TRAFFIC SIGNS RESEARCH STUDY FOR MIAMI-DADE COUNTY

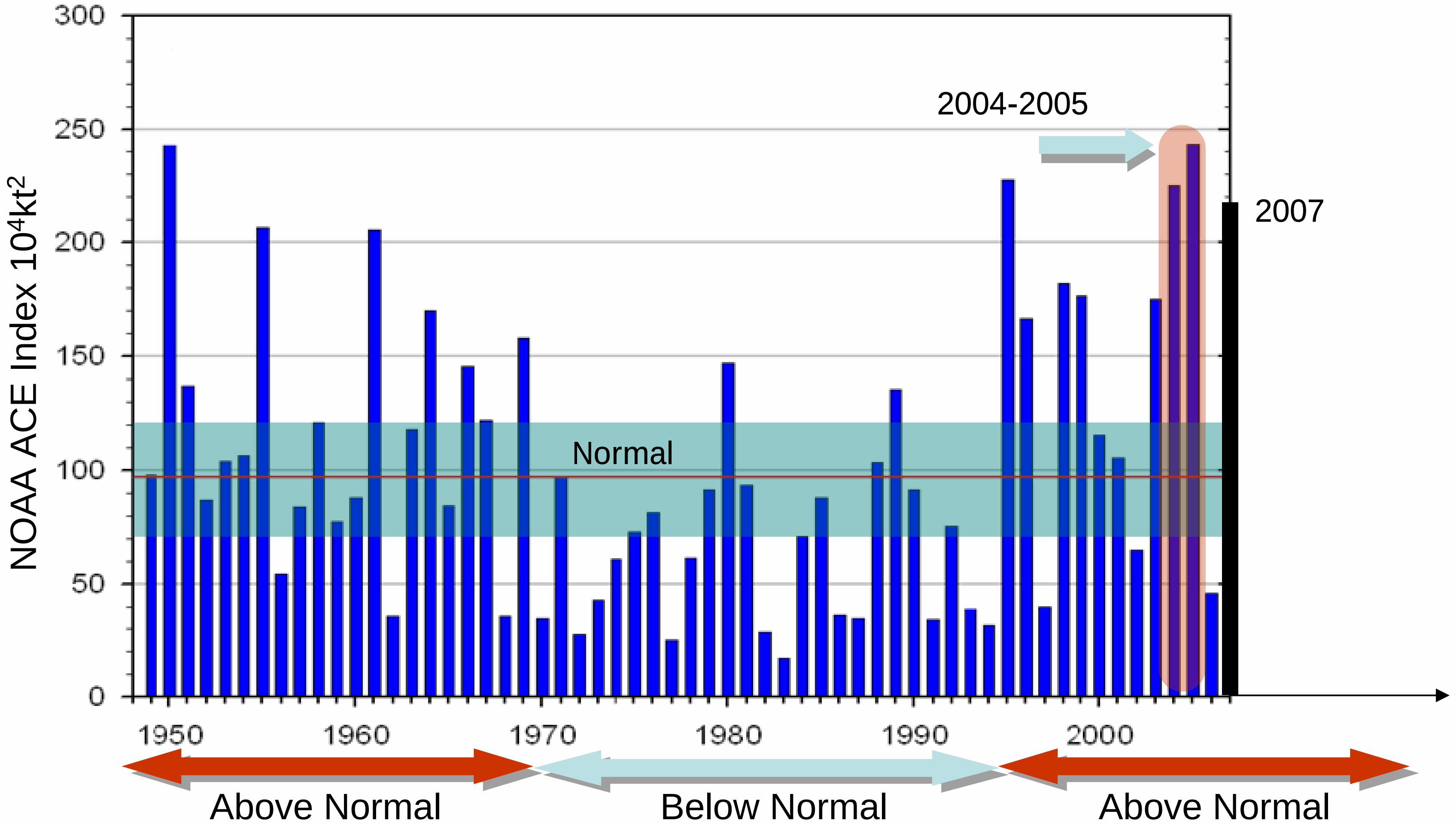
Pei-Sung Lin, Ph.D., P.E., P.T.O.E.
lin@cutr.usf.edu

Aldo Fabregas A.
fabregas@cutr.usf.edu

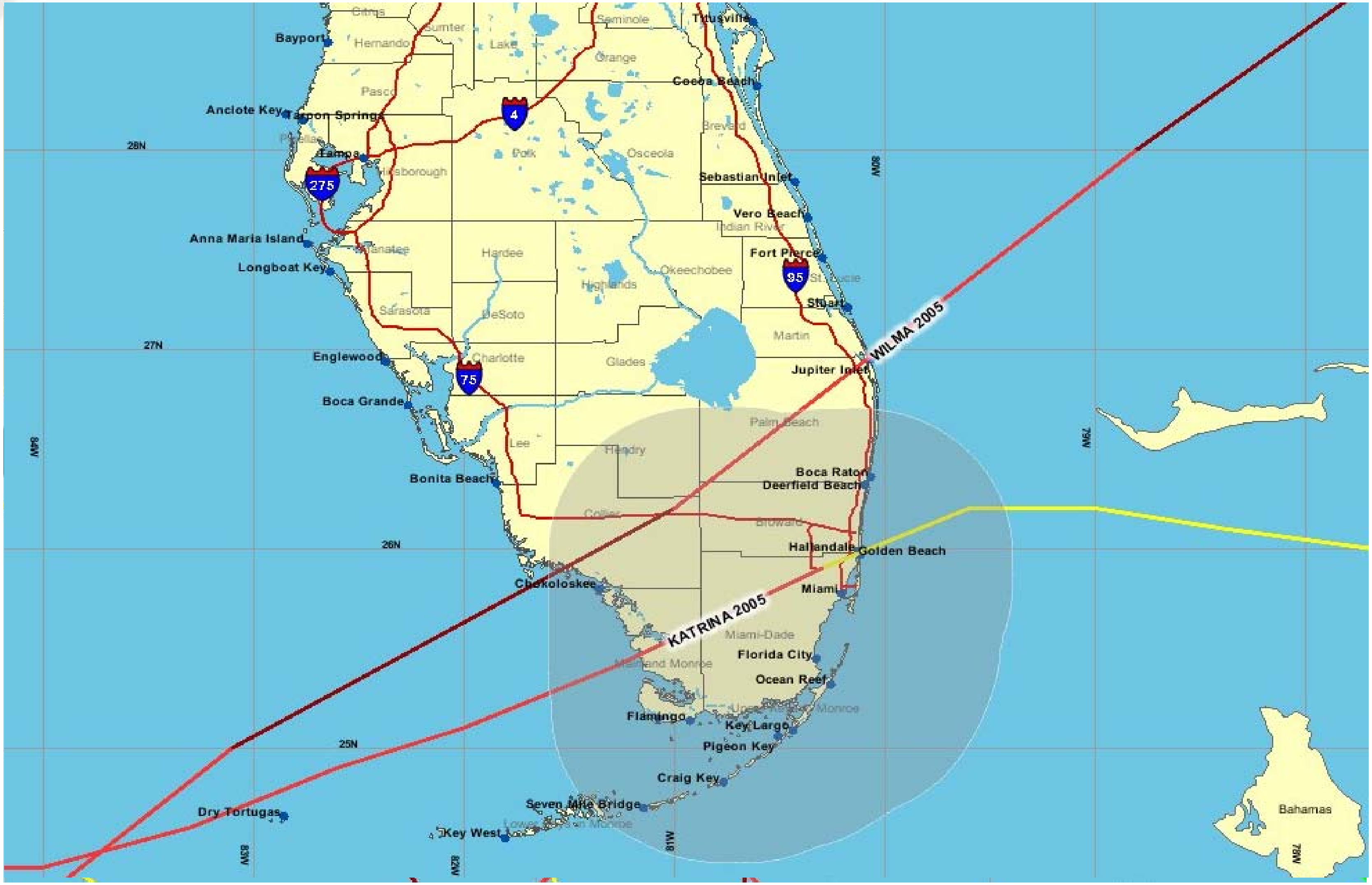
MIAMI-DADE MPO
Miami-Dade
Metropolitan Planning Organization

