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Seminar on Testing and Certification for Fire Safety in Buildings

Building Diagnostics Tests as Assessment Tools

Ir Kenneth PAK 19 Oct 2016

In the presentation, the following NTD test will be introduced:

1. **Hammer Tapping Device**
2. **Covermeter**
3. **Ground Penetrating Radar**
4. **Infrared Thermography**

Hammer Tapping Device

Auto Hammer

- As a rapid check on de-bond of wall tile and/or spalling of concrete
- Able to reach ceiling without working platform

Hammer Tapping Device

Covermeter

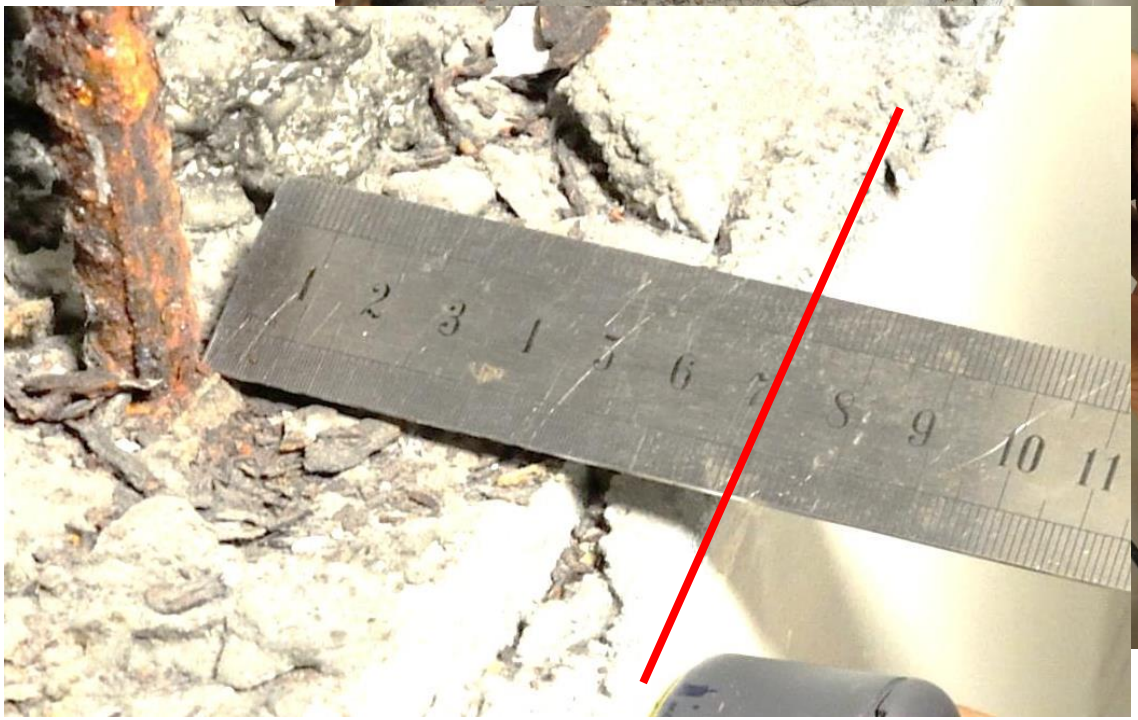
Principles

- mainly used for locating re-bar within concrete member
- By measurement of the change of electromagnetic field caused by steel embedded in the concrete.

