

**Appendix J**  
**White Paper: Effects of**  
**Asphalt on EM-61-MK2**



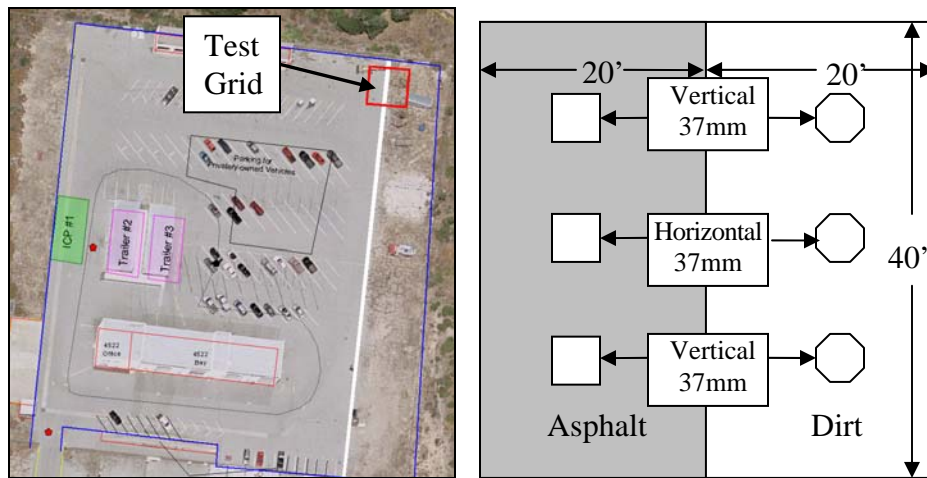
1 **White Paper**  
2 **Effect of Asphalt on EM61-MK2 Response to Subsurface Metallic Items**

3 **1 OBJECTIVE**

4 A test was conducted to determine whether the asphalt found at the former Fort Ord affects the  
5 ability of the Geonics® EM61-MK2 electromagnetometer to detect subsurface metallic items.

6 **2 METHODOLOGY**

7 The EM61-MK2 was tested over a 40-ft by 40-ft grid located in the northeast corner of the  
8 Parsons compound parking lot at the former Fort Ord (Figure 1). Half of the test grid was  
9 positioned over the approximately 3-in.-thick existing asphalt of the parking lot and the other  
10 half was placed over the dirt area adjacent to the asphalt. Six 37mm projectiles were buried  
11 horizontally or vertically in the test site in the pattern displayed by Figure 2.



12  
13 Figures 1 and 2—A 40-ft by 40-ft test grid was placed in the northeast corner of Parsons compound  
14 parking lot (left); the test grid was divided into two 20-ft by 40-ft asphalt and dirt sections with three 37mm  
15 projectiles seeded approximately parallel in each section (right).

16 To place the test items under the asphalt surface, square holes, approximately 14 in. on a side,  
17 were cut into the asphalt. Prior to collecting data, the asphalt pieces were removed from the  
18 ground, the test items were buried, and the asphalt pieces were placed back over the ground.



19  
20 Photograph 1—Approximately 14-in.-squares were cut into the asphalt so test items could be buried  
21 underneath it.

1 An EM61-MK2 cart was pushed over the test grid to collect three sets of geophysical data  
2 (Photograph 2). The first data set was collected with no test items seeded, which was the control  
3 data set; the second set was collected with the test items buried 12 in. below ground surface (bgs  
4 [bgs is measured from the top of the item to the ground surface]); and the third set was collected  
5 with the test items buried 18 in. bgs.



