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Geotechnical Properties and Foundation Requirements of the Lunar Laser Ranger at Matjiesfontein Space Geodesy Observatory

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The intention of this project is to investigate and analyse the requirements for the emplacement of the Lunar Laser Ranger (LLR) at the Matjiesfontein Space Geodesy Observatory (MGO). To ensure accurate measurements and pointing to the exact location on the moon the LLR needs a very stable foundation. The foundation of the LLR should be such that it would cushion the smallest movement of the ground. To ensure that the ground on which the 7 ton LLR will be built is stable a complete slope stability analysis needs to be done. This includes investigations for circular slip failure, wedge failure and planar failure. Other slope stability analyses that have been done at the MGO include the area adjacent to the Gravimeter Vault site, a proposed site for the LLR and the proposed site for the main buildings. All of these studies have determined that these areas are safe to circular slip, toppling and wedge failure. The only instability that may occur on the site is possible planar failure if an access road with a cut of 2m is to be made on the northern side of the site. The cut will expose the toe of the inclined quartzitic sandstone that may lead to a failure. A retaining wall was designed for the site where the administrative buildings will be placed to ensure the safety of the building as a cut will be made into the toe of the slope. More detailed analysis will be done to determine the rock properties of the LLR site and to confirm the stability.
The main concern during construction is early thermal shrinkage. Early thermal shrinkage can influence the geometry and dimensions of a structure. The cracks can cause displacement of the LLR and lower the accuracy of the measurements. Various construction risks have to be taken into consideration to ensure smooth operations during construction. A complete risk register will be developed prior to the start of construction operations.

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