Midtown Corridor
Historic Bridge Study

Prepared for:

Public Works Department
City of Minneapolis, Minnesota

June 11, 2007

City of Minneapolis
Public Works

HCRRA

Hennepin

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SAINT PAUL, MINNESOTA
June 11, 2007

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Final Report

Public Works Department
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CERTIFICATIONS

I hereby certify that this report, except those sections specifically listed elsewhere in these certifications, was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

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I hereby certify that the sections of this report identified as having been prepared by me were prepared under my direct supervision and that I meet the Secretary of the Interior's Professional Qualifications Standards for Historian and Architectural Historian

Charlene Roise _____ _____/_____/_____

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Final Report

Public Works Department
City of Minneapolis, Minnesota

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I. EXECUTIVE SUMMARY

A. PURPOSE OF AND CONTRIBUTORS TO THE STUDY

As part of the reconstruction of the Chicago Avenue bridge, No. 92349, and the Park Avenue bridge, No. 90491, the City of Minneapolis Public Works Department and Hennepin County have conducted a study of the bridges of the Midtown Corridor to address Stipulation 3 of the "Section 106 Memorandum of Agreement (MOA) Between the Federal Highway Administration and the Minnesota State Historic Preservation Office Related to Bridge Replacement Project S.P. 141-165-15". Stipulation 3, in summarized form, includes a planning study for the bridges of the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District, located within the Midtown Corridor, a review of potential repair or rehabilitation limitations, a narrative of the original construction methods, and a discussion of foreseeable effects of additional bridge removals on the historic district.

The Hennepin County Regional Railroad Authority (HCRRA), a separate political entity within the County government, is the property owner of the Midtown Corridor. The City of Minneapolis is the lead agency for coordination of this study with the HCRRA and the Hennepin County Public Works Department. The City, the County and the HCRRA have been active participants in the development of this report. They, along with the City Council, Minneapolis Community Planning and Economic Development, Mn/DOT Cultural Resources, the State Historic Preservation Office, the Midtown Community Works Partnership, and the Midtown Greenway Coalition have reviewed and commented on this report. The City has retained the individual services of TKDA, a consulting engineering firm, and Hess Roise, a historical consulting firm, to prepare this report.

B. THE HISTORIC DISTRICT

In the late nineteenth century, south Minneapolis experienced growth whereby development leapfrogged the at-grade railway line. With the many street at-grade crossings, conflicts between residents and trains mounted. The City demanded that the railroad provide safe crossings by lowering their tracks and constructing a bridge structure at each crossing. The resulting set of bridges created a transportation grid over the rail trench.

Within the historic district, located between and including Hennepin Avenue and Cedar Avenue, there are twenty-six historic bridges crossing the corridor, with twenty owned by the HCRRA and designated as local roadways. The City of Minneapolis is the local road authority of these local roads. There are seven basic bridge types, with the majority of the bridges of cast-in-place concrete T-beam construction.

C. STRUCTURAL EVALUATION

The repetitive design, similar environment, and loading of the twenty-six remaining historic bridges within the historic district afford the City the opportunity to garner information from a representative cross section. This allows the City to more cost effectively analyze deterioration patterns and expected life spans of all the bridges under consideration. A screening process was used to select five candidate bridges for more in-depth analysis. Selected bridges include: Fremont, Pleasant, Columbus, 10th and 18th Avenues South. Analytical results from these bridges, along with bridge inspection and maintenance records of the other structures, yield information to rank and provide a programmatic classification for each bridge between Hennepin and Cedar Avenues. Core sample test results from 1981 varied from sound concrete with high compressive strengths to cores that crumbled when extracted and were not able to be tested. A parallel has been noted between past poor concrete core samples and current low sufficiency ratings, and between past sound concrete core samples and current higher sufficiency ratings.

D. CURRENT REPAIR PRACTICES AND FEASIBLE NEW TECHNOLOGIES

Current concrete repair practices include shotcrete, partial- or full-depth deck area patching, epoxy-injection of cracks, low viscosity sealants, and silane surface sealers. Repairs to limit moisture intrusion into the deck include the use of high performance concrete overlays or milling the existing deck and placing an overlay. While these techniques aim at some level of preservation, they do not completely address the repair of in-depth deterioration of the concrete and reinforcing bars in the cast-in-place concrete T-beam superstructures.

New technologies aim to prevent concrete corrosion by incorporating alternative reinforcing bar materials, high-performance concrete mixes, or cathodic protection in new concrete. If a structure is in need of strengthening as a means to extend its useful life, carbon fiber reinforced polymers applied externally to sound concrete structures may be a viable option for improving its load capacity.

E. EXPECTED BRIDGE LIFE TIMELINE, AND COST ESTIMATE

Based on the current sufficiency ratings of the bridges and their current live loads, in TKDA's opinion the expected useful lives of the structures are approximately less than four years for the Fremont, First, Portland, and Cedar Avenue bridges; approximately four to eight years for the Pleasant, Nicollet, Stevens, and Columbus Avenue bridges, and over eight years for the remaining structures.

If any bridge has its live load reduced as a result of reclassification to non-motorized traffic only (i.e., pedestrians and bicyclists), this reduction would extend the structural life of the bridge.

The Chicago Avenue (in 2005) and Park Avenue (in 2006) T-beam bridges were replaced with shorter-length single-span concrete rigid frame structures. The contractor's bid price for the Chicago Avenue bridge equaled $250.67 per square foot of bridge deck for bridge removal and construction. This price reflects intricate wingwalls, a restrictive construction site, and special aesthetic considerations. Based on this site-specific data, Midtown Corridor bridge replacements are anticipated to average approximately $1,500,000 to $1,800,000 per bridge (in 2004 dollars), depending on span length and deck width.

Structural rehabilitation costs will need to be ascertained on a case-by-case basis, depending on the bridge's condition and level of complexity. Due to the monolithic framing of the concrete deck to the pier caps and columns, or to the abutments, a deck replacement will be a very involved and complicated process.

If the projected structural rehabilitation and life-cycle costs exceed 70 percent of the cost of construction of a new structure, it is TKDA's opinion that it would be most fiscally responsible to construct a replacement bridge. Any removal, replacement or rehabilitation project would involve engaging the owners and the public in the project development process.

F. BRIDGE REMOVAL AND IMPACT ON THE HISTORIC DISTRICT

Engineers have found structural problems with almost every bridge along the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District and have developed the ranges of anticipated useful remaining service life for each bridge. A structural engineering benefit to cost analysis would find it difficult to justify significant expenditures to maintain and repair structures with limited life. The decision to replace or close a bridge would need to be made at the end of a bridge's design life. However, several other characteristic features of the district have already been lost and the replacement or removal of any of the historic bridges could be a tipping point for the district's retaining National Register status. With the trackage gone and redevelopment occurring, pressure to change the corridor's industrial character into something less industrial could seal the fate of the district. At the end of a bridge's useful service life, the decision will have to be made whether to replace or remove it.

The best hope for retaining the historic district lies in preserving the section east of 11th Avenue. The loss of any bridge in this section, given the integrity problems to the west, could be the last straw for the district. The challenge will be to balance the practical needs and economic realities identified by engineers and planners with the unique qualities that characterize the historic district.

G. CONCLUSIONS

The current owner of the corridor, the HCRRA, purchased the former rail corridor for future rail transit use. LRT is currently under study, as is a modern street car line. The HCRRA is cautious that any work planned for the bridges not impede future uses or alignments of the rail transportation corridor.

Bridges reviewed in this report exhibit structural degradation of concrete and reinforcing steel. As the degradation continues, the load carrying capacity of the bridges will be reduced and eventually require the bridges' closure. Comparison of the sufficiency ratings of the bridges gives the best overall indicator of the health of each bridge. For these bridges, a sufficiency rating below 40 may indicate an expected life of less than four years, a rating between 40 and 60 may indicate an expected life of four to eight years, and a rating above 60 may indicate a life expectancy of over eight years. Changing the live loading on some of these bridges from vehicular traffic to pedestrian loads could extend the useful life of the bridge anywhere from four to ten years.

The City Council cannot approve any project without encumbering funding for that project. Local street bridge projects will require the City Council to encumber funds. Most of the bridge work discussed in this report, outside of normal maintenance, is beyond the tenure of the existing Council. State statute limits city councils from committing to funding projects that would occur beyond their immediate tenure. Therefore, the current City Council cannot pass any resolutions binding future councils to fund bridge projects that will occur beyond the current Council's immediate tenure.

During the final review of this report, comments were received from the City Council, Minneapolis Public Works, Hennepin County, the HCRRA, Minneapolis Community Planning and Economic Development, the Midtown Community Works Partnership (Appendix I) the Midtown Greenway Coalition (Appendix J), and the State Historic Preservation Office (SHPO) and Mn/DOT Cultural Resource Unit (CRU) (see Section VIII, below). The majority of the comments that were received support retention of the existing street grid system. The Midtown Community Works Partnership comments that disrupting the transportation grid would significantly curtail future redevelopment opportunities and that decisions affecting the grid should not be considered until the City's Ten Year Action Plan is completed and a decision is made about the best transit mode for the Midtown Corridor. The Midtown Greenway Coalition comments focus on the potential use of streetcars and their benefits, as well as aligning rail transit through the south portal of the three-portal bridges, leaving space for trails in the central portal and avoiding trail reconstruction. The SHPO and CRU do not agree with the recommendation of the report that there should be changes to the contributing/non-contributing status of any bridges in the historic district. They further concur that the district should not be segmented and should stand as a whole; any smaller segment could not adequately reflect the original historic resource.

H. SUBSEQUENT STEPS

The City intends to apply for federal funds to assist in the preservation of these structures. They will utilize the results of this report in evaluating their program for the local bridges of the corridor included in this study. The City, the HCRRA, and Hennepin County will work together to derive agency agreements dealing with future bridge maintenance, programming for any reclassification or replacement programs, financial partnering, and long-term ownership of the structures.

The City (as the local road authority) and the HCRRA (as the owner of the historic bridges) have a vested interest in maximizing the design life of their roads and bridges. This is especially true of these historically significant bridges. Both the City and the HCRRA recognize that decisions made about maintenance, structural rehabilitation, replacement, or removal of bridges in the corridor affect the National Register status of the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District.

To ensure their continued use and preservation, the City is committed to monitoring the Midtown Corridor bridges' condition and possible accelerated deterioration, as part of its annual bridge safety inspections. The City is further committed to soliciting funding that would provide the resources for additional ordinary maintenance and betterments; for exploration of structural rehabilitation technology as successfully used by others; and for exploration of technologies to halt and/or stabilize existing deterioration. Rehabilitation will be considered as possible bridge replacement projects develop.

Prior to any infrastructure work, the City will employ the proper methods for project development, which includes a context sensitive design process. This includes gathering input on future development of the corridor and through the community involvement process from owners, residential and business communities, planners, engineers, the City Council and the Historic Preservation Commission.

II. INTRODUCTION

A. PROJECT OVERVIEW

1. Purpose of the Study

As part of the reconstruction of the Chicago Avenue bridge, No. 92349, and the Park Avenue bridge, No. 90491, the City of Minneapolis Public Works Department and Hennepin County are conducting a study of the bridges of the Midtown Corridor (formerly known as the 29th Street Corridor) to address Stipulation 3 of the "Section 106 Memorandum of Agreement (MOA) Between the Federal Highway Administration and the Minnesota State Historic Preservation Office Related to Bridge Replacement Project S.P. 141-165-15," (see Appendix A). Stipulation 1, design review and concurrence for the Chicago and Park Avenue bridges, and Stipulation 2, recording of the Chicago and Park Avenue bridges, have been completed by the City and County. Stipulation 3, in summarized form, includes a planning study for the bridges of the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District, located within the Midtown Corridor, a review of potential repair or rehabilitation limitations, a narrative of the original construction methods, and a discussion of foreseeable effects of additional bridge removals on the historic district.

2. Definitions of the Midtown Corridor, Midtown Greenway, and the Historic District

The Midtown Corridor lies between France Avenue and the Mississippi River and includes a total of forty-five bridges. Of these forty-five bridges, forty-four cross over or under the existing corridor and one bridge is located adjacent to the corridor.

Within the Midtown Corridor lies the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District. The historic district lies parallel to 29th Street between Humboldt and 20th Avenues South. Its period of significance is from 1912 to 1916, with a historical function related to transportation, specifically railroads. Its current function is transportation, and its sub-function is pedestrian transportation.

From the Secretary of the Interior (SOI), rehabilitation is defined as "the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values." Within this report there are many references to "reclassifying/reclassification" of a bridge from carrying vehicular traffic to a lighter load of pedestrian/trail use. If a bridge is reclassified to pedestrian/trail use and its historical characteristics are maintained, the bridge would meet the SOI definition of rehabilitation.

While there are other definitions applied to the features and infrastructure in this area by various agencies and groups, the Hennepin County Regional Rail Authority (HCRRA), which owns the right-of-way of the Midtown Corridor, defines the boundaries as follows:

The Midtown Corridor, owned by the HCRRA, is the former Canadian Pacific/Soo Line rail corridor purchased by the HCRRA for the purpose of constructing light rail transit or other transportation systems and associated facilities. The corridor is located approximately one block north of Lake Street between France Avenue and Hiawatha Avenue, and approximately three blocks north of Lake Street between Hiawatha Avenue and the Mississippi River. The corridor is approximately 100 feet wide between France Avenue and Hiawatha Avenue. Between Hiawatha Avenue and the Mississippi River, the corridor consists of approximately the southerly 30 feet of the active Canadian Pacific/Soo Line rail corridor.

The Midtown Greenway, owned by the HCRRA, is approximately the northern one-half of the Midtown Corridor between France and Hiawatha Avenues and the 30 southern feet of the Canadian Pacific/Soo Line rail corridor between Hiawatha Avenue and the Mississippi River, where cycling and walking trails have been installed. The trails are operated and maintained by the City of Minneapolis.

The Chicago Milwaukee and St. Paul Grade Separation Historic District is a 2.8-mile-long transportation district formed by a depressed railroad trench that follows a straight, linear path from Humboldt Avenue South (on the west end) to Cedar Avenue South, where it then curves northward to meet 28th Street East at its eastern terminus. The Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District was listed on the National Register of Historic Places in 2005.

3. Contributors to This Study

The City of Minneapolis is the lead agency for coordination of this study with Hennepin County Public Works and the Hennepin County Regional Railroad Authority (HCRRA), a separate political entity within the County government that oversees light rail transit development. The County and the HCRRA have been active participants in the development and review of this report. The City has retained the individual services of TKDA, a consulting engineering firm, and Hess Roise, a historical consulting firm, to prepare this report. The City has asked TKDA to review the local roadway bridges and perform an in-depth structural evaluation of five of the bridges within the historic district. Hess Roise has been retained to provide an analysis of the historic aspects of the district.

The Midtown Corridor right-of-way is currently administered by the HCRRA. Bridges within the study area are owned by the HCRRA, Hennepin County Public Works, the City, and the Minnesota Department of Transportation (Mn/DOT). The HCRRA owns the majority of the bridges along the corridor. As the local road authority, having public interest in the local roadways over the corridor, the local roadway and municipal state aid (MSA) bridges are inspected by the City of Minneapolis. Other structures are inspected by Hennepin County Public Works or Mn/DOT, based on their respective road authorities. Road-side deck and railing maintenance and repair responsibilities for local and MSA bridges are addressed by the City. Road-side deck and railing maintenance and repair responsibilities for County bridges are addressed by the County. Maintenance and repairs for under-deck and substructures are handled on a case-by-case basis between the agencies. Upon bridge reconstruction, ownership of HCRRA-owned bridges will be transferred from the HCRRA to the appropriate road authority.

B. BRIDGES INCLUDED IN THE STUDY

Within the historic district, located between and including Hennepin Avenue and Cedar Avenue, there are thirty-eight bridges. Of these thirty-eight bridges, twenty-six are historic and were constructed between 1912 and 1916 to carry streetcars, buses, automobiles, and pedestrians. In addition, there is one historic bridge, 29th Street West, located adjacent to the corridor between Colfax and Dupont Avenues.

Of the twenty-six historic bridges crossing the corridor, twenty are owned by the HCRRA and designated as local roadways. The City of Minneapolis is the local road authority of these local roads. The City has reviewed these structures and found seven basic bridge types, with the majority of the bridges of cast-in-place concrete T-beam construction. Five of these bridges, Fremont, Pleasant, Columbus, 10th, and 18th Avenues, were selected for the structural evaluation portion of this study, as outlined below.

C. SELECTION OF BRIDGES FOR THE STUDY

Prior to embarking on the structural evaluation, a screening process was applied to the twenty bridge structures. Screening criteria looked for bridges that had lower sufficiency ratings and a selection of bridges that are disbursed throughout the corridor. Five bridges were selected for an in-depth review and the findings were extrapolated to the remaining structures.

D. RESEARCH METHODS

1. Structural Evaluation

The structural evaluation of bridges within the historic district included reviews of the bridge inspection reports, review of the bridge sufficiency ratings from up to the past ten reporting cycles, and chloride ion concentration testing for the decks of two of the bridges. In addition, a visual inspection of the bridges was made to confirm general findings noted in the inspection reports.

2. Historic Study

The historical aspects of the study were prepared by Charlene Roise, of Hess, Roise and Company, and were based on references as cited in the report, as well as the application for the historic district's placement on the National Register.

E. SUBSEQUENT STEPS

The City of Minneapolis will utilize the results of this report in evaluating their program for the local bridges of the corridor included in this study. The City, the HCRRA, and Hennepin County will continue to work together to derive agency agreements dealing with future bridge maintenance, programming for any reclassification or replacement programs, financial partnering, and long-term ownership of the structures.

III. CHICAGO MILWAUKEE AND ST. PAUL RAILROAD GRADE SEPARATION HISTORIC DISTRICT

A. DEFINING CHARACTERISTICS OF THE HISTORIC DISTRICT

The defining characteristics of the historic district are the trench edge that delineates the depressed corridor, the bridges and the visual tunnel they create, and the industrial nature of the corridor, including the hard edges of the trench, the track beds, the commercial elevations, and the volunteer foliage.

To a lesser degree, defining characteristics include retaining walls, fencing, lighting, railroad crossing signals, and utility poles.

B. ORIGIN OF THE GRADE SEPARATION

Prepared by Charlene Roise, Hess, Roise and Company

The historic characteristics of the grade separation were analyzed prior to the construction of the Midtown Greenway in a report completed in March 2002. By the time that the National Register nomination for the Chicago Milwaukee and St. Paul Railroad (CM&SP) Grade Separation was submitted in December 2004, the development of the greenway had begun, requiring a reexamination of the corridor's characteristics for the nomination.[1] Further changes to the corridor since that time necessitate yet another look at the district's distinguishing features.

First, though, it is important to review the characteristics of the corridor at the time of its construction. Several contemporary sources describe the early twentieth-century setting:

- "This work of depression is through a residence district, with numerous industries scattered along."[2]

- The corridor "passes through a residence district, although for a considerable part of its length it is bordered by elevators, coal yards, lumber yards and other industries."[3]

- "The tracks which are to be depressed pass through a portion of the better residence district of Minneapolis and although numerous industries line the right of way for the greater part of the distance, it was desirable to have the finished work give as pleasing an effect as possible."[4]

- "The majority of the industries are located on the north side of the tracks, Twenty-ninth street being adjacent to the right of way on the south side for nearly the full length of the depression."[5]

These writers show that from the outset there were contrasting—and sometimes conflicting—land uses along the corridor, a tension that continues to the present. Clearly, this was an industrial corridor. Industry had claimed it first, when the at-grade rail tracks were originally installed around 1880. As the city grew in the late nineteenth and early twentieth centuries, residential and commercial

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[1] William Stark, Andrea Vermeer, Michelle Terrell, and Kristen Zschomler, "Phases I and II of the Architectural History Investigation for the Proposed Midtown Greenway, Minneapolis, Hennepin County, Minnesota, Volume I: Report," prepared by the 106 Group Ltd. for the Hennepin County Department of Transit and Community Works, March 2002; Andrea Vermeer and William Stark, "Chicago Milwaukee and St. Paul Railroad Grade Separation," National Register of Historic Places Registration Form, prepared by the 106 Group Ltd., December 2004.
[2] "Track Depression Work of the C. M. & St. P. Ry. at Minneapolis," *Railway Review* 57 (July 17, 1915): 70.
[3] "Track Depression at Minneapolis," *Engineering News* 73 (March 18, 1915): 514.
[4] C. N. Bainbridge, "A Large Track Depression Project at Minneapolis," *Railway Age Gazette*, December 3, 1914, 1059.
[5] Bainbridge, "Large Track Depression Project," 1062.

development surged out from the downtown core to 29th Street and well beyond. The conflicts between the old and new land uses were, in fact, the basis for the track depression project.

Photographs of the construction show how significantly the existing properties were affected. This was also discussed in articles in contemporary engineering and railroad publications. C. N. Bainbridge, an engineer for the CM&SP, noted:

> There are about 20 industries situated along the depression and no two were treated alike. Each industry required special treatment to meet the requirements of the particular situation. . . . In some cases where the buildings were old and of little value, they were torn down and the entire property excavated to the new track level and new buildings constructed. Other concerns underpinned the buildings, and added shipping and receiving doors beneath, while still others allowed the slopes to extend under the building, supporting the buildings on skeleton framework.[6]

Another contemporary reported that "the industries required special treatment to suit the conditions and requirements of each case. In some cases a retaining wall had to be built at the right-of-way line, surmounted by a reinforced-concrete fence. In other cases, the owners permitted the slope of the cut to extend over their property, a toe wall being built at the right-of-way line. This occurred usually where a trestle or other structure at the upper level could be built over the slope. In one case, where 29th St. is parallel with and adjacent to the top of the retaining wall of the cut, an industry had a warehouse on the opposite side of this street. Here a track and team driveway have been provided on the railway side, and a lateral subway built under 29th St. to enable the industry's wagons to drive down a private road from 30th St. and pass under 29th St. to the team driveway." The latter explains the unique tunnel on the south side of the corridor between Colfax and Dupont Avenues. The article noted that where retaining walls directly edged 29th Street, iron railings, rather than concrete parapet walls, were installed to protect passersby from falling into the trench.[7]

Given the volume of material they handled, three coal yards along the corridor were faced with a particularly difficult challenge. One chose to keep its yard at the level of the tracks, accessible by an inclined driveway; coal was elevated to loading bins at street level by a conveyor. The other yards were at street grade. One had a hopper by the tracks, equipped with an inclined conveyor. The second lifted the coal from the tracks below with a traveling hoist.[8]

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[6] Bainbridge, "Large Track Depression Project," 1062.
[7] "Track Depression at Minneapolis," 515-516.
[8] Ibid., 516.

The industries were unhappy about the cost to modify their facilities. "The railway company decided," Bainbridge explained, "because of the many switches and the great amount of switching which would otherwise come off of the main track, to construct a third track from which to serve the industry spurs. As in practically all cases the right of way [typically one-hundred feet] was only wide enough to depress two main tracks without resorting to retaining walls, the railway company contributed to the industries an amount approximately equivalent to what it would have had to expend to construct a retaining wall, within the right of way, adequate to provide for the third track, if the spur tracks were absent. The industries expended this money in altering their plants and providing the spur tracks, while the railroad was relieved from any further responsibility for retaining adjacent lands."[9] Hence, the corridor contained the two main sets of tracks and, in some locations, a service track on one or both sides of the main tracks, plus industry spur lines. At the most intensely developed areas, the corridor was wall to wall tracks. The trackage became even more expansive between 3rd and 5th Avenues, where a rail yard filled a flat area north of the corridor. It was here, at 5th Avenue, that the one grade crossing occurred. Ironically, the railroad tracks had originally run over steel viaducts in this area to avoid a natural ravine. Both in the yard and along the corridor, there was switchgear to shift trains from track to track.

The presence of the rail yard forced a deviation from the three-span norm followed by thirty-five of the thirty-seven bridges built for the grade separation. (The bridge at Hennepin Avenue, erected in 1897, was retained, making the total number of bridges on the corridor thirty-eight.) Fourth Avenue had ten spans, Clinton had six. Excepting this disparity in length, though, their superstructures matched the uniform appearance of the other bridges along the corridor. Concrete parapet railings and posts with recessed panels and projecting copings were the most prominent feature above the deck. The curved, cantilevered deck edge and arched openings in the piers provided some interest below. The construction date was stamped prominently on the abutment of each bridge.

Contemporary journals noted other features of the bridges' design as well. According to a 1915 article in *Engineering News*, "An unusual feature in the bridges is a curved shelf on the outer face of the girder, this being intended to act as a smoke shield by diverting the smoke from the parapet as engines pass under the bridges."[10] Bainbridge remarked on the different treatment that the concrete railings received, as mentioned above, with the surface brushed to expose the aggregate initially and then, in 1915 and 1916, left smooth.[11]

Some writers discussed the method for dealing with utility lines at many cross streets that were disturbed by the trench's excavation: "The water mains were cut temporarily and are being relaid permanently between a pair of the girders of the

[9] Bainbridge, "Large Track Depression Project," 1062.
[10] "Track Depression at Minneapolis," 514.
[11] Bainbridge, "Large Track Depression Project," 1061; "Track Depression at Minneapolis," 517.

concrete bridges. For this purpose each of these girders has a ledge on the bottom of the inner side, forming shelves to support concrete slabs. . . . The pipes are inclosed [*sic*] in frost-proof boxing and are laid upon these slabs. Electric and telephone conduits are carried in the same way, while the gas mains are carried under the bridge abutments and beneath the tracks." Sewer lines were usually below the level of the excavation, but sometimes not far below; in those cases, special reinforced-concrete saddles were installed near the bridge piers to protect the lines.[12]

Manholes were located outside the trench, but *Engineering News* observed that "at intervals of about 300 ft. there are special catchbasins with connections to the sewers. These are of concrete, 2½ x 5 ft., with an iron grating on top to retain large pebbles, etc. At the side of the catchbasin is a low toe wall to prevent material from the slope of the cut being washed down upon the grating."[13]

While interested in specific design features of the bridges and other construction, the reporters were most impressed by the large scale of the project. In 1915, even before the project was completed, an *Engineering News* reporter observed: "The bridges are about 350 ft. apart, and a view along the track gives the general appearance of a tunnel."[14]

That tunnel-like characteristic was still apparent at the time the 2002 survey was conducted. There was diminishing evidence, however, of the industrial presence. Bainbridge wrote in 1915 that there were about twenty industries along the corridor, most on the north side. The 2002 survey, however, found only eight buildings that were physically associated with the trench, of which seven were determined to be noncontributing. Six of the noncontributing buildings were erected after the district's period of significance, 1912 to 1916:

- The Norris Creameries Building, 2828 Emerson Avenue South
- Bruer Bros. Lumber Company, 2836 Lyndale Avenue South
- The Eighth Ward Warehouse Building, 2900 Pleasant Avenue South
- The Sears Building, 2843-2929 Elliot Avenue South
- The Stewart-Cepro Grain Elevator, 2836 11th Avenue South
- The Dayton Rogers Manufacturing Company Building, 2820 13th Avenue South

The seventh, the Western Alloyed Steel Casting Company Building (2848 Pleasant Avenue South), dates from 1916, but has lost its historical integrity due to alterations. Only the Twin City Separator Company Building (2841 Dupont Avenue South) was found to be a contributing element in the historic district.

[12] "Track Depression at Minneapolis," 515.
[13] Ibid., 515.
[14] Ibid., 516.

Despite the preponderance of noncontributing buildings along the edge of the trench, however, the study concluded that the grade separation had sufficient integrity to merit listing in the National Register of Historic Places. It was found to be eligible "as a linear transportation district under Criterion A in the areas of significance of government/politics and community planning and development; and under Criterion C in the area of engineering, for its design and construction of the bridges that incorporated the need[s] [of] the community in an aesthetically pleasing manner and for the use of continuous, concrete girder construction."[15]

The report identified "the district's most significant and defining features" as "the trench, including the landscape, structures, and buildings that define it, the bridges spanning the trench, and the existing railroad trackage system." "Trackage" was defined as "extant rails, ties, switches, and other features within the bed directly related to the movement of trains." The report added that there were "other secondary features in the district" including "lesser reinforced concrete, stone, and concrete block retaining walls; concrete and iron fencing; modern lighting and emergency telephone boxes; modern chain link fencing; concrete structures; railroad crossing signals; and utility poles."[16]

The 2002 study contains a table of the bridges indicating whether or not they contribute to the district but does not include detailed descriptions of the bridges. Of the original thirty-seven bridges that were products of the grade separation project, twenty-eight survived. Seven had been replaced by newer structures; two had simply been removed.[17]

Between the time that the 2002 study was released and the time that the National Register nomination was completed in December 2004, a number of changes occurred in the corridor. At least one was an improvement to the corridor's historic character: the removal of the 1964 addition to the Sears, Roebuck and Company complex that spanned the trench. As a result, the nomination counted the Sears building as two structures rather than one because the original 1928 store and warehouse on the south side of the trench and a 1978 addition on the north side were no longer linked by the 1964 addition.