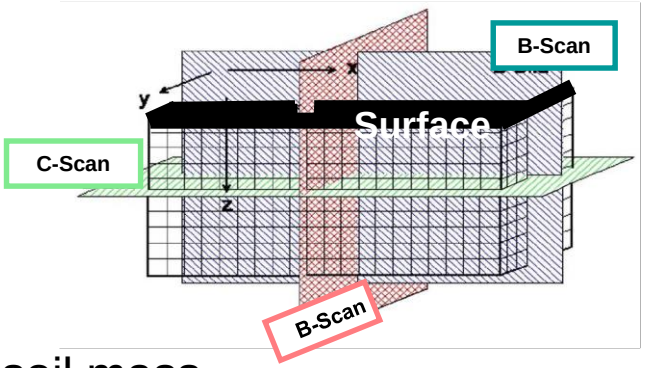
Checking of equipment

Covermeter

Covermeter



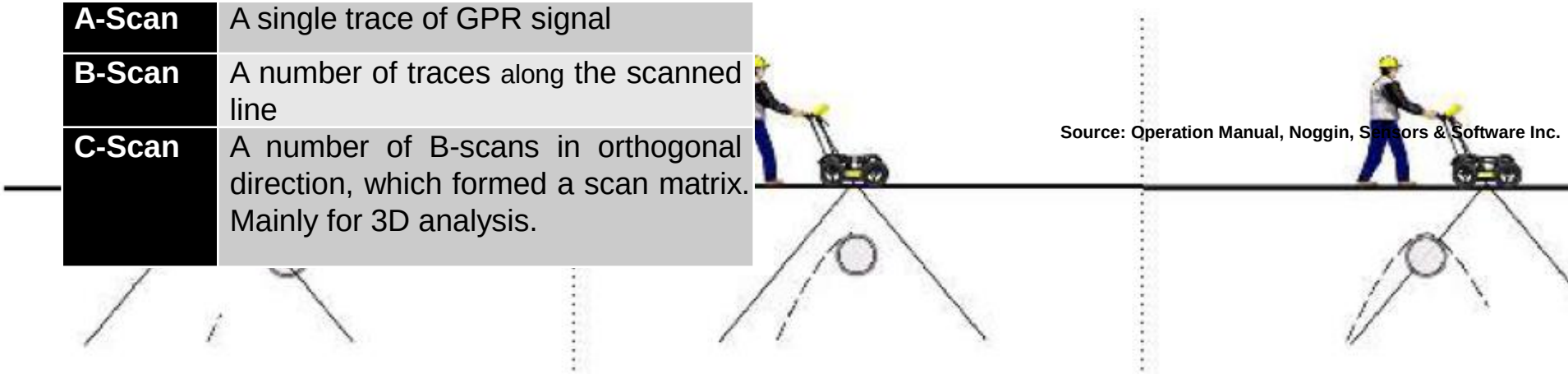
Ground Penetrating Radar



The Ground Penetrating Radar (GPR)

- To locate rebar for further NDT
- operated based on the Maxwell's equations of electromagnetic (EM) theory.
- EM wave generated from transmitter, radiated into soil mass.
- wave reached di-electric contrast, gives a reflection to the receiver
- GPR scans are classified into three types as summarized below:

Type of scan	Feature
A-Scan	A single trace of GPR signal
B-Scan	A number of traces along the scanned line
C-Scan	A number of B-scans in orthogonal direction, which formed a scan matrix. Mainly for 3D analysis.



Source: Operation Manual, Noggin, Sensors & Software Inc.

