Traffic Signs Research Study for Miami-Dade County

Executive Summary

Prepared for

Miami-Dade County

Metropolitan Planning Organization (MPO)

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EXECUTIVE SUMMARY

BACKGROUND

The years 2004 and 2005 were very active regarding hurricane activity in the Atlantic basin. Miami-Dade County experienced damages due to hurricanes Katrina and Wilma within a time span of barely two months. A significant proportion of street signs failed when these two hurricanes impacted Miami-Dade County and its surrounding communities. A traffic sign is considered as failed if it is leaning by more than 15 degrees from its vertical axis. Most of the street signs failed at their foundations, as shown in Figure A. This fact raised the need to find effective alternatives to secure traffic signs and reduce the number of damaged signs during moderate hurricanes. By improving the wind force withstanding capability of street signs, the costs associated with their repair and/or replacement are considerably reduced and the county's valuable resources can be concentrated towards other aspects of the recovery process.

Figure A: Stop signs damaged in Miami-Dade County during Hurricane Wilma

Currently, the installation process for a standard street sign can be performed by one crew member in less than 30 minutes. The goal of this study is to evaluate a set of feasible

alternatives for improving withstanding capabilities of the street signs without making the installation process more difficult.

EXISTING METHODOLOGIES

The AASHTO 2001 standards are the most suitable design standards to evaluate support structures, especially those located in hurricane prone regions of the United States. This is because the wind loads used in the AASHTO 2001 standards included hurricane wind effects. For the evaluation of existing foundations, the methodologies suggested in AASTHO 2001 were applied.

The Florida Department of Transportation (FDOT) standard index and Miami-Dade County design standards were also reviewed in this study. Miami-Dade County standards suggest the use of soil plates in the installation of street signs in case of weak soil.

The AASHTO-AGC-ARTBA guide to small support hardware was also reviewed. This guide provides specifications for concrete foundations and for direct burial installation of street signs. The AASHTO guide is expected to change in the near future in order to incorporate the upgrades listed in the AASHTO 2001 standards.

POTENTIAL ALTERNATIVES

Based on the literature review of existing methodologies and the practices suggested for the installation and support for traffic signs, four major alternatives are proposed in this study in addition to the baseline alternative of taking no action: (1) increase installation depth, (2) use soil plates, (3) use concrete foundations, and (4) use third party hardware (drive anchors). The alternatives were evaluated in terms of the ultimate wind load the sign support is capable of withstanding before the soil foundation fails. The analysis was performed using different soil characteristics of both clay and sand, which are the most general soil types. Combinations of alternatives such as increasing installation depth and concrete foundations yielded the best results. The results of the evaluation of different alternatives are shown in Figure B for sand and in Figure C for clay.

