

The Innes Links Anti-Invasion Beach Defences are situated along the coastline to the north of Lossie Forest and include various defences stretching between Kingston and Lossiemouth which form the east sector of the anti-invasion beach defences of Moray. They ran from Cullen Bay to Burghead Bay and date from 1941 constructed during the second world war. They include pillboxes, anti-tank blocks, inventory observation posts, wire obstacles and gun emplacements, amongst others. Within the forest there are a number of other defences including additional pillboxes and anti-tank blocks but also road blocks and bunkers. (RCAHMS, 2001-2008; J Guy, 1992) During June 2016 three of these sites were visited and surveyed (Figure 1) using laser scanning to create a condition record of a rectangular pillbox with surrounding anti-tank blocks, a hexagonal pillbox and a road block. The rectangular pillbox and anti-tank blocks were situated on the beach whereas the other two sites were within the forestry.

Figure 1 (above): Site location plan

Plate 1 (front cover): View of anti-tank block line looking out from the hexagonal pill, from the NE

Plate 2 (background): View along the beach at Lossie showing the line of anti-tank blocks, and the gun emplacement just visible to the left, from the NE

WWII Defences, Lossie Forest

Pillbox and Anti-tank Blocks

A rectangular pillbox (NJ26NE 14.06) is situated (NJ 28057 67970) on the pebble beach to the north of Lossie Forest. It is aligned E-W and has a long run of anti-tank blocks surrounding it on a similar alignment to both the east and west (Figures 2&3).

The structures sit in a dip in the land overshadowed by dunes to the south and a series of pebble beach terraces to the north (Figures 2 & 4; Plate 9; Video 1). It is unclear whether the pillbox and anti-tank blocks were originally located with a good view out to sea that has been blocked by the formation of the pebble terraces due to tidal action, or whether they were deliberately placed within the land dip for the element of surprise on potential attackers.

The pillbox is one of 22 surviving within Lossie Forest and the anti-tank blocks surveyed are just a sample of the coastal crust that runs from NJ 32050 66220 to NJ 27425 68262 (Marttila et al, 2009:9).

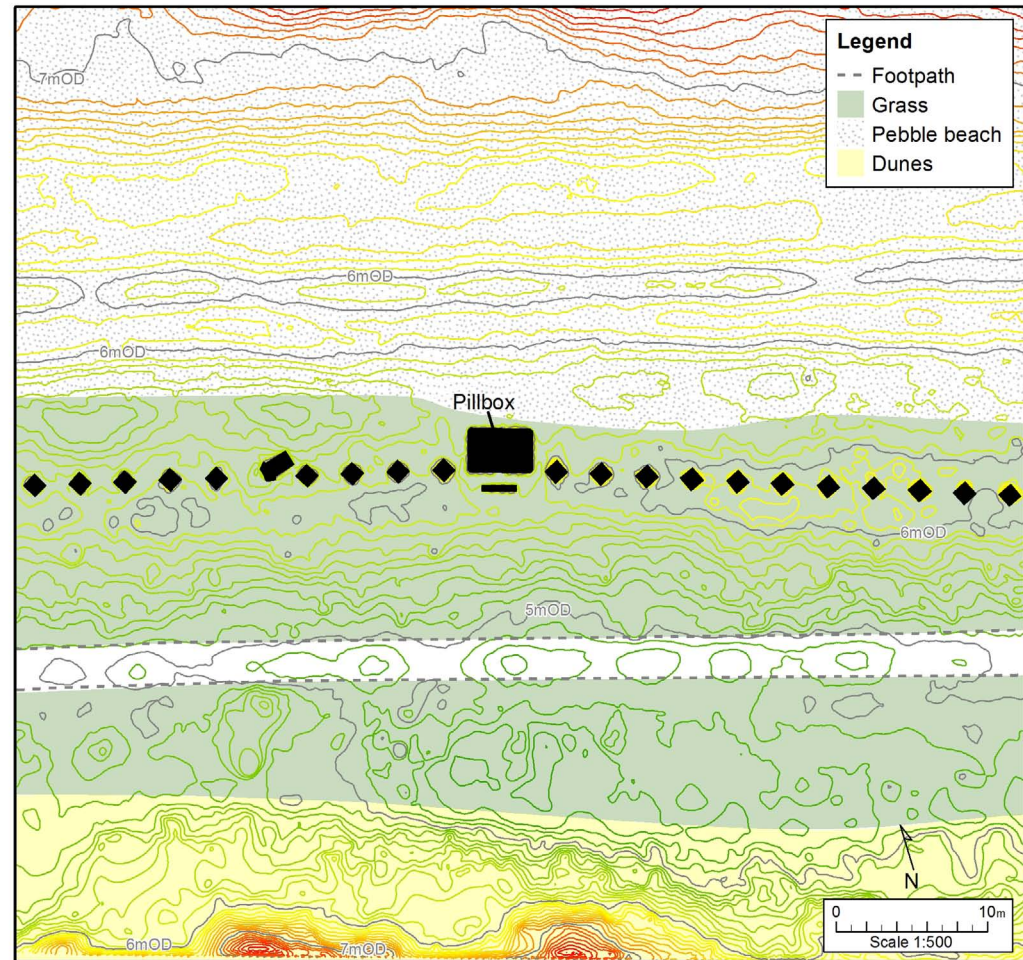


Figure 2: Plan of Pillbox and Anti-tank blocks location

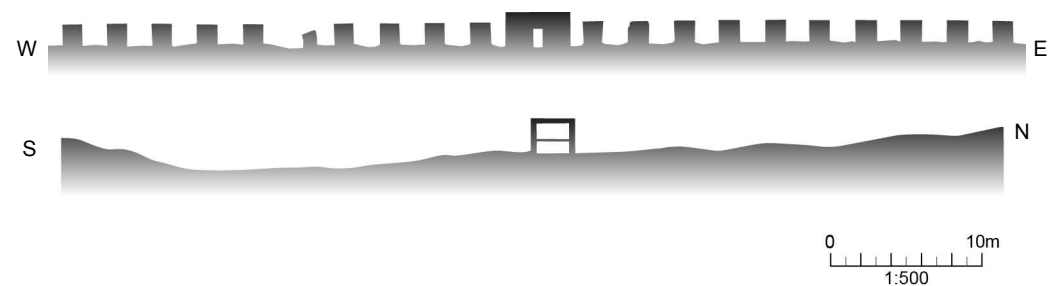


Figure 3 (Top): Section running W-E through pillbox and anti-tank blocks perpendicular to beach

Figure 4 (Above): N-S section across beach showing pillbox sitting in a dip between dunes and pebble beach terrace

The Pillbox

The pillbox is rectangular in shape with chamfered corners (Plans, Figure 5). It is concrete with an encased metal frame that was constructed using the shuttered concrete technique (RCAHMS, 2008); the concrete is imprinted with the shapes of timber planks (Plate 4). It measures just over 4.3m x 2.9m (Figure 5) and stands to a height of 2m. The concrete walls are just less than 0.4m thick and the roof is just 0.3m deep. It is unclear how deep the structure is set within the ground.

The entrance is in the centre of the south wall and is protected by a 0.4m thick anti-blast wall which lies 0.85m outside the entrance in a parallel alignment (Plate 5). This is also constructed of concrete and stands to a height of about 1.4m and a total length of 2.3m. The wall covers the total height of the door and is topped just above the cill height of the windows.

There is a window on both the east and west walls (Plates 4&7) that measures 0.8m in width and 0.4m in height (external measurements). A small shooting slot measuring 0.2m wide by 0.3m high lies in the centre of the north wall (Plate 7) at the same height as the windows.

Within the structure are two concrete benches (Plate 4) each supported by two cuboid, concrete supports 0.2m square by 0.8m high.

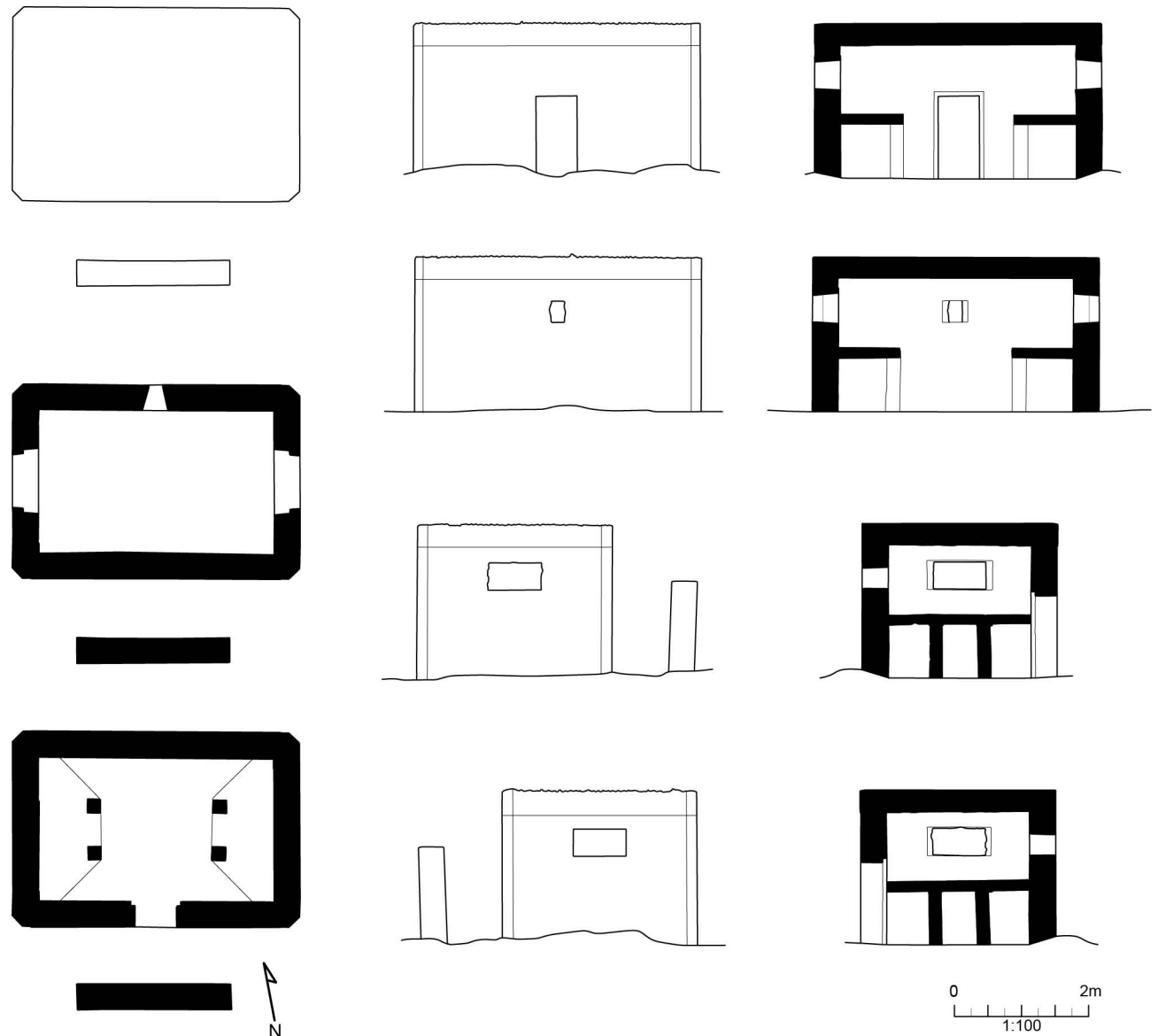


Figure 5 (In columns from left to right): Plans and elevations of the pillbox. Roof plan; Plan at window height; Ground plan; External S elev (minus the anti-blast wall); External N elev; External W elev; External E elev; Internal S elev; Internal N elev; Internal E elev; Internal W elev. NB all internal elevations showing sections through the centre line of the walls

Anti-tank Blocks

The line of anti-tank blocks stretches away to the east and west of the rectangular pillbox as far as the eye can see (Plate 3). The blocks were created using the same shuttered concrete technique as the rectangular pillbox (RCAHMS, 2008).