Ground Penetrating Radar

Selection of Antenna

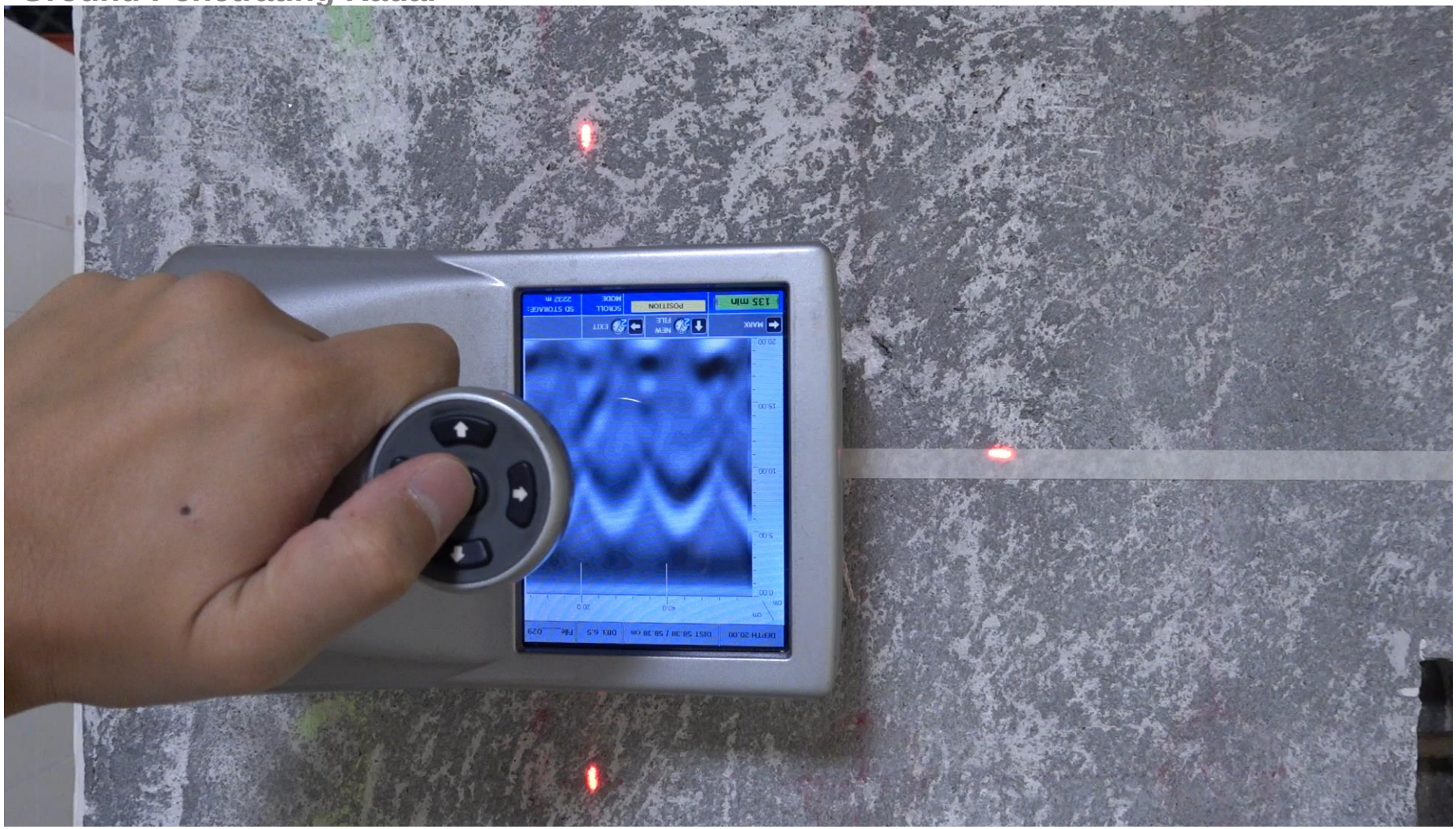
- Frequency ↑, Depth of penetrati

Center Frequency	Depth of Penetration*	
2600 MHz	to 0.4 m (12 in)	
2000 MHz Palm	to 0.4 m (12 in)	
1600 MHz	to 0.5 m (18 in)	Concrete Evaluation
		Concrete Evaluation, Void Detection
		Utility, Engineering, Environmental, Void Detection
		Utility, Engineering, Geotechnical
		technical, Engineering, Environmental
		Geotechnical, Engineering, Mining
		Geotechnical
		ement Thickness and Road Condition Assessment
		ghway and Bridge Deck Evaluations

Source: GSSI

Source: Sensors & Software Inc.

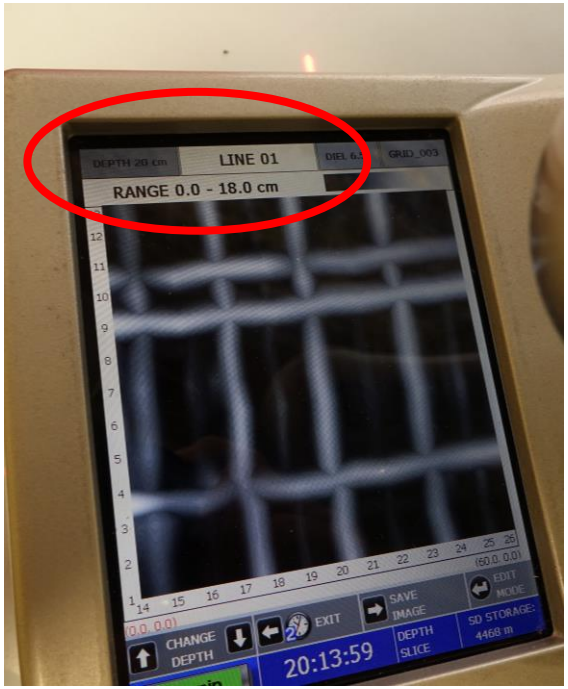
Ground Penetrating Radar

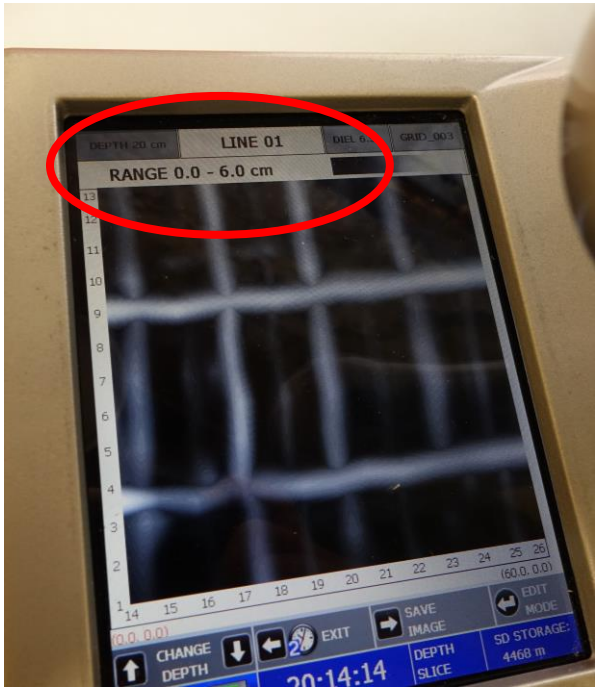


Ground Penetrating Radar

3D interpretation

- C-scan (3D analysis)
- Locate multi layer re-bar
- Estimate cover depth, even the opposite side





