacement, approach roadways, bike lanes, sidewalk, street drainage, and retaining wall improvements. However, the other affected infrastructure departments will need to participate in the funding of the project to complete the design.



Proposed Bridge Deck: 220' x 89' = 19,580 SF
1+6+(5+10+10)+15+(10+10+5)+6+1=89'
Existing Bridge Deck: 200' x 48' = 9,600 SF
Barton Springs Rd
Umlauf Property Retaining Wall
Sidewalk Enhancements
Hike & Bike Trail
Structurally Suspended Sidewalk
Robert E Lee Rd
Terraced
Trail-side
Landscaping
Barton Creek


04/24/2014


01/17/2012


04/24/2014


04/24/2014

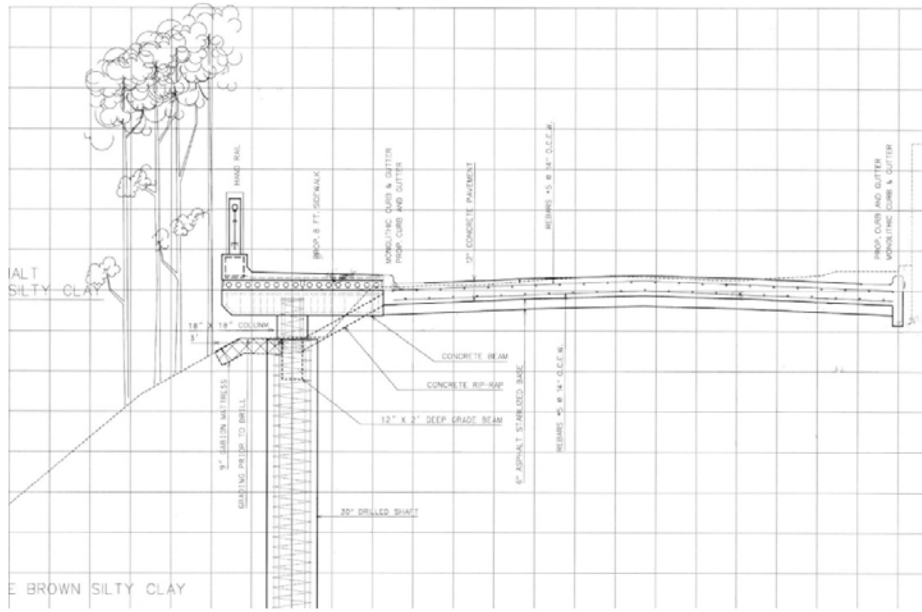

04/24/2014


04/24/2014


04/24/2014


04/24/2014


15 12:31PM


ALT
SILTY CLAY
HAND RAIL
PROP. 8 FT. SIDEWALK
MONOLITHIC CURB & GUTTER
PROP. CURB AND GUTTER
12" CONCRETE PAVEMENT
REBARS #5 @ 14" O.C.E.W.
18" X 18" COLUMN
3'
CONCRETE BEAM
CONCRETE RIP-RAP
12" X 2' DEEP GRADE BEAM
9" GABION MATTRESS
GRADING PRIOR TO DRILL
6" ASPHALT STABILIZED BASE
REBARS #5 @ 14" O.C.E.W.
30" DRILLED SHAFT
PROP. CURB AND GUTTER
MONOLITHIC CURB & GUTTER
E BROWN SILTY CLAY


04/24/2014


04/24/2014


15 11:19AM


15 12:42PM


12/14/2010

E 9th Street Bridge over Waller Creek

Bridge was closed during the bridge inspection on 3/30/2016 for construction of utilities related to new hotel at 9th and Red River.

ROADWAY VIEW

Looking East

NOTE: Bridge closed to house construction equipment for hotel construction at SE corner. Bridge open to pedestrian traffic.