The nomination's building count remained at eight, though, because of the demolition of the Stewart-Cepro Grain Elevator just to the east. Built in 1928, it was outside of the period of significance for the grade separation historic district and was considered noncontributing to the district. Regardless of this technicality, it was a strong symbol of the industrial character of the district, and its profile echoed the scale of other grain elevators and coal bins that initially edged the trench. The elevator was eligible for the National Register in its own right under Criterion A as "the best remaining example of a Minneapolis terminal elevator located on an isolated, individual site," according to a study evaluating its

[15] Stark, et al, "Phases I and II for Midtown Greenway," 81.
[16] Stark et al., "Phases I and II, Midtown Greenway," 54, 70.
[17] Ibid., 68-70.

significance. “These types of elevators, along with those elevators found in larger groupings, help to illustrate the significance of the grain trade in Minneapolis during the first half of the twentieth century.”[18]

The development of the Midtown Greenway introduced some new elements, such as paths, entry ramps, and ornate lighting. As part of this initiative, tracks and related equipment were removed. The modifications were concentrated at the west end of the corridor.

The greenway has been extended throughout the entire corridor since the grade separation district was nominated to the National Register in December 2004, resulting in further attrition of its historic fabric. As the primary focus of this study, the bridges will be examined first. It is difficult to evaluate some details of the surviving bridges because either their design varies from descriptions given in the early twentieth-century articles or the features identified by those writers are hard to observe. This is most apparent when it comes to the smoke shields, the girder ledges that accommodated water lines, and the saddles for the sewer lines, all of which could be considered important design elements. The girder ledges are visible on a minority of the bridges today (for example, those at Harriet and Pillsbury Avenues) and were perhaps not included on all of the structures. The saddles over the sewers cannot be easily examined. The smoke shields appear on bridges at the middle and eastern end of the corridor, but not on some of the bridges at the western end. It is possible that they were not included on the earliest bridges that were constructed. The different treatments of the parapet concrete that one writer noted—brushed to expose aggregate on the west end, then left smooth further east—is no longer discernable; weather has exposed the aggregate throughout the corridor. None of these issues are of sufficient import to make a bridge noncontributing.

Neither the 2002 survey nor the 2004 National Register nomination provided a detailed description of each bridge, so it is not possible to identify changes that have occurred in the past few years. There are, though, some obvious alterations to the original structures that have been made relatively recently. The parapet height of virtually all of the bridges has been raised by a single horizontal metal pipe, supported by a bracket that is bolted to the top of the parapet. In some cases, these anchors are accelerating deterioration of the concrete, which someone has attempted to address by applying paint or a textured coating. While perhaps an economical way to slow the concrete’s deterioration, these treatments are not sensitive to the historic character of the bridges and their effects might be counterproductive. As with the issues mentioned in the preceding paragraph, these alterations do not change the contributing status of the bridges.

[18] William Stark and Kristen Zschomler, “Phase II Architectural History Investigation of the Stewart-Cepro Grain Elevator, Minneapolis, Hennepin County, Minnesota,” prepared by the 106 Group Ltd. for the Hennepin County Department of Transit and Community Works, July 2001.

The damage is greater, however, if a parapet has been removed. The east parapet is completely missing from the Nicollet Bridge. The 2002 study noted that the east facade of the bridge had been "modified," but the nature of that modification was not described. In any event, the study concluded that the modifications were not so adverse as to make the bridge noncontributing. The parapets, though, are a key character-defining feature of the corridor bridges and they contribute greatly to the overall appearance of the historic district. The corridor would look quite different if none of the parapets were intact. It seems reasonable, therefore, to require that a bridge retain both parapet railings to claim good integrity. The parapets on the Pillsbury Bridge illustrate the point. They have been replaced, perhaps since the National Register nomination was prepared, with modified J-barriers, compromising the appearance and integrity of the bridge. In reevaluating the Nicollet and Pillsbury Bridges, it appears that both should now be considered noncontributing.

An even more clear-cut call can be made in the case of the demolition of bridges at Chicago and Portland Avenues. While the new designs are handsome and pay tribute to the three-span structure of the historic bridges, they have only a single span. The removal of the historic bridges seriously weakens the character of the historic district in that vicinity.

Finally, the National Register's designation of the bridges at Elliot and 10th Avenues as contributing is questionable. Both were erected as three-span structures in 1915, but underwent major modification when the train shed for the Sears building was constructed well after the end of the corridor's period of significance. Their abutments were rebuilt south of their original locations and the bridges expanded to four spans, with the southernmost span incorporated into the structure of the train shed. A reconstruction of this magnitude has a major impact on integrity.

Table 1 provides a reassessment of the National Register's list of contributing and noncontributing bridges, based on the considerations above:[19]

[19] The list of bridges in the National Register nomination did not include the Clinton and Third Avenue Bridges, which were removed and not replaced. To provide a comprehensive comparison between original and current conditions, both bridges are included in the list above.

Table 1. Reassessment of the National Register's List of Contributing and Noncontributing Bridges

Bridge Name	Built	NR Nomination	Recommended[20]	Comments
Cedar Avenue	1916/ 1915	Contributing	Contributing	
18th Avenue	1916	Contributing	Contributing	
17th Avenue	1916	Contributing	Contributing	
16th Avenue	1916	Contributing	Contributing	
15th Avenue	1916	Contributing	Contributing	
14th Avenue	1916	Contributing	Contributing	
13th Avenue	1915	Contributing	Contributing	
12th Avenue	1915	Contributing	Contributing	
11th Avenue	1915	Contributing	Contributing	
10th Avenue	1915	Contributing	Noncontributing	Altered after period of significance; included in Sears NRHP boundaries
Elliot Avenue	1915	Contributing	Noncontributing	Altered after period of significance; included in Sears NRHP boundaries
Chicago Avenue	1915	Contributing	Replaced	
Columbus Avenue	1915	Contributing	Contributing	
Park Avenue	1915	Contributing	Replaced	
Oakland Avenue	1915	Contributing	Contributing	
Portland Avenue	1914	Contributing	Contributing	
4th Avenue	1997	Noncontributing	Noncontributing	
Clinton Avenue	1915	N/A	N/A	Removed
3rd Avenue	1914	N/A	N/A	Removed
2nd Avenue	1982	Noncontributing	Noncontributing	
I-35W	1967	Noncontributing		
Stevens Avenue	1982	Contributing		
1st Avenue	1914	Contributing		
Nicollet Avenue	1914	Contributing	Noncontributing	East railing removed
Blaisdell Avenue	1982	Noncontributing	Noncontributing	
Pillsbury Avenue	1914	Contributing	Noncontributing	Railings replaced
Pleasant Avenue	1913	Contributing	Contributing	
Grand Avenue	1914	Contributing	Contributing	
Harriet Avenue	1914	Contributing	Contributing	
Garfield Avenue	1992	Noncontributing	Noncontributing	
Lyndale Avenue	1987	Noncontributing	Noncontributing	
Aldrich Avenue	1913	Contributing	Contributing	
Bryant Avenue	1913	Contributing	Contributing	Changes to the north abutment related to the access ramp are unfortunate
Colfax Avenue	1913	Contributing	Contributing	
Dupont Avenue	1987	Noncontributing	Noncontributing	
Emerson Avenue	1986	Noncontributing	Noncontributing	
Fremont Avenue	1913	Contributing	Contributing	
Hennepin Avenue	1980/ 2000	Noncontributing	Noncontributing	Not part of grade separation project

Key: Retains good integrity (contributing)
Questionable integrity
Historic bridge location—bridge removed or lost integrity (noncontributing)
New bridge location (noncontributing)

[20] See SHPO/Mn/DOT CRU comments in Section IX and the Executive Summary.

The table illustrates the attrition of bridges in the historic district. An excellent concentration of nine bridges remains, though, on the east end of the grade separation. This cluster, which includes about one-quarter of the original bridges, exemplifies the final phase of the corridor's construction. A more diluted, yet still somewhat intact group stretches from Stevens to Fremont Avenues. As a group, the integrity of the bridges between Interstate 35W and 10th Avenue is poor to nonexistent.

An examination of other characteristic features of the corridor reveals a similar pattern. The worst compromises to the district's integrity are evident between Interstate 35W and 11th Avenue. The massive interstate bridge is elevated high above the corridor, an ominous presence that spurns the precedent established by the historic bridges. To the east, only empty abutments mark the locations of the Clinton and 3rd Avenue bridges. The original 4th Avenue bridge has been replaced by a modern structure that is attractive, yet very much out of character with the historic corridor. The land beneath the bridge that once held a rail yard is now occupied by a neatly groomed soccer field. The new bridges at Chicago and Portland Avenues, while more in keeping with the corridor, are the first replacement bridges to break the three-span rhythm. The greenway access by the Sheraton Hotel, just east of Chicago Avenue, and a new access point on the north side between 10th and 11th Avenues are modern intrusions, regardless of how sensitively designed.

In the corridor between Hennepin and Stevens Avenues, it appears that, as with the original construction of the grade separation, recent alterations have moved from west to east. The secondary features mentioned in the National Register district, such as historic fences and retaining walls, are mostly intact. "Improvements," though, have diluted the sense that this was once a rail corridor. These alterations include a new concrete wall between Hennepin and Fremont with an ashlar pattern that is more formal and finished than the gritty vernacular of the original rail corridor; ornate light standards; a tall retaining wall that has replaced the older building directly west of the Twin City Separator Company; and a modern chain-link fence that runs to the south of the pedestrian/bicycle trail. Between Blaisdell and Stevens, there is a noticeable difference in grade between the north and south sides of the area once occupied by the main tracks, and the chain-link fence is on a concrete-block base. New access ramps are also intrusive, but are at least edged with a rock-faced concrete block that has a more industrial character than the ashlar version. Along the trench, industrial buildings are being converted into multifamily residences, offices, galleries, and other uses. New residential buildings display modern interpretations of an industrial aesthetic.

The natural landscape has also undergone a change. During the period of significance, there would have been little, if any, vegetation in the corridor. Since that time, any vegetation that appeared was voluntary, and hence haphazard in type and placement. Today, the corridor plantings are being domesticated, especially on the north side between Lyndale and Harriet Avenues where a

community garden and "Vera's Garden" are delightful, but completely inappropriate to the historic context. In other locations that were once railroad spurs, trees have replaced tracks.

East of 11th Avenue, the natural landscape has experienced less human intervention and the built environment bears fewer traces of alteration in the past decade. While the railroad tracks are gone, the bridges are completely intact and some smaller features of the original corridor, such as a catch basin, survive. All in all, the integrity of this section remains very good. Thanks, in large part, to the volunteer vegetation that screens the trench from the adjacent neighborhoods, this section of the historic district still strongly evokes the tunnel-like feeling of the early twentieth-century railroad corridor, depressed to minimize conflicts with other uses of the area.

The spectrum of integrity within the corridor raises the question of the future of the historic district. It seems that sufficient resources remain in the east and west sections to justify continued designation, but perhaps the boundaries should be revised. One approach would be to adjust the National Register boundaries using the historic precedent of the construction "run-outs" that were at Lyndale in 1912, Nicollet in 1913, Chicago in 1914, and Cedar in 1916.[21] If the Nicollet to Chicago section were removed, it would leave segments of early and final construction at each end. This does not completely align, though, with the artifacts that are intact today. The stretch from 11th Avenue to the east end of the district is clearly the best preserved. The section between Fremont and Stevens Avenues, although borderline, still has sufficient integrity to reflect its origin as a rail corridor. Whether the boundaries should be rewritten to establish a noncontiguous district consisting of these parts, or whether the area between Interstate 35W and 11th Avenue should simply be classified as a noncontributing part of the district, is an issue that should be resolved in consultation with the SHPO. An important consideration in this discussion is the apparent inevitability of continued change along the corridor.

C. ORIGINAL CONSTRUCTION METHODS AND MATERIALS

Prepared by Charlene Roise, Hess, Roise and Company

Between 1879 and 1881, the Chicago Milwaukee and Saint Paul Railway (CM&SP) created what was known as the Benton Cutoff line to haul grain from the fields of western Minnesota to the flour mills of Minneapolis. In south Minneapolis, the route ran just north of 29th Street between Lake of the Isles and Hiawatha Avenue, where a large railroad shops complex was established.

At the time of its construction, the line was well beyond the concentration of residential settlement. As Minneapolis's population boomed in the late nineteenth century, however, the line was quickly leapfrogged by development, and conflicts

[21] "Track Depression at Minneapolis," 515.

between people and trains at intersections proliferated. The city demanded that the railroad depress the tracks below grade, a mandate the company resisted through litigation until the Supreme Court ruled against it. The railroad finally agreed to dig a trench some three miles long for its double track and build thirty-seven bridges over the trench.

Construction of the grade separation began in 1912. Work started by Irving Avenue and proceeded east, reaching completion in fall 1916. The bridge design was state of the art for the period, but not particularly innovative. The project's relatively large scale and high visibility, however, made it a precursor to later transportation infrastructure projects, such as Interstate 35W, that were imposed on well-established urban areas.

The prominence of such projects tends to introduce factors beyond basic function into their development. Aesthetics, for example, influenced the design of the grade separation bridges, as noted in an article in *Railway Age Gazette* in December 1915: "The tracks . . . pass through a portion of the better residence district of Minneapolis, and although numerous industries line the right of way for the greater part of the distance, it was desirable to have the finished work give as pleasing an effect as possible. Considerable attention was, therefore, given to the selection of the most suitable type of bridge." The article was written by C. N. Bainbridge, the Chicago-based engineer for the CM&SP.[22]

That said, the engineers approached the design pragmatically. Reinforced concrete was apparently the only material considered. They thought about casting bridge decks and piers at a central plant, but rejected this concept for a number of reasons. Precast spans would require more concrete because the spans would be simple beams; cast in place, the beams could be continuous and, therefore, of a smaller dimension. Moving the elephantine precast units, weighing thirty-five to forty-five tons, would be dangerous, and might cause delays on the single track that the railroad hoped to keep open during construction. The railroad would have to modify some of its heaviest equipment to maneuver the precast units into place, putting those expensive machines out of service for other projects during the entire construction period. It would need fixed rigging to erect the precast units, as well as a movable concrete plant for the abutments, which accounted for about half of the total concrete in each structure. Finally, to be economical, it would have to run the precast plant continuously until all of the units were produced, which was estimated to take nine months; construction of the bridges, though, was anticipated to take four years, so the precast units would have to be stored until needed.[23]

[22] C. H. Bainbridge, "A Large Track Depression Project at Minneapolis," *Railway Age Gazette*, December 3, 1915, 1059.
[23] Ibid., 1059-1060.

Given these issues, the engineers opted for a monolithic standard plan that featured three spans and was cast in place. In response to existing street dimensions, deck widths ranged from 48 to 68 feet overall and held a roadway flanked by 8-foot sidewalks and concrete parapet railings. The center span, which measured 29 feet 9 inches clear and 31 feet 6 inches center-to-center of pier columns, crossed two sets of mainline tracks with a clearance of 18 feet 6 inches. Each of the 29-foot-clear side spans could potentially accommodate two sets of tracks, either for the CM&SP or spurs to adjacent industrial property. That potential was limited, though, by the height of the abutments, which came in three sizes. The tallest, which rose 24 feet from footing to bridge seat, could handle two tracks. The 19-foot-tall intermediate size could accommodate one track, and the 9-foot small abutment, none. Both the tall and intermediate designs incorporated counterforts; the small abutment was a gravity type. The concrete mix was slightly different for the short abutment (1:3:6) than it was for the medium and tall abutments (1:2 1/2:5).[24]

All of the piers were the same height—25 feet 6 inches—but the number of 2-foot-square columns in the piers varied from four to six depending on the deck width. The columns were separated by arch-topped openings below a transverse girder cap, which was integral with the floor beam.

Two bridges varied from the three-span norm. The one at 4th Avenue was ten spans and that at Clinton Avenue was six spans. Other features of these bridges matched the standard plan. The longer structures accommodated a switchyard with multiple tracks just north of the mainline. Vehicles could enter the yard from 29th Street and also from 5th Avenue, the only road to cross the depressed corridor at grade.[25]

Most of the construction was done by railroad force labor. At its peak, the project employed some five hundred men, of which 50 to 60 percent were assigned to bridge work. Excavation for the abutments sometimes occurred before the trench was completed, allowing the unwanted material to be placed on railcars by steam shovel as the trench was dug. Otherwise, the material was used to fill bridge approaches, with workers hand-shoveling the material into wagons. The six bridges carrying streetcar lines (Lyndale, Nicollet, Chicago, 4th Avenue, Bloomington, and Cedar) were a priority, so construction was started on some of those bridge abutments even before the streets were closed to traffic. Pilings were not required because of good foundation conditions: sand and gravel, with a few clay seams. Abutments were poured in three sections for streets 80 to 100 feet wide, and two sections for narrower streets.[26]

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[24] Ibid., 1060; "Track Depression at Minneapolis," *Engineering News* 73 (March 18, 1915): 516. A few of the side spans were 42 feet to permit three tracks below. Concrete mixes are given as a ratio of cement, fine aggregate (sand), and coarse aggregate (usually gravel); a mix of 1:3:6, for example, is one part cement, three parts sand, and six parts gravel. The higher the percentage of cement, the harder the concrete, so a 1:3:6 mixture (10 percent cement) is not as strong as a 1:2 1/2:5 mixture (about 12 percent cement).
[25] Bainbridge, "Large Track Depression Project," 1060.
[26] Ibid., 1062-1063; "Track Depression at Minneapolis," 516; "Track Depression Work of the C. M. & St. P. Ry. at Minneapolis," *Railway Review* 57 (July 17, 1915): 70-71. Hennepin Avenue also had a streetcar line, but there was

Because of the similarity of the bridges' design, sectional forms for the floors, handrails, and piers were reused several times with only minor modification. Reinforcing bars were cut and bent at a work yard and delivered to each bridge site ready for installation. During the 1912 and 1913 construction seasons, a stiff-legged derrick was installed at each bridge to help place the formwork, position the reinforcing bars, and pour the concrete. The last two years, an A-frame derrick lifted the formwork and reinforcing bars, while the concrete was applied directly from a portable concrete plant—a half-yard drum-type mixer mounted on a flatcar. The concrete was conveyed from the mixer by half-yard dump buckets, specially designed by the railroad's engineering department. The buckets were raised by a track pile driver that had been converted into an elevator, and emptied into chutes, which were positioned to place the concrete.[27]

Railroad engineer Bainbridge, writing in *Railway Age Gazette* in 1915, described the construction of the bridge piers: "The footings were poured in one run, reinforcing bars projecting about 4 ft. above the construction joint to form a splice with the main reinforcing steel in the columns. A key block 14 in. square is placed at the construction joint at the base of each column. The cross girders connecting the top of the columns are cast with the floor beams." The concrete mix for the footings was 1:3:6; the concrete for the remainder of the piers, as well for as the girders and floors, was 1:2:4.[28]

"The floors of the bridges," Bainbridge explained, "are of the T-beam type, are 3 ft. 6 in. deep, including 5 in. of paving, and are built continuous from abutment to abutment, a distance of 91 ft. 6 in., expansion joints being placed at the bridge seats." Bainbridge noted that "a layer of 1:2 cement mortar is placed in the bottom of all beams and slabs to a sufficient depth to insure the covering of all bars before any concrete is poured." False work and forms remained in place for two to three weeks. The reinforced-concrete sidewalks and handrails were then poured in place. During the first two construction seasons, the railing formwork was removed before the concrete was completely set and the fresh surface roughened with a stiff wire brush to expose the aggregate, which included red granite screenings. In 1915 and 1916, aesthetic preferences changed and a smooth concrete face was preferred. The forms were left on longer, and the surface treated only enough to remove irregularities or discoloration. A smoke shield was incorporated into the base of the fascia girders to protect the parapet from smoke stains. The curved ledge was about 6 inches from top to bottom and projected 9 inches from the fascia.[29]

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an existing bridge at Hennepin, dating from 1897, which was left in place (Bainbridge, "Large Track Depression Project," 1059).

[27] "Track Depression at Minneapolis," 516-517; Bainbridge, "Large Track Depression Project," 1063.

[28] Bainbridge, "Large Track Depression Project," 1060-1061; "Track Depression at Minneapolis," 516.

[29] Bainbridge, "Large Track Depression Project," 1061; "Track Depression at Minneapolis," 517.

The design of the sidewalk and roadway on Nicollet Avenue was unique. Existing traffic conditions justified a 50-foot-wide roadway at the time the bridge was constructed, but projections called for a 60-foot roadway in the future. The wider roadway was built flanked by 10-foot sidewalks, slightly wider than the 8-foot norm, with a band of hollow-tile blocks extending each sidewalk into the roadway another 5 feet. The blocks were covered with a layer of concrete to integrate them with the sidewalk, but could be easily removed when a wider roadway was desired.[30]

All told, the thirty-six bridges, including abutments and piers, consumed some 33,000 cubic yards of concrete and 900 tons of reinforcing bars.[31]

IV. POTENTIAL TRANSIT WITHIN THE RAIL CORRIDOR

The HCRRA purchased the Midtown Corridor for the potential use of future rail transit. LRT is currently under study, as is a modern streetcar line. Potential impacts to the corridor of a two-tracked rail line are summarized in Table 2.

The HCRRA is cautious that any work planned for the bridges will not impede future uses or alignments of the transportation corridor. The Southwest Transitway Alternatives Analysis Study, finalized in late 2006, recommends that three options move forward to the Draft Environmental Impact Statement and identifies transitway options that may utilize a portion of the Midtown Corridor. Sufficient engineering has not been performed to determine the specific modifications to the existing bridges that might be needed for a transitway. It may be necessary to remove and/or replace some of the existing bridges to implement a transitway. Even if an option utilizing the Midtown Corridor is not selected as part of the Southwest Transitway, other options for rail transportation within the corridor may be considered in the future, and the extent to which they would impact the existing bridges cannot be determined at this point in time.

[30] "Track Depression at Minneapolis," 517.
[31] Bainbridge, "Large Track Depression Project," 1061.

Table 2. Impacts From Potential Transit Within the Rail Corridor

Bridge Location	Mn/DOT No.	Mpls. No.	Feature	Exisitng South Abutment	Existing North Abutment	Existing Span Configuration (S - N)	32' Wide Double Track	51' Wide Double Track and Center Platform	53' Wide Double Track and Side Platforms	57' Wide Double Track + Center Platform + Vertical Connection	65' Wide Double Track + Side Platforms + Vertical Connection	Greenway Trail	Stairs and/or Ramps	Escalator and Elevator	North Retaining Wall	South Retaining Wall
Hennepin Ave.	27599	4788	LRT STA	Tall	Tall							Need portal opening to assess	Need portal opening to assess	Note 3	Need portal opening to assess	Probably needs to be rebuilt south of current location
Freemont Ave. S.	L8901	7787	LRT	Tall	Short	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	No platform = no impact	- - -	- - -	No platform = no impact	No platform = no impact
Emerson Ave. S.	27665	4786	LRT	Short	Short	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Needs to move north	- - -	- - -	Needed to move trail	Wide track/platfrom may require wall
Dupont Ave. S.	27666	4785	LRT	Short	Short	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Needs to move north	- - -	- - -	Needed to move trail	Wide track/platfrom may require wall
Colfax Ave. S.	L8902	7783	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Existing Bryant ramps push bike path into center portal - need to rebuild	Rebuild ramp to north	- - -	Rebuild to north	Wide track/platfrom may require wall
Bryant Ave. S.	L8903	7782	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Existing Bryant ramps push bike path into center portal - need to rebuild	Rebuild ramp to north	- - -	Rebuild to north	Wide track/platfrom may require wall
Aldrich Ave. S.	L8904	7781	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Existing Bryant ramps push bike path into center portal - need to rebuild	Rebuild ramp to north	- - -	Rebuild to north	Wide track/platfrom may require wall
Lyndale Ave.	27243	5780	LRT STA	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	Track and Platform Stradle South Pier	Side Platforms Under End Spans	Note 1	Note 2	Existing trail in center portal - reconstruct north	- - -	- - -	Build wall to north	Transition walls needed through and out of platform
Garfield Ave.	27675	7779	LRT	Short	Medium	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Existing trail in center portal - reconstruct north	- - -	- - -	Build wall to north	Transition walls needed through and out of platform
Harriet Ave.	L8906	7778	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	Wide track/platfrom may require wall
Grand Ave.	L8907	7777	LRT	Medium	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Existing buildings	- - -
Pleasant Ave.	L8908	7776	LRT	Medium	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	- - -
Pillsbury Ave.	L8909	7775	LRT	Medium	Short	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Rebuild to north	- - -
Blaisdell Ave.	27610	4774	LRT	Short	Short		Center portal	- - -	- - -	- - -	- - -	Existing trail in center portal due to Nicollet ramp- reconstruct north	Rebuild ramp to north	- - -	Rebuild to north	Transition walls needed through and out of platform
Nicollet Ave.	90590	5773	LRT STA	Medium	N/A	30.75' - 31.5' - 30.75'	Center portal	Track and Platform Stradle South Pier	Side Platforms Under End Spans	Note 1	Note 2	Existing trail in center portal due to Nicollet ramp- reconstruct north	Rebuild ramp to north	- - -	Rebuild to north	Transition walls needed through and out of platform
1st Ave. S.	92347	4772	LRT	Tall	Short	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Rebuild to north	Transition walls needed through and out of platform
Stevens Ave.	L8910	7771	LRT	Tall	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
I-35W (Main Line)	27867	1137	LRT	Tall	Tall	Single Span						Need portal opening to assess	Need portal opening to assess	Need portal opening to assess	Need portal opening to assess	
2nd Ave. S.	27648	4741	LRT	Short	Short	New 3-Span Steel						Need portal opening to assess	Need portal opening to assess	Need portal opening to assess	Need portal opening to assess	Wide track/platfrom may require wall

Table continues on next page.

Table 2. Impacts From Potential Transit Within the Rail Corridor (Continued)

Bridge Location	Mn/DOT No.	Mpls. No.	Feature	Exisitng South Abutment	Existing North Abutment	Existing Span Configuration (S - N)	32' Wide Double Track	51' Wide Double Track and Center Platform	53' Wide Double Track and Side Platforms	57' Wide Double Track + Center Platform + Vertical Connection	65' Wide Double Track + Side Platforms + Vertical Connection	Greenway Trail	Stairs and/or Ramps	Escalator and Elevator	North Retaining Wall	South Retaining Wall
4th Ave. S.	27A32	4767	LRT	Short	Short	New 3-Span Slab						Need portal opening to assess	Need portal opening to assess	Need portal opening to assess	Need portal opening to assess	Wide track/platfrom may require wall
Portland Ave.	90494	5766	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	Wide track/platfrom may require wall
Oaklane Ave.	L8911	7765	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	Wide track/platfrom may require wall
Park Ave.	90491	5764	LRT	Tall	Tall	Single Span										
Columbus Ave.	L8913	7763	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	Transition walls needed through and out of platform
Chicago Ave.	92349	4762	LRT STA	Tall	Tall	Single Span										Transition walls needed through and out of platform
Elliot Ave.	L8914	5761	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	Transition walls needed through and out of platform
10th Ave. S.	L8915	7760	LRT	Tall	Tall	30.75' - 2 at 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	- - -
11th Ave. S.	L8916	7759	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	Wide track/platfrom may require wall
12th Ave. S.	L8917	7758	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	Wide track/platfrom may require wall
13th Ave. S.	L8918	7757	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	Wide track/platfrom may require wall
14th Ave. S.	L8919	7756	LRT	Short	Tall	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	- - -	Wide track/platfrom may require wall
15th Ave. S.	L8920	7755	LRT	Short	Short	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Build wall to north	Wide track/platfrom may require wall
Bloomington Ave.	92350	4754	LRT	Medium	Medium	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Build wall to north	Wide track/platfrom may require wall
16th Ave. S.	L8921	7753	LRT	Medium	Medium	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Build wall to north	Wide track/platfrom may require wall
17th Ave. S.	L8922	7752	LRT	Medium	Medium	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Build wall to north	Wide track/platfrom may require wall
18th Ave. S.	L8923	7751	LRT	Medium	Medium	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Build wall to north	Wide track/platfrom may require wall
Cedar Ave.	90437	5750	LRT	Medium	Medium	30.75' - 31.5' - 30.75'	Center portal	- - -	- - -	- - -	- - -	Bike path in center portal - rebuild trail at north portal	- - -	- - -	Build wall to north	Wide track/platfrom may require wall

[1] A vertical connection to the existing bridge would require concrete parapet changes. It would be better to ramp down, cross the tracks, and use the corridor access on the north side.
[2] A vertical connection on each side would demand too much horizontal space. It would be better to ramp down, cross the tracks to the north, and use the corridor access on the north side.
[3] A vertical connection between parallel tracks to the Hennepin Avenue bridge is not feasible.