Center for Urban Transportation Research
University of South Florida
CUTR

Hurricane Activity

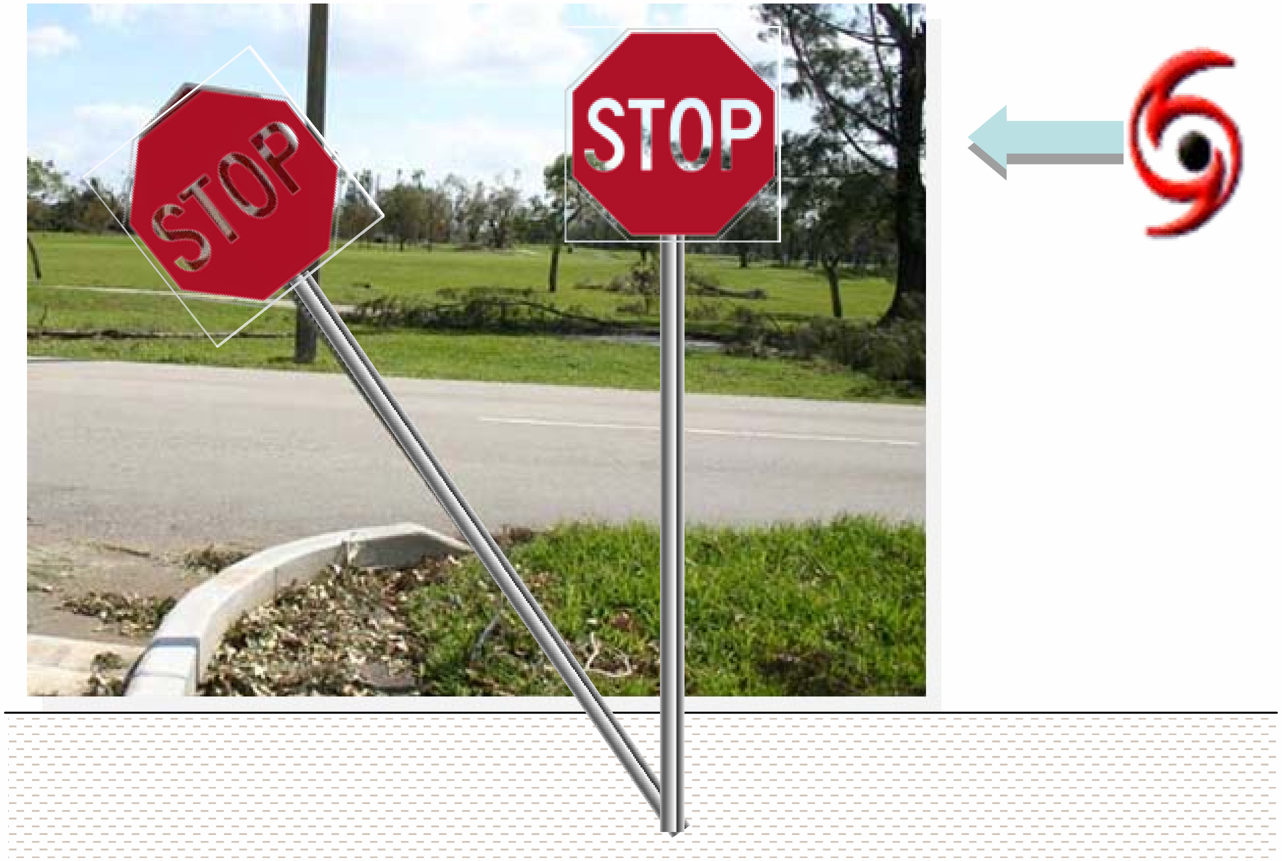


2004-2005 Hurricane Season



Background

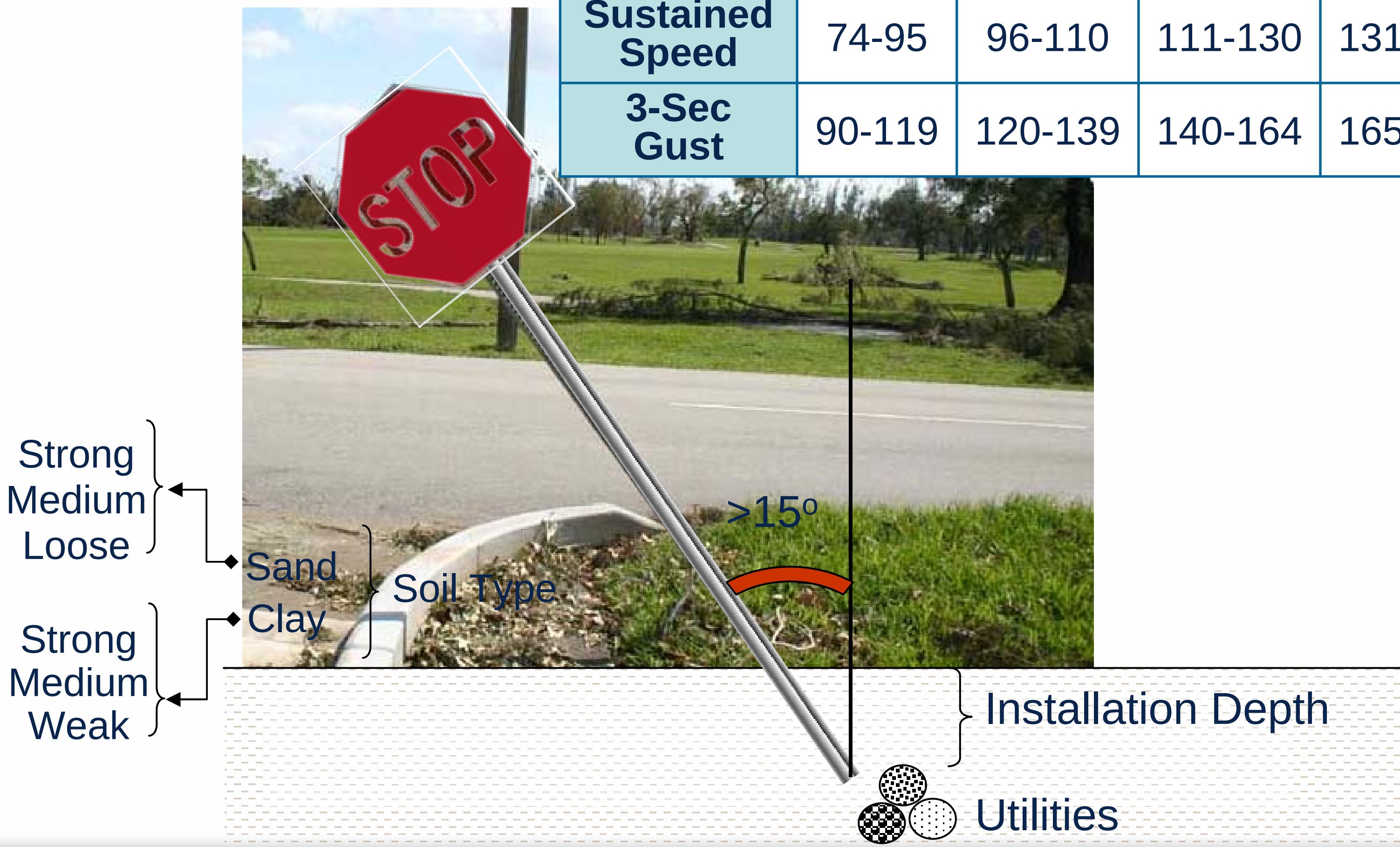
A considerable proportion of traffic signs failed in the 2004-2005 season



