

G-R-05-031

Drawer #24

TRANSPORTATION  
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A Terrain Evaluation of a  
Portion of the Proposed Route  
of the Dempster Highway  
Mile 254-276

1972

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*your copy*

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A Terrain Evaluation of a Portion  
of the Proposed Route  
of the  
Dempster Highway

- from approximately Mile 254  
to Mile 276

N. W. Richardson

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I. A general overview of the length of the survey indicates that permafrost is widespread throughout; frost polygons, solifluction and downslope striping are general while silt boils and some beaded stream patterns are intermittent or occasionally found along the route.

The bedrock to be encountered consists of steeply bedded to near-vertically bedded sedimentary rocks which are often folded or severely distorted to form ridges and "whalebacks". The sediments dip in a westerly direction, creating generally more gradual west-facing slopes and steeper east-facing slopes. By and large the bedrock does not strictly control the drainage in the area; meandering and semi-dendritic patterns are evident along much of the route. Large quantities of material derived from the higher ridges and formations have been deposited on lower ridges and in the valleys. The amount of the material derived from the bedrock and the lack of absolute control over the drainage of the area indicate the bedrock to be relatively soft and easily eroded and weathered. The crests of the bedrock formations remain relatively bare.

Vegetation along the survey route is composed mainly of: black spruce of varying sizes depending on the local environment, birch and possibly some spruce along watercourses, possible tamarack in areas of bog, brush, mosses such as Sphagnum and probably lichens such as Cladonia.

There appears to be little sign of extensive or deep organic material, as palsa mounds and the like are not evident.

II. The ridge appearing in airphotos A 20216-114 to A 20216-108 maintains a relatively open crest, where the bedrock is regularly exposed. The eastern slope of the ridge is relatively steep compared to the west side and displays a number of changes in the slope which would be indicative of some transition in the material comprising the ridge or in its distorted shape. The steepest slopes occur near the valley floor, with the shallowest slopes occurring generally at mid-height. The changes in the slope may be due to a change in the composition of the ridge which affects the resistance to erosion and weathering; this change may be from the predominant shales to sandstones etc., or may be due to differing beds of shales.

Slope instability as indicated by mass wasting is general along the eastern slope; slope movement on the west-facing slope is much less severe, making for better route location, as has been chosen.

Signs of permafrost are limited on the upper reaches of the ridge to some solifluction, especially on the east-facing slope. Some possible silt boiling occurs near the top of the ridge in airphotos #A - 20216-114. Large frost polygons (raised type indicating fairly good drainage) are general along the base of the eastern slope and in conjunction with the water-courses in the valley to the east of the ridge. The large size of polygons and the coarse texture of the drainage in the valley would seem to indicate a somewhat coarse material comprising the valley - possibly a silty sand with some clay-like material.

Generally route location on top of the ridge or on the upper west side should experience the least problems. Any location on the eastern slope may very likely experience slope movement problems. The better developed vegetation on the eastern slope may also be indicative of moisture problems.

The lower valley areas shown in A 20216-108 exhibits widespread frost polygonal characteristics at the base of the "hog-backs" and in conjunction with the drainage pattern indicating extensive permafrost in the low areas.

The vegetation near the drainage channels consists of well-developed spruce and brush indicating abundant moisture present due to drainage from the areas of higher elevation in the east, such as the "hog backs".

The material present can again be expected to be derived from the surrounding bedrock formations, and to be a type of silt or sand with some clay.

III. Airphotos A 20216-108 to A 20216-105 show a series of "hog backs" in the bottom of the photos, and a ridge in the centre, with the proposed location running between these features. The ridge appears to be of sedimentary origin and exhibits similar characteristics to the ridge in photos 114 to 108. The "hog backs" appear to be extensions of sedimentary ridges which, due to harder composition or increased uplifting deformation, rise above their surroundings.

Frost polygonal features and solifluction are evident along the base of the "hog backs", indicating permafrost conditions and slope movement, at least in the active layer of the soil.

Drainage has developed westward through the "hog backs" as indicated by the resultant channels; occasional well-developed vegetation indicates the presence of larger amounts of moisture at locations in this section.

The route through this section will probably experience problems due to this drainage and to the slope movement.

IV. The rivers seen in airphotos 105 to 103 take on a different appearance than those farther to the south. These streams are not cut into their beds as deeply and tend to exhibit much more braiding; this may be indicative of heavier sediment content of the stream and much less erodible material comprising the bed.

