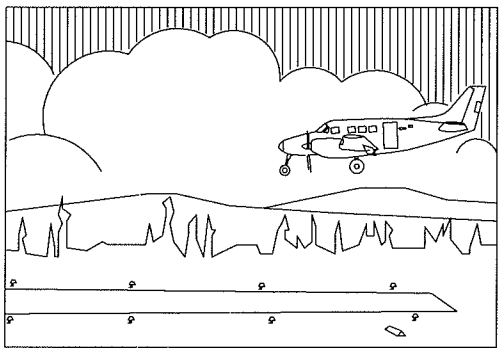
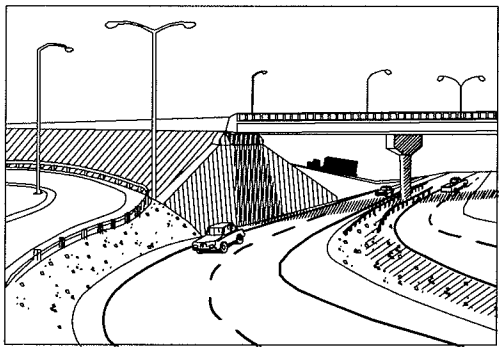
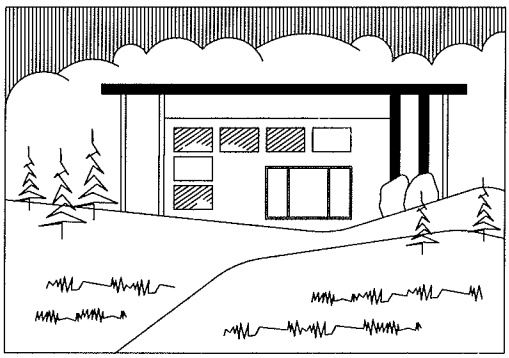
GEOTECHNICAL REPORT

DALTON HIGHWAY 9 MILE HILL NORTH

FEDERAL PROJECT NO. NH-F-065-2(3) / STATE PROJECT NO. 64899

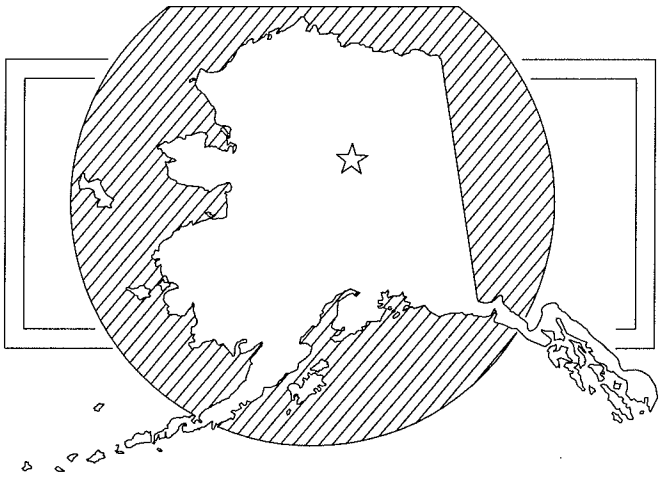






STATE OF ALASKA

Department of Transportation and Public Facilities



NORTHERN REGION

SEPTEMBER 2006

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FEDERAL PROJECT NO. NH-F-065-2(3)
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NORTHERN REGION

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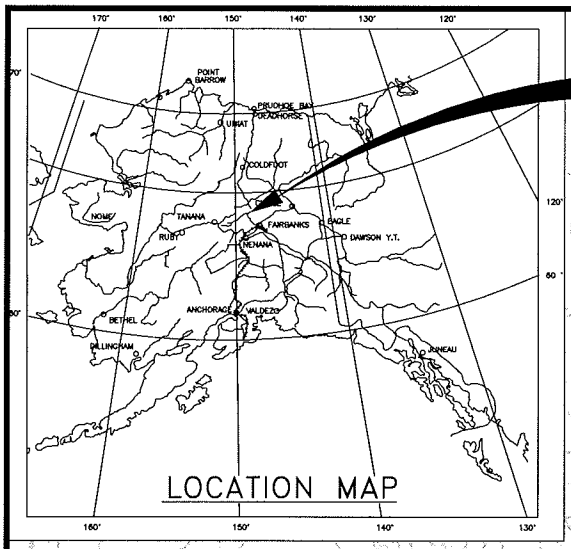

NH-F-065-2(3)/64899

13

12

E.O.P. "L2" 163+52.70

11

PROPOSED "L2" ALIGNMENT

DALTON

10

HIGHWAY

9

B.O.P. "L2" 10+00

MS 65-3-012-2

8

7

6

5

MS 65-3-020-2

FIGURE 1

VICINITY MAP

TAKEN FROM USGS QUADRANGLE LIVENGOOD C-4

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GEOTECHNICAL REPORT
DALTON HIGHWAY 9 MILE HILL NORTH
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Summary

The Alaska Department of Transportation and Public Facilities (DOT&PF) proposes to reconstruct approximately 4 miles of the Dalton Highway between MP 8 and MP 12 to current design standards, and to provide safer alignments, grades, and a new asphalt surface. The Northern Region Materials Section (NRMS) conducted three separate geotechnical investigations of the project area in 1990, 1991, and 2004.

In 1990, we drilled 45 test holes for the proposed "L_1" alignment. From Station 10+00, the "L_1" alignment deviates south of the existing road and passes over ice-rich silt and colluvium, massive ice, and chert bedrock. See pages 37 to 39 for plan and profile sheets.

In 1991, a second alignment, "L_2," was staked in the field, and 29 test holes were drilled along it. From Station 28+00, the proposed "L_2" alignment deviates from existing road and passes over ice-rich silt and colluvium, massive ice, and chert bedrock. See pages 16 to 21 for plan and profile sheets.

After the results of the two exploration programs were analyzed and reviewed, alignment "L_2" was selected as the preferred alignment. A preliminary recommendation memorandum dated April 2, 1992 from Livingston to Keeney gave the reasons for the preference. A second memorandum from Brazo through Livingston to Keeney dated December 20, 1993 presented further and more detailed comments and recommendations on the preferred alignment recommended in the 1992 memorandum. Both memorandums are included as Appendix C.

Prior to initiation of the 2004 investigation, NRMS requested a Design Section review and confirmation of the previous decision on the selection of "L_2" as the preferred alignment. After review, the Design Section confirmed that the "L_2" alignment is to remain as the preferred alignment. The 2004 investigation, a review of the geotechnical data previously gathered, and comments and recommendations presented in this report, are based on that decision.

NRMS proposes three options for designing and constructing the proposed realignment. The first option is to build the road using conventional methods over the proposed route, and to expect considerable future maintenance due to settlement from the thawing of ice-rich foundation soils. The second option is to build portions of the road using the Air Convection Embankment (ACE) method to keep the foundation soils frozen. An ACE is constructed of highly porous, poorly graded material that causes an unstable air density gradient in the winter, resulting in air circulation through the embankment (Goering, 1997). The cold winter air temperatures help to keep the foundation soils frozen. The third option is to clear and strip the organic mat on the proposed route, and to allow the soil to thaw over several years before constructing the new embankment. This option could include some "rough cutting" and the construction of a thin gravel pad with a sprayed asphalt surface to further induce the ice-rich foundation soils to thaw. Wick drains could be placed to facilitate foundation soil consolidation and drainage during embankment construction.

NRMS personnel conducted material site investigations of Material Site (MS) 65-3-012-2 and MS 65-3-020-2 during 1990, 1991, and 2004. This report contains the results of these analyses, as well as the results of a 2004 seismic survey.

Introduction

This project consists of the realignment of the Dalton Highway between Mile Post (MP) 8 and MP 12 (see Figure 1). The Dalton Highway begins at MP 73 of the Elliott Highway near Livengood, and ends at MP 413 at the Deadhorse Airport.

Livengood is east of the project location by approximately 10 miles, and Fairbanks is about 80 miles to the south. The Yukon River is approximately 50 miles north and Manley Hot Springs is approximately 80 miles southwest.

The Trans-Alaska Pipeline generally parallels the Dalton Highway and is located to the east of the highway in the vicinity of this project. The realignment will not encroach on the Trans-Alaska Pipeline.

This report documents physical site conditions and subsurface geotechnical conditions, provides analyses and interpretation of anticipated site conditions along the project, and recommends design and construction criteria for the project. This report is intended as a guide for further geotechnical investigations, and as a resource during the design and construction of the project.

Physical setting

Climate

The Environmental Atlas of Alaska (Hartman and Johnson, 1984) indicates that the project is located within the Continental Climatic Zone of Alaska. Great diurnal and annual temperature variations, and a low amount of precipitation, cloudiness, and humidity characterize the climate. The surface winds are generally light but occasionally can be appreciable and result in snow drifting along and across the roadway.

Located at about N65°40', the project area receives continuous sunlight and twilight from mid-May to late July. The length of sunlight and twilight decreases to a total of less than 8 hours per day between late November and late January.

The closest community with historical climate data is Livengood (N65.5225°, W148.54972°, Elevation 425 ft), located roughly 10 miles east of the project area. Climate data from the Unified Climate Access Network (UCAN) station located at Livengood (Coop ID 505534), from the period between 9/1/1962 to 3/31/2006, were obtained from the Alaska Engineering Design Information System internet site (https://rsgis.crrel.usace.army.mil/aedis). Full years of climate data were available only for 1963 and 1965. Climate data for the period between 1967 and 1996 were not recorded, and the climate data for the remaining years are only for portions of each year. All available data are summarized in Table 1.

Table 2 contains a summary of indices calculated from the available Livengood data. The air thawing and freezing indices are those calculated by the AEDIS internet site from the entire set of data from 1962 to 2006. The lack of complete years of climate data necessitates a departure

from the procedures outlined in the Army / Air Force Technical Manual TM 5-852-6 for the calculation of the design indices. Instead, the design freezing index and design thawing index were chosen from the 1965 and 1963 data, respectively, as these were the only two complete years of data in the period. These values are presented in Table 2.

Table 1: Average monthly temperatures and precipitation from 1962 to 2006 for Livengood, Alaska

Month	Temperature Degrees Fahrenheit		Mean Precipitation Inches
	Mean Max.	Mean Min.	Avg. Total Precip.
January	-7.98	-19.43	0.11
February	0.90	-12.96	0.12
March	14.78	-5.76	0.22
April	35.47	11.39	0.35
May	53.33	30.71	0.75
June	69.99	43.31	1.23
July	71.46	44.93	2.55
August	64.79	40.11	1.92
September	49.73	29.81	1.43
October	27.00	14.47	0.42
November	6.51	-5.06	0.14
December	-0.87	-14.00	0.28
Yearly	32.08	13.13	Average Total 9.52

Table 2: Summary of indices for the project area

Air Thawing Index	1935 Fahrenheit degree-days
Air Freezing Index	5870 Fahrenheit degree-days
Design Thawing Index	2859 Fahrenheit degree-days
Design Freezing Index	6189 Fahrenheit degree-days

Regional/site geology, topography, and vegetation

According to Physiographic Divisions of Alaska (Wahrhaftig, 1965), the project traverses through the northwestern part of the Yukon-Tanana Upland section of the Northern Plateaus physiographic province. Gently sloping, rounded ridges that trend northeast to east typify the western portion of this province. In the immediate vicinity of the project area, these ridges rise up to 2,300 ft with valley bottoms at about 700 ft. The streams that occupy these valleys drain northerly to the Yukon River.

Bedrock in and around the project area consists of highly deformed Paleozoic sedimentary and volcanic rocks (Wahrhaftig, 1965). The bedrock along the alignment consists of chert, which is generally weathered and frozen as evidenced by drill reaction and field observation. Thick blankets of loess overlie the bedrock, with thick deposits of muck (i.e., reworked silt containing organic material) typically in the valley bottoms.

This area exhibits periglacial features. Typical periglacial features and processes present in the project area include solifluction, mass-wasting, pingos, and discontinuous permafrost. The permafrost often contains massive ice wedges, and is considered to be "warm" with ground temperatures just below freezing (Romanovsky, 2004).

Vegetation along the realignment is generally small black spruce trees (1 to 6-in. in diameter) on 1 to 10-ft centers. Aspen trees, 2 to 12-in. in diameter on 5 to 25-ft centers, predominate in some of the larger draws. Willow and alder shrubs 10-ft tall grow among the trees. Low ground cover includes cranberry, blueberry, and Labrador tea shrubs and moss. Grass grows in some of the draws and on some hillsides.

Field Procedures

Exploration, drilling, and sampling

At the request of Joe Keeney, then project manager, NRMS conducted three investigations for the proposed improvements, to determine the general soil and bedrock profile and geotechnical conditions present throughout the length of the project and in two material sites (MS). Northern Region Materials Section (NRMS) personnel performed the soils investigation during two field seasons. From July 30 to August 9, 1990, we investigated the "L_1" centerline, MS 65-3-012-2, and a portion of MS 65-3-020-2. From September 18 to October 1, 1991, we investigated the "L_2" centerline and continued the investigation of MS 65-3-020-2. G. Brazo, engineering geologist, located, sampled, and logged a total of 72 test holes along the proposed centerlines. J. Manthey and J. Nelson, drillers, operated a track-mounted Central Mine Equipment (CME) 45B drill. The drillers used 6.0-in. diameter, continuous-flight, solid-stem auger to drill the test holes. When drilling in bedrock, the hardness of bedrock was based on the penetration rate of the solid-stem auger advanced by a CME 45 drill. Bedrock was labeled as hard on the test hole logs when auger penetration was slower than one foot per minute. Conversely, bedrock was labeled as soft in which auger penetration was faster than one foot per minute. Refusal was noted when auger penetration was less than one inch per minute. All of these drilling rates are dependent on variable factors, such as drill orientation, type of bit, down pressure, frozen state, and type of drill. A CASE 1150C tractor equipped with a blade and backhoe was used to dig test trenches in MS 65-3-020-2. In the two material sites, we drilled and dug 53 test holes and test trenches. We took samples directly from the auger or backhoe bucket, and visually identified the material in the field using the DOT&PF textural descriptions. A total of 171 samples were taken to the Northern Region Materials Laboratory in Fairbanks for further testing and analysis. All test holes were logged using the Alaska textural soil descriptions, and the AASHTO classification system was used to classify the laboratory samples.

In 1990, NRMS personnel ran three seismic profile lines in MS 65-3-012-2 with a Nimbus Model ES-125 Signal Enhancement Seismograph equipped with one geophone. In 2004, we ran

another seismic profile line in MS 65-3-012-2 using a Stataview NZ48 seismograph. See Appendix B for the seismic data and a description of the 2004 work.

The centerline plan and profile sheets show test hole logs, and are accompanied by laboratory results. Test hole locations and material analyses for each of the material sites are presented in the material site discussions (see page 44).

Laboratory testing

NRMS personnel transported samples to the DOT&PF laboratory in Fairbanks for testing. Table 3 is a list of the laboratory testing performed for this project. Laboratory data summary sheets for samples taken along the alignment are located after the centerline plan sheets.

Table 3: Summary of the relevant laboratory test methods

Test Name (*short description or common identifier*)	Test Number	
	AASHTO	ASTM
Sieve Analysis of Fine and Coarse Aggregates (*Gradation*)	T27/T11	C126/C117
Particle Size Analysis of Soils (*Hydrometer Analysis*)	T88	D422
Determining the Liquid Limit of Soils (*Liquid Limit*)	T89	D4318
Determining the Plastic Limit and Plasticity Index of Soils (*Plastic Limit / PI*)	T90	D4318
Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes (*Classification*)	M145-91	D3282
Moisture Content of Soils (*Natural Moisture*)	T265	D2216
Organic Content of Soils by Ignition (*Organic Content*)	T267	D2974
Specific Gravity of Soils (*Fine Specific Gravity*)	T100	D854
Moisture-Density Relations of Soils… (*Proctor Test*)	T99/T180	D698/D1557
Specific Gravity and Absorption of Coarse Aggregate (*Coarse Specific Gravity*)	T85	C127
Specific Gravity of Soils (*Fine Specific Gravity*)	T100	D854
Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate (*Quality – SSc, SSf*)	T104	C88
Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine (*Quality – LA*)	T96	C131
Standard Method of Test for Determining the Degradation Value of Aggregates (*Quality – DEG*)	Alaska Test Method (ATM) T13	

Expected physical site conditions

Based on the data retrieved from the exploration detailed in this report, and on the geology and local climate of the project location, the following physical site conditions should be expected:

1) Expect permafrost throughout the project area.
2) Frozen ground may be present within the active layer at any time of the year.
3) Expect intermittent pockets of soils with high organic contents throughout the project.
4) Expect to encounter massive ice in the foundation soils. Massive ice was intercepted during the geotechnical investigations that ranged from a few feet thick to tens of feet thick.
5) Expect bedrock, frozen bedrock, and frozen silty soils in cut areas and in material sites to require blasting.
6) Expect excavated frozen silt to require containment measures as it thaws.

General material site information

The Materials Source information included in this section is for the purpose of assisting in the project design process. It does not signify that the sources are available or suitable for use during the construction of any current or future project. This Geotechnical Report does not determine source availability or suitability for any construction project; it only provides information that can be used to make that determination during the project design process. Sources available or suitable for use for a construction project will be specified in the appropriate section of the Plans and Specifications of the Contract Documents for the construction project.

NRMS personnel investigated two material sources as potential sources of embankment material and crushed aggregate for use on this project. Each area is summarized briefly below. For further details on the individual material sites, refer to the material site discussions (see page 44).

Inclusion of any of these material sites in this report is not intended to imply adequate quantity, quality, or availability of material for use on this project. Additionally, environmental permits are not granted for any of the sites discussed in this report; further permitting will be necessary.

MS 65-3-012-2 (OMS 71-1HR), Dalton Highway MP 8

This is an existing 114.3-acre source administered by the Department of Natural Resources and used jointly with Alyeska. The contract expires on August 31, 2014. This site is a source of chert bedrock, which may require blasting to extract. Laboratory testing indicates that some of the material from this site does not meet the Standard Specifications for use as crushed aggregates or subbase. Additionally, the moisture/density curves from material tested exhibited narrow peaks, indicating that the material is sensitive to moisture content. This suggests that complicated processing and handling techniques and procedures may be necessary in order to meet standard specifications.

An additional geotechnical exploration of this site was conducted during September 2006. The report summarizing the results of the 2006 exploration is in progress at the time of this writing.

MS 65-3-020-2, Dalton Highway MP 6

This is a mostly undeveloped alluvial source located on both sides of the highway. At the time of this writing, application for this site is in progress. Some of the gravelly material in this site does not meet the LA Abrasion and Degradation requirements for crushed aggregate and subbase. Results from the Sodium Sulfate loss tests indicate that some of the gravelly material does not meet the Standard Specifications for crushed aggregate and subbase. Additionally, the moisture/density curves from material tested exhibited narrow peaks, indicating that the material is sensitive to moisture content. This suggests that complicated processing and handling techniques and procedures may be necessary in order to meet standard specifications.

Additional sites

Table 4 summarizes additional materials sites within ten miles to the north and south of the project location (see page 71 for Table 4). We did not conduct geotechnical investigations in these additional material sites. The information provided in Table 4 summarizes that on file at Northern Region Materials Section.

Design Options

Three design options are presented below. Any one of these options may be applied to the entire project. If preferred, these options may be applied to portions of the project, as further delineated in the station to station descriptions.

Option 1 – Conventional method

Option 1 is to construct the roadway following conventional methods. This consists of clearing the trees, but leaving the organic mat intact, and following plan and profile for indicated cuts and fills. This option includes insulation at selected areas. However, because of the thawing of the existing ice-rich foundation soils, it is expected that there will be areas of extreme settlement, requiring extensive future maintenance for several years until the thermal regime stabilizes.

Option 2 – Keep the ground frozen

Keeping the ground frozen is an option in fill areas or in areas where cuts do not penetrate to bedrock.

a. Use the chert bedrock that underlies, at depth, portions of the proposed route near the BOP to build an Air Convection Embankment (ACE). This option will require an additional geotechnical investigation to verify that the necessary quality and quantities of chert bedrock are available to construct the embankment.

b. Install thermosiphons and insulation within the newly constructed embankment to maintain freezing conditions in the foundation soils.

Either Option 2a or 2b, if included in the final design, should be incorporated as an Experimental Feature.

Option 3 – Prethaw

Option 3 consists of a phased construction. During Phase I, clear, grub and strip the route down to mineral soil in the fill sections, and in the cut sections excavate to the approximate

grade. Construct a 1-ft thick gravel pad across the width of the proposed embankment, and coat the surface with a spray application of asphalt. The presence of the gravel pad darkened with asphalt will accelerate thawing and inhibit plant re-growth after clearing (Esch, 1982). After allowing time for the foundation soils to thaw, build the roadway generally following conventional methods (Phase II). This option could incorporate wick drains to facilitate foundation soil drainage during Phase II embankment construction. Building the embankment on pre-thawed soils would greatly reduce the amount of future settlement, and correspondingly lower future maintenance as compared to Option 1. The thaw time would be estimated by thermal modeling and verified by monitoring of instruments installed during Phase I.

General comments and recommendations

The following comments and recommendations apply to all options unless otherwise noted.

1) The profile shown on the plan and profile sheets was derived from the 1992 preliminary design profile. It is not the final design profile.

2) Without preventative measures, assume that the permafrost underlying the project will degrade over time.

3) Expect differential settlement due to thawing into perennially frozen foundation soils. Expect the silty foundation soils within the active layer to consolidate under the load of the newly constructed embankment.

4) Expect large amounts of consolidation of any peat or surface organics left in place under constructed embankments as the organic material thaws.

5) Expect long-term creep in the ice-rich foundation soils under constructed embankments.

6) Use staged construction methods for thawing of subsurface ice/soils (Options 1 and 3), embankment construction, and final paving steps. Do not pave new alignment until differential settlement and consolidation lessens or can be evaluated (at least 1 to 3 years). Consider wick drains for speeding consolidation, and possibly reducing the moisture content of wet silts.

7) Except for Option 3, preserve the surface organic mat in fill areas. Original surface ground preparation and/or stabilizing berms may be needed on steep side slopes to ensure embankment stability.

8) Except for Option 3, hand clearing is recommended. A Hydro-Ax or equivalent may be substituted for hand methods provided the natural ground is sufficiently frozen to support the equipment without tire or track rutting. Hand clear 10 ft beyond the cut face in ice-rich silt, and 10 ft beyond the toe of fill.

9) Implement temporary erosion control and water runoff plans. Consider surface water diversions to minimize storm and seasonal drainage impacts on the project site. Install temporary drainage across the desired alignment to prevent ponding of water during construction. Avoid channeling water onto potentially unstable slopes.

10) Consider subexcavating areas of peat located underneath the constructed embankment. When subexcavating, use a 4H:1V transition slope in the centerline direction from the bottom of the excavation to the top of the subexcavated zone.

11) Place geotextile separation/reinforcement fabric between silty foundation soils and the new embankment. High-strength geotextile may be necessary to allow equipment to place fill on wet terrain depending on the season.

