

## TECHNICAL REPORT DOCUMENTATION PAGE

|   |  |   |                         |
|---|--|---|-------------------------|
| 1. REPORT NO.<br><b>FHWA-OK-10-04</b>   | 2. GOVERNMENT ACCESSION NO.  | 3. RECIPIENT-S CATALOG NO.  |                         |
| 4. TITLE AND SUBTITLE<br><b>Correlation of Fully-Softened Shear Strength of Clay Soil with Index Properties, Phase I</b>  |  | 5. REPORT DATE<br><b>September 2010</b>   |                         |
|   |  | 6. PERFORMING ORGANIZATION CODE   |                         |
| 7. AUTHOR(S)<br><b>Dr. Garry H. Gregory, Ph.D., P. E., D.GE<br/>Azmi Baryun, GRA</b>  |  | 8. PERFORMING ORGANIZATION REPORT   |                         |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br><b>Oklahoma State University<br/>School of Civil and Environmental Engineering<br/>207 Engineering South<br/>Stillwater, Oklahoma 74078</b>  |  | 10. WORK UNIT NO.   |                         |
|   |  | 11. CONTRACT OR GRANT NO.<br><b>ODOT SPR Item Number 2225</b>                           |                         |
| 12. SPONSORING AGENCY NAME AND ADDRESS<br><b>Oklahoma Department of Transportation<br/>Planning and Research Division<br/>200 N.E. 21st Street, Room 3A7<br/>Oklahoma City, OK 73105</b>  |  | 13. TYPE OF REPORT AND PERIOD COVERED<br><b>Final Report<br/>Oct. 2009 – Sept. 2010</b> |                         |
|   |  | 14. SPONSORING AGENCY CODE  |                         |
| 15. SUPPLEMENTARY NOTES   |  |   |                         |
| 16. ABSTRACT<br>Shallow slope failures in clay soils cause many millions of dollars of damage annually on highway embankments and cut slopes and necessitate difficult and expensive repairs that negatively impact budgets, traffic flow, and the environment. The embankments typically fail when clay soils become “fully softened” due to shrink-swell action during wet-dry-wet cycles and experience downhill creep. Slope analyses using either peak or residual strength properties do not properly model most slope failure or potential failure conditions. The use of peak strength in the analyses tends to overestimate the factor of safety (stability) and the use of residual shear strength in the analysis tends to underestimate the factor of safety (stability). The use of fully-softened shear strength values results in a more accurate analysis and leads to designs or repair methods that provide long-term stability at reasonable costs. Understanding the mechanisms of these slope failures and being able to economically predict the fully softened shear strength of clay soils is key to successful design, repair, and stabilization of clay slopes. |  |   |                         |
| 17. KEY WORDS<br><b>Shear Strength, Fully-Softened Clay, Slope Stability</b>  | 18. DISTRIBUTION STATEMENT<br><b>No restrictions. This publication is available from the Planning &amp; Research Div., Oklahoma DOT.</b> |   |                         |
| 19. SECURITY CLASSIF. (OF THIS REPORT)<br><b>Unclassified</b>   | 20. SECURITY CLASSIF. (OF THIS PAGE)<br><b>Unclassified</b>  | 21. NO. OF PAGES<br><b>68</b>   | 22. PRICE<br><b>N/A</b> |