Technical Memorandum: 
INVESTIGATION OF EXISTING STREETCAR TRACKS

DRAFT

THE CENTRAL CORRIDOR

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1.0 Overview
The Ramsey County Regional Railroad Authority has recently completed a major investment study (MIS) that identified light rail transit as the preferred alternative for the University Avenue corridor between Minneapolis and St. Paul in the state of Minnesota. Additional studies are under way to resolve a number of technical issues prior to the start of preliminary engineering. One of these studies involves identifying potential track guideway types within the corridor.

During the first half of the twentieth century, streetcars were a common sight throughout the Minneapolis/St. Paul (MSP) region. University Avenue was a heavily used streetcar corridor connecting the two cities. The streetcar lines were eventually phased out during the 1950s as buses were introduced throughout the US. In many cases the tracks were not removed, they were simply covered with asphalt paving to allow use of the trackway by rubber tired vehicles.

In the early 1990s the Ramsey County Regional Rail Authority initiated studies to restore mass transit along the University Avenue corridor. An MIS was conducted for the Central Corridor which determined that the mode of transit within the MSP corridor should be light rail, including an alignment along University Avenue. One of the technical issues that are being considered is the re-use of existing streetcar tracks that were paved over in the 1950s and 1960s. This report documents the efforts to investigate the possibility of re-using the existing tracks for the Central Corridor project.

The idea of re-using existing railroad or rail transit tracks for a new transit operation has been considered throughout the country, as agencies have searched for ways to reduce capital costs. In most cases the existing track is a seldom used or abandoned railroad branch line within an exclusive right of way. Analysis of the track structure’s condition is a fairly simple process because the track is readily available for visual inspection, which facilitates an accurate estimate of rehabilitation needs and costs. This is not the case for the Central Corridor project, where the old streetcar tracks were paved over many years ago, as discussed further in this report.

2.0 Track Investigation
The DMJM+HARRIS team conducted research of the Twin City Rapid Transit lines that operated on University Avenue during the first half of the 20th century. It was evident that the streetcar tracks were within the middle of the street right of way, as were many of the streetcar lines throughout the region. The team identified two locations, one near the intersection of University with Pierce Street, the other near Farrington Street. The Pierce Street location was selected because sewer replacement work conducted in 1995 identified the existence of paved-over streetcar tracks.

The team contacted a local underground construction company (Meyer Contracting) to excavate an inspection pit at each location. The pits would be of sufficient size and depth to allow an accurate assessment of the condition of the rails, crossties and substructure including ballast and subgrade. The work was scheduled for June 8th and 9th in 2004. Prior to initiating excavation, the contractor investigated the presence of rails at each location using metal detectors. At both locations metal detectors revealed
what appeared to be parallel rails consistent with the track gauge and track centerline spacing which were common during that period.

The contractor began work at the Pierce Street site, using pavement sawing equipment to remove the asphalt cover over the tracks. Approximately six inches of pavement was removed, revealing the existing trackway which was embedded with granite paving stones (see Exhibit 1).

Exhibit 1 - Pierce Street Excavation

Removal of the granite pavers, which were approximately 5-1/2 inches thick, revealed a sand leveling course underlain by 6 inches of mortar which was placed in the cribs between crossties. The crossties were 8 inches wide by 6 inches deep, spaced at 24 inches, and were in remarkably good condition. The rails were spiked directly to the crossties without use of tie plates. The ties were placed directly on a compacted base material as there was no evidence of ballast within the excavated area. The rail was not a standard AREMA section as evidenced by the flat web and the small fillet radius between web and base. The rail appears to be a plain girder rail (grooveless) which was used primarily on street railways during the early part of the 20th century. Production of this type of rail section was discontinued as streetcar systems began to disappear in the 1940s and 1950s. This particular rail exhibited head wear well beyond condemnation limits (see Exhibit 2).
Exhibit 2 – Pierce Street Track Structure

The Farrington Street site was excavated later in the day after the Pierce Street pit was backfilled. Pavement cutting equipment was used to cut clean lines prior to commencement of excavation activities. At this location the asphalt cover was thicker (10 inches) than the Pierce Street site, it was then removed to expose the top of existing track (see Exhibit 3).

Exhibit 3 – Farrington Street Excavation
The asphaltic material was easier to remove as it had significantly higher moisture content than the Pierce Street pit. The track was paved with granite paving stones however the granite at this location exhibited a grayish tint as opposed to the pink tint that was evident at Pierce Street (see Exhibit 4). The pavers were much easier to remove which may have been the result of the moist condition of the grout that held the pavers in place.