12) Design cuts into soft or highly weathered bedrock at a maximum slope of 2H:1V. Design cuts into hard bedrock at a maximum slope of 1H:1V. Additionally, consider using flat-bottomed ditches in cut areas. Flat-bottomed ditches should be at least 12-ft wide.

13) Expect areas of hard bedrock, frozen weathered bedrock, and frozen foundation soils to require blasting in order to facilitate rapid excavation and placement.

14) Plan for season-specific staged excavation and material placement tasks, especially in cut-fill transition areas.

15) A special cut slope in frozen ice-rich silt is required to provide for the thaw and stabilization of the backslope. A near vertical cut should be made far enough back to allow for a thaw and slump setting to a final slope of approximately 2.5H:1V. The initial ditch width, W, should be three or more times the vertical cut height, H (i.e., W = 3H). Benching will be required where the cut slope is greater than 15-ft high. Limit the vertical bench cuts to 15 ft. Design cuts into thawed silt or other fine-grained soil at 2H:1V or flatter.

16) In some rock cut areas, the upper portion of the cut will expose frozen soils. Consider laying this portion of the slope back to a 2H:1V or flatter angle, and benching the top of the bedrock to serve as a ledge to catch the thawing and slumping soil. Slope the bench above the bedrock to drain, or consider installing interceptor berms and/or ditches to intercept drainage.

17) Consider subexcavation and benching in areas of cut/fill transition. Slope cut/fill area ditches to drain away from or minimize running water across the transition. Alternatively, consider installing insulation to minimize subexcavation in difficult frozen ground conditions.

18) Provide for drainage of the embankment and ditches throughout the project. If ditches in silt are exposed during construction and gradients are 2% or steeper, line ditches with a 1.0-ft thick layer of angular well-graded, granular material. Similarly, protect the slopes at cut/fill transitions. Where ditch grades are less than 2%, use temporary ditch protection such as jute mesh. The bottom of flat-bottom ditches should be sloped toward the embankment at 20H:1V.

19) Provide a minimum of 3 ft of cover over culverts. Alternatively, provide a minimum of 2 ft of cover and increase the gauge of the culvert. Where culverts are to be placed, subexcavate a minimum of 1 ft in areas founded on granular soil. In areas founded on silty or organic soil, subexcavate a minimum of 3 ft. The bottom of the subexcavation should be three culvert-diameters wide, with 3H:1V side slopes from the bottom of the subexcavation to original ground. Line the bottom and backslopes of the subexcavation with 6-in. insulation and backfill with Selected Material, Type A.

20) Establish ditch bottoms a minimum of 4.0 ft below the shoulder of the roadway.

21) For quantity calculations, use a 5% swell factor on the chert bedrock.

22) Any embankment fill or backfill should have a structural core with the slopes no steeper than 1H:1V.

23) For borrow below the pavement structure, specify Selected Material, Type C Modified, with a maximum of 25% passing the No. 200 sieve for backfill or fill for structural embankment construction. This will allow use of some of the weathered chert from the cut near the BOP to construct fills. The number of samples taken through this interval was not sufficient to define what percentage of the weathered bedrock is useable to construct fills.

24) Consider requesting a thermal analysis from the geotechnical engineer in order to determine the optimum embankment height and geometry to mitigate thaw settlement under the embankment.

25) Consider using geogrid within the embankment to help minimize differential settlement in areas where degrading permafrost is expected.

26) Stabilization berms may be needed to stabilize some embankment fill areas in soft ground. The height of the berm may be adjusted according to the availability of material, and the top of the berm should be at or below the level of the bottom of the pavement structure. Design the stabilizing berm slopes between 2H:1V (granular) and 4H:1V (silt), depending on the material quality and the slope of the natural ground. These berms can be built from thawed material if it can be placed, shaped, and compacted. Highly organic silt and/or material coming from cuts or subexcavation into ice-rich soil will require containment berms if used for stabilization berms.

27) Construct fill side slopes at 4H:1V or flatter when using thawed and drained silt for slope flattening. Do not place silt directly next to the pavement structure. Highly organic silt or silt with a moisture content greater than 25% should not be used for slope flattening.

28) Design the pavement structure according to the "Alaska Flexible Pavement Design Manual," effective 4/01/2004 and any later revisions.

29) Seed and fertilize all ditch and embankment slopes below the standard 42-in. pavement structure. Additionally, seed and fertilize all cuts through silty soils.

30) Large volumes of ice-rich material that are unsuitable for use will be generated during construction. Currently, holding areas for this material have not been identified. Measures to control sedimentation and erosion problems upon thawing of this material need to be developed.

Station to station descriptions

NOTE: Within the station to station intervals delineated below, there are localized intervals of massive ice. These intervals will be specifically addressed in a later section (see page 14).

Previous investigations for this project have categorized the rock materials observed on the project as "soft" or "hard" and variously as "moderately to completely weathered," "fractured," or "broken." The rock is highly variable in its characteristics from place to place on the project. The rock strata are bedded and variably oriented at steeply dipping angles. Some of the rock has completely weathered to soil containing gravel, sand, and silt/clay-sized particles. The "broken rock" was observed to consist of rock fragments in a matrix of silt and sand. Other areas have "hard" rock that is comprised of masses of rock with observable bedding of chert and limestone layers. Prior investigations do not provide sufficient information to fully characterize the rock expected to be intercepted along the alignments and in the material sites. We did not make a determination of rippability, but recommend that any such analysis should include consideration of seismic data and its limitations, structural orientation of steeply dipping bedrock bedding, state of weathering, variability of the rock and weathered rock masses, frozen state, presence of ice, and other factors. The reader should expect that **some of the rock will require blasting to excavate because it is frozen or hard or both**, based on seismic velocities obtained during this investigation and on test hole data from prior investigations and visual observations.

Station "L_2" 10+00 (BOP) to Station "L_2" 46+20

Description

The proposed grade necessitates a cut up to 30-ft deep for this interval. Where drilled, the existing embankment was between 6.0-ft and 14.0-ft high and consisted of broken chert fragments. The sampled embankment material had between 13% and 15% passing the No. 200 sieve size. Two samples had liquid limits of 26 and 30, and plastic indices of 8 and 10, respectively. One sample had a moisture content of 3.5%. The foundation soils, where drilled, typically consisted of up to 5 ft of silt or organic silt, overlying chert bedrock. Drill reaction indicated that the bedrock was typically soft with some hard layers, and a colluvial layer was sometimes present at the bedrock surface. Each test hole contained frozen soils. The silty soils typically contained at least 25% visible ice, and TH91-04 contained 4 ft of massive ice. The soils were frozen from 1.0 ft below the ground surface to the bottom of the holes. One sample of the colluvium indicated 15% passing the No. 200 sieve, a liquid limit of 22, and a plastic index of 3. The moisture content of the sampled colluvium ranged between 10.7% and 21.6%. The sampled bedrock had between 9% and 29% passing the No. 200 sieve. The samples that had liquid limits ranged between 20 and 24, with plastic indices between 2 and 4. The moisture content of the sampled bedrock ranged between 3.4% and 20.4%. We intercepted a water table in TH90-06 at 11.0 ft below the ground surface; the soil in this test hole was frozen at 15.0 ft below the ground surface.

Recommendations

In addition to the general recommendations, apply the following recommendation to this stationing interval:

1) Deepen and/or widen this cut for useable bedrock excavation. The laboratory results of the sampled bedrock in this interval indicate that some of the chert bedrock can be used to produce Selected Material, Type C Modified (see the General Recommendation #23).

2) Expect bedrock, frozen bedrock, and frozen silty soils in the cut areas to require blasting.

Station "L_2" 46+20 to Station "L_2" 55+00

Description

The proposed grade in this section necessitates a fill over 50-ft high through a drainage. The soils typically consist of up to 18.0 ft of ice-rich silt and/or organic silt, overlying soft chert bedrock. The foundation soils were frozen between 1.0 ft and 1.5 ft below the ground surface and to the depths drilled. The silty soils contained up to 75% visible ice, and the bedrock in TH91-06 contained 25% visible ice. One sample of the silt demonstrated 100% passing the No. 200 sieve, and the moisture content of the silt ranged between 48.9% and 131.9%. The moisture content of the sampled bedrock ranged between 12.9% and 32.0%.

Recommendations

If following Options 1 or 3, apply the following recommendations to this stationing interval, in addition to the general recommendations:

1) Between Station "L_2" 46+00 and Station "L_2" 55+00, subexcavate to the bedrock surface (about 5 to 18 ft beneath the ground surface). Construct a benched foundation by benching into the bedrock prior to construction of the embankment fill.

2) Use 3H:1V fill slopes or stabilizing berms left and right between Stations "L_2" 46+00 and "L_2" 55+00.

Station "L_2" 55+00 to Station "L_2" 115+00

Description

From Station "L_2" 55+00 to Station "L_2" 80+00, the proposed grade requires cuts up to 30-ft deep. A 40-ft high fill section is proposed from Station "L_2" 80+00 to Station "L_2" 97+40, and the remainder of this interval is a cut section up to 34-ft deep. The foundation soils consist of up to 45 ft of ice-rich silt, organic silt, and massive ice overlying soft chert bedrock. Not all of our test holes intercepted the bedrock surface (see the plan and profile sheets for details). While each test hole in this interval contained some amount of visible ice, the most extreme case was TH91-25, with 34 ft of massive ice. The bedrock in TH91-26 contained 50% visible ice. The sampled silty soils demonstrated between 95% and 99% passing the No. 200 sieve. One sample demonstrated a liquid limit of 29, but was non-plastic. The moisture content of the silt ranged between 22.9% and 148.0%, and the organic content ranged between 3.5% and 12.4%. Two samples of the chert bedrock demonstrated 23% and 24% passing the No. 200 sieve. One sample demonstrated a liquid limit of 29, but was non-plastic. The moisture content of the sampled bedrock ranged between 12.3% and 56.6%.

Recommendations

In addition to the general recommendations, apply the following recommendations to this stationing interval:

1) If following Options 1 or 3, the grade between Stations "L_2" 55+00 and "L_2" 115+00 should be kept as close to bedrock as reasonably possible to minimize the thawing effects of ice-rich soils. This may require lowering the grade between 15 and 50 ft, depending on the location and the final design profile.

2) Expect bedrock, frozen bedrock, and frozen silty soils in the cut areas to require blasting.

3) An air convection embankment is an option for the cut-fill transitional area from Station "L_2" 111+00 to Station "L_2" 115+00, and into the next station to station interval.

4) If following Option 3, install thermistors after rough-cutting to near grade and before constructing the gravel pad. Monitor the thermistors to verify thermal regime change. Begin Phase II when the data indicates the new thermal regime has stabilized.

Station "L_2" 115+00 to Station "L_2" 163+52.70 (EOP)

Description and comments

This interval consists of fills, with the proposed grade requiring fills up to 50-ft high. There is a short cut section up to 10-ft deep from approximately Station "L_2" 159+80 to Station "L_2" 163+52.70. Our test holes through this interval did not intercept the bedrock surface. Instead, the foundation soils consisted of ice-rich silt, organic silt, and massive ice. All test holes contained some amount of visible ice, with TH90-38 containing 10 ft of massive ice. The sampled silt demonstrated between 91% and 95% passing the No. 200 sieve. One sample of the silty soil had a liquid limit of 43 and a plastic index of 3. The moisture content of the silt ranged between 79.2% and 154.7%. Test holes 90-44 and 90-45 were drilled through the existing embankment. A sample of the embankment material demonstrated 13% passing the No. 200 sieve, a liquid limit of 29, and a plastic index of 11. We intercepted a water table in TH90-45 at 5.0 ft below the surface. The soils were frozen at 7.5 ft below the surface in this test hole.

Recommendations

In addition to the general recommendations, apply the following recommendations for this stationing interval:

1) Use 3H:1V or flatter fill slopes and/or stabilizing berms on the left and right from Station "L_2" 115+00 to Station "L_2" 130+00, from Station "L_2" 143+00 to Station "L_2" 158+00, and on the right only from Station "L_2" 158+00 to Station "L_2" 163+52.70

2) If following Options 1 or 2, avoid ditch cutting between Stations "L_2" 132+00 and "L_2" 142+00, and between Stations "L_2" 159+00 and "L_2" 163+52.70.

3) If following Option 1, consider using insulation and thermal berms through this interval. Alternatively, an air convection embankment is an option for this station-to-station interval.

4) If following Option 3, install thermistors after rough-cutting to near grade and before constructing the gravel pad. Monitor the thermistors to verify thermal regime change. Begin Phase II when the data indicates the new thermal regime has stabilized.

5) If following Option 3, consider subexcavation beyond the final grade in the cut-fill transition at Station "L_2" 115+00 to promote deeper thawing during the prethaw period.

Massive ice intervals

The following areas containing massive ice were identified during the 1990 and 1991 investigations:

- Station "L_2" 45+00
- Station "L_2" 60+00
- Station "L_2" 66+00
- Station "L_2" 70+00 to Station "L_2" 81+00
- Station "L_2" 89+00 to Station "L_2" 95+00
- Station "L_2" 109+00 to Station "L_2" 131+00
- Station "L_2" 150+00

Comments and recommendations

1) Additional drilling is required to further delineate the depths and extents of the massive ice.

2) Design alternatives include:
   - subexcavation to bedrock in cut areas;
   - insulation and ACE embankment in fill areas;
   - insulation and thermosiphons in fill areas.

   Additional geotechnical investigation and analysis, along with the final design grade, are required for the detailed design of the above alternatives.

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ALASKA	F-065-2(3)/64899	2004	1	6

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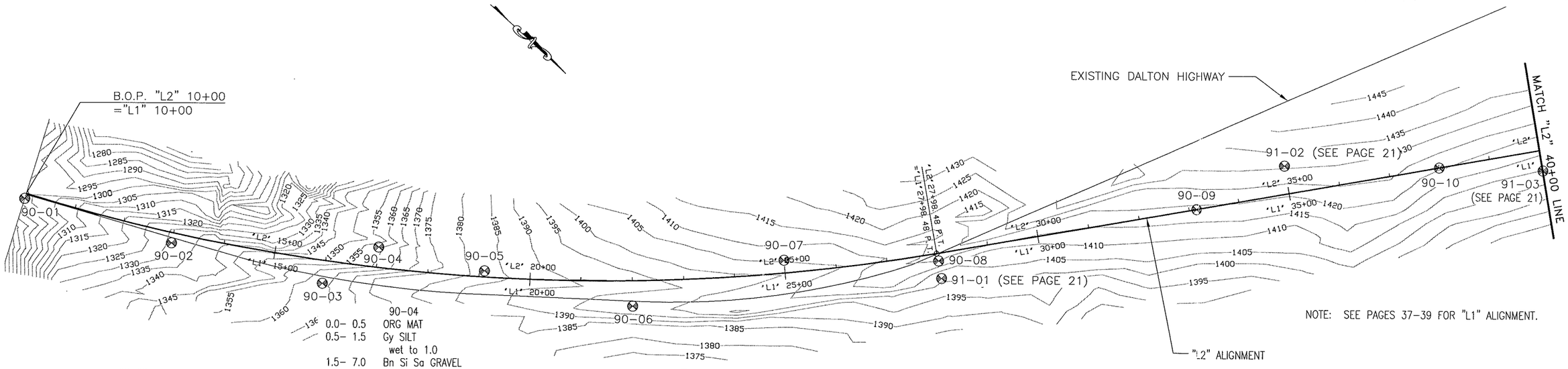

NOTE: SEE PAGES 37-39 FOR "L1" ALIGNMENT.

LEGEND

APPROXIMATE PROPOSED PROFILE
EXISTING GROUND (TYPICAL)

90-02
0.0- 9.0 Bn-Gy Broken CHERT(fill), moist
(tested as sl Cl Si Sa GRAVEL)
SAMPLE 90-1077
(1.0-3.0)
A-2-4, 15% -200
LL 26, PI 8
roots & stems 8.0-9.0
9.0-10.0 Gy Org SILT, wet
10.0-12.5 Bn Si Sa GRAVEL
(Colluvium)
12.5-14.0 Bn BEDROCK, soft(Chert)

90-04
0.0- 0.5 ORG MAT
0.5- 1.5 Gy SILT
wet to 1.0
1.5- 7.0 Bn Si Sa GRAVEL
(Colluvium)
SAMPLE 90-1080
(2.0-3.0)
NM 10.7%
SAMPLE 90-1081
(4.0-6.0)
A-1-b, 15% -200
NM 11.3%
LL 22, PI 3
7.0-14.0 Bn BEDROCK, soft(Chert)

90-06
0.0-14.0 Bn-Gy Broken CHERT(fill), moist
wet 9.0-14.0
(tested as sl Cl Si Sa GRAVEL)
SAMPLE 90-1083
(2.0-4.0)
A-2-4, 13%-200
LL 30, PI 10
14.0-19.0 Gy Si Sa GRAVEL,
(Colluvium) wet to 15.0

90-10
0.0- 0.5 ORG MAT
0.5- 3.5 Gy SILT
wet to 1.0
w/ visible ice 1.0-3.5
3.5- 5.0 Bn-Gy Si Sa GRAVEL
(Colluvium)
5.0- 9.0 Bn-Gy BEDROCK, soft(Chert)

TH90-01
STA "L2" 10+00, Rt 10
30 JUL

90-01
0.0- 6.0 Bn-Gy Broken CHERT(fill), moist
6.0-14.0 Bn-Gy BEDROCK, soft(Chert)
wet to 10.0

TH90-02
STA "L2" 13+00, Rt 20
30 JUL

TH90-03
STA "L2" 16+00, Rt 45
30 JUL

TH90-04
STA "L2" 17+00, Lt 40
30 JUL

90-03
0.0- 8.0 Bn-Gy Broken CHERT(fill), moist
(tested as Si Sa GRAVEL)
SAMPLE 90-1078
(5.0-7.0)
A-1-a, 14% -200
NM 3.5%
8.0- 9.0 Gy SILT, moist
w/ roots
9.0-11.5 Bn Si Sa GRAVEL
(Colluvium)
SAMPLE 90-1079
(10.0-11.0)
NM 11.0%
11.5-16.0 Bn-Gy BEDROCK, soft(Chert)
16.0-17.0 Bn-Gy BEDROCK, hard(Chert)

TH90-05
STA "L2" 19+10, Lt 12
30 JUL

90-05
0.0- 0.5 ORG MAT
0.5- 2.0 Gy SILT, wet
2.0- 3.5 Bn Si Sa GRAVEL
(Colluvium)
3.5-19.0 Gy BEDROCK, soft(Chert)
(tested as Si Gr SAND)
SAMPLE 90-1082A
(6.0-8.0)
A-2-4, 29%-200
NM 10.7%
LL 21, PI 3
SAMPLE 90-1082B
(12.0-13.0)
NM 12.4%

TH90-06
STA "L2" 22+00, Rt 50
30 JUL

TH90-07
STA "L2" 25+00, Lt 25
30 JUL

90-07
0.0- 0.5 ORG MAT
0.5- 4.0 Gy Org SILT
wet to 1.0
w/ visible ice 1.0-4.0
4.0-14.0 Gy BEDROCK, soft(Chert)
w/ hard layer 10.0-12.0

TH90-08
STA "L2" 28+00, Rt 15
31 JUL

90-08
0.0-11.0 Bn-Gy Broken CHERT(fill), moist
wet below 10.0
11.0-14.0 Gy SILT
wet to 12.0
w/ woody debris

TH90-09
STA "L2" 33+15, CL
31 JUL

90-09
0.0- 0.5 ORG MAT
0.5- 3.5 Gy SILT
wet to 1.0
w/ visible ice 1.0-3.5
3.5- 7.0 Bn-Gy BEDROCK, soft(Chert)
hard at 7.0

TH90-10
STA "L2" 38+00, CL
31 JUL

NOTE: SEE PAGE 19 FOR ADDITIONAL 1991 TEST HOLES.

Fri, 25/Aug/06 10:05am

1350 1340 1330 1320 1310 1300 1290 1280 1270 1260

1460 1450 1440 1430 1420 1410 1400 1390 1380 1370

10+00 12+00 14+00 16+00 18+00 20+00 22+00 24+00 26+00 28+00 30+00 32+00 34+00 36+00 38+00 40+00

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	ALASKA	F-065-2(3)/64899	2004	2	6

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EXISTING DALTON HIGHWAY

"L1" ALIGNMENT

"L2" ALIGNMENT

MATCH "L2" 40+00 LINE

MATCH "L2" 69+00 LINE

90-11 90-04 90-12 90-14 90-15 90-13 90-05 90-06 90-07 90-16 90-17 91-08 91-09 90-18 90-19 91-10 91-11 91-12

"L1" 45+00 "L2" 45+00 "L1" 50+00 "L2" 50+00 "L1" 55+00 "L2" 55+00 "L1" 60+00 "L2" 60+00 "L1" 65+00 "L2" 65+00

"L2" 50+91.94 P.T. "L1" 57+31.40 P.T. "L2" 59+74.98 P.C. "L1" 65+89.81 P.C.

NOTE: SEE PAGE 37 FOR "L1" ALIGNMENT AND 1990 TEST HOLES.

