



Case Studies: Long Term Performance of Highway Slopes Stabilized with Recycled Plastic Pin

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Fact About Plastic Bottles!


- 50 Billion Water Bottle end up in US Landfill Each Year
- It takes 700 year to decompose plastic bottles
- Ecosystems and wildlife are negatively impacted by plastic debris.

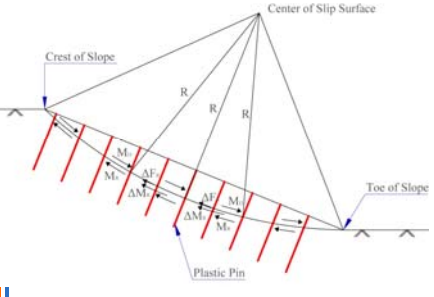



Recycled Plastic Pin to Stabilize Shallow Slope Failure



- Recycled Plastic Pin (RPP)**
 - Mainly Polymeric Materials
 - Fabricated from Recycled Plastics
 - Commercially Available
 - RPP Reduces Waste Volume
 - Resistant to Biological Exposure

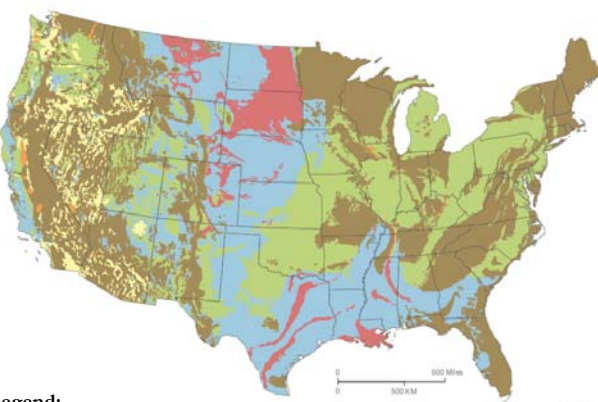







A 10' long RPP can replace 500 Soda Bottles

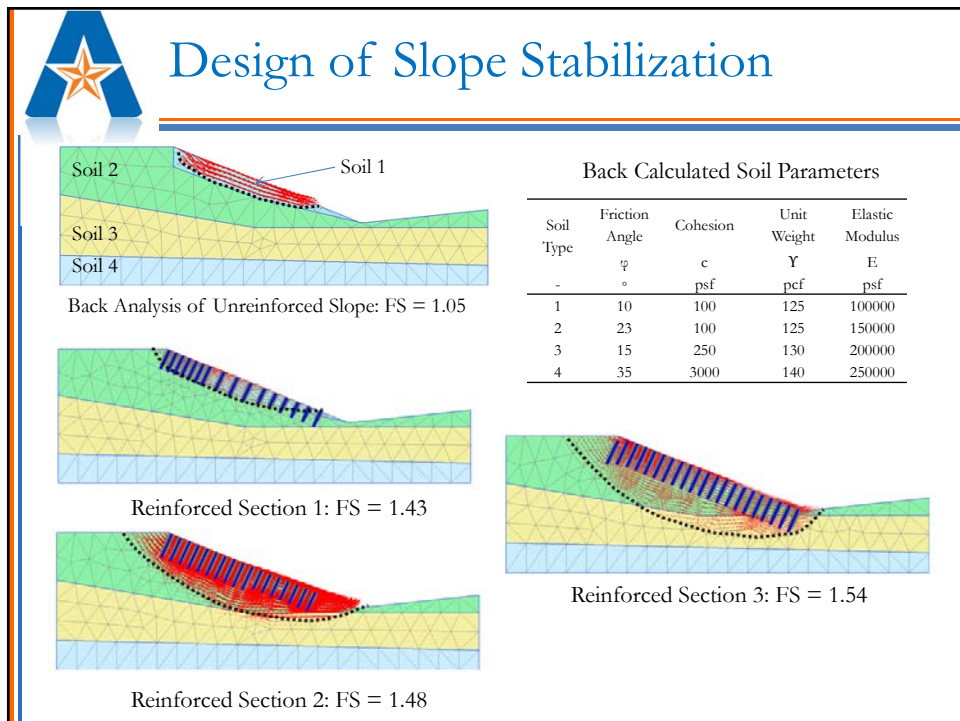
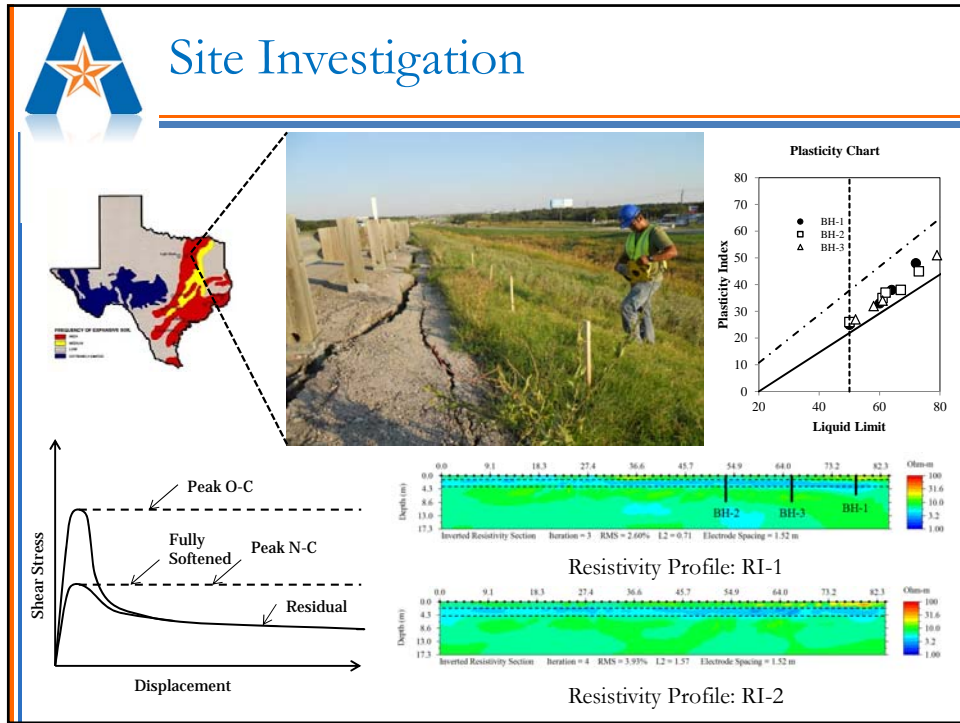
Expansive Clay in US

