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DEVELOPMENT OF A FIELD PROCEDURE TO EVALUATE THE REFORESTATION POTENTIAL OF RECLAIMED SURFACE-MINED LAND.

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Project Description and Objectives:

This project was designed to develop a field procedure using portable equipment for evaluating soil compaction. Much of the information gathered regarding soil compaction and its effect on tree growth has been developed on designed research plots using research equipment that is not suitable for typical reclaimed surface mine conditions.

This proposal outlines the development of a field procedure for evaluating the reforestation potential of reclaimed surface mined land using portable equipment that can be used under any field conditions.

ABOVE PHOTO: This is a photograph of the Dynamic Cone Penetrometer.

Applicability to Mining and Reclamation:

Since soil compaction is one of the leading causes of tree mortality on reclaimed mined lands, development of this procedure will enable mine personnel and regulators to assess the capability of reclaimed land to support trees with much more certainty and to determine where additional compaction alleviation is needed. This procedure can be used in any part of the country where soil compaction may be a problem.

Methodology:

Data was obtained from various research plots incorporating a number of different reclamation techniques and tree species to support the investigation.

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ABOVE PHOTO: The Campbell-Pacific Nuclear (CPN) Inc. dual-probe nuclear density.

Methodology (continued):

Two types of equipment were used: the static cone penetrometer and the portable dynamic cone penetrometer. The equipment was used and evaluated based on their field performance and reliability. Similar research studies were also analyzed.

The major objectives of this study were to:

1) Establish initial values for comparison of depth to refusal and soil resistance using both the static and dynamic cone penetrometer. This was conducted at both the eastern and the western part of the state of Kentucky. Conclude whether the dynamic cone penetrometer is applicable in both locations. Measure values and validity of data at different depth increments for reassurance;
2) establish multiple year data at the Starfire reforestation research location. These test plots were constructed to allow accessibility for the tractor but most typical forest reclamation sites are not. Multiple reclamation techniques were conducted at this location, which provides a suitable basis for comparing the effectiveness of the dynamic cone penetrometer to the static cone penetrometer. Incorporation of these techniques may be useful for future studies; and
3) develop a standard procedure that can be applied in the field under all circumstances to evaluate the physical characteristics of the replaced root growth medium as it relates to reforestation success.

Highlights:

The dynamic cone penetrometer evaluated in the report serves as an adequate alternative for accessing refusal depth on reclaimed surface-mined land for rocky spoil conditions. The dynamic cone penetrometer may also produce better results for soil penetration resistance than that measured by the static cone penetrometer. Past researchers were not able to get good correlation between average penetration resistance and maximum penetration depth due to the presence of rocks in the spoil.

The process of measuring the maximum penetration depth is simple, but very labor intensive. The static cone penetrometer seems better suited to evaluate clayey or loamy soil without rocks present. The presence of rocks in the spoil places excessive limitations on static cone penetrometer measurements for both penetration refusal and soil resistance.

Results/Findings:

The field procedure outlined in this report represents the best current method for evaluating the compaction condition of reclaimed land for reforestation purposes where the surface is not graded smoothly and large rocks are present.

Above Photo: This is a photograph of the Static Cone Penetrometer.

Website Information:

The final project report can be found at **http://www.techtransfer.osmre.gov/NTTMainSite/appliedscience/2005appscience/CompletedProjects/KYFieldProcedureMBower2005.pdf**

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