91-04
0.0- 0.5 ORG MAT
0.5- 3.0 Gy SILT
wet to 1.0
w/ visible ice 1.5-3.0
3.0- 7.0 ICE
7.0- 8.0 Gy Si Sa GRAVEL
(Colluvium)
w/ visible ice
8.0-30.0 Gy BEDROCK, (Chert)
(tested as Si Sa GRAVEL)
soft 8.0-18.0
hard 18.0-19.0
soft 19.0-24.0
hard 24.0-29.0
soft 29.0-30.0
SAMPLE 91-1233
(10.0-12.0)
A-1-a, 10%-200
NM 14.1%
SAMPLE 91-1234A
(18.0-24.0)
A-1-a, 13%-200
SAMPLE 91-1234B
(20.0-21.0)
NM 3.4%
REFUSAL

TH91-04
STA "L2" 44+85, Rt 15
19 SEP

91-05
0.0- 0.5 ORG MAT
0.5- 2.0 Bn Org SILT
wet to 1.0
w/ visible ice 1.0-2.0
2.0- 5.0 Gy SILT
w/ visible ice 2.0-4.0
5.0-18.0 Gy BEDROCK, soft(Chert)
SAMPLE 91-1235
(6.0-7.0)
NM 22.6%
SAMPLE 91-1236
(11.0-12.0)
NM 12.9%

TH91-05
STA "L2" 47+50, Rt 20
19 SEP

91-06
0.0- 0.5 ORG MAT
0.5- 3.0 Gy SILT
wet to 1.5
w/ visible ice 1.5-3.0
SAMPLE 91-1237
(2.0-3.0)
NM 131.9%
3.0- 4.0 Gy Org SILT
w/ woody debris
4.0- 6.0 Gy Si Sa GRAVEL
(Colluvium)
6.0-11.0 Gy BEDROCK, soft(Chert)
w/ visible ice 6.0-8.0
SAMPLE 91-1238
(6.0-7.0)
NM 32.0%

TH91-06
STA "L2" 48+45, Rt 55
19 SEP

TH91-07
STA "L2" 51+50, Lt 10
19 SEP

91-07
0.0- 0.5 ORG MAT
0.5- 1.5 Bn SILT, wet
1.5-18.0 Bn Org SILT
Gy below 3.0
w/ visible ice
w/ woody debris 7.0-9.0
SAMPLE 91-1239
(2.0-3.0)
NM 55.2%
SAMPLE 91-1240
(4.0-6.0)
A-4(0), 100%-200
NM 48.9%
18.0-19.0 Gy BEDROCK, soft(Chert)

TH91-08
STA "L2" 53+90, CL
19 SEP

91-08
0.0- 0.5 ORG MAT
0.5- 3.5 Bn Org SILT
wet to 1.5
w/ visible ice 1.5-3.5
w/ woody debris 2.0-3.0
3.5-14.0 Gy BEDROCK, soft(Chert)
SAMPLE 91-1241
(5.0-6.0)
NM 17.4%
w/ hard layer 6.0-7.0

TH91-09
STA "L2" 56+50, CL
19 SEP

91-09
0.0- 0.5 ORG MAT
0.5-13.0 Bn SILT
moist to 3.0
w/ visible ice 5.0-13.0
Gy below 7.5
SAMPLE 91-1242
(2.0-3.0)
NM 22.9%
SAMPLE 91-1243
(6.0-7.0)
NM 32.7%
13.0-15.0 Gy Si Sa GRAVEL
(Colluvium)
15.0-18.0 Gy BEDROCK, soft(Chert)
18.0-19.0 Gy BEDROCK, hard(Chert)

TH91-10
STA "L2" 60+60, CL
19 SEP

91-10
0.0- 0.5 ORG MAT
0.5- 1.0 Bn SILT, wet
1.0- 6.0 Gy SILT
w/ visible ice 1.0-6.0
SAMPLE 91-1244
(2.0-3.0)
NM 87.7%
6.0-17.0 ICE
17.0-18.0 Gy Si Sa GRAVEL
(Colluvium)
18.0-19.0 ICE

TH91-11
STA "L2" 64+00, CL
19 SEP

91-11
0.0- 0.5 ORG MAT
0.5-21.0 Gy SILT
moist to 1.0, wet 1.0-1.5
w/ visible ice 1.5-21.0
21.0-29.0 Gy BEDROCK, soft(Chert)

TH91-12
STA "L2" 66+00, Lt 20
19 SEP

91-12
0.0- 0.5 ORG MAT
0.5-12.0 Gy SILT
wet to 1.0
w/ visible ice 1.0-12.0
SAMPLE 91-1245
(2.0-3.0)
NM 61.4%
SAMPLE 91-1246
(6.0-8.0)
A-4(1), 98%-200
NM 37.2%
LL 29, PI NP
12.0-18.0 ICE
18.0-29.0 Gy SILT
w/ visible ice

Fri, 25/Aug/06 11:09am

40+00 42+00 44+00 46+00 48+00 50+00 52+00 54+00 56+00 58+00 60+00 62+00 64+00 66+00 68+00 70+00

1400 1390 1380 1370 1360 1350 1340 1330 1320 1310

1450 1440 1430 1420 1410 1400 1390 1380 1370 1360

64899	STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
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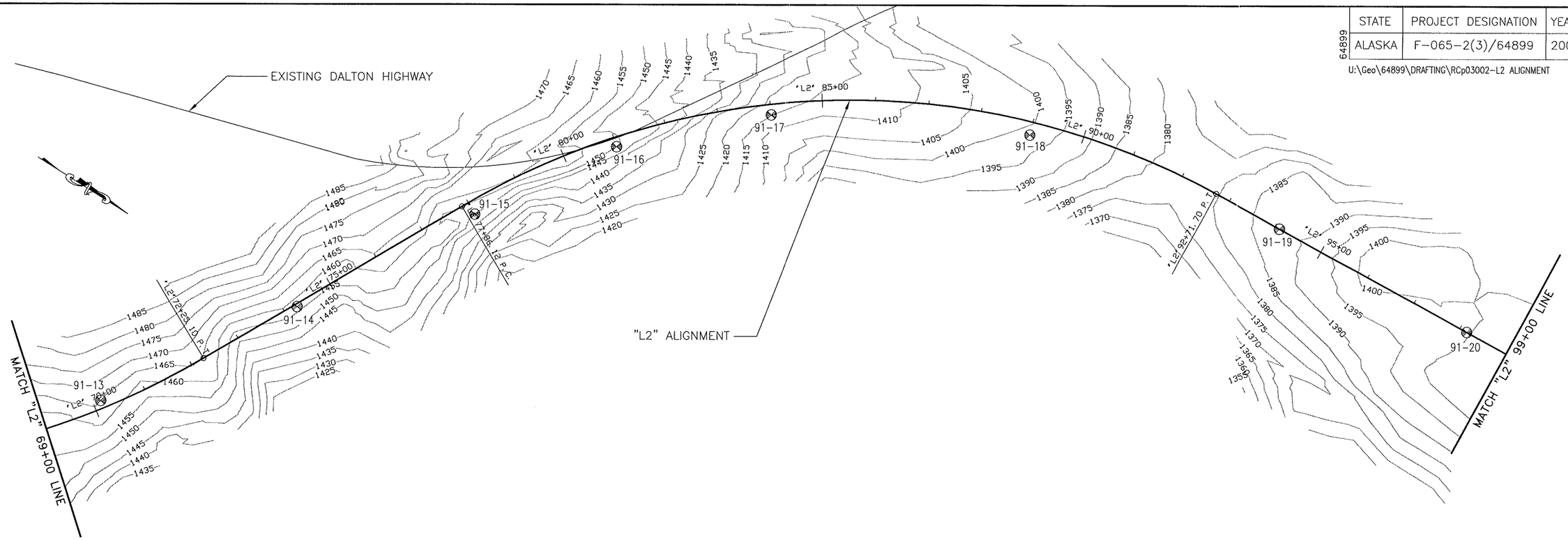

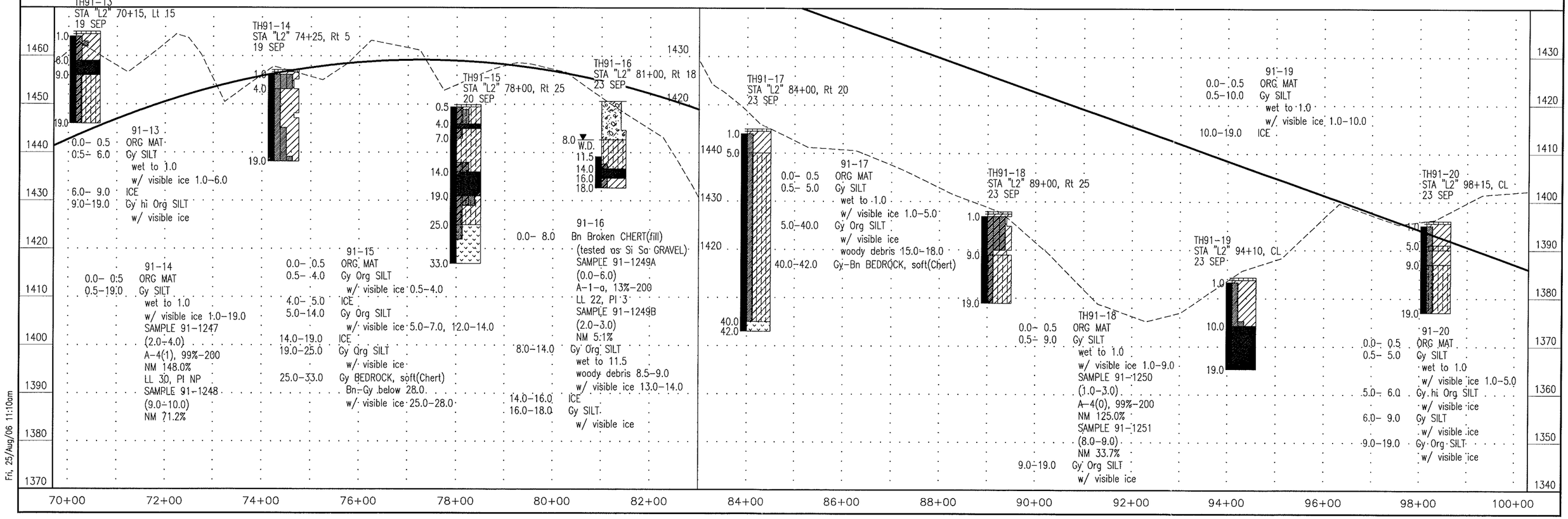

Fri, 25/Aug/06 11:10am

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
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64899

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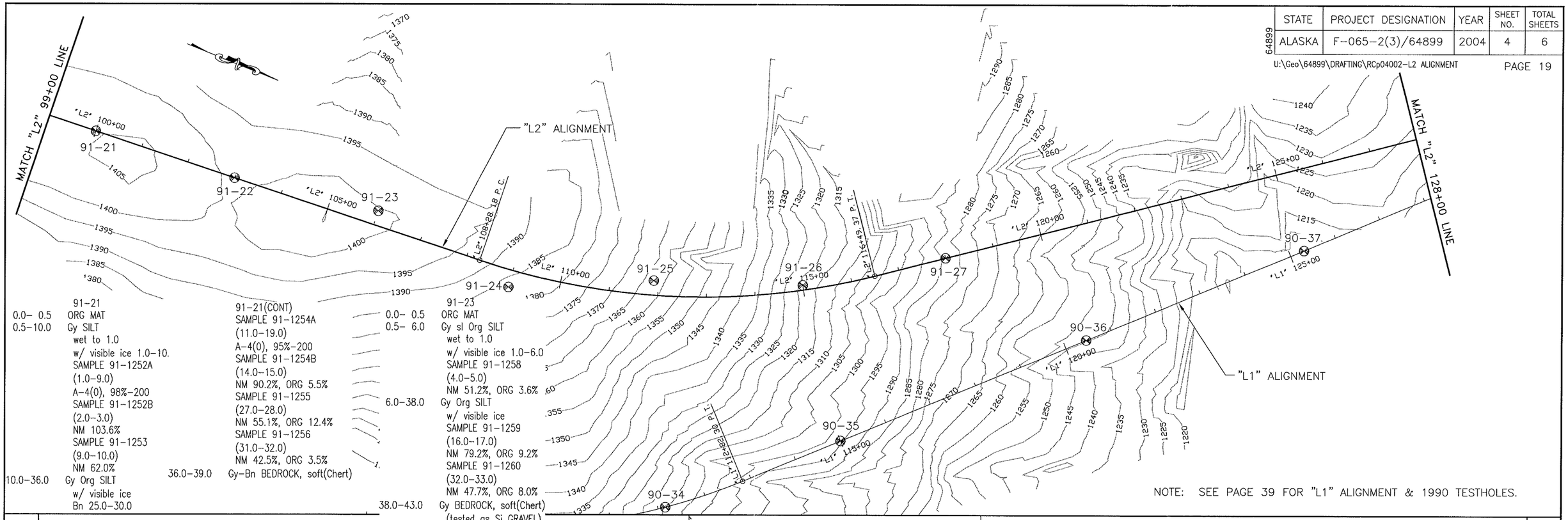
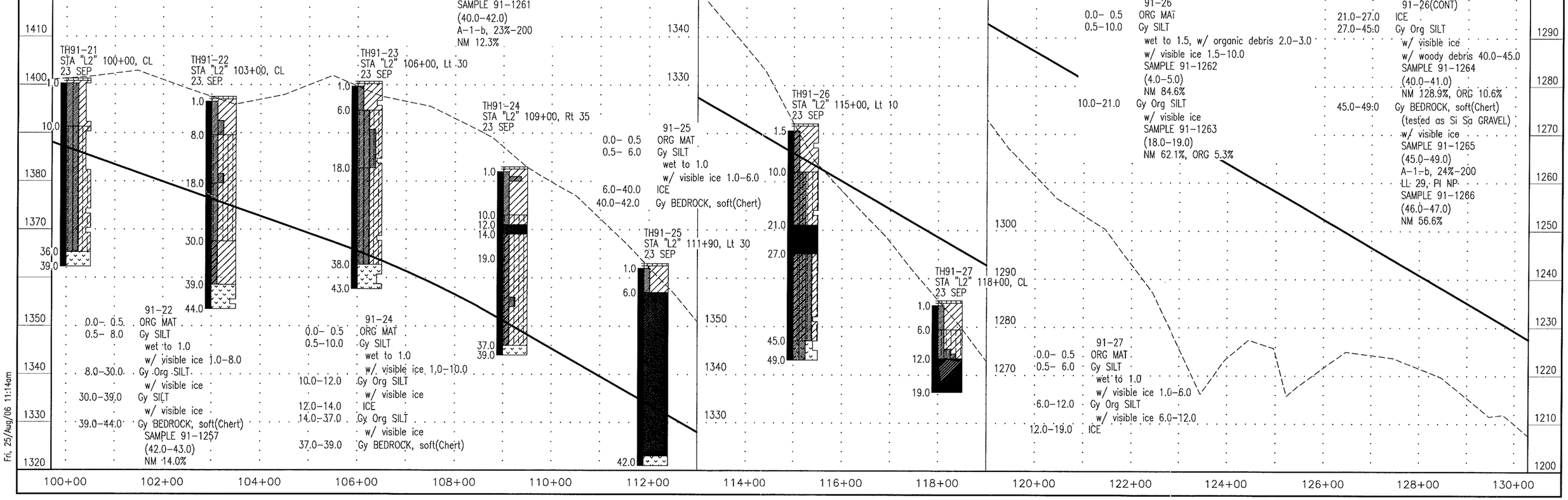


91-21
0.0- 0.5 ORG MAT
0.5-10.0 Gy SILT
wet to 1.0
w/ visible ice 1.0-10.
SAMPLE 91-1252A
(1.0-9.0)
A-4(0), 98%-200
SAMPLE 91-1252B
(2.0-3.0)
NM 103.6%
SAMPLE 91-1253
(9.0-10.0)
NM 62.0%
10.0-36.0 Gy Org SILT
w/ visible ice
Bn 25.0-30.0
36.0-39.0 Gy-Bn BEDROCK, soft(Chert)

91-21(CONT)
SAMPLE 91-1254A
(11.0-19.0)
A-4(0), 95%-200
SAMPLE 91-1254B
(14.0-15.0)
NM 90.2%, ORG 5.5%
SAMPLE 91-1255
(27.0-28.0)
NM 55.1%, ORG 12.4%
SAMPLE 91-1256
(31.0-32.0)
NM 42.5%, ORG 3.5%
38.0-43.0 Gy BEDROCK, soft(Chert)
(tested as Si GRAVEL)
SAMPLE 91-1261
(40.0-42.0)
A-1-b, 23%-200
NM 12.3%

91-23
0.0- 0.5 ORG MAT
0.5- 6.0 Gy sl Org SILT
wet to 1.0
w/ visible ice 1.0-6.0
SAMPLE 91-1258
(4.0-5.0)
NM 51.2%, ORG 3.6%
6.0-38.0 Gy Org SILT
w/ visible ice
SAMPLE 91-1259
(16.0-17.0)
NM 79.2%, ORG 9.2%
SAMPLE 91-1260
(32.0-33.0)
NM 47.7%, ORG 8.0%
Gy BEDROCK, soft(Chert)
(tested as Si GRAVEL)

NOTE: SEE PAGE 39 FOR "L1" ALIGNMENT & 1990 TESTHOLES.



91-22
0.0- 0.5 ORG MAT
0.5- 8.0 Gy SILT
wet to 1.0
w/ visible ice 1.0-8.0
8.0-30.0 Gy Org SILT
w/ visible ice
30.0-39.0 Gy SILT
w/ visible ice
39.0-44.0 Gy BEDROCK, soft(Chert)
SAMPLE 91-1257
(42.0-43.0)
NM 14.0%

91-24
0.0- 0.5 ORG MAT
0.5-10.0 Gy SILT
wet to 1.0
w/ visible ice 1.0-10.0
10.0-12.0 Gy Org SILT
w/ visible ice
12.0-14.0 ICE
14.0-37.0 Gy Org SILT
w/ visible ice
37.0-39.0 Gy BEDROCK, soft(Chert)

91-25
0.0- 0.5 ORG MAT
0.5- 6.0 Gy SILT
wet to 1.0
w/ visible ice 1.0-6.0
6.0-40.0 ICE
40.0-42.0 Gy BEDROCK, soft(Chert)

91-26
0.0- 0.5 ORG MAT
0.5-10.0 Gy SILT
wet to 1.5, w/ organic debris 2.0-3.0
w/ visible ice 1.5-10.0
SAMPLE 91-1262
(4.0-5.0)
NM 84.6%
10.0-21.0 Gy Org SILT
w/ visible ice
SAMPLE 91-1263
(18.0-19.0)
NM 62.1%, ORG 5.3%

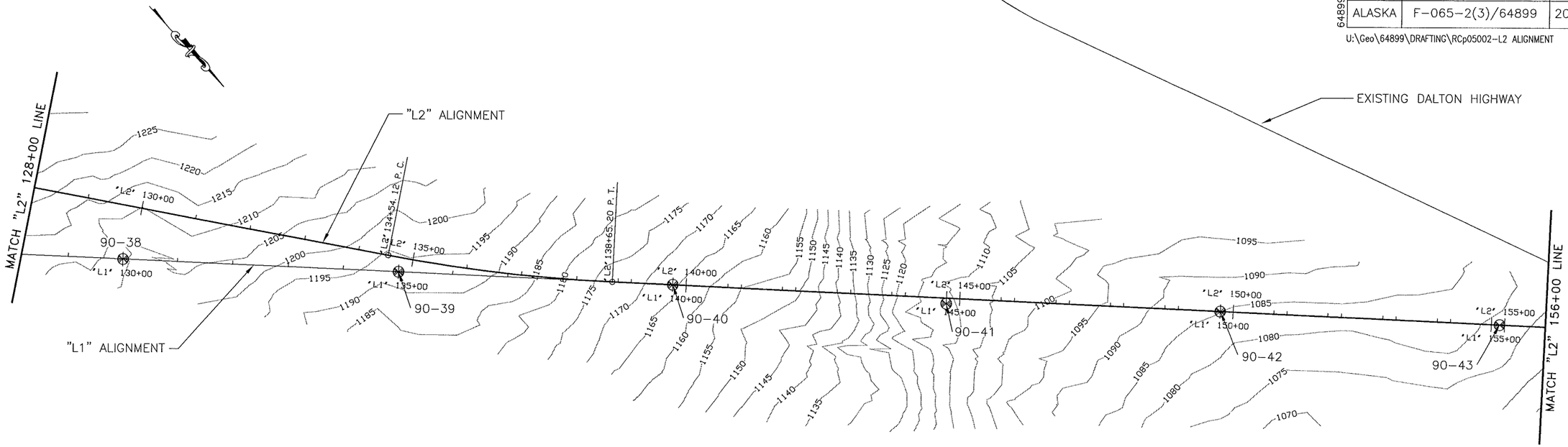
91-26(CONT)
21.0-27.0 ICE
27.0-45.0 Gy Org SILT
w/ visible ice
w/ woody debris 40.0-45.0
SAMPLE 91-1264
(40.0-41.0)
NM 128.9%, ORG 10.6%
45.0-49.0 Gy BEDROCK, soft(Chert)
(tested as Si Sa GRAVEL)
w/ visible ice
SAMPLE 91-1265
(45.0-49.0)
A-1-b, 24%-200
LL: 29, PI NP
SAMPLE 91-1266
(46.0-47.0)
NM 56.6%

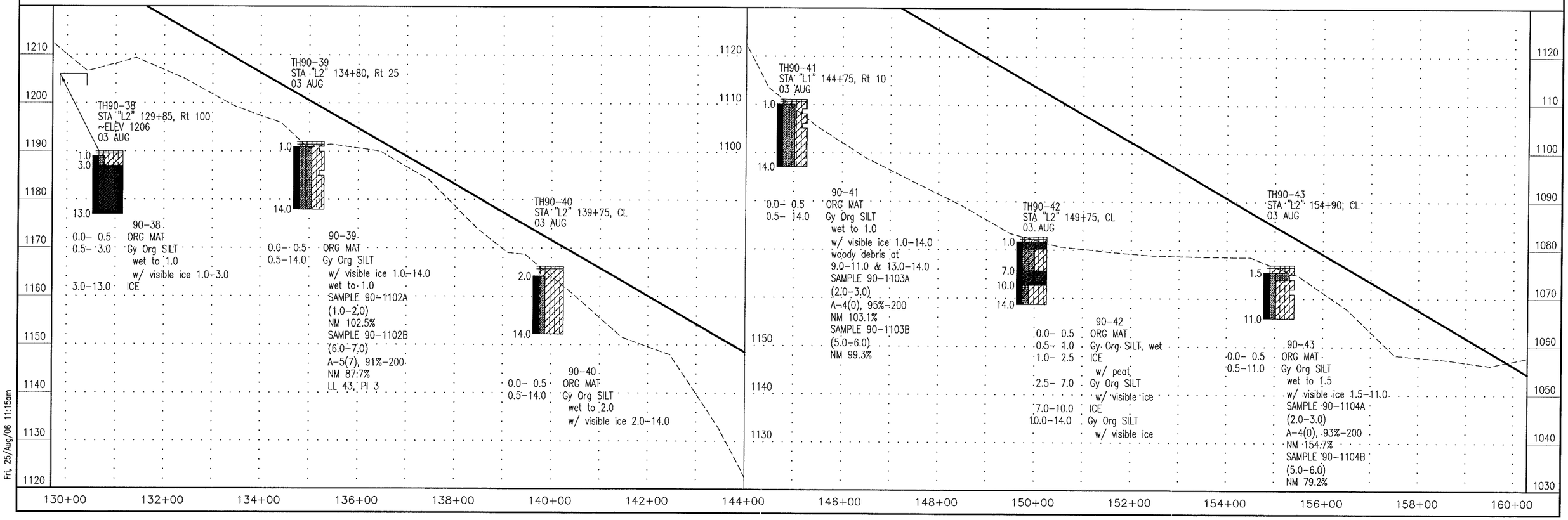
91-27
0.0- 0.5 ORG MAT
0.5- 6.0 Gy SILT
wet to 1.0
w/ visible ice 1.0-6.0
6.0-12.0 Gy Org SILT
w/ visible ice 6.0-12.0
12.0-19.0 ICE

Fri, 25/Aug/06 11:14am

64899	STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
	ALASKA	F-065-2(3)/64899	2005	5	6

U:\Geo\64899\DRAFTING\RCp05002-L2 ALIGNMENT



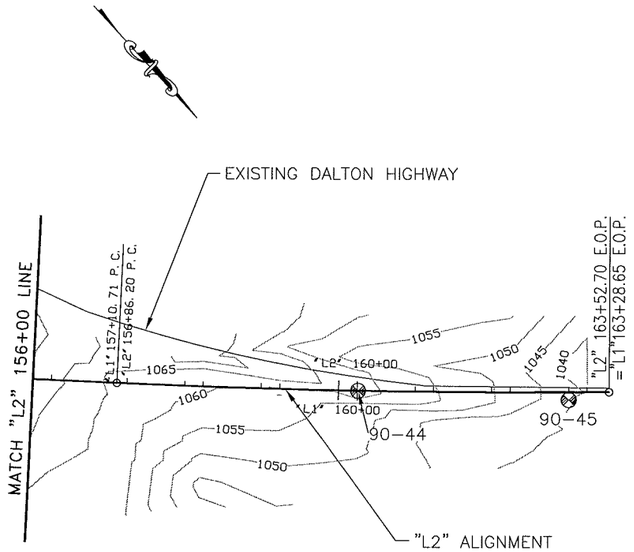


Fri, 25/Aug/06 11:15am

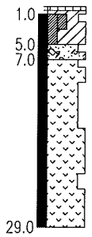
NOTE: SEE PAGE 16 FOR THE PLAN & PROFILE SHEET.