The 10 blocks immediately to the east and west of the surveyed pillbox are all largely identical, measuring about 1m square and 1.4m tall.

Condition

The pillbox remains in good condition with only a few small areas of damage to the concrete. The roof of the pillbox has some shingle from the beach resting on it and some patches of moss and grass growing on it, but structurally it remains sound. There are two areas of graffitied lettering in the concrete. The graffiti on top of the anti-blast wall (Plate 8) appears to have been carved in before the concrete was set but the lettering on the eastern bench inside the pillbox (Plate 4) seems to have been scratched into the concrete after it dried and set.

Most of the concrete blocks have survived well with sharp corners and the steel metal hoops on their top face still in place. Only a small number of the blocks have fallen over or been chipped in some way. The fifth anti-tank block to the west of the surveyed pillbox is now completely fallen and lying on its side in a NE-SW orientation (Figures 2 & 3; Video 1).

Plate 3: Line of anti-tank blocks leading from the surveyed rectangular pillbox to the next pillbox to the west.



Plates

Clockwise from top left: Plate 4: Concrete bench on the pillbox internal east wall and grooves visible in the wall from the concrete shuttering construction method, from the west; Plate 5: Entrance and anti-blast wall to the south of the pillbox, from the SW; Plate 6: Graffiti scratched into the top of the bench on the eastern wall, from the NW; Plate 7: External NE corner of the pillbox showing large window on the east wall and shooting window on the north wall, from the NE

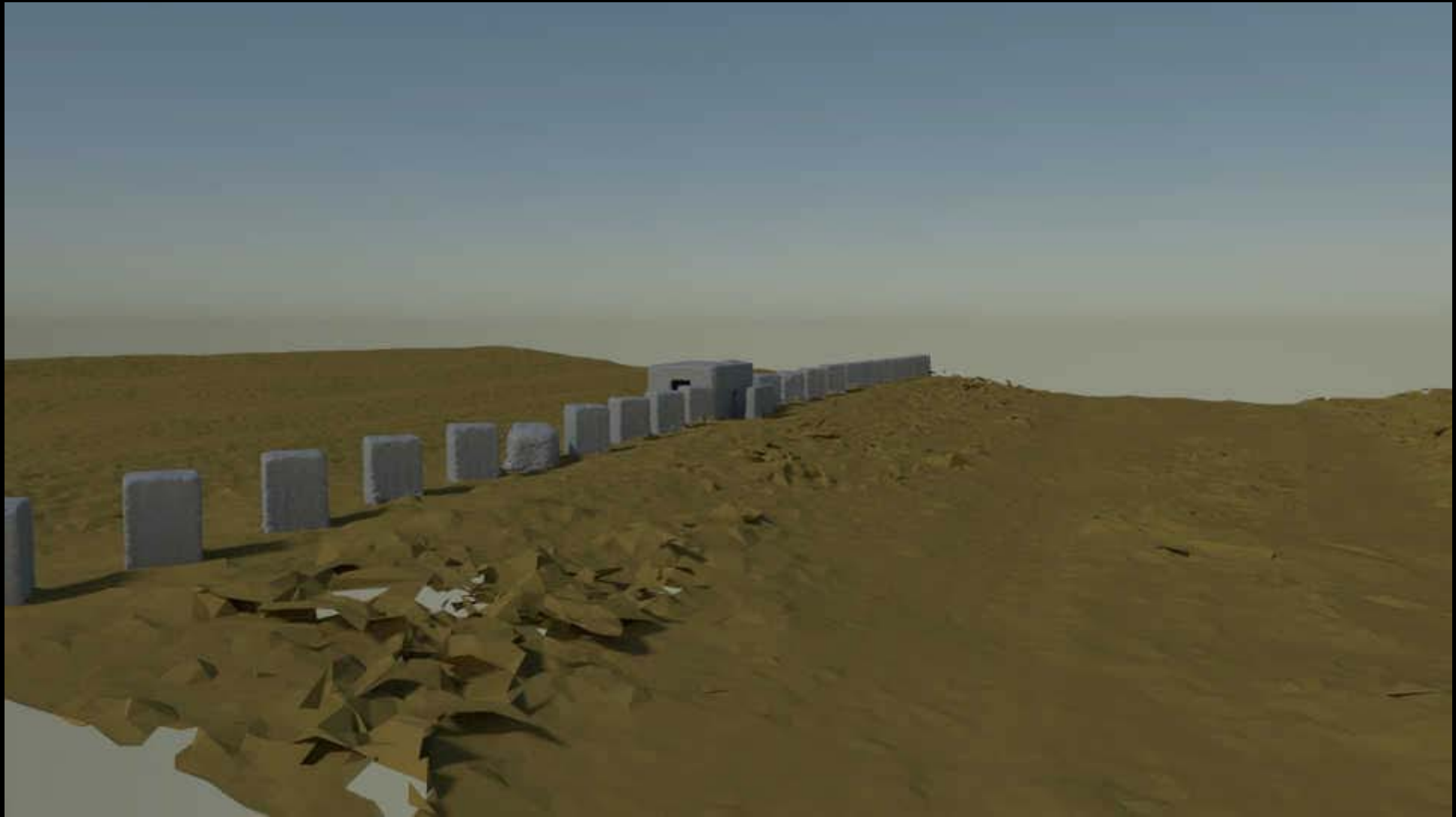


Plates

*Below: Plate 8: Graffitied letters marked in the wet cement on the top of the anti-blast wall at the time of construction.
Bottom: Plate 9: View along the shingle beach terraces and laser scan survey of the anti-tank blocks, from the west;*



Situation



Video 1: Rotating mesh of the rectangular pillbox and anti-tank blocks situated along the shingle beach terraces

Orthos



Figure 6: Orthoimage of the pointcloud data showing the setting of the pillbox and anti-tank blocks on the beach, with real colour and edge lighting viewed from the NE

Orthos

Orthoimages of the laser scan pointcloud data showing the pillbox and anti-tank blocks with real colour and edge lighting:

Figure 7 (right): View from the SE



Figure 8 (right): View from the SW



3D Visualisations

Perspective views of the mesh created from the laser scan data:

Figure 9 (right): View of the rectangular pillbox interior, from above N

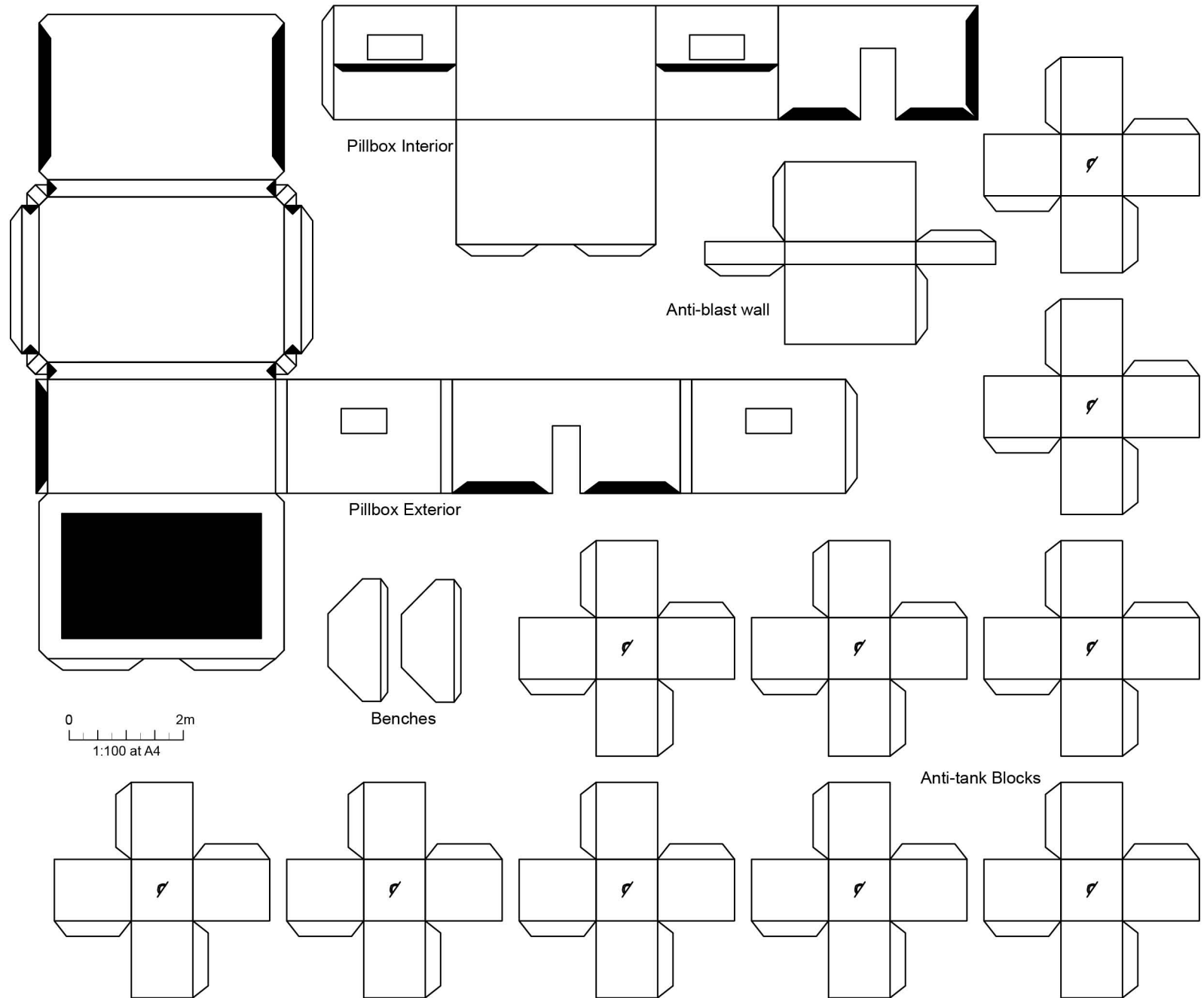


Figure 10 (right): View of the SE internal corner of the pillbox, anti-blast wall and anti-tank blocks, from above NW