A. LIGHT RAIL TRANSIT

The Southwest Transitway Alternatives Analysis Study, finalized in late 2006 by others, identifies options for utilizing a portion of the Midtown Corridor for rail transit. Sufficient engineering has not been performed to determine what specific modifications to the existing bridges, if any, would be needed for a transitway.

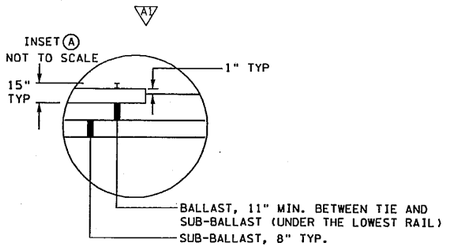
1. Alignment Needs

Alignment needs for LRT would require portal alignment through the corridor such that trackage would be reasonably straight and true. With the number of structures to pass through, misaligned portals would create multiple S-curves in the track. The proximity of bridges may not provide sufficient length between S-curves to fully develop track standards. The bridge piers could complicate matters further, due to the necessary track clearance distances from fixed objects. Matters could be further complicated by the fact that many of the piers do not follow the same alignment.

Required geometric considerations beyond portal alignments include the need for double track platforms; a bridge portal that is no less restrictive (horizontally) than the Park and Chicago Avenue bridges, single-span bridges or bridges that clear span the track area (as these are less restrictive to future corridor arrangements and/or uses); required vertical clearances of 23’-0” unless prior approval is given by the HCRRA (reviewed on a case-by-case basis); and vertical connections to street grade.

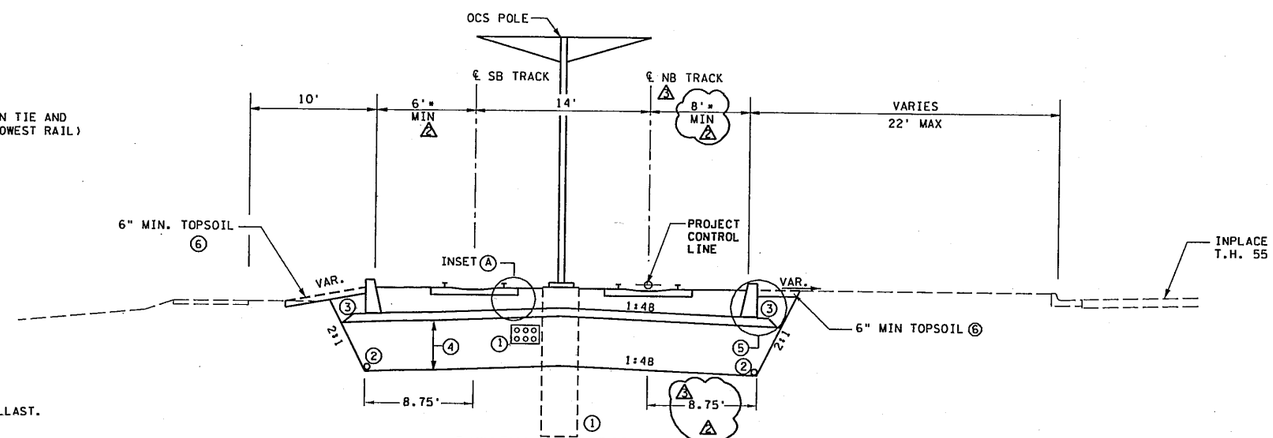
2. Double Track

A typical section of ballasted double track requires a continuous minimum width of approximately 32 feet for construction (26 feet from face of ballast curb to face of ballast curb plus 3 feet on each side for ballast curb and construction space). Double track configurations are shown at the tops of Figures 1 and 2.



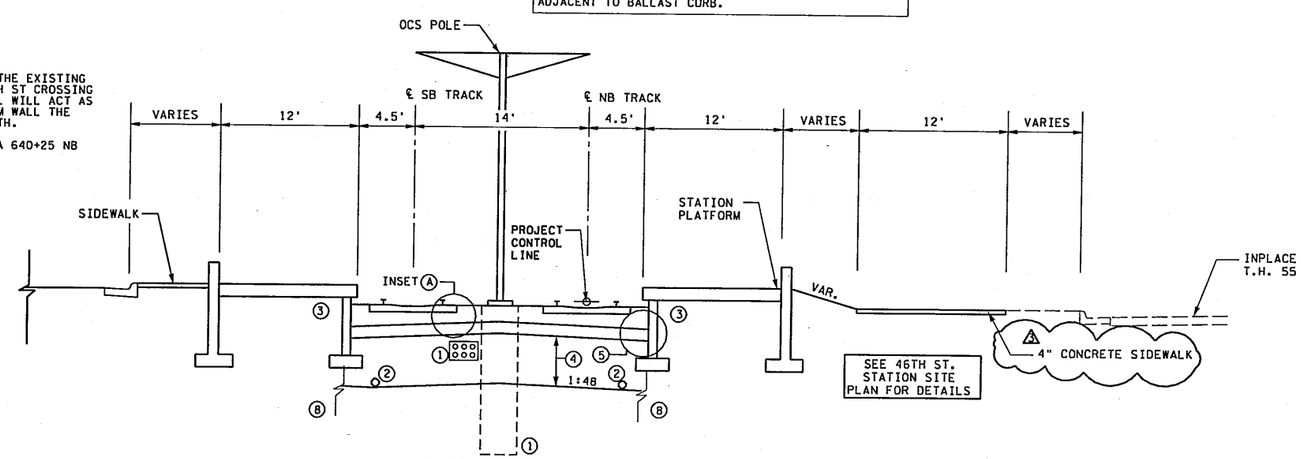
NOTES:

1. SEE OCS PLANS FOR POLE LOCATIONS AND SEE SYSTEMS PLANS FOR DUCT BANK LOCATION AND DIMENSIONS.
2. 6" HDPE PERFORATED SUB-DRAIN, WITH GEOTEXTILE SOCK, LOCATIONS TO BE DETERMINED BY THE GEOTECHNICAL ENGINEER.
3. BACKFILL WITH SUITABLE GRADING MATERIAL.
4. 4' NON-FROST SUSCEPTIBLE SOIL UNDER SUB-BALLAST. DEPTH OF EXCAVATION WILL VARY DEPENDING ON SOILS CONDITION AND COORDINATION WITH GEOTECHNICAL ENGINEER.
5. SEE BALLAST CURB AND BALLAST DRAIN PIPE DETAIL SHEET. (TYPICAL)
6. SEED TOPSOIL WITH TYPE 30A MODIFIED AND MULCH TYPE 1. FERTILIZE WITH SLOW RELEASE TYPE FERTILIZER AT 270 LB/ACRE. TEMPORARY SEEDING AS DIRECTED BY FIELD ENGINEER, SEED MIX 100 AT 40 LB/ACRE.
7. BLANK
8. SEE STATION PLATFORM AND CANOPY PLANS FOR FOUNDATION DETAIL
9. BALLAST CURB IS PLACED ALONG THE SB TRACK FROM THE EXISTING PRECAST NOISE BARRIER AT STA 642+16.2 SB TO 46TH ST CROSSING PRECAST PANEL AT STA 642+85.6. THE CONCRETE WALL WILL ACT AS THE BALLAST CURB & AS THE TRACK TAPERS AWAY FROM WALL THE BALLAST SHLDR WILL TAPER TO THE STANDARD 5' WIDTH.
10. PLACE A BALLAST CURB ALONG THE NB TRACK FROM STA 640+25 NB TO STA 642+82.2 NB.



HIAWATHA CORRIDOR LRT
TRUNK HIGHWAY 55
STA. 642+00 TO STA. 646+40 (9)(10)
NOT TO SCALE

* STA. 644+40 TO STA. 646+40 CONSTRUCT BALLAST CURB 8' RT AND LT OF NB AND SB TRACK ℄. INSTALL FENCE PER MNDOT STND PLATE 9322J ADJACENT TO BALLAST CURB.



HIAWATHA CORRIDOR LRT
TRUNK HIGHWAY 55
STA. 646+40 TO STA. 649+00
(46TH ST. STATION)
NOT TO SCALE

AS-BUILT

I hereby acknowledge that the as-built information shown herein is complete and accurate, to the best of my knowledge, incorporating information provided by the contractor.

David F. Peterson 10-28-05
David F. Peterson
Design Manager

Figure 1

NO	DATE	BY	CKD	APPR	REVISION
A1	10/18/05	DRS	SRM	DFP	ADD NOTE - FDM 234
3	5/6/2002	JLR	MLB	RAB	WALK THICKNESS; FDM 142
2	2/28/2002	JLR	HZ	RAB	BALLAST CURB LIMITS
1	7/25/2001	HPO	DPB	RAB	HPO COMMENT REVISIONS
0	6/22/2001	HZ	DPB	RAB	RELEASED FOR CONSTRUCTION

DESIGNED BY HZ
CHECKED BY JLR
DRAWN BY HZ
CHECKED BY RAB

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Rex A. Brejnik
Printed Name
Date: _____ Lic. No. 23872

PARSONS TRANSPORTATION GROUP INC.
EDWARDS AND KELCEY, INC.
A JOINT VENTURE

RELEASED FOR CONSTRUCTION

HIAWATHA PROJECT OFFICE

MINNESOTA DEPARTMENT OF TRANSPORTATION-S.P. 2724-00LRT

HIAWATHA LRT PROJECT
TYPICAL SECTIONS
STA. 642+00 TO STA. 649+00

CIVIL | DRAWING NAME: T.S38

SHEET 13 OF 272

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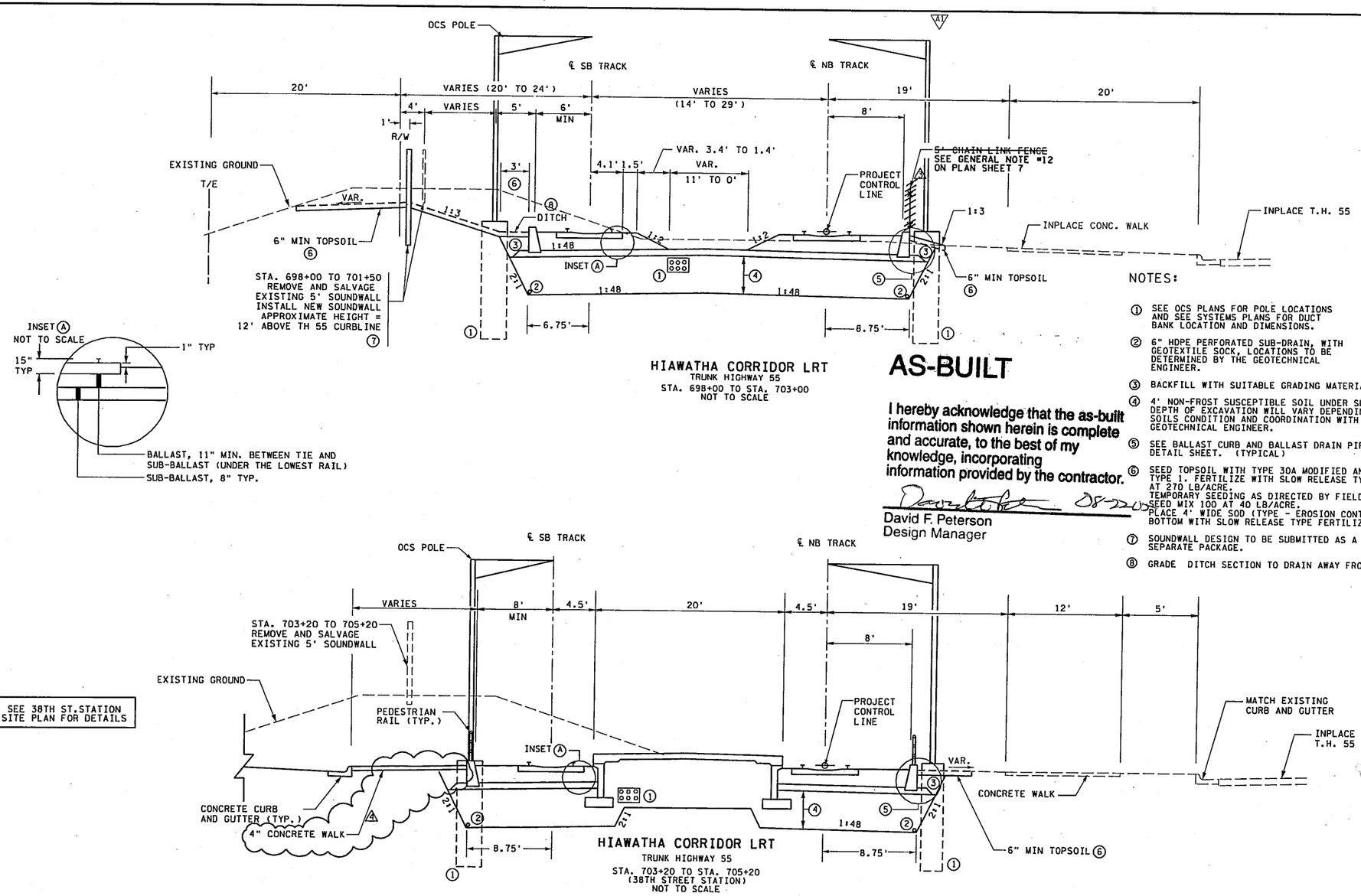

AS-BUILT

I hereby acknowledge that the as-built information shown herein is complete and accurate, to the best of my knowledge, incorporating information provided by the contractor.

08-22-05

David F. Peterson
Design Manager

NOTES:

1. SEE OCS PLANS FOR POLE LOCATIONS AND SEE SYSTEMS PLANS FOR DUCT BANK LOCATION AND DIMENSIONS.
2. 6" HDPE PERFORATED SUB-DRAIN, WITH GEOTEXTILE SOCK, LOCATIONS TO BE DETERMINED BY THE GEOTECHNICAL ENGINEER.
3. BACKFILL WITH SUITABLE GRADING MATERIAL.
4. 4' NON-FROST SUSCEPTIBLE SOIL UNDER SUB-BALLAST. DEPTH OF EXCAVATION WILL VARY DEPENDING ON SOILS CONDITION AND COORDINATION WITH GEOTECHNICAL ENGINEER.
5. SEE BALLAST CURB AND BALLAST DRAIN PIPE DETAIL SHEET. (TYPICAL)
6. SEED TOPSOIL WITH TYPE 30A MODIFIED AND MULCH TYPE 1. FERTILIZE WITH SLOW RELEASE TYPE FERTILIZER AT 270 LB/ACRE.
   TEMPORARY SEEDING AS DIRECTED BY FIELD ENGINEER, SEED MIX 100 AT 40 LB/ACRE.
   PLACE 4' WIDE SOD (TYPE - EROSION CONTROL) OVER DITCH BOTTOM WITH SLOW RELEASE TYPE FERTILIZER AT 135 LB/ACRE.
7. SOUNDWALL DESIGN TO BE SUBMITTED AS A SEPARATE PACKAGE.
8. GRADE DITCH SECTION TO DRAIN AWAY FROM TRACKS.

Figure 2

NO	DATE	BY	CKD	APPR	REVISION
A1	02/20/04	RLH	RJH	DFP	ADDED NOTE PER SA D073
4	5/6/2002	JLR	MLB	RAB	CONCRETE WALK LIMITS @ 38TH
3	2/28/2002	JLR	MJW	RAB	FENCE LOCATION
2	7/25/2001	HPO	DPB	RAB	HPO COMMENT REVISIONS
1	6/22/2001	HZ	DPB	RAB	RELEASED FOR CONSTRUCTION
0	6/1/2001	HZ	DPB	RAB	RELEASED FOR CONST., TRACK BED EXC.

DESIGNED BY HZ
CHECKED BY JLR
DRAWN BY HZ
CHECKED BY RAB

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Rex A. Brejnik
Printed Name
Date: Lic. No. 23872

PARSONS TRANSPORTATION GROUP INC.
EDWARDS AND KELCEY, INC.
A JOINT VENTURE

RELEASED FOR CONSTRUCTION

HIAWATHA PROJECT OFFICE

MINNESOTA DEPARTMENT OF TRANSPORTATION-S.P. 2724-00LRT

HIAWATHA LRT PROJECT
TYPICAL SECTIONS
STA. 698+00 TO STA. 705+20

CIVIL | DRAWING NAME: T.S41

SHEET 16 OF 272

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3. Platform Arrangements

Double track LRT platforms may be located either between the tracks or on the outsides of the double track. Double track at a station with side platforms would require a minimum width of approximately 53 feet for construction. Double track at a station with a center platform would require a minimum width of approximately 51 feet for construction. Platform arrangements are shown at the bottoms of Figures 1 and 2.

4. Pedestrian Circulation and Access

Having a vertical pedestrian connection to the center platform, by elevators and escalators, requires an additional 6 feet to the platform width, so the necessary minimum width would become approximately 56 feet. The necessary width needed for side platforms and vertical connections would be 60+ feet. Due to the nature of this corridor, there would likely need to be elevators/escalators at some or most of the stations. Stations would be anticipated near Hennepin, Lyndale, Nicollet, and Chicago Avenues.

5. Impacts to the Greenway Trail

Widths noted above do not account for the existing 20-foot-wide Greenway trail, nor the widths that would be required for connections between the stations and the trail, differences in the vertical profiles between the trail and stations, drainage considerations, snow storage considerations, or additional horizontal clearances from piers. In some areas, new retaining walls at the trench edge may aid in achieving the necessary widths, but sufficient engineering has not been performed to determine exact needs.

The bridges east of 12th Avenue have a slightly different geometric layout. These bridges were not built with high abutments, thus the end spans have sloped embankment beneath. At each of these bridges, the central portal under the bridge midspan is the only currently viable space for corridor use. At a minimum, the end span and north abutment of these bridges would require reconstruction such that a high abutment could be constructed. The north portal would then be large enough to accommodate the trail and/or vertical circulation of pedestrians. There are impediments and concerns to removing stub abutments and constructing high abutments. The construction of high abutments may not be physically feasible due to the depth of excavations required and the proximity of buildings, sewer utilities, and water lines.

B. MODERN STREETCAR

As part of the Access Minneapolis Plan, several modern streetcar lines are being examined, one of which is along the Midtown Corridor. There are no current streetcar standards in Minnesota, but one could assume they would be very similar to the LRT horizontal and geometric constraints noted above. Several differences are that a streetcar line would have less restrictive vertical constraints, the platform would be lower to the tracks, profile grades could be steeper, curves could have smaller radii, and there is the possibility that segments could be implemented as single-track. Streetcars would run on standard gage rail tracks with power from overhead electric lines, similar to an LRT train.

C. BUSWAY

BRT would require similar arrangements as for LRT, but with a decreased vertical requirement. There would be a need for passenger loading platforms, vertical access, and a traffic lane in each direction for the bus traffic. At the platform locations, the traffic lane would need additional width to accommodate stranded buses and/or snow storage. If the passenger platforms are center-running, the additional width would be required on each side of the platform, essentially doubling the traffic lane width. Away from the stations, the traffic lanes would mimic ordinary roadways with two-way traffic.

D. POTENTIAL TRANSIT—CONCLUSIONS

The HCRRA, the owner of the bridges, may determine that it may be necessary to remove and/or replace some of the existing bridges to implement a transitway. The HCRRA is cautious that any work planned for the bridges will not impede future uses or alignments of the transportation corridor. Even if an option to utilize the Midtown Corridor is not selected as part of the Southwest Transitway Alternatives Analysis Study, other options for transportation within the corridor may be considered in the future. There are numerous factors which would require extensive engineering to assess the impacts that transit construction would have on the existing bridges.

V. STRUCTURAL EVALUATION

A. OVERVIEW

1. Goals

Goals of this section are to explore bridge conditions and expected life potential for structural rehabilitation, and/or reclassification.

2. Methodology of Analysis

Five bridges (Fremont, Pleasant, Columbus, 10th, and 18th Avenues) were evaluated, due to budget constraints. Since the bridges were constructed within a three year period, the results from the five bridges were then extrapolated to the remaining bridges constructed during that timeframe. Methods employed for the assessment of the five bridges included gathering and reviewing available inspection data, chloride ion concentration testing from the decks of two bridges, and review of the sufficiency ratings from up to the past ten reporting cycles. In addition, a visual inspection of the bridges was made to confirm general findings noted in the inspection reports.

3. Available Information

The bridge data that was used in evaluating the five bridges included annual bridge inspection reports, appraisal ratings, and sufficiency ratings (see Appendices B-F), element condition codes (summarized in Appendix G), and the Report of Chloride-Ion Content (Appendix H).

With regard to the sufficiency ratings, it must be understood that the equations used to derive the ratings have recently been changed. As a result of this change, sufficiency ratings for some of the bridges have gone up in comparison with previous years' ratings, thereby appearing to indicate that improvements have been made to those structures. In fact, no such improvements have been made and the actual condition is a continued aging of the structure.

B. DESCRIPTION OF BRIDGE TYPES AND CRITERIA THRESHOLDS

Within the Midtown Corridor there are seven different bridge structure types. The most prolific type is the cast-in-place concrete beam superstructure. Other types include continuous concrete slab span, steel beam, post-tensioned continuous concrete slab span, culverts, pre-stressed concrete beam and slab span, and the concrete frames. These bridge types are described in further detail below.

To determine the potential for structural rehabilitation or repair limitations, the guidelines from Mn/DOT's Office of Bridges and Structures were consulted, which describe criteria thresholds associated with the various steps of bridge preservation, improvement, structural rehabilitation, and replacement. Each successive step embodies greater work effort and cost, with the last step being full replacement. All the bridges considered in this report were built between 1912 and 1916 and are beyond the average 70-year average life of a structure, and as such, replacement of the structures is the most fiscally responsible alternative.

C. BRIDGE TYPE SUMMARY

1. Cast-in-Place Concrete T-Beams (Structure Type 1)

The twenty-six bridges of this type of superstructure incorporate beam elements cast monolithic with the concrete deck. If the deck were cut on either side of a beam mid-way between the beams, the resulting cross section would have a "T" appearance. On each of the Midtown Corridor bridges of this type, there are seven beams placed between curb lines and an outer fascia beam that supports the edge of the sidewalk and the concrete railing. This bridge type consists of three or four spans.

Beams on the Midtown Corridor bridges are 3 feet 6 inches deep, including five inches of paving, and are 13 inches wide on 5-foot centers. The beams under the roadway area are straight on the bottom, with fillets at the supports.

The fascia beams on the Midtown Corridor bridges, being more visible, were given the form of three 3-centered arches to enhance their appearance.

On the Midtown Corridor bridges, the superstructure was cast monolithic with the pier cap (the element which caps the columns of the pier). These caps are 2 feet wide and 4 feet 6 inches deep and are joined to the tops of the columns by arches.

2. Continuous Concrete Slab Span (Structure Type 2)

The eight bridges of this type have superstructures comprised of a monolith slab cast in place. The slab is greater in depth than the slab of a cast-in-place T-beam structure, but there are no projecting beam elements. For this reason, this type of structure is used for bridges with shorter spans where depth is a major consideration. Within the Midtown Corridor, this bridge type consists of one, three, or four spans.

3. Steel Beam (Structure Type 3)

This type of structure, utilized on two bridges, is comprised of a cast-in-place concrete deck on top of steel beams and is well suited for complex structures with limited depth, long spans, and complex geometrics.

Advantages include a shallower depth of structure than prestressed concrete beams, the ability to be field-spliced to produce long span lengths, beams that can be curved horizontally, and beams that can be painted a color which contrasts with the slab to make the structure appear thinner.

Disadvantages include a typically higher cost than other structure types, more difficult fabrication and inspection, a longer fabrication time, the possible need for painting and future maintenance painting, the possibility that weathering steel will stain supports, rusting of weathering steel when under salt exposure, and required annual inspections.

4. Post Tensioned Continuous Concrete Slab Span (Structure Type 4)

This structure is similar to the continuous concrete slab span except that high-strength steel cables are embedded within the concrete and tensioned after the concrete attains its compressive strength. This additional structural component allows the span length to be greater, without a significant increase in structure depth. One bridge is of this type.

5. Culvert (Structure Type 5)

Precast concrete box shapes are available for culverts up to 14 feet by 14 feet in size and are commonly used for stream crossings and trails. Advantages include quick installation and low maintenance. Disadvantages include span limitations, possible debris build-up when multiple barrels are used in a stream setting, and lack of a natural stream for fish unless the invert is lowered and rip rap is placed on the floor of the concrete box shapes. One structure is of this type.

6. Prestressed Concrete Beam and Slab Span (Structure Type 6)

This is the most common highway structure type in Minnesota. The superstructure is comprised of cast-in-place concrete deck on top of precast concrete beams. The precast concrete beams incorporate pretensioned steel cables as the primary strength component. Advantages include low initial and future maintenance costs, high quality factory produced product, a stiff deck, and simple spans that accommodate tapers. Beams are limited to standard depths and straight segments, and a maximum length of about 145 feet based on shipping limitations. One bridge is of this type.

7. Concrete Frames (Structure Type 7)

The three newest bridges in the corridor are concrete frame structures. A concrete frame provides for a full moment connection between the superstructure and the abutments. Concrete frame bridges are typically single-span with a concrete slab superstructure integral with the abutment, without any individual beam or bearing elements.

D. STRUCTURAL ANALYSIS OF FIVE REPRESENTATIVE BRIDGES

Due to budgetary constraints, this section of the report reviews five representative bridges of Structure Type 1, the cast-in-place concrete T-beam superstructure bridge. Since all of the bridges in the Midtown Corridor were built within a four-year timeframe, excluding the newest bridges built over the last several years, the results from this section will be extrapolated to the remaining structures of the corridor.

1. Evaluation Process

The evaluation process included a review of current inspection reports, sufficiency ratings, and site condition analysis for each bridge. The condition analysis looked at criteria of cracking, crevices, protective concrete cover over reinforcing bars, spalling, checking, condition of exposed reinforcing bars, and presence of water on the underside of the deck, as well as undermining or rotations/settlement of the abutments and/or piers.

A review of the sufficiency ratings from the late-1980s through 2005 generally shows a decreasing rating value. An anomaly occurs in 2004, when the sufficiency ratings increased. This was not due to a widespread rehabilitation of all of these structures but rather a change in the formula used to derive the ratings.

Figure 3

Bridge 6 (L8901) - Fremont Ave S over Midtown Greenway

ROADWAY CLASSIFICATION: LOCAL **OWNER: HCRRA** **YEAR BUILT: 1913**

YEAR PROGRAMMED: TBD
SUFFICIENCY RATING 2005: 29.5

a. Bridge L8901, Fremont Avenue South

Condition Analysis

The railings on the bridge are below the minimum height requirements of Mn/DOT's *Bridge Design Manual* and have many cracks and spalls. The cold joints between the bridge rail and wingwall rails are connected with external steel splice plates bolted into the concrete. (See Photos A1 and A2.)

Photo A1

Photo A2

The deck and T-girders are in an advanced state of deterioration. Large spalls with exposed and deteriorating reinforcing bars are present. (See Photos A3, A4 and A5.) Concrete is weathered and degradation is advanced. Water is leaking through cracks, to the extent that stalactites have formed (see Photo A6) and, as a peculiar testament to the volume and duration of leaking, the splash region on the ground has all the fines washed away from the soil, leaving a gravel bed.

Photo A3

Photo A4

Photo A5

Photo A6

The abutments are severely cracked at the junction with the wingwalls (see Photos A7 and A8). The north abutment has been repaired, but the settlement and rotation of the wingwalls has not been corrected (see Photo A8).

The inspection reports indicate heavy scaling, spalls and large hollow areas. The south wingwalls are heavily cracked, with protrusions of concrete indicating settlements. Also, crevices up to 4 inches deep are noted on the inspection reports.

Photo A7

Photo A8

The pier columns have large spalls with reinforcement bars that have been exposed and undermined. The pier caps have many cracks and areas of heavy leaching and efflorescence.

