GUIDELINEGEO | ABEM | MALÅ

CASE STORY

Building Investigation

| GPR |

GPR Imaging of the Western Wall in Jerusalem

SUMMARY

GPR was successfully used to investigate the structure and size of ashlars (building rocks) on parts of the Western Wall, in Jerusalem during an investigations campaign by Geo-Sense in 2020 and 2021.

CHALLENGE

The Temple Mount compound, planned by King Herod in the late first century BCE was built through the mid-first century CE and is still a monumental building in modern Israel, with significant parts preserved. The Western Wall is one of these parts, stretched almost 490 meters and with a height of 19 meters, also about 10 meters covered below the current surface.

The Temple Mount and its building technique, with huge ashlars (building rocks) has been of major interest throughout the years. The investigations need to be non-destructive and still precise to get information from the inner structure of the walls. The previous investigations have most often covered only several sporadic ashlars, but with GPR the plan was to cover a larger area and by that reveal King Herod building technique.

SOLUTION

As the resolution was of high importance, to define the structure of ashlars in a correct way, the MALÅ GX system was used. The GX system is based on HDR technology giving excellent bandwidth, resulting in both high resolution and good depth penetration. From start the size of the stones were unknown so both a 750 and 450 MHz antenna was tried out. To get the correct velocity in these ancient stone, measurements were first carried out on ashlars laying on the ground outside the Western wall.

The resulting radargram was matched to the measured thickness and by that giving a correct velocity range for the imaging of hidden sides of the ashlars of the Western Wall. After this the investigations on the wall itself were carried out.

Measurements were made on ashlars on the ground, where the actual thickness were matched to the radargram to get a correct velocity.

It showed the thickness of the investigated ashlars were varying from 0.7 meters up to 3.35 meters depending on the location of the raw. Therefore, the 450MHz antenna was used for the measurements on the wall in places where the penetration of the 750 MHz was not sufficient enough. Measurements were carried out as both in part of the lines using both frequencies.

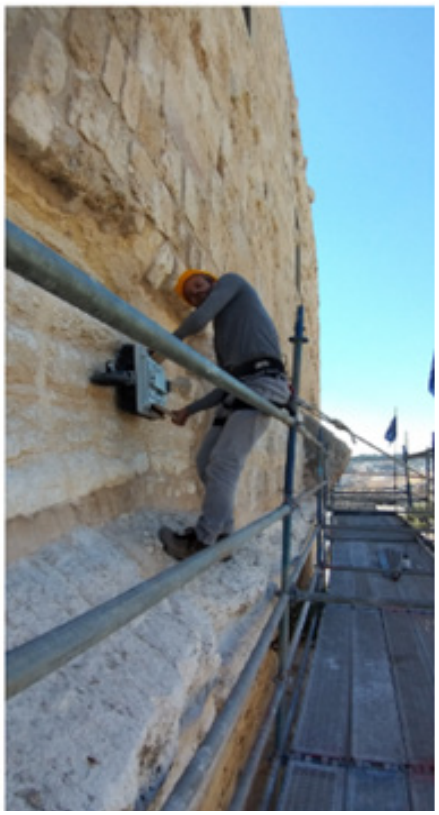
The processing of data was made by Geo-Sense own developed post-processing algorithms for GPR data.

RESULTS & CONCLUSION

The GPR investigation, with the MALÅ GX system, could reveal the inner structure of the Western Wall and give information on thicknesses of single ashlars in the wall construction. The results from the investigations concluded that:

The walls were not built from ashlars at a uniform thickness. The thickness of the ashlars was very varying.
Two layers of stones were detected nearby one stone when thicker structure was needed.

The backside of the ashlar was most often not as worked as the front side.



Measurements carried out with the MALÅ GX450 system on different parts of the Western Wall, Jerusalm, Israel, by GeoSense.

MORE TO READ

Basson U., 2021. Ground Penetrating Radar Imaging of the Western Wall. New studies in the Archaeology of Jerusalem and its region. 65-88 pp. (editors: Zelinger, Y., Peleg-Barakat, O., Uziel, J. and Gadot, Y.)

Baruch, Y., Basson. U., Nachum, O. and Reich, R., 2021. Robinson's Arch: Results of a Geophysical Study. The 22nd conference, City of David – Studies of ancient Jerusalem. 99-116 pp.

PROJECT

Method: Ground Penetrating Radar (GPR)
Solution: MALÅ GroundExplorer (GX) 450 and 750 systems
Measurement: For 450MHz antenna: 5 cm trace interval and 146 ns time window. For 750MHz antenna: 2 cm trace interval and 75 ns time window.
Inversion & Visualization SW: Developed by client, *see More to Read*

ACKNOWLEDGEMENT

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