Problem Description

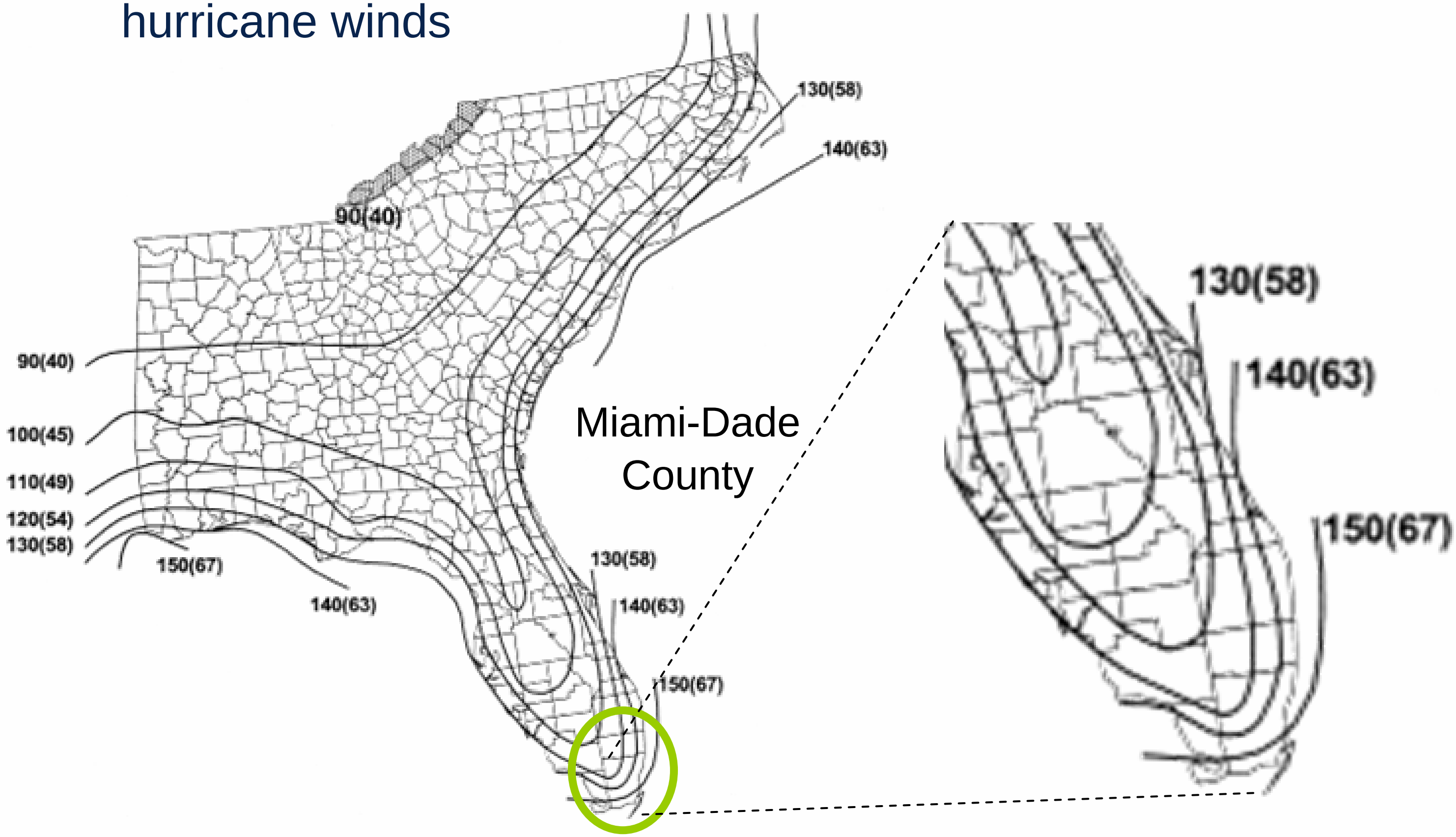
Wind Speed

	Cat1	Cat2	Cat3	Cat4	Cat5
Sustained Speed	74-95	96-110	111-130	131-155	>155
3-Sec Gust	90-119	120-139	140-164	165-194	>194



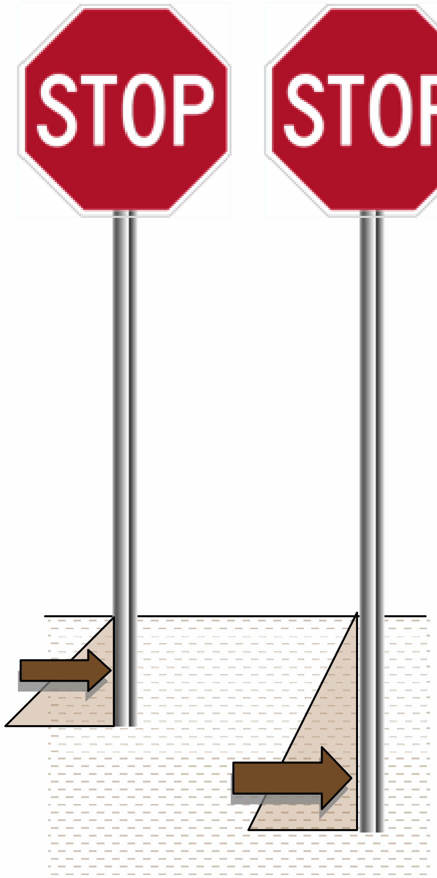
Design Standards

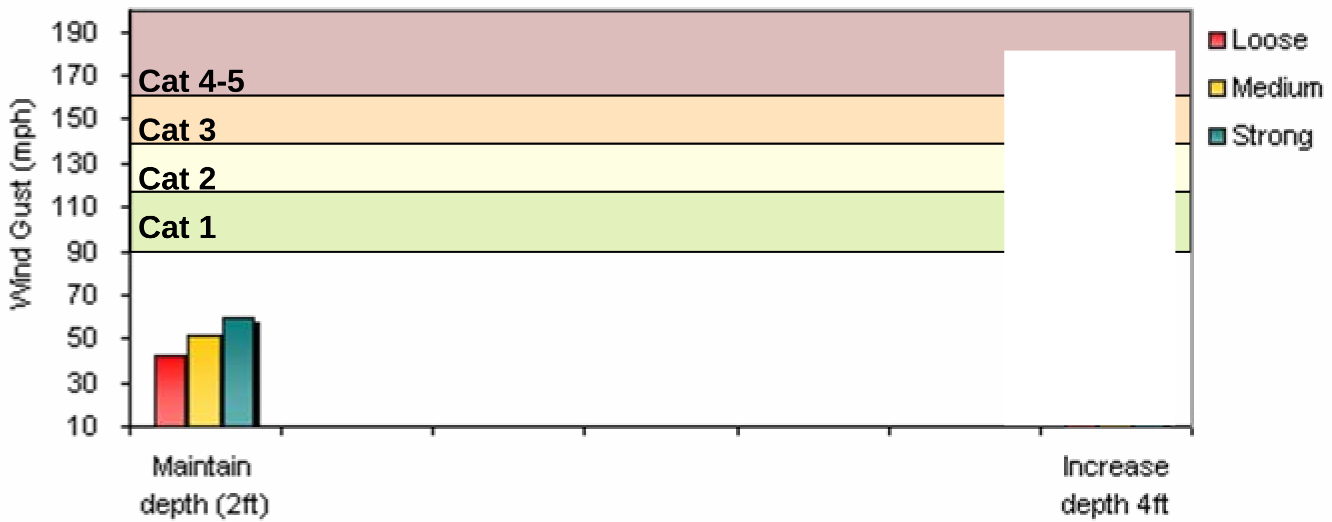
AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals 2001 includes provisions for hurricane winds



