THE "WINTER" TOPSOIL STRIPPER

PRESENTED TO THE
ALBERTA RECLAMATION CONFERENCE
SPONSORED BY THE
CANADIAN LAND RECLAMATION ASSOCIATION

BY

STEVE MORCK
ENVIRONMENTAL AFFAIRS
NOVA, AN ALBERTA CORPORATION
CALGARY, ALBERTA

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Presentation on the Topsoil Stripper

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Presented by Steve Morck

ABSTRACT

NOVA, AN ALBERTA CORPORATION embarked on a research and development project approximately one and one-half years ago to develop a machine capable of stripping frozen topsoil. The result was a modified Rock-Saw which was used for topsoil stripping on the construction of three pipelines during the past winter. After minor operational problems on the first pipeline were alleviated, the machine was very successful in almost all respects and will be used in the future during pipeline construction on agricultural soils.

Presentation on the Topsoil Stripper

Mr. Dave Paton has already alluded to the fact that NOVA has developed a machine for stripping frozen topsoil. In fact, NOVA operated the topsoil stripper on the construction of three pipeline laterals in January and February of this past winter. The object of this paper is to introduce the development phases and discuss the success of the prototype during the 1981/82 winter construction season, its first season of action.

About one and one half years ago, NOVA embarked on a research and development project aimed at the development of a machine capable of stripping frozen topsoil with a tentative completion schedule of December, 1981 in anticipation of the subsequent construction scheduled to occur on agricultural lands.

The development of the topsoil stripper was a multi-phased progression which is, in fact, still ongoing. The first phase was the delineation of criteria and the assessment of potential machines in existence as either adequate for our use or capable of accepting modifications to suit our purpose. Some of the criteria set down by our environmental and engineering personnel included:

(i) Operate in frozen ground.
(ii) Operate in stoney soils with minimal wear and damage.
(iii) Placement of topsoil pile be flexible.
(iv) Produce a chipped but not powdery or excessively lumpy topsoil spoil.
(v) Minimize the ground pressure - preferably a tracked unit.
(vi) Stripping be over the ditch only - a minimum width of 36" was suggested because this was capable of handling the large majority of pipe sizes we install. The suggestion was also put forward that the machine should be capable of a double pass to 72" to accommodate large diameter pipe installation.

(vii) Operate with good depth control, preferably instantaneous.
(viii) Modify an existing proven power unit to minimize operational down time when in use on pipeline construction.

With those criteria defined, we started to investigate machines with potential for field testing to assess tooth design and potential power units. The second and subsequent phases involved field testing, tooth design and prototype development.

Tests were performed on three machines. One machine which was initially judged suitable for field testing had inherent problems such as tooth angle, shape and strength and the drum rotated in the wrong direction. All of these features caused accelerated wear and damage in less than a one km distance.

Two asphalt planers were also tested. Both of these units had tooth and traction problems which were not as severe as the first one.

Another alternative considered was the method of ripping followed by using a "step-blade". This consisted of ripping with a conventional crawler tractor and single tooth ripper over the ditchline. This was followed by a dozer with a blade insert 90 centimetres wide and extending down from the dozer blade about 20 centimetres. This "step-blade" peeled out the dirt in the trench and rolled it out of the way. The limitations to this method were:

(i) large lumps
(ii) no depth variance (constant depth)
(iii) uneven ditchline
(iv) was a stop-gap or interim process - and not really a desirable end-product in terms of the established criteria.

At this time, a satisfactory tooth design was discovered in the Rock-Saw trenchers used for rock or perma-frost. After investigation of the Rock-Saw tooth and trencher, NOVA decided to have Bortunco (owners of Rock-Saw International) attempt to manufacture a cutter bar to suit our purposes as their design seemed most practical for modification. After about six months of development and testing, we had the unit ready by late fall for the winter construction season.

The conventional Rock-Saw is used for trenching rock and/or permafrost. Our unit modified for topsoil stripping, may look similar but the modifications are, in fact, quite significant. The conveyor system, hopper and crumbling shoe are additions. The cutter bar assembly is about one-half the length and twice the width of the normal trenching unit. These modifications are quite extensive when they have to be hand made in a shop set up exclusively for production of the conventional Rock-Saw.

The tooth used in the topsoil stripper has a tungsten carbide head making it extremely hard and durable. It sits in a sleeve, held in place by a clip-on O-ring which allows replacement of the tooth in less than one-half minute.