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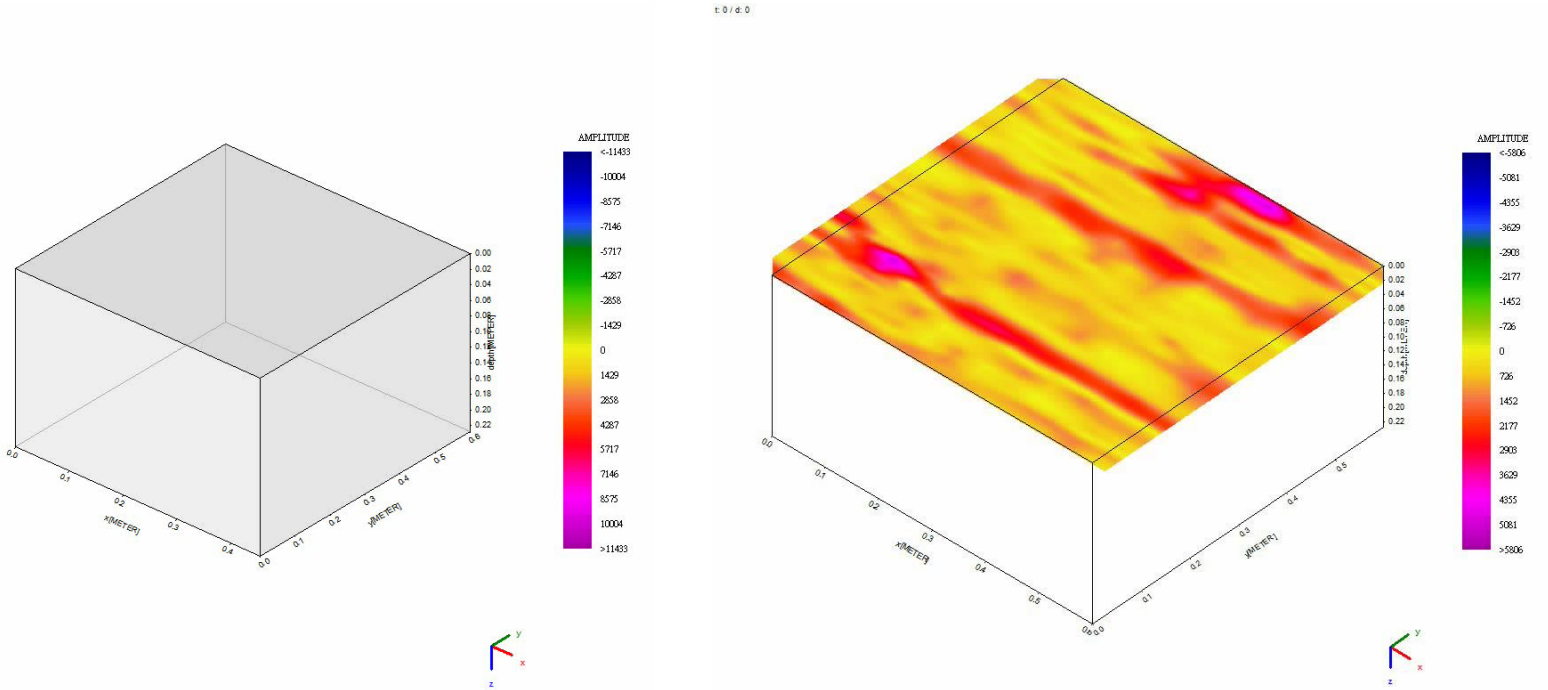
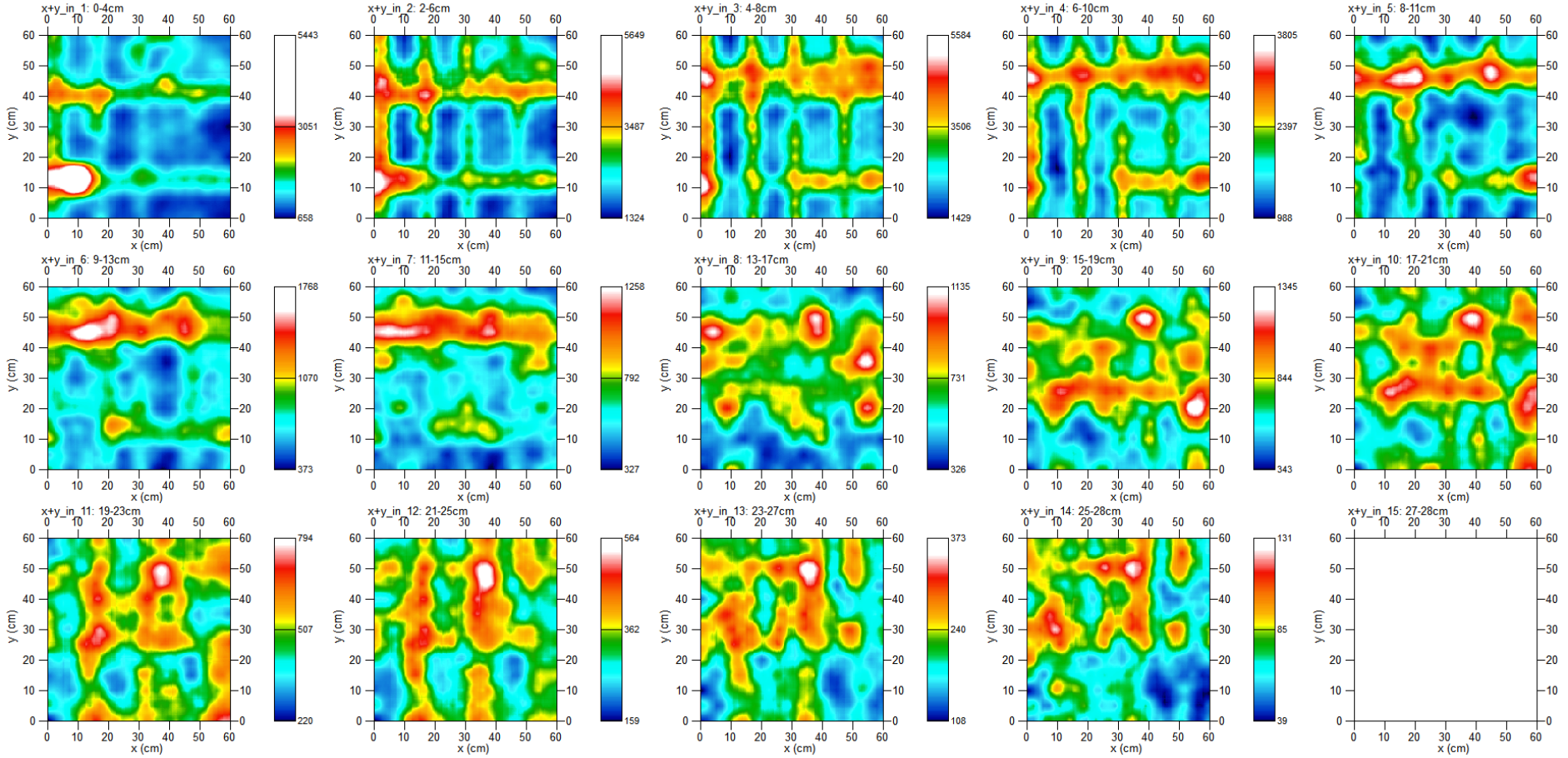