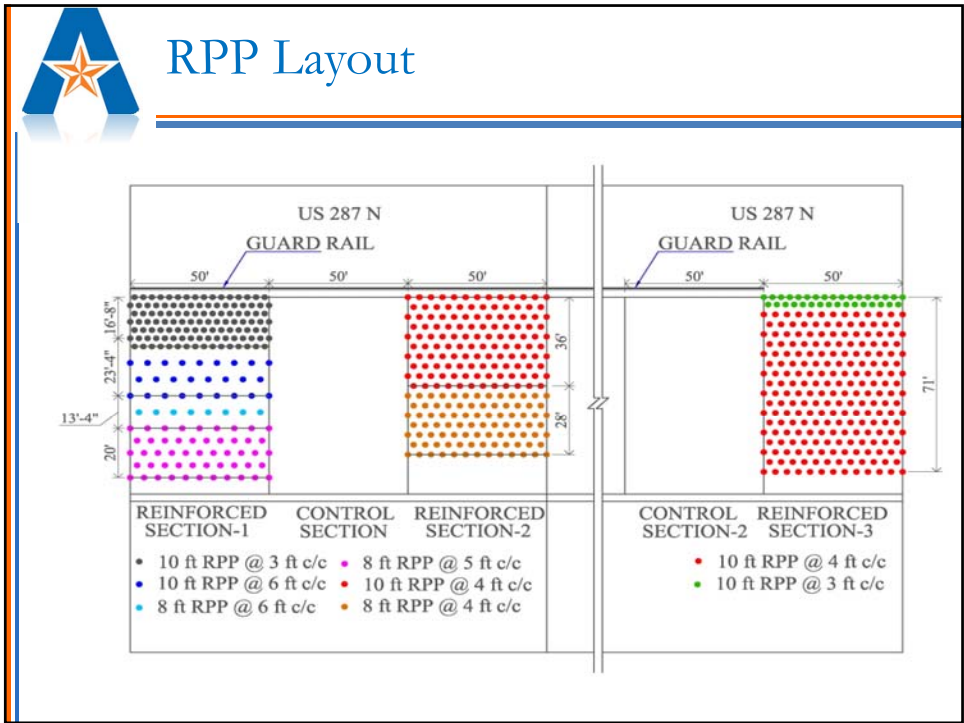




Legend:

- Red:** Clay having high swelling potential
- Blue:** Less than 50% of clay contents having high swelling potential
- Orange:** Clay content having slight to moderate swelling potential
- Green:** Less than 50% of clay contents having slight to moderate swelling potential
- Brown:** Little or no swelling clay
- Yellow:** Insufficient data







Installation of RPP: Reinforced Section 1 and Reinforced Section 2



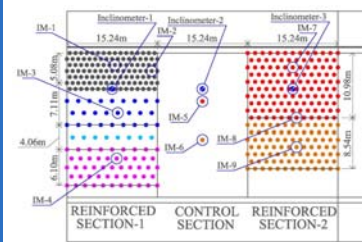
Installation of RPP: Reinforced Section 3



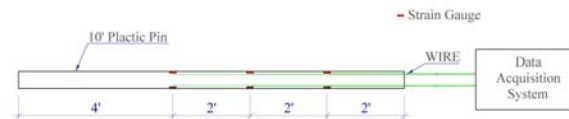


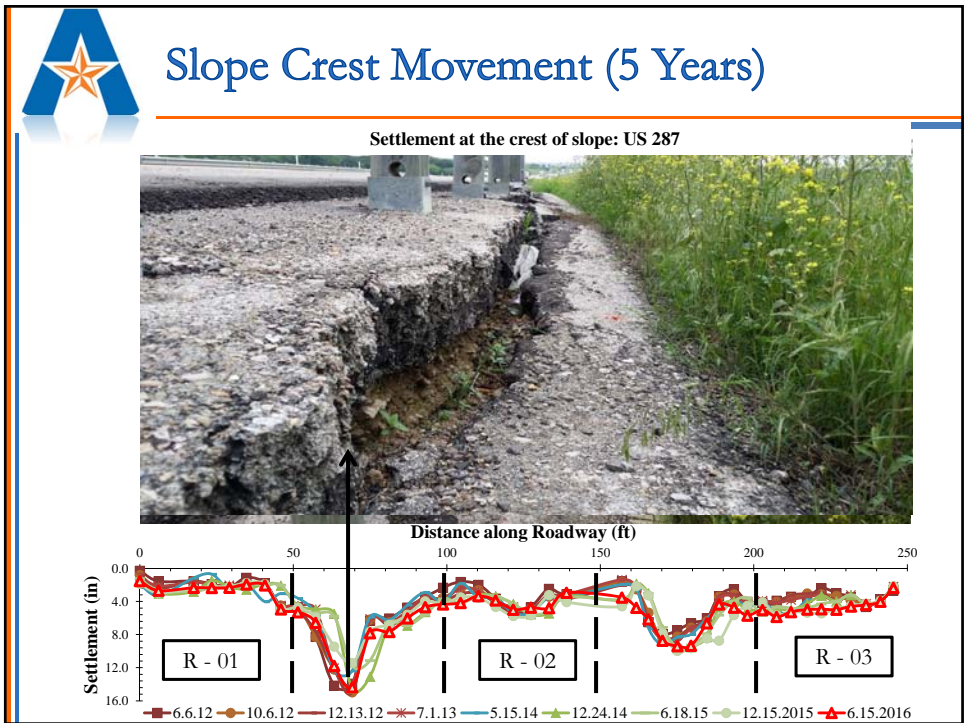
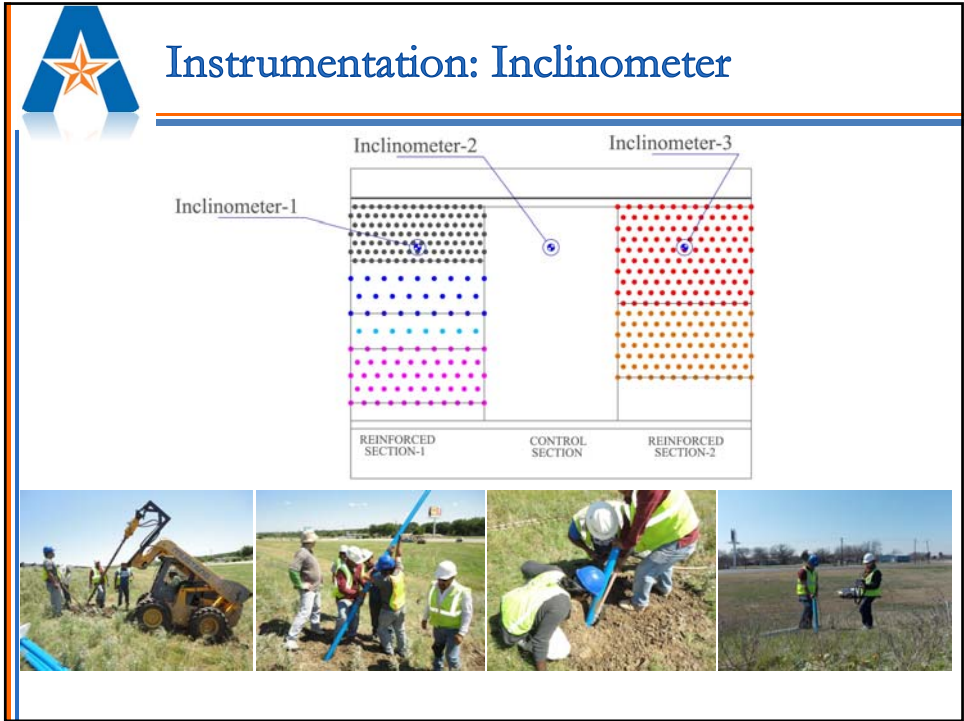
Instrumentation