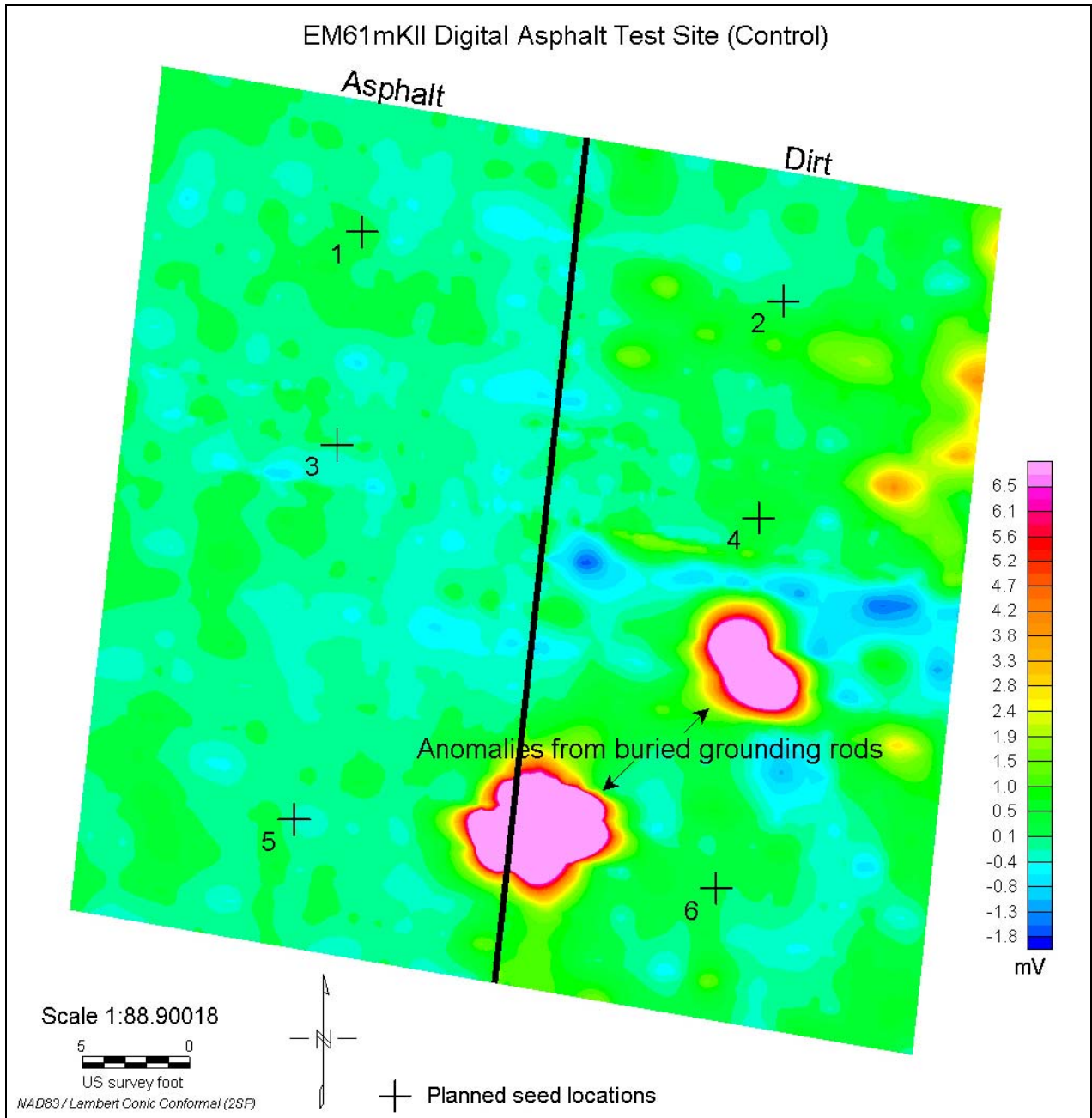
6  
7 Photograph 2—Three sets of geophysical data were collected with the EM61-MK2 system pictured.

8 The first control data set was collected before the test items were buried to ensure that they were  
9 not placed over existing anomalies. During the review of the control data set, two large  
10 anomalies were found within the test site. The anomalies were investigated and found to be  
11 grounding rods that were unfeasible to move. Consequently, the proposed locations of test items  
12 were shifted slightly to avoid interference from these anomalies and still maintain adequate  
13 distance between all test items (Figure 3).

14 The six test items were then buried 12 in. bgs, their locations were recorded using a Leica global  
15 positioning system (GPS), and EM61-MK2 data was collected using 2-ft line spacing with a  
16 sampling rate of 10 readings per second (Figure 4). After the second data set was collected, the  
17 items were re-buried 18 in. bgs and the location identification and data collection procedures  
18 were repeated (Figure 5).