Settlement behind the abutments in the regions of the returned-leg wingwalls is evidenced by concrete compressive failure at the top of the curb in line with the abutments, large gaps where the railing interacts with the bridge railing, compression cracks at the top of curb above the paving bracket zone, and bituminous “ramps” at the sidewalks.

Concrete core samples were taken by the City in 1981. The report from the coring and compression testing indicates a sidewalk core thickness of 5.4 inches, a compressive strength of 4,400 psi, and a notation that the core was “quite soft during drilling.” Of the three bridge deck cores attempted, all broke up and disintegrated during coring and no compressive tests were possible.

Rehabilitation/Reclassification Potential

Due to the advanced state of deterioration of the T-girders (which are the primary load carrying elements of the bridge), the condition of the abutments, wingwalls, and piers, the sufficiency rating of 29.5, and the 92-year age of the bridge, it is TKDA's opinion that the most fiscally responsible alternative for this structure is to program the bridge for replacement within the next three years. Inspection of this bridge should continue on an annual basis unless there is more delamination of concrete or the abutment/wingwall settlements change from their current conditions. Railing "extenders," similar to those on other Midtown Corridor bridges, should be installed atop the rail to meet the requirements of Mn/DOT's *Bridge Design Manual*.

Construction Cost Estimate

Based on a bridge deck of approximately 95 feet by 46 feet, the anticipated replacement bridge construction cost, including wingwalls and approach work, is $1,100,000.00.

Figure 4

Bridge 16 (L8908) - Pleasant Ave S over Midtown Greenway

ROADWAY CLASSIFICATION: LOCAL OWNER: HCRRA YEAR BUILT: 1913

YEAR PROGRAMMED: TBD
SUFFICIENCY RATING 2005: 54.3

b. Bridge L89081, Pleasant Avenue

Condition Analysis

The railings on the bridge have metal pipe "extenders" that bring the rail height into compliance with requirements of Mn/DOT's *Bridge Design Manual*. The concrete is severely weathered. Many railing reinforcement bars, both vertical and horizontal, are exposed. The sidewalks have spalls and aggregate pop-outs. The sidewalks also have bituminous ramps at the abutments due to settlement. (See Photo B1.)

Photo B1

The abutments and wingwalls are cracked from settlement. The northwest wall is leaning out and has between a 3- to 4-inch projection. The railing atop this wall section has a steel strap spanning the crack at the corner. (See Photo B2.)

Photo B2

The deck and T-beams are in an advanced state of deterioration. The City's bridge inspectors have mapped and monitored the cracks in the pier caps, T-beams, and underside of the deck. There is significant concrete spalling from the faces of the T-beams. (See Photos B3, B4, B5.)

Photo B3

Photo B4

Photo B5

Chloride-ion testing was performed on the deck of this bridge (the report is included in Appendix H). The result at a depth of 1 to 2 inches was 465 ppm and at 2 to 3 inches was 320 ppm. Chloride-ion levels in excess of 300 to 400 ppm exhibit an environment where the steel reinforcement corrodes. Additionally, deicer salts allow the concrete to become critically saturated, causing each freeze-thaw cycle to become more severe.

The Inspection Report in Appendix C has notes regarding the T-beams and piers. From the notes, the T-beams of the center span have heavy to moderate accident damage, with exposed reinforcement bars. The pier columns have hollow areas with large spalls and exposed reinforcement bars.

Concrete core samples were taken by the City in 1980. The report from the coring and compression testing indicates a sidewalk core thickness of 5 inches and a compressive strength of 3,440 psi. Of the three bridge deck cores taken, one included a vertical reinforcing bar and was not tested. The remaining two had compressive test results of 4,080 and 4,820 psi.

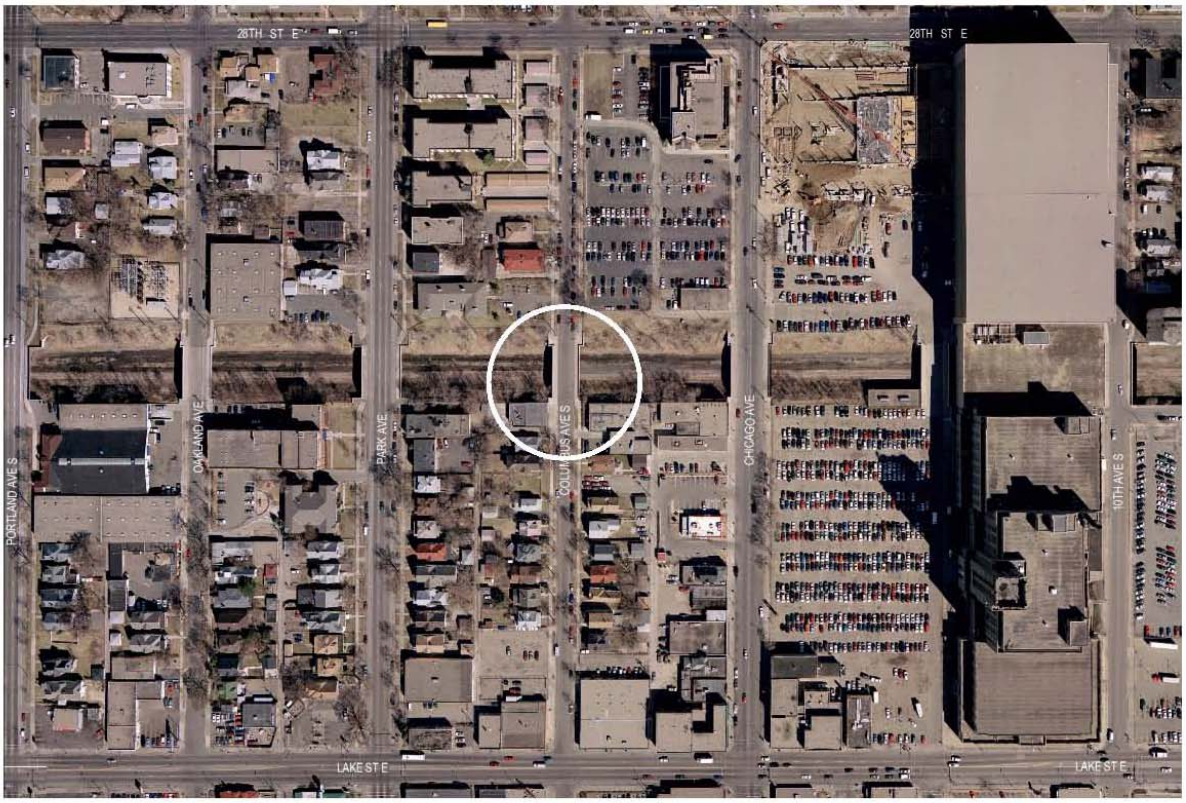
Rehabilitation/Reclassification Potential

Due to the advanced state of the deterioration of the T-girders (which are the primary load carrying elements of the bridge), the condition of the abutments, wingwalls, and piers, the sufficiency rating of 54.3, and the 93-year age of the bridge, it is TKDA's opinion that the most fiscally responsible alternative for this structure is to program the bridge for replacement within the next five years. Inspection of this bridge should continue on an annual basis unless there is more delamination of concrete or the abutment/wingwall settlements change from their current conditions.

Construction Cost Estimate

Based on a bridge deck of approximately 95 feet by 46 feet, the anticipated replacement bridge construction cost, including wingwalls and approach work, is $1,200,000.00.

Figure 5



Bridge 28 (L8913) Columbus Ave S over Midtown Greenway

ROADWAY CLASSIFICATION: LOCAL OWNER: HCRRA YEAR BUILT: 1915 SUFFICIENCY RATING 2005: 44.9

c. Bridge L8913, Columbus Avenue

Condition Analysis

The west sidewalk on the bridge has been rehabilitated. The east sidewalk has spalled concrete at the curbline. The concrete railing is in a weathered state, but appears generally sound. The concrete cap of the rail has advanced deterioration in several locations. Metal pipe “extenders” are in place atop the concrete rail. (See Photo C1.)

Photo C1

The wingwalls are in generally good condition, with only limited cracks. (See Photo C2.)

Photo C2

The superstructure supports a water main between two T-beams. Some efflorescence is apparent at several cracks in the underside of the deck. (See Photo C3.) There is a construction joint (cold joint) in the deck that has some spalling along the joint.

Photo C3

Three of the eight pier columns have hollow areas, and two columns have spalls with exposed reinforcing. Also, the south abutment had a stabilizing shear block that was added in 1988 to prevent further rotation (tipping) of the abutment. (See Photos C4 and C5.)

Photo C4

Photo C5

Concrete core samples were taken by the City in 1981. The report from the coring and compression testing indicates a sidewalk core thickness of 7.75 inches and a compressive strength of 4,800 psi. Of the three bridge deck cores attempted, one broke off during the coring operation and the other two were 10 and 12.25 inches long. These two cores had compressive strengths of 5,590 and 5,630 psi.

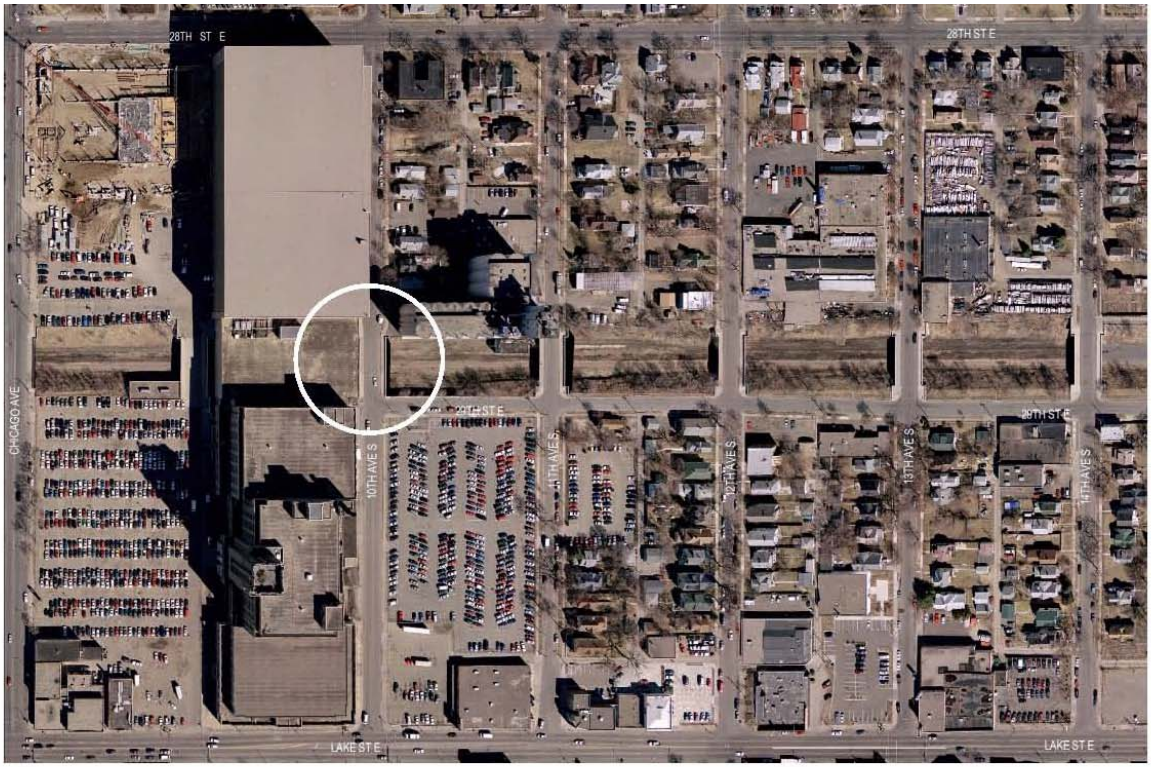
Rehabilitation/Reclassification Potential

Due to the condition of the piers, the deterioration of the T-girders, the rotational stability of the abutments, the sufficiency rating of 44.9, and the 91-year age of the bridge, it is TKDA's opinion that the most fiscally responsible alternative for this structure is to program the bridge for replacement within the next eight years. Inspection of this bridge should continue on an annual basis unless there is more delamination of concrete or the abutment/wingwall settlements change from their current conditions. Alternately, TKDA's opinion is that this bridge's useful life could be extended by reducing the loading and reclassifying the bridge to a trail/pedestrian-only facility. With a reduced load requirement, this structure could have a useful life of twelve to fourteen years.

Construction Cost Estimate

Based on a bridge deck of approximately 95 feet by 46 feet, the anticipated replacement bridge construction cost, including wingwalls and approach work, is $1,200,000.00.

Figure 6



Bridge 31 (L8915) 10TH Ave S over Midtown Greenway

ROADWAY CLASSIFICATION: LOCAL OWNER: HCRRA YEAR BUILT: 1915 SUFFICIENCY RATING 2005: 64.6

d. Bridge L8915, 10th Avenue South

Condition Analysis

The bridge's sidewalk concrete has some spalls and bituminous transitions at the abutments (see Photo D1). The railings have pipe "extenders" and generally weathered concrete with some exposed reinforcing. Damage to the concrete corner post at the southeast corner has been cut back to a bevel (see Photo D2).

Photo D1

Photo D2

The superstructure supports a water main between two T-beams. The underside of the deck exhibits a fair amount of spalling and exposed reinforcing (see Photo D3). In the north span, the spalling goes deeper than the reinforcement.

Photo D3

The substructures have recently been white washed. There are large spalls at the north abutment backwall, and one located directly at a T-beam bearing location (see Photo D4). The piers appear in generally good condition, with one column showing signs of poor concrete consolidation (see Photo D5). The inspection report notes that three of the twelve columns have hollow areas.

Concrete core samples were taken by the City in 1981. The report from the coring and compression testing indicates a sidewalk core thickness of 7.4 inches and a compressive strength of 3,900 psi. Three bridge deck cores were retrieved, with compressive strengths of 3,400, 3,420, and 4,270 psi. All the cores were noted to be in good condition.

Rehabilitation/Reclassification Potential

Based on the sufficiency rating of 64.6, as reported in Appendix E, and considering the 91-year age of the bridge, it is TKDA's opinion that the most fiscally responsible alternative for this structure is to repair the bearing areas and program the bridge for replacement within the next twelve years. Inspection of this bridge should remain on an annual basis unless there is more delamination of concrete or the abutment/wingwall settlements change from their current conditions. Alternately, TKDA's opinion is that this bridge's useful life could be extended by reducing the loading and reclassifying the bridge to a trail/pedestrian-only facility. With a reduced load requirement, this structure could have a useful life of twelve to fifteen years.

If the bearing seats are not repaired, the useful life of this structure can be anticipated to be reduced to five to eight years.

Construction Cost Estimate

Based on a bridge deck of approximately 95 feet by 46 feet, the anticipated replacement bridge construction cost, including wingwalls and approach work, is $1,200,000.00.

Figure 7

Bridge 40 (L8923) 18th Ave S over Midtown Greenway

ROADWAY CLASSIFICATION: LOCAL OWNER: HCRRA YEAR BUILT: 1916 SUFFICIENCY RATING 2005: 64.8

e. Bridge L8923, 18th Avenue South

Condition Analysis

The bridge's railings have the metal pipe "extenders," except for a short segment where an access ramp has been built for the bicycle trail. The concrete is in relatively good condition and appears sound. Where substructures have moved, the differential settlement is noticeable at the joints of the railing above. (See Photo E1.)

Photo E1

Both sidewalks appear to have been replaced and are in good condition.

The wingwalls have experienced movement, which is noted by cracking. This movement appears to be located mostly in the region above the bridge seats or at the corners of the wingwall. (See Photo E2.)

Photo E2

The superstructure supports a water main between two T-beams. The deck underside and T-beams have a great deal of efflorescence. There is some water dripping through the beams. This bridge has very little spalling, but the concrete is cracked and has the appearance that it could flake off. (See Photos E3 and E4.)

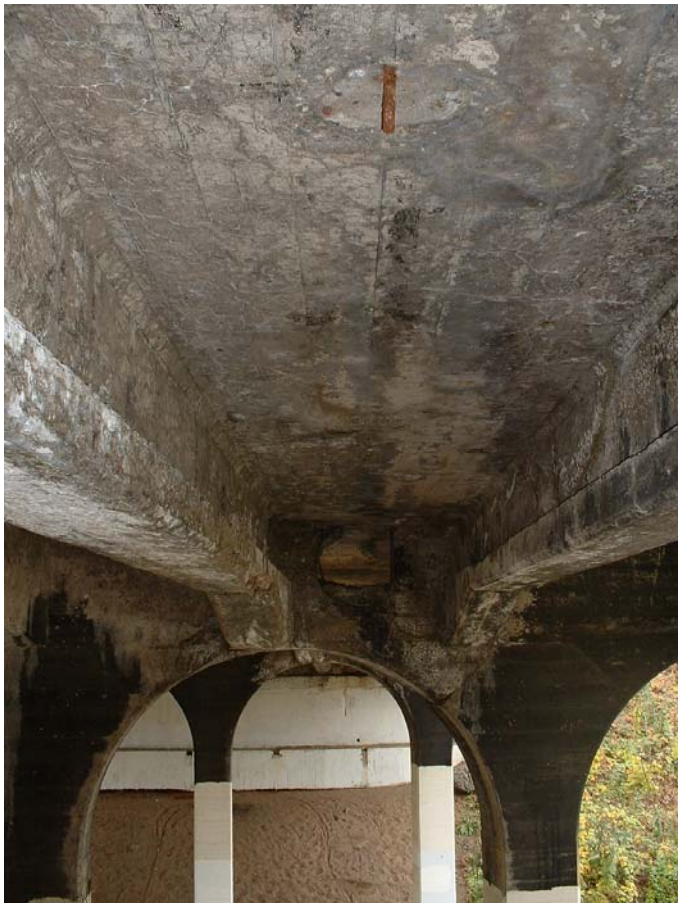


Photo E3

Photo E4

Pier deterioration in three of the eight columns is noted in the inspection report, with large spalls and exposed reinforcing (see Photo E5).

Photo F5

Both abutment footings have been modified by the addition of a concrete sleeper in front of the main footing. The north sleeper has begun to undermine. (See Photo E6.) The inspection report notes that the south abutment is bowed out as much as 6 inches at the east end.

Photo E6

Rehabilitation/Reclassification Potential

Based on the sufficiency rating of 64.8 and considering the 90-year age of the bridge, it is TKDA's opinion that the most fiscally responsible alternative for this structure, with an estimated life of eight to ten years, is to program the bridge for replacement. Alternately, TKDA's opinion is that this bridge's useful life could be extended by reducing the loading and reclassifying the bridge to a trail/pedestrian-only facility. With a reduced load requirement, this structure could have a useful life of twelve to fifteen years. Inspection of this bridge should continue on an annual basis unless spalling or delamination of concrete begins or the abutment/wingwall settlements change from their current conditions.

Concrete core samples were taken by the City in 1981. The coring and compression testing report shows that four core samples were taken. One core sample was broken, with cracks, while another had a reinforcement bar within the core. Both were not able to be tested. The remaining two cores were noted to be solid and in good condition, with compressive strengths of 5,640 and 8,260 psi.

Construction Cost Estimate

Based on a bridge deck of approximately 95 feet by 51 feet, the anticipated replacement bridge construction cost, including wingwalls and approach work, is $1,300,000.00.

2. Conclusions

All five bridges reviewed in this report exhibit degradation of concrete, either through materials used in the original construction or through the environmental exposure of more than 90 years. Once general concrete degradation begins, it is common for further deterioration to be accelerated. These general concrete conditions have left reinforcement bars exposed and unprotected. In this state, the steel reinforcement will more readily oxidize and have less strength. If the steel corrosion and concrete degradation continue, the load carrying capacity of the bridges will be reduced and eventually require the bridges' replacement.

Comparison of the sufficiency ratings of the five bridges gives the best overall indicator of the health of each bridge. For these bridges, a sufficiency rating below 40 may indicate an expected life of less than four years, a rating between 40 and 60 may indicate an expected life of four to eight years, and a rating above 60 may indicate a life expectancy of over eight years.

VI. CURRENT REPAIR PRACTICES AND NEW TECHNOLOGIES

A. CURRENT PRACTICES

Current repair practices for reinforced concrete bridges have two main goals, repair of damaged concrete sections and improvement of the concrete's ability to shed water and moisture. Damaged concrete, if not too large an area, can be repaired with shotcrete or partial- or full-depth deck area patching. Shotcrete is especially suited to vertical or overhead horizontal placement. Technologies to seal cracks and surfaces from moisture include epoxy-injection of cracks, low viscosity sealants, and silane surface sealers. Moisture intrusion into the deck can be lessened by using high performance concretes, by milling the existing deck and placing an overlay, or by improving drainage off the deck.

1. Shotcrete

Shotcrete is the process whereby cement and fine aggregates, the dry components of concrete, are conveyed pneumatically through a hose to a placement nozzle. Water is added to the mixture at the nozzle by the operator during the placement process. The concrete is not completely mixed as it exits the nozzle, but rather relies on the impact onto the receiving surface to complete the mixing process. Shotcrete can be applied to vertical surfaces as well as to the undersides of horizontal surfaces.

Shotcrete has been used for repairs of bridges within the Midtown Corridor. The City Bridge Maintenance crew has the machinery and trained staff necessary for the application of shotcrete. Using this repair technique does not leave the finished surface as smooth and flat as the original surface, but it can help in the preservation (repair) of the concrete surface. This technique is generally considered for repair depths up to three inches and would not address deep concrete degradation problems or major reinforcing steel corrosion. Shotcrete remains a viable concrete repair process, especially for large vertical surfaces and the undersides of decks, where the base substrate is in sound condition.

2. Deck Area Patching (Partial- and Full-Depth)

Partial- or full-depth area patching aims to maintain the structural integrity of the concrete deck by removing unsound materials and placing conventional or high-performance concrete. Partial-depth repairs generally extend from the surface of the deck to just above the top mat of reinforcing steel, or to a prescribed distance beneath the reinforcing steel. Partial depth repairs can include reinforcing steel replacement. Full-depth patching includes the entire deck section thickness being chipped out and replaced for the area of the patch. Concrete forms beneath the deck are required to contain the wet concrete. As with partial-depth repairs, reinforcing steel replacement can occur with full-depth patching.

Deck area patching has been used on the bridges in the past by maintenance crews. It is difficult to gauge deck delaminations or areas of poor quality concrete through the bituminous wearing course; therefore, the extent of this repair method is generally not completely known until the bituminous wearing surface is removed and the deck can be fully inspected. As a beginning measure, inspectors can unscientifically gauge the deck's condition by monitoring its condition from beneath. If alligator-cracking in a localized area is witnessed from beneath, a full-depth patch may be warranted for that area. If the deck underside reveals heavy alligator or map cracking, the entire deck may require eventual replacement.

Patching of a deck is a viable repair method to extend the useful life of the deck. This method of repair is intended for only small portions of the total deck area. If the combined areas of patching become too excessive, complete deck or bridge replacement may be warranted.

3. Epoxy Injection of Cracks

Crack repair techniques vary, depending on the crack characteristics and anticipated structural performance of the concrete element. For a structural repair of a small-width crack, epoxy injection is utilized. This repair technique requires pressure injection ports drilled and inserted into the crack with an epoxy "dome" placed over the port to hold it in place and bond it to the concrete surface. The crack also receives an epoxy seal along its length to contain the epoxy repair product, with exhaust ports to allow air to escape. The epoxy repair product is injected into the port under high pressure and travels along the crack to the exhaust port. As one reach is completed, the injection port is sealed and another reach of crack is injected.

Epoxy injection is an appropriate repair method only if the adjoining concrete is sound and not showing signs of deterioration. This method is not suitable for areas of cracking, such as map cracking or alligator cracking. It is suited for solitary small-width cracks that can be sealed or capped as the epoxy is injected. Based on the generally weathered and degraded condition of the 90-year-old concrete of the Midtown Corridor bridges, epoxy injection is not considered a viable preservation technique.

4. Low Viscosity Sealants and Silane Surface Sealers

For a smaller crack, checking, or crazing, the surface could be treated with low viscosity sealants or silane surface sealers. The low viscosity sealants are flooded over the surface and provide complete filling of cracks and micro cracks by capillary action. This flooding application method is used primarily on horizontal deck surfaces. With the depth of penetration these sealants achieve, the repair has a long life even in trafficked areas. For vertical surfaces and overhead horizontal surfaces, a brush- or roll-on application of a sealer is common. Silane sealers, by far the most widely used products for protecting new and existing bridge decks, penetrate and chemically attach to the concrete to reduce water and chloride intrusion. By properly protecting the surface of concrete, water and moisture are prevented from penetrating the surface, thus reducing chloride ion penetration, impacts from moisture freeze/thaw cycles, scaling, and spalling.

Low viscosity sealants and/or silane surface sealers are most beneficial when applied to concrete surfaces that have not experienced penetration of contaminants or degradation of concrete quality. However, with the relative low cost of approximately $1.50 per square foot, this measure can still be applied to exposed deck-side concrete surfaces (railings and sidewalks) and bridge fascia elements in an attempt to ward off water intrusion and thereby help to preserve these bridge elements.

5. Deck Drainage Improvements

Preventing water intrusion into a bridge deck has been found to be one of the most beneficial means to promoting a long structure life. In a northern climate, deicing chemicals blend with water and create a corrosive environment for the reinforcing steel and concrete. Several methods have been used to prevent this water intrusion, including membranes with an asphalt overlay, high performance concrete, and deck drainage improvements.

Of course, one of the simplest means to prevent water intrusion is to have adequate road grade and deck cross-slopes to shed any water. Unfortunately, local topography and other constraints often prevent adequate slopes off of a bridge, and may even place the bridge in the local low point. Sometimes, adding bridge scuppers to improve deck drainage may increase the ability to shed water. These same scuppers penetrate through the deck and have been found to lead to increased concrete deterioration immediately adjacent to the scuppers. It is thought that small gaps form at the interface of the scupper and the concrete surface and allow water to intrude.

The bridges of the Midtown Corridor generally have a slight crest curve profile grade and a parabolic deck cross section. Both of these assets help to shed water, so long as the riding surface is not permeable.

The wearing surface of most of the corridor bridges is a bituminous asphalt overlay placed directly on the structural concrete deck. Some water can migrate through this wearing surface or where it abuts the sidewalks, and attack the structural concrete deck unseen. When viewed from beneath the bridge deck, map cracking or alligator cracking on these bridge can often be seen with water dripping through. To preserve bridges from this water attack, the deck surface would need to sealed against water intrusion. For some of the bridge decks that are in better condition, several preservation methods, namely a membrane with asphalt overlay or a mill and concrete overlay, may be a viable preservation step.

6. Membrane With Asphalt Overlay

A measure to protect the concrete deck from water intrusion is to apply a rubber membrane between the structural concrete deck and the wearing surface. This method provides far greater water resistance than just the asphalt wearing surface alone; however, water will still migrate through the asphalt and puddle, unseen, on the membrane. This will contribute to the degradation of the overlay above the membrane, and if the membrane has the smallest pinhole or slit, the water will pass to the concrete undetected and attack the concrete's integrity.

Membrane technology has progressed but is still an uncertain application that cannot be inspected once covered with an overlay. In the last twenty years, membrane use has declined and the high-performance concretes, such as low-slump concrete overlays, have prevailed.

As a preservation repair method for bridge decks in relatively good condition, the membrane with overlay method would be a viable attempt to seal the structural concrete deck from water intrusion.

7. Mill and Overlay of Road Surface

Another approach to preventing water intrusion is to place a sacrificial layer, or depth, of plain concrete or a high-performance concrete over the structural concrete deck. With either mix, drill-hole samples into the overlay can extract concrete dust for testing of chloride-ion concentrations. If concentrations exceed predetermined levels, the sacrificial layer can be milled off and a new layer installed, continuing the protection of the structural deck.

This method of repair may be appropriate for some structures within the Midtown Corridor that have a high traffic demand and a high life expectancy. The entire bridge structure would need to be in very good condition to realize the return on investment of a mill and overlay application.

8. High Performance Concrete

High-performance concrete (HPC), as defined by the American Concrete Institute, is concrete meeting special combinations of performance and uniformity requirements that cannot always be achieved routinely when using conventional constituents and normal mixing, placing, and curing practices. Normally, a specific application or environment drives the certain characteristics of the high-performance concrete. Examples of characteristics that may be considered critical for an application are ease of placement, compaction without segregation, early age strength, permeability, density, heat of hydration, volume stability, and long life in severe environments. Locally available materials, manufacturing experience, and costs are also factors that influence the mix proportions. Consequently, the many variables lead to many mix proportions that may result in the desired properties. For this reason, more trial mix batches of concrete, and subsequent testing, are necessary with HPC than with conventional concrete mixtures.

