BollardScan™

Any idea why we do test bollards?

BollardScan™
The smartest solution for testing bollards

The increase in international trade and the growing popularity of cruises have caused an increase in both shipping density and size of vessels. This has not only resulted in an increased level of activity in ports and harbours, but also in an increased level of safety risks, particularly during mooring and un-mooring operations.

The state of the mooring bollards is often unknown. Bollards are expected to withstand larger forces, but the construction and the anchoring are often worn out and no longer have the capacity to meet with the increased forces.
A conservative estimate is that eighty percent of all bollards are over 60 years of age. The lack of dedicated regular maintenance may result in serious damage to vessels and quayside walls and fatal accidents cannot be ruled out.

What does BollardScan offer:

- New, non-destructive technology
- Fully trained operators
- Informative and clear management reports
- Approved by Lloyd's Register and Vienna Consulting Engineers
- Major clients worldwide

The smartest bollard test

The BollardScanTM is a unique way to establish the integrity of the bollard and its foundation. And whether it still meets the design requirements of the structure.
The methodology that was developed in-house is based on the transmission of vibration and sound through the structure allowing us to pinpoint any errors.




The BollardScan™ Better safe than sorry!

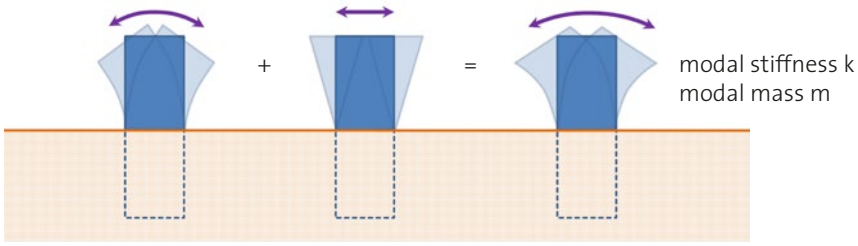
Bollards appear in a variety of forms, in shapes, material and capacity. All bollards, however, have one thing in common. Sooner or later they will be exposed to corrosion, metal fatigue or other types of wear and tear, diminishing the bollards' overall capability. This will increase the safety risks associated with the bollard. The BollardScan method will allow you to get a comprehensive picture of the state of the bollard and will indicate whether a replacement is in order.

Smart, simple, safe!

When scanning a bollard we place a number of sensors on the surface of the structure above the ground. A vibration is initiated by tapping on the bollard in various directions and with various forces. Experiments have proven that the bollard and around 1 m^3 is covered by the vibration. The returned vibrations will be recorded and analysed by a sophisticated computer program. This will result in a number of graphs. The results of the test and the visual inspection form the basis for clear and concise reporting including a risk analysis.

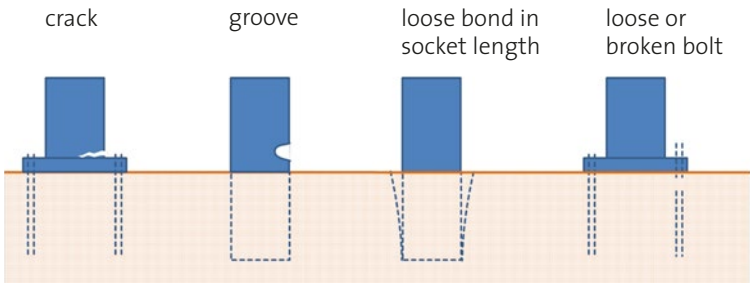
In short, a BollardScan is a must for every responsible port and dock manager aiming to reduce health and safety risks.

Amongst our clients are the ports of Amsterdam, Rotterdam and Vlissingen (The Netherlands), Antwerp (Belgium), Dover, Southampton, Immingham, Newcastle and Liverpool (United Kingdom), Tanger (Morocco), New York (USA), Sydney (Australia), Barcelona and Las Palmas (Spain).

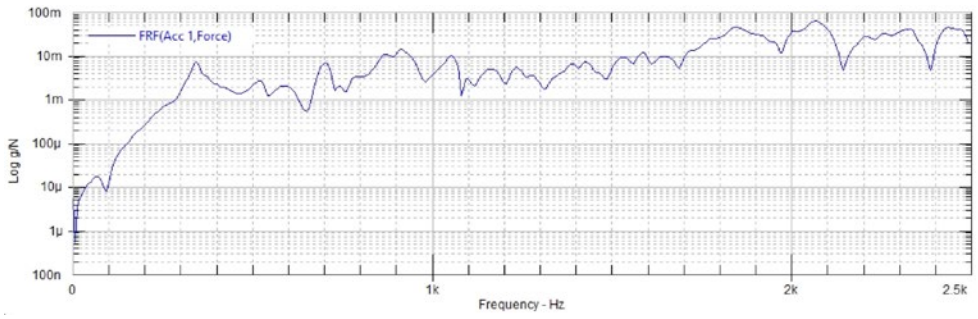


The combination of bending and shear deformation for the first vibration mode

This image shows that the natural frequency is a combination of bending deformation and shear deformation. Since bollards are plumb structures the shear deformations are not negligible. The nett result of this first vibration will give a stiffness of the system (bollard + Anchoring, steel, concrete, grouting, reinforcement, bolts, etc.) The defects that can be determined from this data are shown below.