Permafrost is again seen to be general throughout this section. Little vegetation and organic material is present, except near the streams and to the west of the proposed location. Some solidification and slope movement is evident; landsliding is evident along the stream courses.

V. The characteristics shown by the proposed route location appear to be quite similar through photos # 102 to 90, where the route follows the western base of a series of ridges and "hog backs" which are sedimentary in nature.

Frost polygons are general along the route, in both raised and depressed forms, indicating variations in drainage of the area; the sizes of the polygons in this section indicate variations in soil type from clay-silt type to silt-sand type. Tonal variations in the slope to the west of the ridge also indicate variations in soil type or soil moisture.

This section of the route location has very little vegetation except for those areas around water-courses where well developed black spruce, birch and willow type trees are found. Some patches of mosses exist in areas of high soil moisture, while intermittent scrub occupies other areas of the west-facing slopes extending from the ridges.

Some evidence of slope movement is apparent, particularly due to solifluction in spots along the ridge bases and on rises in the valley floor seen in the upper portion of the photos (see #99). Extensive mass wasting is not evident except along the banks of rivers such as that in photo #99.

Drainage continues to occur through the gaps in the ridge and between the "hog backs"; thus drainage ranges from minor channels to relatively major rivers as seen in photo #99. Such drainage and the possibility of washouts could present problems to location in this area. The drainage through the "hog backs" also carries sediment with it which has built up esker-like ridges at various points in this section, such as shown in photo #97. This material could be expected to be well sorted silts and sands. Organic material often occurs adjacent to this drainage, and on occasion appears to be relatively deep as shown by the drainage channel in the north-west portion of photo #96.

The material to be expected in this location is again derived from the nearly bedrock ridges. Variations from silts to sands to broken rock can be expected. The broken rock appears on and at the base of the ridges adjoining the route, while the silts and sands have been carried farther down into the valley.

The ridges and "hog backs" adjoining the proposed route location, on the east side, may present problems concerning snow accumulation. The prevailing wind direction is from the east so that large amounts of snow could be deposited on the west (or the lee-side) slope. This snow could be deposited on the highway itself, or could present the danger of avalanches. In this respect, the farther from the ridge, the better off the highway.

VI. The large river shown in photo #88 has cut deeply into the valley, especially where it crosses the proposed location. The banks on both sides of the river are very steep; those on the north side are slightly shallower, indicating perhaps, some change in their make up as opposed to those on the south. The steep banks suggest a relatively stable, inerodible material: the material at this location could be very silty in nature and somewhat consolidated, or possibly the sedimentary bedrock (shale or sandstone) occurs near the surface to exert this control. A wide terrace has formed on the north side of the river with smaller ones intermittent on the south side. The river has taken on a braided appearance; this may be due to a high sediment content or due to a decreased river flow coursing its way through a now over-fit channel.

The vegetation in this area is very sparse except on the river banks and terraces where well developed black spruce, possible white spruce, birch and brush occurs. A thin layer of moss and lichens may cover the flat area adjacent to the river.

Permafrost is evident throughout this area, as indicated by polygons and striping on the flats.

Little slope movement is evident or instability can be seen on the south slope of the river while some may be encountered on the north bank of the tributary which enters the valley from the north-east.

Location of the proposed bridge must be dependent on an extensive foundation study. There appears to be at least two strata comprising the south banks, as evident from the change in slope; the upper layer is softer but less permeable than the lower layer. This pattern is repeated in the north bank except that the upper is much thinner or non-existent in places. A check of bank stability may show location of the bridge at the narrows to be the most desirable. A check must also be made on the major area of frost polygon patterns to the north of the river.

VII. The stretch of proposed location north of the river, shown in photos #87 to 84 is dominated by a series of "hog's backs" comprised of sedimentary rocks which have been severely folded and are somewhat more erosion resistant than the rocks surrounding them. Valleys exist on both the west and east sides of the "hog's backs"; these valleys; in turn are bordered by ridges of sedimentary rocks. The ridges and "hog's backs" east of the proposed location are much more steeply bedded than those within the proposed location.

A route placed through the series of "hog's backs" would probably run into problems achieving a desirable vertical alignment. For this reason, a location circumventing the "hog's backs" would prove more favorable.

A route to the west of the "hog's backs" would lie in a relatively wide valley, but would encounter chronic solifluction all along its length. This phenomenon may or may not be a critical factor depending on the depth of the active layer in which it takes place. The solifluction originates on or at the base of the "hog's backs" and continues well out in the floor of the valley. Some slope movement is also occurring on the ridge bordering the route on the west.