Ground Penetrating Radar

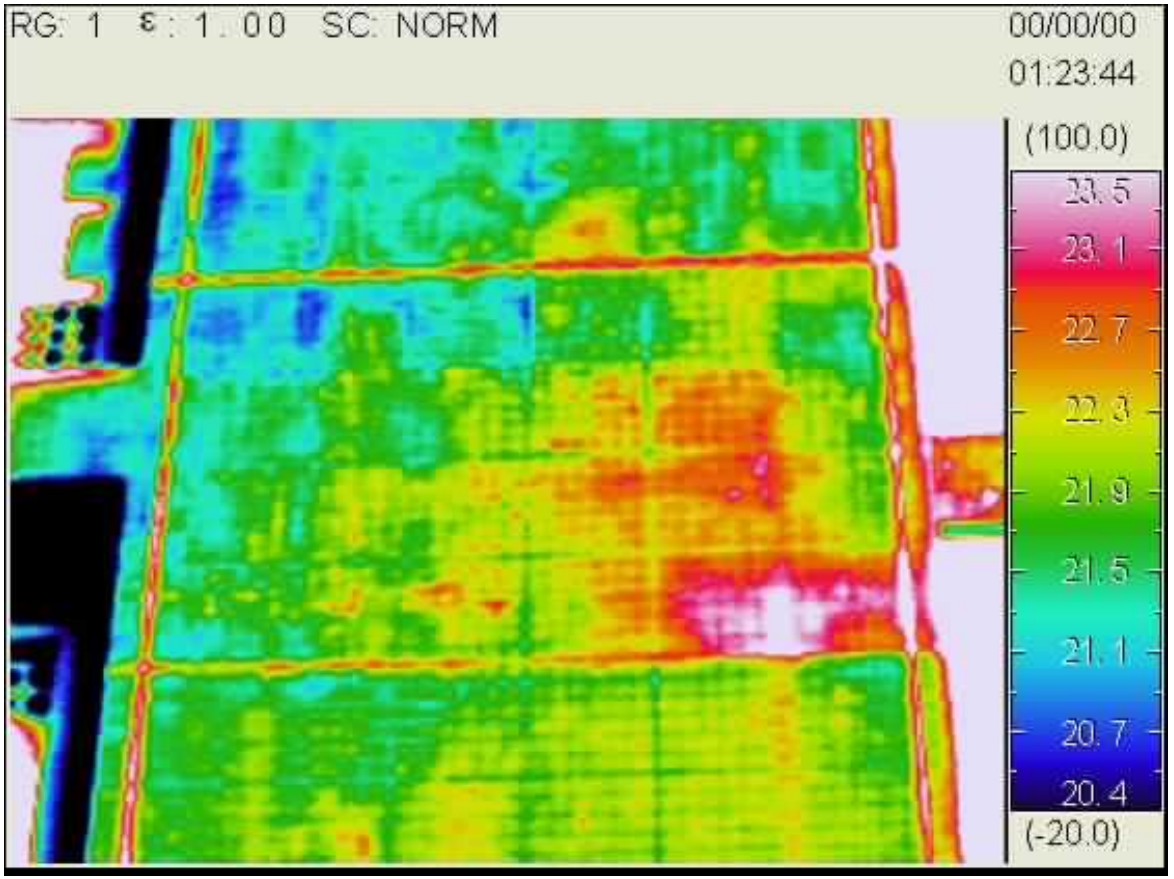
3D interpretation



Infrared Thermography

Principles

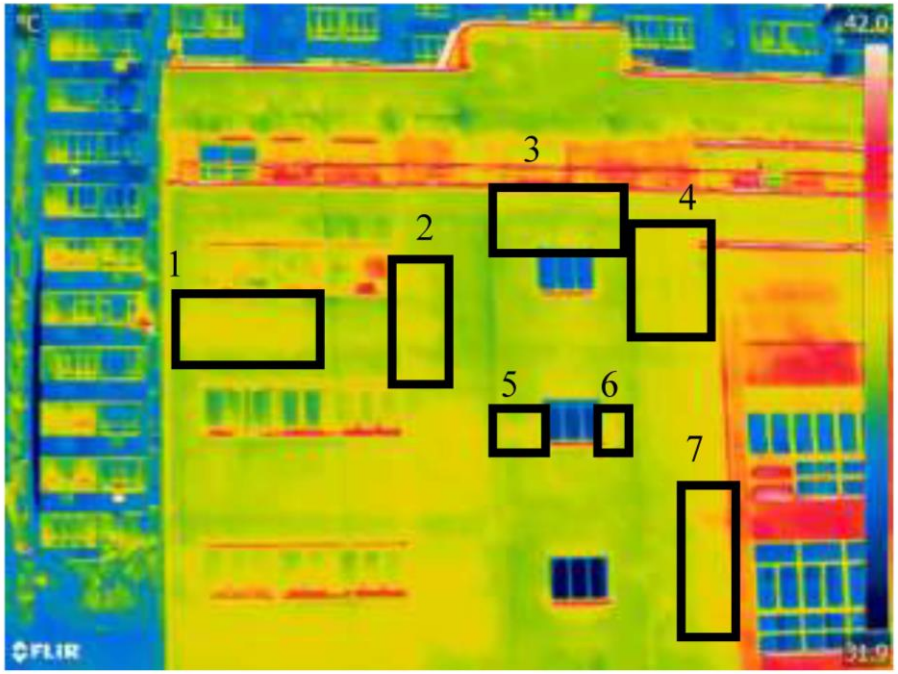
- involves the measurement of surface temperature differentials on a concrete member undergoing heating or cooling.
- Hidden features, such as voids or cracks, will influence the local rate of heating or cooling
- detected by examination of temperature contour