Proposed Alternatives

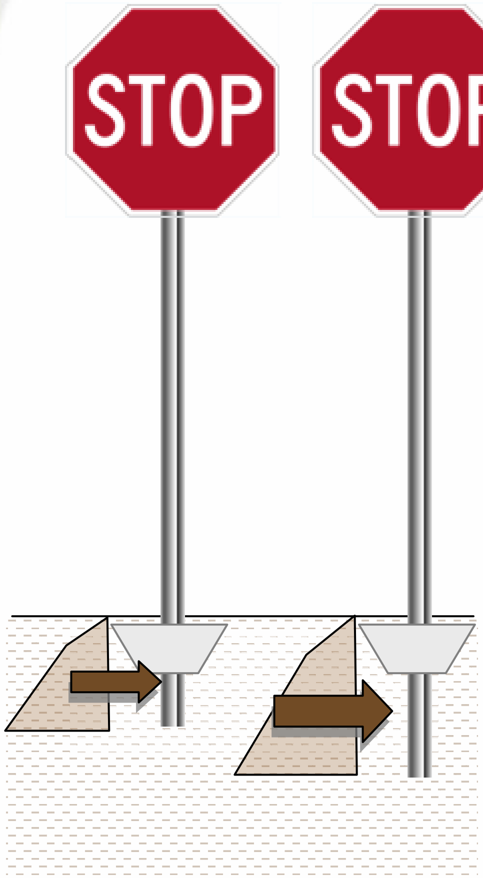
Increase Installation Depth

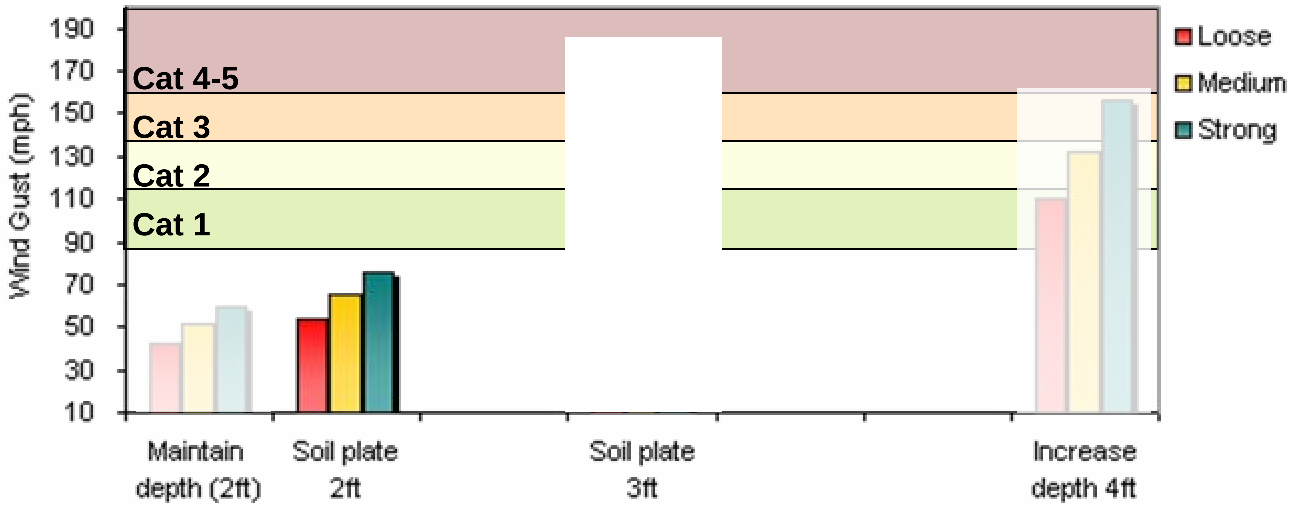




Proposed Alternatives

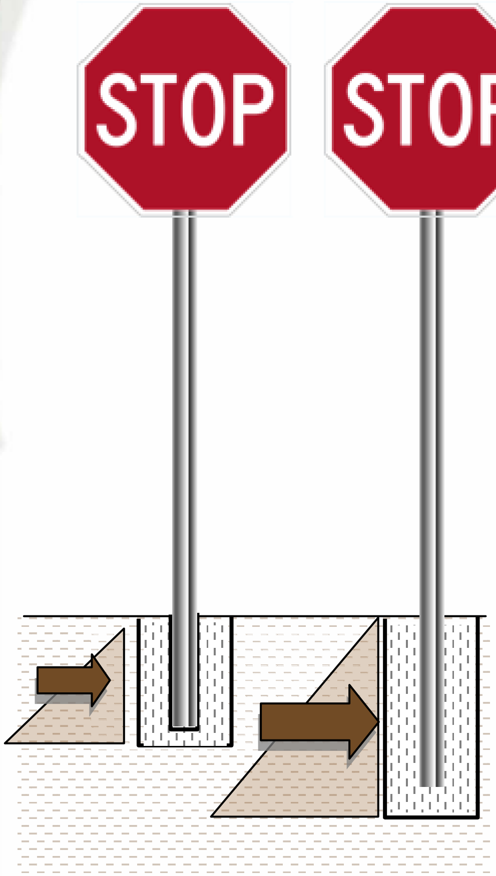
Soil Plates

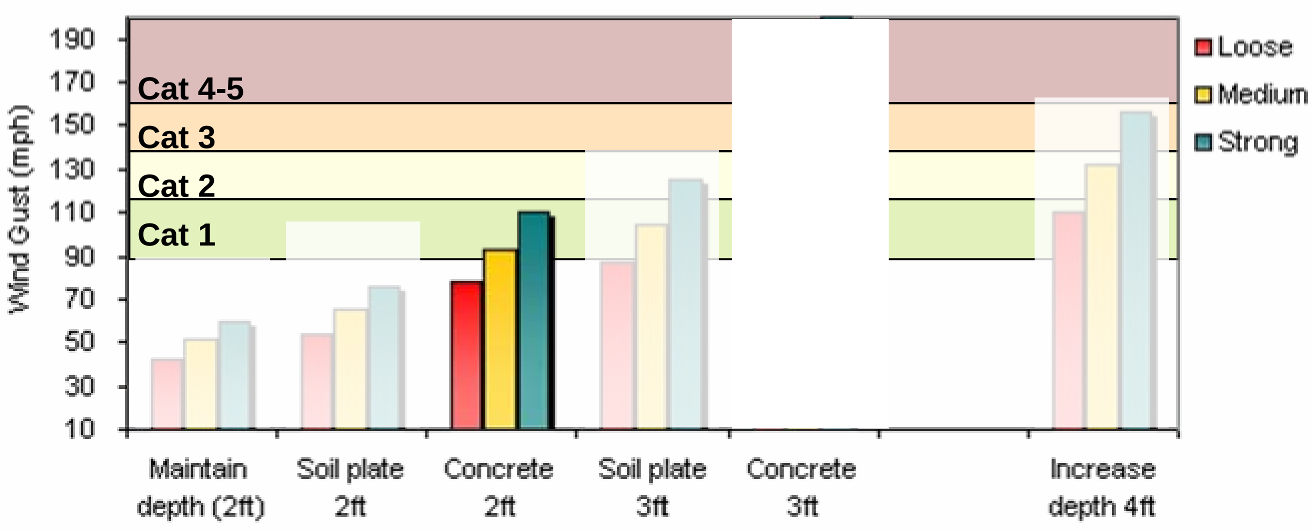




Proposed Alternatives

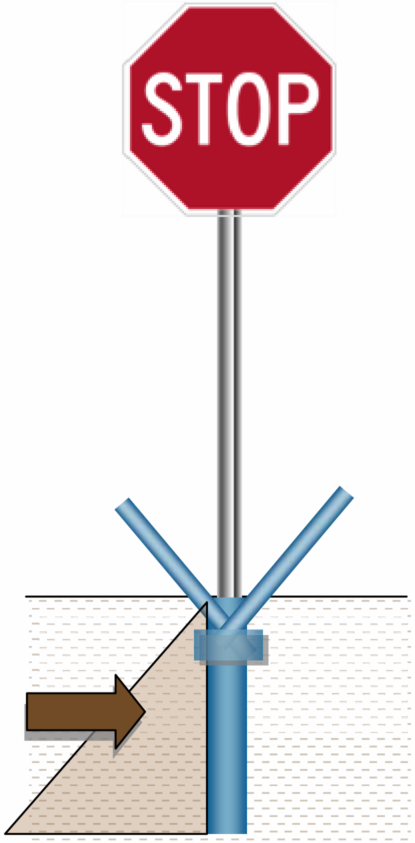
Concrete Foundation

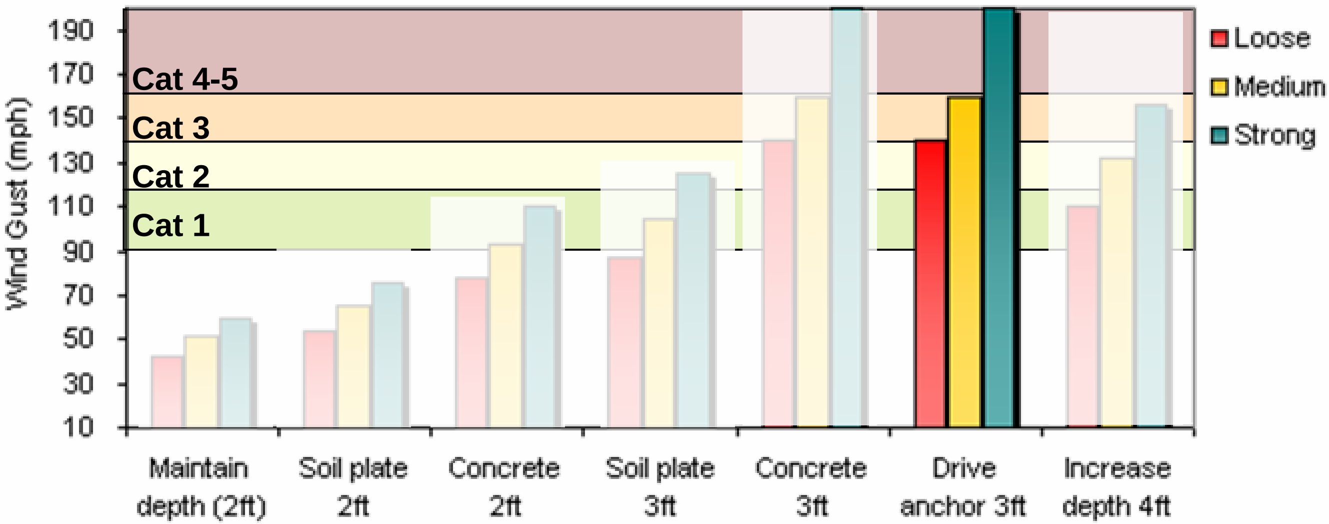




Proposed Alternatives

Drive Anchors



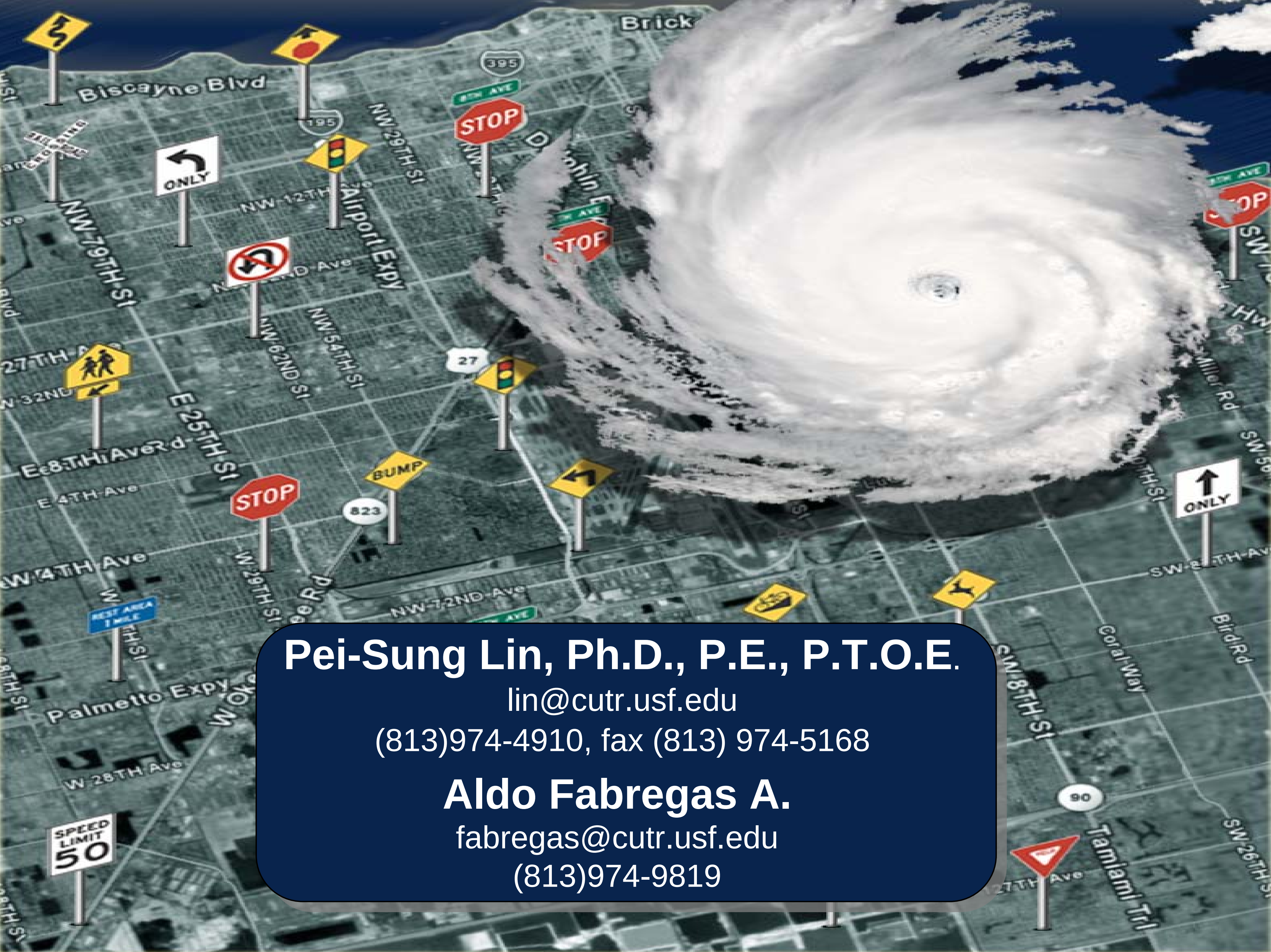


Conclusions and Recommendations

- Revise the local standards against the 2001 AASTHO standards and take the appropriate actions
- Design traffic signs capable of withstanding at least Category 1 hurricane wind which accounts for 90% of the scenarios for Miami-Dade County
- For the installation depth of 2 ft., the top two alternatives are concrete foundation and drive anchors
- The main advantage of drive anchors is that the installation time is significantly shorter than that required for concrete foundations
- If the installation depth is greater than 2 ft., then the selected two alternatives can perform better

Recommendations for Improvements

- Perform physical testing of the proposed alternatives. In the case of the drive anchors, testing 2, 3 or 4 anchor blades may be helpful
- Promote the regulations in the Utility Accommodation Manual which states that utilities should not be placed within 3 ft. of the right-of-way
- The purchase or rental of ground penetrating radars could be considered as an alternative to safely bypass the process of requesting horizontal clearance (verify with SSOCOF)
- The implementation of a GIS-based signage inventory will allow to relate sign failures with soil and wind data