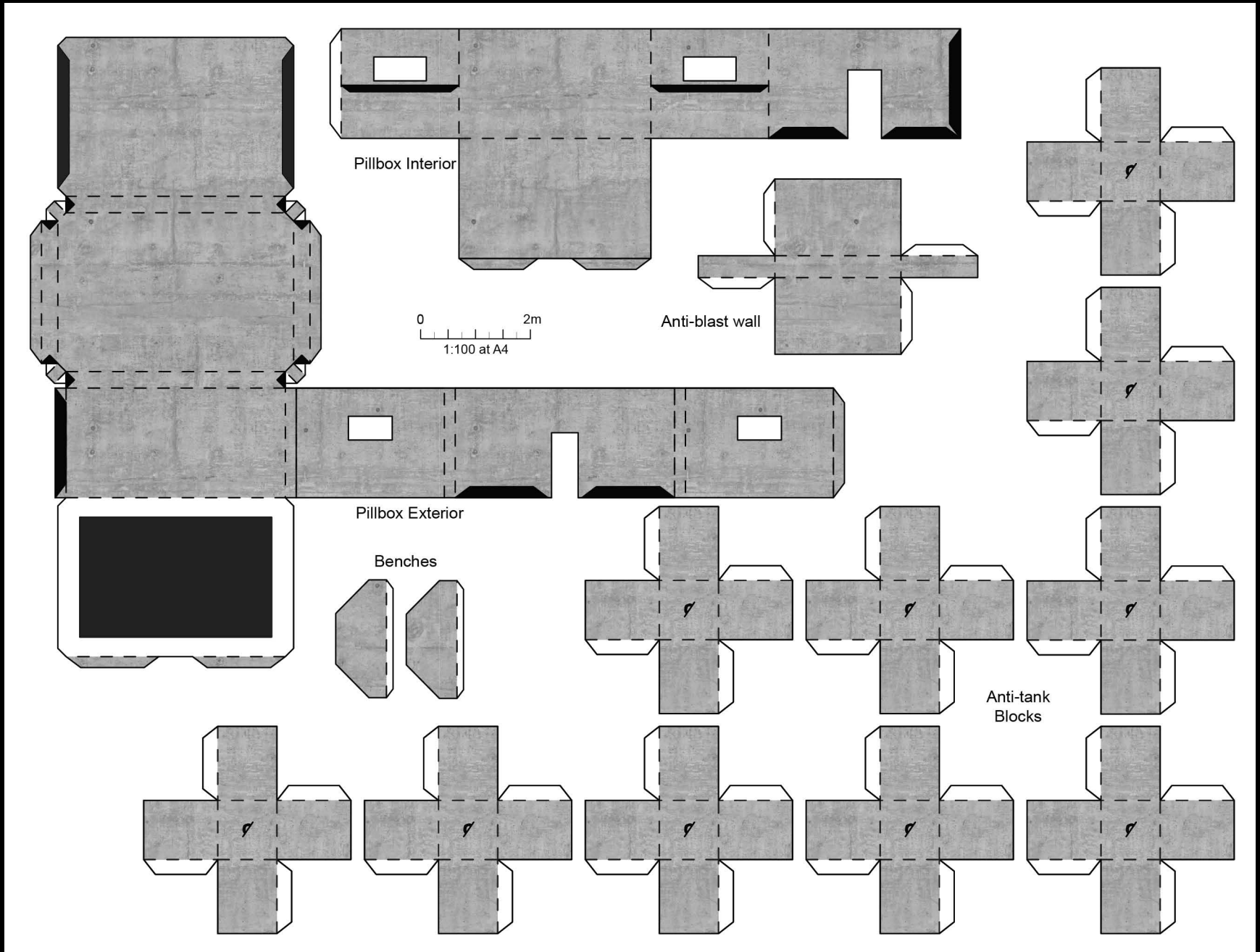
FCS Cut-Outs Series

Figure 11:
Cut-Out Templates of the
rectangular pillbox and
anti-tank blocks produced
for the FCS Cut-Outs
Series.



FCS Cut-Outs Series

Figure 12:
Cut-Out Templates of the
rectangular pillbox and
anti-tank blocks, with real
concrete texture



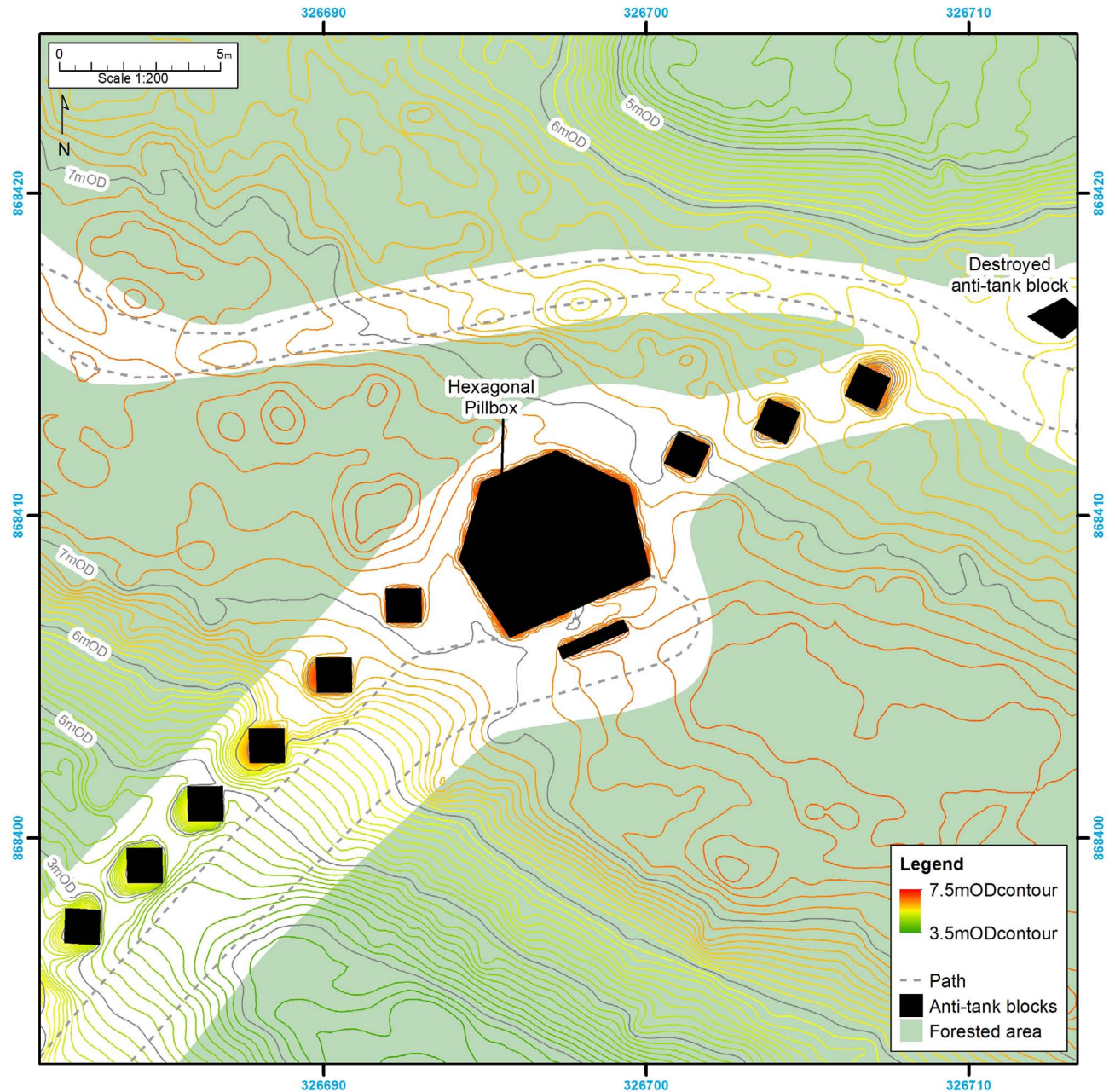
Hexagonal Pillbox

A hexagonal pillbox (NJ26NE 14.15) is situated (NJ26697 68409) within Lossie Forest, approximately 250m south of the beach and the coastal defences. It is incorporated into a line of anti-tank blocks which run from the beach through the forest in a NE-SW direction.

The pillbox sits on the crest of a ridge running NW-SE which slopes away to the NE and SW by around 4m (Figure 13). The structures sit within a clearing that has an entry footpath coming from the SW, although the trees are encroaching. Before the trees were planted around this site the location would have had a good view of the surrounding area.

There is another path which approaches the site from the west. It continues past the site to the north-east and passes through a large gap in the anti-tank block line three blocks to the NE of the pillbox. The fourth block to the NE is in poor condition as it has shattered and no longer has a cuboid shape (Plate 10).

Figure 13: Location plan of the hexagonal pillbox and surrounding anti-tank blocks.





Description and Condition



Plate 10 (left): Anti-tank blocks heading NE from the pillbox with destroyed block in the foreground

Plate 11 (above): SW view of the hexagonal pillbox and adjacent anti-tank blocks

The pillbox is hexagonal in shape with its longest dimensions being 5.7m x 4.4m x 2.3m (Figure 14). It was constructed using the shuttered concrete technique which is evident from the patterning on the internal walls. The walls and roof are 0.4m thick but it is unclear how deep the structure is set in the ground.

The entrance is situated on the SE wall (Plate 12; Figure 16) which is the longest side at 4.75m. It is protected by an anti-blast block (Figure 15) which measures 2.2m x 0.4m x 1.9m and was constructed in the same way. There is a small window either side of the door which could be shooting slots. A window measuring almost a metre in width and 0.4m high is present on each of the other walls (Plate 13; Figure 14).

Within the pillbox are two benches which each come out from three of the walls and are propped up by 3 concrete posts (Figure 14, ground plan; Plate 15).

The pillbox remains mostly in good condition although the exterior is suffering from moss growth on the roof and wall tops. The interior has a few areas of modern graffiti scratched into the concrete and there are a number of chips in the concrete surface (Plate 14). Apart from the one destroyed anti-tank block the rest of the blocks remain in good condition with just a few areas of moss growth on the tops (Plate 10)

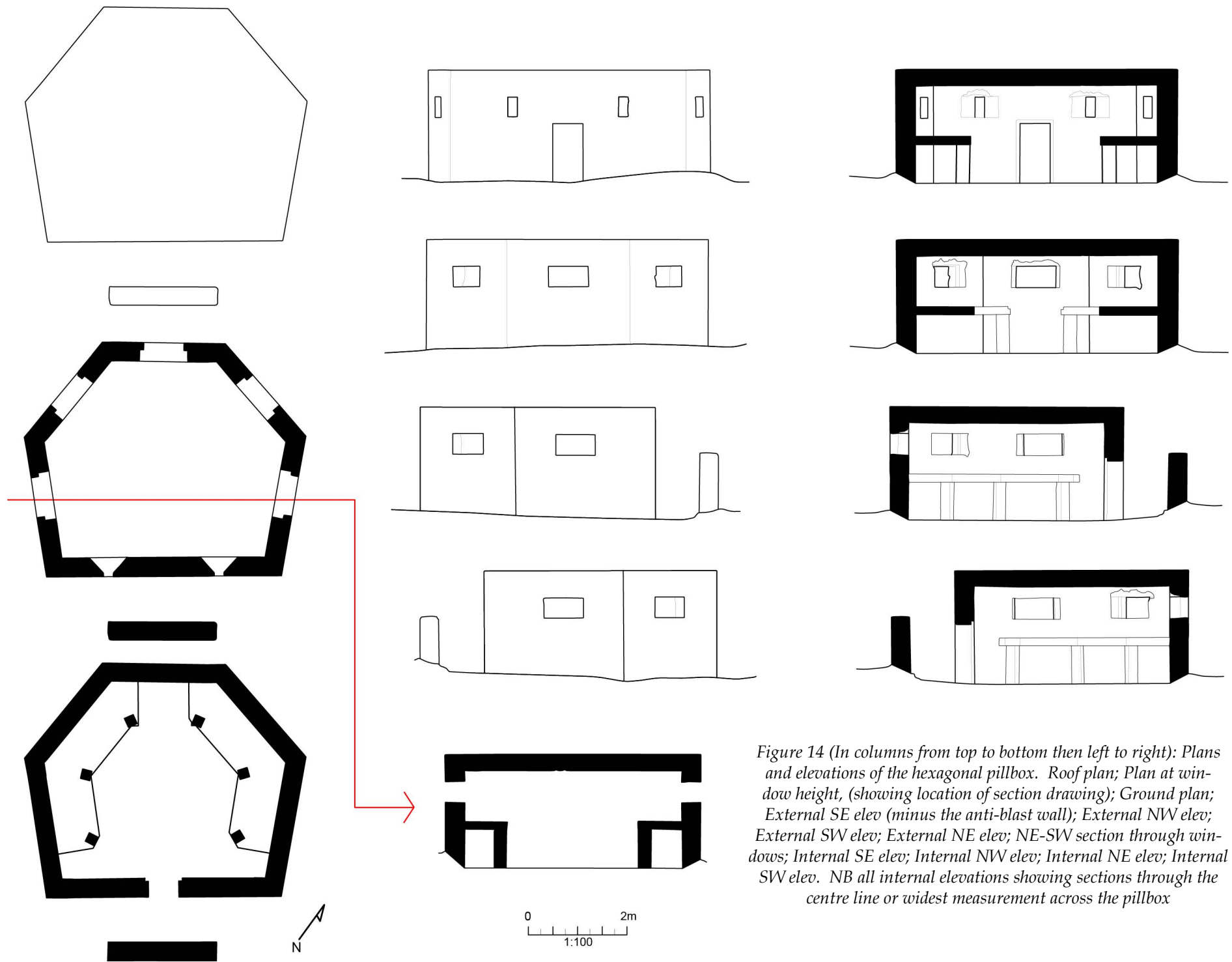


Figure 14 (In columns from top to bottom then left to right): Plans and elevations of the hexagonal pillbox. Roof plan; Plan at window height, (showing location of section drawing); Ground plan; External SE elev (minus the anti-blast wall); External NW elev; External SW elev; External NE elev; NE-SW section through windows; Internal SE elev; Internal NW elev; Internal NE elev; Internal SW elev. NB all internal elevations showing sections through the centre line or widest measurement across the pillbox

