

Structure diagnosis device

Identifying internal status of port structures quickly without destruction



Niigata Research and Engineering Office for
Port and Airport, Hokuriku Regional Development Bureau,
MLIT (Ministry of Land, Infrastructure and Transport);

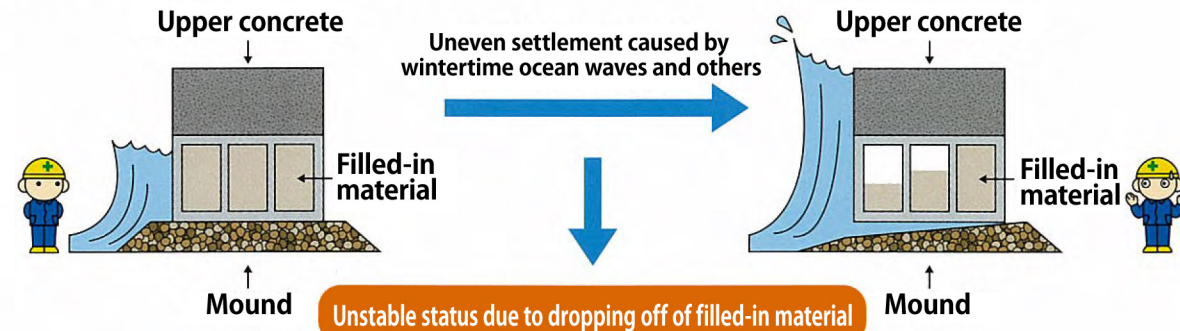
Our structure diagnosis device is the best monitoring tool of port structures that realizes non-destruction, low-cost and high efficiency

Background of development

Recently, the development of new investigation method was highly requested for maintenance of port structures to carry out regular check work simply and more effectively.

1. Deterioration of port structures such as breakwaters

It is focused as difficult problem that port structures such as breakwaters exposed to severe natural conditions receive damages caused by waves along with ageing deterioration. Such damaged and unstable status as dropping off of filled-in material from the caisson is confirmed.



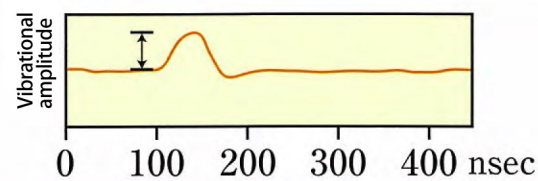
2. Conventional investigation method

To check inside status, there was not so much choice of the checking method but to open holes onto the upper concrete section by boring work to see the presence of filled-in material, that requires significant cost, time, and labor force.

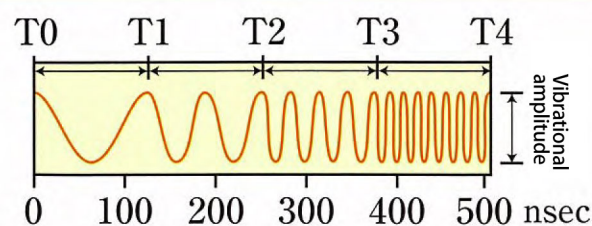
Features of the device

The structure diagnosis device newly developed this time can investigate inside status of breakwaters with upper concrete thickness of up to 5m or more by utilizing efficient continuous-wave Doppler radar without making any holes on concrete layer.

Difference of wave form



Pulse wave
(Used for road exploration)
Exploration depth: Approx. 1.5m



Continuous wave
(Vary in the range between 1MHz and 40MHz)
Exploration depth: Approx. 5~7m