64899	STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
	ALASKA	F-065-2(3)/64899	2004	6	6

U:\Geo\64899\DRAFTING\RCp06002-L2 ALIGNMENT



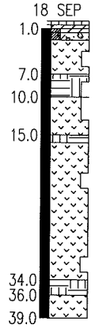
TH91-01
STA "L2" 28+00, Rt 50
~ELEV 1402
18 SEP



91-01

0.0- 0.5 ORG MAT
0.5- 5.0 Gy SILT
wet to 1.0
w/visible ice 1.0-5.0
SAMPLE 91-1221
(1.0-2.0)
NM 95.6%
5.0- 7.0 Bn Si Sa GRAVEL
(colluvium)
SAMPLE 91-1222
(5.0-6.0)
NM 21.6%
7.0-29.0 Gy BEDROCK, soft(Chert)
(tested as Si Sa GRAVEL)
SAMPLE 91-1223
(7.0-8.0)
NM 16.1%
SAMPLE 91-1224A
(10.0-16.0)
A-1-b, 18%-200
LL 21, PI 2
SAMPLE 91-1224B
(10.0-11.0)
NM 18.3%
SAMPLE 91-1224C
(15.0-16.0)
NM 8.6%
SAMPLE 91-1225
(22.0-24.0)
A-1-b, 12%-200
NM 6.2%

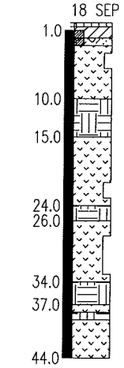
TH91-02
STA "L2" 35+00, Lt 55
~ELEV 1431
18 SEP



91-02

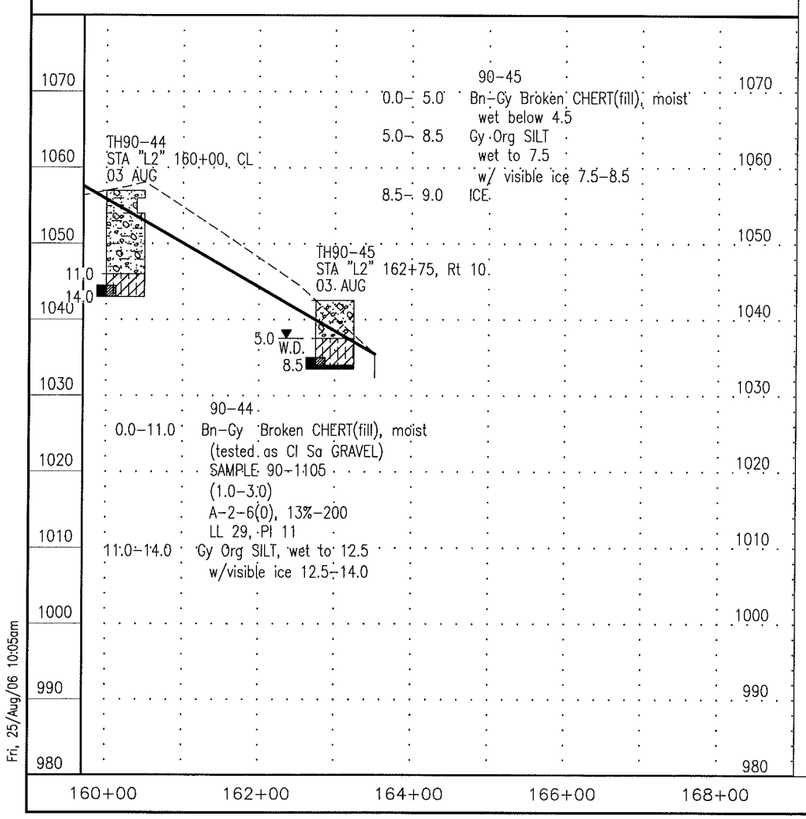
0.0- 0.5 ORG MAT
0.5- 1.5 Gy SILT
wet to 1.0
w/visible ice 1.0-1.5
1.5- 2.5 Gy Si Sa GRAVEL
(Colluvium)
w/visible ice
2.5-39.0 Gy BEDROCK, soft(Chert)
(tested as Si GRAVEL, sl Si Sa GRAVEL,
& Si Gr SAND)
SAMPLE 91-1226
(4.0-6.0)
A-1-a, 13%-200
NM 4.9%
LL 24, PI 4
w/hard layers 7.0-10.0, 34.0-36.0
SAMPLE 91-1227A
(8.0-13.0)
A-1-a, 14%-200
LL 20, PI 2
SAMPLE 91-1227B
(10.0-11.0)
NM 5.1%
SAMPLE 91-1228
(20.0-22.0)
A-1-a, 10%-200
NM 3.9%
SAMPLE 91-1229
(31.0-33.0)
A-1-b, 12%-200
NM 3.8%

TH91-03
STA "L2" 40+00, Rt 40
~ELEV 1410
18 SEP



91-03

0.0- 0.5 ORG MAT
0.5- 2.0 Gy SILT
wet to 1.0
w/visible ice 1.0-2.0
2.0- 3.0 Gy Si Sa GRAVEL
(Colluvium)
w/visible ice
3.0-44.0 Gy BEDROCK, soft(Chert)
(tested as Sa Si GRAVEL, sl Si GRAVEL,
& Si Sa GRAVEL)
w/hard layers 10.0-15.0, 24.0-26.0,
34.0-37.0, 38.0-39.0
SAMPLE 91-1230
(4.0-6.0)
A-2-4, 26%-200
NM 20.4%
SAMPLE 91-1231
(21.0-23.0)
A-1-a, 9%-200
NM 4.1%
LL 20, PI 2
SAMPLE 91-1232A
(28.0-33.0)
A-1-a, 14%-200
SAMPLE 91-1232B
(31.0-32.0)
NM 3.3%



Fri, 25/Aug/06 10:05am

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		90-02	90-03	90-03	90-04	90-04	90-05	90-05
DEPTH (feet)		1.0-3.0	5.0-7.0	10.0-11.0	2.0-3.0	4.0-6.0	6.0-8.0	12.0-13.0
STATION (LOCATION)		"L_2" 13+00	"L_2" 16+00	"L_2" 16+00	"L_2" 17+00	"L_2" 17+00	"L_2" 19+10	"L_2" 19+10
OFFSET (feet)		Rt 20	Rt 45	Rt 45	Lt 40	Lt 40	Lt 12	Lt 12
LAB NO.		90-1077	90-1078	90-1079	90-1080	90-1081	90-1082A	90-1082B
DATE SAMPLED		30-Jul-90	30-Jul-90	30-Jul-90	30-Jul-90	30-Jul-90	30-Jul-90	30-Jul-90
% Passing	**3"**							
	2"		100					
	1.0"	100	99					
Gravel	**0.75"**	98	98			100	100	
	0.5"	91	93			97	99	
	0.375"	83	87			94	98	
	#4	63	66			86	90	
	#10	47	49			54	71	
Sand	**#40**	26	24			24	45	
	#50	23	22			21	41	
	#100	19	17			18	34	
Silt/Clay	**#200**	15	14			15	29	
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		26	NV			22	21	
PLASTIC INDEX		8	NP			3	3	
AASHTO CLASSIFICATION		A-2-4	A-1-a			A-1-b	A-2-4	
SOIL DESCRIPTION		slClSiSaGr	SiSaGr	(SiSaGr)	(SiSaGr)	SiSaGr	SiGrSa	(Bx)
NATURAL MOISTURE			3.5	11.0	10.7	11.3	10.7	12.4
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		(fill)					(Bx)	

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		90-06	91-01	91-01	91-01	91-01	91-01	91-01
DEPTH (feet)		2.0-4.0	1.0-2.0	5.0-6.0	7.0-8.0	10.0-16.0	10.0-11.0	15.0-16.0
STATION (LOCATION)		"L_2" 22+00	"L_2" 28+00	"L_2" 28+00	"L_2" 28+00	"L_2" 28+00	"L_2" 28+00	"L_2" 28+00
OFFSET (feet)		Rt 50	Rt 50	Rt 50	Rt 50	Rt 50	Rt 50	Rt 50
LAB NO.		90-1083	91-1221	91-1222	91-1223	91-1224A	91-1224B	91-1224C
DATE SAMPLED		30-Jul-90	18-Sep-91	18-Sep-91	18-Sep-91	18-Sep-91	18-Sep-91	18-Sep-91
% Passing	**3"**							
	2"							
	1.0"	100						
Gravel	**0.75"**	96						
	0.5"	86				100		
	0.375"	76				99		
	#4	56				91		
	#10	41				48		
Sand	**#40**	23				29		
	#50	21				24		
	#100	17				21		
Silt/Clay	**#200**	13				18		
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		30				21		
PLASTIC INDEX		10				2		
AASHTO CLASSIFICATION		A-2-4				A-1-b		
SOIL DESCRIPTION		slClSiSaGr	(Si)	(SiSaGr)	(Bx)	SiSaGr	(Bx)	(Bx)
NATURAL MOISTURE			95.6	21.6	16.1		18.3	8.6
ORGANICS								
SP.GR. (FINE)						2.64		
SP.GR. (COARSE)						2.74		
MAX DRY DENSITY						140.5		
OPTIMUM MOISTURE						6.7		
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:			w/ ice			(Bx)		

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA – NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

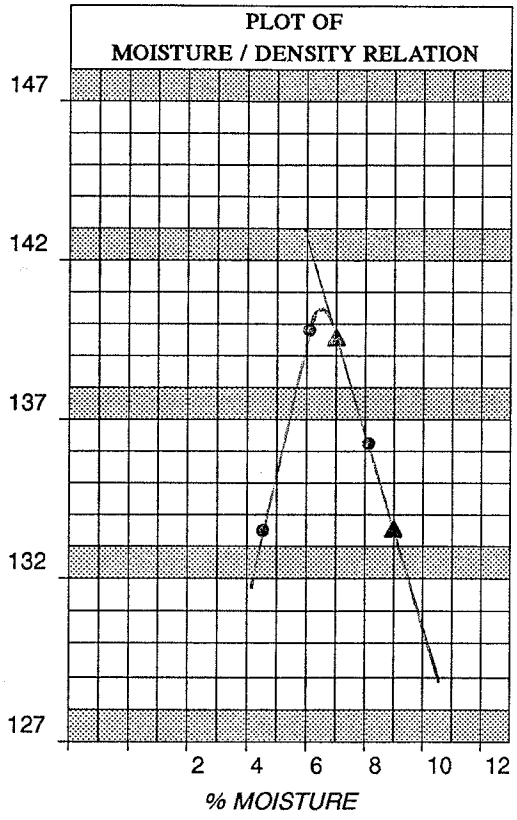
AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY,9 Mile Hill-North
PROJECT #: 64899
LAB #: 91-1224-A
DATE SAMPLED: 9-18-91

TEST HOLE #: 91-1
SOURCE: Centerline
SAMPLED BY: G.Brazo
DEPTH: 10-16
STATION: "L1" 28+00
OFFSET: Rt.50

SIEVE SIZE	% PASS
3"	
2"	
1 1/2"	
1"	
3/4"	
1/2"	100
3/8"	99
#4	91
#8	71
#10	48
#16	
#20	34
#30	
#40	29
#50	24
#60	
#80	22
#100	21
#200	18

TEST	%	
OVERSIZE:		
DELETERIOUS:		
LL	21	
PI	2	
SP GR (APP)		
FINE AGG:	2.64	
COARSE AGG	2.74	
LA:		
DEG:		
		DEPTH
NATURAL MOISTURE:		
% ORGANICS:		



HYDRO	
.002mm	
.005mm	

	COARSE	FINE
Na2SO4 SOUNDNESS:		

T-180D* TEST RESULT	REG. LAB	FIELD LAB
MAX DENSITY	140.5	
OPT MOIST	6.7	
ZAV SP GR	2.65	

* +3/4" MATERIAL REMOVED

ZAV POINT	133.5 @ 9.0 %
ZAV POINT	139.5 @ 7.0 %

AASHTO CLASS: A-1-b
TEXTURAL CLASS: SiSaGr
UNIFIED CLASS:

REMARKS:

MOLD NO.	1	2	3	4	5
DRY UNIT WT	133.5	139.8	136.2		
% MOISTURE	4.5	6.1	8.1		
FREE MOIST					

SIGNATURE: Ted C. Harwood

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		91-01	91-02	91-02	91-02	91-02	91-02	91-03
DEPTH (feet)		22.0-24.0	4.0-6.0	8.0-13.0	10.0-11.0	20.0-22.0	31.0-33.0	4.0-6.0
STATION (LOCATION)		"L_2" 28+00	"L_2" 35+00	"L_2" 35+00	"L_2" 35+00	"L_2" 35+00	"L_2" 35+00	"L_2" 40+00
OFFSET (feet)		Rt 50	Lt 55	Lt 55	Lt 55	Lt 55	Lt 55	Rt 40
LAB NO.		91-1225	91-1226	91-1227A	91-1227B	91-1228	91-1229	91-1230
DATE SAMPLED		18-Sep-91	18-Sep-91	18-Sep-91	18-Sep-91	18-Sep-91	18-Sep-91	18-Sep-91
% Passing	**3"**							
	2"							100
	1.0"		100	100				97
Gravel	**0.75"**		96	99				96
	0.5"	100	75	92		100	100	89
	0.375"	98	61	82		99	99	81
	#4	87	34	52		85	88	64
	#10	55	24	33		49	58	49
Sand	**#40**	21	18	21		20	25	37
	#50	18	17	19		16	21	35
	#100	15	15	17		14	16	30
Silt/Clay	**#200**	12	13	14		10	12	26
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		NV	24	20		NV	NV	NV
PLASTIC INDEX		NP	4	2		NP	NP	NP
AASHTO CLASSIFICATION		A-1-b	A-1-a	A-1-a		A-1-a	A-1-b	A-2-4
SOIL DESCRIPTION		slSiSaGr	SiGr	SiGr	(Bx)	slSiSaGr	slSiGrSa	SaSiGr
NATURAL MOISTURE		6.2	4.9		5.1	3.9	3.8	20.4
ORGANICS								
SP.GR. (FINE)				2.70				
SP.GR. (COARSE)				2.71				
MAX DRY DENSITY				142.0				
OPTIMUM MOISTURE				5.6				
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
		(Bx)	(Bx)	(Bx)		(Bx)	(Bx)	(Bx)

REMARKS:
Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA - NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY,9 Mile Hill-North
PROJECT #: 64899

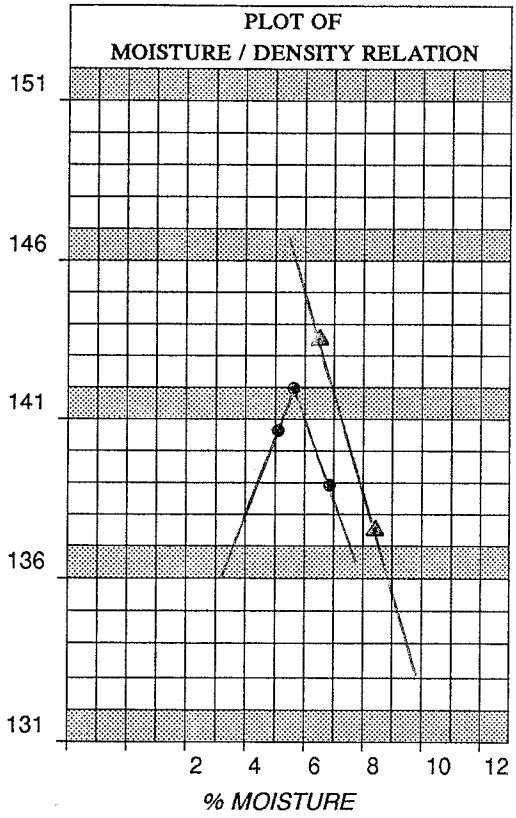
LAB #: 91-1227A
DATE SAMPLED: 9-18-91

TEST HOLE #: 91-2
SOURCE: Centerline
SAMPLED BY: G.Brazo

DEPTH: 8-13
STATION: "L1" 35+00
OFFSET: Lt.55

SIEVE SIZE	% PASS
3"	
2"	
1 1/2"	
1"	100
3/4"	99
1/2"	92
3/8"	82
#4	52
#8	36
#10	33
#16	
#20	25
#30	
#40	21
#50	19
#60	
#80	18
#100	17
#200	14

TEST	%	
OVERSIZE:		
DELETERIOUS:		
LL	20	
PI	2	
SP GR (APP)		
FINE AGG:	2.70	
COARSE AGG	2.71	
LA:		
DEG:		
		DEPTH
NATURAL MOISTURE:		
% ORGANICS:		



HYDRO	
.002mm	
.005mm	

	COARSE	FINE
Na2SO4 SOUNDNESS:		

T-180D* TEST RESULT	REG. LAB	FIELD LAB
MAX DENSITY	142.0	
OPT MOIST	5.6	
ZAV SP GR	2.71	

* +3/4" MATERIAL REMOVED

ZAV POINT	137.5 @ 8.4 %
ZAV POINT	143.5 @ 6.5 %

AASHTO CLASS: A-1-a
TEXTURAL CLASS: SiGr
UNIFIED CLASS:

REMARKS:

MOLD NO.	1	2	3	4	5
DRY UNIT WT	140.7	142.0	138.9		
% MOISTURE	5.1	5.6	6.8		
FREE MOIST					

SIGNATURE:

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		91-03	91-03	91-03	91-04	91-04	91-04	91-05
DEPTH (feet)		21.0-23.0	28.0-33.0	31.0-32.0	10.0-12.0	18.0-24.0	20.0-21.0	6.0-7.0
STATION (LOCATION)		"L_2" 40+00	"L_2" 40+00	"L_2" 40+00	"L_2" 44+85	"L_2" 44+85	"L_2" 44+85	"L_2" 47+50
OFFSET (feet)		Rt 40	Rt 40	Rt 40	Rt 15	Rt 15	Rt 15	Rt 20
LAB NO.		91-1231	91-1232A	91-1232B	91-1233	91-1234A	91-1234B	91-1235
DATE SAMPLED		18-Sep-91	18-Sep-91	18-Sep-91	19-Sep-91	19-Sep-91	19-Sep-91	19-Sep-91
% Passing	**3"**							
	2"							
	1.0"							
Gravel	**0.75"**		100		100	100		
	0.5"	100	99		97	99		
	0.375"	99	96		93	96		
	#4	59	78		70	76		
	#10	22	50		40	48		
Sand	**#40**	13	25		17	21		
	#50	13	23		15	19		
	#100	11	18		12	15		
Silt/Clay	**#200**	9	14		10	13		
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		20	NV		NV	NV		
PLASTIC INDEX		2	NP		NP	NP		
AASHTO CLASSIFICATION		A-1-a	A-1-a		A-1-a	A-1-a		
SOIL DESCRIPTION		slSiGr	SiSaGr	SiSaGr	slSiSaGr	SiSaGr	SiSaGr	(Bx)
NATURAL MOISTURE		4.1		3.3	14.1		3.4	22.6
ORGANICS								
SP.GR. (FINE)			2.70			2.72		
SP.GR. (COARSE)			2.70			2.75		
MAX DRY DENSITY			140.5			142.6		
OPTIMUM MOISTURE			5.6			5.5		
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		(Bx)	(Bx)	(Bx)	(Bx)	(Bx)	(Bx)	

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA - NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY,9 Mile Hill-North
PROJECT #: 64899

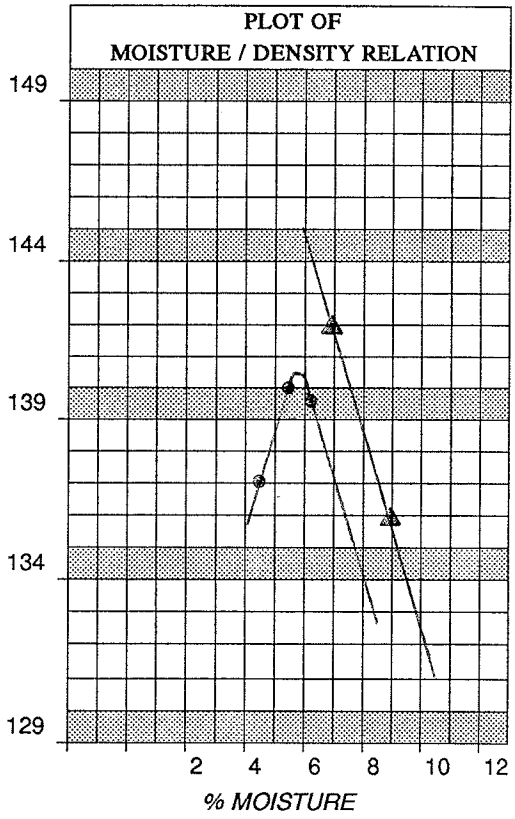
LAB #: 91-1232A
DATE SAMPLED: 9-18-91

TEST HOLE #: 91-3
SOURCE: Centerline
SAMPLED BY: G.Brazo

DEPTH: 28-33
STATION: "L1" 40+00
OFFSET: Rt.40

SIEVE SIZE	% PASS
3"	
2"	
1 1/2"	
1"	
3/4"	100
1/2"	99
3/8"	96
#4	78
#8	55
#10	50
#16	
#20	33
#30	
#40	25
#50	23
#60	
#80	20
#100	18
#200	14

TEST	%	
OVERSIZE: DELETERIOUS:		
LL PI	NV NP	
SP GR (APP) FINE AGG: COARSE AGG	 2.70 2.70	
LA:		
DEG:		
		DEPTH
NATURAL MOISTURE:		
% ORGANICS:		



HYDRO	
.002mm	
.005mm	

	COARSE	FINE
Na2SO4 SOUNDNESS:		

T-180D* TEST RESULT	REG. LAB	FIELD LAB
MAX DENSITY	140.5	
OPT MOIST	5.6	
ZAV SP GR	2.70	

* +3/4" MATERIAL REMOVED

ZAV POINT	135.9 @ 8.9 %
ZAV POINT	141.9 @ 6.9 %

AASHTO CLASS: A-1-a
TEXTURAL CLASS: SiSaGr
UNIFIED CLASS:

REMARKS:

SIGNATURE: T. C. Harwood

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

MOLD NO.	1	2	3	4	5
DRY UNIT WT	137.0	140.0	139.6		
% MOISTURE	4.4	5.3	6.2		
FREE MOIST					

STATE OF ALASKA – NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

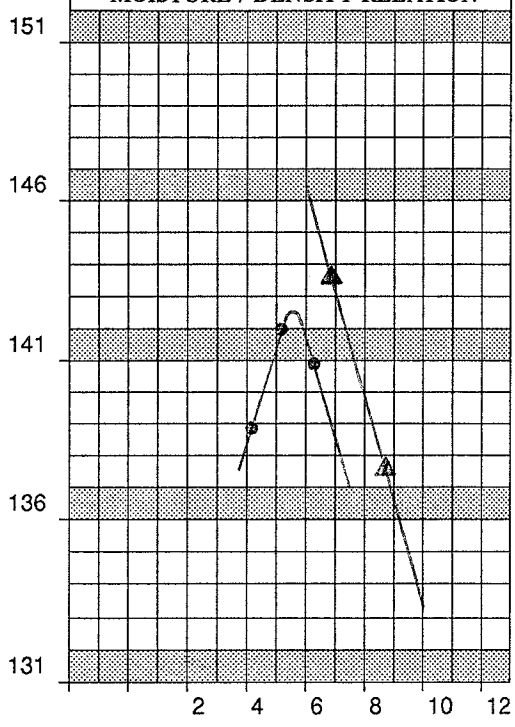
PROJECT: DALTON HIGHWAY,9 Mile Hill-North
PROJECT #: 64899
LAB #: 91-1234A
DATE SAMPLED: 9-19-91

TEST HOLE #: 91-4
SOURCE: Centerline
SAMPLED BY: G.Brazo
DEPTH: 18-24
STATION: "L2" 44+85
OFFSET: Rt.15

SIEVE SIZE	% PASS
3"	
2"	
1 1/2"	
1"	
3/4"	100
1/2"	99
3/8"	96
#4	76
#8	53
#10	48
#16	
#20	29
#30	
#40	21
#50	19
#60	
#80	16
#100	15
#200	13

TEST	%	
OVERSIZE:		
DELETERIOUS:		
LL	NV	
PI	NP	
SP GR (APP)		
FINE AGG:	2.72	
COARSE AGG	2.75	
LA:		
DEG:		
		DEPTH
NATURAL MOISTURE:		
% ORGANICS:		

PLOT OF
MOISTURE / DENSITY RELATION



HYDRO	
.002mm	8
.005mm	5

	COARSE	FINE
Na2SO4 SOUNDNESS:		

T-180D* TEST RESULT	REG. LAB	FIELD LAB
MAX DENSITY	142.6	
OPT MOIST	5.5	
ZAV SP GR	2.73	

* +3/4" MATERIAL REMOVED

ZAV POINT	137.6 @ 8.7 %
ZAV POINT	143.6 @ 6.8 %

AASHTO CLASS: A-1-a
TEXTURAL CLASS: SiSaGr
UNIFIED CLASS:

REMARKS:

MOLD NO.	1	2	3	4	5
DRY UNIT WT	138.8	142.0	140.9		
% MOISTURE	4.2	5.2	6.2		
FREE MOIST					

SIGNATURE: T C Harwood

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		91-05	91-06	91-06	91-07	91-07	91-08	91-09
DEPTH (feet)		11.0-12.0	2.0-3.0	6.0-7.0	2.0-3.0	4.0-6.0	5.0-6.0	2.0-3.0
STATION (LOCATION)		"L_2" 47+50	"L_2" 48+45	"L_2" 48+45	"L_2" 51+50	"L_2" 51+50	"L_2" 53+90	"L_2" 56+50
OFFSET (feet)		Rt 20	Rt 55	Rt 55	Lt 10	Lt 10	Centerline	Centerline
LAB NO.		91-1236	91-1237	91-1238	91-1239	91-1240	91-1241	91-1242
DATE SAMPLED		19-Sep-91	19-Sep-91	19-Sep-91	19-Sep-91	19-Sep-91	19-Sep-91	19-Sep-91
% Passing	**3"**							
	2"							
	1.0"							
Gravel	**0.75"**							
	0.5"							
	0.375"							
	#4							
	#10							
Sand	**#40**							
	#50							
	#100							
Silt/Clay	**#200**					100		
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT						NV		
PLASTIC INDEX						NP		
AASHTO CLASSIFICATION						A-4(0)		
SOIL DESCRIPTION		(Bx)	(Si)	(Bx)	(OrgSi)	Si	(Bx)	(Si)
NATURAL MOISTURE		12.9	131.9	32.0	55.2	48.9	17.4	22.9
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:			w/ ice		w/ ice	(Org) w/ ice		

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		91-09	91-10	91-12	91-12	91-14	91-14	91-16
DEPTH (feet)		6.0-7.0	2.0-3.0	2.0-3.0	6.0-8.0	2.0-4.0	9.0-10.0	0.0-6.0
STATION (LOCATION)		"L_2" 56+50	"L_2" 60+60	"L_2" 66+00	"L_2" 66+00	"L_2" 74+25	"L_2" 74+25	"L_2" 81+00
OFFSET (feet)		Centerline	Centerline	Lt 20	Lt 20	Rt 5	Rt 5	Rt 18
LAB NO.		91-1243	91-1244	91-1245	91-1246	91-1247	91-1248	91-1249A
DATE SAMPLED		19-Sep-91	19-Sep-91	19-Sep-91	19-Sep-91	20-Sep-91	20-Sep-91	23-Sep-91
% Passing	**3"**							
	2"							100
	1.0"							98
Gravel	**0.75"**							96
	0.5"							87
	0.375"							79
	#4							59
	#10					100		41
Sand	**#40**					99		23
	#50				100	99		20
	#100				99	99		16
Silt/Clay	**#200**				98	99		13
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT					29	30		22
PLASTIC INDEX					NP	NP		3
AASHTO CLASSIFICATION					A-4(1)	A-4(1)		A-1-a
SOIL DESCRIPTION		(Si)	(Si)	(Si)	Si	Si	(Si)	SiSaGr
NATURAL MOISTURE		32.7	87.7	61.4	37.2	148.0	71.2	
ORGANICS								
SP.GR. (FINE)								2.69
SP.GR. (COARSE)								2.70
MAX DRY DENSITY								138.7
OPTIMUM MOISTURE								6.4
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:			w/ ice	w/ ice	w/ ice	w/ ice	w/ ice	(fill)

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA – NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY,9 Mile Hill-North
PROJECT #: 64899

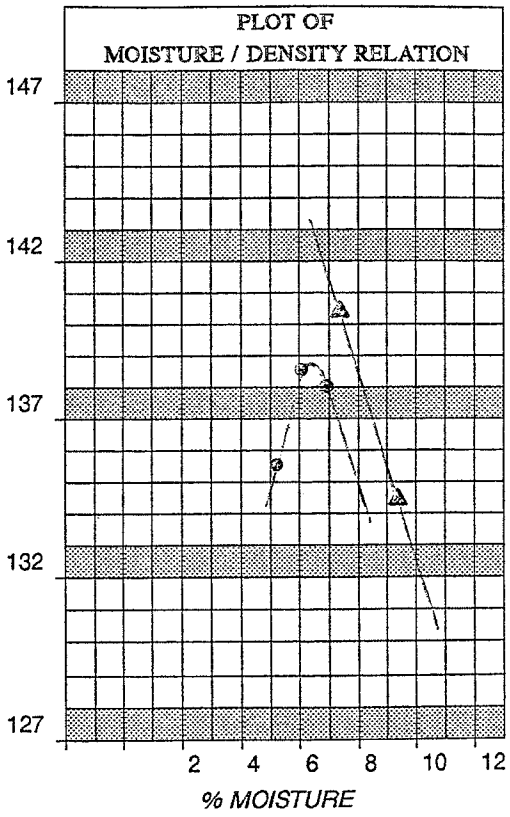
LAB #: 91-1249A
DATE SAMPLED: 9-23-91

TEST HOLE #: 90-16
SOURCE: Centerline
SAMPLED BY: G.Brazo

DEPTH: 0-6
STATION: "L2" 81+00
OFFSET: Rt.20

SIEVE SIZE	% PASS
3"	
2"	100
1 1/2"	99
1"	98
3/4"	96
1/2"	87
3/8"	79
#4	59
#8	44
#10	41
#16	
#20	29
#30	
#40	23
#50	20
#60	
#80	17
#100	16
#200	13

TEST	%	
OVERSIZE: DELETERIOUS:		
LL	22	
PI	3	
SP GR (APP)		
FINE AGG:	2.69	
COARSE AGG	2.70	
LA:		
DEG:		
		DEPTH
NATURAL MOISTURE:		
% ORGANICS:		



HYDRO	
.002mm	
.005mm	

	COARSE	FINE
Na2SO4 SOUNDNESS:		

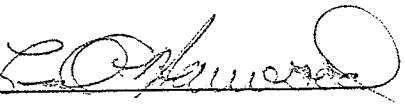
T-180D* TEST RESULT	REG. LAB	FIELD LAB
MAX DENSITY	138.7	
OPT MOIST	6.4	
ZAV SP GR	2.69	

* +3/4" MATERIAL REMOVED

ZAV POINT	134.4 @ 9.3 %
ZAV POINT	140.4 @ 7.3 %

AASHTO CLASS: A-1-a
TEXTURAL CLASS: SiSaGr
UNIFIED CLASS:

REMARKS:

SIGNATURE: 

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

MOLD NO.	1	2	3	4	5
DRY UNIT WT	135.6	138.6	138.0		
% MOISTURE	5.2	6.1	6.9		
FREE MOIST					

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		91-16	91-18	91-18	91-21	91-21	91-21	91-21
DEPTH (feet)		2.0-3.0	1.0-3.0	8.0-9.0	1.0-9.0	2.0-3.0	9.0-10.0	11.0-19.0
STATION (LOCATION)		"L_2" 81+00	"L_2" 89+00	"L_2" 89+00	"L_2" 100+00	"L_2" 100+00	"L_2" 100+00	"L_2" 100+00
OFFSET (feet)		Rt 18	Rt 25	Rt 25	Centerline	Centerline	Centerline	Centerline
LAB NO.		91-1249B	91-1250	91-1251	91-1252A	91-1252B	91-1253	91-1254A
DATE SAMPLED		23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91
% Passing	**3"**							
	2"							
	1.0"							
Gravel	**0.75"**							
	0.5"							
	0.375"							
	#4							
	#10				100			100
Sand	**#40**				99			99
	#50		100		99			98
	#100		99		98			97
Silt/Clay	**#200**		99		98			95
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT			NV		NV			NV
PLASTIC INDEX			NP		NP			NP
AASHTO CLASSIFICATION			A-4(0)		A-4(0)			A-4(0)
SOIL DESCRIPTION		SiSaGr	Si	(Si)	Si	Si	(Si)	OrgSi[1]
NATURAL MOISTURE		5.1	125.0	33.7		103.6	62.0	
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		(fill)	w/ ice	w/ ice	w/ ice	w/ ice	w/ ice	w/ ice

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		91-21	91-21	91-21	91-22	91-23	91-23	91-23
DEPTH (feet)		14.0-15.0	27.0-28.0	31.0-32.0	42.0-43.0	4.0-5.0	16.0-17.0	32.0-33.0
STATION (LOCATION)		"L_2" 100+00	"L_2" 100+00	"L_2" 100+00	"L_2" 103+00	"L_2" 106+00	"L_2" 106+00	"L_2" 106+00
OFFSET (feet)		Centerline	Centerline	Centerline	Centerline	Lt 30	Lt 30	Lt 30
LAB NO.		91-1254B	91-1255	91-1256	91-1257	91-1258	91-1259	91-1260
DATE SAMPLED		23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91
% Passing	**3"**							
	2"							
	1.0"							
Gravel	**0.75"**							
	0.5"							
	0.375"							
	#4							
	#10							
Sand	**#40**							
	#50							
	#100							
Silt/Clay	**#200**							
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT								
PLASTIC INDEX								
AASHTO CLASSIFICATION								
SOIL DESCRIPTION		OrgSi[1]	(OrgSi)	(OrgSi)	(Bx)	(slOrgSi)	(OrgSi)	(OrgSi)
NATURAL MOISTURE		90.2	55.1	42.5	14.0	51.2	79.2	47.7
ORGANICS		5.5	12.4	3.5		3.6	9.2	8.0
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		w/ ice	w/ ice	w/ ice		w/ ice	w/ ice	w/ ice

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

[1] Organic content determination is based on the results of the ATM T-6 test method.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		91-23	91-26	91-26	91-26	91-26	91-26	90-39
DEPTH (feet)		40.0-42.0	4.0-5.0	18.0-19.0	40.0-41.0	45.0-49.0	46.0-47.0	1.0-2.0
STATION (LOCATION)		"L_2" 106+00	"L_2" 115+00	"L_2" 115+00	"L_2" 115+00	"L_2" 115+00	"L_2" 115+00	"L_2" 134+80
OFFSET (feet)		Lt 30	Lt 10	Lt 10	Lt 10	Lt 10	Lt 10	Rt 25
LAB NO.		91-1261	91-1262	91-1263	91-1264	91-1265	91-1266	90-1102A
DATE SAMPLED		23-Sep-91	26-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91	23-Sep-91	3-Aug-90
% Passing	**3"**							
	2"							
	1.0"					100		
Gravel	**0.75"**	100				99		
	0.5"	96				98		
	0.375"	80				94		
	#4	50				81		
	#10	30				60		
Sand	**#40**	24				34		
	#50	24				31		
	#100	23				27		
Silt/Clay	**#200**	23				24		
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		NV				29		
PLASTIC INDEX		NP				NP		
AASHTO CLASSIFICATION		A-1-b				A-1-b		
SOIL DESCRIPTION		SiGr	(Si)	(OrgSi)	(OrgSi)	SiSaGr	SiSaGr	(OrgSi)
NATURAL MOISTURE		12.3	84.6	62.1	128.9		56.6	102.5
ORGANICS				5.3	10.6			
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		(Bx)	w/ ice	w/ ice	w/ ice	(Bx) w/ ice	(Bx) w/ ice	w/ ice

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		90-39	90-41	90-41	90-43	90-43	90-44	
DEPTH (feet)		6.0-7.0	2.0-3.0	5.0-6.0	2.0-3.0	5.0-6.0	1.0-3.0	
STATION (LOCATION)		"L_2" 134+80	"L_2" 144+75	"L_2" 144+75	"L_2" 154+90	"L_2" 154+90	"L1" 160+25	
OFFSET (feet)		Rt 25	Rt 10	Rt 10	Centerline	Centerline	Centerline	
LAB NO.		90-1102B	90-1103A	90-1103B	90-1104A	90-1104B	90-1105	
DATE SAMPLED		3-Aug-90	3-Aug-90	3-Aug-90	3-Aug-90	3-Aug-90	3-Aug-90	
% Passing	**3"**							
	2"						100	
	1.0"						99	
Gravel	**0.75"**						94	
	0.5"						81	
	0.375"						70	
	#4						51	
	#10	100	100		100		35	
Sand	**#40**	97	98		99		20	
	#50	95	98		98		18	
	#100	93	96		95		15	
Silt/Clay	**#200**	91	95		93		13	
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		43	NV		NV		29	
PLASTIC INDEX		3	NP		NP		11	
AASHTO CLASSIFICATION		A-5(7)	A-4(0)		A-4(0)		A-2-6(0)	
SOIL DESCRIPTION		Si	Si	(OrgSi)	Si	(OrgSi)	ClSaGr	
NATURAL MOISTURE		87.7	103.1	99.3	154.7	79.2		
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		(Org) w/ ice	(Org) w/ ice	w/ ice	(Org) w/ ice	w/ ice	(fill)	

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	F-065-2(3)/64899	2005	1	3

64899

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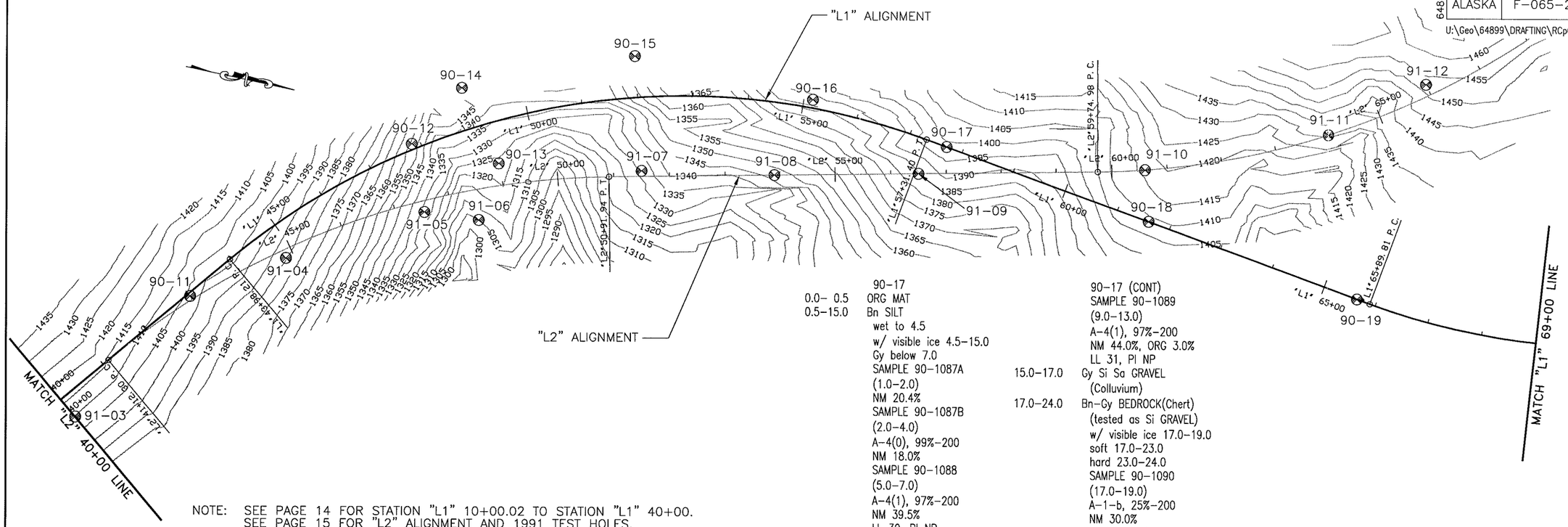


NOTE: SEE PAGE 14 FOR STATION "L1" 10+00.02 TO STATION "L1" 40+00.
SEE PAGE 15 FOR "L2" ALIGNMENT AND 1991 TEST HOLES.

90-17

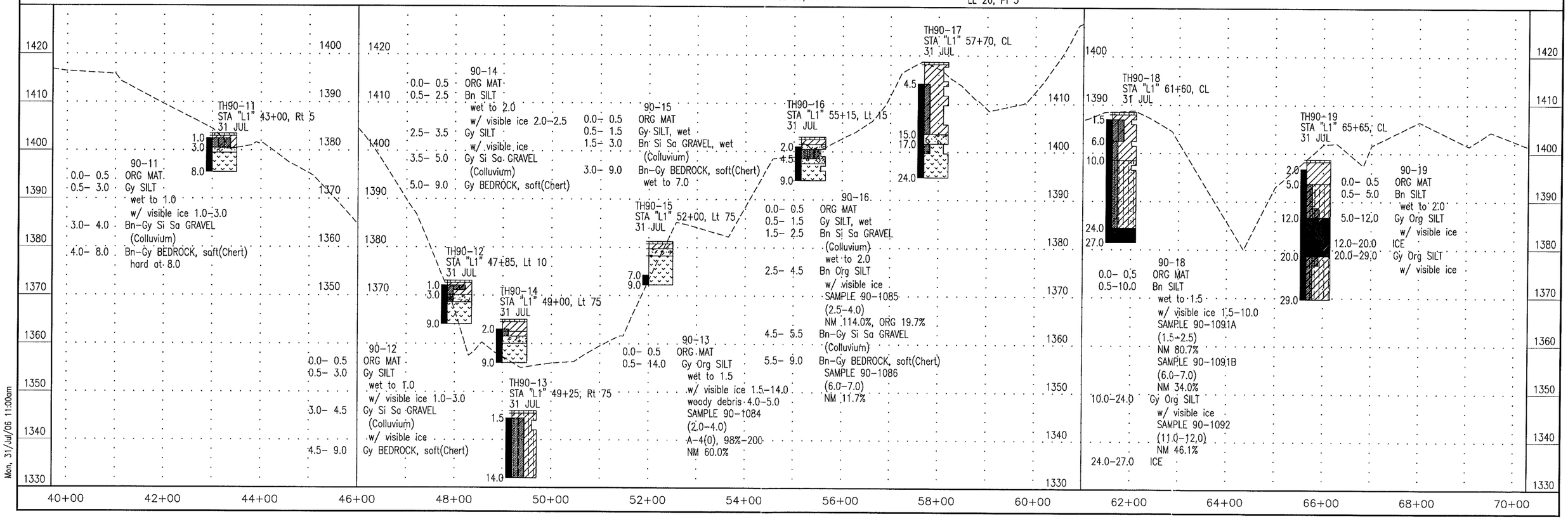
0.0- 0.5 ORG MAT
0.5-15.0 Bn SILT
wet to 4.5
w/ visible ice 4.5-15.0
Gy below 7.0
SAMPLE 90-1087A
(1.0-2.0)
NM 20.4%
SAMPLE 90-1087B
(2.0-4.0)
A-4(0), 99%-200
NM 18.0%
SAMPLE 90-1088
(5.0-7.0)
A-4(1), 97%-200
NM 39.5%
LL 30, PI NP

90-17 (CONT)

SAMPLE 90-1089
(9.0-13.0)
A-4(1), 97%-200
NM 44.0%, ORG 3.0%
LL 31, PI NP

15.0-17.0 Gy Si Sa GRAVEL
(Colluvium)

17.0-24.0 Bn-Gy BEDROCK(Chert)
(tested as Si GRAVEL)
w/ visible ice 17.0-19.0
soft 17.0-23.0
hard 23.0-24.0
SAMPLE 90-1090
(17.0-19.0)
A-1-b, 25%-200
NM 30.0%
LL 26, PI 3