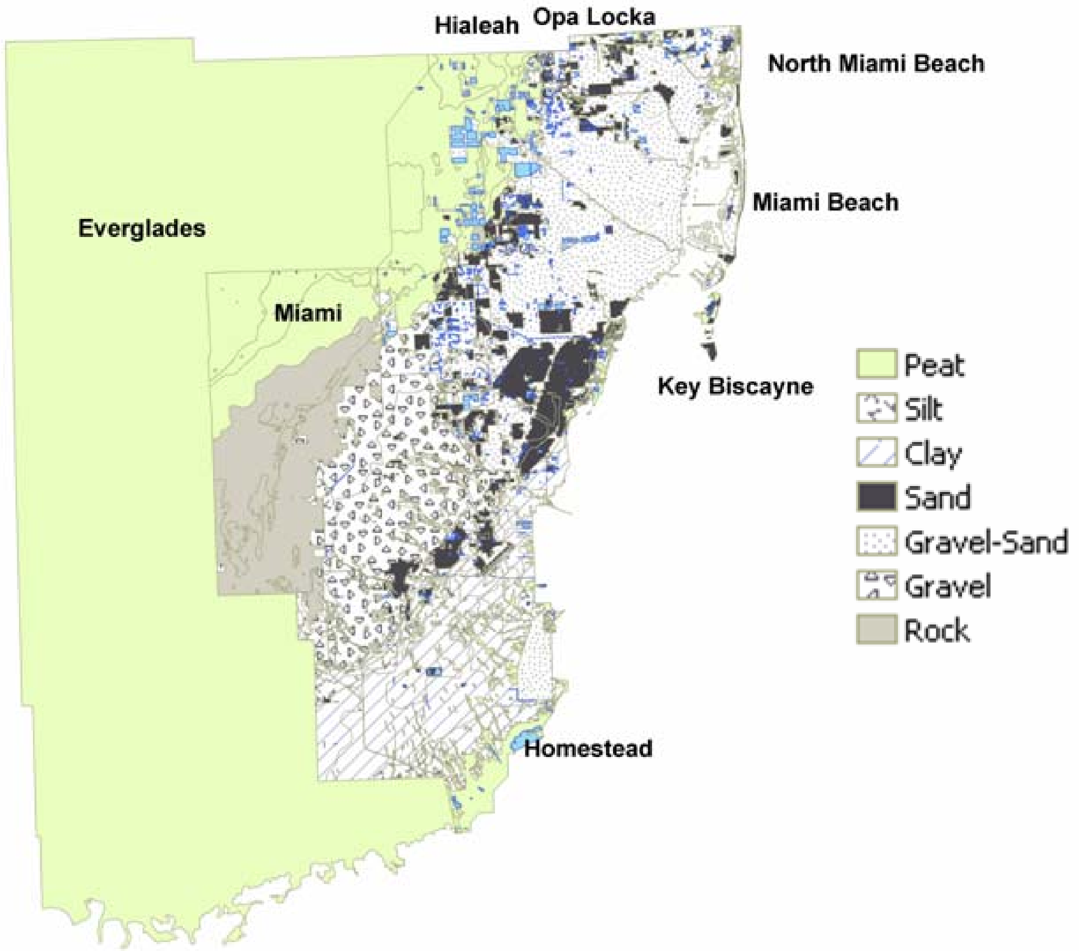
Pei-Sung Lin, Ph.D., P.E., P.T.O.E.
lin@cutr.usf.edu
(813)974-4910, fax (813) 974-5168

Aldo Fabregas A.
fabregas@cutr.usf.edu
(813)974-9819

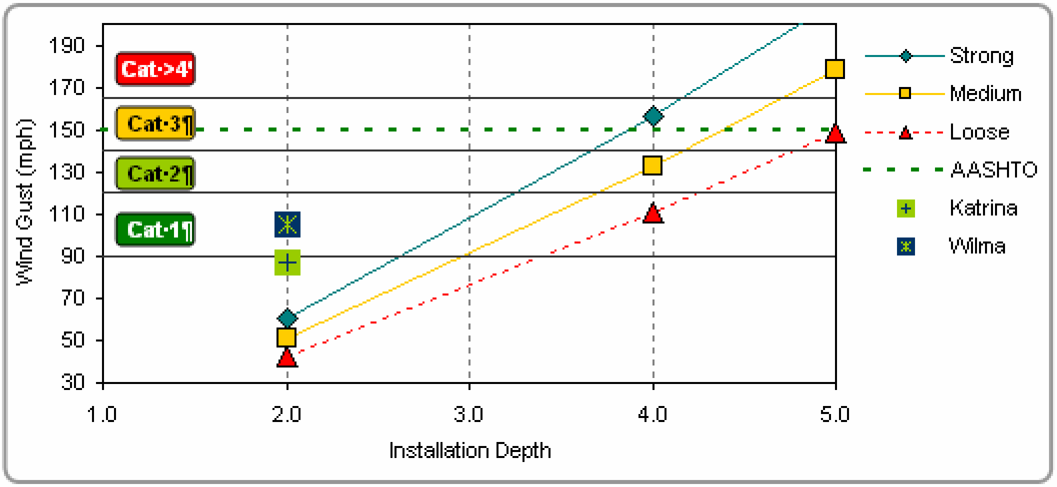
Appendix

- Soil Map
- Charts for Installation Depth
- Charts for Soil Plates
- Charts for Concrete
- Drive Anchor Picture
- Cost Effectiveness Table
- AASHTO Formulations
- Hurricane Probabilities
- Proposed Testing Procedure
- Wall of wind

