mds technologies, inc.

September 25, 2017

City of Fairbanks
800 Cushman Street
Fairbanks, AK 99701

Attention: Andrew Ackerman
Environmental Manager

Re: City Sidewalk Inventory and Condition Assessment Project Report

Dear Sir:

MDS Technologies, Inc. (MDST) is pleased to provide the results of the Sidewalk Inventory and Condition Assessment Project. An overview of the project scope and presentation of the key findings can be found in the attached document. GIS data files containing the detailed data resulting from the project have been supplied to the City via e-mail.

Please contact me if any questions arise regarding the contents of the report.

Thank you for the opportunity to provide our services to the City.

Sincerely,

MDS Technologies, Inc.

Trevor Triffo

Trevor T. Triffo
Principal

Attachment

Project Overview and Details of Data Collected and Items Delivered to the City

Project Overview

MDS Technologies, Inc. (MDST) was hired by the City of Fairbanks (City) to inventory and assess the condition of approximately 55 miles of City-maintained sidewalks. To achieve this, a GPS-enabled Garmin VIRB 30 camera was mounted to the handle bars of a bicycle. The camera was used to capture full high-definition (1080p) digital video imagery along each sidewalk segment. A GIS Shape file showing the location of the sidewalks was provided by the City.

The digital video was then analyzed in an office environment to capture the following information:

1. Sidewalk Damage Locations
2. Sidewalk Ramp Issue Locations
3. Driveway Ramp Issue Locations
4. Sidewalk Encroachment Locations

Each of these items are described in detail below.

The sidewalk damage data was used, in conjunction with other factors, to determine a priority list for sidewalk repairs. The cost to repair each sidewalk segment was estimated based on the number of panels identified as requiring repair and a unit replacement cost provided by the City.

An iPad-based application that City staff can use to perform future sidewalk inspections is being provided by Rival Solutions.

Sidewalk Linework and Repair Priorities

Sidewalk GIS File Geometry

MDST acquired a GIS shape file depicting the City's sidewalk network from the City. This was created by converting CAD drawings into a GIS file. Several actions were performed to improve the accuracy and completeness of this file:

1. The geometry of individual line segments was improved by adding or removing vertex points to make the line segments less curvy and better represent the actual shape of the sidewalk segments themselves;
2. Line segments were split or combined when necessary so that each line segment represented a sidewalk block face; and,

3. Line segments were added so that sidewalks that were not represented in the original file were represented in the updated file.

The City owns at total of 56.34 miles of sidewalk. Of this total, 3.78 miles has an Asphaltic Concrete surface or is on a bridge deck. These sidewalks were inventoried, but their condition was not assessed. The remaining 52.56 miles of sidewalk have a Portland Cement Concrete surface.

Sidewalk GIS File Attribute Data

The attribute table for this file contains several fields with important information:

1. Segment ID - This field contains a unique ID number assigned to each sidewalk segment by MDST.
2. Sidewalk Length – The length of the sidewalk segment in feet, acquired by determining the length of each line segment using GIS tools.
3. Count – The number of damaged panels that occurred on the segment at the time of evaluation.
4. Severity – The number of damaged panels that occurred on the segment that were considered to be severely damaged.
5. Usage – The use of adjacent land. This data was assigned as shown in Table 1. Assignments were made based on ortho-photography available from the City and other sources such as Google and Bing maps, and from knowledge gained by MDST staff during the time of the field work.
6. Priority Factor – A multiplier assigned to each sidewalk segment based on Usage. These values were assigned as shown in Table 1. These values, while somewhat subjective in nature, were designed to assign priority to sidewalks in high profile/high traffic areas of the City.

Table 1
Usage and Priority Factor Assignment

Usage	Priority Factor
Local Residential	1.0
High Volume Residential	1.5
Hospital	1.5
Parks/Recreation	1.5
Commercial	2.0
Central Business District (CBD)	2.5

7. Priority Score – A calculated figure that can be used to prioritize sidewalk repair. This figure is weighted by sidewalk length to account for the density of damaged panels per 100 feet of sidewalk length.