Mon, 31/Jul/06 11:00am

64899	STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
	ALASKA	F-065-2(3)/64899	2005	2	3

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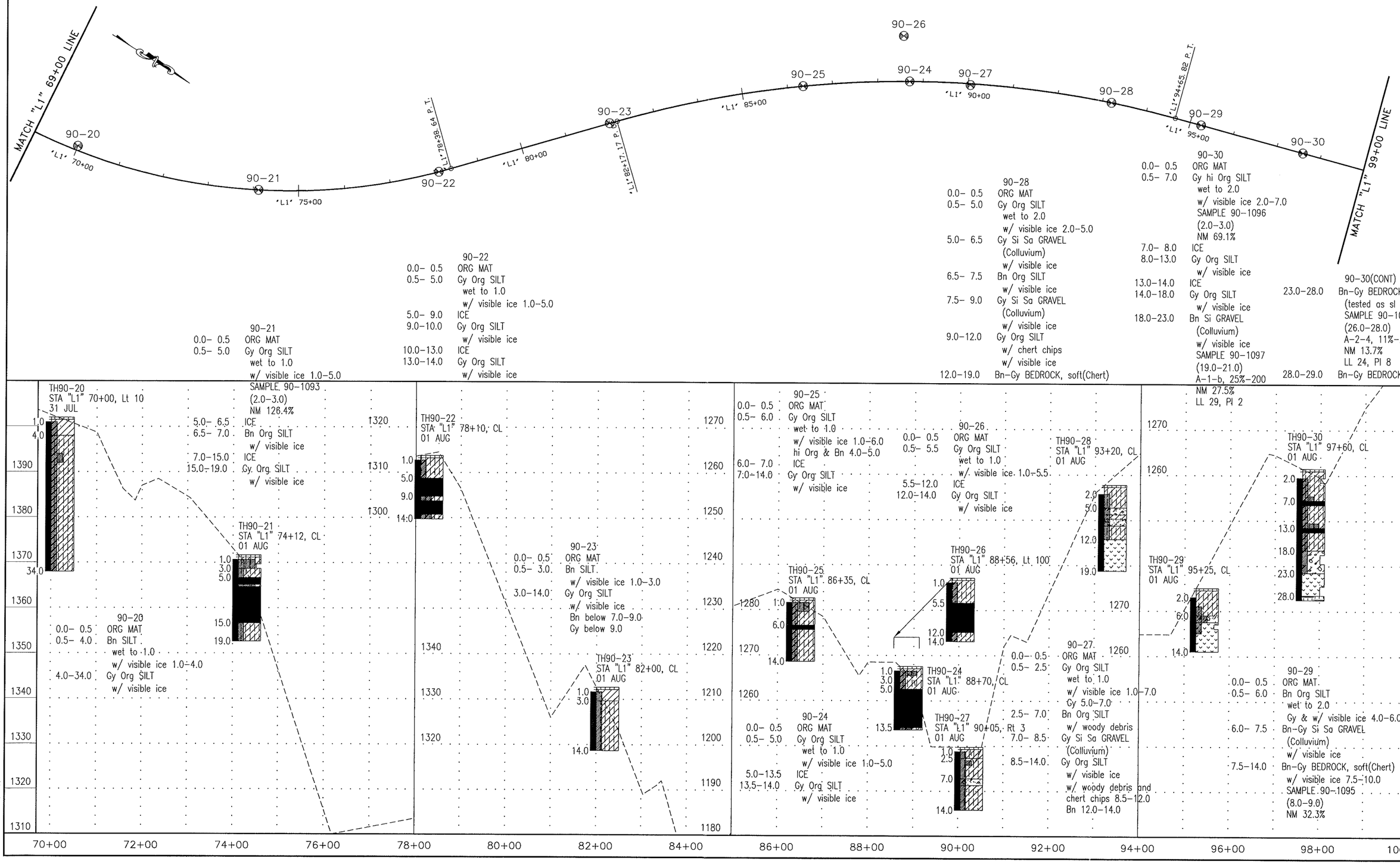

Wed, 13/Sep/06 08:43am

64899	STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
	ALASKA	F-065-2(3)/64899	2005	3	3

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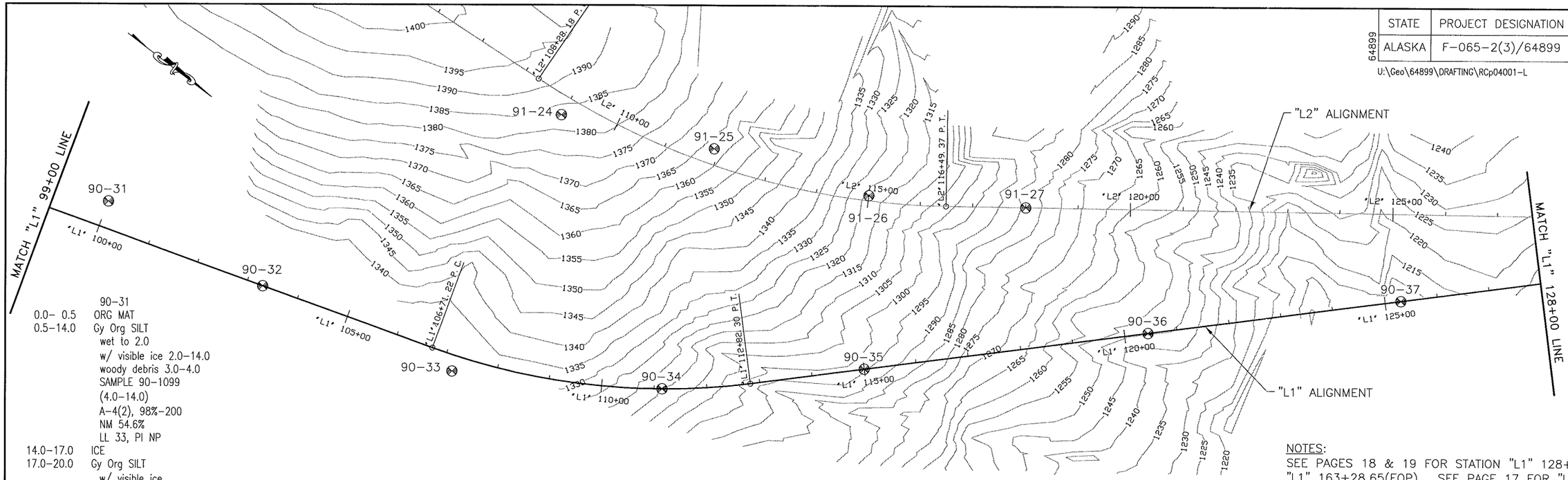
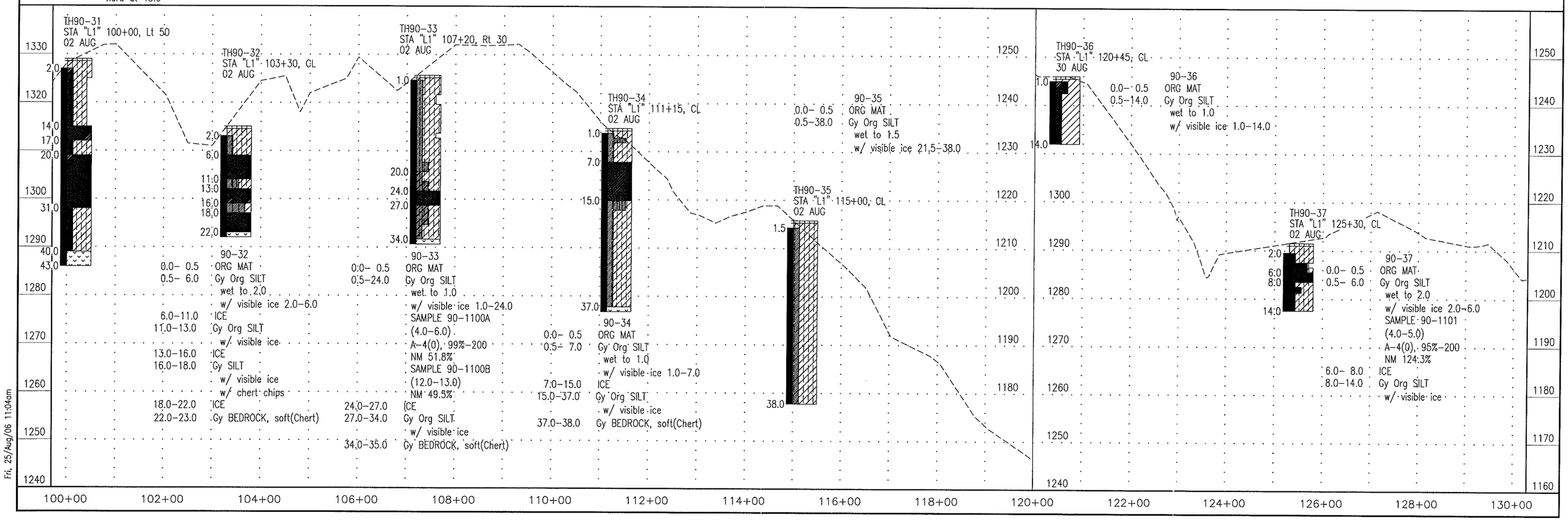


90-31
0.0- 0.5 ORG MAT
0.5-14.0 Gy Org SILT
wet to 2.0
w/ visible ice 2.0-14.0
woody debris 3.0-4.0
SAMPLE 90-1099
(4.0-14.0)
A-4(2), 98%-200
NM 54.6%
LL 33, PI NP
14.0-17.0 ICE
17.0-20.0 Gy Org SILT
w/ visible ice
20.0-31.0 ICE
31.0-40.0 Gy Org SILT
w/ visible ice
40.0-43.0 Gy BEDROCK, soft(Chert)
hard at 43.0

NOTES:
SEE PAGES 18 & 19 FOR STATION "L1" 128+00 TO STATION "L1" 163+28.65(EOP). SEE PAGE 17 FOR "L2" ALIGNMENT AND 1991 TEST HOLES.



Fri, 25/Aug/06 11:04am

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		90-13	90-16	90-16	90-17	90-17	90-17	90-17
DEPTH (feet)		2.0-4.0	2.5-4.0	6.0-7.0	1.0-2.0	2.0-4.0	5.0-7.0	9.0-13.0
STATION (LOCATION)		"L_1" 49+25	"L_1" 55+15	"L_1" 55+15	"L_1" 57+70	"L_1" 57+70	"L_1" 57+70	"L_1" 57+70
OFFSET (feet)		Rt 75	Lt 15	Lt 15	Centerline	Centerline	Centerline	Centerline
LAB NO.		90-1084	90-1085	90-1086	90-1087A	90-1087B	90-1088	90-1089
DATE SAMPLED		31-Jul-90	31-Jul-90	31-Jul-90	31-Jul-90	31-Jul-90	31-Jul-90	31-Jul-90
% Passing	**3"**							
	2"							
	1.0"							
Gravel	**0.75"**							
	0.5"							
	0.375"							
	#4							
	#10							
Sand	**#40**	100					100	100
	#50	99				100	99	99
	#100	99				99	98	98
Silt/Clay	**#200**	98				99	97	97
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		NV				NV	30	31
PLASTIC INDEX		NP				NP	NP	NP
AASHTO CLASSIFICATION		A-4(0)				A-4(0)	A-4(1)	A-4(1)
SOIL DESCRIPTION		Si	(OrgSi)	(Bx)	(Si)	Si	Si	Si
NATURAL MOISTURE		60.0	114.0	11.7	20.4	18.0	39.5	44.0
ORGANICS			19.7					3.0
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		w/ ice	w/ ice				w/ ice	w/ ice

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		90-17	90-18	90-18	90-18	90-21	90-29	90-30
DEPTH (feet)		17.0-19.0	1.5-2.5	6.0-7.0	11.0-12.0	2.0-3.0	8.0-9.0	2.0-3.0
STATION (LOCATION)		"L_1" 57+70	"L_1" 61+60	"L_1" 61+60	"L_1" 61+60	"L_1" 74+12	"L_1" 95+25	"L_1" 97+60
OFFSET (feet)		Centerline	Centerline	Centerline	Centerline	Centerline	Centerline	Centerline
LAB NO.		90-1090	90-1091A	90-1091B	90-1092	90-1093	90-1095	90-1096
DATE SAMPLED		31-Jul-90	31-Jul-90	31-Jul-90	31-Jul-90	1-Aug-90	1-Aug-90	1-Aug-90
% Passing	**3"**							
	2"							
	1.0"	100						
Gravel	**0.75"**	98						
	0.5"	87						
	0.375"	77						
	#4	57						
	#10	42						
Sand	**#40**	30						
	#50	29						
	#100	27						
Silt/Clay	**#200**	25						
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		26						
PLASTIC INDEX		3						
AASHTO CLASSIFICATION		A-1-b						
SOIL DESCRIPTION		SiGr	(Si)	(Si)	(OrgSi)	(OrgSi)	(Bx)	(hiOrgSi)
NATURAL MOISTURE		30.0	80.7	34.0	46.1	126.4	32.3	69.1
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		(Bx) w/ ice	w/ ice	w/ ice	w/ ice	w/ ice	w/ ice	w/ ice

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: Centerline

TEST HOLE NO.		90-30	90-30	90-31	90-33	90-33	90-37	
DEPTH (feet)		19.0-21.0	26.0-28.0	4.0-14.0	4.0-6.0	12.0-13.0	4.0-5.0	
STATION (LOCATION)		"L_1" 97+60	"L_1" 97+60	"L_1" 100+00	"L_1" 107+20	"L_1" 107+20	"L_1" 125+30	
OFFSET (feet)		Centerline	Centerline	Lt 50	Rt 30	Rt 30	Centerline	
LAB NO.		90-1097	90-1098	90-1099	90-1100A	90-1100B	90-1101	
DATE SAMPLED		1-Aug-90	1-Aug-90	2-Aug-90	2-Aug-90	2-Aug-90	2-Aug-90	
% Passing	**3"**							
	2"							
	1.0"	100	100					
Gravel	**0.75"**	99	99					
	0.5"	92	92					
	0.375"	83	82					
	#4	60	51					
	#10	40	29	100			100	
Sand	**#40**	31	16	99			98	
	#50	29	15	99	100		97	
	#100	26	14	98	99		96	
Silt/Clay	**#200**	25	11	98	99		95	
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		29	24	33	NV		NV	
PLASTIC INDEX		2	8	NP	NP		NP	
AASHTO CLASSIFICATION		A-1-b	A-2-4	A-4(2)	A-4(0)		A-4(0)	
SOIL DESCRIPTION		SiGr	slClGr	Si	Si	(OrgSi)	Si	
NATURAL MOISTURE		27.5	13.7	54.6	51.8	49.5	124.3	
ORGANICS								
SP.GR. (FINE)				2.64				
SP.GR. (COARSE)								
MAX DRY DENSITY				103.5				
OPTIMUM MOISTURE				17.0				
L.A. ABRASION								
DEGRADATION FACTOR								
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		w/ ice	(Bx)	(Org) w/ ice	(Org) w/ ice	w/ ice	(Org) w/ ice	

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA – NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY, 9 MILE HILL-NORTH
PROJECT #: F-065-2(3)/64899

LAB #: 90-1099
DATE SAMPLED 8-2-90

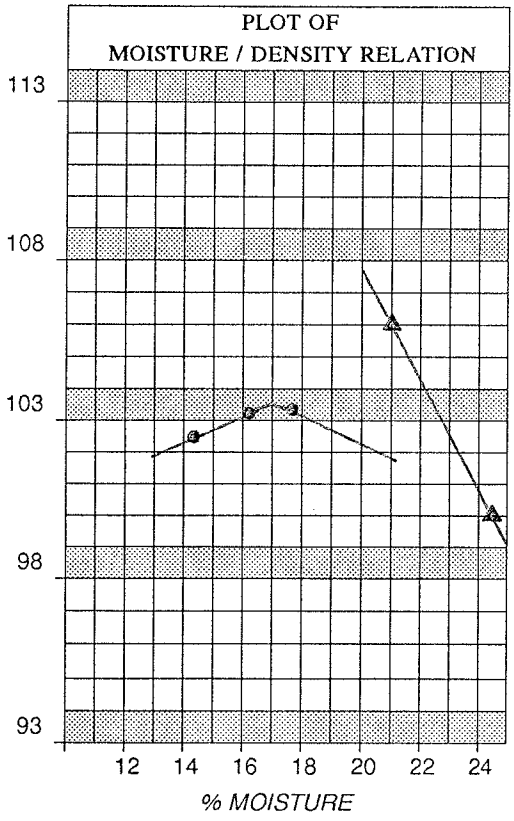
TEST HOLE #: 90-31
SOURCE: Centerline
SAMPLED BY: G.Brazo

DEPTH: 4-14
STATION: L 100+00
OFFSET: Lt.50

SIEVE SIZE	% PASS
3"	
2"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	
#8	
#10	
#16	
#20	
#30	100
#40	99
#50	99
#60	
#80	98
#100	98
#200	98

TEST	%	
OVERSIZE: DELETERIOUS:		
LL PI	33 NP	
SP GR (APP) FINE AGG: COARSE AGG	2.64	
LA:		
DEG:		
		DEPTH
NATURAL MOISTURE:	54.6	4-5
% ORGANICS:		

PLOT OF
MOISTURE / DENSITY RELATION



HYDRO	
.002mm	
.005mm	

	COARSE	FINE
Na2SO4		
SOUNDNESS:		

T-180D* TEST RESULT	REG. LAB
MAX DENSITY	103.5
OPT MOIST	17.0
ZAV SP GR	2.64

* +3/4" MATERIAL REMOVED

REMARKS:

AASHTO CLASS:	A-4 (2)
TEXTURAL CLASS:	Si
UNIFIED CLASS:	

ZAV POINT	100.0 @ 24.5 %
ZAV POINT	106.0 @ 21.0 %

SIGNATURE: Ted C. Harwood

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

MOLD NO.	1	2	3	4	5
DRY UNIT WT	102.5	103.2	103.3		
% MOISTURE	14.3	16.2	17.7		
FREE MOIST					

Material sites

The Materials Source information included in this section is for the purpose of assisting in the project design process. It does not signify that the sources are available or suitable for use during the construction of any current or future project. This Geotechnical Report does not determine source availability or suitability for any construction project; it only provides information that can be used to make that determination during the project design process. Sources available or suitable for use for a construction project will be specified in the appropriate section of the Plans and Specifications of the Contract Documents for the construction project.

MS 65-3-012-2 (OMS 71-1HR)

Location and access

This site is located on a hilltop approximately a quarter mile east of Mile 7.5 on the existing Dalton Highway. Access is by an approximately 0.5 mile-long road that leaves the highway past MP 8. The surrounding boreal spruce forest and the elevation of the hilltop above the highway generally screen this site from the highway.

Description

The material in this site is a steeply-dipping, highly-fractured chert interlayered with thin seams of gray-white limestone. The color of the chert varies among brown, purple, gray, and black. The drill rates from the 1990 geotechnical investigation indicated the bedrock is generally soft (greater than 1 ft of penetration per minute) with hard layers (less than 1 ft of penetration per minute). We recorded auger refusal at depths of 5.0 ft to 31.0 ft beneath the pit floor. A 2006 geotechnical investigation (Staff, in progress) indicated that the chert bedrock is moderately to completely weathered, as per the Alaska Geotechnical Procedures Manual. Seismic data indicate the bedrock may require blasting for removal (see Appendix B for seismic information).

This site was used for construction of the Dalton Highway and the Trans-Alaska Pipeline, and is currently used for maintenance purposes by both Alaska DOT&PF and Alyeska.

The permitted area covers 114.3 acres, and the existing worked area is approximately 1300 ft by 900 ft. The depth of the excavations is approximately 10-ft deep with back slopes of 2H:1V.

Land status

The Alaska DOT&PF holds a Negotiated Material Sale Contract, No. ADL 413799, from the Alaska Department of Natural Resources for this site. This contract expires on August 31, 2014, with 100,000 cu yd permitted for removal.

Clearing and stripping

The existing mined area has scattered 4- to 6-ft tall alder shrubs and birch trees with scattered grass tufts growing on it. Waste berms on the periphery of excavation support 6- to 10-ft high willow shrubs, spruce and aspen saplings, and grass. The uncleared areas of the site support 2- to 6-in. diameter black spruce trees on 2- to 15-ft centers and birch with Labrador tea and moss ground cover.

The overburden has been stripped from the excavation and the thickness of overburden beneath the spruce trees is unknown.

Water table

We intercepted a water table at 30 ft beneath the pit floor in TH 90-7 located in the eastern portion of the excavation.

Frozen conditions

We did not intercept frozen bedrock in the test holes drilled in the site in August 1990. However, frozen conditions in the uncleared parts of the site are unknown, and as previously stated, frozen ground should be anticipated at any time of year in all areas of the material site.

Quality of materials

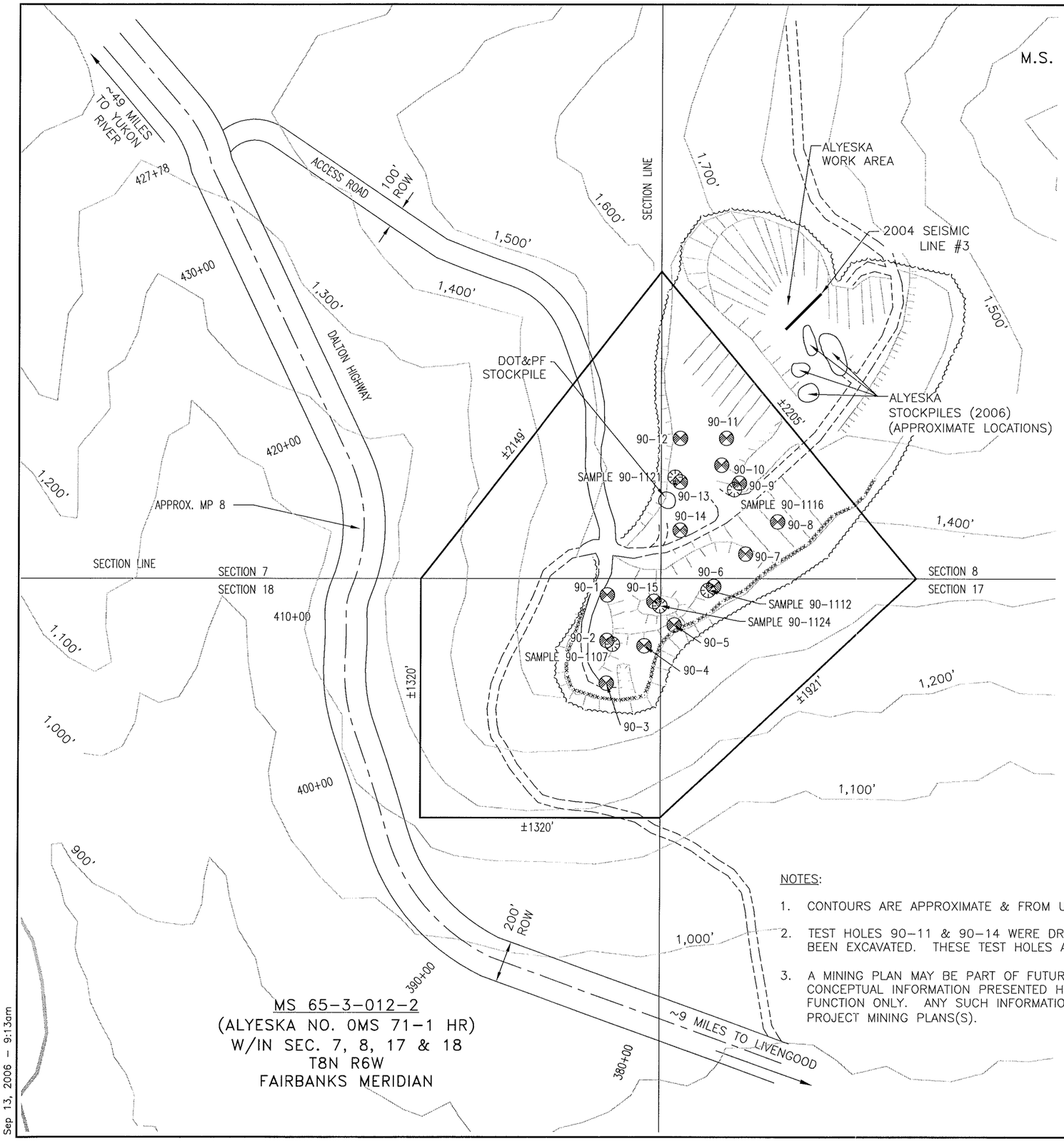
Table 5 contains a summary of the laboratory testing results of the bedrock from MS 65-3-012-2. The data summarized include: percent passing the No. 200 sieve (% -200), liquid limit, plastic index, optimum moisture, moisture content, LA Abrasion values, and Degradation values. See the seven column sheets for other laboratory results not included here.

