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**Materials Testing**

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**Acknowledgement**

Mr John Gibson is a highly regarded educator and engineer. John taught Industrial Arts at a number of high schools before taking a position at Sydney Teachers’ College, then University of Sydney. He had an engineering education consultancy and has extensive experiencing working with NESA on Engineering Studies syllabus development and the HSC examination committee. The STEM Industry School Partnerships (SISP) Program asked John for his responses to the iTeachSTEM topic discussion questions. SISP is grateful to John for submitting these example discussion responses.

1. **Why is testing of materials important?**

* to determine the various properties that a given material possesses
* testing can be carried out **prior to** the material being used in a specific application, to determine if it is satisfactory
* testing can be applied **after** completion when faults in the material have shown it to be unsuitable

1. **What type of data can be collected from testing?**

* physical measurements
* survey tests

1. **Evaluate the appropriateness of various tests to particular applications in civil structures.**

The type, and scale, of a chosen test has to relate specifically to the civil structure being constructed.

1. **Explain how the units chosen to display test results are relevant.**

They are relevant in that they set the scale of the measurement.

Non-Destructive Testing

1. **Explain the advantages and disadvantages of non-destructive testing.**

* an advantage of non-destructive tests is that the test sample does not degrade the specimen/s they are applied to
* a disadvantage of non-destructive testing is that the size of the test equipment may not be able to be used in a set environment

1. **List applications in civil structures for non-destructive testing.**

* site surveys
* sampling

1. **Describe the process of a non-destructive test such as X-Ray inspection.**

The process is similar to an X-Ray examination of a human. The component to be tested is placed in an X-Ray laboratory. An X-Ray is projected toward the specimen, passes through the specimen, and either passes onto a photographic plate which can be developed, or onto an X-Ray sensitive panel which can record the image.

1. **How can concrete be tested prior to pouring?**

Subject a sample of wet/mixed concrete to a slump test. If it fails this test, the batch of concrete would be rejected.

Destructive Testing

1. **Explain the advantages and disadvantage of destructive testing.**

An advantage of destructive testing is that the inner core of the material can be exposed, enabling further examination possible.

1. **List applications in civil structures for destructive testing.**

* concrete slab compression test

1. **How can concrete be tested after it has set?**

Specific samples of a prepared batch of concrete are taken from the mix and allowed to cure. When cured, they are compression tested to ensure strength and consistency of the mix.

1. **Describe the procedure for a Load/Extension test.**

* prepare the tensile testing machine
* prepare the test specimen according to standards
* place test specimen in position, apply load
* measure values of **load** and **extension** until specimen fails
* analyse results

1. **Calculate material property values based on test data.**

Test data on a specific construction material is used to set the required (minimum) dimensions of individual components.

Use the formula: Stress = Load/Area

If the maximum allowable stress for a component is for example, 400 MPa, and the measured load is 10 kN then the maximum cross sectional area of the component must be 0.025 sq.m or 25,000 sq.mm or 158mm x 158mm sq.