8. Ranking – Used to assign sidewalk segments to a ten segment Priority Group based on Priority Score.
9. Unweighted Priority Score – The Priority Score, not weighted to account for the density of damaged panels.
10. Estimated Repair Cost – Based on a unit price of $100/linear foot and assuming a 5-foot panel length. Calculated by multiplying the number of damaged panels by $500.

Priority Score Calculations

The Priority Score was calculated using the following formula:

Priority Score = 5 * (Count + Severe) * Priority Factor* 100/Segment Length

Where: Count = the number of damaged panels on a segment
Severe = the number of excessively damaged panels on a segment
Priority Factor = assigned as shown in Table 1
Segment Length = the length of the sidewalk segment in feet

If a sidewalk does not contain any damaged panels, the Priority Score is zero. The Priority Score increases as the number of damaged panels increases. Excessively damaged panels are also included in the overall damage count, so they are weighted double in the Priority Score calculation. Also, a higher segment Priority Factor increases the Priority Score.

For example, if a 300-foot sidewalk segment in the CDB was determined to have 6 damaged panels, 3 of which were considered severely damaged, the Priority Score for that segment would be:

Priority Score = 5 * (6 +3) * 2.5 * 100ft /300ft = 37.5

The Unweighted Priority Score is not weighted to account for panel damage density. The formula to calculate this score is:

Unweighted Priority Score = Priority Score = 5* (Count + Severe) * Priority Factor

The Priority Score takes advantage of a systematic evaluation of the condition of all City sidewalks and applies the same selection criteria to all sidewalk segments to determine maintenance priorities. However, the Priority Score is simply a relative indicator to assist City staff with this determination. Altering the equation would change the relative priorities, and other factors not considered by the formula may also come into play when determining a maintenance plan.

A GIS line feature class shape file named SW_Priorities containing the above information was supplied to the City. A map showing the top fifty locations for sidewalk repair based on the Priority Score is shown in Figure 1.

