

# ***Cultural Landscape Management and Treatment Guidelines***

For the  
Chicago Milwaukee and St Paul Grade Separation

Historic District  
Of the  
Midtown Corridor  
Minneapolis, Minnesota

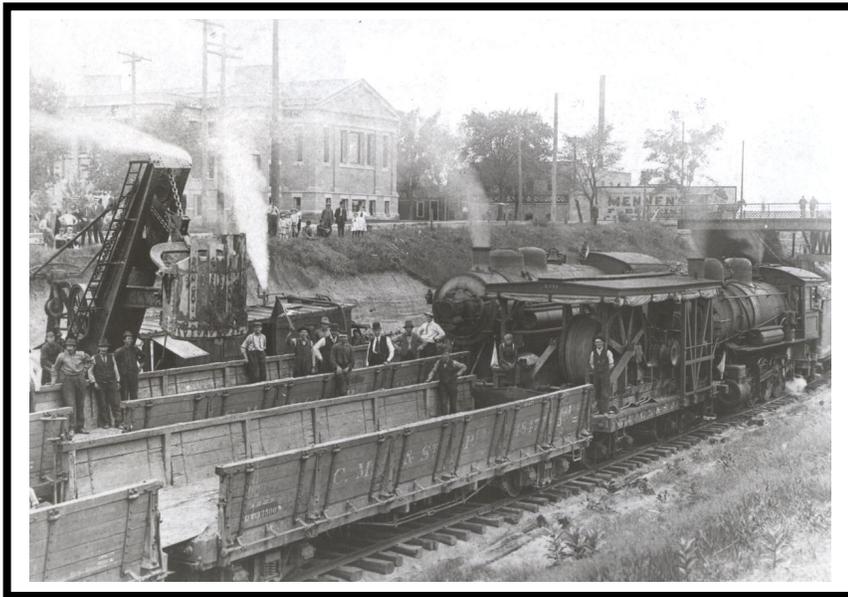
Hennepin County Regional Railroad Authority

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## Introduction

In 2005 the Chicago Milwaukee and St. Paul (CM and StP) Grade Separation was listed on the National Register of Historic Places as a Historic District. The Chicago Milwaukee and St. Paul Grade Separation is a 2.8-mile-long transportation district formed by a depressed railroad trench located in southeast Minneapolis, Minnesota. The historic district follows a straight, linear path from Humboldt Avenue South (on the west end) to Cedar Avenue South, where it then arches northward to meet East Twenty-Eighth Street (at its eastern terminus).

The intent of these guidelines is to layout the cultural landscape management and treatment guidelines for this historic district in an effort to prevent irrevocable damage to the character defining features of the district. The guidelines begin by explaining the historical significance of the National Historic District followed by the specific management and treatment guidelines.

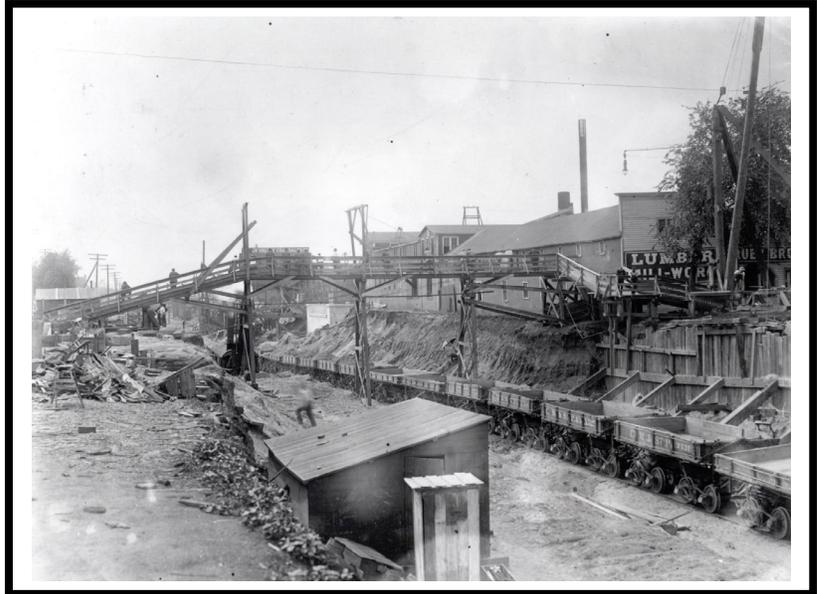


Photograph 1: Excavation of the rail line near Hennepin Avenue and the Walker Library, 1914. Hennepin County Historical Society Photo.

# Section 1: Historical Significance of the Chicago Milwaukee and St Paul Grade Separation Historic District of the Midtown Greenway

## Historical Significance

The CM and St. P rail line began running through what is now the identified as the Midtown Greenway in 1879. The original CM and St. P railroad corridor was constructed between 1879 and 1881 as part of the Benton Cutoff, connecting Minneapolis flour mills with the wheat producing regions of western Minnesota and southern Dakota Territory. Following a 1910 ordinance by the Minneapolis City Council, ordering the CM and St. P to depress the railroad line between Irving and Hiawatha Avenues South, and the subsequent Minnesota Supreme Court decision upholding the city's right to enforce such an action, work on the track depression began in 1912 and was completed in 1916. The design engineer was H. C. Lothholz, and the project was supervised by C. F. Loweth, Chief Engineer for the CM and StP.



Photograph 2: Track side of Bruer Brother's Lumber Yard and Planning Mill after track depression excavation partially completed. Photo from Minnesota Historical Society Album #212, the C.M. & St. P Track Depression Construction Project, ca. 1900. Negative #87067

Railroads entered the trench between Humboldt and Hennepin Avenues South on the west end or between East Twenty-Eighth Street and Cedar Avenue South on the east end. The Hennepin and Cedar Avenue bridges mark the first street-crossing bridges on either end of the corridor. The majority of the sidewalls of the trench are formed by a sloped earthen embankment with a ratio of one-and-a-half horizontal to one vertical. The approximate width of the trench at the track grade ranges from 60 feet (18.3 meters) to 35 feet (10.7 meters). The approximate width of the trench at the top of the slope (street grade) ranges from 135 feet (41.1 meters) to 110 feet (33.5 meters).

In 1912, the year that construction on the trench began, the neighborhoods surrounding the corridor were primarily residential and comprised mostly of modest middle- or working-class houses, but included the wealthy Park Avenue residences as well; however, over half of the properties directly alongside the rail line were industrial concerns, and Lake Street, one block south of the rail corridor, was rapidly developing as one of the city's major commercial corridors.

Most of the industrial properties are located on the north side of the railroad and either serviced the railroad (such as coal yards) or were manufacturing plants that took advantage of the rail transportation (such as sash and blind manufacturers). In spite of the surrounding residential community, the presence of these industries along the corridor gave a distinctly industrial feel to the CM and StP

corridor. Although several industrial facilities are still located along the route, most of the properties present during the historic district's period of significance are no longer extant.

### Features of the Historic District

The CM and StP Grade Separation Historic District is comprised of a collection of structures and seven buildings which have been found to be contributing or non-contributing to the historic district. Contributing features existed during the period of significance (1912-1916) and retain historical integrity. Non-contributing features may not have existed during the period of significance or may have been significantly altered.