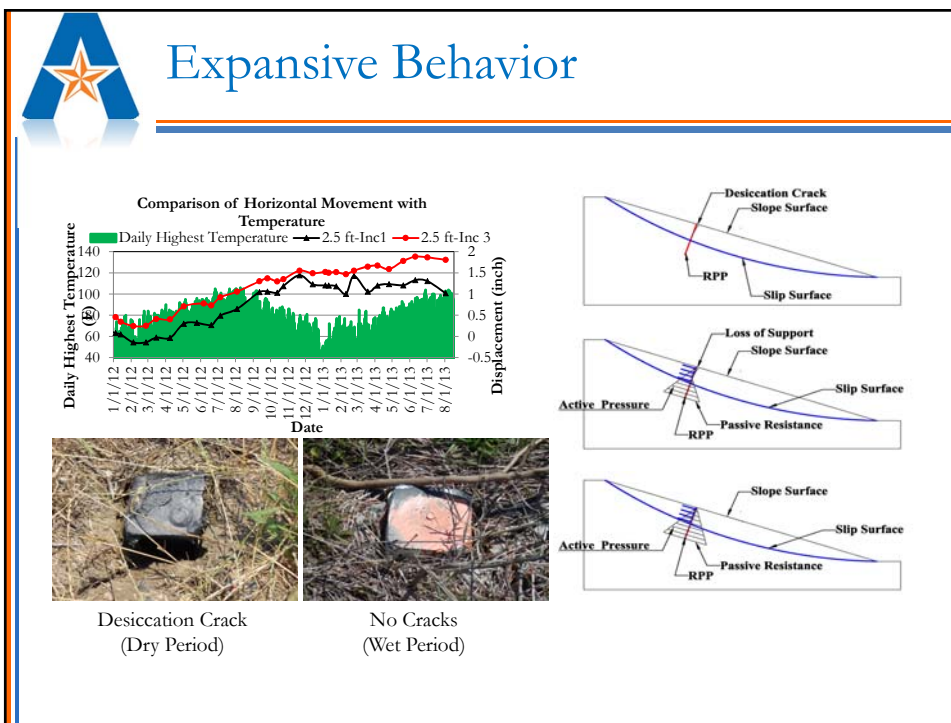
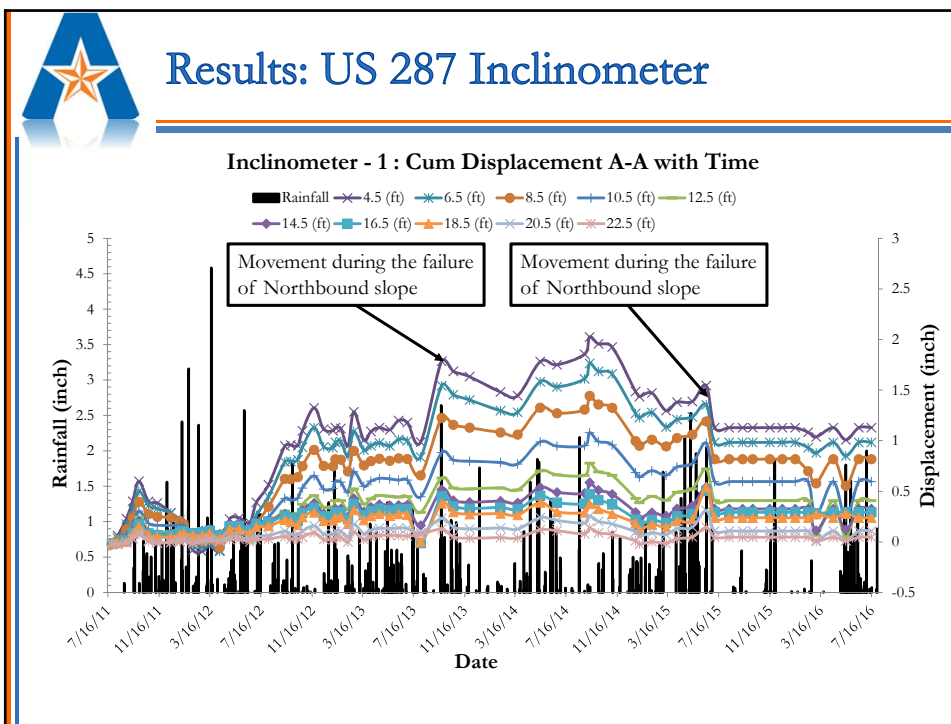
- Rain Gauge
- Instrumented RPP
- Surveying
- Inclinometer
- Moisture Sensor
- Water Potential Probe