Plates

Clockwise from top left: Plate 12: Southern corner of hexagonal pillbox showing entrance, shooting slots and anti-blast wall, from S; Plate 13: View along anti-tank block line up to pillbox showing undulating ground, from SW; Plate 14: Areas of modern graffiti and concrete damage on internal roof and around windows on the SE wall along with grooves from construction method, from NW; Plate 15: View of internal N wall with concrete bench, from S





Figure 15: Orthoimage of the laser scan pointcloud showing the south side of the pillbox with its entrance and anti-blast wall, with real colour and edge lighting, from above S

Orthos

Orthoimages of the laser scan pointcloud showing the pillbox:

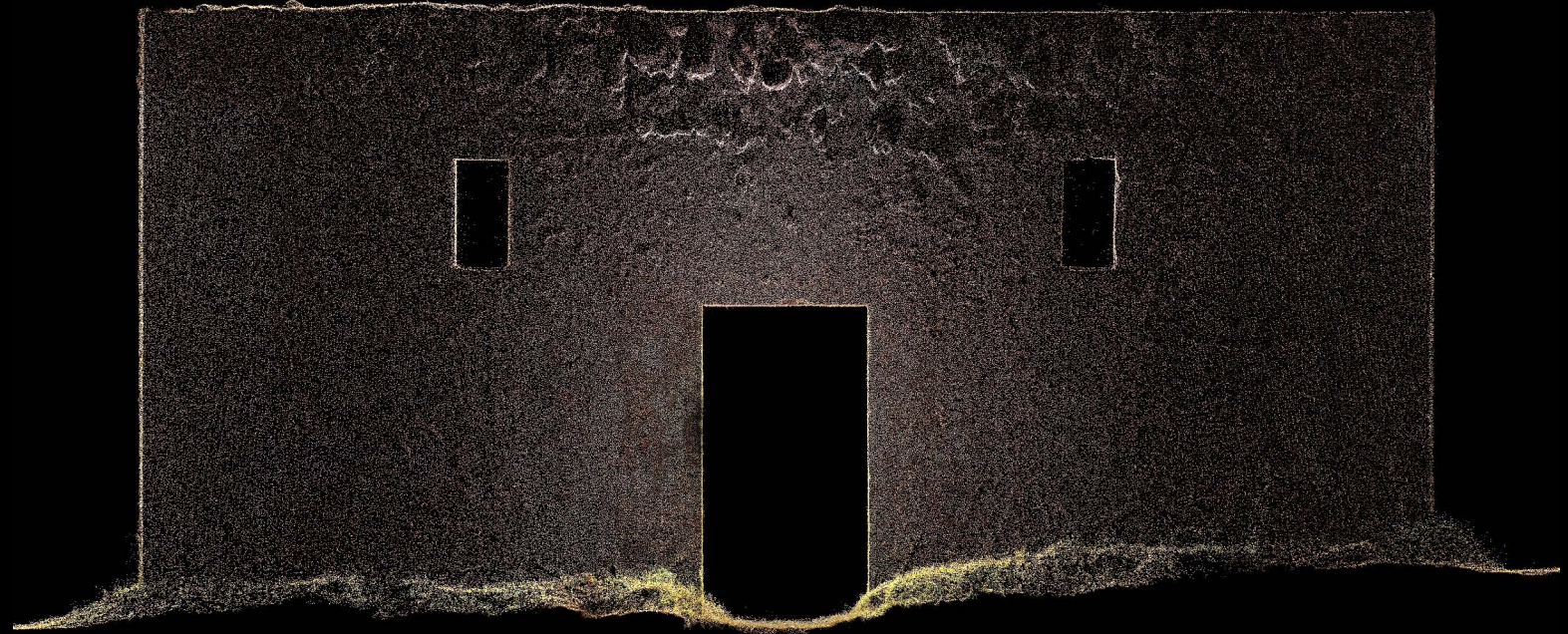


Figure 16 (right): Pillbox entrance and shooting slots without the anti-blast wall,



Figure 17 (left): Plan view of pillbox and anti-tank blocks, with edge lighting

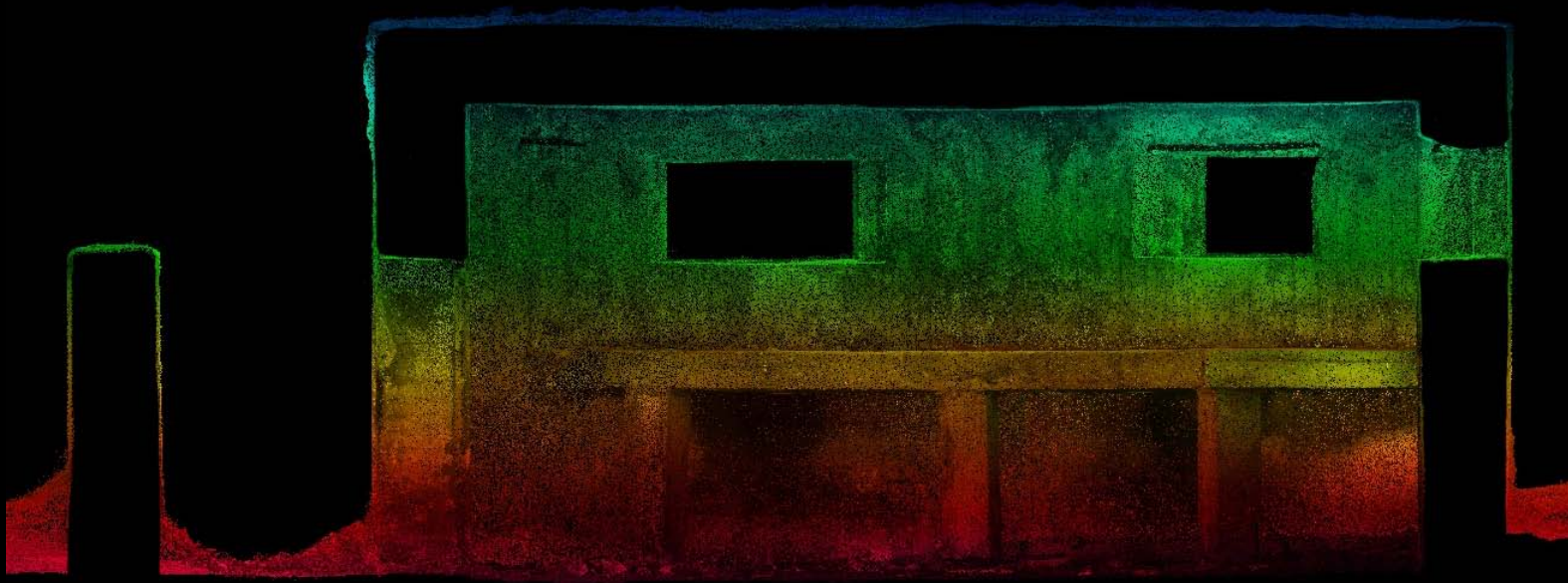


Figure 18 (above): Orthographic view of the pointcloud showing the hexagonal pillbox's internal SW elevation, colour filtered by elevation

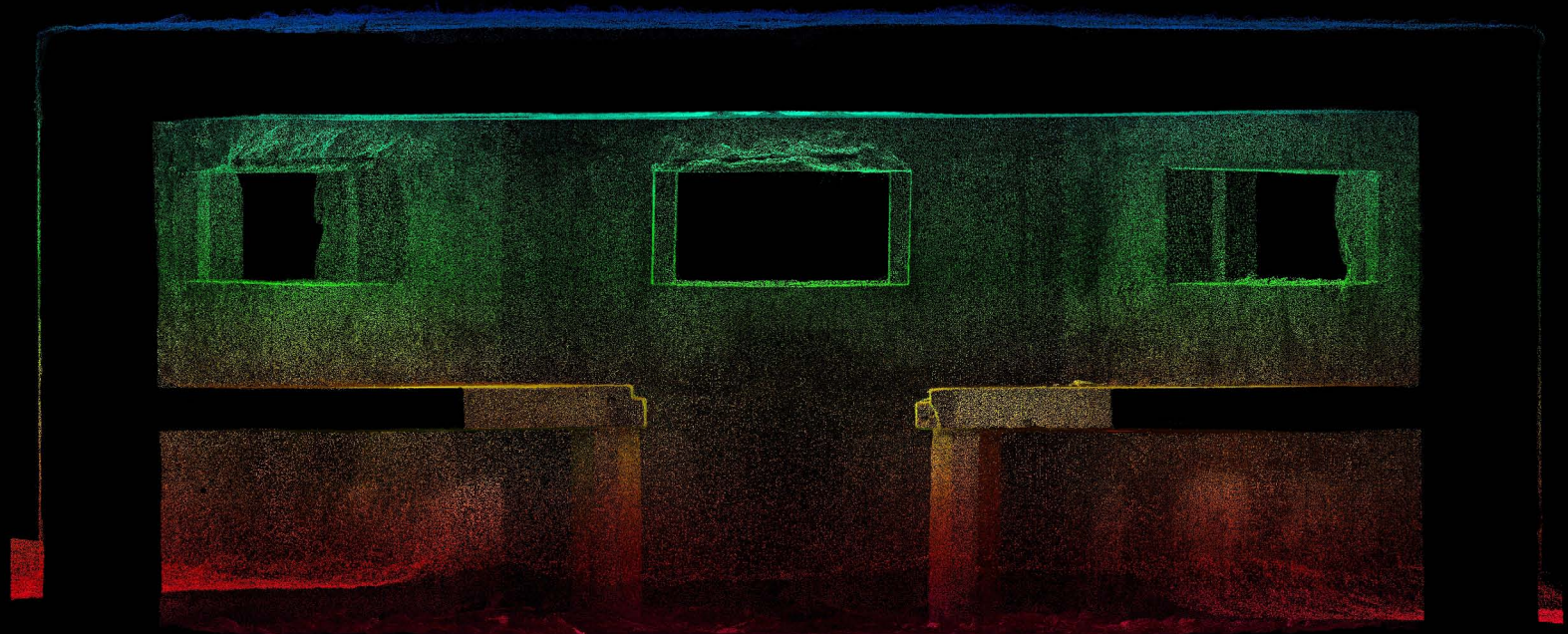


Figure 19 (right): Orthographic view of the pointcloud showing the hexagonal pillbox's internal NW elevation, colour filtered by elevation