The Rock-Saw operates completely on hydraulics. There are hydraulic drive motors for the cutter bar developing upwards of 1,000 horsepower; even the main drive of the cat is hydraulic. The hydraulic systems are powered by a diesel V-12. The original Rock-Saws were mechanical, however hydraulics were eventually chosen because of their ability to absorb shock and impact and to give infinite variability to operating speed. Located in front of the engine, are the main hydraulic drives and just in front is the 250 gallon tank holding the fluid. There are cooling fans, four in all, necessary to keep the system cool under extreme heat but as most of you are aware, heat was hardly a problem this winter. In fact, the extremely long stretches of weather in the -30° to -40° Celsius range during the inauguration compounded some minor operational problems associated with any new prototype. The problems were alleviated and the machine went on to strip topsoil in an excellent fashion.

The cutter unit is capable of stripping down to 102 centimetres (40") at a width of 96 centimetres (38"). The machine is capable of making a double pass, however this was not required for any jobs this past winter. The topsoil stripper produces a wind and freezing resistant coarse spoil carried to location by a conveyor. The conveyor is capable of running in either direction and having additions added on for placement of the topsoil spoil wherever it is desired. The topsoil was placed on the working side between the trench and the strung and welded pipe. This minimized the distance to be moved and kept it on the opposite side of the trench from the "subsoil" spoil.

Originally, sweepers were installed to clean up side-cast on the edge of the trench but were removed because they were constantly being torn off. This was due to being attached to the conveyor assembly on a suspension separate from the cutter unit. Often when the cutter unit would twist and the conveyor would not, the sweepers would be torn off by the cutter assembly. Consequently, the last two pipelines stripped did not have this small amount of side-cast picked up and placed with the rest of the topsoil. Our personnel involved with the engineering and operation of the machine feel they have a suitable solution which should be in place by the fall of 1982.

In the final assessment, we judged the machine excellent in almost all respects, particularly in:

(i) Speed - we stripped as much as 6 km/day.
(ii) Spoil quality was excellent.
(iii) Depth control - this was instantaneous. This information was relayed to the operator by a swamper as he saw the changes in the soil horizons or as marked by the soils specialist.

(iv) Hydraulic drive - this provides infinite variability of drive, cutter bar speed and conveyor speed.

(v) The machine is versatile:
  (a) by switching the cutter bar we can trench through rock
  (b) the topsoil stripper unit could be run one-way for stripping, then turned around and run back for trenching
  (c) the cutter bar can be speeded up enough to provide a fine subsoil capable of substituting the need for sand padding in rocky areas.

This machine was very successful and will probably look like this for one or two more years, however, we are investigating potential modifications that may change the look and reduce the size of the front end power-unit.

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Last Spring the Provincial Government's Reclamation Research Technical Advisory Committee presented a two day Reclamation Research Seminar at the Chateau Lacombe. We were surprised by the large turnout and an overwhelming majority of those in attendance indicated the desirability of an Annual Reclamation Conference for Alberta which would focus on Policy and Practice as well as Research and which would include industry, academic and government participation.

These were very sensible suggestions though their implementation would exceed the mandate and manpower of the Reclamation Research Technical Advisory Committee. So various groups were contacted to sponsor and help organize the Conference. Positive responses where received from the Canada Land Reclamation Association (CLRA) The Alberta Government's Land Conservation and Reclamation Council, The Coal Association of Canada and The Oil Sands Environmental Study Group (OSESG).

The CLRA authorized formation of an Alberta Chapter to serve as the umbrella organization with a Program Committee consisting of representatives of the Government and the two Industry groups. Through this Conference and perhaps other functions the Alberta Chapter of the CLRA can fulfill two important roles:

1. To provide an opportunity for members of the Reclamation community to meet, exchange experiences or argue and otherwise improve communications among its industry, government and academic factions.

2. To provide a public forum for reclamation activities, capabilities, issues and challenges.

This was the first function of its kind in Alberta. Special thanks are due the Sponsors, Speakers and the other Members of the organizing Committee: Jennifer Hansen, Malcolm Ross and Al Fedkenheuer. Their talents and efforts made the Conference a success.

One final word on the Speakers: they were given very short notice of the Conference and not only responded enthusiastically but prepared presentations which were of remarkable quality and consistency. We are fortunate to have individuals of this caliber working in the Field of Reclamation in Alberta.

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