

FIG  
2018  
ISTANBUL



Presented at the FIG Congress 2018,  
May 6-11, 2018 in Istanbul, Turkey

6-11 May 2018

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FIG Congress 2018

## Accessing the Accuracy of Surveying/Photogrammetric Methods to Identify Damages on Physical Models of Rubble Mound Breakwaters

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## Presentation

- The breakwater (real and model)
- The tests
  - the equipment
  - the software
- The results

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## The breakwater

- A (real) breakwater of a port in Portugal is going to be extended 300m
- The shore is subjected to mild-to-severe wave regimes
- The design of the extension has two phases:
  - 1<sup>st</sup> – numerical model test phase: to determine the best shape
  - 2<sup>nd</sup> – evaluation of the hydraulic structural behaviour of the planned breakwater extension: (physical) scale model was built and placed in an irregular wave tank where the necessary wave conditions are reproduced.



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1970's

2009 & 2016

Damages of the breakwater

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The model



The tank

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## The equipment (test)



DJI software didn't allow the flight (the pavillion is less than 500m from the airport)  
&  
electromagnetic interferences affected the radio connections between the remote control and the drone

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## The equipment (test)



(3d scanner)

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Points were coordinated with a total station (GCP)



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Other points, check points, were also coordinated with a total station



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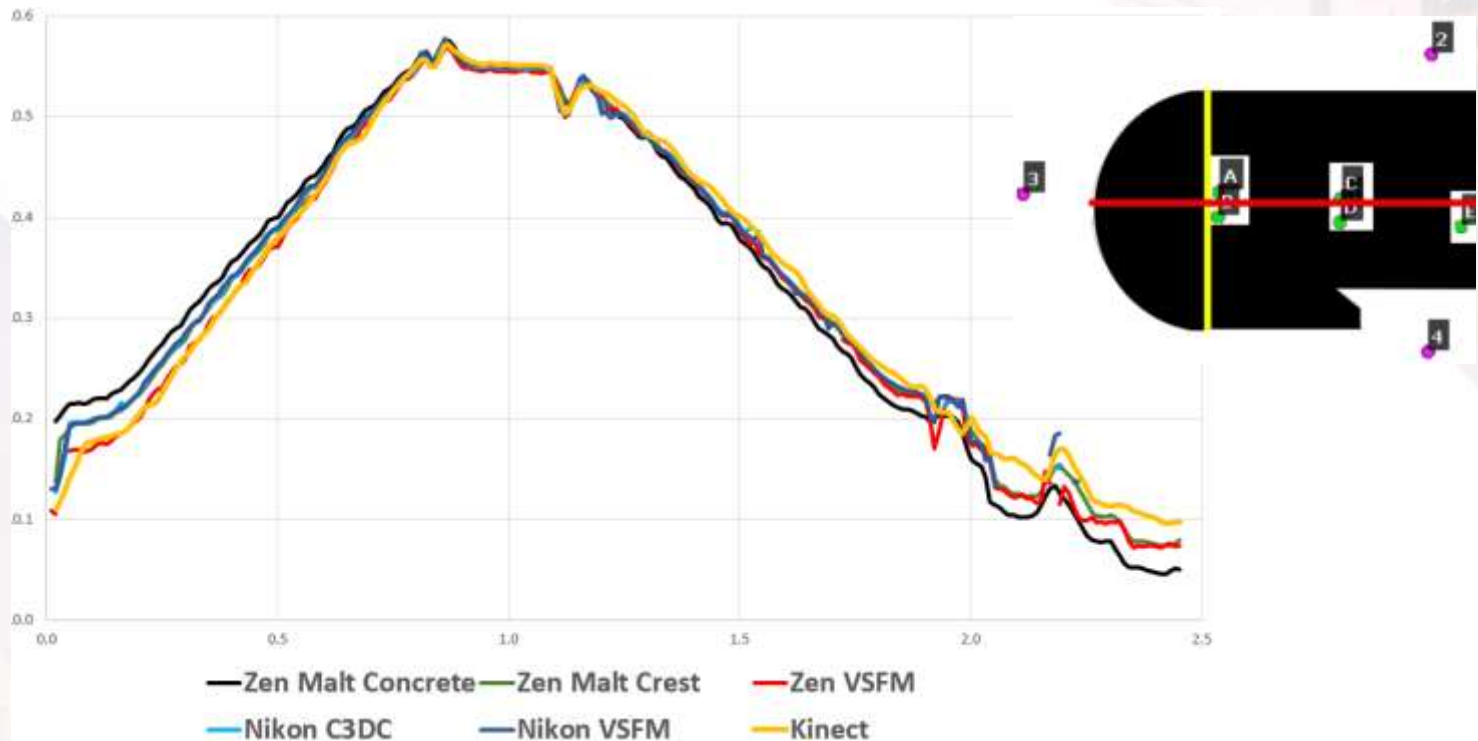
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With the photos point clouds were generated using two free software Micmac and Visual SFM