3D Visualisation

Images of the textured mesh created from the laser scan pointcloud showing:

Figure 20 (right): View of the hexagonal pillbox and anti-tank blocks, from the NW



Figure 21 (right): View of the hexagonal pillbox and anti-tank blocks in their undulating surrounding topography, from N



Videos



Video 2: Orbit around the interior of the hexagonal pillbox created from the laser scan mesh. Click on the image to start the video

Videos



Video 3: Flythrough video of the structures mesh created from the laser scan data with real concrete and forestry floor texture

FCS Cut-Outs Series

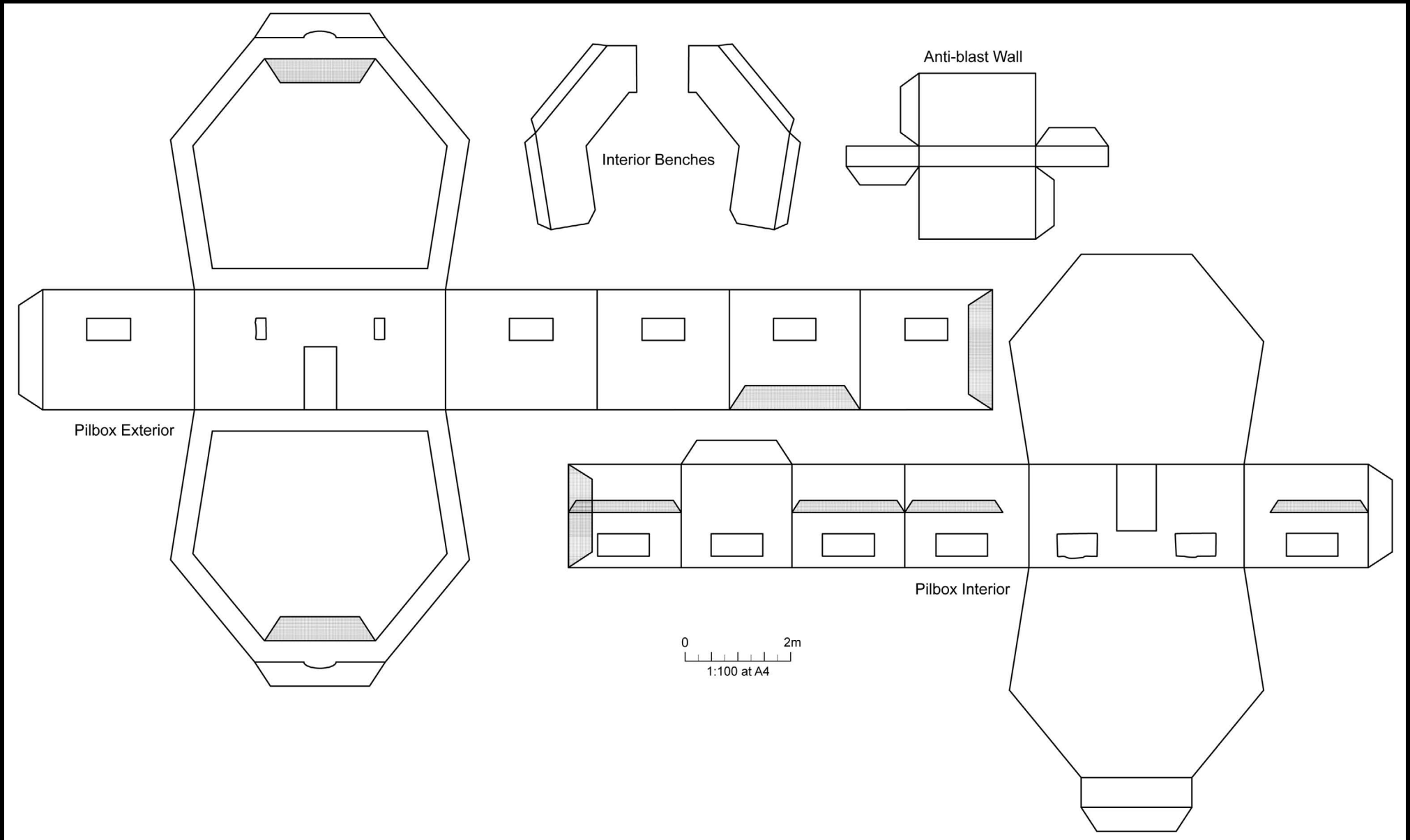


Figure 22: Templates of hexagonal pillbox and anti-blast wall created for the FCS Cut Outs Series

FCS Cut-Outs Series

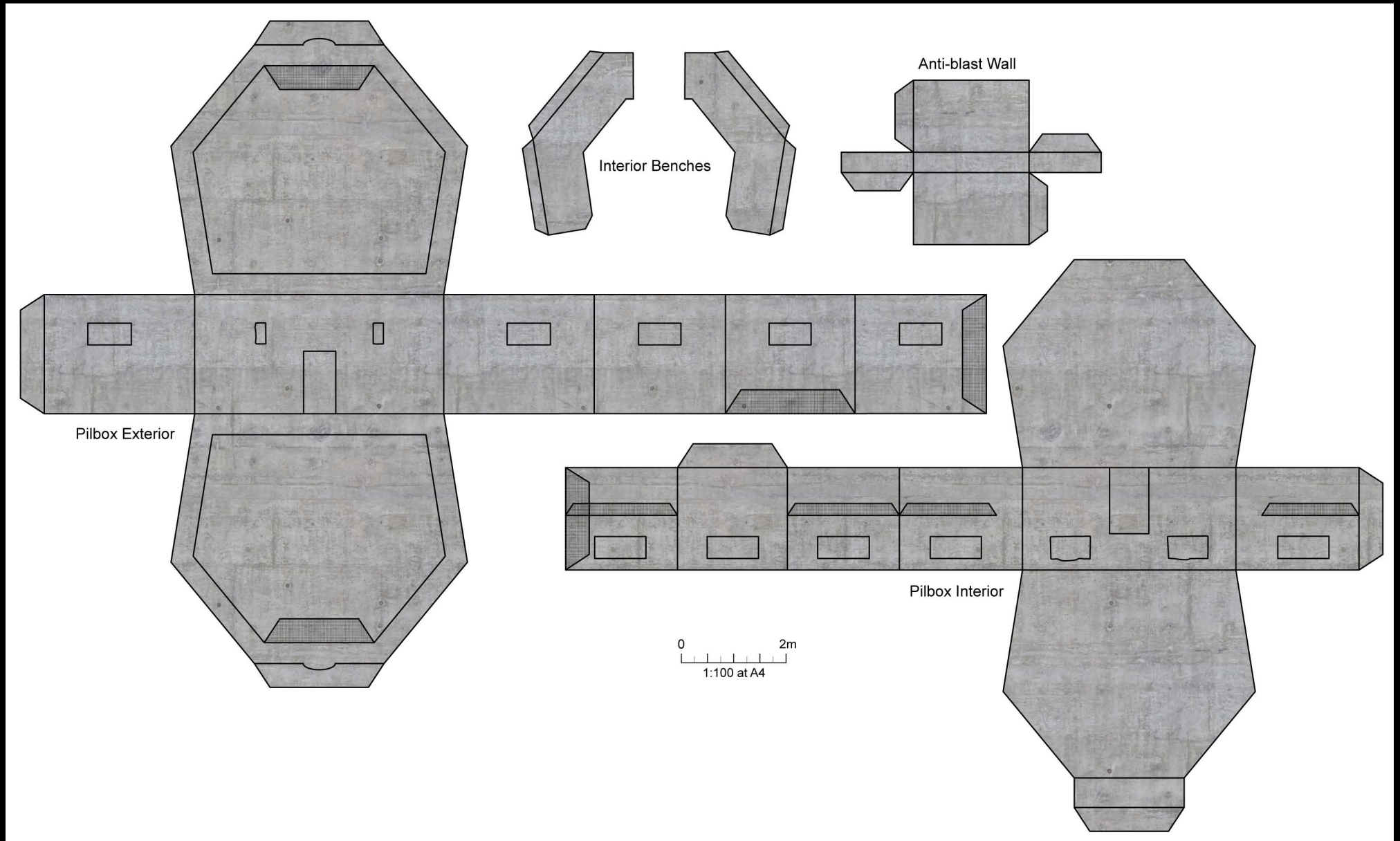


Figure 23: Templates of hexagonal pillbox and anti-blast wall, with real concrete texture, created for the FCS Cut Outs Series

Road Block

A road block (NJ26NE 14.13) is situated (NJ25586 68174) within Lossie Forest, approximately 10m east of the N-S aligned Innes Canal (Figure 24). It sits on a narrow flat area straddling the canal towpath. The ground slopes down by about 3m to the canal on the west and similarly to the east down to a dry river channel. Four anti-tank blocks run in a NE-SW line from the east side of the road block down into the dry river channel and one anti-tank block exists to the SW of the road block. The road block and line of blocks form a barrier line between the canal and the dry river channel, thereby stopping anyone from using the canal toepath without permission.

The trees are encroaching on the area and there is general foliage overgrowth all over the anti-tank blocks, although the road blocks remain clear apart from some moss growth. (Plates 16-19)