### 19 3 ANALYSIS

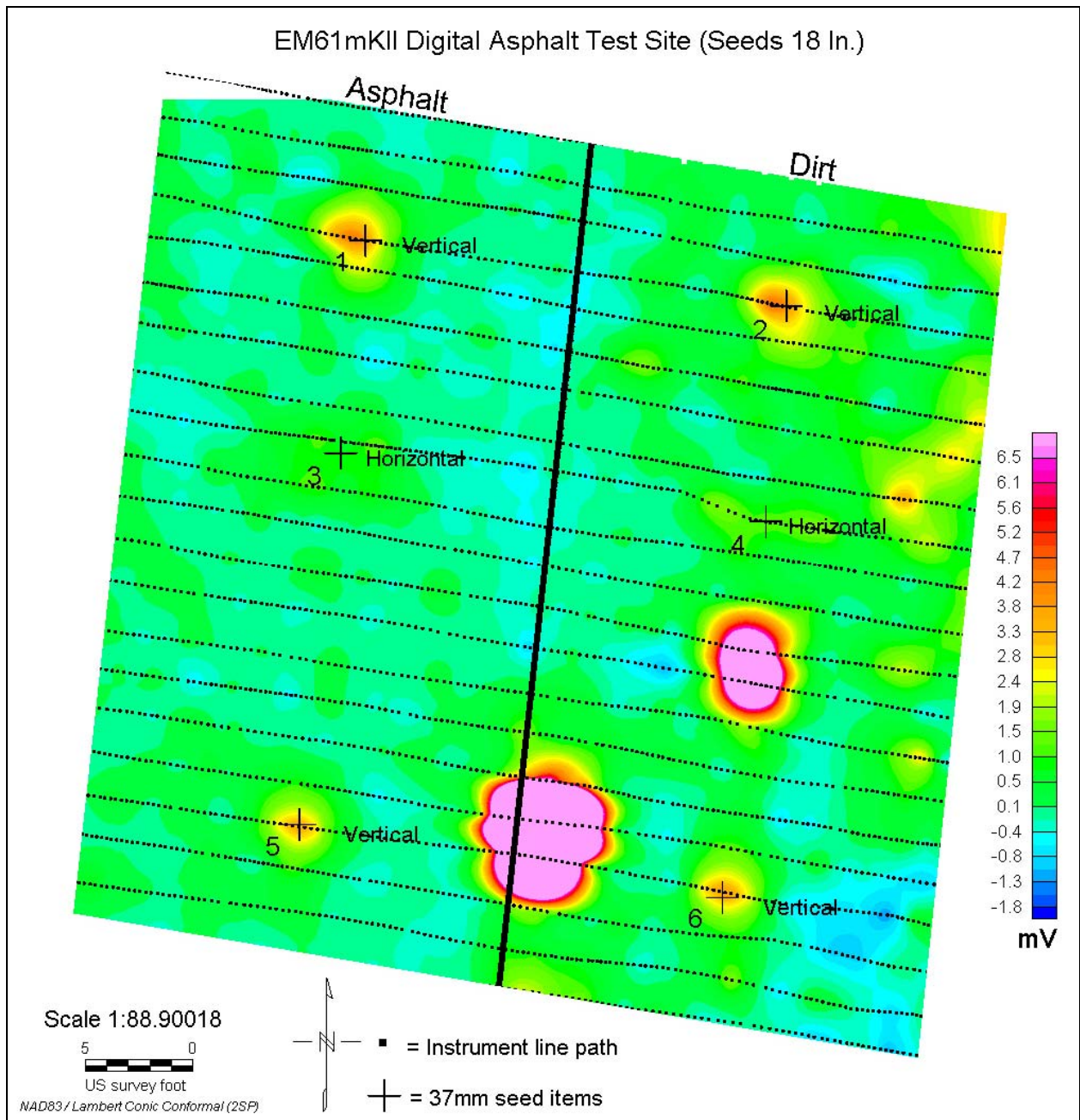
20 Each of the three sets of EM61-MK2 data was processed with Geosoft Oasis Montaj software  
21 following the standard processing steps listed in the *Former Fort Ord Military Munitions*  
22 *Response Program Programmatic Work Plan* (May 2004, second edition with updates). The  
23 EM61-MK2 asphalt test results are listed in Table 1; the data indicates that the instrument  
24 responses below the asphalt and the dirt ground surface are comparable.



1  
 2 Figure 3—EM61-MK2 data was first collected before test items were buried in the test grids to ensure that  
 3 the test items would not be placed over existing anomalies. The data revealed two large anomalies from  
 4 grounding rods buried in the subsurface.



1



2

3

4

Figure 5—Finally, EM61-MK2 data was collected over the test grid with test items buried horizontally and vertically at a depth of 18 in. bgs.

Table 1—EM61-MK2 Asphalt Test Results

ID	Description	Orientation	Channel 3 Instrument Response (mV)		Surface
			12 in. bgs	18 in. bgs	
1	37mm projectile	Vertical	9.6	4.4	Asphalt
2	37mm projectile	Vertical	8.1	4.6	Dirt
3	37mm projectile	Horizontal	3.2	.94	Asphalt
4	37mm projectile	Horizontal	3.3	1.1	Dirt
5	37mm projectile	Vertical	7.8	3.6	Asphalt
6	37mm projectile	Vertical	7.8	3.7	Dirt

- With the test items buried 12 in. bgs, the channel 3 response for item 1 (buried vertically under the asphalt) was 1.5mV higher than the response for item 2 (buried vertically under the dirt ground surface). The response to item 1 may have been higher because the data line passed within 0.2 feet of the item. While over item 2, though, the data line passed more than 0.4 ft from the center of the coil to the item.
- With the test items buried 18 in. bgs, the channel 3 instrument responses to the four test items buried vertically were greater than 3 mV. The channel 3 instrument responses to the two test items buried horizontally, though, were less than 3mV—near the instrument noise level.

#### 4 CONCLUSION

The approximately 3-in.-thick asphalt parking lot in Parsons' compound at the former Fort Ord did not significantly affect the ability of the Geonics EM61-MK2 to detect subsurface metallic items. It can be assumed that modifying the test parameters with different test items and/or other burial depths would not affect the EM61-MK2's ability to detect the metallic test items through the asphalt.

#### 5 RECOMMENDATIONS

This asphalt test confirmed observations from when the EM61-MK2 was used on paved areas at the Seaside (SEA.1–4) and MOCO.2 munitions response sites (MRSs). If large areas of asphalt on MRSs at the former Fort Ord are to be digitally mapped, it is recommended that the asphalt areas be subjected to the site's QC seeding program. This should be done to ensure that different characteristics of the asphalt (e.g., thickness, composition) are not reducing the ability of the EM61-MK2 to detect metallic items under the asphalt.

It should be noted that the scope of this recommendation is limited to MRSs at the former Fort Ord. It is likely that the asphalt areas at other defense sites have a different composition. A separate asphalt test, similar to the one described herein, should be conducted for each defense site where asphalt areas are to be digitally mapped.