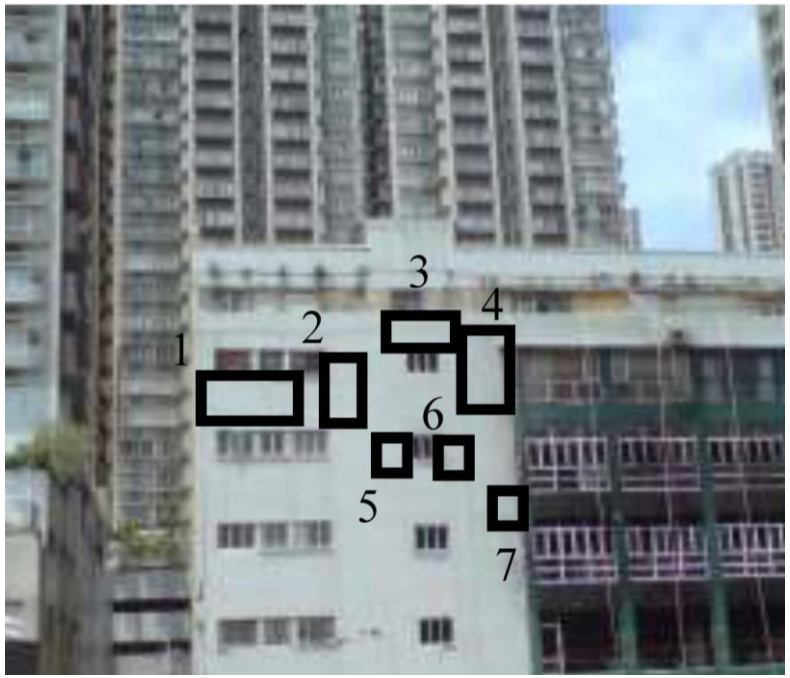
Infrared Thermography

Application

- To determine suspected de-bond of finished and/or spalling concrete



IR image

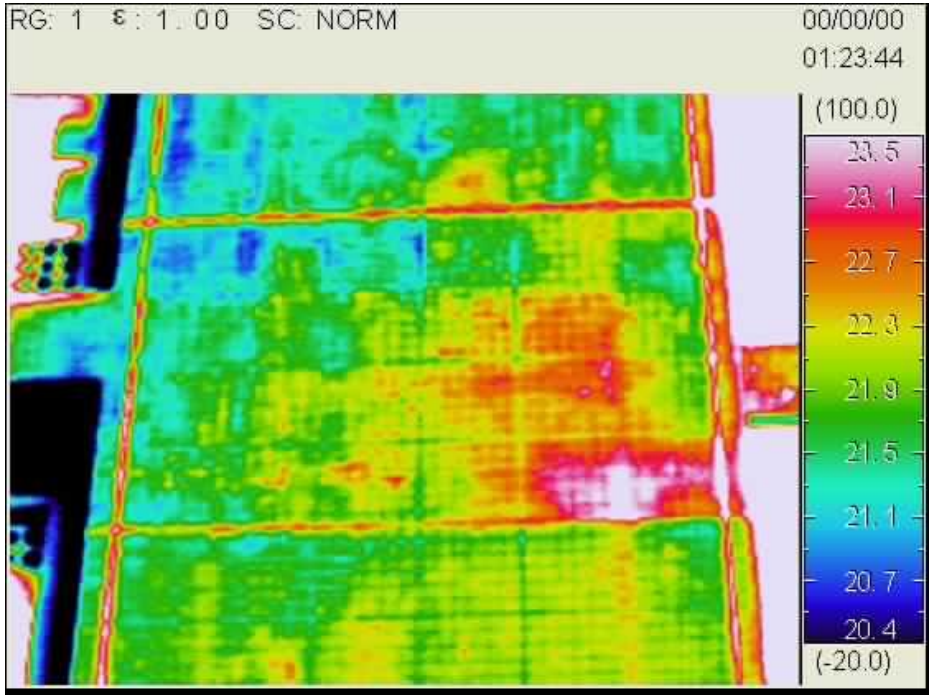


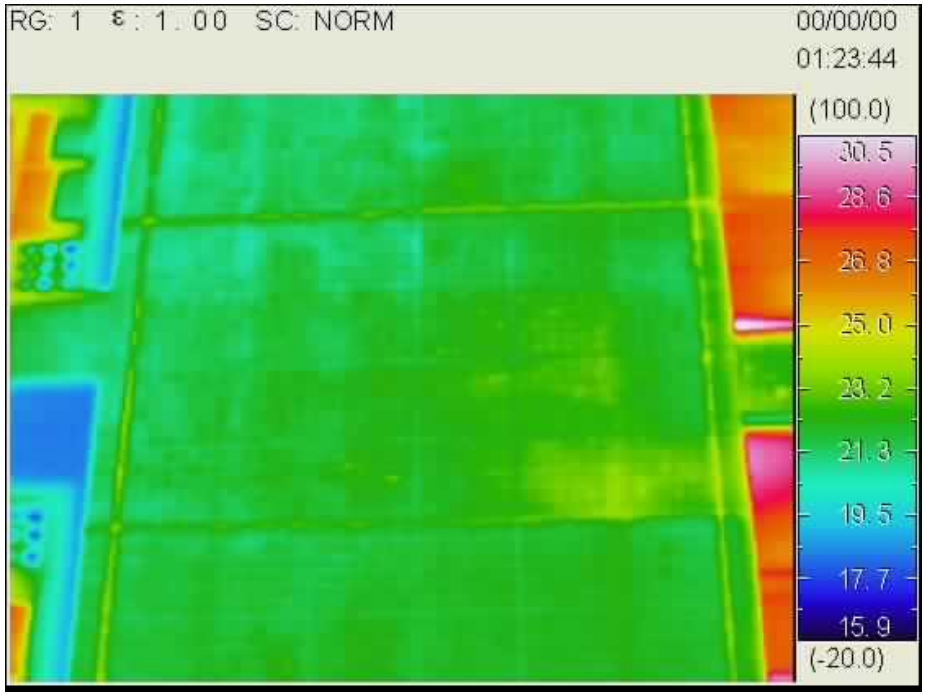
Site photo

Infrared Thermography

Discussion

- Is the repair works effective?



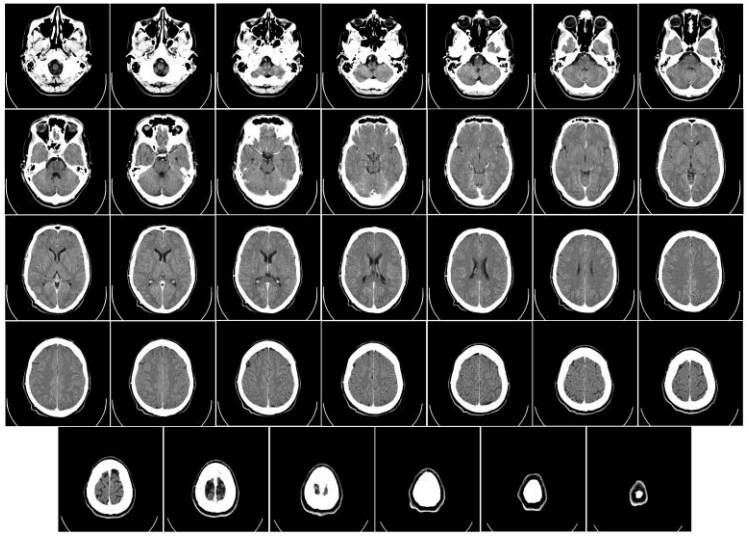


- Actually, the two IR images are identical but with different temperature scale

Quality Control

How to control the quality of NDT

- Use HOKLAS Laboratory
- Proper training
- Change on mind set about accuracy of NDT



Source: http://www21.ha.org.hk/smartpatient/tc/cancerin_focus/details.html?id=169#6

HOKLAS Supplementary Criteria No. 19

Construction Materials Test Category – Accreditation of Diagnostic Tests on Concrete

1 Introduction

1.1 This Supplementary Criteria is an amplification and interpretation of the requirements of HKAS 002, HOKLAS 003 and other relevant HKAS and HOKLAS requirements for the accreditation of diagnostic tests on concrete under the Construction Materials Test Category. The diagnostic tests on concrete include, but not limited to, the following methods:

Carbonation test

Covermeter survey

Half-cell potential measurement

Infrared thermography

Resistivity measurement

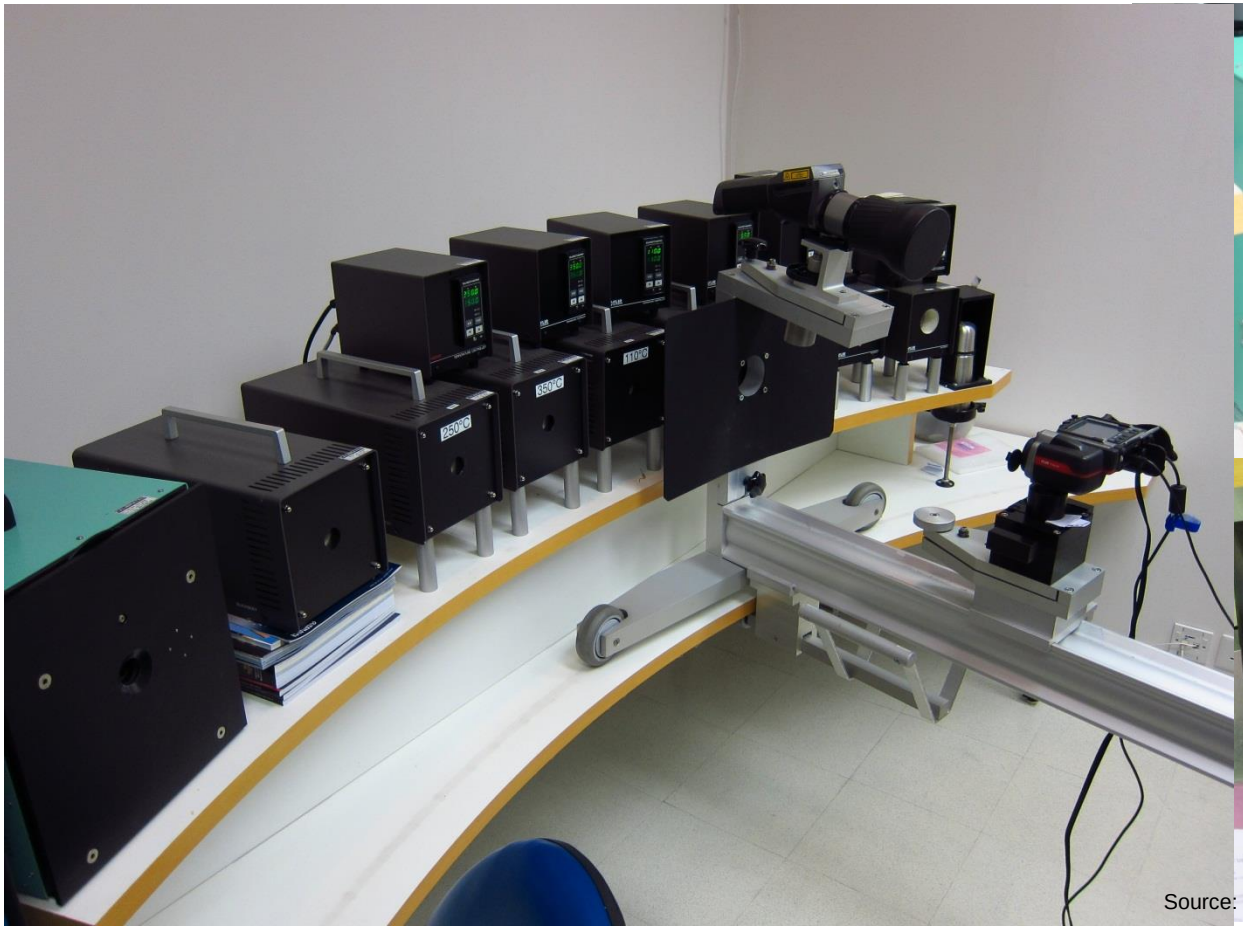
Surface hardness measurement

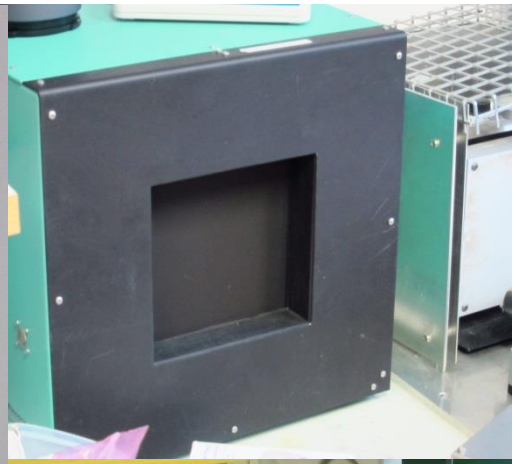
Surface penetration radar survey

Ultrasonic pulse velocity measurement

Quality Control

Calibration of IR Camera





Source: Calibration Lab of Flir (HK)

Credit & Special Thanks

- HKAS
- Department of Land Surveying and Geo-informatics, The Hong Kong Polytechnic University
- Castco Testing Centre Ltd.
- Fugro Technical Services Limited
- FLIR Systems Co., Ltd
- Sensors & Software Inc.
- Advanced NTD Technology Limited

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