The bridge industry has found that a low-slump high-density HPC mix provides an adequate life cycle to protect the underlying structural deck from chloride-ion intrusion and is capable of being milled off when chloride-ion concentrations so dictate. (See the discussion on the mill and overlay method, above.)

B. NEW TECHNOLOGIES

New technologies for concrete bridge construction aim to prevent corrosion before it has a chance to begin, or if corrosion has already set in, aim to reverse the chemical reactions that cause corrosion. During construction, new technologies incorporate alternative reinforcing bar materials, high-performance concrete mixes (as previously discussed), and cathodic protection. Once a structure is built, electrochemical extraction and cathodic protection are means to slow or, if deterioration is not too severe, potentially reverse chemical deterioration. If a structure is in need of strengthening as a means to extend its useful life, carbon fiber reinforced polymers can be applied externally to the structure.

1. Reinforcing Bars

As a means to prevent corrosion, the bridge industry has primarily used steel reinforcing bars and chemical-reaction corrosion systems. New materials for reinforcing bars include MMFX2 reinforcing steel, steel with fusion bonded coatings, or alternative bar materials.

a. Steel Bars With Metallic Coating and Alternative Solid Metal Bars

The use of reinforcing materials that have inherently good corrosion resistance such as stainless steel clad bars, solid stainless steel bars, and low-carbon, chromium steel reinforcing bars is being researched. MMFX Steel Corporation of America produces a low-carbon, chromium steel bar for concrete reinforcement (100 ksi yield strength), marketed as MMFX Microcomposite (MMFX2) Steel Rebar. The manufacturer claims that the MMFX rebar has five times the corrosion resistance of a normal ASTM A615 rebar (http://www.mmfxsteel.com/).

Materials that inherently possess good corrosion resistance are less likely to have their long-term corrosion resistance affected by field cutting and abrasion from construction activities, and they may have lower life-cycle costs.

These new reinforcing materials may have the potential to increase the life of new structures. The use of these materials in patching and repair of old structures may not be prudent until the chemical interactions of new and old materials are investigated. At this time, the new reinforcing materials are not considered contenders for preservation of the corridor bridges.

b. Prefabricated Fusion Bonded Epoxy Coated Reinforcing Bars

Many of the bridges built within approximately the last twenty years have used fusion-bonded epoxy coated reinforcing (ECR) bars. The epoxy coating is factory applied and provides a barrier between the steel and any chloride ions. Problems occur when the coating is breached, such as field cutting or abrasions from construction activities. Laboratory testing suggests that ECR extends the useful life of a structure.

Epoxy coating on reinforcing bars is an effective method to protect the steel for a long service life. Epoxy coated bars must be installed during original construction for optimal benefit to the structure. In structures where this was not done, ECR bars can be installed as a part of structural repairs made during normal maintenance or preservation steps.

2. Cathodic Protection

Cathodic protection (CP) is a technique to control the corrosion of a metal surface by making that surface the cathode of an electrochemical cell. Cathodic protection systems are most commonly used to protect steel pipelines, steel storage tanks, steel pier piles, ships, offshore oil platforms, and onshore oil well casings. A potential side effect of improperly performed cathodic protection is the production of molecular hydrogen, which can be absorbed by the protected metal, leading to subsequent hydrogen embrittlement. The galvanic anode corrosion system discussed below is a form of cathodic protection. For larger structures, the galvanic system cannot produce enough current to provide complete protection. In these cases, a DC power source is used in conjunction with tubular solid anodes to create an Impressed Current Cathodic Protection system.

To combat the underlying chemical reaction that generates the corrosion of steel, a small electrical current can be introduced to reinforcing steel to slow the rate of reaction. Galvanic corrosion systems, generally consisting of sacrificial zinc core anodes, are desirable since they create this protective current internally through a natural chemical reaction wherein the anode corrodes in preference to the nearby reinforcing steel. This reaction thereby provides protection for the reinforcing steel. The zinc anodes are wired to the uncoated reinforcing steel and verified for electrical connectivity to, and through, the grid of reinforcing. Each anode can only protect a certain area, or depth of concrete, so adequate numbers of anodes need to be installed. With the required electrical connectivity of the bars, this method only works for uncoated reinforcing bars.

Cathodic protection is generally applicable in instances where there is complete saturation or immersion in liquid. In areas of high potential for corrosion, CP should be considered for new construction to improve the life cycle cost of the structure. Since the bridges of the corridor are not immersed in liquids and corrosion of the reinforcing steel has begun, CP is not a viable preservation method.

3. Electrochemical Extraction (ECE)

Another concrete restoration technique available for reducing corrosion-induced concrete deterioration is electrochemical chloride extraction (ECE), which removes chloride ions while simultaneously re-alkalizing the concrete adjacent to the steel. The concept of removing chloride ions from concrete by electrochemical migration was born in 1973 out of Kansas Department of Transportation experiments on electro-stabilization of clayey soils. Since then, numerous studies have shown that it is possible to remove chlorides from concrete using electrochemical means. The benefit of removing the chloride ions electrochemically is that contaminated concrete that is still structurally sound does not require excavation and can remain in place after the application of the chloride removal process. This restoration technique has inherited various names, "electrochemical chloride removal," "desalination," and "electrochemical chloride extraction" (http://www.tfhrc.gov/structur/pubs/02107/01.htm#chloride).

ECE has a promising future as a concrete restoration technique; however, it will not reverse the effects of reinforcing steel degradation. For this reason, ECE is not thought to be a prudent restoration technique for the Midtown Corridor structures, as their reinforcing, where visible, is showing signs of degradation and section loss.

4. Strengthening Using Carbon Fiber Reinforced Polymer (CFRP)

If a concrete structure is in sound condition but requires strengthening, the application of carbon fiber reinforced polymers (CFRP) may be the solution. CFRP sheets are externally bonded for retrofit of concrete structures and improve the flexural capacity and sheer strength of the concrete. Due to their external application, a key element is the bond between the carbon fiber sheets and the concrete. For this reason, the substrate concrete must be in very sound condition. Drawbacks to CFRP retrofits include the following: 1) further inspection of the concrete is only capable by destructive testing through the CFRP and 2) the CFRP could inhibit the passage of water out of a concrete element, thereby creating a worse condition for the concrete.

The application of CFRP is not seen to be a prudent rehabilitation method for the Midtown Corridor structures due to their concrete surface condition and the anticipated costs of this method.

C. CASE STUDIES

To better understand potential preservation applications, three bridges with varying sufficiency ratings have been studied. The bridges at Fremont Avenue on the west end of the corridor, and 10th and 18th Avenues on the east end of the corridor were all members of the in-depth bridge study and are members of the following case studies. Potential preservation steps are explored within each case study. Some of the suggested steps are routine maintenance, while others are beyond normal maintenance but are not full rehabilitation steps. These in-between preservation steps have been termed "betterments" within this report.

1. Bridge L8901 - Fremont Avenue

It is TKDA's opinion that the Fremont Avenue bridge, with the lowest sufficiency rating of 29.5, has the least potential for rehabilitation of all the bridges and could be a candidate for reconstruction within the next three years (see Figure 3 and Photos A1 through A8). As preservation methods in the interim, the following maintenance steps are suggested:

a. Install metal railing extenders.

b. Construct sidewalk approach panels (4 total).

c. Patch spalls in the curb and sidewalk (the sidewalk was replaced in 1983).

d. Flush all above-deck concrete surfaces with water and seal.

e. The bituminous wearing course is in good condition. The cracks should be routed and filled with joint sealer. Joint sealer should also be applied along the curb line.

f. The wingwalls are cracked and require stabilization. The northwest wingwall has had a previous application of shotcrete (see Photo A8). The south wingwalls should be anchored to the soil behind them to prevent further movement (Photos A1, A2, A7) and the cracks should be filled with concrete or shotcrete.

g. The pier columns and abutments should have any loose concrete removed and their surfaces sounded, and any unsound concrete areas should be chipped off and have shotcrete applied.

h. The substructures could be painted to blend the repaired areas with their surroundings.

i. The underside of the structural deck is in a severe state of deterioration (see Photos A3-A6). Loose concrete should be removed so it will not endanger trail users. Shotcrete should be applied; however, the patches should be considered very temporary, as water migrating through the deck and T-beams will quickly loosen the bond of the shotcrete.

2. Bridge L8915 - 10th Avenue

The 10th Avenue bridge has a sufficiency rating of 64.6. It is TKDA's opinion that current maintenance repairs continue and programming for future reconstruction be planned (see Figure 6 and Photos D1 through D3). As preservation methods, the following betterments are suggested:

a. Monitor the northeast wingwall railing segment and patch any gaps.

b. Seal the vertical joint between the northeast wingwall and adjacent retaining wall.

c. Patch the north abutment bridge seat area with shotcrete.

d. Consider epoxy-injecting the small-width vertical crack in the north abutment under the water main.

e. Preserve the smoke shield.

f. On the underside of the deck, remove any loose concrete, sandblast the reinforcing steel, paint the reinforcing steel with epoxy, and apply shotcrete to the patch areas (Photo D3).

g. Replace the sidewalk and curb, and preserve the rails (see Photo D1).

h. Remove the bituminous wearing surface, sound the deck, make partial depth repairs (if necessary), and place a low slump concrete overlay wearing surface.

i. Construct concrete approach panels.

j. Reconstruct the approximately 8-foot-long concrete rail on top of the northwest wingwall.

k. Reconstruct the corner post of the southeast wingwall to the east bridge rail (see Photo D2).

l. Reconstruct the structural cantilever sidewalk at the southeast wingwall area.

m. Power wash and seal all concrete surfaces.

3. Bridge L8923 - 18th Avenue

It is TKDA's opinion that the 18th Avenue bridge, with a sufficiency rating of 64.8, is a good candidate for reclassification or replacement (see Figure 7 and Photos E1 through E6). Prior to making a decision on reclassification, the City will need to look more closely at the space available for road culs-de-sac, especially on the north approach. As preservation methods for the interim, the following betterments are suggested:

a. Provide soil fill at the abutments (see Photo E6) and construct slope paving.

b. Fill in the voids in the abutment backwalls where the water main used to be.

c. Patch the several spalled areas on the piers. These areas have been painted over and will require sandblasting. Sound the piers for other areas of loose or unbonded concrete, and where found, chip it off and apply shotcrete to all patch areas.

d. Sound the underside of the bridge deck for loose or unbonded concrete, and where found, chip it off and apply shotcrete to all patch areas.

e. Preserve the remaining one-half of the west smoke shield. The east smoke shield is completely missing, except the small reinforcement bars projecting out of the fascia beam.

f. The bituminous surfacing is in good condition. Seal any cracks and apply joint seal at the curb lines.

g. The sidewalk and railing, with pipe extenders, are in good condition and do not require structural maintenance.

h. Monitor the wingwalls for any further settlement or rotation, and if further movement occurs, soil-anchor the segments with helical anchors. Sound the wingwalls for loose or unbonded concrete, and where found, chip it off and apply shotcrete to all patch areas.

i. Power wash all concrete surfaces. Paint all substructure areas to the bottom of the T-beam elevation and seal all remaining concrete surfaces.

VII. EXPECTED BRIDGE LIFE TIMELINE, AND COST ESTIMATE

Based on the current sufficiency ratings of the bridges and their current live loads, in TKDA's opinion the expected useful lives of the structures are approximately less than four years for the Fremont, First, Portland, and Cedar Avenue bridges; approximately four to eight years for the Pleasant, Nicollet, Stevens, and Columbus Avenue bridges, and over eight years for the remaining structures.

If any bridge has its live load reduced as a result of reclassification to non-motorized traffic only (i.e., pedestrians and bicyclists), this reduction would extend the structural life of the bridge.

Structural rehabilitation costs will need to be ascertained on a case-by-case basis, depending on the bridge's condition and level of complexity. Due to the monolithic framing of the concrete deck to the pier caps and columns, or to the abutments, a deck replacement will be a very involved and complicated process.

If the projected structural rehabilitation and life-cycle costs exceed 70 percent of the cost of construction of a new structure, it is TKDA's opinion that it would be most fiscally responsible to construct a replacement bridge. Any removal, replacement or rehabilitation project would involve engaging the owners and the public in the project development process.

The expected bridge life timeline, and roadway classifications for each bridge are summarized in Table 3.

Table 3. Expected Bridge Life Timeline, and Roadway Classifications for the Midtown Corridor Bridges

ORDER (W to E)	BRIDGE LOCATION	ROADWAY CLASSIFICATION	OWNER	RECONSTRUCTED	SUFFICIENCY RATING (2006 Insp.)	SUFFICIENCY RANKING	EXPECTED LIFE BASED ON SUFFICIENCY RATING	REMARKS
5	HENNEPIN AVENUE	MSA	City	1980	99.3	36	30+	
6	FREMONT AVENUE SOUTH	Local	HCRRA		31.8	1	<4	
7	EMERSON AVENUE SOUTH	MSA	City	1986	99.8	37	30+	
8	DUPONT AVENUE SOUTH	MSA	City	1987	96.8	30	30+	
9	COLFAX AVENUE SOUTH	Local	HCRRA		68.2	12	>8	
10	BRYANT AVENUE SOUTH	Local	HCRRA		77.0	15	>8	
11	ALDRICH AVENUE SOUTH	Local	HCRRA		89.8	29	>8	
12	LYNDALE AVENUE SOUTH	CSA	County	1987	86.0	26	30+	
13	GARFIELD AVENUE	Local	City	1992	97.9	32	40+	
14	HARRIET AVENUE	Local	HCRRA		73.2	14	>8	
15	GRAND AVENUE	Local	HCRRA		67.4	11	>8	
16	PLEASANT AVENUE	Local	HCRRA		54.3	7	4-8	
17	PILLSBURY AVENUE	Local	HCRRA		87.7	28	>8	
18	BLAISDELL AVENUE	MSA	City	1982	99.2	35	30+	
19	NICOLLET AVENUE	Local	HCRRA		47.0	6	4-6	
20	1ST AVENUE SOUTH	MSA	HCRRA		35.7	2	<4	
21	STEVENS AVENUE	Local	HCRRA		59.8	8	4-8	
22	I-35W (MAINLINE)	Mn/DOT	State	1967	84.3	25	20+	
23	2ND AVENUE SOUTH	MSA	City	1982	80.6	19	30+	
24	4TH AVENUE SOUTH	MSA	HCRRA	1997	99.8	37	40+	
25	PORTLAND AVENUE	CSA	HCRRA		36.6	3	<4	2008 Reconstruction
26	OAKLAND AVENUE	Local	HCRRA		97.7	31	>8	
27	PARK AVENUE	CSA	County	2006	99.0	33	70+	
28	COLUMBUS AVENUE	Local	HCRRA		44.9	5	4-8	
29	CHICAGO AVENUE	MSA	City	2005	99.1	34	70+	
30	ELLIOT AVENUE	Private	Private		81.7	21	Private	Private
31	10TH AVENUE SOUTH	Local	HCRRA		64.6	9	>8	
32	11TH AVENUE SOUTH	Local	HCRRA		81.0	20	>8	
33	12TH AVENUE SOUTH	Local	HCRRA		83.4	23	>8	
34	13TH AVENUE SOUTH	Local	HCRRA		72.0	13	>8	
35	14TH AVENUE SOUTH	Local	HCRRA		83.4	23	>8	
36	15TH AVENUE SOUTH	Local	HCRRA		79.9	17	>8	
37	BLOOMINGTON AVENUE	MSA	HCRRA		80.3	18	>8	
38	16TH AVENUE SOUTH	Local	HCRRA		86.7	27	>8	
39	17TH AVENUE SOUTH	Local	HCRRA		83.0	22	>8	
40	18TH AVENUE SOUTH	Local	HCRRA		64.8	10	>8	
41	CEDAR AVENUE	CSA	HCRRA		36.9	4	<4	2008 Reconstruction

New bridges (built since 1967).

With today's construction methods and costs, a replacement structure for the cast-in-place concrete T-beam structure type would be either a cast-in-place slab span structure or prestressed concrete beams with a composite concrete deck. Replacement costs for these types of structures, based on average 2004 bridge costs, range from $80.15/square foot for a slab span structure to $80.87/square foot for a prestressed concrete beam structure. These values are averages for all bridges of the respective type built in Minnesota, irrelevant of site constraints, foundation types, substructure types (and difficulties), and other specific individual characteristics and settings of each bridge.

The Chicago Avenue (in 2005) and Park Avenue (in 2006) T-beam bridges were replaced with shorter-length single-span concrete rigid frame structures. The contractor's bid price for the Chicago Avenue bridge of $1,497,400 for bridge removal and bridge construction (not including engineering and utility relocation costs) equaled a unit price of $250.67 per square foot of bridge deck. This price reflects intricate wingwalls, a restrictive construction site, and special aesthetic considerations. Based on this site-specific data, Midtown Corridor bridge replacements are anticipated to average approximately $1,500,000 to $1,800,000 per bridge (in 2004 dollars), depending on span length and deck width. For an estimate of costs for bridge replacement, removal, or reclassification, see Table 4.

Table 4. Estimated Costs for Replacement, Removal, and Reclassification

		BRIDGE REPLACEMENT	BRIDGE REMOVAL	BRIDGE RECLASSIFICATION (CLOSURE TO VEHICULAR TRAFFIC)
CONSTRUCTION				
REMOVE OLD BRIDGE		$ 100,000	$ 100,000	
NEW BRIDGE (DECK AREA: 88' LENGTH BY 52' WIDTH = 4576 SF)		$ 900,000		
APPROACH ROADWAY CONSTRUCTION		$ 100,000	$ 150,000	$ 150,000
SHEETING/SHORING PROTECTION ($50,000 PER STRUCTURE/BUILDING)		$ 100,000	$ 50,000	$ 50,000
TRAFFIC CONTROL (TEMPORARY)		$ 5,000	$ 1,000	
MIDTOWN GREENWAY (TEMPORARY TRAIL, TRAFFIC CONTROL, RESTORATION)		$ 20,000	$ 10,000	
WATERMAIN CONSTRUCTION		$ 100,000	$ 100,000	
SEWER RECONSTRUCTION		$ 20,000		
ADDITIONAL SIGNING, BARRICADES, FENCING			$ 10,000	$ 10,000
EXTRA AMENITIES				$ 50,000
SUBTOTAL CONSTRUCTION		$ 1,345,000	$ 421,000	$ 260,000
ENGINEERING				
DEVELOPMENT, DESIGN, ENGINEERING AT 0.35	35%	$ 471,000		
DEVELOPMENT, DESIGN, ENGINEERING AT 0.30	30%			$ 78,000
DEVELOPMENT, DESIGN, ENGINEERING AT 0.25	25%		$ 106,000	
SUBTOTAL ENGINEERING		$ 471,000	$ 106,000	$ 78,000
TOTAL (ROUNDED)		$ 1,820,000	$ 530,000	$ 340,000

VIII. BRIDGE REMOVAL AND IMPACT ON THE HISTORIC DISTRICT

Prepared by Charlene Roise, Hess, Roise and Company

Engineers have found structural problems with almost every bridge along the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District and have developed the ranges of anticipated useful remaining service life for each bridge. A structural engineering benefit to cost analysis would find it difficult to justify significant expenditures to maintain and repair structures with limited life. The decision to replace or close a bridge would need to be made at the end of a bridge's design life. However, several other characteristic features of the district have already been lost and the replacement or removal of any of the historic bridges could be a tipping point for the district's retaining National Register status. With the trackage gone and redevelopment occurring, pressure to change the corridor's industrial character into something less industrial could seal the fate of the district. At the end of a bridge's useful service life, the decision will have to be made whether to replace or remove it.

The bridges are only one of the characteristic features of the historic district. Another, the trackage, has already been lost, leaving the district extremely vulnerable as other changes occur. This makes the stakes higher for the bridges, since their removal can be the tipping point between the district's retaining National Register status and its being delisted.

The integrity of the section of the corridor between Stevens and 11th Avenues has already been compromised beyond redemption. Removal of other bridges would pose a serious threat to the integrity of the remaining sections. The fate of the district from Stevens to Fremont Avenues is perhaps already sealed by the intense pace of redevelopment in this area and the accompanying pressure to transform the corridor's industrial character into something more comfortable for the new, nonindustrial uses.

The best hope for retaining a justifiable district lies in the section east of 11th Avenue. The loss of any bridge in this section, given the integrity problems to the west, could be the last straw for the district. The challenge will be to balance the practical needs and economic realities identified by engineers and planners with the unique qualities that characterize the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District.

The State Historic Preservation Office (SHPO) and the Mn/DOT Cultural Resources Unit (CRU) have been afforded an opportunity to review this report. SHPO and the CRU do not agree with the recommendation of the report that there should be changes to the contributing /non-contributing status of the 10th, Elliot, Nicollet, and Pillsbury Avenue bridges in the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District. There are twenty-nine bridges in the district, twenty-seven of which are contributing. It is the opinion of SHPO and the CRU that the district is large in scale and changes to the parapet railings of these three bridges does not warrant changing their contributing status, particularly when one considers that the piers and decks remain. In addition, SHPO and the CRU concur that the district should not be segmented and should stand as a whole. The district is significant for both the engineering and scale of the project, and any smaller segment could not adequately reflect the original historic resource.

IX. CONCLUSIONS

The City of Minneapolis Public Works Department and Hennepin County have conducted a study of the bridges of the Midtown Corridor to address Stipulation 3 of the "Section 106 Memorandum of Agreement (MOA) Between the Federal Highway Administration and the Minnesota State Historic Preservation Office Related to Bridge Replacement Project S.P. 141-165-15." This study has included a planning study for the bridges of the historic district, a review of potential repair or rehabilitation limitations, a narrative of the original construction methods, and a discussion of foreseeable effects of additional bridge removals on the historic district.

A. SUMMARY OF EXISTING BRIDGE CONDITIONS

Bridges reviewed in this report exhibit degradation of concrete, either through materials used in the original construction or through the environmental exposure of more than ninety years. Once general concrete degradation begins, it is common for further deterioration to be accelerated. These general concrete conditions have left reinforcement bars exposed and unprotected. In this state, the steel reinforcement will more readily oxidize and have less strength. If the steel corrosion and concrete degradation continue, the load carrying capacity of the bridges will be reduced and eventually require the bridges' replacement. Structural rehabilitation for the bridges with severe map cracking of the deck and integral T-beams and pier caps would likely require complete concrete deck replacement, including the railings, integral T-beams, and integral pier caps. At this level of rehabilitation, the entire bridge would likely be replaced so that it would meet current design codes. If a new superstructure were built atop the existing substructures, design exceptions might be required to deviate from some aspects of the current bridge design code.

Structural rehabilitation and repair techniques, both past and more present methods, have been discussed. In the past, the City has utilized some of the current repair practices on the corridor bridges with good success, including shotcrete, patching, and milling the road asphalt surface and placing a low slump concrete overlay wearing surface. While these methods have been used mostly to stabilize gross foundation issues, deck wearing surfaces, and/or railing issues, they have not completely answered the deterioration of the concrete and reinforcing in the cast-in-place concrete T-beam superstructures.

Core sample test results from 1981 varied from sound concrete with high compressive strengths to cores that crumbled when extracted and were not able to be tested. A parallel has been noted between past poor concrete core samples and current low sufficiency ratings, and between past sound concrete core samples and current higher sufficiency ratings.

Comparison of the sufficiency ratings of the bridges gives the best overall indicator of the health of each bridge. For these bridges, a sufficiency rating below 40 may indicate an expected life of less than four years, a rating between 40 and 60 may indicate an expected life of four to eight years, and a rating above 60 may indicate a life expectancy of over eight years. Changing the live loading on some of these bridges from vehicular traffic to pedestrian loads could extend the useful life of the bridge anywhere from four to ten years.

B. AGENCY COORDINATION

While review of these bridge structures is an attempt to formulate a course of action for the foreseeable future, bridge rehabilitation or replacement is a process that would take longer than the three-year period set forth in Stipulation 6 of the MOA, which reads:

> If the terms of this agreement have not been implemented 3 years after signature, this agreement should be null and void. In such event, FHWA shall notify the parties of this agreement of the expiration, and if appropriate, shall re-initiate review of the undertaking in accordance with 36CFR 800.7(c)(4) and Section 110(1) of NHPA.

The City Council cannot approve any project without encumbering funding for that project. Local street bridge projects will require the City Council to encumber funds. Most of the bridge work discussed in this report, outside of normal maintenance, is beyond the tenure of the existing Council. State statute limits city councils from committing to funding projects that would occur beyond their immediate tenure. Therefore, the current City Council cannot pass any resolutions binding future councils to fund bridge projects that will occur beyond the current Council's immediate tenure.

During the final review of this report, comments were received from the City Council, Minneapolis Public Works, Hennepin County, the HCRRA, Minneapolis Community Planning and Economic Development (CPED), the Midtown Community Works Partnership (Appendix I) the Midtown Greenway Coalition (Appendix J), and the State Historic Preservation Office (SHPO) and Mn/DOT Cultural Resource Unit (CRU) (see Section VIII).

C. FUTURE PROJECT DEVELOPMENT

Even if an option to utilize the Midtown Corridor is not selected for the Southwest Transitway, other options for transportation within the corridor may be considered in the future. There are numerous factors which would require extensive engineering to assess the impacts that transit construction would have on the existing bridges.

As Charlene Roise, Hess, Roise and Company, points out in Section VII, above:

> The challenge will be to balance the practical needs and economic realities identified by engineers and planners with the unique qualities that characterize the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District.

The City intends to apply for federal funds to assist in the preservation of these structures. They will utilize the results of this report in evaluating their program for the local bridges of the corridor included in this study. The City, the HCRRA, and Hennepin County will work together to derive agency agreements dealing with future bridge maintenance, programming for any reclassification or replacement programs, financial partnering, and long-term ownership of the structures.

The City (as the local road authority) and the HCRRA (as the owner of the historic bridges) have a vested interest in maximizing the design life of their roads and bridges. This is especially true of these historically significant bridges. Both the City and the HCRRA recognize that decisions made about maintenance, structural rehabilitation, replacement or removal of bridges in the corridor affect the National Register status of the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District.

To ensure their continued use and preservation, the City is committed to monitoring the Midtown Corridor bridges' condition and possible accelerated deterioration, as part of its annual bridge safety inspections. The City is further committed to solicit funding that would provide the resources for additional ordinary maintenance and betterments; for exploration of structural rehabilitation technology as successfully used by others; and for exploration of technologies to halt and/or stabilize existing deterioration. Rehabilitation will be considered as possible bridge replacement projects develop.

Prior to any infrastructure work, the City will employ the proper methods for project development, which includes a context sensitive design process. This includes gathering input on future development of the corridor and through the community involvement process from owners, residential and business communities, planners, engineers, the City Council and the Historic Preservation Commission.

APPENDIX A

Section 106 Memorandum of Agreement (MOA) Between the Federal Highway Administration and the Minnesota State Historic Preservation Office Related to Bridge Replacement Project S.P. 141-165-15

SECTION 106 MEMORANDUM OF AGREEMENT
BETWEEN
THE FEDERAL HIGHWAY ADMINISTRATION
AND THE
MINNESOTA STATE HISTORIC PRESERVATION OFFICE
RELATED TO BRIDGE REPLACEMENT PROJECT S.P. 141-165-15
IN MINNEAPOLIS, HENNEPIN COUNTY, MINNESOTA

WHEREAS, the Federal Highway Administration (FHWA) is proposing to provide funding to the Minnesota Department of Transportation (Mn/DOT) for the reconstruction of the Chicago Avenue Bridge No. 92349 over the Midtown Greenway (located between 28th Street and Lake Street) in Minneapolis, Hennepin County; and

WHEREAS, the Chicago Avenue Bridge No. 92349 has been determined to be both individually eligible for listing in the National Register of Historic Places, and is a contributing element in the National Register eligible Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District and will be adversely affected by this project; and

WHEREAS, on behalf of FHWA, Mn/DOT Cultural Resource Unit has consulted with the Minnesota State Historic Preservation Office pursuant to 36CFR 800; and

WHEREAS, Hennepin County is also proposing a non-federally funded replacement of the eligible Park Avenue Bridge No. 90491, also within the eligible Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District, and has agreed to partially fund a portion of the bridge study stipulated within this MOA; and

WHEREAS, MnDOT, the City of Minneapolis Public Works, and Hennepin County Public Works have responsibilities under this MOA, and have been invited to be a signatories to the MOA; and

WHEREAS, the Hennepin County Regional Rail Authority, the Midtown Greenway Coalition and the Minneapolis Heritage Preservation Commission have been invited to concur with the MOA;

NOW, THEREFORE, FHWA and the Minnesota SHPO agree that, upon execution of the MOA, the FHWA shall ensure that the following stipulations are implemented in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

The FHWA will ensure that the following measures are carried out:

1. The final design for the replacement structures for the Chicago Avenue and Park Avenue bridges will be reviewed and approved by the Mn/DOT CRU and submitted to MnSHPO for concurrence before construction.