Defects that influence the natural frequency



The Frequency Response Function (FRF) is measured by placing sensors on and around the bollard. The bollard is than excited by applying a force in different directions with a calibrated hammer. The result of all measurements will give the natural frequency of the bollard. This will subsequently lead to a damping (absorption of the vibration) and stiffness of the system as stated above

Explanation of the vibration test

In order to a viable analysis of a bollards integrity a base line for stiffness and Peak to Peak had to be found. With the number of type of bollards tested we have been able to determine this required stiffness for the various types of bollards. It is without doubt that the more bollards we can test this value will be fine-tuned. The algorithms in use have been used in the vibration testing for many years and have proven their validity.

Testing at different angles

The vibration test is aimed to determine the integrity of the bollards. The integrity is a function of the Frequency Response Function (FRF) and is measured by placing sensors on the bollard. We than excite (make it vibrate) the bollard with a calibrated hammer. This is done at 0, 90 and 270 degrees. These angles replicate the directions of ships ropes. Different forces of 5 and 10 KN are used to measure the FRF. What has to be remembered is that this test is a comparison in similar bollards. In this case the mushroom bollards can be compared with each other taking the size into consideration, the T heads can also be compared as they are the identical.

The FRF is used for further analysing the characteristics of the bollard. This is the bollard's natural frequency (every object has a natural frequency) as a result of the combination of the bending and shear deformation characteristics of the bollard. These two factors determine the stiffness of the bollard. The higher the frequency the higher the stiffness.

The damping is the loss of energy in the bollard and is an indicator for the fixation of the bollard. The better the bollard is fixed the lower the damping. The Peak to Peak ratio is the displacement (movement) of the bollard measured at the sensor. You will note that the displacement on sensor 3 in general is the lowest as this sensor is placed at the bottom of the bollard and sensors 1 and 2 are on the top.

For accuracy purpose, more bollards of a similar type should be tested as this will reduce (at present) and avoid (in future if more bollards are tested) any ambiguity in the test results. In the opinion of BollardScan the stiffness of the amber and green bollards as shown in the stiffness tables is heavily influenced by the method of construction.

Safety is the name of our game

The safety of man and environment has been tantamount to the development of the BollardScan. The risks of accidents and incidents during mooring operations are likely to increase rather than decrease. The load testing of bollards with tugboats, heavy wires and other machinery belong to the past now that BollardScan is available.

BollardScan is a non-destructive way of testing and will be executed by well-trained staff who are highly experienced in port operations. The equipment is portable and lightweight and can be used even in the most remote parts of any port.

Approved by Lloyd's

In august 2018 a review of the procedures and an on-site demonstration of the application of the BollardScan technique to a sample bollard was conducted by Lloyd's Register NDE specialists. From their report:
'The non-destructive dynamic testing is designed for the inspection of dock side bollards in order to assess the integrity of the bollard structure and evaluate the condition of the bollard mountings, supports by the assessment of in-depth analysis of the captured data'.
'The reviewed documents and an on-site demonstration of the technique applied to a typical bollard has confirmed that the company are considered technically acceptable for their intended applications, and are of a high, professional standard. The inspection provides an empirical, non-destructive method of assessing and monitoring the structural integrity of a bollard and its mountings'.

The company

BollardScan is a trade name of Dutch based Mooring BV, which is affiliated to Transoil Transhipment Services (www.transoil.nl) and Marpol Services (www.marpolservices.nl). Together, these companies offer over 60 years of experience in the maritime industry. In collaboration with science institutes TNO Delft (The Netherlands) and Vienna Consulting Engineers (Austria), BollardScan delivers a highly reliable, scientifically underpinned way of testing marine bollards in a non-destructive way.

APPROVED LR

VCE Vienna Consulting Engineers ZT GmbH

Why shouldn't you test us?

Please get in touch with the safety experts of BollardScan.
Contact us directly by phone or send an email to info@bollardscan.com

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Worldwide network

BollardScan is represented in Argentina, Australia, Canada, Chile, Colombia, Germany, Ghana, Oman, Spain, Turkey, United Arab Emirates and the USA.

Mooring BV is registered in The Netherlands under registration number 70797298.
BollardScan Ltd. is registered in the United Kingdom under registration number 10092019.

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