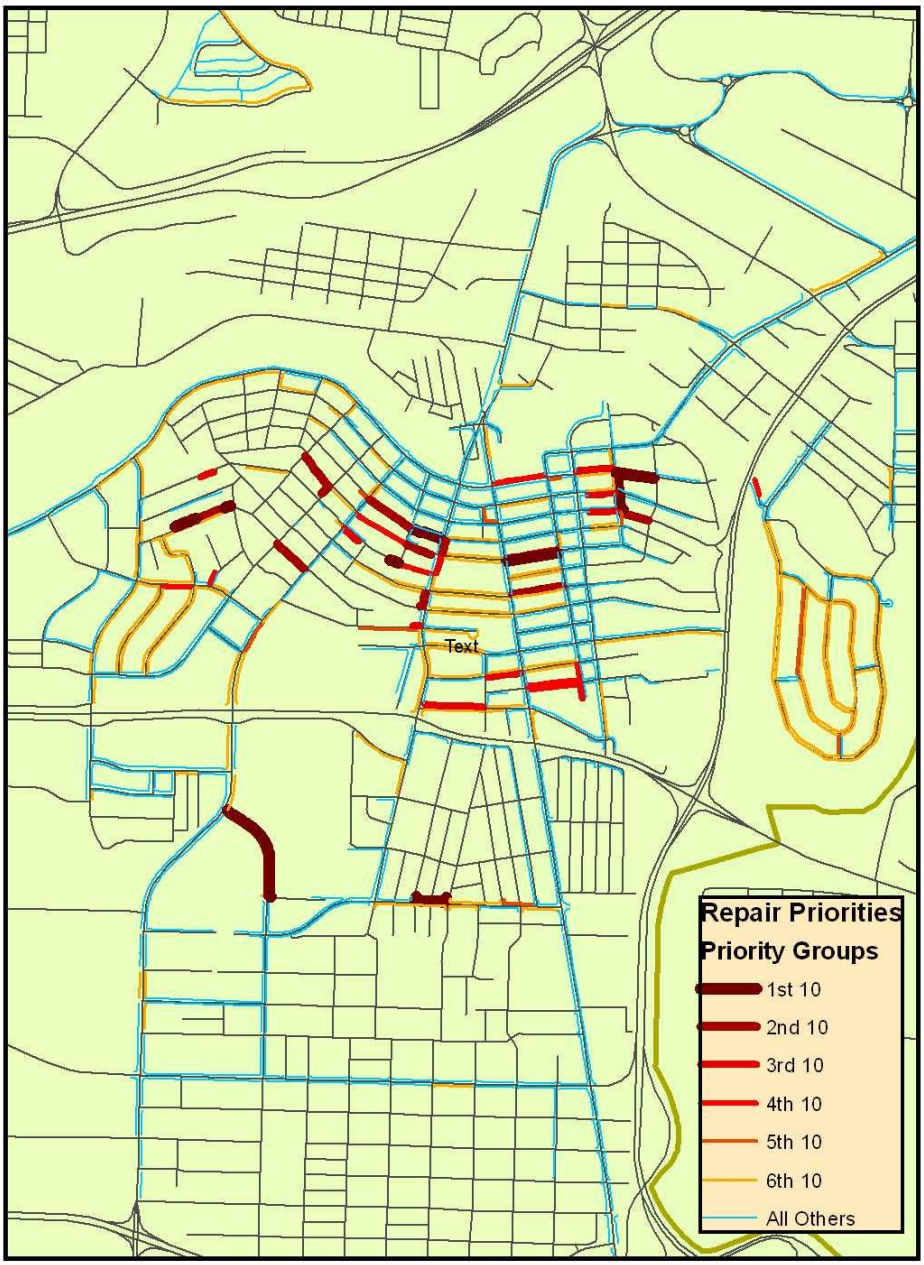

Figure 1: Sidewalk Repair Priority Groups

Sidewalk Repair Costs

The City supplied a sidewalk repair unit cost of $100/per linear foot. Assuming a panel length of 5 feet, the cost to replace a sidewalk panel is $500. Multiplying this figure by the number of damaged panels gives the repair cost for a sidewalk segment.

Based on these figures, the cost to repair the ten segments in Priority Group 1 is $54,000. The estimated cost to repair damaged panels for the entire City is $321,500. Note that this figure may underestimate the actual cost because in some cases it may be desirable to replace adjacent panels to restore grade, or replace addition panels exhibiting distress while working on a segment. Also, this figure does not include costs to install ramps at intersections where none currently exist, retrofit warning panels into existing ramps, address driveway ramp issues. It also does not include the cost of relocating objects creating sidewalk encroachment issues.

Sidewalk Damage Locations

Sidewalk damage locations were identified through a review of the digital video collected in the field work phase of the project. The following types of sidewalk damage were identified:

1. Cracked – Transverse (primarily) or Longitudinal crack.
2. Corner Break – Diagonal crack creating a roughly triangular shaped piece.
3. Differential Elevation – Heaving or sinking at interface between two panels.
4. Shattered – cracked into 4 or more pieces.
5. Spalled – includes apparent snow plow damage.
6. Missing Slab – Limited to just a few slabs. Does not include large gaps (i.e. several properties or more) between sidewalk segments along a street.

Discussions were held with City staff to review various examples of distressed panels to determine the point at which damage was considered significant enough to identify. The general rule of thumb was that only panels that deviated significantly from the original flat surface plane were identified. Slightly distressed panels that did not vary significantly from the original plane of the panel surface were not identified.

Panels that were considered excessively damaged were flagged as such. This includes panels with very significant surface distortion and/or elevation differences between panels or pieces of panels.

A GIS point feature class shape file named SW_Damage containing the location the above information was supplied to the City.

Sidewalk and Driveway Ramp Issue Locations

Sidewalk and driveway ramp issue locations were identified through a review of the digital video collected in the field work phase of the project. The following types of issues were identified:

Sidewalk Ramps – The location of sidewalks end points at road intersections that did not have a ramp were identified. The location of sidewalks with an existing ramp but no warning panel were also identified.

Driveway Ramps – The location of driveway ramps considered excessively steep and/or creating an excessive transverse slope were identified.

A GIS point feature class shape file named SW_Ramp_Issues containing the above information was supplied to the City.

Encroachment Locations

Locations where various obstacles result in a sidewalk being overly narrow were identified through a review of the digital video collected in the field work phase of the project. The types of obstacles that were encountered were:

1. Utility Pole
2. Street Lighting
3. Traffic Signal
4. Hydrant
5. Traffic Sign Post

A GIS point feature class shape file named SW_Encroach containing the above information was supplied to the City.