2. The City of Minneapolis Department of Public Works and Hennepin County Public Works will record the Chicago Avenue and Park Avenue bridges to Minnesota Historic Property Record (MHPR) standards. The documentation will be submitted to Mn/DOT CRU for review and approval and submitted to SHPO for concurrence.

3. The City of Minneapolis Department of Public Works and Hennepin County Public Works will complete a planning study for the bridges within the Chicago Milwaukee and St. Paul Railroad Grade Separation Historic District. The document should include an organized analysis of each bridge's condition, potential for rehabilitation and any proposed schedule for removal and replacement. The analysis of bridge condition should include a narrative discussing the original construction method of the bridges as well as repair or rehabilitation limitations peculiar to the bridge type and the most current practices in the repair of this type of bridge and its materials. The study should also contain an analysis of the foreseeable effects of additional bridge removals/change of use to the historic district. That analysis should include a reiteration of the historic characteristics of the district, the significance of the bridges to the district, an analysis of the most coherent sections of the historic corridor, and a studied opinion of how bridge replacement will affect the National Register eligibility of the grade separation district as a whole. The document will be completed in consultation with the Mn/DOT CRU and the Minnesota SHPO and will apply the Secretary of Interior's National Register Criteria for Evaluation and the Secretary of Interior's Standards for the Treatment of Historic Properties. The study will be complete 18 months after finalization of this MOA.

4. Disputes regarding the completion of the terms of this agreement shall be resolved by the signatories. If the signatories cannot agree regarding a dispute, any one of the signatories may request the participation of the Advisory Council on Historic Preservation to assist in the dispute.

5. Any signatory to this MOA may terminate the agreement by providing thirty (30) days written notice to the other parties, provided the parties consult during the period prior to termination to agree on amendments or other actions that would avoid termination.

6. If the terms of this agreement have not been implemented 3 years after signature, this agreement should be null and void. In such an event, FHWA shall notify the parties of this agreement of the expiration, and if appropriate, shall re-initiate review of the undertaking in accordance with 36CFR 800.7(c)(4) and Section 110(l) of NHPA.

Execution of this agreement and implementation of its terms evidence that FHWA has taken into account the effects of the undertaking on historic properties.

FEDERAL HIGHWAY ADMINISTRATION

By: A. Grasczyk Date: 3/4/04
Name and Title of signer: Project Development Team Leader

MINNESOTA STATE HISTORIC PRESERVATION OFFICE

By: Nancy M. Archabal Date: 1/12/04
Name and Title of signer:

Invited Signatories:

MINNESOTA DEPARTMENT OF TRANSPORTATION

By: [illegible] Date: 2/24/04
Name and Title of signer:

CITY OF MINNEAPOLIS DEPARTMENT OF PUBLIC WORKS

By: [illegible] Date: 2-19-04
Name and Title of signer:

HENNEPIN COUNTY DEPARTMENT OF PUBLIC WORKS

By: [illegible] Date: 2-11-04
Name and Title of signer: Asst Co Administrator for Public Works.

Concurring Signatories:

HENNEPIN COUNTY REGIONAL RAIL AUTHORITY

By: [illegible] Date: 2-11-04
Name and Title of signer: Executive Director, HCRRA

MIDTOWN GREENWAY COALITION

By: [illegible] Date: 2/18/04
Name and Title of signer: TIM SPRINGER, EXECUTIVE DIR.

MINNEAPOLIS HERITAGE PRESERVATION COMMISSION

By: Date:
Name and Title of signer:

APPENDIX B

Bridge L8901 (Fremont Avenue South) Mn/DOT Structure Inventory Report and Bridge Inspection Report

Mn/DOT STRUCTURE INVENTORY REPORT

Bridge ID: L8901 **1030(FREMONT AV S) OVER HCRRA GREENWAY** Date: 08/22/2006

* IDENTIFICATION *

Agency Br. No. (7787) (RS 1) - 1
District METRO **Maint. Area**
County 27 HENNEPIN (53)
City 2585 MINNEAPOLIS
Township
Placecode 43000
Desc. Loc. 0.1 MI N OF LAKE ST
Sect. 33 **Tnsp.** 029N **Range** 24W
Lat. 44d 57m 00s **UTM-Y** 4977438.38
Long. 93d 17m 42s **UTM-X** 476729.27
Toll Bridge (Road) NO
Custodian RAILROAD
Owner RAILROAD
Inspector CITY OF MINNEAPOLIS
BMU Agreement No
Year Built 1913 **Yr Fed Rehab**
Year Remod.
Temp.
Skew 0 **Plan Avail.** MUNICIPAL

* STRUCTURE DATA *

Service On HWY;PED
Service Under PED;BICYCLE
MN Main Span 206 CONC CNT/DECK GRDR
MN MSpn Det Def
MN Appr. Span
MN ASpn Det Def
Culvert Type
Barrel Length
No. Main Spans 3 **No. Appr.Span** 0
Total Spans 3 **NBI Len. (?)** YES
Main Span Length 31.7 ft
Structure Length 94.0 ft
Abut. Mat'l. CONCRETE
Abut. Fnd. Type SPRD/SOIL
Pier Mat'l. CONCRETE
Pier Fnd. Type SPRD/SOIL
Deck Width 49.0 ft
Deck Material CIP CONC
Wear Surf. Type BITUMINOUS
Wear Surf. Inst. Yr.
Wr. Crs/Fill Depth 0.40 ft
Deck Membrane NONE
Deck Rebars NOT/APPL
Deck Rebars Inst. Yr.
Structure Area 4,606 sq ft
Roadway Area 2,820 sq ft
Swk Width L/R 8.0 ft 8.0 ft
Curb Ht. L/R 0.6 ft 0.6 ft
Rail L/R/FHWA 36 36 NO
Ped. Fencing
Hist. Significance NATL REG ELEG
Bird Nests (?) NO

* ROADWAY DATA *

Route System (Fed) CITY
Mn. Route System MUN
Route Number 1030
Roadway Name MUN 1030
Roadway Function MAINLINE
Roadway Type 2 WAY TRAF
Control Section
BDG. Reference Point
Date Opened to Traffic 01-01-1913
Detour Length 1 mi
Lanes 2 ON BRIDGE (1)
ADT 1,702 **HCADT**
ADT Year 2001
Functional Class URBAN LOCAL
Nat'l. Hwy. System NOT NHS
STRAHNET NOT STRAHNET
Truck Net NOT TRUCKNET
Fed. Lands Hwy. N/A
OnBaseNet NOT BASENET

* ROADWAY CLEARANCES *

If Divided	NB-EB	SB-WB
Rdwy. Wid. Rd 1/Rd 2	30.0 ft	
Vrt. Clr. Ovr. Rd 1/Rd 2		
Max Vert Clr Rd 1/ Rd 2		
Horz U/Clr - Rd 1/Rd 2	30.0 ft	
Lat UndClr Left/Right		
RR UndClr Vert/Lat		
Appr. Surface Width	31.0 ft	
Median Width		

* ROADWAY TIS DATA *

	TIS 1st KEY	TIS 2nd KEY
Route System	10	
Route Number	25851030	
High End	47	
Low End	47	
Direction	N	
Reference Pt.	000+00.870	
Interchg. Elem.		

* MISC. BRIDGE DATA *

Struct. Flared
Parallel Struct. NONE
Field Conn. ID
Cantilever ID
Permit Code A
Permit Code B
Permit Code C
Permit Code Fut.

* BRIDGE SIGNS *

Posted Load VEHICLE & SEMI
Traffic NOT REQUIRED
Horizontal NOT REQUIRED
Vertical NOT APPLICABLE

Def. Status S.D. **Suff. Rating** 29.5

* WATERWAY DATA *

Drng. Area
Wtrwy. Opening
Navigation Control NOT APPL
Nav. Vert./Hrz Clr.
Nav. Vert. Lift Clr.
MN Scour Code A-NON WATERWAY
Scour Eval. Year 1993

* INSPECTION DATA *

Inspection Date 06-30-2005 (JWRV)
Inspection Frequency 12
Inspector PONTIS

Condition Codes		Appraisal Ratings	
Deck	3	Struct. Eval.	2
Superstruct.	2	Deck Geometry	5
Substruct.	3	Underclearances	N
Chan. & Prot.	N	Waterway Adeq'cy	N
Culvert	N	Appr. Alignment	5

Other Inspection Codes

Open, Posted, Clsd.	P	Rail Rating	0
Pier Protection		Appr. Guardrail	
Scour Critical	N	Appr. Trans.	
Deck Pct. Unsnd.		Appr. Term.	

In Depth Inspections

	Y/N	Freq.	Last Insp.
Frac. Critical			
Pinned Asbly.			
Underwater			
Spec. Feat.			

* PAINT DATA *

Year Painted **Pct.Unsound**
Total Painted Area
Primer Type
Finish Type

* CAPACITY RATINGS *

Design Load UNKN
MN
Operating Rating HS 14.4
Inventory Rating HS 5.4
Posting Veh: 20 Semi: 33 Dbl:
Rtg Date 03-03-1980

* IMPROVEMENT DATA *

Prop. Work REPLACE COND.
Work By CONTRACT
Prop. Structure BRIDGE
Length 111.5 ft **Width** 52.5 ft
Appr. Rdwy. Work
Bridge Cost 456,000
Approach Cost 23,000
Project Cost 349,000
Data - Year/Method 2006 COMPUTER

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8901 1030(FREMONT AV S) OVER HCRRA GREENWAY INSP. DATE: 06-30-2005

County: HENNEPIN
City: MINNEAPOLIS
Township:
Section: 33 Township: 029N Range: 24W
Span Type: CONC CNT / DECK GRDR
NBI Deck: 3 Super: 2 Sub: 3 Chan: N Culv: N

Location: 0.1 MI N OF LAKE ST
Route: MUN 1030 Ref. Pt.: 000+00.870
Control Section: Maint. Area:
Local Agency Bridge Nbr: 7787

Length: 94.0 ft
Deck Width: 49.0 ft
Rdwy. Area / Pct. Unsnd: 2,820 sq ft
Paint Area / Pct. Unsnd:

Open, Posted, Closed: LOAD POSTED

Appraisal Ratings - Approach: 5 Waterway: N
MN Scour Code: A-NON WATERWAY Def. Stat: S.D. Suff. Rate: 29.5
Required Bridge Signs - Load Posting: VEHICLE & SEMI Traffic: NOT REQUIRED
Horizontal: NOT REQUIRED Vertical: NOT APPLICABLE

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
13	CONC DECK - BIT O/L	2	06-30-2005	4,607 SF	0	0	4,607	0	0
			07-15-2004	4,607 SF	0	0	4,607	0	0
	Notes: 13. THERE IS A GAP IN THE ASPHALT OVERLAY ALONG THE CURBLINES. MAP CRACKS IN THE ASPH. SURFACE.								
320	CONC APPR SLAB-BITOL	2	06-30-2005	2 EA	0	2	0	0	N/A
			07-15-2004	2 EA	0	2	0	0	N/A
	Notes: 320. THERE IS SOME MINOR SETTLEMENT AND SEPARATION AT THE JOINT.								
331	CONCRETE RAILING	2	06-30-2005	187 LF	0	0	187	0	N/A
			07-15-2004	187 LF	0	0	187	0	N/A
	Notes: 331. THERE ARE MANY CRACKS AND SPALLS WITH RUST STAINS AND REBARS EXPOSED. THE RAILING IS BELOW MINIMUM HEIGHT REQUIREMENTS.								
110	CONCRETE GIRDER	2	06-30-2005	846 LF	0	0	253	594	N/A
			07-15-2004	846 LF	0	0	253	594	N/A
	Notes: 110. & 963. MOST OF THE GIRDERS ARE IN AN ADVANCED STATE OF DETERIORATION. THERE IS HEAVY ACCIDENT DAMAGE OVER THE TRACKS. REFER TO THE IN-DEPTH INSPECTION REPORT FROM 1989 FOR MORE DETAILED INFORMATION. THERE ARE LARGE SPALLS WITH REBARS EXPOSED. SOME OF THE HAUNCHES ARE HOLLOW SOUNDING. THE CONCRETE IS DISINTEGRATING AROUND REINFORCING STEEL WITH LOSS OF BOND WHICH IS AFFECTING THE LOAD CARRYING CAPACITY OF THE STRUCTURE. THERE IS LOSS OF SECTION TO THE REBAR. THE BOTTOM REBAR WAS MEASURED IN 1998 ON THE SECOND GIRDER FROM THE WEST IN THE CENTER SPAN (RED ARROW PAINTED) AND SOUND STEEL WAS FOUND TO HAVE BEEN REDUCED TO 5/8" SQUARE. THE PLAN SHOWS A 3/4" BAR AT THIS LOCATION. SOME LOSS CONCRETE OVER PATH , HAZARDOUS TO PED. AND BIKES.								
205	CONCRETE COLUMN	2	06-30-2005	8 EA	0	0	8	0	N/A
			07-15-2004	8 EA	0	0	8	0	N/A
	Notes: 205. THERE ARE LARGE SPALLS WITH REBARS EXPOSED AND UNDERMINED, CRACKS AND HOLLOW AREAS ON ALL EIGHT OF THE COLUMNS. THERE IS ACCIDENT DAMAGE TO THE S.W. CORNER OF THE N.W. COLUMN.								
215	CONCRETE ABUTMENT	2	06-30-2005	98 LF	0	79	20	0	N/A
			07-15-2004	98 LF	0	79	20	0	N/A
	Notes: 215. THERE ARE SIGNS OF SEEPAGE, AREAS OF HEAVY SCALING AND SPALLS WITH LARGE HOLLOW AREAS, SOME CRACKS, EROSION AT THE CAPS AND THE BACKWALLS ARE IN AN ADVANCED STATE OF DETERIORATION. SOME LOOSE CONCRETE ON THE NORTH ABUTMENT SEAT. THE N.E & N.W. CORNER HAS BEEN SHOTCRETED AND STARTING TO GET FINE SIZE RANDOM CRACKS.								
234	CONCRETE CAP	2	06-30-2005	98 LF	0	69	30	0	N/A
			07-15-2004	98 LF	0	69	30	0	N/A
	Notes: 234. THERE ARE MANY CRACKS, AREAS OF HEAVY LEACHING AND EFFLORESCENCE AT ALL OF THE ARCHES AND CAPS.								
387	CONCRETE WINGWALL	2	06-30-2005	4 EA	0	0	4	0	N/A
			07-15-2004	4 EA	0	0	4	0	N/A
	Notes: 387. THE WALLS HAVE HEAVY EROSION, SCALING, MASSIVE CRACKS AND CREVICES UP 4".								
359	CONC DECK UNDERSIDE	2	06-30-2005	1 EA	0	0	0	0	1
			07-15-2004	1 EA	0	0	0	0	1

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8901 1030(FREMONT AV S) OVER HCRRA GREENWAY INSP. DATE: 06-30-2005

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
	Notes: 359. THE SUBSURFACE HAS SEVERE LEACHING, EFFLORESCENCE, LARGE SPALLS WITH REBARS EXPOSED AND AREAS OF MAP CRACKING.								
362	TRAFFIC IMPACT	2	06-30-2005	1 EA	0	1	0	N/A	N/A
			07-15-2004	1 EA	0	1	0	N/A	N/A
	Notes: 963. SE ELEMENT 110.								
964	CRITICAL FINDING	2	06-30-2005	1 EA	1	0	N/A	N/A	N/A
			07-15-2004	1 EA	1	0	N/A	N/A	N/A
	Notes: DO NOT DELETE THIS CRITICAL FINDING SMART FLAG.								
981	SIGNING	2	06-30-2005	1 EA	1	0	0	0	0
			07-15-2004	1 EA	1	0	0	0	0
	Notes: 981. POSTED 20/33								
986	CURB & SIDEWALK	2	06-30-2005	1 EA	0	1	0	N/A	N/A
			07-15-2004	1 EA	0	1	0	N/A	N/A
	Notes: 986. CURB: THERE ARE SOME SEALED CRACKS AND SMALL SPALLS. THE N.E. APPROACH CURB HAS SPALLED AND THE ASPH. PATCH IS LOOSE. SIDEWALK: THERE ARE SOME FINE SIZED TRANSVERSE CRACKS. THE SIDEWALK SUBSURFACE HAS MANY TRANSVERSE AND MAP CRACKS, AREAS OF LEACHING AND EFFLORESCENCE, PATCHES AND SPALLS. THE N.E. & S.E. APPROACH SIDEWALKS HAVE ASPHALT PATCHES.								

General Notes: *CITY BRIDGE #7787,
AREA UNDER: THERE IS A ASPHALT BIKE PATH AND A 6' CHAIN LINK FENCE ADDED TO THE MIDTOWN GREENWAY IN 2000.
NOTE: THE PEDESTRIAN RAMPS ARE IN PLACE ON THE SOUTH.
REPAIRS MADE: NEW CURB AND SIDEWALK WAS PLACED IN 1983. THE RAILING WAS PAINTED IN 1985. THE NORTH APPROACH SIDEWALKS WERE PATCHED IN 1993. THE WEST SIDE WALK APPROACHS PANELS WERE REPLACED IN 1998. THE N.E. AND N.W. WING WALLS WERE SHOTCRETED IN 2001.
NOTE: STORM SEWER WAS ADDED UNDER ABRIDGE SOUTH SIDE OF SOUTH COLUMN.

Inspector's Signature

Reviewer's Signature / Date

APPENDIX C

Bridge L8908 (Pleasant Avenue South) Mn/DOT Structure Inventory Report and Bridge Inspection Report

Mn/DOT STRUCTURE INVENTORY REPORT

Bridge ID: L8908 **718(PLEASANT AV) OVER HCRRA GREENWAY** Date: 08/22/2006

* IDENTIFICATION *

Agency Br. No. (7776) (RS 1) - 1
District METRO **Maint. Area**
County 27 HENNEPIN (53)
City 2585 MINNEAPOLIS
Township
Placecode 43000
Desc. Loc. 0.1 MI N OF LAKE ST
Sect. 34 **Tnsp.** 029N **Range** 24W
Lat. 44d 57m 00s **UTM-Y** 4977434.64
Long. 93d 16m 54s **UTM-X** 477781.06
Toll Bridge (Road) NO
Custodian RAILROAD
Owner RAILROAD
Inspector CITY OF MINNEAPOLIS
BMU Agreement No
Year Built 1913 **Yr Fed Rehab**
Year Remod.
Temp.
Skew 0 **Plan Avail.** MUNICIPAL

* STRUCTURE DATA *

Service On HWY;PED
Service Under PED;BICYCLE
MN Main Span 206 CONC CNT/DECK GRDR
MN MSpn Det Def
MN Appr. Span
MN ASpn Det Def
Culvert Type
Barrel Length
No. Main Spans 3 **No. Appr.Span** 0
Total Spans 3 **NBI Len. (?)** YES
Main Span Length 31.5 ft
Structure Length 94.3 ft
Abut. Mat'l. CONCRETE
Abut. Fnd. Type SPRD/SOIL
Pier Mat'l. CONCRETE
Pier Fnd. Type SPRD/SOIL
Deck Width 49.0 ft
Deck Material CIP CONC
Wear Surf. Type BITUMINOUS
Wear Surf. Inst. Yr.
Wr. Crs/Fill Depth 0.37 ft
Deck Membrane NONE
Deck Rebars NOT/APPL
Deck Rebars Inst. Yr.
Structure Area 4,621 sq ft
Roadway Area 2,831 sq ft
Swk Width L/R 8.0 ft 8.0 ft
Curb Ht. L/R 0.5 ft 0.5 ft
Rail L/R/FHWA 09 09 YES
Ped. Fencing
Hist. Significance NATL REG ELEG
Bird Nests (?) NO

* ROADWAY DATA *

Route System (Fed) CITY
Mn. Route System MUN
Route Number 718
Roadway Name MUN 718
Roadway Function MAINLINE
Roadway Type 2 WAY TRAF
Control Section
BDG. Reference Point
Date Opened to Traffic 01-01-1913
Detour Length 1 mi
Lanes 2 ON BRIDGE (1)
ADT 2,308 **HCADT**
ADT Year 2001
Functional Class URBAN LOCAL
Nat'l. Hwy. System NOT NHS
STRAHNET NOT STRAHNET
Truck Net NOT TRUCKNET
Fed. Lands Hwy. N/A
OnBaseNet NOT BASENET

* ROADWAY CLEARANCES *

If Divided	NB-EB	SB-WB
Rdwy. Wid. Rd 1/Rd 2	30.0 ft	
Vrt. Clr. Ovr. Rd 1/Rd 2		
Max Vert Clr Rd 1/ Rd 2		
Horz U/Clr - Rd 1/Rd 2	30.0 ft	
Lat UndClr Left/Right		
RR UndClr Vert/Lat		
Appr. Surface Width	36.0 ft	
Median Width		

* ROADWAY TIS DATA *

	TIS 1st KEY	TIS 2nd KEY
Route System	10	
Route Number	25850718	
High End	47	
Low End	47	
Direction	N	
Reference Pt.	000+00.570	
Interchg. Elem.		

* MISC. BRIDGE DATA *

Struct. Flared
Parallel Struct. NONE
Field Conn. ID
Cantilever ID
Permit Code A
Permit Code B
Permit Code C
Permit Code Fut.

* BRIDGE SIGNS *

Posted Load NOT REQUIRED
Traffic NOT REQUIRED
Horizontal NOT REQUIRED
Vertical NOT APPLICABLE

Def. Status ADEQ **Suff. Rating** 54.3

* WATERWAY DATA *

Drng. Area
Wtrwy. Opening
Navigation Control NOT APPL
Nav. Vert./Hrz Clr.
Nav. Vert. Lift Clr.
MN Scour Code A-NON WATERWAY
Scour Eval. Year 1993

* INSPECTION DATA *

Inspection Date 06-28-2005 (FZQR)
Inspection Frequency 12
Inspector PONTIS

Condition Codes		Appraisal Ratings	
Deck	5	Struct. Eval.	4
Superstruct.	5	Deck Geometry	4
Substruct.	5	Underclearances	N
Chan. & Prot.	N	Waterway Adeq'cy	N
Culvert	N	Appr. Alignment	7

Other Inspection Codes

Open, Posted, Clsd.	A	Rail Rating	
Pier Protection		Appr. Guardrail	
Scour Critical	N	Appr. Trans.	
Deck Pct. Unsnd.		Appr. Term.	

In Depth Inspections

	Y/N	Freq.	Last Insp.
Frac. Critical			
Pinned Asbly.			
Underwater			
Spec. Feat.			

* PAINT DATA *

Year Painted **Pct.Unsound**
Total Painted Area
Primer Type
Finish Type

* CAPACITY RATINGS *

Design Load UNKN
MN
Operating Rating HS 22.1
Inventory Rating HS 9.8
Posting Veh: Semi: Dbl:
Rtg Date 03-01-1980

* IMPROVEMENT DATA *

Prop. Work REPLACE COND.
Work By CONTRACT
Prop. Structure BRIDGE
Length 111.5 ft **Width** 52.5 ft
Appr. Rdwy. Work
Bridge Cost 457,000
Approach Cost 25,000
Project Cost 385,000
Data - Year/Method 2006 COMPUTER

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8908 718(PLEASANT AV) OVER HCRRA GREENWAY INSP. DATE: 06-28-2005

County: HENNEPIN
City: MINNEAPOLIS
Township:
Section: 34 Township: 029N Range: 24W
Span Type: CONC CNT / DECK GRDR
NBI Deck: 5 Super: 5 Sub: 5 Chan: N Culv: N

Location: 0.1 MI N OF LAKE ST
Route: MUN 718 Ref. Pt.: 000+00.570
Control Section: Maint. Area:
Local Agency Bridge Nbr: 7776

Length: 94.3 ft
Deck Width: 49.0 ft
Rdwy. Area / Pct. Unsnd: 2,831 sq ft
Paint Area / Pct. Unsnd:

Open, Posted, Closed: OPEN

Appraisal Ratings - Approach: 7 Waterway: N
MN Scour Code: A-NON WATERWAY Def. Stat: ADEQ Suff. Rate: 54.3
Required Bridge Signs - Load Posting: NOT REQUIRED Traffic: NOT REQUIRED
Horizontal: NOT REQUIRED Vertical: NOT APPLICABLE

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
13	CONC DECK - BIT O/L	2	06-28-2005	4,618 SF	0	0	4,618	0	0
			07-13-2004	4,618 SF	0	0	4,618	0	0
	Notes: 13. THE GUTTERS HAVE VEGETATION GROWING IN THEM AND THERE IS SOME MINOR PONDING. THERE IS A GAP IN THE ASPHALT OVERLAY ALONG THE CURBLINES.								
320	CONC APPR SLAB-BITOL	2	06-28-2005	2 EA	0	2	0	0	N/A
			07-13-2004	2 EA	0	2	0	0	N/A
	Notes: 320. THERE ARE SOME RANDOM CRACKS AND PATCHES. BOTH HAVE MINOR SETTLEMENT.								
333	RAILING - OTHER	2	06-28-2005	190 LF	0	0	190	N/A	N/A
			07-13-2004	190 LF	0	0	190	N/A	N/A
	Notes: 333. BOTH CONCRETE RAILINGS ARE HEAVILY ERODED WITH MANY SPALLS AND BROKEN OUT AREAS WITH REBARS EXPOSED AND UNDERMINED. THE S.W. AND S.E RAIL IS CRACKED THROUGH.THE N.E. AND N.W. APPROACH RAILINGS ARE BOTH PUSHED TO THE SOUTH AND HAVE LOSS OF BEARING. MANY OF THE NUTS ON THE METAL EXTENSION RAILING ARE MISSING. SOME OF THE RAIL IS LOOSE. SOME GRAFFITI								
110	CONCRETE GIRDER	2	06-28-2005	860 LF	0	0	843	16	N/A
			07-13-2004	860 LF	0	0	843	16	N/A
	Notes: 110 & 963. THERE IS HEAVY ACCIDENT DAMAGE TO TWO AND MODERATE DAMAGE TO THE REST OF THE GIRDERS IN THE CENTER SPAN. THE FASCIAS HAVE SOME MINOR SPALLING WITH REBARS EXPOSED AND SOME EFFLORESCENCE STAINS.								
205	CONCRETE COLUMN	2	06-28-2005	8 EA	0	0	8	0	N/A
			07-13-2004	8 EA	0	0	8	0	N/A
	Notes: 205. ALL EIGHT COLUMNS HAVE HOLLOW AREAS WITH LARGE SPALLS AND REBARS EXPOSED WITH SOME UNDERMINED. THE 4 NORTH COLUMNS WERE BACK FILLED 2 TO 3 FEET FOR BIKE TRAIL.								
215	CONCRETE ABUTMENT	2	06-28-2005	98 LF	0	89	10	0	N/A
			07-13-2004	98 LF	0	89	10	0	N/A
	Notes: 215. THE NORTH ABUTMENT FACE HAS LARGE HOLLOW AREAS AND CRACKS. BOTH HAVE SIGNS OF SEEPAGE, SCALING, SPALLING, FULL HEIGHT CRACKS AND HOLLOW AREAS. BOTH BACKWALLS HAVE SOME SPALLS.								
234	CONCRETE CAP	2	06-28-2005	98 LF	0	98	0	0	N/A
			07-13-2004	98 LF	0	98	0	0	N/A
	Notes: 234. THERE IS ONE DELAMINATION AND ONE SPALL WITH A REBAR EXPOSED ON THE SOUTH PIER CAP.								
387	CONCRETE WINGWALL	2	06-28-2005	4 EA	0	2	1	1	N/A
			07-13-2004	4 EA	0	2	1	1	N/A
	Notes: 387. THE N.W. IS LEANING SOUTH 4". THE N.E. IS PUSHED SOUTH ON THE EAST END 6" AND HAS A 6" HOLE IN THE WING WALL AT THE BRIDGE. THEY ARE ALL HEAVILY SCALED, SPALLED WITH REBARS EXPOSED AND HAVE LARGE CRACKS. THE N.W CORNER OF THE S.E. WING WALL IS CRUSHING.								
359	CONC DECK UNDERSIDE	2	06-28-2005	1 EA	1	0	0	0	0
			07-13-2004	1 EA	1	0	0	0	0
	Notes: 359. THE SUBSURFACE HAS A FEW FINE SIZED TRANSVERSE CRACKS. THERE IS SOME SCALING AND EFFLORESCENCE STAINS AT THE LONGITUDINAL CONSTRUCTION JOINTS. THERE ARE SMALL AREAS OF LEACHING AND SOME SPALLS WITH REBARS EXPOSED.								