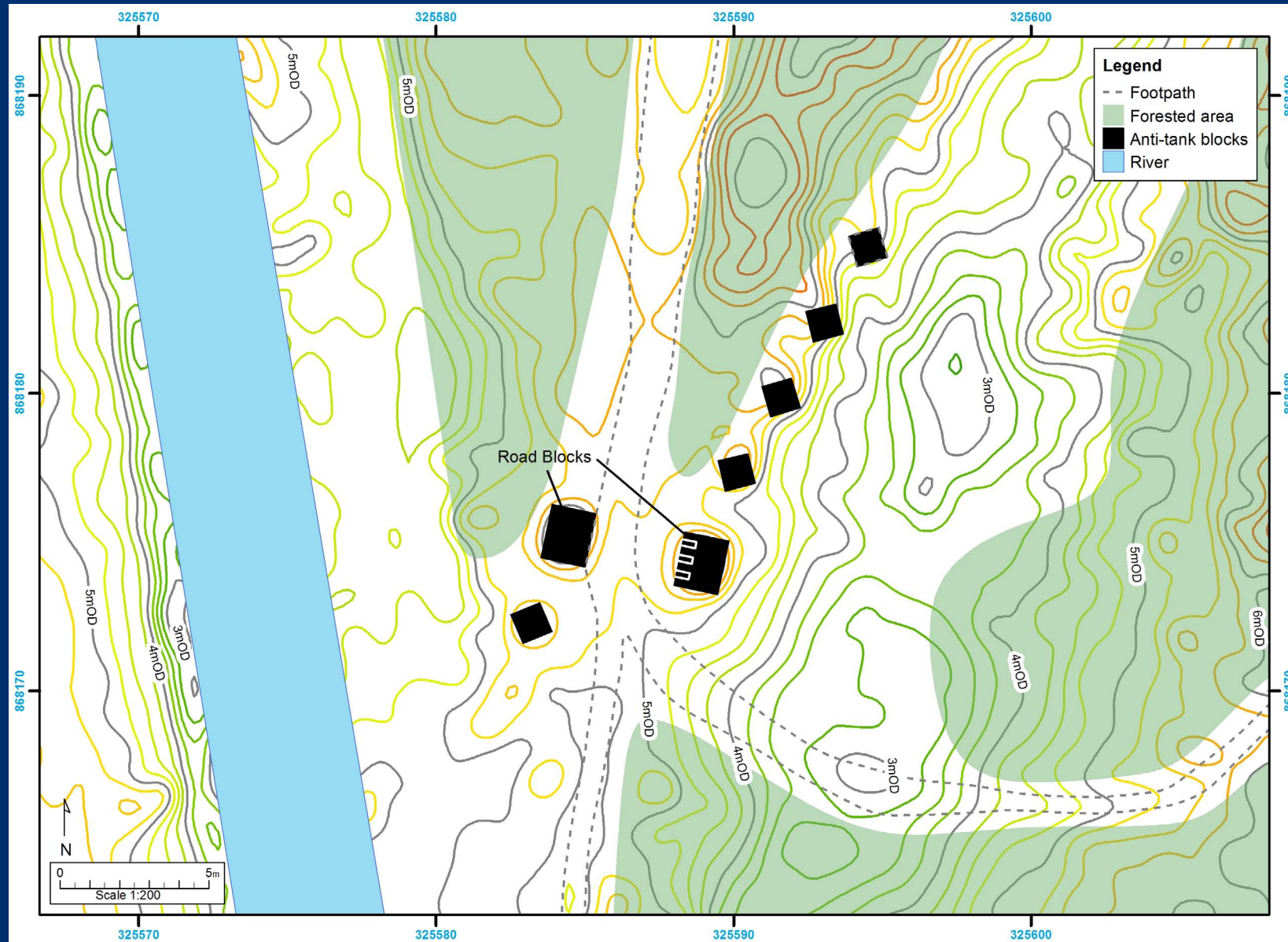


Figure 24: Location plan of the road block and surrounding anti-tank blocks.

Road Block

The road block consists of two concrete blocks measuring 1.85m x 1.55m x 1.85m aligned just off N-S (Figure 25). The road block is aligned almost E-W as it crosses the N-S canal towpath. It is clear from the grooves visible on the blocks (Plates 16-19) that they were constructed using the shuttered concrete method.

The two blocks only differ in their shape by the presence of either slots or sockets (Figures 26-28) on their side facing into the roadblock. The western block has three sockets set at different heights ascending from south to north. The sockets were designed to receive a rail to be manoeuvred into the corresponding slot on the block opposite.

The surrounding anti-tank blocks are the same as seen on the other two sites, measuring about 1m square and 1.3m in height. Both the anti-tank blocks and the road block blocks have steel lifting hoops in their top faces.

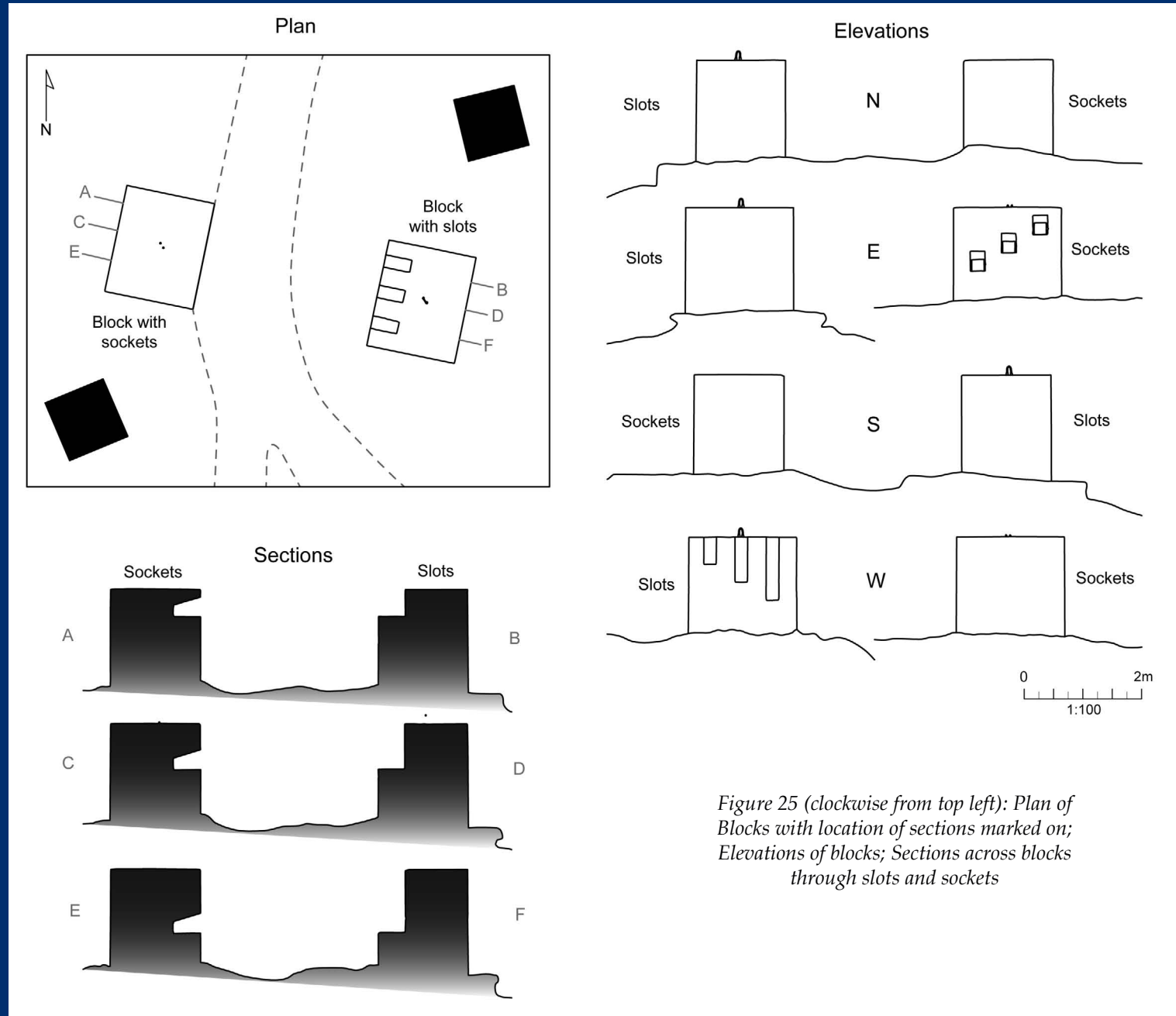


Figure 25 (clockwise from top left): Plan of Blocks with location of sections marked on; Elevations of blocks; Sections across blocks through slots and sockets

Plates

Clockwise from top left: Plate 16: View of the western face of the east block showing the different slot heights; Plate 17: Blocks on either side of the path with slots visible on eastern block; grooves visible on western block showing construction method, from the NW; Plate 18: Eastern face of the western block showing the different socket heights with anti-tank block to the S in the background, from the NE; Plate 19: Laser scanning of the blocks with spheres to control the survey and human scale showing the large size of the blocks, from the S



Orthoimages

Orthoimages of the laser scan point cloud going clockwise from top left:

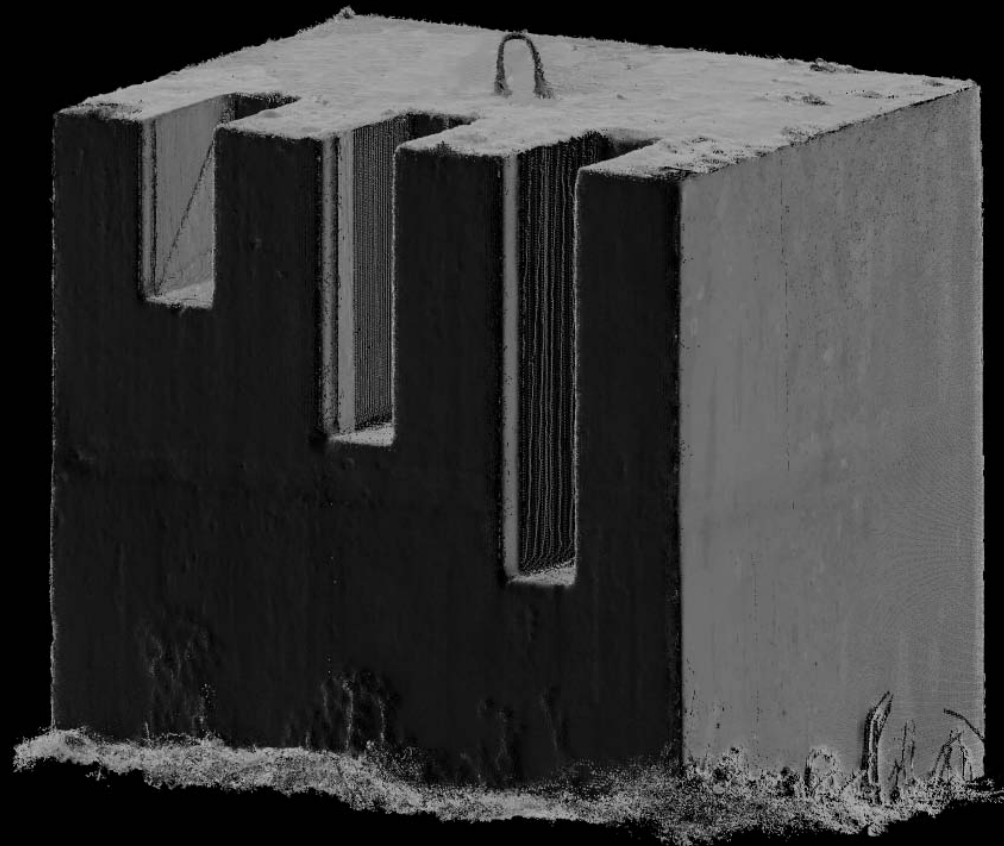


Figure 26: Orthographic view of the eastern face of the western block showing the sockets, with real colour from the E



Figure 27: Orthographic view of the western face of the eastern blocking showing the slots, with real colour from the W

Figure 28: Isometric view of the eastern blocking highlighting the depth of the slots and the metal loop on the top of the block