Instrumentation: Instrumented RPP









Settlement at Control Section

R. Section 1



Control Section 2



Control Section




R. Section 3




News and Media

Comparison of Performance Northbound and Southbound (Reinforced) Slope


Failure Location	Time
Failure Location-1	October 2013
Failure Location-2	October 2013
Failure Location-3	June 2015
Failure Location-4	June 2015



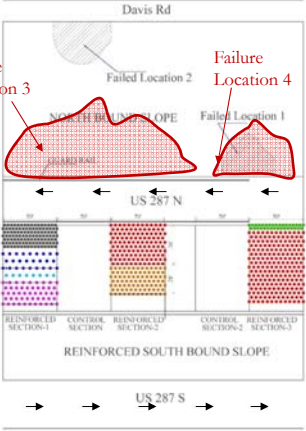
Failure Location 1



Failure Location 2



Failure Location 3



REINFORCED SOUTH BOUND SLOPE


Reconstruction of Northbound Slope




September 2015



Soil Nailed Wall




North Side




October 2015

Comparison between RPP Stabilized Slope and Reconstructed Control Slope



Northbound slope
(after construction of soil nail wall)



Southbound slope (RPP stabilized)

Failure of Northbound Slope After Repair

Slope Failed on 1st week of November, 2015



Date	Precipitation (inch)
10/1/2015	0
10/8/2015	0
10/15/2015	0
10/22/2015	5.5
10/29/2015	3.2
11/3/2015	4.8
11/12/2015	0.5
11/19/2015	1.2
11/26/2015	2.8





DRAINAGE DITCH
REINFORCED SOUTH BOUND SLOPE

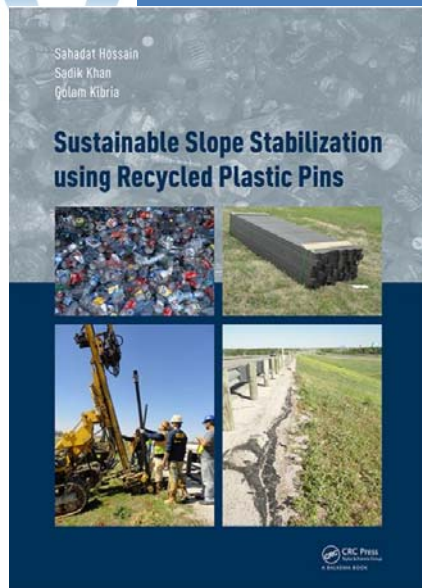


Summary and Conclusion

- **RPP provided resistance against shallow slope failure**
- A Crawler-Mounted Rig, Equipped with a Mast-Mounted Pseudo Vibratory Hammer, Worked Effectively to Install RPPs
- On Average, a RPP Can be Installed within 4 Minutes, and a Total of 100 to 120 RPPs can be Installed in a Single Day.
- Settlement at Control Section is 15 inch
- Settlement at Reinforced Section 1 is 2.5 inch.
- Closer RPP Spacing at Crest Provided Higher Resistance against Slope Deformation
- RPP can save the stabilization cost up to 60% - 80% of conventional technique, and have potential to be a **effective sustainable alternative** to stabilize shallow slope failure.



Upcoming Book



Sustainable Slope Stabilization using Recycled Plastic Pins

Sahadat Hossain, Sadik Khan, Golam Kibria

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