

# Condition Assessment of Concrete Pipes using Rebound Hammer

## *A feasibility study*



### **Keywords:**

*material science, rebound hammer, strength measurement, concrete pipes*

### **Abstract:**

Concrete is undoubtedly one of the most prevalent materials used in civil engineering. This implies the importance of condition assessment of the concrete structures both in the lab and also in-situ, hence after deployment.

The tests which provide information about properties of concrete can be divided to destructive and non-destructive testing (NDT). The latter is highly preferred in case of in-situ conditions because it leaves the subject material intact after the assessment.

One of the widely-used NDT methods is Rebound or Schmidt hammer. Although the device is highly sensitive to disturbances (e.g., humidity, and shape and size of the local aggregates on the surface) it is favorable for evaluating the compressive strength of concrete slabs.

The method was originally introduced for flat surfaces and many studies have focused on improving the correlation between the output of the measurement device and compressive material of the subject in this condition. However, no study has been done on the possibility of applying the method on curved surfaces such as concrete pipes (to the knowledge of the author).

The goal of this assignment is to check the feasibility of using rebound hammer to evaluate the compressive strength of concrete pipes *where the access point is pipe interior*.

The assignment consists of following sections:

- 1) Background study: The student has to know the operating principle of the rebound hammer and to have a good understanding about environmental conditions which affect the measurements and to be familiar with facts about compressive strength of concrete pipes.

- 2) Experiments: A test plan needs to be developed based on the studies conducted in the previous phase. The experiments are planned to be done on campus of University of Twente. The required equipment, e.g., rebound hammer, concrete pipes, are to be provided to the student.
- 3) Discussion and analysis: Observations from the conducted experiments should be explained with related physical phenomena. The effect of environmental conditions needs to be determined. Most importantly, conclusion must be made about any correlation between rebound hammer numbers and compressive strength of the test pipes.

The results of this assignment will be contributed to TISCALI (Technology Innovation for Sewer Condition Assessment Long-distance Information-system); a project which is defined as a collaboration between departments of Robotics and Mechatronics (RaM), Construction Management and Engineering (CME), and ITC within University of Twente and industrial partners. TISCALI aims at utilizing, integrating, and further development of relatively low-cost, off the shelf, techniques to arrive at an objective detection and quantification of defects in sewers and to determine the constructive strength and stability of sewers.

***Related literature:***

- <http://www.ndt.net/ndtaz/content.php?id=641>
- Brožovský, J., et al. (2009). Determination of High Performance Concrete Strength by Means of Impact Hammer. The 10th International Conference of the Slovenian Society for Non-Destructive Testing. Ljubljana, Slovenia.
- Sibbald, A. (1988). Impact Hammer Testing of Masonry Sewers, University of Edinburgh. PhD.

***Envisioned starting date:*** Quartile 4 2018

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