The primary structures of the historic district include the earthen trench which extends the length of the district (contributing), 37 street bridges (28 contributing and nine non-contributing), one discontinuous retaining wall (contributing), one bicycle/pedestrian trail (non-contributing), and seven buildings that serve to form the edge of the corridor (one contributing, six non-contributing). In addition, smaller features are believed to date to the period of significance and are considered to be contributing to the historic district's feel and association. Among the contributing features are an iron picket fence and a system of small patches of granite block, limestone, and concrete retainers, and a series of wooden utility poles. Several non-contributing minor features were constructed when the bicycle/pedestrian trail was constructed and include modern light standards, emergency telephone boxes, bicycle ramps with rock-faced block retaining walls, and a chain-link fence and rock-faced block retaining wall that divide the trail from the former rail line.



Photograph 3: Sheffield Elevator "K"- underpinnings nearly completed. Photo from Minnesota Historical Society Album #212, The C.M. & St P. Track Depression Construction Project, ca 1900. Negative #87069.

#### a. Buildings

Seven buildings that are adjacent to the corridor and situated within the slope of the trench contribute to the formation of its edge (Table 1). On each of these buildings, the walls facing onto the railroad corridor define the vertical plane of the trench, thus the buildings, in their entirety, are within the boundaries of the historic district. With the exception of the Sears building, which is taller, these properties are one- or two-story buildings, generally rectangular in plan, with the long side oriented parallel to the railroad tracks. Their uses (creamery, separator company, lumber company, steel works, warehouse, manufacturer, and retail distributor) typically took advantage of their proximity to the railroad, creating portals that allowed access to railroad spurs. In the case of the Sears building, an addition was later (1964) constructed to bridge the railroad trench enclosing the section between Elliot and Tenth Avenues South.

Since only one of the properties that form a vertical plane of the trench, the Twin City Separator Company building, was extant during the period of significance (1912-1916) and retains historical

integrity, it is the only property among the seven that is contributing to the district. The remaining six properties are non-contributing but included within the historic district boundaries because they help to define the edge of the trench (see accompanying map “District Boundary and Sketch Map, 2002”).

Table 1. Buildings

Name	Address	Date of Construction	Contributing/ Non-Contributing	Reason for Non-Contributing
Norris Creameries building	2828 Emerson Avenue South	1946	Non-Contributing	Not within period of significance
Twin City Separator Company building	2841 Dupont Avenue South	c. 1890; 1909	Contributing	--
Bruer Bros. Lumber Company building	2836 Lyndale Avenue South	1921	Non-Contributing	Not within period of significance
Western Alloyed Steel Casting Company building	2848 Pleasant Avenue South	1916	Non-Contributing	Lack of integrity
Eighth Ward Warehouse building	2900 Pleasant Avenue South	1919; 1927	Non-Contributing	Not within period of significance
Sears, Roebuck and Company building	2843-2929 Elliot Avenue South	1928; 1929	Non-Contributing	Not within period of significance
Dayton Rogers Manufacturing Company building	2820 Thirteenth Avenue South	1937; 1940-1947	Non-Contributing	Not within period of significance

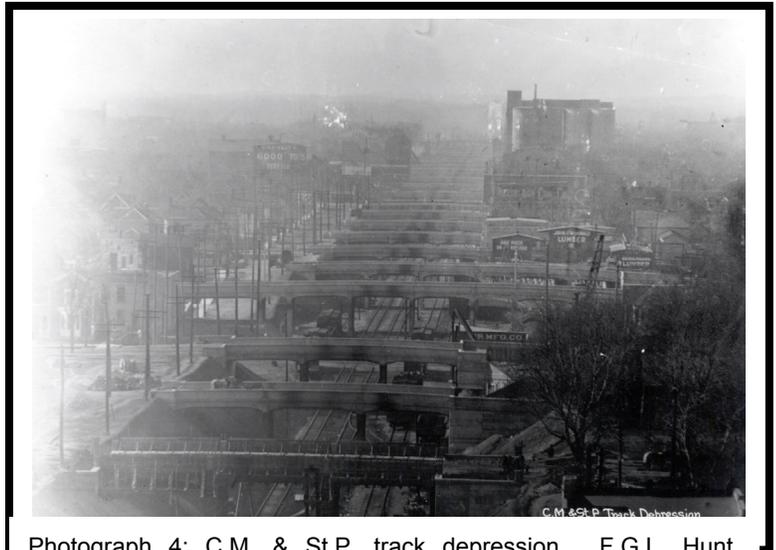
The Twin City Separator Company building was a brick manufacturing facility, once comprised of several units stretching between Dupont and Colfax Avenues South on the north edge of the railroad corridor. The site has been used for manufacturing since the 1890s. The various sections that now make up this building are believed to have been constructed between 1898 and 1954 for use as a fence factory, separator company, and window and sash manufacturer. Several modifications to the building were necessary when the trench was dug for the CM and StP track depression, including underpinnings to support the building at the railroad grade level. The Twin City Separator is a contributing building.

The Twin City Separator building is currently used to store lumber. It is proposed that the building will be converted to housing in the near future.

## b. Structures

The primary structures in the CM and StP Railroad Historic District are the earthen trench and the bridges carrying city streets over the trench. The trench extends from Humboldt Avenue on the west to Twentieth Avenue South on the east (Table 2). The trench is approximately 22 feet (6.7 meters) deep and has a steeply sloped earthen wall on the north and south. In several locations along the depressed rail corridor, the vertical plane of the trench is defined not by the earthen slope, but by reinforced-concrete retaining walls. These walls were usually installed where the trackage was expanded to accommodate additional spurs to provide a wider rail bed. These walls are unadorned and utilitarian in nature, but they contribute to the industrial character of the depressed corridor. Several segments have a parapet wall with recessed panel (much like the associated bridges) located at street grade. One wall segment on the south side, between Dupont and Colfax Avenues South, is supported by buttresses and features a tunnel under Twenty-Ninth Street, providing access to the adjoining property. The various segments of this wall comprise one contributing structure.

In three locations, a vertical plane does not define the edge of the trench. On the north side of the corridor, between Emerson and Dupont Avenues South, the adjacent lot is at the grade of the railroad bed. This property was historically used as a coal yard, and it is now used as a lumber storage yard. The second area is on the north side of the tracks between Garfield and Harriet Avenues South. This parcel is not divided from the tracks by a wall or by a steep slope, but is instead terraced and currently used as public garden. It was formerly the location of a grain elevator. The third area is between Fourth and Portland Avenues South, including Fifth Avenue South. This was the only at-grade street crossing permitted in the original plan and continues to be the only at-grade crossing in the district. Because the street meets the railroad grade via a gentle slope, the edges of the track depression are not present within this area. Portions of



Photograph 4: C.M. & St.P. track depression. F.G.L. Hunt, Engineer. From Minnesota Historical Society Album #212, The C.M. & St. P. Track Depression Construction Project, ca. 1900. Negative #87062.



Photograph 5: View from the tower on Clinton Avenue showing the bridges across the railroad tracks in the vicinity of Clinton Avenue and 29th St E; Portland Avenue bridge is in the foreground. Photo by Charles Hibbard. Minnesota Historical Society Locator #MH 5.9/MP4.7/p4. Negative #80198.

this segment also include what was formerly the railroad switching yard. Although the railroad tracks are no longer present, the open areas are maintained and have been converted into sports fields.

The 28 remaining of the 37 original reinforced-concrete street bridges spanning the depressed railroad corridor are contributing structures to the CM and StP Grade Separation Historic District. After the trench itself, the bridges are the most prominent structural features of the district. The bridges are concrete, continuous-girder design and feature modest Classical Revival-style detailingXX The city ordinance was particular in specifying not only the bridge width, but also in requesting that the roadway of each bridge be paved and outfitted with an eight-foot sidewalk on either side.

