

RESEARCH PROBLEM STATEMENT

DATE: 09/25/2020	PROJECT AREA: Maintenance
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TITLE: Estimating Timber Pile Capacity Using the IML-RESI PowerDrill

PROBLEM STATEMENT:

ARDOT Heavy Bridge Maintenance has acquired an iML PD400 RESI Micro-Drill for measuring drilling resistance in timber piles to determine suitability. Current procedures do not provide a pile capacity value. These resistance measurements can theoretically be correlated to the in place strength of bridge elements like piles. The proposed investigation would involve testing new timber piles made of locally available species from ARDOT suppliers as well as testing of piles with decay. Drill measurements would be made throughout the length, material tests would be performed to determine the tensile and compressive strengths of the piles (parallel and perpendicular to the grain) and full-scale column tests would be performed with the intention of mimicking the real-life shear and moment diagrams for a pile. Importantly, efforts will be made to investigate the robustness of the Micro-Drill test method. Testing the pile at the maximum moment region is important, but defects could be present at locations of lower force effects that cannot be tested by the Micro-Drill. This proposed study will develop a testing protocol that will enable ARDOT to determine an actual pile capacity value.

OBJECTIVES:

- Comprehensive literature review of non-destructive testing of timber bridge elements (especially piles).
- Acquisition and conditioning (to induce local or general decay) of timber piles in the laboratory.
- Calibrate energy results from full-capacity piles with compromised piles using the IML-RESI PowerDrill.
- Full-scale testing in CEREC lab to develop correlation between Micro-Drill measurements and remaining capacity.
- Develop a testing protocol that will enable ARDOT to determine actual pile capacity.
- Train ARDOT inspectors on the testing protocol by presenting the study results in a workshop forum.

FORM OF RESEARCH IMPLEMENTATION AND RETURN ON INVESTMENT:

The results of this research can be implemented by heavy bridge maintenance and the bridge division to determine remaining capacity of timber bridge piles for maintenance and load rating purposes. Recommendations on effective use of the Micro-Drill will be provided and a model will be developed to relate Micro-Drill measurements to the capacity of the pile.

Estimated Project Duration: 36 Months

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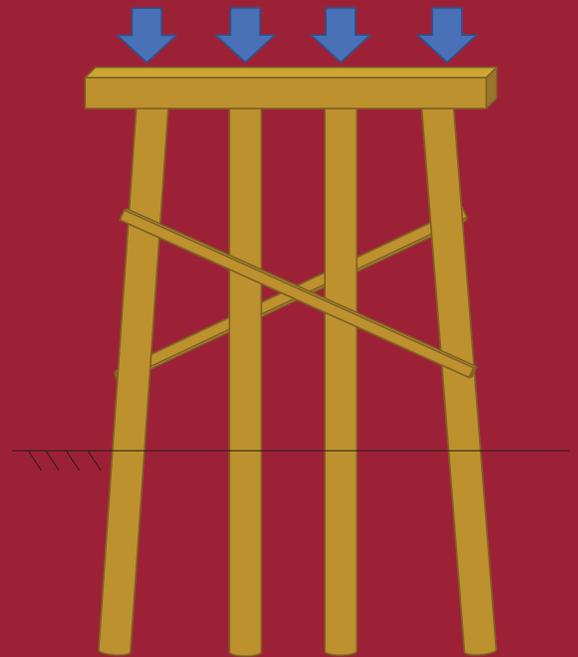
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Estimating Timber Pile Capacity

Cameron D. Murray

Timber Piles

- Timber piles are often used in bridges, especially older ones
- The level of decay in piles is often difficult to assess
- The stresses in piles vary, but typically the maximums are close to the ground surface



Micro-Drilling

- ARDOT Heavy Bridge Maintenance has a micro-drill (iML PD400 RESI Micro-Drill)
 - Method for measuring resistance to drilling within wood structural members
 - Can detect defects within sound wood



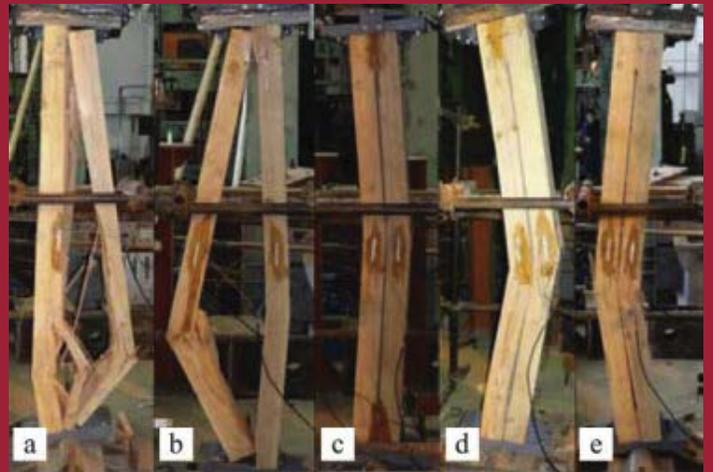
Inspectapedia.com



iml-na.com

Plan of study

- Piles will be obtained and tested in as-received and decayed state
 - Accelerated decay will be induced
 - Standard material strengths will be obtained
 - Micro-drilling will be performed
 - Full-scale pile tests will be performed in the lab



Example of timber column testing

Chang, W-S 2015, 'Repair and reinforcement of timber columns and shear walls - A review', *Construction and Building Materials*, vol. 97, pp. 14-24.

Expected outcomes

- The goal of the study is to provide robust recommendations on best practices for timber pile testing
- A correlation will be made between the results of micro-drilling and the resistance of piles with different levels of decay
- Since local defects may not be directly tested, further recommendations will be made on how to properly interpret micro-drill data and how best to test piles in a representative fashion.