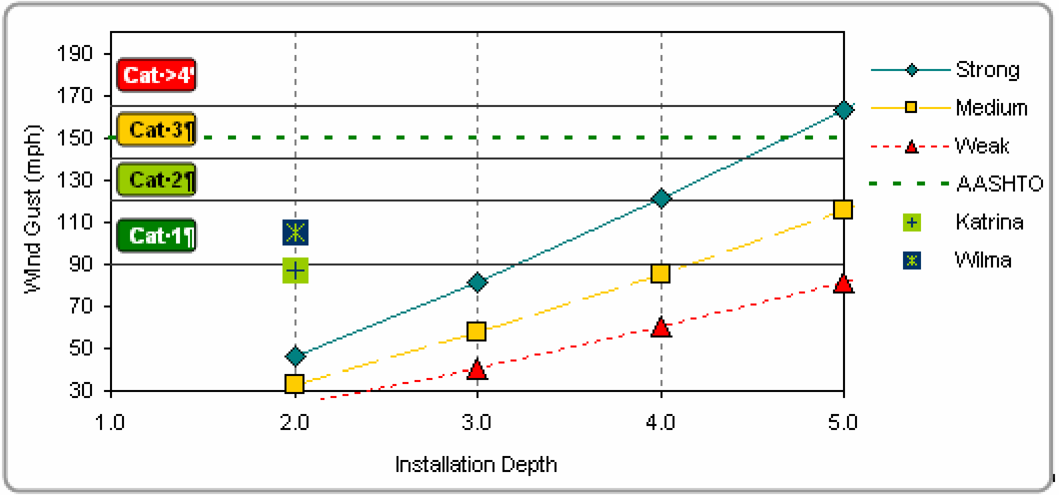
Miami-Dade Soil Survey



Charts

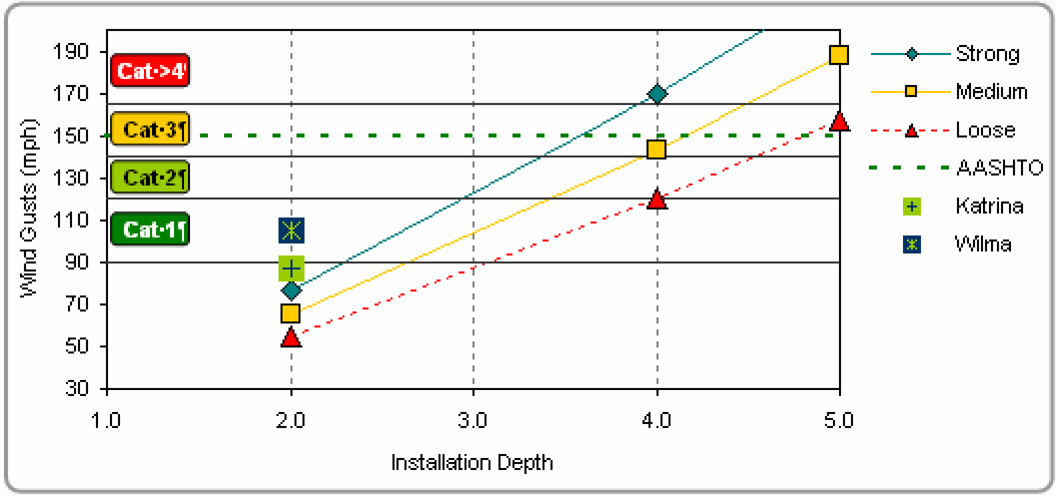


Increase installation depth in sand

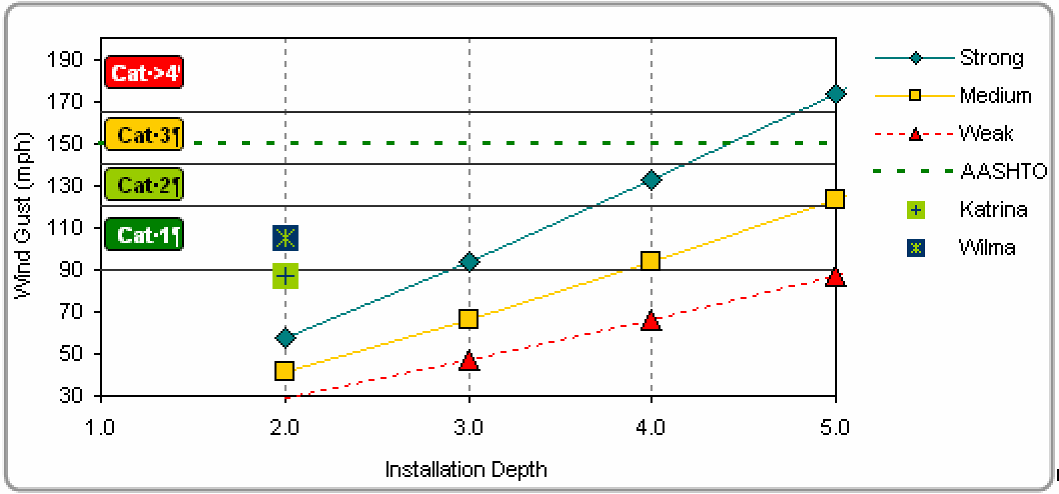


Increase installation depth in clay

Charts

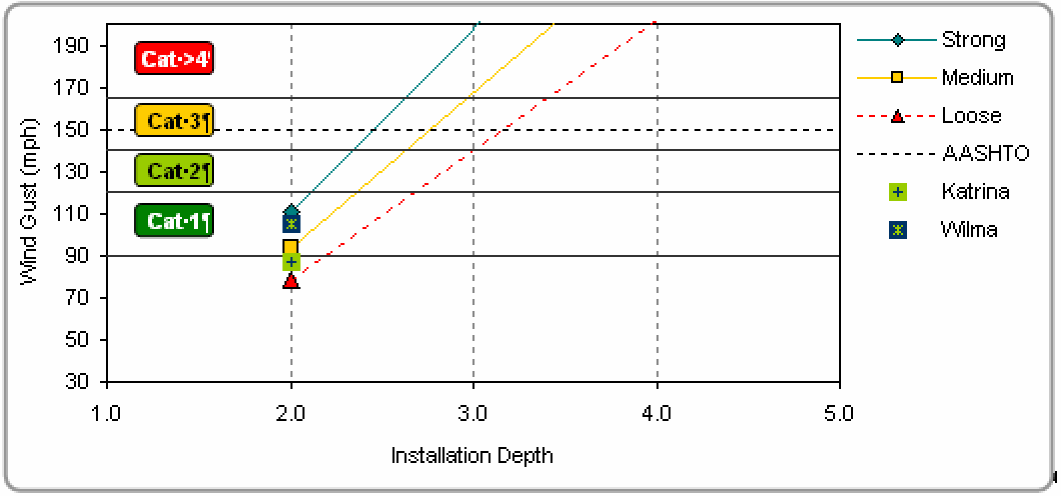


Soil plates in sand

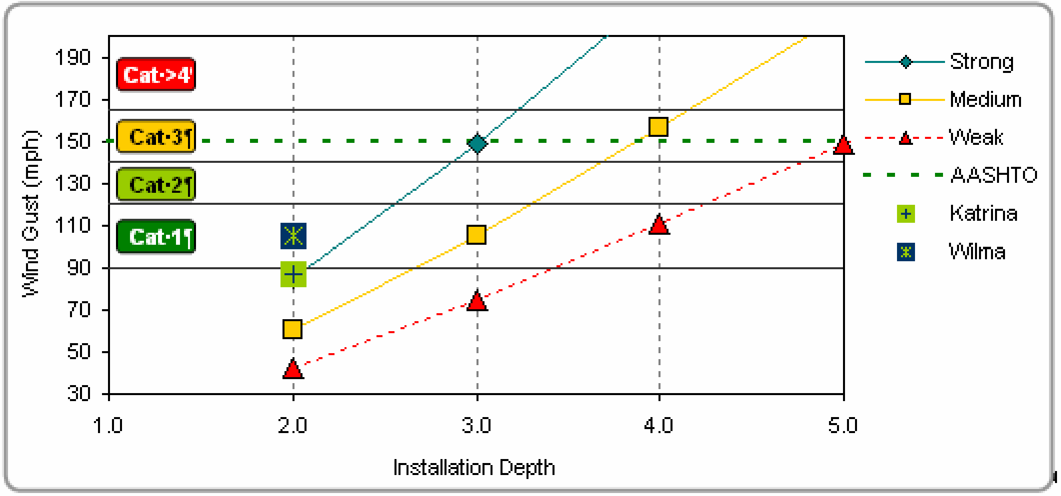


Soil plates in clay

Charts



Concrete in sand



Concrete in clay

Cost Effectiveness

Rank	Soil	Action	CE (mph/$)
1	Loose	Drive anchor 3ft	8.6
2		Increase depth 4ft	3.8
3		Concrete 3ft	1.9
4		Soil plate 3ft	1.8
5		Soil plate 2ft	1.2
6		Concrete 2ft	1.0
1	Medium	Drive anchor 3ft	9.6
2		Increase depth 4ft	4.5
3		Soil plate 3ft	2.2
4		Concrete 3ft	2.1
5		Soil plate 2ft	1.4
6		Concrete 2ft	1.1
1	Strong	Drive anchor 3ft	13.9
2		Increase depth 4ft	6.3
3		Soil plate 3ft	3.4
4		Soil plate 2ft	3.3
5		Concrete 3ft	3.0
6		Concrete 2ft	1.8

Cost Effectiveness
for signs in sand

Rank	Soil	Action	CE (mph/$)
1	Weak	Drive anchor 3ft	4.5
2		Increase depth 4ft	2.0
3		Concrete 3ft	1.0
4		Soil plate 3ft	1.0
5		Concrete 2ft	0.5
6		Soil plate 2ft	0.5
1	Medium	Drive anchor 3ft	6.4
2		Increase depth 4ft	2.9
3		Concrete 3ft	1.4
4		Soil plate 3ft	1.4
5		Soil plate 2ft	0.8
6		Concrete 2ft	0.7
1	Strong	Drive anchor 3ft	9.6
2		Increase depth 4ft	3.5
3		Soil plate 3ft	2.2
4		Concrete 3ft	2.1
5		Soil plate 2ft	1.7
6		Concrete 2ft	1.2