Table 2. Structures

Name	Year of Construction	Mn/DOT Bridge No.	Minneapolis Bridge No.	Contributing/ Non-Contributing
Trench	1912-1916	n/a	n/a	Contributing
Retaining Wall	1912-1916	n/a	n/a	Contributing
Bicycle/Pedestrian Trail Roadway	2000	n/a	n/a	Non-Contributing
Cedar Avenue Bridge	1916/1915	90437	4750	Contributing
Eighteenth Avenue Bridge	1916	L8923	7751	Contributing
Seventeenth Avenue Bridge	1916	L8922	7752	Contributing
Sixteenth Avenue Bridge	1916	L8921	7753	Contributing
Bloomington Avenue Bridge	1916	92350	4754	Contributing
Fifteenth Avenue Bridge	1916	L8920	7755	Contributing
Fourteenth Avenue Bridge	1916	L8919	7756	Contributing
Thirteenth Avenue Bridge	1915	L8918	7757	Contributing
Twelfth Avenue Bridge	1915	L8917	7758	Contributing
Eleventh Avenue Bridge	1915	L8916	7759	Contributing
Tenth Avenue Bridge	1915	L8915	7760	Contributing
Elliot Avenue Bridge	1915	L8914	7761	Contributing
Chicago Avenue Bridge rebuilt in 2005	1915	92349	4762	Contributing
Columbus Avenue Bridge	1915	L8913	7763	Contributing
Park Avenue Bridge rebuilt in 2006	1915	90491	5764	Contributing
Oakland Avenue Bridge	1915	L8911	7765	Contributing
Portland Avenue Bridge	1914	90494	5766	Contributing
Fourth Avenue Bridge	1997	92348	4767	Non-Contributing

Name	Year of Construction	Mn/DOT Bridge No.	Minneapolis Bridge No.	Contributing/ Non-Contributing
Second Avenue Bridge	1982	27648	4741	Non-Contributing
I-35W Bridge	1967	27867	1137	Non-Contributing
Stevens Avenue Bridge	1914	L8910	7771	Contributing
First Avenue Bridge	1914	92347	4772	Contributing
Nicollet Avenue Bridge	1914	90590	7773	Contributing
Blaisdell Avenue Bridge	1982	27610	4774	Non-Contributing
Pillsbury Avenue Bridge	1914	L8909	7775	Contributing
Pleasant Avenue Bridge	1913	L8908	7776	Contributing
Grand Avenue Bridge	1914	L8907	7777	Contributing
Harriet Avenue Bridge	1914	L8906	7778	Contributing
Garfield Avenue Bridge	1992	27675	7779	Non-Contributing
Lyndale Avenue Bridge	1987	27243	5780	Non-Contributing
Aldrich Avenue Bridge	1913	L8904	7781	Contributing
Bryant Avenue Bridge	1913	L8903	7782	Contributing
Colfax Avenue Bridge	1913	L8902	7783	Contributing
Dupont Avenue Bridge	1987	27666	4785	Non-Contributing
Emerson Avenue Bridge	1986	27665	4786	Non-Contributing
Fremont Avenue Bridge	1913	L8901	7787	Contributing
Hennepin Avenue Bridge	1980/2000	27599	5788	Non-Contributing

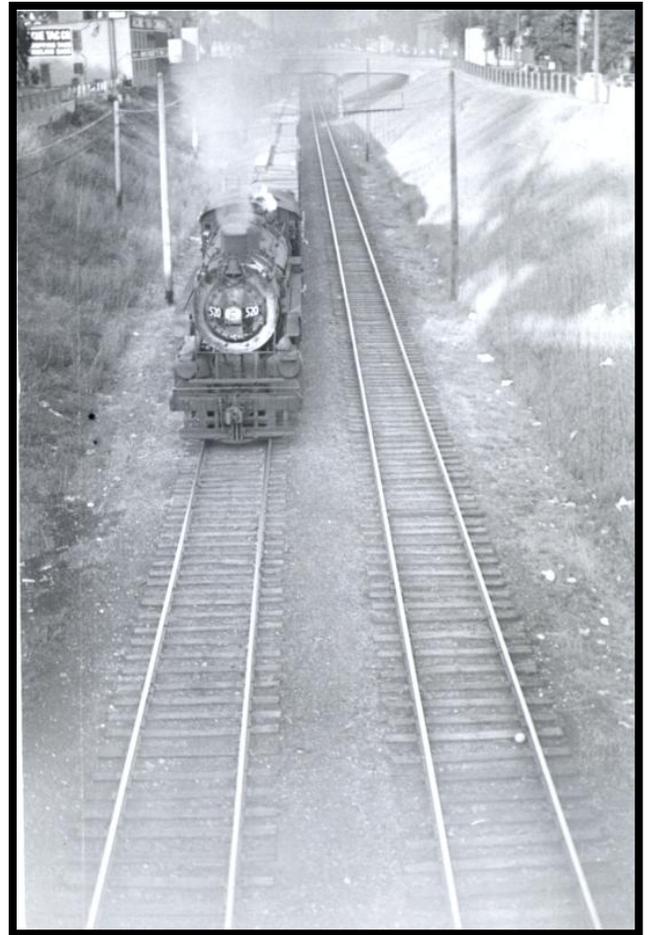
Although each bridge was specifically engineered for its location, their overall designs were nearly identical, with only minor variations. The width of the bridge deck (from outer edge to outer edge) for most of the bridges is 49 or 51 feet. Wider bridges include Cedar Avenue (60 feet), Bloomington Avenue (63 feet), Chicago Avenue (71 feet), Park Avenue (70.4 feet), and Nicollet Avenue (83 feet). Except in the case of Park Avenue, these wider bridges correspond with the north-south streetcar lines that once used the bridges. With two exceptions (at Fourth Avenue and Clinton Avenue where the a sidings yard required ten and six spans, respectively; both historical bridges are no longer extant), the reinforced-concrete bridges were comprised of three spans, with the bed supported by three square, concrete, double-arched, vaulted piers (six piers were used on the wider Chicago Avenue and Park Avenue bridges; the Nicollet Avenue bridge employed wider piers and vaulting).

The two main tracks were laid under the center span, while the side spans accommodated the slope of the depression wall in most instances. In some cases, additional tracks that were necessary for industrial or railroad operations were constructed under these side spans. Where these additional tracks were placed under the side spans, a reinforced-concrete wall was built integral with the abutments and any adjacent retaining wall. A full-height retaining wall could accommodate two industry tracks, while a lower retaining wall was sufficient for one industry track. The full-height retaining walls are located on north side of the Fourteenth Avenue, Thirteenth Avenue, Eleventh Avenue, Tenth Avenue, Elliot Avenue, Chicago Avenue, Columbus Avenue, Park Avenue, Oakland Avenue, Portland Avenue, Stevens Avenue, Pleasant Avenue, Grand Avenue, Harriet Avenue, Aldrich Avenue, Bryant

Avenue, Colfax Avenue, and Fremont Avenue bridges, where most of the industrial facilities are located. Full-height retaining walls are located on the south side of the Tenth Avenue, Elliot Avenue, Nicollet Avenue, Pleasant Avenue, and Colfax Avenue bridges. The lower retaining walls, which could accommodate only one track, were constructed on the north side of the Twelfth Avenue, Nicollet Avenue, and Pillsbury Avenue bridges, and on the south side of the Eleventh Avenue, Pillsbury Avenue, Grand Avenue, and Harriet Avenue bridges.