Table 5: Summary of laboratory testing data for MS 65-3-012-2. Numbers in parentheses indicate the number of tests performed.

Material Type	% -200	Liquid Limit	Plastic Index	Optimum moisture (%)	Moisture content (%)	LA Abrasion	Degradation
Soft Chert Bx	5 – 24 (16)	NV – 33 (16)	NP – 13 (16)	3.9 – 7.4 (3)	1.2 – 8.0 (16)	30 – 39 (5)	23 – 84 (5)

Comments and recommendations

1) Results from laboratory testing indicate that some of the bedrock from this site can be used to produce Selected Material, Type C Modified (see General Recommendation #23).
2) Degradation test results indicate that some the material from this site does not meet the Standard Specifications for use as crushed aggregates or subbase. Additionally, based on the gradation results included in the seven column sheets, expect a high reject rate due to the small percentage of plus 3/8-in. particles.
3) The laboratory test results indicate that the moisture content of some of the chert bedrock found in the site was greater than its optimum moisture. Additionally, the moisture/density curves from material tested exhibited narrow peaks, indicating that the material is sensitive to moisture content. These results suggest that complicated processing and handling techniques and procedures may be necessary in order to meet standard compaction specifications.
4) The highly fractured nature of the chert bedrock in this site may preclude its use for air convection embankment material.
5) Drilling and blasting may be required to extract bedrock from this site.

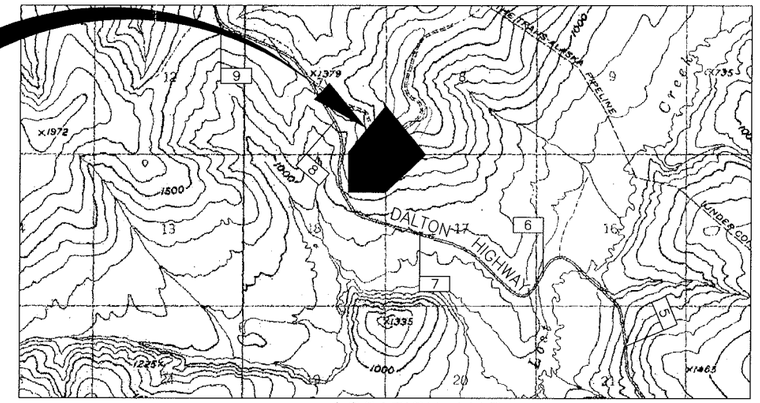


MS 65-3-012-2
(ALYESKA NO. 0MS 71-1 HR)
W/IN SEC. 7, 8, 17 & 18
T8N R6W
FAIRBANKS MERIDIAN

M.S. 65-3-012-2

PROTRACTED SECTIONS 7,8,17&18 T8N, R6W, F.M.

0 300' 600'



LOCATION MAP
TAKEN FROM USGS QUADRANGLE LIVENGOOD C-4

TH 90-01
06 AUG

9.0

90-01
0.0- 8.0 Bn-Gy BEDROCK, soft(Chert), dry
(tested as sl Cl Si Sa GRAVEL)
SAMPLE 90-1106
(1.0-3.0)
A-1-b, 24%-200
LL 22, PI 5
8.0- 9.0 Bn-Gy BEDROCK, hard(Chert), dry
REFUSAL

TH 90-02
06 AUG

34.0

90-02
0.0- 34.0 Bn-Gy BEDROCK
soft(Chert)
(tested as Sa GRAVEL)
SAMPLE 90-1108
(6.0-8.0)
A-1-a, 5%-200
NM 1.3%
SAMPLE 90-1109
(9.0-16.0)
A-1-a, 5%-200
NM 1.2%

TH 90-04
06 AUG

7.5
10.0
12.0
14.0

90-04
0.0- 7.5 Bn-Gy BEDROCK, soft(Chert), dry
(tested as sl Si Sa GRAVEL)
SAMPLE 90-1110
(5.0-7.0)
A-1-a, 12%-200
NM 5.3%
LL 22, PI NP
7.5-10.0 Bn-Gy BEDROCK, hard(Chert), dry
10.0-12.0 Bn-Gy BEDROCK, soft(Chert), dry
(tested as sl Cl Si Sa GRAVEL)
SAMPLE 90-1111
(10.0-12.0)
A-2-4, 18%-200
NM 3.8%
LL 27, PI 8
12.0-14.0 Bn-Gy BEDROCK, hard(Chert), dry
REFUSAL

TH 90-03
06 AUG

4.0
8.5
13.0

90-03
0.0- 13.0 Bn-Gy BEDROCK(Chert)
soft 0.0-4.0
hard 4.0-5.5
soft 5.5-8.5
hard 8.5-9.5
soft 9.5-12.5
hard 12.5-13.0

NOTES:

1. CONTOURS ARE APPROXIMATE & FROM USGS QUADRANGLE LIVENGOOD C-4.
2. TEST HOLES 90-11 & 90-14 WERE DRILLED THROUGH BEDROCK KNOBS THAT HAVE SINCE BEEN EXCAVATED. THESE TEST HOLES ARE INCLUDED FOR INFORMATIONAL PURPOSES ONLY.
3. A MINING PLAN MAY BE PART OF FUTURE PROJECT(S) UTILIZING THIS MATERIAL SITE. ANY CONCEPTUAL INFORMATION PRESENTED HEREON IS INTENDED FOR PRELIMINARY, ENVIRONMENTAL FUNCTION ONLY. ANY SUCH INFORMATION INDICATED HEREON IS SUPERSEDED BY SPECIFIC PROJECT MINING PLANS(S).

WATER TABLE

W.D. - WHILE DRILLING
A.D. - AFTER DRILLING

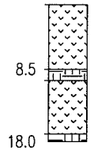
Vert. 10 feet 0

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
ENGINEERING GEOLOGY UNIT

DATA: GB, SJS, MD	DALTON HWY 9 MILE HILL NORTH MS 65-3-012-2
DRAWN: TAD, RDP	
APPROVED: SM	PROJECT NO.: 64899
DATE: Sep 2006	U:\Geo\64899\DRAFTING\TH\ms_65-3-012-2-MS012

Sep 13, 2006 - 9:13am

TH 90-05
06 AUG

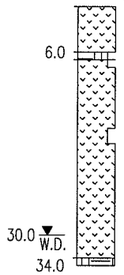


90-05
0.0–18.0 Bn-Gy BEDROCK(Chert), dry
soft 0.0–8.5
hard 8.5–10.0
soft 10.0–17.0
hard 17.0–18.0

TH 90-06
06 AUG

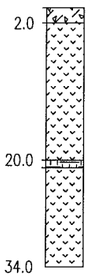
90-06
0.0– 4.0 Bn-Gy BEDROCK(Chert)
soft 0.0–1.0
hard 1.0–2.0
soft 2.0–3.0
hard 3.0–4.0
4.0– 6.0 Bn-Gy BEDROCK, soft(Chert)
(tested as sl Si Sa GRAVEL)
SAMPLE 90-1113
(4.0–6.0)
A-1-a, 12%-200
NM 1.7%
6.0– 6.5 Bn-Gy BEDROCK, hard(Chert)
REFUSAL

TH 90-07
06 AUG



90-07
0.0–33.0 Bn-Gy BEDROCK, soft(Chert), dry
Gy below 2.0
(tested as sl Si Sa GRAVEL)
w/hard layer 6.0–7.0
SAMPLE 90-1114
(6.0–8.0)
A-1-b, 12%-200
LL 17, PI NP
wet below 25.0
SAMPLE 90-1115
(16.0–18.0)
A-1-b, 17%-200
NM 5.2%
LL 21, PI 2
33.0–34.0 Gy BEDROCK, hard(Chert), wet

TH 90-08
06 AUG

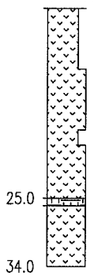


90-08
0.0– 2.0 Bn-Gy Si GRAVEL, dry
rock fragments
2.0–34.0 Gy-Bn BEDROCK, soft(Chert), dry
w/hard layer 20.0–21.0

TH 90-09
06 AUG

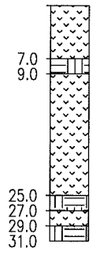
90-09
0.0– 8.5 Bn-Gy BEDROCK(Chert), dry
soft 0.0–3.0
hard 3.0–4.5
soft 4.5–5.5
hard 5.5–7.0
soft 7.0–8.0
hard 8.0–8.5
REFUSAL

TH 90-10
06 AUG



90-10
0.0–34.0 BEDROCK, soft(Chert), dry
Bn-Purple 0.0–8.0
Bn-Gy 8.0–15.0
Bn-Purple 15.0–34.0
(tested as sl Cl Sa GRAVEL)
w/hard layer 25.0–26.0
SAMPLE 90-1117A
(0.0–8.0)
A-1-a, 11%-200
SAMPLE 90-1117B
(2.0–3.0)
NM 2.9%
SAMPLE 90-1117C
(7.0–8.0)
NM 4.0%
SAMPLE 90-1118
(16.0–18.0)
A-1-a, 12%-200
NM 4.2%
LL 21, PI 6

TH 90-11
07 AUG

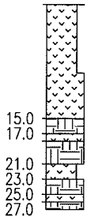


90-11
0.0–29.0 Bn-Gy BEDROCK, soft(Chert), dry
w/hard layers 7.0–9.0, 25.0–27.0
29.0–31.0 Bn-Gy BEDROCK, hard(Chert), dry
REFUSAL

TH 90-12
07 AUG

90-12
0.0–19.0 Bn-Gy BEDROCK, soft(Chert), moist
(tested as sl Cl Si Sa GRAVEL
& sl Cl Si GRAVEL)
SAMPLE 90-1119
(7.0–9.0)
A-2-4, 14%-200
NM 7.9%
LL 29, PI 7
SAMPLE 90-1120
(16.0–18.0)
A-2-4, 13%-200
NM 6.7%
LL 31, PI 10
19.0–20.0 Bn-Gy BEDROCK, hard(Chert), moist
REFUSAL

TH 90-13
07 AUG

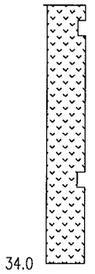


90-13
0.0–15.0 Bn-Gy BEDROCK, soft(Chert)
Bn-Purple below 3.0
(tested as sl Cl Si Sa GRAVEL)
SAMPLE 90-1122A
(0.0–9.0)
A-1-a, 13%-200
LL 23, PI 5
SAMPLE 90-1122B
(2.0–3.0)
NM 2.8%
SAMPLE 90-1122C
(8.0–9.0)
NM 3.4%
15.0–27.0 Bn-Gy BEDROCK(Chert)
hard 15.0–17.0
soft 17.0–18.0
hard 18.0–21.0
soft 21.0–23.0
(tested as sl Cl GRAVEL)
SAMPLE 90-1123
(21.0–23.0)
A-1-a, 7%-200
NM 1.3%
LL 23, PI 5
hard 23.0–25.0
soft 25.0–26.0
hard 26.0–27.0
REFUSAL

TH 90-14
07 AUG

90-14
0.0– 4.0 Bn-Gy BEDROCK
soft(Chert), dry
4.0– 5.0 Bn-Gy BEDROCK
hard(Chert), dry
REFUSAL

TH 90-15
07 AUG



90-15
0.0–34.0 Bn-Gy BEDROCK, soft(Chert), moist
(tested as sl Cl Si Gr SAND & Cl Gr SAND)
SAMPLE 90-1125
(2.0–4.0)
A-2-4, 20%-200
NM 8.0%
LL 31, PI 10
SAMPLE 90-1126
(22.0–24.0)
A-2-6(0), 21%-200
NM 7.5%
LL 33, PI 13

SAMPLE 90-1107
06 AUG
(SURFACE)
Bn-Gy BEDROCK, soft(Chert)
LA 33, DEG 84

SAMPLE 90-1112
06 AUG
(SURFACE)
Bn-Gy BEDROCK, hard(Chert)
LA 34, DEG 67

SAMPLE 90-1116
06 AUG
(SURFACE)
Bn-Gy BEDROCK, soft(Chert)
LA 32, DEG 37

SAMPLE 90-1121
06 AUG
(SURFACE)
Bn-Gy BEDROCK, soft(Chert)
LA 30, DEG 23

SAMPLE 90-1124
06 AUG
(SURFACE)
Bn-Gy BEDROCK, soft(Chert)
LA 39, DEG 24

WATER TABLE

W.D. – WHILE DRILLING

A.D. – AFTER DRILLING

Vert. 10 feet 0

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
ENGINEERING GEOLOGY UNIT

DATA: GB, SJS, MD	DALTON HWY 9 MILE HILL NORTH MS 65-3-012-2
DRAWN: TAD, RDP	
APPROVED: SM	PROJECT NO. 64899
DATE: Jul 2006	U:\Geo\64899\DRAFTING\TH\ms_65-3-012-2-MS012 (2)

Jul 25, 2006 - 1:40pm

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-012-2

TEST HOLE NO.		90-01	Grab	90-02	90-02	90-04	90-04	Grab
DEPTH (feet)		1.0-3.0	Surface	6.0-8.0	9.0-16.0	5.0-7.0	10.0-12.0	Surface
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		90-1106	90-1107	90-1108	90-1109	90-1110	90-1111	90-1112
DATE SAMPLED		6-Aug-90	6-Aug-90	6-Aug-90	6-Aug-90	6-Aug-90	6-Aug-90	6-Aug-90
% Passing	**3"**							
	2"	100		100	100			
	1.0"	98		98	99	100		
Gravel	**0.75"**	98		97	98	98	100	
	0.5"	94		95	96	92	99	
	0.375"	90		91	92	87	96	
	#4	74		77	75	70	81	
	#10	57		49	48	47	58	
Sand	**#40**	36		15	17	22	31	
	#50	33		12	14	19	28	
	#100	28		8	8	15	22	
Silt/Clay	**#200**	24		5	5	12	18	
	0.02				4			
Hydro	**0.005**				2			
	0.002							
LIQUID LIMIT		22		NV	NV	22	27	
PLASTIC INDEX		5		NP	NP	NP	8	
AASHTO CLASSIFICATION		A-1-b		A-1-a	A-1-a	A-1-a	A-2-4	
SOIL DESCRIPTION		slClSiSaGr	(Bx)	SaGr	SaGr	slSiSaGr	slClSiSaGr	(Bx)
NATURAL MOISTURE				1.3	1.2	5.3	3.8	
ORGANICS								
SP.GR. (FINE)					2.62			
SP.GR. (COARSE)					2.64			
MAX DRY DENSITY					128.4			
OPTIMUM MOISTURE					3.9			
L.A. ABRASION			33					34
DEGRADATION FACTOR			84					67
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
		(Bx)		(Bx)	(Bx)	(Bx)	(Bx)	

REMARKS:
Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA – NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY, 9 MILE HILL-NORTH
PROJECT #: F-065-2(3)/64899

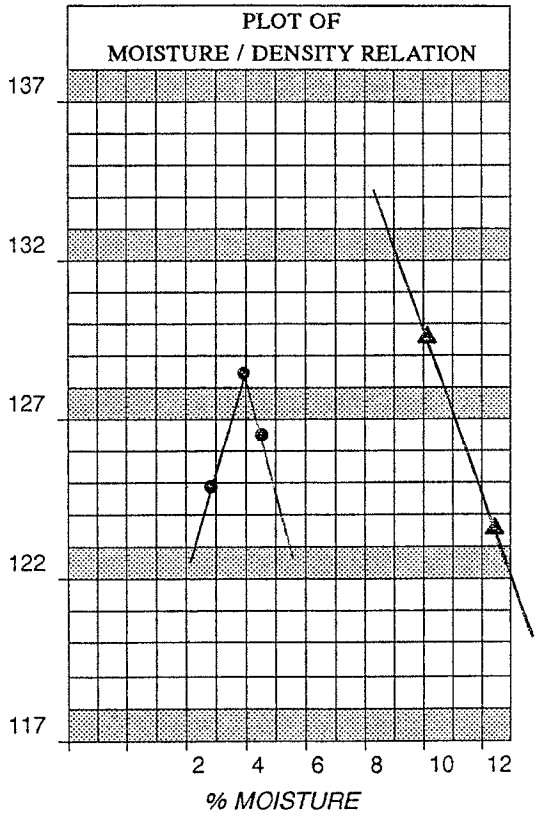
LAB #: 90-1109
DATE SAMPLED 8-6-90

TEST HOLE #: 90-2
SOURCE: M.S.65-3-012-2
SAMPLED BY: G.Brazo

DEPTH: 9-16
STATION:
OFFSET:

SIEVE SIZE	% PASS
3"	
2"	
1 1/2"	100
1"	99
3/4"	98
1/2"	96
3/8"	92
#4	75
#8	53
#10	48
#16	
#20	28
#30	
#40	17
#50	14
#60	
#80	10
#100	8
#200	5

TEST	%	
OVERSIZE:		
DELETERIOUS:		
LL	NV	
PI	NP	
SP GR (APP)		
FINE AGG:	2.62	
COARSE AGG	2.64	
LA:		
DEG:		
		DEPTH
NATURAL MOISTURE:	1.2	10–12
% ORGANICS:		



HYDRO	
.002mm	4
.005mm	2

	COARSE	FINE
Na2SO4		
SOUNDNESS:		

T-180D* TEST RESULT	REG. LAB
MAX DENSITY	128.4
OPT MOIST	3.9
ZAV SP GR	2.62

* +3/4" MATERIAL REMOVED

ZAV POINT	123.6 @ 12.4 %
ZAV POINT	129.6 @ 10.1 %

MOLD NO.	1	2	3	4	5
DRY UNIT WT	124.9	128.4	126.5		
% MOISTURE	2.8	3.9	4.5		
FREE MOIST					

REMARKS:

AASHTO CLASS:	A-1-a
TEXTURAL CLASS:	SaGr
UNIFIED CLASS:	

SIGNATURE:

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-012-2

TEST HOLE NO.		90-06	90-07	90-07	Grab	90-10	90-10	90-10
DEPTH (feet)		4.0-6.0	6.0-8.0	16.0-18.0	Surface	0.0-8.0	2.0-3.0	7.0-8.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		90-1113	90-1114	90-1115	90-1116	90-1117A	90-1117B	90-1117C
DATE SAMPLED		6-Aug-90	6-Aug-90	6-Aug-90	6-Aug-90	6-Aug-90	6-Aug-90	6-Aug-90
% Passing	**3"**							
	2"					100		
	1.0"	100				99		
Gravel	**0.75"**	99	100	100		98		
	0.5"	96	98	98		93		
	0.375"	91	94	95		87		
	#4	70	73	81		68		
	#10	48	51	59		47		
Sand	**#40**	24	25	30		22		
	#50	20	21	27		19		
	#100	16	17	22		14		
Silt/Clay	**#200**	12	12	17		11		
	0.02					8		
Hydro	**0.005**					4		
	0.002							
LIQUID LIMIT		NV	17	21		NV		
PLASTIC INDEX		NP	NP	2		NP		
AASHTO CLASSIFICATION		A-1-a	A-1-b	A-1-b		A-1-a		
SOIL DESCRIPTION		slSiSaGr	slSiSaGr	Chert Bx	(Bx)	Chert Bx	Chert Bx	Chert Bx
NATURAL MOISTURE		1.7		5.2			2.9	4.0
ORGANICS								
SP.GR. (FINE)						2.68		
SP.GR. (COARSE)						2.75		
MAX DRY DENSITY						141.0		
OPTIMUM MOISTURE						7.4		
L.A. ABRASION					32			
DEGRADATION FACTOR					37			
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:		(Bx)	(Bx)					

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA - NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHGWAY, 9 MILE HILL
PROJECT #: F-065-2(3)/64899

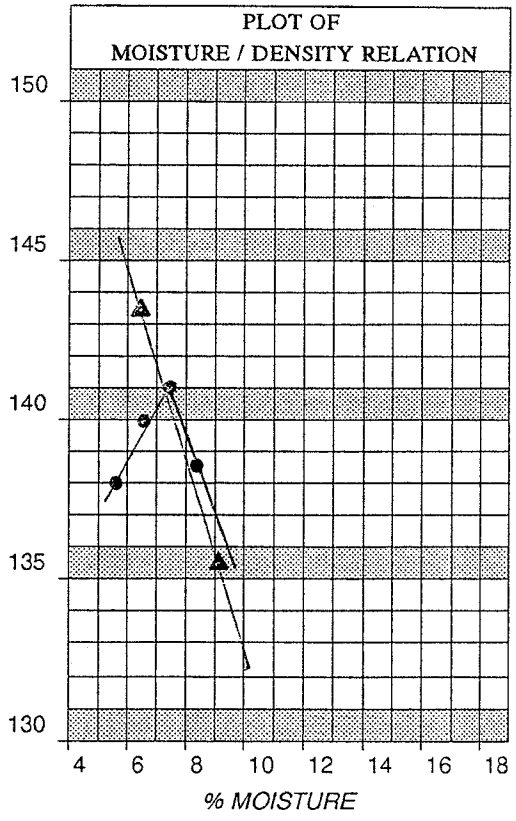
LAB #: 90-1117
DATE SAMPLED 8-6-90

TEST HOLE #: 90-10
SOURCE: M.S.65-3-012-2
SAMPLED BY: G.Brazo

DEPTH: 0-8
STATION:
OFFSET:

SIEVE SIZE	% PASS
3"	
2"	
1 1/2"	100
1"	99
3/4"	98
1/2"	93
3/8"	87
#4	68
#8	51
#10	47
#16	
#20	32
#30	
#40	22
#50	19
#60	
#80	16
#100	14
#200	11

TEST	%	
OVERSIZE:		
DELETERIOUS:		
LL	NV	
PI	NP	
SP GR (APP)		
FINE AGG:	2.68	
COARSE AGG	2.75	
LA:		
DEG:		
		DEPTH
NATURAL	2.9	2-3
MOISTURE:	4.0	7-8
% ORGANICS:		



HYDRO	
.002mm	8
.005mm	4

	COARSE	FINE
Na2SO4		
SOUNDNESS:		

T-180D* TEST RESULT	REG. LAB
MAX DENSITY	141.0
OPT MOIST	7.4
ZAV SP GR	2.70

* +3/4" MATERIAL REMOVED

ZAV POINT	135.4 @ 9.1 %
ZAV POINT	143.4 @ 6.5 %

MOLD NO.	1	2	3	4	5
DRY UNIT WT	138.0	139.9	141.0	138.6	
% MOISTURE	5.5	6.5	7.4	8.3	
FREE MOIST					

REMARKS:

AASHTO CLASS: *	A-1-a
TEXTURAL CLASS:	Chert Bx
UNIFIED CLASS:	