Orthoimages

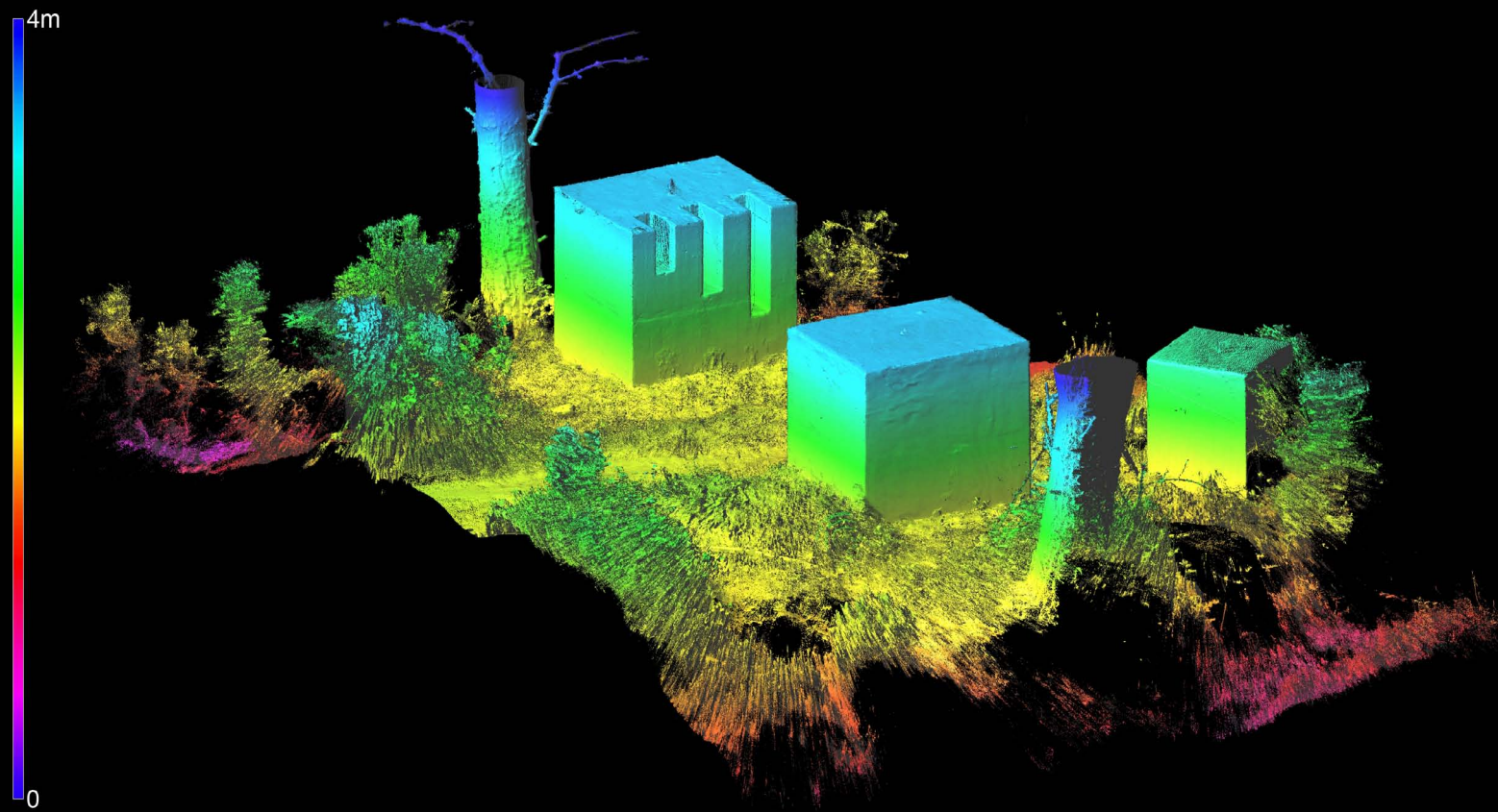


Figure 29: Isometric view of the laser scan pointcloud showing the road block, with colour by elevation of local site grid from the NW

Orthoimages

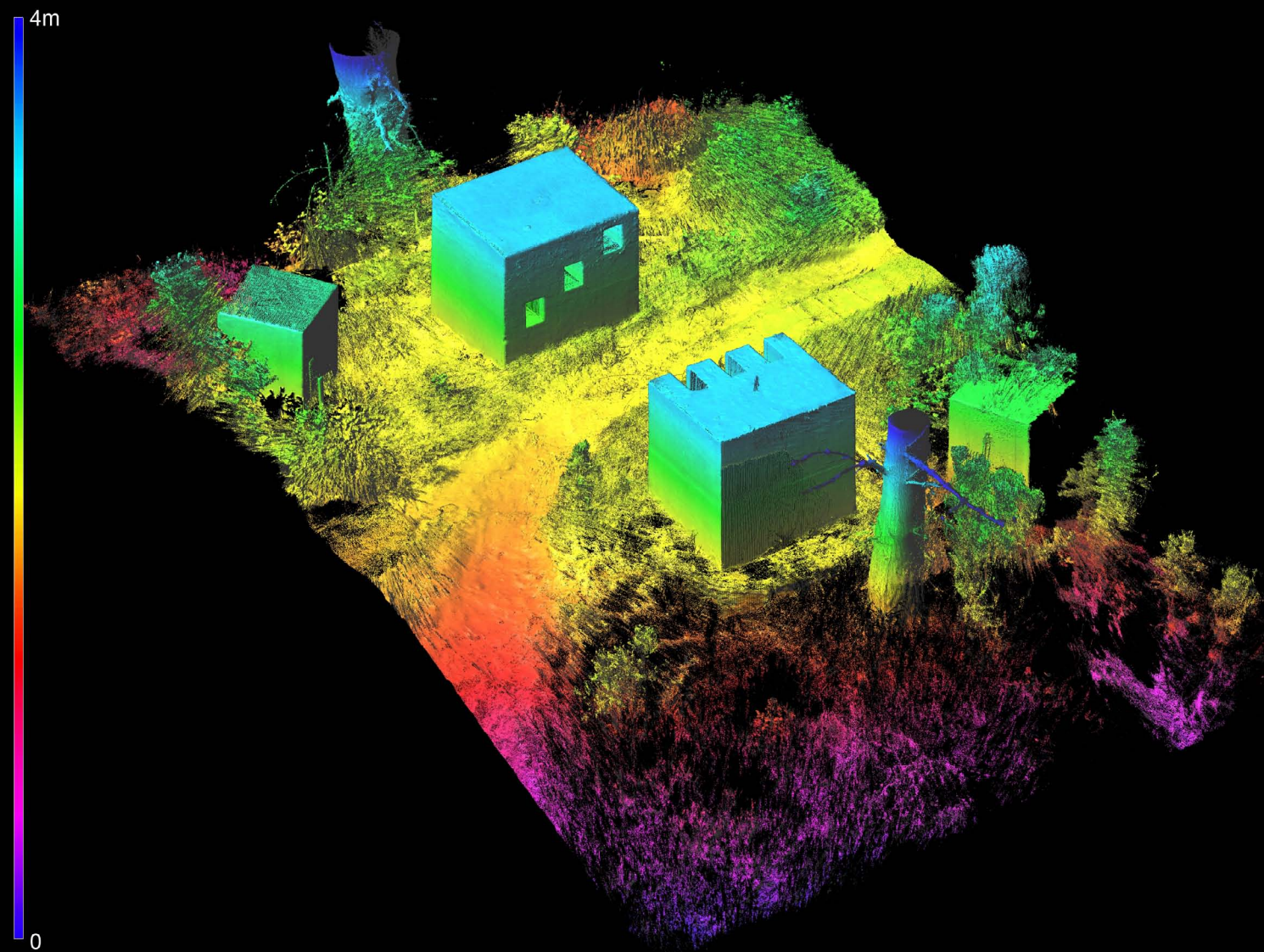
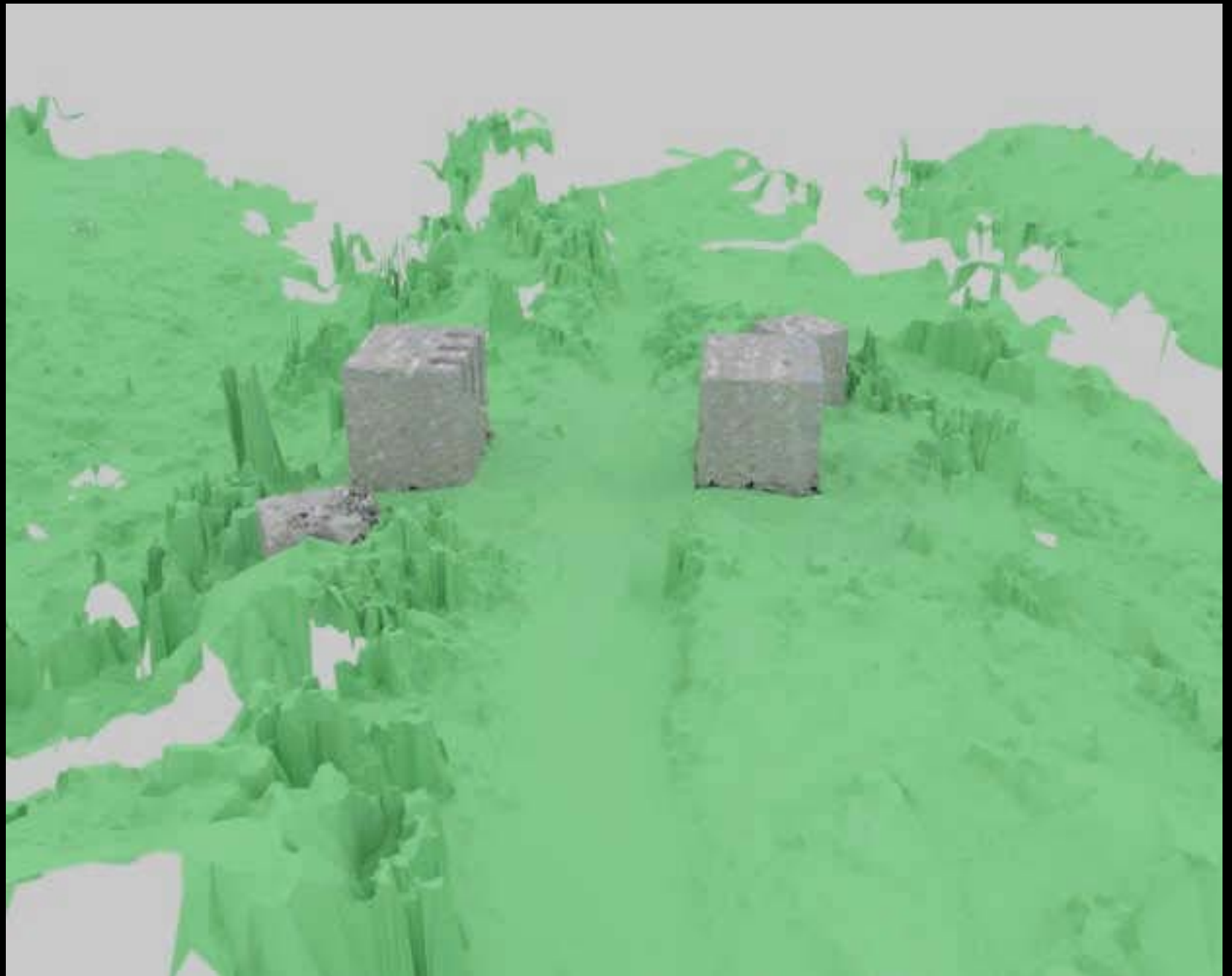


Figure 30: Isometric view of the laser scan pointcloud showing the road block and surrounding anti-tank blocks, with colour by elevation of local site grid from the SE

Video 4: Orbit around the road block mesh created from the laser scan data, with real concrete texture





Video 5: Orbit around the western block with sockets pointcloud. Click on the image to start the video

Video 6: Orbit around the eastern block with slots pointcloud. Click on the image to start the video