The superstructure exhibits arched fascia girders decorated with recessed panels at the juncture of the piers. The deck is bound by solid parapet railings with simple recessed panels (the Nicollet Avenue Bridge lacks the parapet panel details on its east side). The specific construction date for each bridge (1912, 1913, 1914, 1915, or 1916) is impressed into the concrete abutment.

Thirty-seven crossings were constructed as part of the grade separation project, 28 of which are extant (contributing), 11 of which have been replaced (non-contributing), and two of which were removed and not replaced (Clinton Avenue and Third Avenue). Although the original city ordinance specified that the depressed rail corridor extend from Hiawatha Avenue to Irving Avenue, no bridges were constructed west of Hennepin Avenue or east of Cedar Avenue. The original Hennepin Avenue bridge predated the project, having been built in 1897, and brought the total number of historical crossings over the trench to 38. Of the 28 remaining bridges associated with the grade separation project, few have had any significant alterations to their character-defining features. A metal pole railing was added to the parapet wall to meet modern pedestrian safety requirements on each of the bridges. Some minor skim-coat repairs have been made to the substructure of the Aldrich Avenue and Bryant Avenue bridges. The parapet wall has been replaced on the Pillsbury Avenue bridge. The Elliot Avenue bridge was modified in 1964 when Sears purchased the air rights from the railroad and constructed a large warehouse addition on the north side of their building that extended over the rail bed and beyond.



Photograph 6: Midtown Greenway ca. March, 1923.

Today, 37 bridges cross the trench, including the 28 bridges constructed as part of the grade separation project; the 10 replacement bridges; the Interstate 35W bridge, created when the interstate was constructed; and the replacement Hennepin Avenue bridge, constructed in 1980 and modified in 2000.

A bituminous bicycle/pedestrian trail system with entrance ramps was constructed in the bed of the trench from Fifth Avenue west in 2000. The trail system between Fifth Avenue east to Hiawatha opened in 2004, completing the trail system within the historic district.

A total of 40 structures are present in the CM and StP Railroad Grade Separation Historic District, including the trench (contributing), the retaining walls (contributing), the bicycle/pedestrian trail roadway (non-contributing), and 37 bridges (28 contributing and nine non-contributing) (Table 2).

### c. Other Features

The trackage along the CM and StP Grade Separation Historic District has been removed. During the period of significance, the corridor had a minimum of two track systems (one for east bound and one for west bound). Where necessary for the adjacent industries, spur tracks were added to accommodate delivery and distribution. Between Clinton Avenue South and Fifth Avenue South, many more tracks were built on the north side to accommodate a switching yard. Other features associated with the trackage, including switch stands and railroad crossing signals at Fifth Avenue South, have been removed.



Photograph 7: Typical segment of historical fence on south side of corridor at street grade.

An iron picket fence with concrete posts with five discontinuous segments is placed on street grade at the top of the trench from Fremont and Lyndale Avenues South and helps to comprise the historical and visual character of the district. A system of small patches of granite block, limestone, and concrete retainers with mortar have been placed near the bridge abutments near the upper portion of the slope between Pillsbury and Cedar avenues. Although its age could not be conclusively determined, this system visually supports the feeling and association of the district and is, therefore, recommended as contributing. A series of wooden utility poles extends along the slope of southern side of the trench and contributes to the feel and association of the historic district.

Several non-contributing features are located within the CM and StP Grade Separation Historic District. Many of these were added when a bicycle/pedestrian trail was constructed in the corridor in 2000. These features include a series of modern light standards; several emergency telephone boxes; and three bicycle ramps at Bryant Avenue, Nicollet Avenue, and 18<sup>th</sup> Avenue with associated concrete block retaining walls. A modern chain link fence extends the length of the constructed bicycle trail, dividing the trail from the former rail line. Portions of the chain-link fence are placed on top of a rock-faced concrete block retaining wall where the bicycle trail is situated at a higher grade than the former rail line.



Photograph 8: Typical granite block retainer.

Other non-contributing features include several types of modern retaining walls made of materials such as rock-faced block, concrete, railroad ties, and concrete slab.

## **Section 2: Landscape Management Guidelines**

The previous section explained the historical significance and the main physical components of the Midtown Greenway between Humboldt Avenue South to East Twenty-Eighth Street. This section addresses specific character-defining features and landscape qualities of the historic district of the Midtown Greenway: its spatial organization, topography, vegetation, structures, and objects. Following a discussion of each of the contributing features, recommended and not recommended treatment guidelines are identified. The Secretary of Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes (National Park Service, 1996) were used extensively in the creation of these guidelines.

### **Application of Guidelines**

These guidelines provide a framework for future public projects as well as for other activities subject to approval by the Hennepin County Regional Rail Authority, including community landscape/garden projects and public arts projects. They do not apply to the entire Midtown Greenway, but only to activities in the designated historic district that fall within the jurisdiction of the HCRRA, including applications for permits relating to public projects, landscaping, or public art. The *Chicago Milwaukee and St. Paul Grade Separation Historic District*, or the "Historic District" is formally defined as follows:

The Historic District is that 2.8-mile section of the depressed railroad trench within the Midtown Greenway that is listed on the National Register of Historic Places. The Historic District includes the section of the depressed trench between Humboldt Avenue South to 28<sup>th</sup> Street near Hiawatha Avenue; its earthen, vegetated side slopes with grades of 60%; and certain of its intermittent retaining walls and building walls that form the trench's vertical wall. The Historic District also includes 37 bridges that cross the trench, 28 of which are "contributing" features of the historic district.

The Guidelines were developed in consultation MnSHPO, the MnDOT Cultural Resources Unit, and the Midtown Community Works Partnership.

### **Rehabilitative Approach**

These guidelines follow the "Rehabilitation" treatment option from *The Secretary of the Interior's Standards for the Treatment of Historic Properties*. Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values (*Guidelines for Treatment of Cultural Landscapes*, 1996).

For the Midtown Greenway, successful rehabilitation may mean promoting new and compatible uses along and within the Corridor that serve a different purpose than in the past, when adjacent properties were occupied by industries and businesses that either directly served the railroad or took advantage of its proximity. Historic rehabilitation should be directed toward retaining the historic characteristics that make the Greenway eligible for designation as a National Register historic district, while allowing new and changing uses along the corridor.

For this reason, these guidelines can be flexibly applied. (As guidelines, judgments will have to be made and in doing so, *The Secretary of Interior Standards for the Treatment of Historic Properties* should be followed.) In cases where a proposed action significantly departs from the recommendations in these Guidelines, HCRRA will consult with a professional with proven experience in the application of *The Secretary of Interior's Standards for the Treatment of Historic Properties*.

*Currently, the Greenway is a special and unique place. It is one of the few places in Minneapolis where one can have a sense of what it must have been like a century ago. It retains a strong character, more rural than urban. The level of existing form and texture created by the railroad track and ties, the embankments, the bridges, the old concrete, is inherently beautiful. The quality of feeling one gets on the Greenway should be preserved.* (Public Art Master Plan Midtown Greenway Corridor, 2001, page 10.)



Photo 8: Looking west at the 13<sup>th</sup> Avenue Ramp. Hennepin County Photo. 2005.

