

Desert Soil Characterization for Detection of Buried Landmines, Unexploded Ordinance, and Tunnels

The goal was to characterize the terrain of the Patton Hilly Trails (PHT) vehicle endurance test course grade. This project was conducted because extensive vehicle testing, especially with heavy tracked vehicles, affects the grades and roughness of a vehicle test course. Over time, the most extreme grades at PHT have decreased due to vehicle test activities and conditions would likely further degrade over time (depending on use). The characterization provided parameters for Yuma Proving Ground (YPG) to locate a suitable replacement test course site. Reported in 2019, our results facilitate planning on the part of YPG to preserve consistent, expected test conditions.

Summary of Project Details: Our analyses summarized techniques that could be applied across other areas of YPG that might meet test course requirements based on grade, roughness, and terrain conditions. We combined the data collected for this project with data from prior work at PHT and a second site. We used Light Detection and Ranging (LiDAR) data, Unmanned Aircraft Systems (UAS), and landform data to create slope maps, grade profiles, and hill counts and distributions. We had previously characterized landforms of the PHT and incorporated this into our assessment. Based on our results, we were able to identify a possible replacement test course site that was both proximal to other vehicle test courses and had required grade ranges. Graphics show the change in grade of the PHT test course over time with easy visualization.

Management Implications:

We recommended planning for an eventual relocation of the PHT test course to ensure that sufficient conditions of test course severity are maintained and available to meet client demand. The process of relocating or implementing an additional test course at YPG would be a long term, multiyear process that would require planning well in advance of the immediate need. We summarized techniques of characterization and assessment that could be employed across other areas of YPG to identify areas with similar grade, roughness, and/or terrain conditions, as required to meet test course requirements. We recommended using the process we developed to identify additional alternative sites. We recommended producing a detailed landform and surface cover map for siting future automobile activities. Lastly, we recommended that UAS data be collected for sites slated to become test courses before being established to allow for monitoring of test course conditions over time with use.

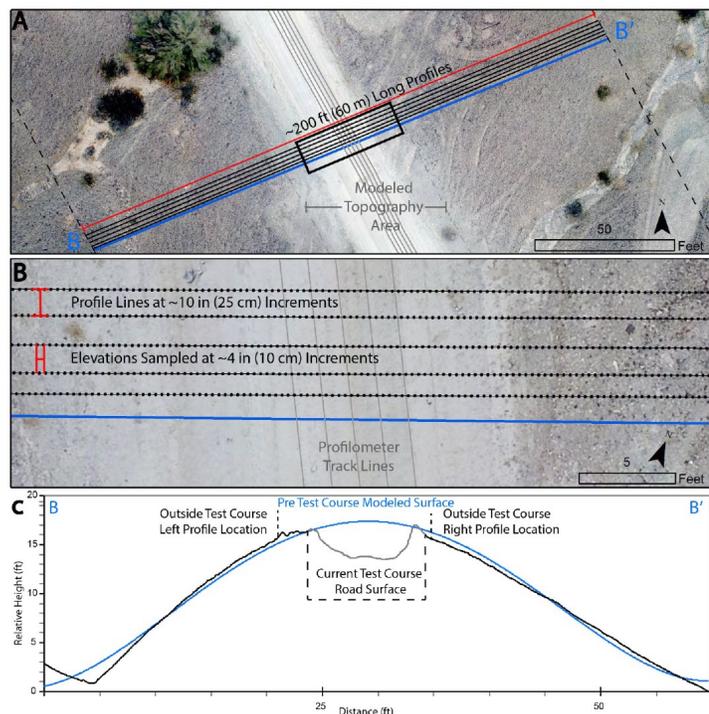


Figure A-1. The pre-test course modeling technique for PHT was conducted with ~200 ft. (60 m) long profiles perpendicular to the test course road at ~10 inch (25 cm) intervals. B) On these profile lines, elevations were sampled at ~4 inch (10 cm) intervals. Data was excluded within the Modeled Topography Area where the natural topography has been disturbed. C) The pre-test course modeled surface (blue) is calculated from a 4th-order best-fit polynomial line from the outside test course profiles (black). Elevation values for the current test course surface (grey) are excluded when performing this calculation.