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8908 718(PLEASANT AV) OVER HCRRA GREENWAY INSP. DATE: 06-28-2005

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
362	TRAFFIC IMPACT	2	06-28-2005	1 EA	0	1	0	N/A	N/A
			07-13-2004	1 EA	0	1	0	N/A	N/A
	Notes: 963. SEE ELEMENT 110.								
964	CRITICAL FINDING	2	06-28-2005	1 EA	1	0	N/A	N/A	N/A
			07-13-2004	1 EA	1	0	N/A	N/A	N/A
	Notes: DO NOT DELETE THIS CRITICAL FINDING SMART FLAG.								
986	CURB & SIDEWALK	2	06-28-2005	1 EA	0	0	1	N/A	N/A
			07-13-2004	1 EA	0	0	1	N/A	N/A
	Notes: 986. CURB: BOTH ARE HEAVILY SPALLED WITH REBARS EXPOSED. SIDEWALK: THERE ARE SOME FINE SIZED TRANSVERSE CRACKS, UNIFORM HEAVY SCALING, POPOUTS AND SPALLING WITH A LARGE SPALL WITH REBARS EXPOSED ON THE N.W.. THREE OF THE FOUR APPROACH SIDEWALKS HAVE ASPHALT PATCHES. THE SIDEWALK SUBSURFACE HAS MANY TRANSVERSE CRACKS WITH EFFLORESCENCE.								

General Notes: *CITY BRIDGE #7776,
AREA UNDER: DUE TO THE MIDTOWN GREENWAY A ASPHALT BIKE TRAIL AND 6' CHAIN LINK FENCE WERE PUT IN. THE TRAIL IS STARTING TO WASH OUT, NO MODULAR WALL WAS ADDED TO TRAIL.
NOTE: PEDESTRIAN RAMPS ARE NOT NECESSARY DUE TO THE MID-BLOCK LOCATION OF THE STRUCTURE.
REPAIRS MADE: A CHAINLINK FENCE WAS INSTALLED ON THE S.E. IN 1992. METAL EXTENSIONS WERE ADDED ON THE RAILINGS IN 1997.

Inspector's Signature

Reviewer's Signature / Date

APPENDIX D

Bridge L8913 (Columbus Avenue) Mn/DOT Structure Inventory Report and Bridge Inspection Report

Mn/DOT STRUCTURE INVENTORY REPORT

Bridge ID: L8913 **1050(COLUMBUS AV) OVER HCRRA GREENWAY** Date: 08/22/2006

* IDENTIFICATION *

Agency Br. No. (7763) (RS 1) - 1
District METRO **Maint. Area**
County 27 HENNEPIN (53)
City 2585 MINNEAPOLIS
Township
Placecode 43000
Desc. Loc. 0.1 MI N OF LAKE ST
Sect. 35 **Tnsp.** 029N **Range** 24W
Lat. 44d 57m 00s **UTM-Y** 4977429.64
Long. 93d 15m 46s **UTM-X** 479271.09
Toll Bridge (Road) NO
Custodian RAILROAD
Owner RAILROAD
Inspector CITY OF MINNEAPOLIS
BMU Agreement No
Year Built 1915 **Yr Fed Rehab**
Year Remod.
Temp.
Skew 0 **Plan Avail.** MUNICIPAL

* STRUCTURE DATA *

Service On HWY;PED
Service Under PED;BICYCLE
MN Main Span 206 CONC CNT/DECK GRDR
MN MSpn Det Def
MN Appr. Span
MN ASpn Det Def
Culvert Type
Barrel Length
No. Main Spans 3 **No. Appr.Span** 0
Total Spans 3 **NBI Len. (?)** YES
Main Span Length 31.5 ft
Structure Length 94.5 ft
Abut. Mat'l. CONCRETE
Abut. Fnd. Type SPRD/SOIL
Pier Mat'l. CONCRETE
Pier Fnd. Type SPRD/SOIL
Deck Width 49.0 ft
Deck Material CIP CONC
Wear Surf. Type BITUMINOUS
Wear Surf. Inst. Yr.
Wr. Crs/Fill Depth 0.37 ft
Deck Membrane NONE
Deck Rebars NOT/APPL
Deck Rebars Inst. Yr.
Structure Area 4,631 sq ft
Roadway Area 2,831 sq ft
Swk Width L/R 8.0 ft 8.0 ft
Curb Ht. L/R 0.4 ft 0.4 ft
Rail L/R/FHWA 36 36 NO
Ped. Fencing
Hist. Significance NATL REG ELEG
Bird Nests (?) NO

* ROADWAY DATA *

Route System (Fed) CITY
Mn. Route System MUN
Route Number 1050
Roadway Name MUN 1050
Roadway Function MAINLINE
Roadway Type 2 WAY TRAF
Control Section
BDG. Reference Point
Date Opened to Traffic 01-01-1915
Detour Length 1 mi
Lanes 2 ON BRIDGE (1)
ADT 1,030 **HCADT**
ADT Year 2001
Functional Class URBAN LOCAL
Nat'l. Hwy. System NOT NHS
STRAHNET NOT STRAHNET
Truck Net NOT TRUCKNET
Fed. Lands Hwy. N/A
OnBaseNet NOT BASENET

* ROADWAY CLEARANCES *

If Divided	NB-EB	SB-WB
Rdwy. Wid. Rd 1/Rd 2	30.0 ft	
Vrt. Clr. Ovr. Rd 1/Rd 2		
Max Vert Clr Rd 1/ Rd 2		
Horz U/Clr - Rd 1/Rd 2	30.0 ft	
Lat UndClr Left/Right		
RR UndClr Vert/Lat		
Appr. Surface Width	32.0 ft	
Median Width		

* ROADWAY TIS DATA *

	TIS 1st KEY	TIS 2nd KEY
Route System	10	
Route Number	25851050	
High End	47	
Low End	47	
Direction	N	
Reference Pt.	001+00.240	
Interchg. Elem.		

* MISC. BRIDGE DATA *

Struct. Flared
Parallel Struct. NONE
Field Conn. ID
Cantilever ID
Permit Code A
Permit Code B
Permit Code C
Permit Code Fut.

* BRIDGE SIGNS *

Posted Load NOT REQUIRED
Traffic NOT REQUIRED
Horizontal NOT REQUIRED
Vertical NOT APPLICABLE

Def. Status S.D. **Suff. Rating** 44.9

* WATERWAY DATA *

Drng. Area
Wtrwy. Opening
Navigation Control NOT APPL
Nav. Vert./Hrz Clr.
Nav. Vert. Lift Clr.
MN Scour Code A-NON WATERWAY
Scour Eval. Year 1993

* INSPECTION DATA *

Inspection Date 06-27-2005 (QRXR)
Inspection Frequency 12
Inspector PONTIS

Condition Codes		Appraisal Ratings	
Deck	6	Struct. Eval.	2
Superstruct.	6	Deck Geometry	5
Substruct.	5	Underclearances	N
Chan. & Prot.	N	Waterway Adeq'cy	N
Culvert	N	Appr. Alignment	7

Other Inspection Codes

Open, Posted, Clsd.	A	Rail Rating	0
Pier Protection		Appr. Guardrail	
Scour Critical	N	Appr. Trans.	
Deck Pct. Unsnd.		Appr. Term.	

In Depth Inspections

	Y/N	Freq.	Last Insp.
Frac. Critical			
Pinned Asbly.			
Underwater			
Spec. Feat.			

* PAINT DATA *

Year Painted **Pct.Unsound**
Total Painted Area
Primer Type
Finish Type

* CAPACITY RATINGS *

Design Load UNKN
MN
Operating Rating HS 18.2
Inventory Rating HS 7.1
Posting Veh: Semi: Dbl:
Rtg Date 03-01-1980

* IMPROVEMENT DATA *

Prop. Work REPLACE COND.
Work By CONTRACT
Prop. Structure BRIDGE
Length 114.8 ft **Width** 52.5 ft
Appr. Rdwy. Work
Bridge Cost 458,000
Approach Cost 23,000
Project Cost 349,000
Data - Year/Method 2006 COMPUTER

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8913 1050(COLUMBUS AV) OVER HCRRA GREENWAY INSP. DATE: 06-27-2005

County: HENNEPIN
City: MINNEAPOLIS
Township:
Section: 35 Township: 029N Range: 24W
Span Type: CONC CNT / DECK GRDR
NBI Deck: 6 Super: 6 Sub: 5 Chan: N Culv: N

Location: 0.1 MI N OF LAKE ST
Route: MUN 1050 Ref. Pt.: 001+00.240
Control Section: Maint. Area:
Local Agency Bridge Nbr: 7763

Length: 94.5 ft
Deck Width: 49.0 ft
Rdwy. Area / Pct. Unsnd: 2,831 sq ft
Paint Area / Pct. Unsnd:

Open, Posted, Closed: OPEN

Appraisal Ratings - Approach: 7 Waterway: N
MN Scour Code: A-NON WATERWAY Def. Stat: S.D. Suff. Rate: 44.9
Required Bridge Signs - Load Posting: NOT REQUIRED Traffic: NOT REQUIRED
Horizontal: NOT REQUIRED Vertical: NOT APPLICABLE

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
13	CONC DECK - BIT O/L	2	06-27-2005	4,628 SF	0	0	4,628	0	0
			07-12-2004	4,628 SF	0	0	4,628	0	0
	Notes: 13. THE ROADWAY ASPHALT SURFACE HAS MANY LARGE OPEN RANDOM CRACKS. THERE IS GAP IN THE ASPHALT OVERLAY ALONG THE CURBLINES ON THE EAST.								
320	CONC APPR SLAB-BITOL	2	06-27-2005	2 EA	0	1	1	0	N/A
			07-12-2004	2 EA	0	1	1	0	N/A
	Notes: 320. THERE IS SOME SETTLEMENT AND SOME RANDOM CRACKS ON BOTH. THERE IS A ROUGH TRANSITION ON THE SOUTH.								
333	RAILING - OTHER	2	06-27-2005	190 LF	0	190	0	N/A	N/A
			07-12-2004	190 LF	0	190	0	N/A	N/A
	Notes: 333. THERE ARE MANY HOLLOW AREAS, CRACKS, SPALLS AND PATCHES IN THE CONCRETE RAILINGS. THE APPROACH RAILINGS HAVE LARGE SPALLS AND GAPS. THE N.E. APPROACH RAILING IS PUSHED DOWN AND OUT 3". THE S.E. METAL APPROACH RAILING IS MISSING. THE TOP OF THE WALL IS DETERIORATING, SPALLED WITH REBAR EXPOSED. CHAIN LINK FENCE SHOULD BE RE-ATTACHED ON N.W. CORNER. GRAFFITI ON THE EAST FACE OF RAIL.								
110	CONCRETE GIRDER	2	06-27-2005	850 LF	0	833	16	0	N/A
			07-12-2004	850 LF	0	833	16	0	N/A
	Notes: 110. THERE IS MINOR LEACHING ON SOME OF THE HAUNCHES AND A MINOR SPALL ON THE N.E. BOTH OF THE FASCIAS HAVE SOME SPALLS WITH REBAR EXPOSED.								
205	CONCRETE COLUMN	2	06-27-2005	8 EA	0	5	3	0	N/A
			07-12-2004	8 EA	0	5	3	0	N/A
	Notes: 205. THREE OF THE EIGHT COLUMNS HAVE HOLLOW AREAS. TWO COLUMNS HAVE SPALLS WITH REBARS EXPOSED.								
215	CONCRETE ABUTMENT	2	06-27-2005	98 LF	3	89	7	0	N/A
			07-12-2004	98 LF	0	89	7	0	N/A
	Notes: 215. & 360. THE SOUTH ABUTMENT IS TIPPED TO THE NORTH AND A STABILIZER SHEER BLOCK WAS INSTALLED IN 1988. THERE ARE SIGNS OF SEEPAGE, SOME SCALING AND SPALLING, SOME FULL HEIGHT CRACKS, AND HOLLOW AREAS . THE BACKWALLS HAVE SOME AREAS OF SPALLING WITH REBARS EXPOSED. ONE TOE WALL ON THE SOUTH, WITH SOME UNDERMINING. GALVANIZED WEEP HOLE COVERS ADDED IN 2005.								
234	CONCRETE CAP	2	06-27-2005	98 LF	0	95	3	0	N/A
			07-12-2004	98 LF	0	95	3	0	N/A
	Notes: 234. THERE ARE SOME AREAS OF EFFLORESCENCE AT THE JOINTS ON THE CONCRETE CAPS.								
387	CONCRETE WINGWALL	2	06-27-2005	4 EA	0	4	0	0	N/A
			07-12-2004	4 EA	0	4	0	0	N/A
	Notes: 387. THE WALLS HAVE SOME CRACKS AND SPALLS AND HEAVY VEGETATION GROWING AGAINST THE SOUTH SIDE.								
359	CONC DECK UNDERSIDE	2	06-27-2005	1 EA	0	1	0	0	0
			07-12-2004	1 EA	0	1	0	0	0

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8913 1050(COLUMBUS AV) OVER HCRRA GREENWAY INSP. DATE: 06-27-2005

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
	Notes: 359. THE SUBSURFACE HAS A FEW TRANSVERSE CRACKS WITH EFFLORESCENCE. THERE IS SOME LEACHING AT THE CENTER CONSTRUCTION JOINT. THERE IS ONE SPALL 1'X2' MID SPAN BETWEEN GIRDER 3&4 FROM THE EAST WITH REBAR EXPOSED.								
360	SETTLEMENT	2	06-27-2005	1 EA	1	0	0	N/A	N/A
			07-12-2004	1 EA	1	0	0	N/A	N/A
	Notes: 360. SEE ELEMENT 215.								
964	CRITICAL FINDING	2	06-27-2005	1 EA	1	0	N/A	N/A	N/A
			07-12-2004	1 EA	1	0	N/A	N/A	N/A
	Notes: DO NOT DELETE THIS CRITICAL FINDING SMART FLAG.								
986	CURB & SIDEWALK	2	06-27-2005	1 EA	0	0	1	N/A	N/A
			07-12-2004	1 EA	0	0	1	N/A	N/A
	Notes: 986. CURB: THERE ARE MANY LARGE SPALLS ON THE EAST & DETERIORATING. SIDEWALK: THE EAST IS HEAVILY SCALED WITH SPALLS AND PATCHES. SOME FINE SIZE TRANSVERSE CRACK WEST SIDEWALK. THE SIDEWALK SUBSURFACE HAS SOME FINE SIZED TRANSVERSE CRACKS WITH EFFLORESCENCE. SOME GRAFFITI ON THE EAST SIDE.								
988	MISCELLANEOUS	2	06-27-2005	1 EA	1	0	0	N/A	N/A
	Notes: 988. LIGHTING UNDER; ATTACHED TO THE NORTH COLUMN								

General Notes: *CITY BRIDGE #7763,
AREA UNDER:GREENWAY COMPLETE 2005.
NOTE: PEDESTRIAN RAMPS ARE UNNECESSARY DUE TO THE STRUCTURES MID-BLOCK LOCATION.
REPAIRS MADE: A NEW RAILING POST WAS INSTALLED ON THE S.W. IN 1986. A NEW ABUTMENT SHEER BLOCK WAS INSTALLED IN 1988. THERE WERE SOME PATCHES IN THE RAILINGS IN 1992. THE RAILING EXTENSIONS WERE ADDED IN 1993. THE WEST SIDEWALK AND ALL FOUR APPROACH SIDEWALKS WHERE REPAIRED IN 1998.

Inspector's Signature

Reviewer's Signature / Date

APPENDIX E

Bridge L8915 (Tenth Avenue South) Mn/DOT Structure Inventory Report and Bridge Inspection Report

Mn/DOT STRUCTURE INVENTORY REPORT

Bridge ID: L8915 **1946(10TH AVE S) OVER HCRRA GREENWAY** Date: 08/22/2006

* IDENTIFICATION *

Agency Br. No. (7760) (RS 1) - 1
District METRO **Maint. Area**
County 27 HENNEPIN (53)
City 2585 MINNEAPOLIS
Township
Placecode 43000
Desc. Loc. 0.1 MI N OF LAKE ST
Sect. 35 **Tnsp.** 029N **Range** 24W
Lat. 44d 57m 00s **UTM-Y** 4977428.51
Long. 93d 15m 30s **UTM-X** 479621.68
Toll Bridge (Road) NO
Custodian RAILROAD
Owner RAILROAD
Inspector CITY OF MINNEAPOLIS
BMU Agreement No
Year Built 1915 **Yr Fed Rehab**
Year Remod.
Temp.
Skew 0 **Plan Avail.** MUNICIPAL

* STRUCTURE DATA *

Service On HWY;PED
Service Under PED;BICYCLE
MN Main Span 206 CONC CNT/DECK GRDR
MN MSpn Det Def
MN Appr. Span
MN ASpn Det Def
Culvert Type
Barrel Length
No. Main Spans 4 **No. Appr.Span** 0
Total Spans 4 **NBI Len. (?)** YES
Main Span Length 31.5 ft
Structure Length 114.3 ft
Abut. Mat'l. CONCRETE
Abut. Fnd. Type SPRD/SOIL
Pier Mat'l. CONCRETE
Pier Fnd. Type SPRD/SOIL
Deck Width 51.0 ft
Deck Material CIP CONC
Wear Surf. Type BITUMINOUS
Wear Surf. Inst. Yr.
Wr. Crs/Fill Depth 0.48 ft
Deck Membrane NONE
Deck Rebars NOT/APPL
Deck Rebars Inst. Yr.
Structure Area 5,829 sq ft
Roadway Area 3,660 sq ft
Swk Width L/R 8.0 ft 8.0 ft
Curb Ht. L/R 0.6 ft 0.3 ft
Rail L/R/FHWA 36 36 NO
Ped. Fencing
Hist. Significance NATL REG ELEG
Bird Nests (?) NO

* ROADWAY DATA *

Route System (Fed) CITY
Mn. Route System MUN
Route Number 1946
Roadway Name MUN 1946
Roadway Function MAINLINE
Roadway Type 2 WAY TRAF
Control Section
BDG. Reference Point
Date Opened to Traffic 01-01-1915
Detour Length 1 mi
Lanes 2 ON BRIDGE (1)
ADT 3,687 **HCADT**
ADT Year 2001
Functional Class URBAN LOCAL
Nat'l. Hwy. System NOT NHS
STRAHNET NOT STRAHNET
Truck Net NOT TRUCKNET
Fed. Lands Hwy. N/A
OnBaseNet NOT BASENET

* ROADWAY CLEARANCES *

If Divided	NB-EB	SB-WB
Rdwy. Wid. Rd 1/Rd 2	32.0 ft	
Vrt. Clr. Ovr. Rd 1/Rd 2		
Max Vert Clr Rd 1/ Rd 2		
Horz U/Clr - Rd 1/Rd 2	32.0 ft	
Lat UndClr Left/Right		
RR UndClr Vert/Lat		
Appr. Surface Width	38.0 ft	
Median Width		

* ROADWAY TIS DATA *

	TIS 1st KEY	TIS 2nd KEY
Route System	10	
Route Number	25851946	
High End	56	
Low End	56	
Direction	N	
Reference Pt.	000+00.550	
Interchg. Elem.		

* MISC. BRIDGE DATA *

Struct. Flared
Parallel Struct. NONE
Field Conn. ID
Cantilever ID
Permit Code A
Permit Code B
Permit Code C
Permit Code Fut.

* BRIDGE SIGNS *

Posted Load NOT REQUIRED
Traffic NOT REQUIRED
Horizontal NOT REQUIRED
Vertical NOT APPLICABLE

Def. Status ADEQ **Suff. Rating** 64.6

* WATERWAY DATA *

Drng. Area
Wtrwy. Opening
Navigation Control NOT APPL
Nav. Vert./Hrz Clr.
Nav. Vert. Lift Clr.
MN Scour Code A-NON WATERWAY
Scour Eval. Year 1993

* INSPECTION DATA *

Inspection Date 06-24-2005 (QXAG)
Inspection Frequency 12
Inspector PONTIS

Condition Codes		Appraisal Ratings	
Deck	5	Struct. Eval.	5
Superstruct.	5	Deck Geometry	4
Substruct.	5	Underclearances	N
Chan. & Prot.	N	Waterway Adeq'cy	N
Culvert	N	Appr. Alignment	5

Other Inspection Codes

Open, Posted, Clsd.	A	Rail Rating	0
Pier Protection		Appr. Guardrail	
Scour Critical	N	Appr. Trans.	
Deck Pct. Unsnd.		Appr. Term.	

In Depth Inspections

	Y/N	Freq.	Last Insp.
Frac. Critical			
Pinned Asbly.			
Underwater			
Spec. Feat.			

* PAINT DATA *

Year Painted **Pct.Unsound**
Total Painted Area
Primer Type
Finish Type

* CAPACITY RATINGS *

Design Load UNKN
MN
Operating Rating HS 18.0
Inventory Rating HS 12.0
Posting Veh: Semi: Dbl:
Rtg Date 04-01-1980

* IMPROVEMENT DATA *

Prop. Work REPLACE COND.
Work By CONTRACT
Prop. Structure BRIDGE
Length 137.8 ft **Width** 55.8 ft
Appr. Rdwy. Work
Bridge Cost 577,000
Approach Cost 30,000
Project Cost 457,000
Data - Year/Method 2006 COMPUTER

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8915 1946(10TH AVE S) OVER HCRRA GREENWAY INSP. DATE: 06-24-2005

County: HENNEPIN
City: MINNEAPOLIS
Township:
Section: 35 Township: 029N Range: 24W
Span Type: CONC CNT / DECK GRDR
NBI Deck: 5 Super: 5 Sub: 5 Chan: N Culv: N

Location: 0.1 MI N OF LAKE ST
Route: MUN 1946 Ref. Pt.: 000+00.550
Control Section: Maint. Area:
Local Agency Bridge Nbr: 7760

Length: 114.3 ft
Deck Width: 51.0 ft
Rdwy. Area / Pct. Unsnd: 3,660 sq ft
Paint Area / Pct. Unsnd:

Open, Posted, Closed: OPEN

Appraisal Ratings - Approach: 5 Waterway: N
MN Scour Code: A-NON WATERWAY Def. Stat: ADEQ Suff. Rate: 64.6
Required Bridge Signs - Load Posting: NOT REQUIRED Traffic: NOT REQUIRED
Horizontal: NOT REQUIRED Vertical: NOT APPLICABLE

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
13	CONC DECK - BIT O/L	2	06-24-2005	5,834 SF	0	5,834	0	0	0
			07-08-2004	5,834 SF	0	5,834	0	0	0
	Notes: 13. THE ASPHALT ROADWAY SURFACE HAS MANY TRANSVERSE AND SOME LONGITUDINAL CRACKS. THERE IS A LARGE CRACK OVER THE NORTH ABUTMENT. THERE IS A WIDE GAP IN THE ASPHALT OVERLAY ALONG THE CURBLINES.								
320	CONC APPR SLAB-BITOL	2	06-24-2005	2 EA	0	1	1	0	N/A
			07-08-2004	2 EA	0	1	1	0	N/A
	Notes: 320. THE SOUTH HAS SOME RANDOM CRACKS AND MINOR SETTLEMENT. THE NORTH HAS A LARGE SIZED TRANSVERSE CRACK AND MODERATE SETTLEMENT.								
333	RAILING - OTHER	2	06-24-2005	230 LF	0	230	0	N/A	N/A
			07-08-2004	230 LF	0	230	0	N/A	N/A
	Notes: 333. THERE IS SOME ACCIDENT DAMAGE TO THE S.E. POST. THERE ARE A FEW VERTICAL CRACKS WITH REBAR EXPOSED. MANY OF THE NUTS ARE LOOSE OR MISSING ON THE RAILING. THE S.E. APPROACH RAIL IS ATTACHED TO A 8' CHAIN LINK FENCE. THERE IS A HOLE ON THE BOTTOM OF THE FENCE AT RAIL THAT COULD BE HAZARDOUS. N.E. CORNER HAS TEMP. CHAIN LINK FENCE DUE TO REMOVAL OF GRAIN ELEVATOR. THE S.W. COR. EXTRUSION REMOVED DUE TO CONSTRUCTION.								
110	CONCRETE GIRDER	2	06-24-2005	1,030 LF	3	1,007	20	0	N/A
			07-08-2004	1,030 LF	0	1,007	20	0	N/A
	Notes: 110. & 363. THE FIRST GIRDER FROM THE EAST IN THE SEARS SPAN IS SEVERELY CRACKED. THERE ARE AREAS OF HEAVY LEACHING AND SPALLS WITH REBAR EXPOSED ON THE SOUTHWEST CURBLINE. THERE IS MINOR ACCIDENT DAMAGE TO TWO OF THE GIRDERS IN THE NORTH SPAN. THE FASCIAS HAVE MANY SPALLS WITH REBARS EXPOSED. THERE IS SOME MINOR ACCIDENT DAMAGE ON THE S.E.								
205	CONCRETE COLUMN	2	06-24-2005	12 EA	0	9	3	0	N/A
			07-08-2004	12 EA	0	9	3	0	N/A
	Notes: 205. THREE OF THE TWELVE COLUMNS HAVE HOLLOW AREAS AND FOUR ARE GRAFFITIED. ONE SPALLED WITH REBAR EXPOSED.								
215	CONCRETE ABUTMENT	2	06-24-2005	102 LF	0	82	20	0	N/A
			07-08-2004	102 LF	0	82	20	0	N/A
	Notes: 215. THERE ARE SIGNS OF SEEPAGE, FULL HEIGHT CRACKS, SPALLS WITH REBARS EXPOSED, AREAS OF LEACHING, EFFLORESCENCE. THERE ARE MANY LARGE SPALLS WITH REBARS EXPOSED ON THE BACKWALL. THERE IS SOME MASSIVE LOSS OF BEARING ON TWO OF THE GIRDERS ON THE NORTH.								
234	CONCRETE CAP	2	06-24-2005	154 LF	0	154	0	0	N/A
			07-08-2004	154 LF	0	154	0	0	N/A
	Notes: 234. SPALLS WITH REBARS EXPOSED CENTER PIER NORTH SIDE SECOND FROM WEST. THE SOUTH SIDE HAS LARGE CRACKS.								
387	CONCRETE WINGWALL	2	06-24-2005	4 EA	0	4	0	0	N/A
			07-08-2004	4 EA	0	4	0	0	N/A
	Notes: 387. THERE ARE SOME SMALL SIZED CRACKS AND SPALLS. N.E. COR. HAS 2 NEW DEADMAN ANCHORS AND A BLOCK WALL EXTENSION.								
359	CONC DECK UNDERSIDE	2	06-24-2005	1 EA	0	0	1	0	0
			07-08-2004	1 EA	0	0	1	0	0

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8915 1946(10TH AVE S) OVER HCRRA GREENWAY INSP. DATE: 06-24-2005

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
	Notes: 359. THE STRUCTURE SUBSURFACE HAS A FEW CRACKS, SPALLS AND DELAMINATED AREAS. THERE ARE FOUR LARGE SPALLS ONE IS IN THE SEARS SPAN, TWO ARE AT THE CONSTRUCTION JOINT AND ONE IS AT THE EAST CURBLINE. ALL HAVE REBARS EXPOSED.								
362	TRAFFIC IMPACT	2	06-24-2005	1 EA	0	1	0	N/A	N/A
			07-08-2004	1 EA	0	1	0	N/A	N/A
	Notes: 963. SEE ELEMENT 110.								
964	CRITICAL FINDING	2	06-24-2005	1 EA	1	0	N/A	N/A	N/A
			07-08-2004	1 EA	1	0	N/A	N/A	N/A
	Notes: DO NOT DELETE THIS CRITICAL FINDING SMART FLAG.								
986	CURB & SIDEWALK	2	06-24-2005	1 EA	0	0	1	N/A	N/A
			07-08-2004	1 EA	0	0	1	N/A	N/A
	Notes: 986. CURB: THERE ARE SOME BROKEN OUT AREAS, MANY LARGE SPALLS WITH RREBARS EXPOSED, UNDERMINED, THERE IS VEGETATION GROWING IN BOTH GUTTER LINES. THE CURB IS ONLY 4" HIGH IN MANY AREAS. SIDEWALK: THERE IS UNIFORM HEAVY DETERIORATING SCALING, LARGE PATCHES AND SOME SPALLS.THE SIDEWALK SUBSURFACE HAS MANY SMALL SIZED TRANSVERSE CRACKS. TWO OF THE APPROACH SIDEWALKS HAVE ASPHALT PATCHES. THERE ARE NO HANDICAP RAMPS.								
988	MISCELLANEOUS	2	06-24-2005	1 EA	1	0	0	N/A	N/A
	Notes: 988. LIGHTING UNDER: NEW LIGHTING ON NORTH COLUMN.								

