PRESENTATION OUTLINE

Background and Problem Description

Research Objectives and Methodology

Phase-I: Data Collection (Dr. Bayraktar)

Phase-II: Analysis and Recommendations (Dr. Svinkin)

Questions & Answers
BACKGROUND

- Construction-induced ground vibrations
  - Blasting
  - Pile driving
  - Dynamic compaction
  - Operation of heavy construction equipment

- Level of ground vibrations
  - Source energy
  - Distance from the source of vibration
  - Soil characteristics
  - Characteristics of wave propagation

- Concern to engineers
  - Annoyance to people in urban environment
  - Interference with sensitive devices
  - Architectural and structural damage
  - Soil settlement
BACKGROUND

FDOT Research Need Statement

- Work needed on:
  - Anticipated vibration levels generated by construction operations
    - Prediction of peak particle velocity (PPV)
    - Vibratory rollers, tandem rollers, sheet pile installation of particular interest in addition to pile driving
  - Evaluation of vibration limits
    - Currently, 0.5 in/sec is the general PPV limit in FDOT projects
  - Evaluation of vibration mitigation techniques
  - Standardized procedures for pre-construction surveys

- Recommendations for addressing vibration issues in the “Standard Specifications for Road and Bridge Construction” and/or “Soils and Foundations Handbook”
  - 455-1.1 “Structures Foundations” >> Protection of Existing Structures
  - 7.1.6 Vibration Monitoring; 9.2.4 Existing Structures Survey and Evaluation
OBJECTIVES OF THE PROJECT

1. Analysis of the current practice in assessment and control of the vibration effects of construction operations in Florida;

2. Development of appropriate equations for the calculation of expected ground vibrations prior to the beginning of construction activities;

3. Evaluation of condition surveys of structures as an important step in mitigating vibration effects from construction operations;

4. Evaluation of diverse vibration limits of ground and structural vibrations for application to roadway and bridge construction in Florida;

5. Evaluation of mitigation strategies to control ground and structural vibrations from construction sources;

6. Development of recommendations for addressing vibration issues in FDOT Specifications;” and

7. Preparation of a final research report for the Florida DOT.
RESEARCH APPROACH

PHASE-I: DATA COLLECTION

Task-1: Conduct a literature review (Reported at GRIP 2012)
Task-2: Conduct a survey on practice and policies for vibrations (Reported at GRIP 2012)
Task-3: Collect and sort available field-measured data from construction operations (GRIP 2013)
Task-4: Prepare an interim report

PHASE-II: ANALYSIS AND RECOMMENDATIONS

GRIP 2013
Task-5: Develop simple equations to calculate PPV of ground vibrations
Task-6: Develop criteria and standardized procedures for pre-construction surveys
Task-7: Evaluate existing vibration limits and develop flexible limits for FDOT projects
Task-8: Evaluate mitigation techniques
Task-9: Develop recommendations
PHASE-I: DATA COLLECTION

Project Data Collection

- Data collected
  - hammer/equipment characteristics: (manufacturer, model, maximum energy, maximum stroke, etc.)
  - pile information: material, length, cross-section
  - pile driving logs
  - soil conditions
  - results of measurements of ground vibrations
  - results of static and dynamic pile testing
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PHASE-1: DATA COLLECTION

Project Data Collection

- **Challenges**
  - required data scattered among different stakeholders
  - long lead times; lost information
  - vibration measurement reports with minimal information

- **Recommendation:** FDOT Construction Vibration Database
  - collect, store and track construction vibration data in a database to:
    - facilitate standardized data collection from Districts, contractors and vibration consultants
    - provide decision support during design and construction phases
    - refine and modify specifications/methods over time by analyzing collected data
NEXT:

- PHASE-II: ANALYSIS AND RECOMMENDATIONS

THANK YOU!