FCS Cut-Outs Series

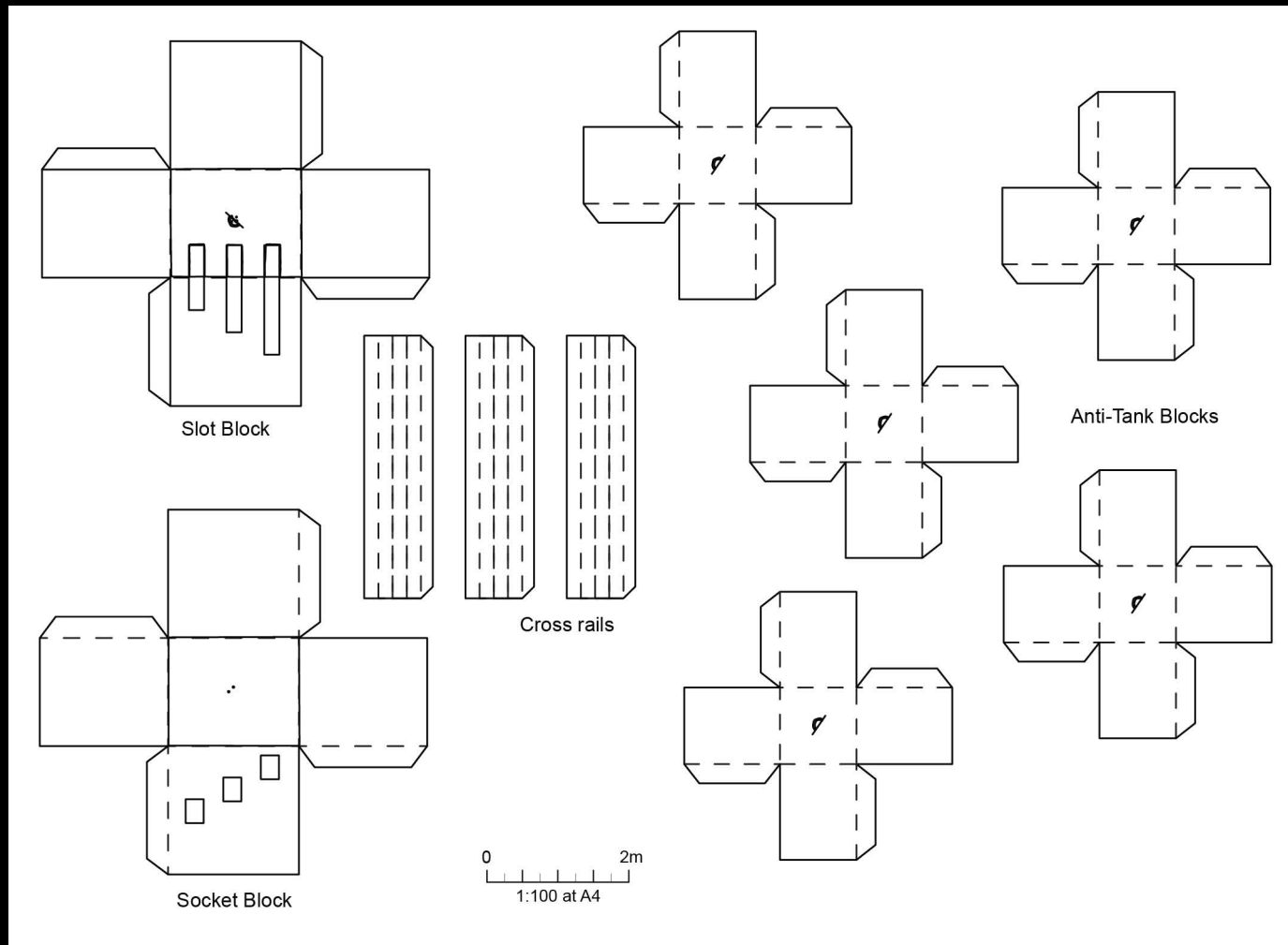


Figure 31: Templates of road block created for the FCS cut-outs series.

FCS Cut-Outs Series

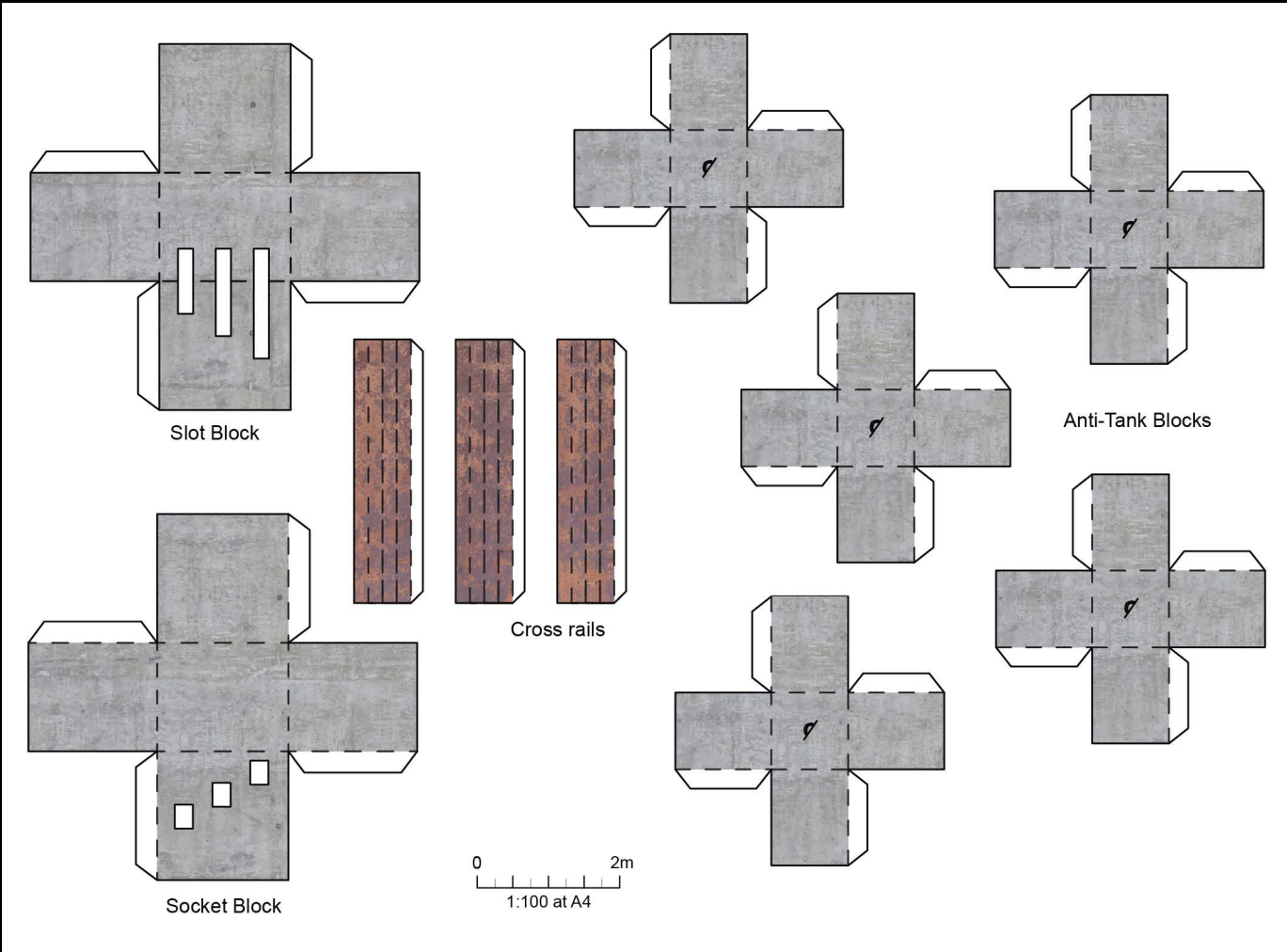


Figure 32: Templates of road block, with real concrete and iron texture

Survey Metadata

The measured surveys were undertaken using a Faro Focus 3D laser scanner. The Focus 3D scanner is a phase comparison system, capable of full dome scanning at ranges of c.0.5m to 50m, at resolutions of up to 92 lines per degree. Scanning was undertaken at the sites using resolutions as recorded below yielding a typical point-cloud resolution of between 6.7mm and 20mm at 10m from the instrument. Overlapping stations, and station placement closer to the structures, mean that the majority of the monument is scanned at a greater resolution. The survey was controlled using spherical targets, located using a Trimble S6 total station with site control provided by a Garmin Oregon 200 handheld GPS. The laser scan data was registered in Trimble Realworks v.10.0.

Interpreted detail was surveyed in the field using the Trimble S6 total station, on the same grid as the control survey, allowing interpretation to be overlain on the laser scan data. The final site drawings were produced in Rhino 4.0, AutoCAD LT 2009 and Adobe Illustrator CS5.5. Ortho-images and videos of the pointcloud were produced using Pointools View 1.8 Pro and then edited in Adobe Photoshop CS5.5 and Microsoft Movie Maker V16.4. 3D visualisations and videos of the meshed laser scan data were produced in Blender 2.70.

A detailed photographic record was produced. A detailed descriptive record was compiled in the field which forms the basis for the survey report.

Road Block Metadata

Scan Number	Number of points	Resolution	Quality
IL_RB001	14908950	1/5	4x
IL_RB002	3153803	1/10	6x
IL_RB003	15213941	1/5	4x
IL_RB004	5431678	1/8	4x
IL_RB005	17653255	1/5	4x
IL_RB006	3535726	1/10	6x
IL_RB007	1182335	1/16	6x
IL_RB008	3044718	VOID	VOID
IL_RB009	3054726	1/10	6x
IL_RB010	5164747	1/8	4x
IL_RB011	5171268	1/8	4x
IL_RB012	24635904	1/4	4x



Key plan showing locations of scanner stations during survey of Lossie Forest Road Block

Survey Metadata

Hexagonal Pillbox Metadata

Scan Number	Number of points	Resolution	Quality
IL_HP001	2732575	1/16	6x
IL_HP002	2743854	1/16	6x
IL_HP003	2706960	1/16	6x
IL_HP004	2733234	1/16	6x
IL_HP005	2753240	1/16	6x
IL_HP006	2634728	1/16	6x
IL_HP007	28040882	1/5	4x
IL_HP008	5175599	1/10	6x
IL_HP009	16671186	1/5	4x
IL_HP010	17564166	1/5	4x
IL_HP011	16771062	1/5	4x
IL_HP012	17869378	1/5	4x
IL_HP013	17116554	1/5	4x
IL_HP014	14685125	1/5	4x
IL_HP015	14946347	1/5	4x



Key plan showing locations of scanner stations during survey of Lossie Forest Hexagonal Pillbox

Pillbox and Anti-Tank Blocks Metadata

Scan Number	Number of points	Resolution	Quality
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IL_PBandATB002	2,715,055	1/16	6x
IL_PBandATB003	2,738,261	1/16	6x
IL_PBandATB004	2,708,528	1/16	6x
IL_PBandATB005	10,855,536	1/8	6x
IL_PBandATB006	7,796,935	1/8	6x
IL_PBandATB007	11,129,560	1/5	4x
IL_PBandATB008	10,966,030	1/5	4x
IL_PBandATB009	10,321,670	1/5	4x
IL_PBandATB010	10,359,386	1/5	4x
IL_PBandATB011	11,121,939	1/5	4x
IL_PBandATB012	11,290,284	1/5	4x
IL_PBandATB013	17,988,975	1/5	4x
IL_PBandATB014	17,893,050	1/4	4x
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IL_PBandATB017	15,790,665	1/4	4x
IL_PBandATB018	VOID	VOID	VOID
IL_PBandATB019	16,417,856	1/4	4x
IL_PBandATB020	10,712,552	1/5	4x
IL_PBandATB021	4,158,297	1/8	4x
IL_PBandATB022	4,128,406	1/8	4x
IL_PBandATB023	4,135,970	1/8	4x



Key plan showing locations of scanner stations during survey of Lossie Forest Rectangular Pillbox and Anti-Tank Blocks

References

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Guy, J. 1992. Description of site visit. From <https://canmore.org.uk>

Marttila, Dr. J., Carruthers, G., Hudson, G., 2009. Lossie Forest, Moray, Desk Based Assessment, AOC 21234. AOC Archaeology Group, Unpublished DBA.

RCAHMS, 2001-2008. Various site visits by different inspectors between these years. From <https://canmore.org.uk>

Survey by: G.Hudson and J. Humble
Illustration and Reporting by: G. Hudson, J. Humble & G.Cavers

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