## Spatial Organization and Land Patterns

The Midtown Corridor trench of the Chicago Milwaukee and St Paul Railroad Grade Separation Historic District was constructed between 1912 and 1916. It is one of the few rail lines of its time that was recessed in an urban area. During this time period railroads typically achieved grade separation in urban areas by elevating the railroad tracks or staying at grade and using road bridges or underpasses for vehicular traffic.

The following paragraphs describe the spatial organization and land patterns of the historic district. *Spatial organization and land patterns refer to the three-dimensional organization and patterns of the spaces in the landscape, like the arrangement of rooms in a house. Spatial organization is created by the landscape's cultural and natural features. Some form of visual links or barriers (such as fences and hedgerows); others create spaces and visual connections in the landscape (such as topography and open water). The organization of such features defines and creates spaces in the landscape and often is closely related to land use. Both the functional and visual relationship between spaces is integral to the historic character of a property.* This definition of spatial organization and land patterns is taken from The Secretary of the Interior's Guidelines for the Treatment of Cultural Landscapes, 1996.

The Historic District of the Midtown Corridor is a unique recessed transportation corridor that cuts through South Minneapolis, an area that would otherwise be a flat Midwestern plain. This lineal trench is hidden away from the city grid above and provides an uninterrupted bike/pedestrian connection between the lakes on the east side of Minneapolis and Mississippi River on the west. The Corridor connects these two points but the trench does not.

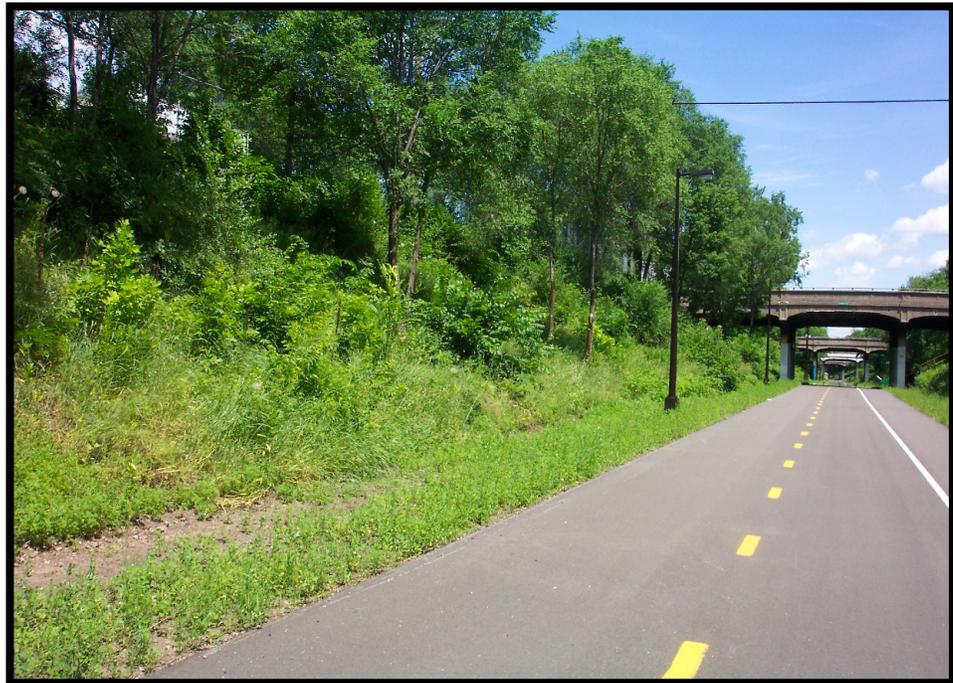


Photo 9: Midtown Corridor between 15<sup>th</sup> and 16<sup>th</sup> Avenue. Hennepin County Photo. 2005.

The trench and the bridges significantly define spaces and land patterns of the Historic District. The trench forms a second level to the traditional street delineated grid of South Minneapolis. The trench has a flat floor with the vegetated side slopes and intermittent retaining walls or buildings. The trench sides give a feeling of enclosure when traveling through the corridor.

The regularly spaced bridges frame the transportation experience from the trench and can be appreciated simply by standing on a bridge and looking east or west. The repetition of the bridges, along with the lineal depressed corridor, creates a landscape pattern similar to the rungs on a ladder.

Even though the trains have disappeared from the trench, the sense of movement remains within the corridor. When traversing through the corridor, the repeating bridges give an intermittent change in openness as well as a providing a rhythmic pattern of light and dark. The area beneath the bridges is dark; this is followed by the shadows of the bridge and then the direct light.

### **Character-Defining Features**

Lineal trench.

Depth and width of the trench.

Volunteer vegetation.

Slopes of the trench.

Bridges and the repetition of the bridges.

Long unobstructed views of the bridges and the trench from both levels.

Corridor “reads” as a transportation corridor.

**Guidelines for Spatial Organization**

Recommended	Not Recommended
Maintaining the lineal trench.	Shifting the trench north or south.
Maintaining the depth and width of the trench. The trench is approximately 22 feet deep and 35' to 60' wide at the trench floor. The trench at the top of the slope ranges from 110 to 135 feet wide.	Unnecessarily filling, scraping, or otherwise altering the existing trench dimensions.
Maintaining the existing slopes of the trench, either the earthen embankment or the solid concrete retaining walls.	Altering the slopes of the trench. Replacing graded slopes with retaining walls or vice-versa.
Retaining as much of the original retaining walls as possible, use care in removing graffiti.	Wholesale replacement of original retaining walls for uniformity.
Repairing deterioration of bridges and retaining walls with compatible materials.	Removing bridges and retaining walls without considering rehabilitation. See <u>Midtown Corridor Historic Bridges Planning Study, 2007.</u>
Replacing deteriorated elements with historic matching elements.	
Retaining the scale of the building walls that form the vertical plane of the trench.	Introducing retaining walls with height outside the existing parameters.
Maintaining the city grid pattern through the preservation of bridges or the reconstruction of the new bridges in the same location.	Removal of bridges without consideration of the city grid system.
Developing plan for additional system-wide access points.	
Working with existing sites where slopes have been altered or demolished to create additional access points.	

## Topography

The topography of the historic district is an artifact of urban transportation planning in Minneapolis in the early 20<sup>th</sup> century. Previously, the topography of the linear district was essentially level, being composed of the southern lots of the city blocks immediately north of 29<sup>th</sup> Street. The need to separate the through rail traffic from the pedestrian and vehicular traffic of the city resulted in the removal of huge amounts of soil to create 2.8 mile long trench for the trains. The excavation of the depression, in its own right, was an engineering feat for its time.

To accommodate the needs of rail traffic, the bottom of the trench is essentially level. For most of the trench length the sides are sloped earthen embankments with a ratio of one-and-a-half horizontal to one vertical (66% slope). In some places, to accommodate buildings or other features on the upper city level, the side of the trench is defined by retaining walls or the lower story of the buildings.



Photo 10: Midtown Corridor near Midtown Exchange Building. Hennepin County photo. 2005.

The track depression is the most significant feature of the historic district and creates a unique transportation environment. Because of the grade separation between the rail tracks and the city above, train travelers of the past, may have been unaware they were passing through a city. The trees of the slopes and the inability to see residential or commercial structures, gave travelers little clues to the area they were in. The only indication of city life was the occasional industrial building that formed the sides of the trench.

### **Character Defining Features**

Separation of the elevation of the city and the elevation of the rail bed.

Level surface/flat plane of city and rail bed.

Predominant steep side slopes with grades of 60%.