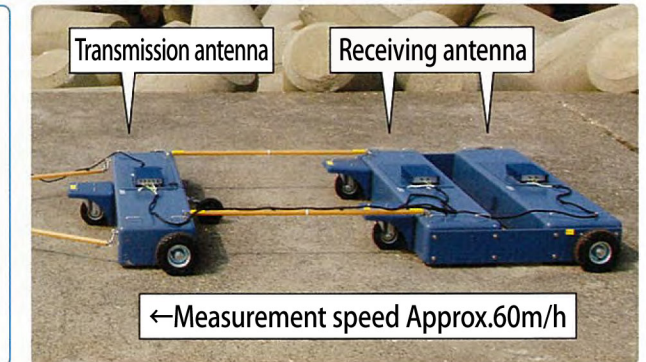
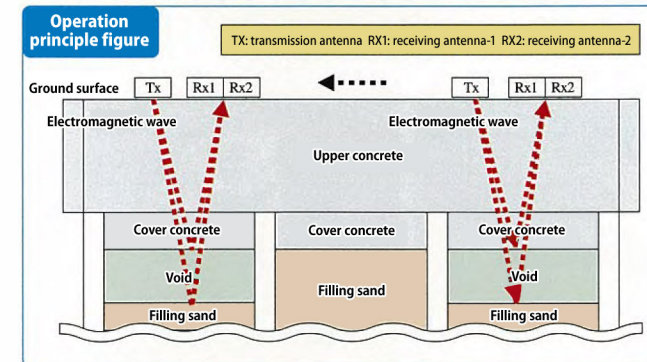
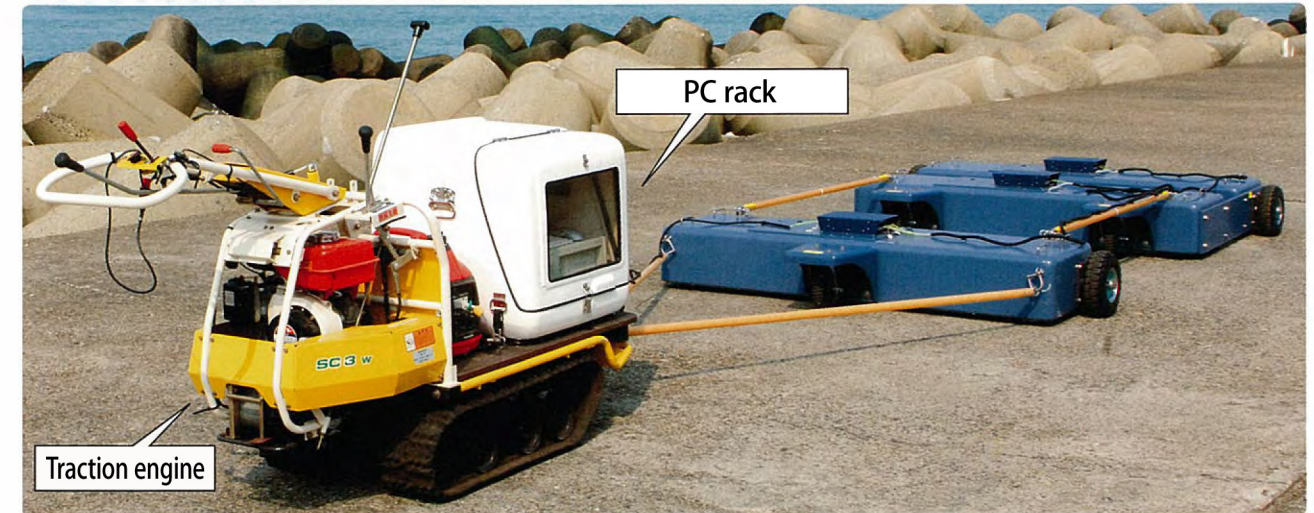
The transmission energy increases by broadening of the area of the sending wave. 

Improving S/N ratio (ration of signal strength and noise) by superimposing and stacking

Superimposing: This is the technique to superimpose the reflection waves obtained by two receiving antennas after measuring the waves.
Stacking: This is the technique to stack several different reflection waves.

Appearance and operation principle

The structure diagnosis device is composed by the tractor engine unit and the antenna unit. Generator and PC for the data analysis are mounted on the tractor engine unit while the antenna unit is composed by a transmission antenna and receiving antennas.



