Kingdom of Saudi Arabia
Ministry of Education
Majmaah University
College of Engineering
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Determination of Compressive Strength of Concrete using Rebound Hammer Test (NDT)

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Abstract

Concrete is the single most widely used construction material in the world (An estimated 30 billion tones of concrete were consumed globally in 2006).

It is often necessary to test concrete structures after the concrete has hardened to determine whether the structure is suitable for its designed use. Ideally, such testing should be done without damaging the concrete.

In this context, the Rebound hammer test is the most frequently used non-destructive method for estimation of concrete strength that have the benefits to ensure decreasing costs and damage to the structure.

Objectives

- The method is a non-destructive test used as a part of the procedure applied to evaluate existing structures. The concrete core tests are usually combined with rebound hammer tests to decrease costs and damage to the structure.

- The results of such tests are used for engineering design and quality control either by the materials producer to verify the process or by the end user to confirm the material specifications.

Significance to the Kingdom

Kingdom of Saudi Arabia (***KSA***) is the largest economy in the Middle East and the construction sector in ***KSA*** is the largest and fastest growing market in the Gulf region. Indeed, the building materials segment play a large part in the Kingdom's massive industrial expansion and help to establish a strong infrastructure for the industry in the kingdom.

Therefore, the use of non-destructive test (for inspection, examination, or evaluation) such as rebound hammer test techniques are being increasingly adopted in concrete structures to decrease costs and damage to the structure.

Description

Rebound hammer test method is based on the principle that the rebound of an elastic mass depends on the hardness of the concrete surface against which the mass strikes.

Figure 1: Horizontal orientation of hammer during a measurement

When the plunger of the rebound hammer is pressed against the surface of the concrete, the Spring-controlled mass rebounds and the extent of such a rebound depends upon the surface hardness of the concrete. The surface hardness and therefore the rebound is taken to be related to the compressive strength of the concrete. The operation of the rebound hammer is shown in figure above:

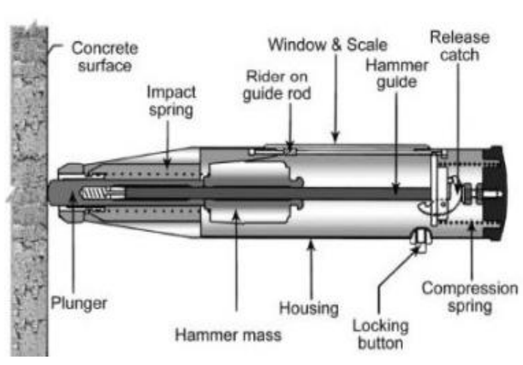
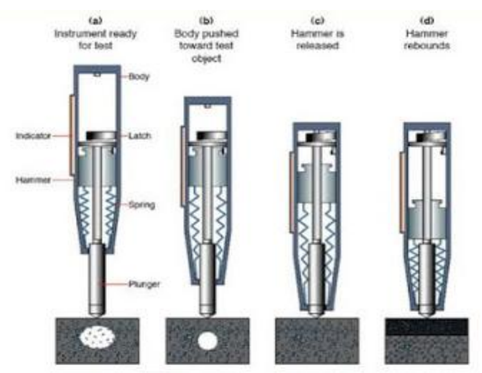


Figure 2 : Typical rebound hammer.



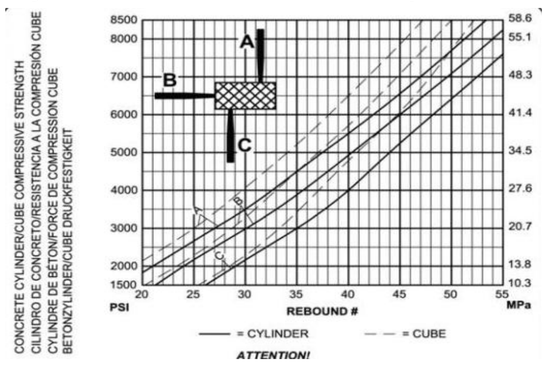
Figures 3: Principle of rebound hammer test

Interpretation of results

The rebound reading on the indicator scale has been calibrated by the manufacturer of the rebound hammer for horizontal impact, that is, on a vertical surface, to indicate the compressive strength. When used in any other position, appropriate correction as given by the manufacturer is to be taken into account.

Table 1 : Average Rebound number and quality of concrete for horizontal impact.

Average Rebound Number	Quality of Concrete
>40	Very good hard layer
30 to 40	Good layer
20 to 30	Fair
< 20	Poor concrete
0	Delaminated



•Refers to using the Rebound Hammer against a concrete floor (downward).
•Refers to using it against a concrete wall (forward)
•Refers to using it against a concrete ceiling (upward).

Figures 4: correlation between reading and the angle of inclination.