SIDE VIEW

Looking Southwest

STRUCTURE NUMBER: 14-227-0-B000-28-007 0011 RT 1 0

BRIDGE STATUS: Active

INSPECTION STATUS: Approved

(006-1) FEATURE: WALLER CREEK

B

Texas Department of Transportation

Bridge Division

PonTex Detail Bridge Report

Run Date: 4/11/2016

(007-0) FACILITY: E 9TH ST EB

(009-0) LOCATION: 0.42 MI E OF CONGRESS

ITEM #	DESCRIPTION	VALUE
(005-1)	STRUCTURE FUNCTION	1
(004-0)	CITY CODE	02100
(005-2)	HWY. SYS	31
(005-3)	RT. DESIGN	1
(005-4)	HWY NO	0000
(005-5)	ROUTE DIR	0
(005-6)	ROUTE SUFFIX	
(006-2)	CRIT. BRDG	
(010-0)	RT.MIN VERT CLR	99FT 99IN
(011-0)	MI-POINT	00.420
(011-1)	MIPT DATE (PRI)	201404
(011-2)	REF-MKR and DISP	
(011-A1)	MIPT DATE (IR)	
(012-0)	BASE HWY NETWORK	
(013-1)	LRS INVENTORY	
(013-2)	LRS SUB RT.	
(016-0)	LATITUDE (D / M / S)	30° 16' 08.12"
(016-1)	GPS LAT (DEG.)	30.26892208
(017-0)	LONGITUDE (D / M / S)	97° 44' 06.40"
(017-1)	GPS LONG (DEG.)	97.73511014
(017-2)	COLLECTION METHOD	3
(019-0)	BYPASS LENGTH	2
(020-0)	TOLL	3
(021-0)	MAINT. RESPON	04
(022-0)	OWNER	04
(022-1)	MAINT.SECT NO	B0
(023-1)	PROJECT TYPE	1
(023-2)	CONT / SECT / JOB	8031-14-000
(026-0)	FUNCT.CLASS	44
(027-0)	YR ORGIN BUILT	1968
(028-1)	LANES ON STR	03
(028-2)	LANES UNDER STR	00
(029-0)	AADT	1870
(030-0)	YR OF AADT	2010
(031-0)	DESIGN LOAD	0
(032-0)	APPROACH WIDTH	40
(033-0)	MEDIAN	0
(034-0)	SKEW	0
(035-0)	STR.FLARED	0
(036-0)	TRAF.SAFETY FEAT	0NNN ~~0000~~
(037-0)	HISTORICAL SIGNIF	3
(038-0)	NAVIG CNTL	0
(039-0)	NAVIG VERT CLR	0
(040-0)	NAVIG HORIZ CLR	0
(041-0)	OPER.STATUS	K ~~A~~
(041-1)	LOAD TYPE	N
(041-2)	LOAD IN 1000 LBS	NNN
(042-0)	TYPE SERVICE	15
(043-1)	MAIN SPAN TYPE	1131
(043-2)	MAJ.APP SPAN TYPE	
(043-3)	MIN.APP SPAN TYPE	
(043-4)	CULVERT TYPE	
(043-5)	TUNNEL TYPE	
(044-1)	SUBSTR MAIN SPAN	
(044-2)	SUBSTR MAJ APP SPAN	
(044-3)	SUBSTR MIN APP SPAN	
(045-1)	NO.MAIN SPAN	1
(045-2)	NO.MAJ APPR SPAN	

ITEM #	DESCRIPTION	VALUE
(045-3)	NO.MIN APPR SPAN	
(046-0)	TOTAL NUMBER SPANS	1
(047-0)	TOTAL HORIZ CLR	064.0
(048-0)	MAX.SPAN LENGTH	58
(049-0)	STR.LENGTH	60
(050-1)	LEFT SIDEWALK	07.0
(050-2)	RIGHT SIDEWALK	07.0
(051-0)	ROADWAY WIDTH	046.0
(052-0)	DECK WIDTH	080.0
(053-0)	VERT.CLR OV	99FT 99IN
(054-1)	VERT.CLR REF FEAT	N
(054-2)	VERT.CLR UND	00FT 00IN
(055-1)	LAT.CLR REF FEAT	N
(055-2)	RIGHT LAT CLEAR	99.9
(056-0)	LEFT LAT CLEAR	00.0
(058-0)	DECK COND	7
(059-0)	SUPERSTR COND	8
(060-0)	SUBSTR COND	7
(061-0)	CHANN-PROTECT	6
(062-0)	CULVERT	N
(063-0)	METHOD OPR.RATING	5
(064-0)	OPERATIONAL RATING	236
(065-0)	RDWY APPR COND	6 7
(065-1)	METHOD INV.RATING	5
(066-0)	INVENTORY RATING	227
(067-0)	STR.EVALUATION	6
(068-0)	DECK GEOMETRY	5
(069-0)	UND.CLR VERT / HORIZ	N
(070-0)	BRIDGE POSTING	5
(071-0)	WATERWAY ADEQUACY	6
(072-0)	APPR RDWY ALIGN	8
(075-0)	TYPE WORK-REPLACE	
(076-0)	LENGTH IMPROVEMENT	0
(088-0)	ST-FRAC-CRIT/STEEL	NNNN
(090-0)	LAST INSP(MMDDYYYY)	3/30/16 ~~3/24/2014~~
(091-0)	DESIGNAT INSP FREQ	24
(092-1)	FRACT/CRITI DETAIL	N
(092-2)	UNDERWATER INSP	N
(092-3)	OTHER SPECIAL INSP	N
(092-1-2)	FRACT/CRIT FREQUENCY	
(092-2-2)	UNDERWATER FREQUENCY	
(092-3-2)	OTHER SPECIAL FREQUENCY	
(093-1)	FRACT/CRITI (MMYYYY)	
(093-2)	UN/WATER INSP (MMYYYY)	
(093-3)	OT/SPEC.INSP (MMYYYY)	
(094-0)	BDG IMPROVE COST	
(095-0)	RDWY IMPROVE COST	
(096-0)	TOTAL PROJECT COST	
(097-0)	YR IMPROVE COST EST	
(098-0)	BORDER BRIDGE	
(099-0)	BORDER STR NO	
(100-0)	DEFENSE HWY DESIGN	0
(101-0)	PARALLEL STR DESIGN	N
(102-0)	DIR OF TRAFFIC	1
(103-0)	TEMP STR DESIGN	
(104-0)	N H S	0
(105-0)	FED LANDS HWY	0
(106-0)	YR RECONST	0