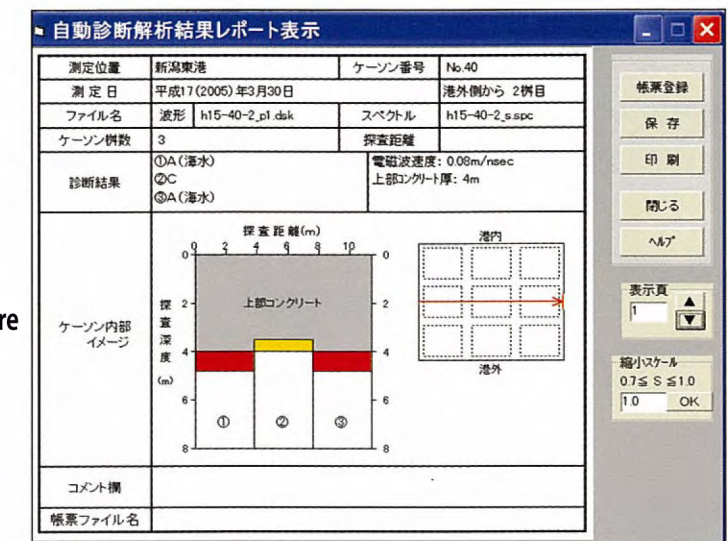
Diagnostic method

The acquired data is promptly analyzed with the special software. Storage of acquired data is also possible in text file and others for future utilization of secular change analysis

1.Acquiring of data



2.Data analyzing by automatic diagnosis software



Automatic diagnosis result report (Page 1)

3.The result of automatic diagnosis can be output in a few seconds and the details are displayed in the page 1 and 2 (Detailed data of each item)

4.Description of diagnosis result

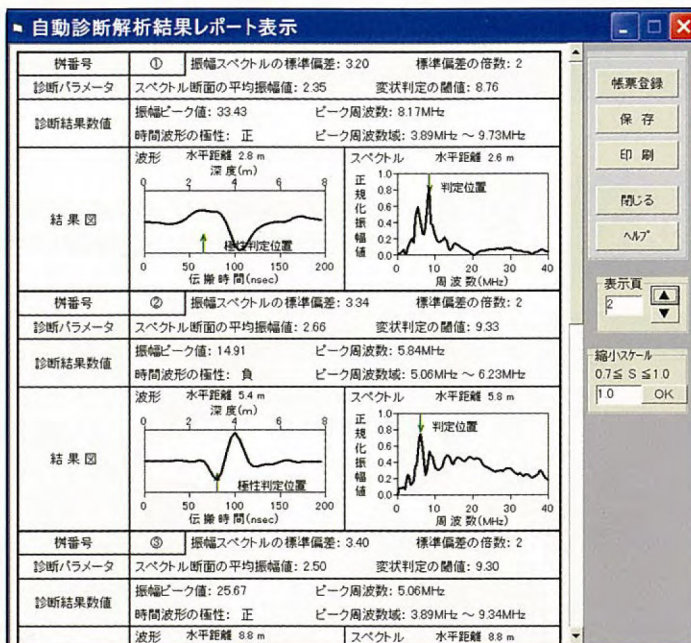
A-Thick cavity (water and or air void)

B-Thin cavity (water and or air void)

C-Air gap trapped or crack running inside concrete

D-No existing void

Above 4 types status are diagnosed by the system.



Automatic diagnosis result report (Page 2)

Flow to start repair work

1. Primary research

The presence of cavities shall be checked for all the structures using structure diagnosis device. If existence of cavities is detected, then rough thickness of them shall be investigated.

Structure diagnosis device can be fully utilized at the phase of primary research, for screening of safety caisson and for extract dangerous caisson



2. Secondary research

Depth measurement and camera shoot check shall be carried out after hole drilling operation to obtain detailed data of the conditions.

3. Repair work

Repairing section, method, and repairing order shall be carefully studied and repairing work shall be then started.



Niigata Research and Engineering Office for Port and Airport,
Hokuriku Regional Development Bureau,
MLIT (Ministry of Land, Infrastructure and Transport);

4-3778, Irifune-cho, Chuo-ku, Niigata City, 951-8011, Japan
Phone : (025)222-6115 (Representing)
FAX : (025)222-120
Web site <http://www.pa.hrr.mlit.go.jp/gicho/>