**Guidelines for Topography**

Recommended	Not Recommended
<p>Retaining the graded slopes to maintain definition to the property. Selected modifications of the grade will be considered to</p> <ul style="list-style-type: none"> <li>a.) provide access to transit stations and to</li> <li>b.) provide public access to public facilities.</li> </ul> <p>Where possible, access needs should be accommodated in areas where grade permits.</p>	<p>Adding new structures or buildings on the side slopes so that the definition and linear nature of the separation is lost.</p>
<p>Restoring slopes temporarily altered during construction to pre-construction conditions. A topographic survey and photo documentation of site must be completed prior to project work.</p>	<p>Grading back the side slopes so that a sense of the separation and definition of the rail bed is lost.</p>
<p>Repairing of slopes damaged by erosion, compaction or traffic patterns.</p>	<p>Using heavy maintenance or construction equipment which destroys or degrades the topography.</p>
<p>Controlling drainage and grading to correct existing erosion problems.</p>	<p>Altering existing grades or drainage in a manner that causes or increases erosion.</p>
<p>Cleaning of drainage systems and the mowing of vegetative cover to maintain the slopes.</p>	<p>Replacing graded slopes with retaining walls.</p>
<p>Retaining the sense of the level grid of the city at an elevation above the rail bed.</p>	<p>Creating varied elevations along the trench backslope with embankments, structures, or furniture.</p>
<p>Stabilizing the slopes with hydroseeding, vegetation, or other appropriate ground cover when restoring slopes.</p>	<p>Encouraging human activity on sloped areas.</p>
<p>Using mulch or straw to temporary stabilize slopes where final grading is delayed.</p>	

## Vegetation

During the construction of the grade separation district, all existing vegetation was removed. Since the construction of the trench, the railroad allowed the slopes to revegetate with plants tolerant of the conditions of the depression. Throughout the years, the slopes revegetated with trees such as Boxelder, Siberian Elm, and Green Ash. Beneath the trees is grass and a variety of plants.

The wildness of existing vegetation is indicative the vegetative maintenance management strategies used by the railroad and contributes to the unmanicured, industrial feeling of the corridor. Engineers could have created a corridor that was primarily retaining walls; instead they allowed earthen embankments to revegetate.

These Guidelines recommend retaining this historic sense of non-cultivated wildness in a form that reflects a modern understanding of what constitutes a healthy, successful plant community, particularly by planting largely native species, or non-native species that are well-suited to the environment in the trench. Plantings should be consistent with principles of ecological sustainability and other landscape design criteria as developed by public entities and community stakeholders in the Greenway.



Photo 11: Midtown Corridor between 15<sup>th</sup> and 16<sup>th</sup> Avenues. Hennepin County photo. 2005.

### **Character Defining Features**

Random spacing of trees.

Random groupings of trees.

A variety of hardy tree species, such as Boxelder and Green Ash.

Volunteer plant species.

Grassy ground plane.

No designed landscapes.

**Guidelines for Vegetation**

Recommended	Not Recommended
Planting trees randomly.	Planting trees in rows, lines, or a select pattern.
Grouping a variety of trees together.	Planting a monoculture.
Limiting the use of shrubs and perennials.	Planting flowering annuals and bulbs.
Protecting vegetation from disease and damage caused by vehicles.	Planting or allowing through poor maintenance plants listed on the <i>Minnesota Noxious Weed List</i> .
Placing vegetation to maintain views of the bridge portals and landmarks such as the former Sears building and the Minneapolis skyline.	Mowing of large areas of turf.
Installing low maintenance, naturalized plantings over formal, geometric plantings.	Planting high maintenance species such as trees that fruit or sucker.
Maintaining existing vegetation with the same care and attention as any newly installed vegetation.	Planting vegetation that is dependent on an annual burn to thrive.
Intensive landscaping may be considered to reinforce specific nodes along the corridor. These include access points, ramps, gateways, and locations for public art.	Unnatural pruning (i.e. espalier) to control size and to shape.
Selecting largely native plants appropriate for the site conditions, including soil conditions (pH, texture, nutrient levels, compaction), drainage, sun exposure, slopes, drought tolerance, deicing salt tolerance, microclimate, and exhaust fumes.	

## Circulation

The primary form of circulation through the trench during the period of significance was rail transportation. Vehicular or pedestrian access within the historic district was restricted to the bridges and not permitted within the trench for safety reasons.

The two main rail line tracks, an east bound track and a west bound track, were laid under the center span of the bridge, while the side spans accommodated the slope of the depression wall in most instances. A series of spurs and side tracks to the rail tracks provided access to the adjacent businesses and made possible the connection and disconnection of rail cars. In the past, spurs could be found between the following locations:

Humboldt and Hennepin Avenues  
Fremont and Aldrich Avenues  
Bryant and Dupont Avenues  
Aldrich and Lyndale Avenues  
First and Third Avenues

In addition to these spurs, three spurs at Third Avenue formed the rail yard. This is also where the corridor widened out and the Clinton and Fourth Avenue bridges lengthened to accommodate the additional rail lines of the yard.

A three track system continued on east from the rail yard east of Portland to 15<sup>th</sup> Avenue. Between Chicago and Elliot Avenues, two spurs on the north side served the grain elevators of Rahr Properties, Inc. Two spurs on the south side of the main tracks between 10<sup>th</sup> and 12<sup>th</sup> Avenues serviced the Sears and Robuck Company. Between 12<sup>th</sup> and 15<sup>th</sup> Avenues, two spurs on the north side of the mainline serviced lumber and coal yards. The two track mainline system existed eastward from 15<sup>th</sup> Avenue to Longfellow Avenue, where the two tracks split off to downtown Minneapolis and two tracks split south of 28<sup>th</sup> Street.

The bridges, which supported vehicular and pedestrian movement over the depression, have a concrete design that features modest Classical Revival-style detailing. The City ordinance relating to the bridge construction was particular in specifying not only the bridge width, but also in requesting that the roadway of each bridge be paved and outfitted with an eight-foot sidewalk on either side.

The City of Minneapolis recently concluded a study of the bridges and will be developing a treatment plan in the future. The rail track system that once ran the course of the district was replaced by bituminous bicycle and pedestrian paths beginning in 2000. The path system was designed in a matter to allow for mass transit in the future. Access to the paths is provided by a new system of ramps and simple stairs.



Photo 12: Midtown Corridor at Bloomington Avenue looking east. Hennepin County photo. 2005.

**Character Defining Features**

The lineal nature of the railroad trench.

The repetition of the bridges overhead.

The intersection of vehicle, pedestrian and train traffic at the bridges.

The segregation of the various types of transportation: trains, automobiles, and people.

**Guidelines for Circulation**

<b>Recommended</b>	<b>Not Recommended</b>
Retaining the existing alignment, trench width and slopes.	Altering the alignment or width of the historic corridor, except where identified as part of comprehensive planning for corridor-wide access.
Developing a system-wide plan for additional access points.	Overwhelming the industrial feel of the corridor with additional access structures.
Maintaining the perpendicular intersection of the bridges/streets with the trench.	Making connections that change the grid of the city streets.
Maintain maximum number of original bridges when feasible. Removing bridges without considering rehabilitation or reuse as a pedestrian bridge.	
Creating access points in manner that allows for safe access and egress to the trench.	Constructing new bridges that angle or curve across the trench.
Using materials for sidewalks and pathways that are industrial in nature (i.e. plain concrete).	Using colored concrete, stone, or a concrete with a brushed or washed aggregate finish for walkways.
Constructing stairs within the greenway in a lineal/rectilinear manner.	Constructing curvilinear walks.
To limit the visual impact of the stairways, limit stairway width to 8'.	Permitting stairways from private developments that border the greenway, unless the structure of the private development is a contributing historic structure.
Stairways should be industrial in appearance. The use of concrete and wood is encouraged. Hand rails should be simple (not ornate) and meet safety standards.	Ornate stairways.