Structural Evaluation data was missing (0) for SR calculation. 6 is Satisfactory.

ITEM #	DESCRIPTION	VALUE
(106-1)	WIDENING CODE	0
(107-1)	DECK STR TYPE MAIN SPAN	1
(108-1)	MAIN SPAN WEAR SF	188
(107-2)	STR.TYP MAJ APP SP	N
(108-2)	MAJ.APP SPN WEAR SF	NNN
(107-3)	STR.TYP MIN APP SP	N
(108-3)	MIN.APP SPN WEAR SF	NNN
(109-0)	AADT TRK PRECENT	0
(110-0)	DESIGN NATION NETWORK	0
(111-0)	PIER/ABUT PROTECT	
(112-0)	NBIS BRIDGE LENGTH	Y
(113-0)	SCOUR CRITI BRDG	5
(113-1)	SCOUR VULNERABILITY	A
(114-0)	FUTURE AADT	2000
(115-0)	FUTURE AADT YEAR	2030
(116-0)	MIN.NAVIG VERT CLR	
(119-0)	COST ORIGN CONSTR	
(120-0)	DEFI / OBSO / 10YR RULE (Def./Obs.)	
(121-0)	SUFF.RATING (SR)	088.5
(122-0)	X-REF. PRIMARY RT ID	8031140070
(123-0)	X-REF STR FUNC PRIMARY RT	1
(124-0)	X-REF IR ID	
(125-0)	X-REF STR FUNC IR	
(126-0)	DIST USE	B00
(128-0)	OV HEIGHT DAMAGE	N
(008-4A)	IR.CONTROL	
(008-5A)	IR.SECTION	
(011-0A)	IR.MILEPOINT	
(008-6A)	IR.STR NO	
(008-3A)	IR.DUPL OVER	
(005-1A)	IR.FUNCTION	
(005-3A)	IR.DESIGNAT	
(005-2A)	IR.HWY SYS	
(005-4A)	IR.HWY NO	
(005-5A)	IR.DIR	
(005-6A)	IR. ROUTE SUFFIX	
(011-2A)	IR.REF-MKR / DISP	
(047-0A)	IR.HORIZ CLR	
(010-0A)	IR.RT.MIN VERT CLR	
(012-0A)	IR.BASE HWY NETWK	
(013-1A)	IR.LRS HWY	
(013-2A)	IR.LRS SUB RT	
(019-0A)	IR.BYPASS LGTH	
(020-0A)	IR.TOLL	
(026-0A)	IR.FUNCT CLASS	
(029-0A)	IR.AADT	
(030-0A)	IR.YEAR OF ADT	
(100-0A)	IR.DEF HWY DESIGN	
(101-0A)	IR.PAR STR DESIG	
(102-0A)	IR.DIR OF TRAF	
(103-0A)	IR.TEMP STR DESIGN	
(104-0A)	IR.N H S	
(109-0A)	IR.AADT TRK PCT	
(110-0A)	IR.DESIG NAT NETWK	
(114-0A)	IR.FUTURE AADT	
(115-0A)	IR.YEAR OF AADT	

Neither Deficient nor Obsolete

Very Good