General Notes: *CITY BRIDGE #7760, RAILROAD #0-1528
AREA UNDER: THE TRACKS UNDER THE STRUCTURE WERE REMOVED AND CONSTRUCTED GREENWAY (BIKE AND WALKWAY) IN 2004.
NOTE: THERE ARE NO PEDESTRIAN RAMPS ON THE SOUTH.
REPAIRS MADE: NEW POSTS WERE INSTALLED ON THE S.W. AND N.W. IN 1986. THE PIPERAIL EXTENSION WAS ADDED TO THE N.E. RAILING IN 1992. NEW CONC. APPROACH SIDEWALK ON THE NORTH IN 1997.

Inspector's Signature

Reviewer's Signature / Date

APPENDIX F

Bridge L8923 (Eighteenth Avenue South) Mn/DOT Structure Inventory Report and Bridge Inspection Report

Mn/DOT STRUCTURE INVENTORY REPORT

Bridge ID: L8923 **MUN 164(18 AV S) OVER HCRRA GREENWAY** Date: 08/22/2006

* IDENTIFICATION *

Agency Br. No. (7751) (RS 1) - 1
District METRO **Maint. Area**
County 27 HENNEPIN (53)
City 2585 MINNEAPOLIS
Township
Placecode 43000
Desc. Loc. 0.1 MI N OF LAKE ST
Sect. 35 **Tnsp.** 029N **Range** 24W
Lat. 44d 57m 00s **UTM-Y** 4977426.05
Long. 93d 14m 54s **UTM-X** 480410.52
Toll Bridge (Road) NO
Custodian RAILROAD
Owner RAILROAD
Inspector CITY OF MINNEAPOLIS
BMU Agreement No
Year Built 1916 **Yr Fed Rehab**
Year Remod.
Temp.
Skew 5L **Plan Avail.** MUNICIPAL

* STRUCTURE DATA *

Service On HWY;PED
Service Under PED;BICYCLE
MN Main Span 206 CONC CNT/DECK GRDR
MN MSpn Det Def
MN Appr. Span
MN ASpn Det Def
Culvert Type
Barrel Length
No. Main Spans 3 **No. Appr.Span** 0
Total Spans 3 **NBI Len. (?)** YES
Main Span Length 32.5 ft
Structure Length 95.0 ft
Abut. Mat'l. CONCRETE
Abut. Fnd. Type SPRD/SOIL
Pier Mat'l. CONCRETE
Pier Fnd. Type SPRD/SOIL
Deck Width 51.0 ft
Deck Material CIP CONC
Wear Surf. Type BITUMINOUS
Wear Surf. Inst. Yr.
Wr. Crs/Fill Depth 0.35 ft
Deck Membrane NONE
Deck Rebars NOT/APPL
Deck Rebars Inst. Yr.
Structure Area 4,845 sq ft
Roadway Area 3,035 sq ft
Swk Width L/R 8.0 ft 8.0 ft
Curb Ht. L/R 0.6 ft 0.6 ft
Rail L/R/FHWA 36 36 NO
Ped. Fencing
Hist. Significance NATL REG ELEG
Bird Nests (?) NO

* ROADWAY DATA *

Route System (Fed) CITY
Mn. Route System MUN
Route Number 164
Roadway Name MUN 164
Roadway Function MAINLINE
Roadway Type 2 WAY TRAF
Control Section
BDG. Reference Point
Date Opened to Traffic 01-01-1916
Detour Length 1 mi
Lanes 2 ON BRIDGE (1)
ADT 814 **HCADT**
ADT Year 2001
Functional Class URBAN LOCAL
Nat'l. Hwy. System NOT NHS
STRAHNET NOT STRAHNET
Truck Net NOT TRUCKNET
Fed. Lands Hwy. N/A
OnBaseNet NOT BASENET

* ROADWAY CLEARANCES *

If Divided	NB-EB	SB-WB
Rdwy. Wid. Rd 1/Rd 2	32.0 ft	
Vrt. Clr. Ovr. Rd 1/Rd 2		
Max Vert Clr Rd 1/ Rd 2		
Horz U/Clr - Rd 1/Rd 2	32.0 ft	
Lat UndClr Left/Right		
RR UndClr Vert/Lat		
Appr. Surface Width	32.0 ft	
Median Width		

* ROADWAY TIS DATA *

	TIS 1st KEY	TIS 2nd KEY
Route System	10	
Route Number	25850164	
High End	48	
Low End	48	
Direction	N	
Reference Pt.	002+00.380	
Interchg. Elem.		

* MISC. BRIDGE DATA *

Struct. Flared
Parallel Struct. NONE
Field Conn. ID
Cantilever ID
Permit Code A
Permit Code B
Permit Code C
Permit Code Fut.

* BRIDGE SIGNS *

Posted Load NOT REQUIRED
Traffic NOT REQUIRED
Horizontal NOT REQUIRED
Vertical NOT APPLICABLE

Def. Status S.D. **Suff. Rating** 64.8

* WATERWAY DATA *

Drng. Area
Wtrwy. Opening
Navigation Control NOT APPL
Nav. Vert./Hrz Clr.
Nav. Vert. Lift Clr.
MN Scour Code A-NON WATERWAY
Scour Eval. Year 1993

* INSPECTION DATA *

Inspection Date 06-23-2005 (RERD)
Inspection Frequency 12
Inspector PONTIS

Condition Codes		Appraisal Ratings	
Deck	4	Struct. Eval.	4
Superstruct.	4	Deck Geometry	6
Substruct.	4	Underclearances	N
Chan. & Prot.	N	Waterway Adeq'cy	N
Culvert	N	Appr. Alignment	6

Other Inspection Codes

Open, Posted, Clsd.	A	Rail Rating	0
Pier Protection		Appr. Guardrail	
Scour Critical	N	Appr. Trans.	
Deck Pct. Unsnd.		Appr. Term.	

In Depth Inspections

	Y/N	Freq.	Last Insp.
Frac. Critical			
Pinned Asbly.			
Underwater			
Spec. Feat.			

* PAINT DATA *

Year Painted **Pct.Unsound**
Total Painted Area
Primer Type
Finish Type

* CAPACITY RATINGS *

Design Load UNKN
MN
Operating Rating HS 30.3
Inventory Rating HS 16.0
Posting Veh: Semi: Dbl:
Rtg Date 03-01-1980

* IMPROVEMENT DATA *

Prop. Work REPLACE COND.
Work By CONTRACT
Prop. Structure BRIDGE
Length 114.8 ft **Width** 55.8 ft
Appr. Rdwy. Work
Bridge Cost 480,000
Approach Cost 23,000
Project Cost 355,000
Data - Year/Method 2006 COMPUTER

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8923 MUN 164(18 AV S) OVER HCRRA GREENWAY INSP. DATE: 06-23-2005

County: HENNEPIN
City: MINNEAPOLIS
Township:
Section: 35 Township: 029N Range: 24W
Span Type: CONC CNT / DECK GRDR
NBI Deck: 4 Super: 4 Sub: 4 Chan: N Culv: N

Location: 0.1 MI N OF LAKE ST
Route: MUN 164 Ref. Pt.: 002+00.380
Control Section: Maint. Area:
Local Agency Bridge Nbr: 7751

Length: 95.0 ft
Deck Width: 51.0 ft
Rdwy. Area / Pct. Unsnd: 3,035 sq ft
Paint Area / Pct. Unsnd:

Open, Posted, Closed: OPEN

Appraisal Ratings - Approach: 6 Waterway: N
MN Scour Code: A-NON WATERWAY Def. Stat: S.D. Suff. Rate: 64.8
Required Bridge Signs - Load Posting: NOT REQUIRED Traffic: NOT REQUIRED
Horizontal: NOT REQUIRED Vertical: NOT APPLICABLE

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
13	CONC DECK - BIT O/L	2	06-23-2005	4,844 SF	0	4,844	0	0	0
			07-06-2004	4,844 SF	0	4,844	0	0	0
	Notes: 13. THERE ARE SOME RANDOM CRACKS WITH SMALL CRACKS OVER BOTH OF THE ABUTMENTS.								
320	CONC APPR SLAB-BITOL	2	06-23-2005	2 EA	0	2	0	0	N/A
			07-06-2004	2 EA	0	2	0	0	N/A
	Notes: 320. THERE ARE SOME RANDOM CRACKS ON THE SOUTH. BOTH HAVE TRANSVERSE CRACKS OVER THE ABUTMENTS.								
333	RAILING - OTHER	2	06-23-2005	190 LF	95	95	0	N/A	N/A
			07-06-2004	190 LF	95	95	0	N/A	N/A
	Notes: 333. THERE ARE SOME CRACKS, SPALLS AND OPEN JOINTS IN THE CONCRETE RAILING. THE RAILING IS LOOSE ON THE S.W. COR. WITH ONE NUT MISSING & 3 LOOSE. CONCRETE RAIL CUT FOR PEDESTRIAN RAMP ON N.W. CORNER.								
110	CONCRETE GIRDER	2	06-23-2005	856 LF	3	469	384	0	N/A
			07-06-2004	856 LF	0	469	384	0	N/A
	Notes: 110. THERE ARE AREAS OF HEAVY MAP CRACKING WITH LEACHING AND SPALLS WITH REBARS EXPOSED. THE WORST CONDITION BEING ON THE WEST. THERE IS HEAVY SPALLING ON BOTH FASCIAS WITH SOME REBARS EXPOSED.								
205	CONCRETE COLUMN	2	06-23-2005	8 EA	0	5	3	0	N/A
			07-06-2004	8 EA	0	5	3	0	N/A
	Notes: 205. THREE OF THE EIGHT COLUMNS HAVE LARGE SPALLS WITH REBARS EXPOSED AND HAVE HOLLOW AREAS.								
215	CONCRETE ABUTMENT	2	06-23-2005	102 LF	0	75	26	0	N/A
			07-06-2004	102 LF	0	75	26	0	N/A
	Notes: 215. & 360. THE EAST SIDE OF THE SOUTH ABUTMENT IS BOWED OUT AS MUCH AS 6". BOTH OF THE ABUTMENTS HAVE SHEAR BLOCKS. BOTH OF THE SHEAR BLOCKS HAVE MINOR AREAS OF UNDERMINING. THE FACES HAVE SOME FULL HEIGHT FINE TO SMALL SIZED CRACKS. THE BACKWALLS ARE HEAVILY MAP CRACKED WITH LARGE AREAS OF LEACHING AND SCALING. THERE ARE SPALLS WITH REBARS EXPOSED AND HOLLOW SOUNDING AREAS. THE SOUTH WOODEN TOEWALL HAS FIRE DAMAGE AND MINOR UNDERMINING.								
234	CONCRETE CAP	2	06-23-2005	102 LF	0	92	10	0	N/A
			07-06-2004	102 LF	0	92	10	0	N/A
	Notes: 234. THERE IS SOME EFFLORESCENCE ON BOTH BENT CAPS ON THE WEST.								
387	CONCRETE WINGWALL	2	06-23-2005	4 EA	0	4	0	0	N/A
			07-06-2004	4 EA	0	4	0	0	N/A
	Notes: 387. THE WINGWALLS ARE HEAVILY SCALED WITH SMALL TO LARGE SIZED CRACKS AND SPALLS WITH REBAR EXPOSED. THERE IS SOME VEGETATION. N.W. WINGWALL HAS NEW BLOCK RETAINING WALL BUTTING INTO THE WINGWALL.								
359	CONC DECK UNDERSIDE	2	06-23-2005	1 EA	0	0	0	1	0
			07-06-2004	1 EA	0	0	0	1	0

Mn/DOT BRIDGE INSPECTION REPORT

Inspector: PONTIS

BRIDGE L8923 MUN 164(18 AV S) OVER HCRRA GREENWAY INSP. DATE: 06-23-2005

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
	Notes: 359. THE SUBSURFACE HAS AREAS OF SEVERE EFFLORESCENCE AND MAP CRACKING WITH SOME SPALLS ALONG THE LONGITUDINAL JOINT. THE SIDEWALK SUBSURFACE HAS SEVERE UNIFORM EFFLORESCENCE AND MANY FINE TO SMALL SIZED TRANSVERSE CRACKS.								
360	SETTLEMENT	2	06-23-2005	1 EA	1	0	0	N/A	N/A
			07-06-2004	1 EA	1	0	0	N/A	N/A
	Notes: 360. LOOK AT ELEMENT 215.								
964	CRITICAL FINDING	2	06-23-2005	1 EA	1	0	N/A	N/A	N/A
			07-06-2004	1 EA	1	0	N/A	N/A	N/A
	Notes: DO NOT DELETE THIS CRITICAL FINDING SMART FLAG.								
986	CURB & SIDEWALK	2	06-23-2005	1 EA	0	1	0	N/A	N/A
			07-06-2004	1 EA	0	1	0	N/A	N/A
	Notes: 986. CURB: THERE ARE SOME FINE SIZED CRACKS. SIDEWALK: THE SURFACE HAS MANY FINE SIZED CRACKS. THERE IS AN AREA OF FINE SIZED MAP CRACKING ON THE S.E. AND N.E. THE N.W. APPROCH IS RAMPED DOWN TO GREENWAY.								
988	MISCELLANEOUS	2	06-23-2005	1 EA	1	0	0	N/A	N/A
	Notes: 988. LIGHTING UNDER: LIGHTING ON NORTH COLUMN AND MISSING LENS.								

General Notes: *CITY BRIDGE #7751, RAILROAD #0-1510
AREA UNDER: TRACK REMOVED. HAS GREENWAY CONNECTION (BIKEWAY AND PED. WALKWAY.
NOTE: PEDESTRIAN RAMPS ARE ON THE SOUTH.
REPAIRS MADE: NEW SIDEWALKS WERE PLACED IN 1983. THE S.W., N.W AND S.E. SIDEWALK APPROACHES WERE REPLACED IN 1995.

Inspector's Signature

Reviewer's Signature / Date

APPENDIX G

NBI General Bridge Rating Codes

NBI General Bridge Rating Codes

Code	Description
N	**Not Applicable**
9	**Excellent Condition**
8	**Very Good Condition** - no problems noted
7	**Good Condition** - some minor problems
6	**Satisfactory Condition** - structural elements show some minor deterioration
5	**Fair Condition** - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
4	**Poor Condition** - advanced section loss, cracking, spalling or scour.
3	**Serious Condition** - loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present
2	**Critical Condition** - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is completed.
1	**"Imminent" Failure Condition** - major deterioration or section loss present in critical structural components, or obvious vertical or horizontal movement affecting structural stability. Bridge is closed to traffic, but corrective action may put back in light service.
0	**Failed Condition** - out of service, beyond corrective action.

In order to promote uniformity between bridge inspectors, these guidelines will be used to rate and code items #58, 59, 60, 61, and 62.

Condition ratings are used to describe the existing, in-place bridge as compared to the as-built condition. Evaluation is for the materials related, physical condition of the deck, superstructure, and substructure components of a bridge. The condition evaluation of channels and channel protection and culverts is also included. Condition codes are properly used when they provide an overall characterization of the general condition of the entire component being rated. Conversely, they are improperly used if they attempt to describe localized or nominally occurring instances of deterioration or disrepair. Correct assignment of a condition code must, therefore, consider both the severity of the deterioration or disrepair and the extent to which it widespread throughout the component being rated.

The load-carrying capacity will not be used in evaluating condition items. The fact that a bridge was designed for less than current legal loads and may be posted shall have no influence upon the condition ratings.

Portions of bridges that are being supported by or strengthened by temporary members will be rated base upon their actual condition; that is, the temporary members are not considered in the rating of the item.

Completed bridges not yet open to traffic, if rated, shall be coded as if open to traffic.

APPENDIX H

Report of Chloride-Ion Content

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
• GEOTECHNICAL
• MATERIALS
• ENVIRONMENTAL

'05 DEC 01 AM 11:13

November 29, 2005

Mr. James Bellefeuille, P.E.
TKDA
1500 Piper Jaffray Plaza
444 Cedar Street
St. Paul, MN 55101-2140

Re: Midtown Greenway Bridges
Chloride Ion Testing
Minneapolis, MN
TKDA Project No. 0013200.000
AET Job No. 05-02458

Dear Jim:

Attached please find the results of the chloride ion testing performed by our sister company, American Petrographic Services, Inc. (APS). The samples were removed from cores obtained by American Engineering Testing, Inc. (AET) from the following bridges:

10th Avenue South (MnDOT Bridge No. L8915)
Pleasant Avenue South (MnDOT Bridge No. L8908)

One core was removed from the northbound lane of each bridge approximately 3 feet from the east curb near midspan. The core holes were filled with a high strength, low shrinkage concrete patch material.

It has been a pleasure to be of service to you on this project. Please contact us if you have any questions about this report or if we can be of further assistance.

Sincerely,
American Engineering Testing, Inc.

Daniel J. Larson, P.E.
Principal
Phone: 651-659-1337
Fax: 651-647-2744
dlarson@amengtest.com

DJL/jw

enc.

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AMERICAN PETROGRAPHIC SERVICES, INC.

REPORT OF CHLORIDE-ION CONTENT
AASHTO-T260 PROCEDURE C

PROJECT:

MIDTOWN GREENWAY BRIDGES
MINNEAPOLIS, MINNESOTA
AET JOB NO. 05-02458

REPORTED TO:

AMERICAN ENGINEERING TESTING, INC.
550 CLEVELAND AVENUE NORTH
ST. PAUL MN 55114

ATTN: DAN LARSON

APS JOB NO: 10-04120

DATE: NOVEMBER 28, 2005

INTRODUCTION

This report presents the results of laboratory work performed by our firm on two concrete samples submitted to us by Mr. Dan Larson of AET/St. Paul on November 17, 2005. The scope of our work was limited to documenting the chloride-ion content of each sample at various levels.

SAMPLE IDENTIFICATION

Sample Identification	Original Sample Size
Pleasant Avenue South	2-3/4" diameter by 7-13/16" long
10th Avenue South	2-3/4" diameter by 4" long

TEST RESULTS

Sample Number	Parts Per Million	Cl^- lbs/yd^3**
Pleasant (1"-2")	465	1.9
Pleasant (2"-3")	320	1.3
10th (1"-2")	<80	<0.3
10th (2"-3")	<80	<0.3

**Calculations based on 3990 and 4160 lb. unit weights

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550 Cleveland Ave. No. • St. Paul, MN 55114 • 651-659-9001 • Fax 651-647-2744 • www.ampetrographic.com
AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

Our experience has been that chloride-ion levels in excess of 300 to 400 ppm will cause problems with corrosion of embedded steel reinforcement and significantly increase the number of freeze-thaw cycles. Additionally, deicer salts allow the concrete to become critically saturated. This critical saturation causes each freeze-thaw cycle to be more severe.

TEST PROCEDURES

Laboratory testing was performed on November 17, 2005 and subsequent dates, our procedures were as follows:

We obtained a 3-gram pulverized portion of each sample by crushing a saw cut piece or by use of an impact drill. We then mixed the powder with 20 ml of digestion solution for a total of three minutes and then added 80 ml of stabilizing solution. We then immersed a calibrated electrode coupled to an Orion Model 720 pH/ISE meter in the solution and recorded the chloride-ion concentration. This method is consistent with APS Standard Operating Procedure 00 LAB 017, "Sampling and Testing for Chloride-Ion in Concrete and Concrete Raw Materials, AASHTO:T260 - Procedure C."

By testing six pulverized concrete QA samples of known chloride content, we were able to determine the standard deviation for this chloride test. Each QA sample was tested five times and the following standard deviation ranges were calculated. Samples with chloride levels from 80-200 ppm have a STD = 10 ppm, 201-450 ppm STD = 20 ppm, 451-950 ppm STD= 30 ppm, 951-2000 ppm STD=40 ppm, 2001-4000 ppm STD= 65 ppm and 4001-6000 ppm STD= 225 ppm. Results that are <80 ppm or >6000 ppm are reported as such due to the high magnitude of the standard deviation in both cases.

REMARKS

The test samples will be retained for a period of at least thirty days from the date of this report. Unless further instructions are received by that time, the samples may be discarded.

Report Prepared by:
American Petrographic Services, Inc.

Christine Tillema
Christine Tillema
Geologist/Petrographer

Reviewed by:
American Petrographic Services, Inc.

Scott Wolter
Scott Wolter, PG
President
MN License #30024

APPENDIX I

Response Letter From the Midtown Community Works Partnership

MIDTOWN COMMUNITY WORKS

Business Leadership Public Commitment Citizen Involvement

April 24, 2007

Ms. Stephanie Malmberg
City of Minneapolis Public Works
309 2nd Avenue South
Minneapolis, MN 55401

Re: Midtown Community Works Partnership's Comments to the Midtown Corridor Bridges Study - Final Draft

Dear Ms. Malmberg:

Thank you for providing the Midtown Community Works Partnership with a copy of the draft Midtown Corridor Study Final Report. The Partnership has reviewed and generally endorses the comments already submitted by the Midtown Greenway Coalition. In particular, we strongly echo the Coalition's concerns that the Report does not adequately distinguish between the differing impacts of a streetcar versus a light rail system on the Corridor's bridges. On behalf of the Partnership, I would also like to offer two additional comments, which we hope can be made part of the record as the Report is made final and submitted to the City Council and others for review and possible action.

First, the Partnership is concerned that closure or reclassification of a significant number of the bridges on the eastern end of the historic district would be very damaging to the adjacent neighborhood. The report identifies all five bridges between 14th Avenue and 19th Avenue as candidates for closure or reclassification. Eliminating vehicular traffic from even every other bridge in this area would likely disrupt the grid and this neighborhood's connections to Lake Street, and would significantly curtail future redevelopment opportunities that are much needed in this part of the city. The Report should state in unequivocal terms that consideration of these kinds of impacts is a critical component of any decision about the fate of individual bridges.

Second, demolition or reclassification should not occur or even be considered until the City has completed its Ten Year Action Plan and a decision is made about the best transit mode for the Greenway. The Report should also explicitly recommend that final disposition of any particular bridge is not possible in advance of clarity on a number of complex issues, including, among others, the different portal configurations required for different transit modes and a determination of specific funding mechanisms for transit and bridge repair.

We appreciate the opportunity to submit these comments, and look forward to reviewing the final report. Please feel free to contact me if you have any questions.

Sincerely,

Louis Smith
Counsel, Midtown Community Works Partnership

Cc: MCW Partnership Committee

APPENDIX J

Response Letter From the Midtown Greenway Coalition

Midtown Greenway Coalition
118 East 26th Street, Suite 100b
Minneapolis, MN 55404
612 879-0103
www.midtowngreenway.org

May 1, 2007

Stephanie Malmberg, P.E.
City of Minneapolis
Engineering Services
309 2nd Av. S. - Room 300
Minneapolis, Minnesota 55401-2268

Dear Ms. Malmberg:

Thank you to you and the City of Minneapolis for your efforts to better understand the great resource we have in the bridges over the Greenway and how they may be managed over time. The Midtown Greenway Coalition approved the following comment document on March 22, 2007 regarding the 2/27/07 version of the Midtown Corridor Planning Study.

SUMMARY: The Midtown Greenway Coalition appreciates the opportunity to review the draft *Midtown Corridor Planning Study*. Based on a staff review and subsequent discussions at the committee and board levels, we have the following concerns. First, we believe that more attention should be given to the potential benefits of streetcars in terms of minimizing impacts on the corridor and its bridges as compared to light rail transit. Second, we advocate for permanent bicycle and pedestrian access across the Greenway at 15th Avenue.

REGARDING POSSIBLE CORRIDOR MODIFICATIONS FOR TRANSIT:
The analysis is largely based on how the corridor would need to be modified to accommodate LRT with two tracks, one for each direction of travel, all the way through the corridor, constructed on ballast as opposed to "turf tracks." On page 45 under "Alignment" there are statements that LRT track placement underneath the bridges would need to be "reasonably straight and true" and questioning whether there is enough distance between bridges for an S-curve to change track alignment from one bridge to the next. On page 48 there is a section for Trolleys that is only two sentences long where an assumption is stated that trolley constraints are similar to those for LRT except the vertical clearance needs may be lower. The Coalition wishes to challenge this assumption. Furthermore there is no mention of possible single-track segments which may be easier to implement with streetcars as compared to LRT, and which could significantly decrease construction costs. In Table 13 on page 44 there are Greenway trail recommendations to rebuild the trails further north at 26 bridges.

Please consider the following changes to the study:

1. Recognize that streetcars may be more versatile in terms of:
    a. Allowing shorter turning radii to afford a less "straight and true" alignment under the bridges, perhaps decreasing the need to reconstruct some bridges,
    b. Operating with some single track segments, also potentially decreasing the need to reconstruct some bridges,
    c. Operating on turf tracks rather than ballast tracks to maintain the look and function of a Greenway.

    Rationale: At this time, the City of Minneapolis is studying potential streetcar routes and the Midtown Greenway corridor has been identified as one of the viable corridors for implementation. Possible funding mechanisms are now being looked at by consultants. The Midtown Greenway Coalition has been advocating for streetcars in the Midtown Greenway for about seven years, and the Midtown Community Works Partnership, a collection of corporate and elected officials, now also advocates for streetcars in the Greenway as soon as possible. Streetcars are by nature smaller and more versatile than Light Rail Trains. It only makes sense that a streetcar line's advantageous characteristics as compared LRT in the Midtown Greenway should be recognized.

2. Identify that the corridor could be modified to accommodate rail transit not only by shifting the cycling and walking trails to the north, but also by aligning the transit further south with one or two tracks passing through the south portal of the three-portal bridges. This would leave some space for trails in the central portal, avoiding the reconstruction of trails on a shelf sliced into the north embankment.

    Rationale: If the trench floor must be widened in places to accommodate both rail transit and the cycling/walking trails, why not consider widening it on either the north or south side rather than just the north side? If the trails are forced through the north portal under all the three-portal bridges, this would likely require reconstructing the trails on top of a retaining wall at mid-level between the trench floor at the street grade. This configuration would likely require trails users to be squeezed in between a fence for safety along the retaining wall at the trails' south edge and another retaining wall immediately north of the trail, and perhaps a narrower trail altogether. This design seems less safe and attractive than other scenarios that continue to utilize portions of the trench floor for the trails.

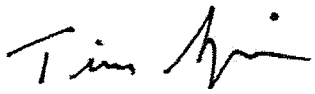
REGARDING BRIDGE CLOSURES: A table on page 42 shows which bridges could be considered for change to bike/ped access only or full closure. Please consider a possible change to the "action for consideration" for 15th Ave as follows:

> Change from "full closure" to
> "change to ped/bike or full closure."
>
> Rationale: If there is an entrance ramp in the future offering Greenway trail access from the north side of the Greenway at 15th and Bloomington Avenues, there should be a way for cyclists and pedestrians to reach this entrance ramp by passing over the Greenway on 15th Avenue. This would avoid a situation in which busy Bloomington Avenue is the only direct route to this entrance ramp for trail users approaching from the south. The Midtown Greenway Coalition and the Midtown Phillips Neighborhood Association have been advocating for years for such an entrance ramp. The ramp would be in the shape of an amphitheater and offer access to the Greenway from both Bloomington and 15th Avenues. In 2002 the City of Minneapolis supported this concept and submitted a grant application to fund its implementation. The application was ranked just below the cut-off and therefore was not funded at that time, but there remains a strong desire for a graceful entrance ramp to the trail here that is characterized by a more gradually sloping embankment, long sight lines in and out of the corridor and some greenspace and activity spaces.

When the Coalition board discussed the above resolution they also felt that there should be follow-up policy discussions about the appropriateness of possible bridge closures over the Greenway, offering more guidance and recommendations to supplement the study which merely addresses what is possible from technical and traffic standpoints.

We look forward to continuing our collaboration with the City of Minneapolis and other stakeholders to balance the aesthetics, adaptive reuse opportunities, and historic character of the Midtown Greenway.

Sincerely,



Tim Springer, Executive Director
Direct line: 612-879-0105