Cost Effectiveness
for signs in clay

AASHTO Parameters

$$P_z = 0.613 K_z G V^2 I_r C_d \qquad (Pa)$$

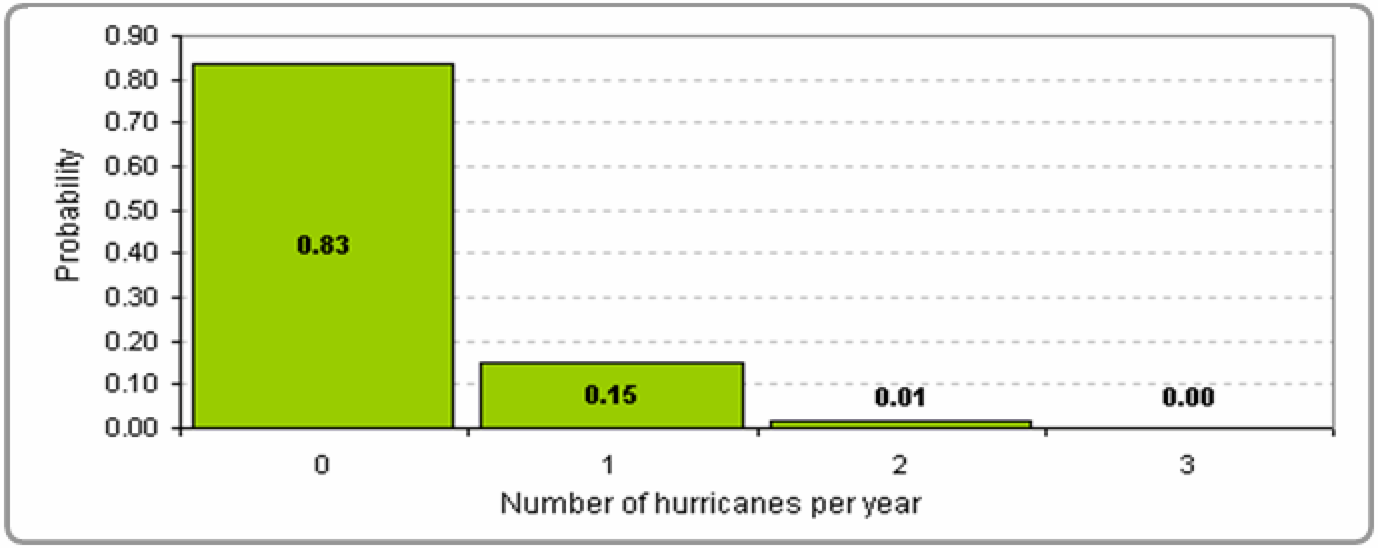
$$P_z = 0.00256 K_z G V^2 I_r C_d \qquad (psf)$$

Where,

- V: Design wind speed at 10 m. (32.8 ft.)
- C_d: Drag coefficient
- G: Gust effect factor
- K_z: Height and exposure factor
- I_r: Wind importance factor

In summary, for street signs in the Miami-Dade case, Kz=0.87, G=1.14, V=150 mph Ir=0.71. The drag coefficient should be established for each sign type; for the regular stop sign with street name, the coefficient is 1.14.

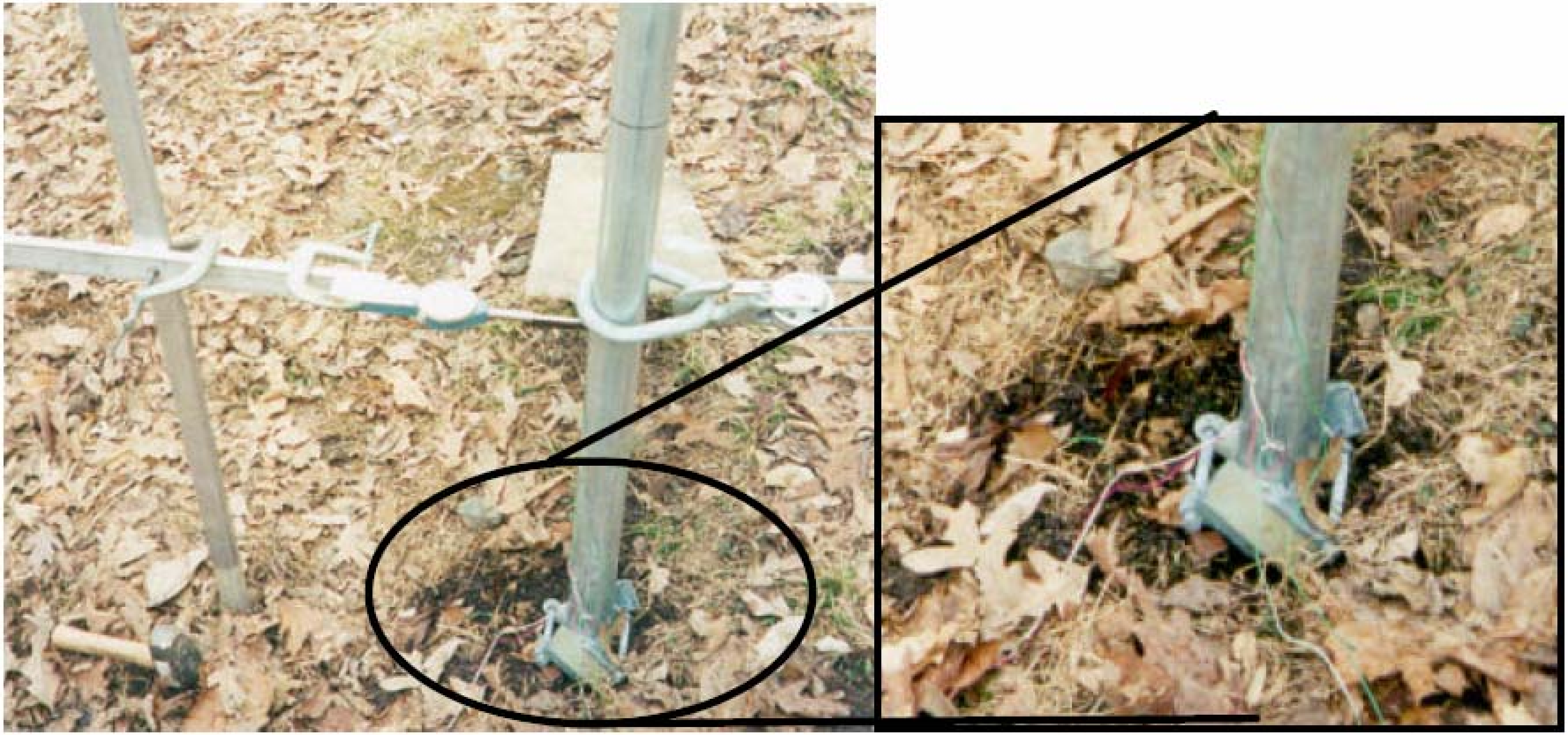
Hurricane Probabilities



The probabilities for a hurricane to be category 1, 2, 3 or 4 are 37, 21, 26 and 16 percent, respectively, based on the information presented in Figure 9. Therefore, for the most likely scenario for Miami-Dade the probabilities of occurrence of hurricanes category 1, 2 3, and 4 or more are 5.6 (once every 10 years), 3.2 (once every 30 years), 4 (once every 25 years), and 2.4 percent (once every 40 years), respectively

Drive Anchor Picture

Proposed Testing Procedure



Proposed Testing Procedure

Wall of Wind