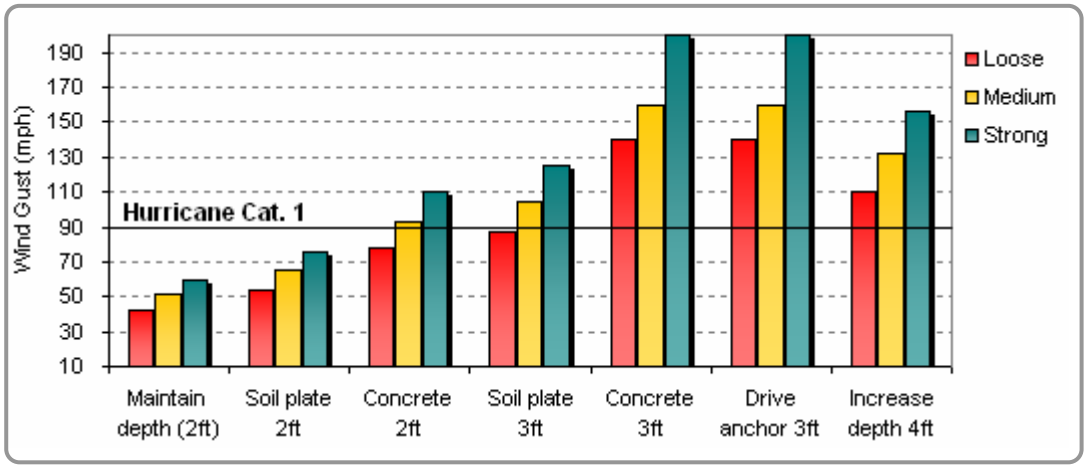

Figure B: Ultimate wind load resistance for improvement alternatives in sand

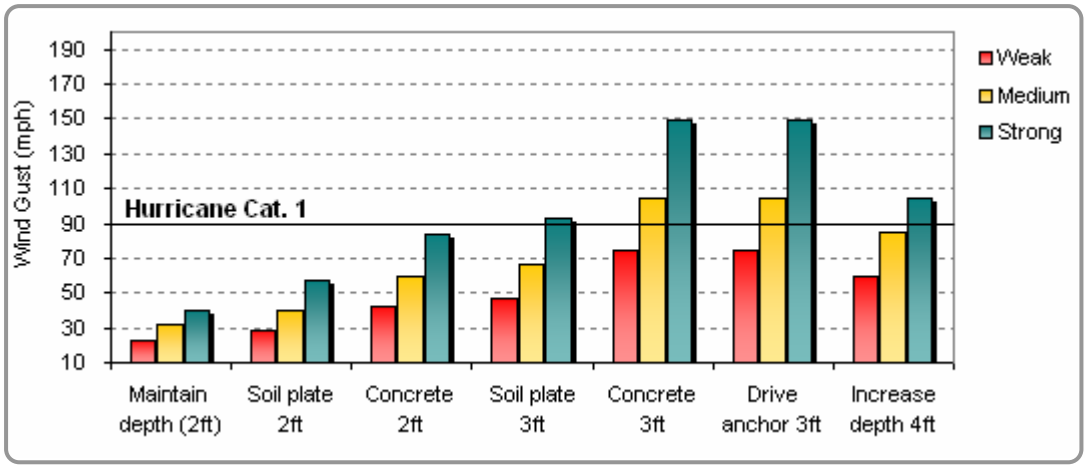

Figure C: Ultimate wind load resistance for improvement alternatives in clay

CONCLUSIONS AND RECOMMENDATIONS

This study covered the evaluation of proposed major actions that can be taken to improve the hurricane-withstanding capabilities of Miami-Dade County's traffic signs. A primary obstacle to an adequate sign installation is the presence of buried utilities (wires, cables, water mains etc.) within the right-of-way. In Florida, buried utilities can be found 30 inches below the surface, which has led Miami-Dade County to install traffic signs at a depth of 24 inches (2 ft.). In general, the soil at that depth is not strong enough to provide

adequate support to the signposts during a major tropical storm. The following recommendations are intended to improve the withstanding capabilities of street signs as well as provide directions for further analysis:

- For the embedment depth of 2 ft., the top two alternatives from the four major proposed options are drive anchors and concrete foundations. Drive anchors provide withstanding capabilities equivalent to those of concrete foundations. Concrete foundations were consistently ranked at the top of the studied options in terms of ultimate wind resistance for all soil types. Therefore, drive anchors can be used in all types of soils with similar results to those of concrete foundation. The main advantage of drive anchors is that the installation time is significantly less than what is required to cast a concrete foundation for a street sign. The installation time for a sign with drive anchor is approximately 25 minutes, whereas it takes around 60 minutes for a sign with concrete foundation. It is important to note that if the foundation depth is greater than 2 ft., then the selected two alternatives can perform even better.

- The most likely events for Miami-Dade County during any particular year are 0 hurricanes or, at most, 1 hurricane of Category 1. The combination of these two scenarios accounts for 90 percent of the possible cases for any year. If an improvement alternative for traffic signs on hurricane-withstanding capabilities is designed based on the above-mentioned scenarios, then it will reasonably reduce the number of failed signs during a hurricane.

- By promoting the use of regulations such as those in the Utility Accommodation Manual where utilities cannot be located within 3 ft. of the right-of-way, the problem of installation depth might be overcome for new developments.

- The results obtained from this study might be improved by performing physical testing of the proposed alternatives. Custom formulas or spreadsheets can be obtained for different soils and different sign support designs to allow for a better assessment of the performance of the alternatives for improving the wind resistance capability.