## Planning for Additional Trench Access

In contrast to the need to prevent public access that informed its original design, an important part of the Corridor's successful rehabilitation will be inviting people to enter the trench. These guidelines recognize that further changes to the trench may be necessary at select sites to allow access by pedestrians, bicyclists, and residents, and to support future transit stations, public safety and access to Lake Street and adjacent business nodes. At the same time, access points should be well designed and take into consideration the sense of grade separation and the spatial rhythm of the bridges that are among the Corridor's key historic attributes.

Determining whether a site is appropriate for opening should begin with corridor-wide access planning. HCRRA will consult with a professional with proven experience in the application of *The Secretary of Interior's Standards for the Treatment of Historic Properties* as part of its consideration of a proposed trench opening. In 2006, the Midtown Community Works Partnership identified the following preliminary list of sites as their priorities for additional access and openings of the trench for transit and other public uses within the historic district:

### First Priority – Future Rail Transit Station.

1. Aldrich to Lyndale—for plaza at future rail station.
2. Blaisdell to Nicollet—for entrance to trails and plaza at future rail station.

### Second Priority –Additional Public Access

1. Pleasant to Pillsbury.
2. Garfield to Harriet.
3. Chicago to Elliot.
4. 10<sup>th</sup> to 11<sup>th</sup>.
5. 15<sup>th</sup> to Bloomington.

The list represents the Partnership's best understanding of priority locations for transit stations and open spaces at the time these Guidelines were developed in 2006-2007, and may change as development occurs and transit decisions are made along the corridor.

## Water Features

Water features have never existed within the historic district, either within the period of significance (1912-1916) or following this period.

### Character Defining Features

None

### Guidelines for Water Features

Recommended	Not Recommended
Limiting water features to those necessary to ameliorate storm water issues.	Introducing fountains, waterfalls, ponds, pools, or other features that mimic water to the corridor.
Storm water detention basins should be limited in depth to 8" inches, naturalist in form, and limited in number.	Lining the detention/storm water pond to maintain water instead of allowing for the natural percolation of water into the subsurface soil layers.

## Buildings

Eight buildings have elevations that are situated within the slope of the trench and contribute to the formation of its edge. Only one of the eight buildings was extant during the period of significance (1912-1916) and retains historical integrity, the Twin City Separator Company building. The remaining seven properties are non-contributing but are included within the historic district boundaries because they help to define the edge of the trench.

### Character Defining Features

The elevations illustrate the relationship between the historic business and the rail and the separation of these activities by a grade separation. The exterior building walls form a vertical plane of the trench.

### Guidelines for Buildings

Recommended	Not Recommended
Retaining the building walls that form the trench when feasible.	Designing and installing a new building that is needed for a new use that is incompatible with the historic character of the corridor.
Maintaining as much of the historical fenestration of the building walls as possible.	Blocking in windows on corridor facing walls.
Using replacement windows in the corridor facing building walls that are an accurate restoration or a historically compatible window opening.	Introducing wall materials or windows that are incompatible with the historic character of the corridor.

Installing additional windows on the non-corridor side of the building.	An unlimited number of private entrances on the corridor facing facade
Reestablishing public entrances onto the corridor that previously existed.	Constructing additions to give a false historical appearance.
Maintaining the brick, concrete, metal or other exterior surfaces.	
Following the Secretary of Interior's Standards for Rehabilitation by the National Park Service in the reconstruction of buildings. The standards can be found on the National Park Service website at <a href="http://www.cr.nps.gov/hps/tps/tax/rhb/stand.htm">www.cr.nps.gov/hps/tps/tax/rhb/stand.htm</a>	

### Structures, Furnishings and Objects

The primary structure of the CM and StP Grade Separation is the earthen trench, which extends from Humboldt Avenue on the west to Twentieth Avenue South on the east. The trench is approximately 22 feet (6.7 meters) deep and has a steeply sloped earthen wall on the north and south. In several locations along the depressed rail corridor, the vertical plane of the trench is defined not by the earthen slope, but by a reinforced-concrete retaining wall or a building wall. In two locations within the historic district the railroad corridor is at grade with street level.

The railroad tracks that once ran through the historic district have been removed and replaced with a bicycle and walking paths. In order to accommodate the paths, it was necessary to construct retaining walls to support the access/egress ramps. Two different materials were used in the construction of the retaining walls. In the first phase of construction between Lake Street and 5<sup>th</sup> Avenue, the retaining walls were constructed of a brown/tan modular block. In the second phase of construction between 5<sup>th</sup> Avenue and Hiawatha Avenue the retaining walls were constructed of monolithic concrete block. It was found the monolithic concrete block created the industrial feel that was sought.



Photo 12: Midtown Corridor. Hennepin County photo. 2005.

When the cycling and walking paths were constructed two different lighting styles were used for the two phases of construction. In the first segment the city standard acorn light was used. In the second segment of construction a shoe box light was used. It was found the shoe box light was more compatible with the past and present transportation uses of the corridor.

After the trench itself, the bridges are the most prominent structural features of the district. Twenty-seven of the original 37 reinforced-concrete street bridges still span the depressed railroad corridor. Treatment of the bridges and their associated structural integrity is currently under study by the City of Minneapolis.

A total of 40 primary structures are present in the CM and StP Railroad Grade Separation Historic District, including the trench (contributing), the retaining walls (contributing), the bicycle/pedestrian path system (non-contributing), and the 37 bridges (28 contributing and nine non-contributing).

Other minor features of the railroad era remain. An iron picket fence with concrete posts with five discontinuous segments found at the top of the trench, at street grade, between Fremont and Lyndale Avenues South. A system of small patches of granite block, limestone, and concrete retainers with mortar have been placed near the bridge abutments near the upper portion of the sloped on the eastern half of the corridor. A series of wood utility poles extends along the slope of the southern side of the trench.

**Character Defining Features**

The earthen trench.

The bridges that span the depressed railroad corridor.

The reinforced concrete retaining walls constructed between 1912 and 1916 that form the sides of the trench in specific locations.

Parapet wall constructed during the period of significance with a recessed panel located at street grade.

The monolithic concrete block retaining walls constructed between 5<sup>th</sup> Avenue and Hiawatha Avenue.

The iron picket fence with concrete posts.

The series of wood utility poles located on the south side of the trench.

The small patches of granite block, limestone, and concrete retainers.