The material in the western route is likely derived in total from the surrounding bedrock, and can be expected to be of a silty-sand type due to the rather coarse drainage. Drainage, once again occurs between the "hog's backs"; in doing so it transports some material.

Bedrock can be seen to be outcropping in the valley floor. Larger drainage channels through the western route provide a locale for the only extensive growth of vegetation; black spruce, possible tamarack and brush make up the vegetation evident. Organic matter also exists in moist areas and along the larger drainage channels.

The eastern route around the series of "hog's backs" must move through a drainage channel into a much narrower, steeper sided valley than does the western route. Little slope movement is evident along the western bank of the valley, while changes in the slope of the eastern side may indicate mass wasting in the past or may be a reflection of different plains of bedded rock types.

The drainage channel which runs to the southeast corner of photo #86 goes through an abrupt change in grade as it moves between two "hog's backs". This change in grade may be due to a change in the strata through which it is moving, in which case it goes from a relatively inerodible or impermeable material to a more easily eroded material or a slightly more permeable layer, such as some type of silt. The stream may be also encountering less restriction of flow from bedrock at the place where it deepens, or may be encountering unfrozen ground.

The eastern route encounters a number of drainage channels which carry sediment to the valley floor and must contend with drainage which has cut into the valley floor, at each end of the section. If proper precautions are taken to ensure drainage downslope, no problems should result.

The eastern route must go over two bridges of bedrock which cross the valley between "hog's backs" and the ridge on the east side of the valley; this will result in the road being more vertically variable than a road through the western route, but permissible grades should be easily attained.

The eastern route has a good deal more vegetation than has the western route; small black spruce cover the western slope of the valley and parts of the valley floor, while small to large black spruce are found in conjunction with the drainage courses, along with what appears to be birch trees. Brush accompanies the tree growth and is general over the lower portions of the slopes on the east side of the valley. Some tamarack may exist in the odd low spot near or in the valley floor. For the most part the covering of vegetation on the slopes is relatively uniform, indicating no recent slope movement, however caution should be exercised in cutting into the slopes as any colluvial-alluvial material could slide.

The material to be encountered in the valley is derived from the surrounding sedimentary bedrock. Light to white toned areas coexisting with bare bedrock on the summits of the "hog's backs" may be indicative of sandy material which could also be found lower in the valley. Broken rock and silty material should also be present as products of erosion of the bedrock.

A route location near the western valley slope of eastern route would seem to be the best choice through this region as virtually no active permafrost features are seen and slopes appear to be stable. Materials in the immediate vicinity should be favorable.

VIII. A route through the valley on the east side of the corridor seems to provide the best route through the area immediately north of the series of "hog's backs". The western route exhibits a good deal of solifluction and steep grades would have to be dealt with. The eastern valley offers easy access from the eastern route through the "hog's backs" and few problems of vertical alignment would be encountered. The western slope of the valley is relatively steep, but is covered by small to medium black spruce and scrub in a relatively continuous growth; this is indicative of a relatively stable slope. The eastern slope of the valley is more shallow and seems to have an amount of colluvial-alluvial material associated with it; vegetation is limited to scrubs and mosses which may be indicative of unstable slopes. Drainage courses move down the eastern slope but should present no difficulties out of the ordinary; vegetation in conjunction with these is better developed, including some possible birch and tamarack. Fine solifluction can be seen on the eastern valley slope to the east of the point where the proposed route leaves the corridor. This solifluction does continue down to the valley floor of the proposed route and could present continuing problems.

The material found in the valley area can again be expected to be of the silty variety with some more granular material found in conjunction with the drainage courses.

IX. The proposed route shown in photos #83 to 81 must run on a side hill for a distance and then run along side the banks of the South Cornwall to the point where the crossing of the river is planned. No problem should be encountered crossing the side hill distance as the slope seems to be stable, as indicated by the continuous growth of small to medium size black spruce in that area. Some solifluction is evident along the flat on the east side of the South Cornwall, as seen in the extreme bottom centre of photo #82. The conspicuous absence of vegetation excepting some possible mosses may also indicate slope movement toward the river.

The relatively steep or near vertical walls of the streambed near the end of the survey at the proposed river crossing would indicate a relatively solid, stable channel of sedimentary bedrock similar to that forming the ridges; overlying material is probably of a silty nature. Beyond the crossing, the channel bedrock exhibits some landsliding and is likely softer material.

Snow accumulation on the side hill area may be a problem as it may be throughout the region of ridges and "hog's backs", especially due to the prevailing wind direction.