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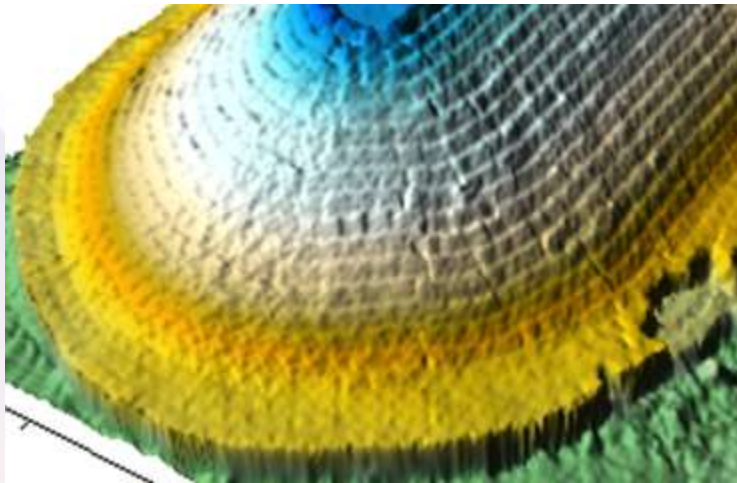
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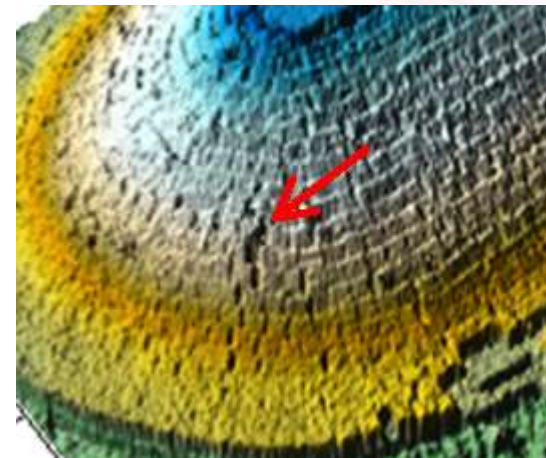
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## 3D representations (using point cloud data)



Point cloud used in the generation of the ortho



Point cloud generated with SFM tool

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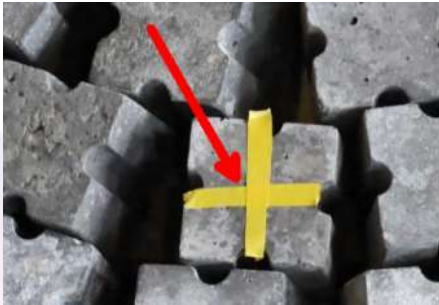
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## The results

### 1. Coordinates comparison



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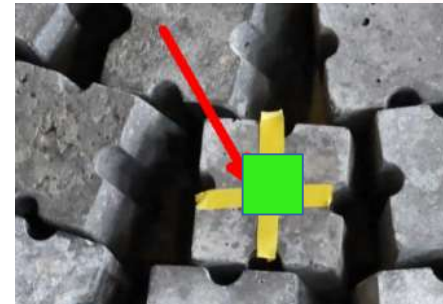
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## 2- Quality of the reconstruction of the faces of the blocks in the clouds



1. select points
2. determine equation flat surface
3. determine  $R^2$  coefficient of determination

## Conclusions

The tests were performed to contribute to a greater confidence in the use of photogrammetric and 3D scanning methods in the identification of surface changes of physical breakwater models.

The best results were achieved with the aerial survey (Zenmuse, the camera from the drone).

The other methodologies that use oblique photographs show results a little bit worse than those using Zenmuse camera, although they are quicker and more efficient techniques to use in laboratory

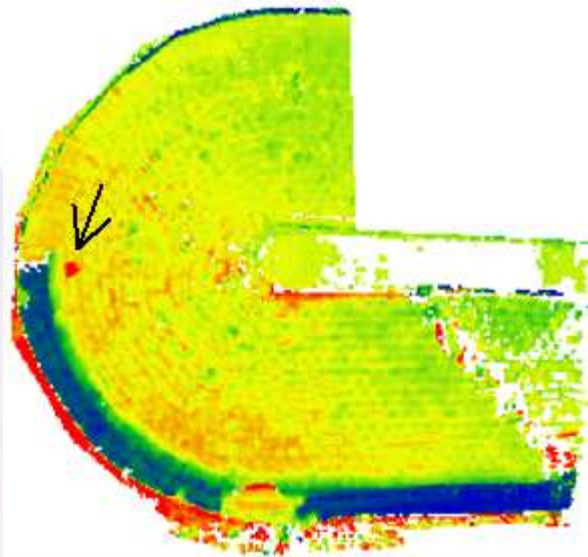


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Thank you for your attention

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