**Guidelines for Structures, Furnishings and Objects**

Recommended	Not Recommended
<b>General</b>	
Developing a standard palette of structures, retaining walls, and furnishings for the historic district to support an integrated aesthetic environment within the Corridor, while at the same	

time providing the flexibility necessary to support diverse artistic expressions.	
Designing and constructing new structures, retaining walls, and furnishings that are compatible with the transportation theme of the corridor, yet distinctive from the historic structures.	
<b>Structures</b>	
Maintaining the historic relationship of the trench to the street, bridges, and buildings.	Removing or relocating bridges, buildings, or the trench without understanding the significance of this structure to the historic landscape.
Designing and installing a new structure, furnishing, or piece of art that is compatible with the preservation of the historic character of the district.	
Designing and installing bridge railings needed for transit comprehensively.	
<b>Retaining Walls</b>	
Using monolithic concrete blocks in the construction of retaining walls.	Using small modular block to create retaining walls.
Replacing the existing modular retaining wall block with the monolithic concrete blocks as a retaining wall material according to budgetary constraint. If the modular block walls should fail, replacing them with monolithic concrete blocks.	Terracing of the earthen trench.
<b>Lighting</b>	
Replacing the acorn light fixture with the shoebox light fixture when replacement is needed and the necessary budget exists.	Using a number of lighting types in the greenway
	Using flashing of neon lighting as a means of illumination or drawing attention, on signs that are not used for safety purposes.
<b>Furnishings and Objects</b>	
Removing features that diminish the quality of the historic experience, for example the existing bill boards.	Introducing a furnishing, object or art piece that is incompatible with the industrial nature of the railroad corridor.
Retaining, repairing and preserving the iron picket fence and where able to document its previous existence, replicating the fence.	Relocating the wood utility poles.
Designing and installing a new furnishing or piece of art that is compatible with the preservation of	Using materials that were not available or widely used during the time period of 1912-1916 (for

the historic character of the district.	example, plastic).
Supplying trash receptacles that are industrial in appearance. A responsible entity for trash pick-up must be identified prior to installation.	Placing numerous benches and objects throughout the corridor. The location of furnishings and objects (including stone for seating) should be well thought out.
Providing barrier-free access that promotes independence for the disabled person, while preserving, to the extent possible, character-defining landscape features, materials and finishes.	Providing stands for the distribution of newspaper and literature. This will create a litter problem.
<b>Permanent Art</b>	
Designing and installing art that is compatible with the transportation history of the corridor.	Installing traditional architectural statuary within the historic district.
Installing art in a manner that preserves the unique historic character of the district.	
Installing art with a unique quality, that is not pseudo-historic and that does not overwhelm the historic characteristics of the district.	
Designing art that is integrated into new bridges, as opposed to historic bridges.	
Developing a plan for mural and mosaic installation so that murals are interspersed throughout the historic district and do not compete with the unique historic character of the corridor, such as by designing and installing framed and contained murals on a select number of bridges.	
Reusing old materials in art selectively when appropriate, but art should not be limited to this approach.	
Installing art that is compatible with the goals of the public art master plan.	
<b>Signs</b>	
Installing trail operational signs that are compatible with the railroad character, similar to the interpretive panels or landmark signs. No bright, day glow or florescent colors should be used on the signs.	Installing signs not related to the operation of the Midtown Corridor (i.e. private advertising)
Limiting the size of memorial plaques to 6" by 6" or smaller. For numerous donations, larger plaques	Installing permanent signs to bridges or historic retaining walls.

may be used. Plaques should be inset into paving, attached to benches or sign posts.	
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## Accessibility Considerations

The historical decision to depress this railroad corridor was predicated on safety. The City of Minneapolis strove to separate people from trains as much as possible. Therefore, historically access to the depressed area of the railroad corridor was extremely limited for safety reasons.

Today, the trains no longer serve this area of Minneapolis and the railroad tracks have been removed. The cycling and walking paths have replaced the tracks. Providing access to this recreational and commuter paths is challenge due to the grade of the slopes that form the sides of the trench. A system of ramps and steps provide access to the cycling and walking paths on the trench bottom.

To date, two types of ramps have been constructed in the corridor to provide access for all to the cycling and walking paths. The first ramps were constructed of brown/tan modular retaining wall block. The second set of ramps was constructed with monolithic concrete retaining blocks. This concrete block was found to be more compatible with the poured in place concrete retaining walls that were constructed during the 1912-1916 period of significance and with the overall industrial character of the corridor.

In addition to the ramps, stairs with bicycle rails have been installed intermittently throughout the corridor. These stairs are meant to compliment the ramps as additional access and egress points. The stairs primarily serve walkers, joggers, and cyclists and are constructed of preserved wood.

### Guidelines for Accessibility Considerations

Recommended	Not Recommended
Developing an overall access plan to the corridor that retains the character-defining features of the historic landscape.	Undertaking barrier free access activities without identifying character-defining features that are important to preserve.
Designing access ramps in a manner that minimally affects the slopes of the trench.	Designing the ramps in such a manner that character defining features are inadvertently destroyed by ramp users.
Using monolithic concrete block or poured in place concrete to construct the access ramps.	Unlimited private access from private property to the Midtown Corridor.
Designing the ramps to take advantage of sight lines to the bridges and down the corridor.	
Designing rectilinear stairs which perpendicularly meet the trench floor.	

## Health and Safety Considerations

The Chicago Milwaukee and St Paul Railroad served industrial uses along the corridor. These industrial uses, along with the corridor railroad ties, the train exhaust, and the rail cargo caused environmental contamination of the soils or surface materials of the corridor. The corridor soils may be contaminated with lead, petroleum products, or arsenic.

All railroad ties have been removed from the corridor; however, the remaining ballast could contain the carcinogenic compounds (poly aromatic hydrocarbons) from the creosote treatment (a wood preservative that is no longer used) of the railroad ties.

### Guidelines for Health and Safety Considerations

Recommended	Not Recommended
Developing safety plans that consider and incorporate the character defining features of the greenway.	Destroying character defining features without first considering less destructive alternatives to meet safety and health goals.
Using light judiciously to enhance safety.	Removing volumes of contaminated soils and not returning the land to its original grade through the replacement of soils.
Testing all soil for contamination prior to manipulation of the soil.	Failing to remove sediment or erosion from the path system.
Providing all personnel working with potentially contaminated soils the appropriate protective equipment.	Allowing vegetation to block lights, emergency telephones, security cameras and important sight lines.
Designing landscape plans to promote the visibility into and from spaces.	Planting shrubs with a mature height and width that would allow individuals to hide behind the shrubs.
Designing development to provide public access into the Midtown Corridor while taking into account the character defining features of the corridor.	Planting closer than 5' from the cycling/walking paths.
Maintaining lights, emergency telephones, and security cameras.	Controlled burning as a maintenance practice for native plantings.
Using physical and biological means to control pests. Physical management activities include the hand removal of pests. Biological activities involve the use of beneficial insects to control invading insects. For example, using ladybugs to control aphids.	Applying chemicals (insecticides, pesticides, and herbicides) to control pests prior to using all other suitable physical and biological control strategies. Chemicals are to be applied by Minnesota-certified pesticide applicators.

Removing sediment and erosion from the path system.	Grading the slopes so water and the associated sediment drains on to the cycling and walking paths.
Removing any bio hazards such as needles.	

### **Environmental and Energy Considerations**

Environmental concerns related to the Midtown Greenway Corridor are the handling of storm water, water conservation, and the lighting pollution. Historically the train corridor was not well lit.

#### **Guidelines for Environmental and Energy Considerations**

<b>Recommended</b>	<b>Not Recommended</b>
Using the shoebox light fixture or another industrial light fixture that directs the light downward.	Using extensive retaining walls to maintain the slopes of the corridor.
Minimizing the use of hard paved impermeable surfaces or installing permeable pavers where appropriate.	
Replacing the existing acorn light fixture with the shoebox fixture as the acorn fixture ages and the budget allows.	
Plantings should be located to conserve energy, modify temperature, ameliorate wind extremes, and not require irrigation after initial establishment.	