Exhibit 4 – Farrington Track Surface

The track structure components at this location were identical to the Pierce Street site, however considerable degradation of the crossties was evident. The ties were very damp and crumbled with very little effort. The granular material supporting the crossties had become very damp as well. Overall the track structure at this location was in very poor condition (see Exhibit 5).
3.0 Findings and Conclusions
Re-use of the existing University Avenue tracks would present a number of challenges. First and foremost, the top of rail is below the existing paving surface as evidenced by observations made of the two inspection pits. The University Avenue portion of the Central Corridor project includes approximately 50 street crossings. Although it would be prudent to close many of these crossings for safety reasons there would still be a significant number of crossings remaining. When the light rail system is built, the top of rails must be placed at the same elevation as the top of pavement at these crossings. This will require raising the track profile at every crossing if the existing tracks are to be re-used. The track profile adjustment could extend 50-100 feet beyond each crossing, depending on the differential elevation between existing top of rail and top of paving at the crossing. Furthermore, if the profile were only raised within the vicinity of grade crossings, the top of remaining trackway would be below street level by several inches, resulting in a drainage "bathtub". To alleviate flooding of the trackway, parallel under drains or v-ditches would be required, along with drop inlets at frequent intervals. Additionally, flangeway drains will be required at sag points within the vertical alignment to reduce the potential for derailments as water trapped in the flangeway freezes during winter months.

Another concern is the condition of the rails, crossties, and rail fastening system. Examination of the existing rail at the inspection pits revealed a very thin rail head, approximately ½ inch at both locations. This is significantly thinner than the head thickness of a new rail, which is 1-1/4 inches for 115RE rail. Re-use of the existing rail would not be allowed per Federal Railroad Administration (FRA) track safety standards because the level of wear exceeds the allowable limits. Replacement of the rails would require removal of paving stones. It is difficult to judge the condition of the crossties based on an inspection of four ties. Even if you assume that fifty percent of the ties are in good condition, you would have to replace half the ties, the other half would not have
a full service life available. Furthermore, use of wood crossties in embedded track will not provide adequate protection against stray current corrosion unless further measures are introduced. These could include installation of a protective rubber sleeve around the rail (rail boot) or some other exotic measures however most of the alternative solutions are not compatible with track supported on wood ties.

Adjustment of the track profile and replacement of rails and crossties will necessitate removal of paving stones, rails, crossties, and mortar between ties. During removal, an accurate assessment can be made of the base material supporting the track. As the inspection pits revealed there is a good possibility that much of the support material will either need replacement or rehabilitation. In essence, rehabilitation may require removal of most of the existing track and substructure to allow component replacement.

The track structure designed for University Avenue was typical for streetcar systems during the early 20th century. Streetcars were lighter, and rubber tire vehicles that were allowed to drive on the trackway exerted significantly lighter wheel loads. In today's environment the existing track structure design, even if rehabilitated, would not provide adequate service life compared to new track. New track, using a concrete support slab with concrete embedment should provide upwards of 50 years of service life. Although difficult to assess, we cannot foresee a service life anywhere near that length for rehabilitated track. The cost of rehabilitation may be 75% or more of the cost of new track. This cost will be applied to a design that may not be adequate under current operating conditions. Furthermore, as the re-used components wear out, replacement will be difficult and may require disruption of service.

4.0 Recommendations

In summary, re-use of the existing track is not recommended. This recommendation is based upon the following elements:

1. Most of the alignment would have to be raised to meet existing street grades, resulting in removal of embedment pavers, rails and crossties.
2. A considerable amount of drainage facilities would be required if the profile is raised only within the limits of grade crossings.
3. All of the rail will require replacement because the existing rail exceeds wear limits specified in the FRA track safety standards. Replacement should include provisions for stray current corrosion isolation (rail boot) as well as rail fastening system.
4. It is likely that the majority of crossties will require replacement.
5. The track support foundation (ballast, sub-ballast and subgrade) would require a significant amount of rehabilitation and/or replacement.
6. If existing components were re-used they would need to be replaced much sooner than if new materials were installed. The replacement process could result in lost patronage due to service disruptions necessitated by replacement of worn track components. Additionally, a significant level of community impacts would result during this process.