* Drill Cuttings

SIGNATURE: T. C. Harwood

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-012-2

TEST HOLE NO.		90-10	90-12	90-12	Grab	90-13	90-13	90-13
DEPTH (feet)		16.0-18.0	7.0-9.0	16.0-18.0	Surface	0.0-9.0	2.0-3.0	8.0-9.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		90-1118	90-1119	90-1120	90-1121	90-1122A	90-1122B	90-1122C
DATE SAMPLED		6-Aug-90	7-Aug-90	7-Aug-90	7-Aug-90	7-Aug-90	7-Aug-90	7-Aug-90
% Passing	**3"**							
	2"					100		
	1.0"		100			99		
Gravel	**0.75"**	100	99	100		98		
	0.5"	97	93	98		94		
	0.375"	93	85	92		88		
	#4	72	63	60		68		
	#10	49	43	32		48		
Sand	**#40**	22	24	18		23		
	#50	19	22	17		20		
	#100	15	18	15		16		
Silt/Clay	**#200**	12	14	13		13		
	0.02					10		
Hydro	**0.005**					6		
	0.002							
LIQUID LIMIT		21	29	31		23		
PLASTIC INDEX		6	7	10		5		
AASHTO CLASSIFICATION		A-1-a	A-2-4	A-2-4		A-1-a		
SOIL DESCRIPTION		slClSaGr	slClSiSaGr	slClSiGr	(Bx)	slClSiSaGr	slClSiSaGr	slClSiSaGr
NATURAL MOISTURE		4.2	7.9	6.7			2.8	3.4
ORGANICS								
SP.GR. (FINE)						2.68		
SP.GR. (COARSE)						2.83		
MAX DRY DENSITY						141.4		
OPTIMUM MOISTURE						6.4		
L.A. ABRASION					30			
DEGRADATION FACTOR					23			
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
		(Bx)	(Bx)	(Bx)		(Bx)	(Bx)	(Bx)

REMARKS:
Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA - NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY, 9 MILE HILL-NORTH
PROJECT #: F-065-2(3)/64899

LAB #: 90-1122
DATE SAMPLED 8-7-90

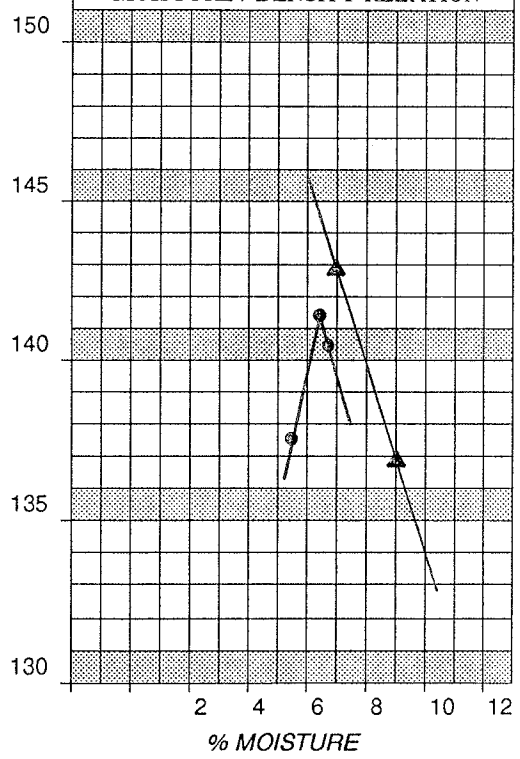
TEST HOLE #: 90-13
SOURCE: M.S.65-3-012-2
SAMPLED BY: G.Brazo

DEPTH: 0-9
STATION:
OFFSET:

SIEVE SIZE	% PASS
3"	
2"	
1 1/2"	100
1"	99
3/4"	98
1/2"	94
3/8"	88
#4	68
#8	52
#10	48
#16	
#20	32
#30	
#40	23
#50	20
#60	
#80	18
#100	16
#200	13

TEST	%	
OVERSIZE:		
DELETERIOUS:		
LL	23	
PI	5	
SP GR (APP)		
FINE AGG:	2.68	
COARSE AGG	2.83	
LA:		
DEG:		
		DEPTH
NATURAL	2.8	2-3
MOISTURE:	3.4	8-9
% ORGANICS:		

PLOT OF
MOISTURE / DENSITY RELATION



HYDRO	
.002mm	10
.005mm	6

	COARSE	FINE
Na2SO4		
SOUNDNESS:		

T-180D* TEST RESULT	REG. LAB
MAX DENSITY	141.4
OPT MOIST	6.4
ZAV SP GR	2.73

* +3/4" MATERIAL REMOVED

ZAV POINT	136.8 @ 9.0 %
ZAV POINT	142.8 @ 7.0 %

MOLD NO.	1	2	3	4	5
DRY UNIT WT	137.5	141.4	140.4		
% MOISTURE	5.4	6.4	6.6		
FREE MOIST					

REMARKS:

AASHTO CLASS:	A-1-a
TEXTURAL CLASS:	sl.ClSiSaGr
UNIFIED CLASS:	

SIGNATURE: T. C. Harwood

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-012-2

TEST HOLE NO.		90-13	Grab	90-15	90-15			
DEPTH (feet)		21.0-23.0	Surface	2.0-4.0	22.0-24.0			
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		90-1123	90-1124	90-1125	90-1126			
DATE SAMPLED		7-Aug-90	7-Aug-90	7-Aug-90	7-Aug-90			
% Passing	**3"**							
	2"							
	1.0"			100				
Gravel	**0.75"**	100		99	100			
	0.5"	99		96	97			
	0.375"	95		92	94			
	#4	57		79	81			
	#10	26		60	62			
Sand	**#40**	12		33	32			
	#50	10		29	29			
	#100	9		24	24			
Silt/Clay	**#200**	7		20	21			
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		23		31	33			
PLASTIC INDEX		5		10	13			
AASHTO CLASSIFICATION		A-1-a		A-2-4	A-2-6(0)			
SOIL DESCRIPTION		slClGr	(Bx)	slClSiGrSa	ClGrSa			
NATURAL MOISTURE		1.3		8.0	7.5			
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION			39					
DEGRADATION FACTOR			24					
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
		(Bx)		(Bx)	(Bx)			

REMARKS:
Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

MS 65-3-020-2

Location and access

This site is on a north-south trending ridge near MP 6 of the Dalton Highway. Gravel is exposed in a full cut through the approximate center of the site. The ridgeline within the site drops approximately 150 ft in elevation from north to south. The ridge top is approximately 500-ft wide at a point 900 ft north of the highway, and narrows to approximately 100-ft wide at a point 1400 ft south of the highway. The slope of the ridgeline is approximately 2H:1V north of the highway, and 1.5H:1V south of the highway, steepening abruptly 1500 ft south of the highway. Presently, no access exists but access could be built at a convenient location at one end of the road cut. Vegetation on the slopes of the ridge will screen any excavation into the ridge.

Description

Three materials are available in this site. The first is alluvial silty sandy to sandy gravel with cobbles. NRMS personnel visually estimated the cobbles to comprise less than 2% of the alluvial gravel in the backhoe trenches. The gravel is composed chiefly of chert fragments and is the bulk of the available material in the site. The second material is a mixture of colluvial bedrock fragments in a silt-sand matrix, which is called broken bedrock in this report. Chert bedrock is the third material, and the drill rate indicated that the bedrock is generally soft.

The alluvial soils were at least 62-ft thick in TH90-2 south of the highway, but were absent in TH91-33 north of the highway. We detected a broken bedrock / colluvial layer in many of the test holes, which varied from 2-ft to 21-ft thick. We intercepted the bedrock surface in 27 test holes. Bedrock was as shallow as 5 ft below the surface, to deeper than our deepest test hole (i.e., 62 ft).

The alluvial soils from the road cut were used during the construction of the highway. M&O have since used portions of the material on the south side of the road, creating a pull-out off of the highway.

Land status

At the time of this writing, application for this material site is in progess.

Clearing and stripping

Vegetation has been cleared for approximately 300 ft south of the highway centerline. Elsewhere on the ridge, 1 to 3-in. diameter black spruce trees on 1 to 10-ft centers predominate with scattered 2 to 6-in. diameter aspen trees. Ground cover includes Labrador tea shrubs and moss. Overburden on the ridge generally consists of a 0.5-ft thick organic mat and up to 9.0 ft of silt.

Water table

We did not intercept a water table in any of the test holes or test trenches while exploring in August 1990, or September and October 1991.

Frozen conditions

We found frozen soils in all but two test holes on the ridge. The depth to the top of the frozen soils ranged between 1.0 to 20.0 ft beneath the surface. Four of the test holes contained up to 50% visible ice. The reader is directed to the test hole logs for details.

Quality of materials

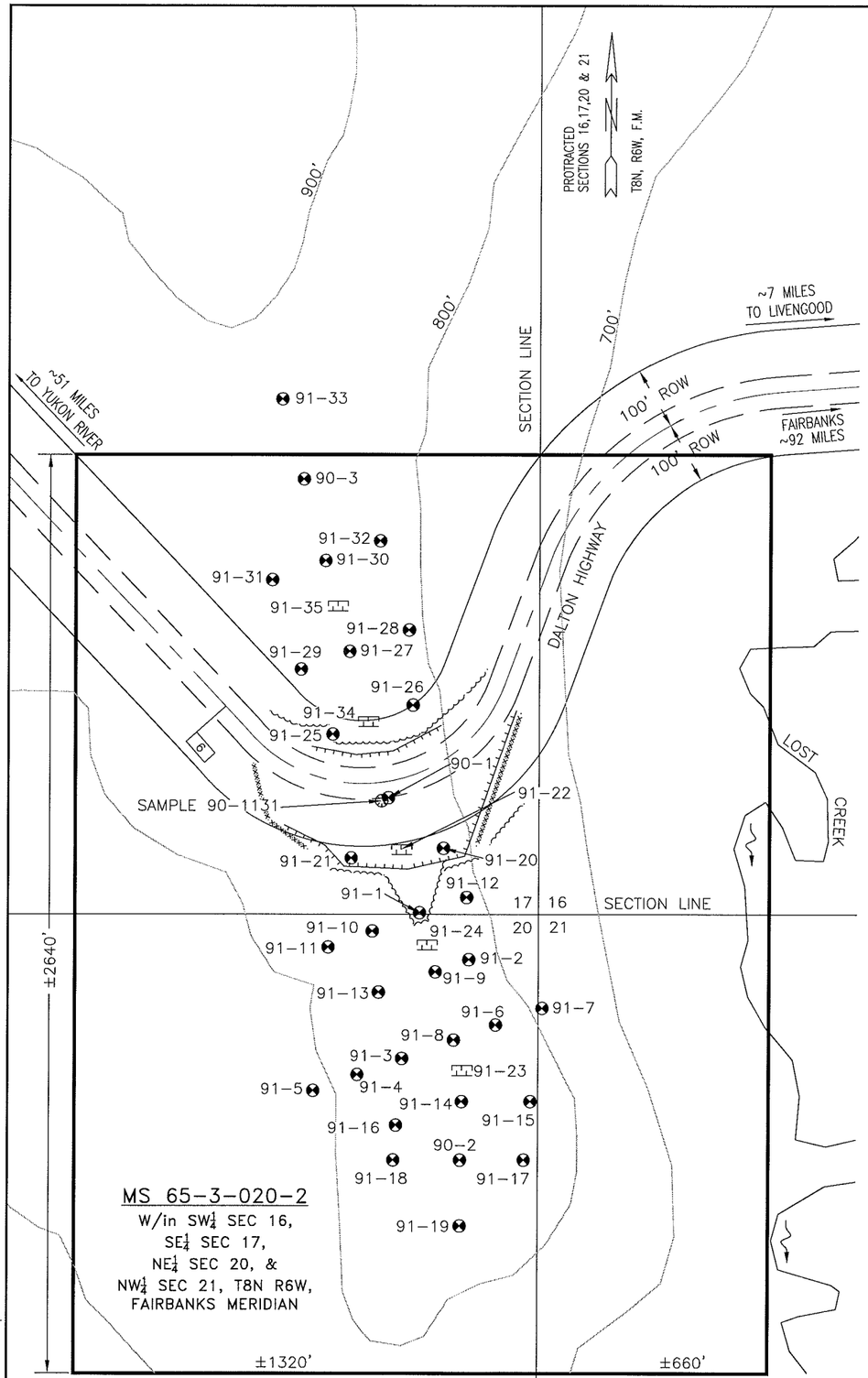
Table 6 contains a summary of the laboratory testing results of the soils and bedrock from MS 65-3-020-2. The data summarized include: percent passing the No. 200 sieve (% -200), liquid limit, plastic index, optimum moisture, moisture content, LA Abrasion values, Degradation values, and Sodium Sulfate loss, both coarse (SSc) and fine (SSf). See the seven column sheets for other laboratory results not included here.

Table 6: Summary of laboratory testing data for MS 65-3-020-2. Numbers in parentheses indicate the number of tests performed.

Material Type	% -200	Liquid Limit	Plastic index	Optimum moisture (%)	Moisture content (%)	LA Abrasion	Degradation	SSc	SSf
Gravelly soil	6 – 23 (39)	NV – 21 (39)	NP – 3 (39)	5.7, 5.9 (2)	3.7 – 9.5 (9)	28 – 36 (8)	26 – 82 (11)	8.5 – 15.7 (4)	3.7 – 13.1 (4)
Colluvium	10 – 14 (7)	NV – 21 (7)	NP – 2 (7)	---	8.7, 9.3 (2)	---	81 (1)	---	---
Chert bedrock	13 (1)	21 (1)	3 (1)	---	4.1 (1)	---	---	---	---

Comments and recommendations

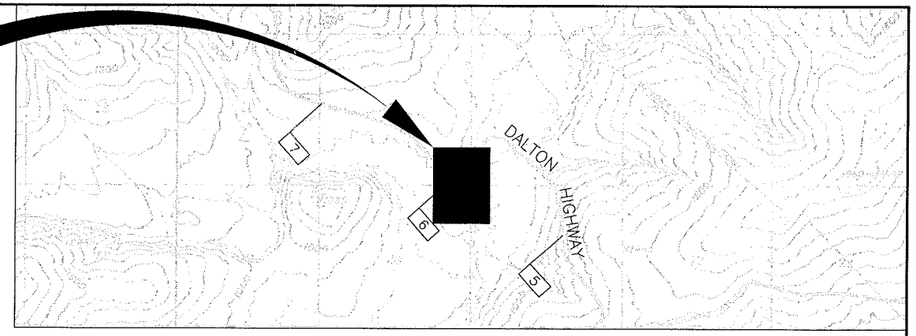
1) Results from laboratory testing indicate that the gravelly soil, colluvium, and bedrock from this site can be used to produce Selected Material, Type C Modified (see General Recommendation #23).
2) Some of the tested gravelly material in this site does not meet the LA Abrasion and Degradation requirements for crushed aggregate and subbase; for example, one grab sample from the surface that had a Degradation of 26. Results from the Sodium Sulfate loss tests indicate that some of the gravelly material does not meet requirements for crushed aggregate and subbase.
3) The laboratory test results indicate that the moisture content of some of the gravelly material found in the site was greater than its optimum moisture. Additionally, the moisture/density curve from material tested exhibits a narrow peak, indicating that the material is sensitive to moisture content. These results suggest that complicated processing and handling techniques and procedures may be necessary in order to meet standard compaction specifications.
4) The overlying organic silty soil is not suitable for embankment material or slope flattening.
5) Drilling and blasting may be required to extract material from this site.
6) Expect cobbles within the soils overlying bedrock.



MS 65-3-020-2

W/in SW¼ SEC 16,
SE¼ SEC 17,
NE¼ SEC 20, &
NW¼ SEC 21, T8N R6W,
FAIRBANKS MERIDIAN

M.S. 65-3-020-2

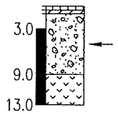


LOCATION MAP
TAKEN FROM USGS QUADRANGLE LIVENGOOD C-4

TH90-01
09 AUG

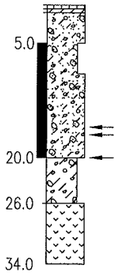
90-01
0.0- 11.0 Bn sl Si Sa GRAVEL, moist
SAMPLE 90-1132
(0.0-6.0)
A-1-a, 12%-200
LL 20, PI NP
11.0- 20.0 Bn Gr SAND, moist
20.0- 31.0 Bn Sa GRAVEL
moist to 21.0
31.0- 34.0 Gy BEDROCK, soft(Chert), wet

TH90-03
09 AUG



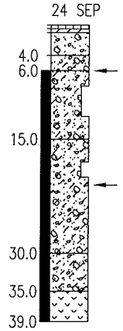
90-03
0.0- 0.5 ORG MAT
0.5- 1.0 Bn SILT, moist
1.0- 9.0 Bn Sa GRAVEL
w/ Cobbles
moist to 3.0
9.0-13.0 Bn-Gy BEDROCK, soft(Chert)
weathered

TH 91-01
24 SEP



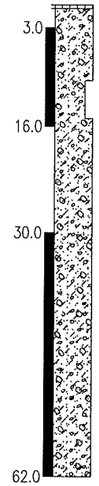
91-01
0.0- 0.5 ORG MAT
0.5- 1.0 Bn SILT, moist
1.0-20.0 Bn sl Si Sa GRAVEL
w/ Cobbles
moist to 5.0
SAMPLE 91-1267
(5.0-9.0)
A-1-a, 11%-200
20.0-26.0 Bn sl Si GRAVEL, wet
(Colluvium)
SAMPLE 91-1268
(20.0-21.0)
NM 9.3%
SAMPLE 91-1269
(21.0-26.0)
A-1-a, 11%-200
LL 21, PI 2
26.0-34.0 Bn BEDROCK, soft(Chert), wet

TH91-04
24 SEP



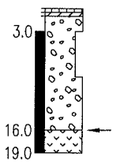
91-04
0.0- 0.5 ORG MAT
0.5- 1.0 Bn SILT, moist
1.0- 4.0 Bn Sa GRAVEL, moist
4.0- 6.0 Bn Si Sa GRAVEL, wet
6.0-15.0 Bn Si Sa GRAVEL
w/ Cobbles
SAMPLE 91-1274
(8.0-12.0)
A-1-b, 20%-200
LL 18, PI NP
15.0-30.0 Bn sl Si Sa GRAVEL
(Colluvium) Gr ¾"(-)
w/ Cobbles
SAMPLE 91-1275
(18.0-20.0)
A-1-a, 11%-200
NM 8.7%
35.0-39.0 Bn-Wh BEDROCK, soft(Chert)
clayey

TH90-02
09 AUG



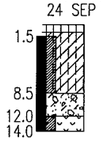
90-02
0.0- 0.5 ORG MAT
0.5-62.0 Bn sl Si Sa GRAVEL
moist to 3.0, moist 16.0-30.0
SAMPLE 90-1133
(10.0-15.0)
A-1-a, 12%-200

TH91-02
24 SEP



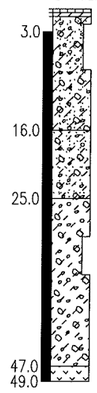
91-02
0.0- 0.5 ORG MAT
0.5- 1.0 Bn SILT, moist
1.0-16.0 Bn GRAVEL
w/ Cobbles
moist to 3.0
SAMPLE 91-1270
(3.0-9.0)
A-1-a, 6%-200
DEG 81
16.0-19.0 Bn BEDROCK, soft(Chert)
clayey

TH91-05
24 SEP



91-05
0.0- 1.0 ORG MAT
1.0- 8.5 Bn Org SILT
wet to 1.5
w/ visible ice 1.5- 8.5
8.5-12.0 Bn Si Sa GRAVEL
(Colluvium?)
12.0-14.0 Gy BEDROCK, soft(Chert)
w/ visible ice 12.0- 14.0

TH91-03
24 SEP



91-03
0.0- 0.5 ORG MAT
0.5- 1.0 Bn SILT, moist
1.0-16.0 Bn Sa Si GRAVEL
moist to 3.0
SAMPLE 91-1271
(2.0-8.0)
A-1-b, 23%-200
LL 19, PI NP
SAMPLE 91-1272
(4.0-5.0)
NM 5.9%
16.0-25.0 Bn Si Sa GRAVEL
25.0-47.0 Bn sl Si GRAVEL
SAMPLE 91-1273
(30.0-35.0)
A-1-a, 11%-200
47.0-49.0 Bn-Wh BEDROCK, soft(Chert)

TH91-06
24 SEP

91-06
0.0- 0.5 ORG MAT, dry
0.5- 1.0 Bn SILT, moist
1.0-15.0 Bn sl Si GRAVEL
moist to 3.0
SAMPLE 91-1276
(1.0-8.0)
A-1-a, 9%-200
LA 29
SAMPLE 91-1277
(4.0-5.0)
NM 3.7%
15.0-30.0 Bn sl Si Sa GRAVEL
SAMPLE 91-1278
(20.0-22.0)
A-1-a, 11%-200
NM 4.0%
30.0-40.0 Bn Si Sa GRAVEL
(Colluvium)
SAMPLE 91-1279
(33.0-35.0)
A-1-a, 11%-200
40.0-53.0 Bn BEDROCK, soft(Chert)

SAMPLE 90-1131
9 AUG
sl Si GRAVEL
(SURFACE)
A-1-a, 7%-200
SSc 11.3 SSf 12.3
LA 35, DEG 26

NOTES:
1. CONTOURS ARE APPROXIMATE & FROM USGS QUADRANGLE LIVENGOOD C-4.
2. A MINING PLAN MAY BE PART OF FUTURE PROJECT(S) UTILIZING THIS MATERIAL SITE. ANY CONCEPTUAL INFORMATION PRESENTED HEREON IS INTENDED FOR PRELIMINARY, ENVIRONMENTAL FUNCTION ONLY. ANY SUCH INFORMATION INDICATED HEREON IS SUPERSEDED BY SPECIFIC PROJECT MINING PLAN(S).

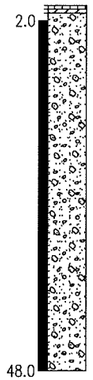
Vert. 10 feet 0 — Horiz. 0 feet 200

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
ENGINEERING GEOLOGY UNIT

DATA: GB, SJS, MD	LOST CREEK RIDGE MILE 6.2 MS 65-3-020-2
DRAWN: TAD, RDP	
APPROVED: SM	PROJECT NO. 64899
DATE: Aug 2006	U:\Geo\64899\DRAFTING\TH\ms_65-3-020-2-1

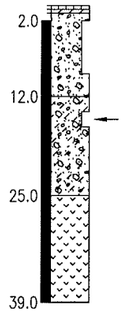
Aug 24, 2006 - 4:11pm

TH91-07
24 SEP



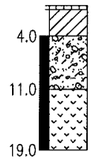
91-07
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–48.0 Bn Sa GRAVEL, loose moist to 2.0
1-1/2"(–)

TH91-08
24 SEP



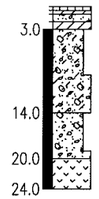
91-08
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–12.0 Bn Sa GRAVEL moist to 2.0 SAMPLE 91-1280 (2.0–9.0) A-1-a, 6%-200 DEG 81
12.0–25.0 Bn sl Si Sa GRAVEL w/ Cobbles (Colluvium) SAMPLE 91-1281 (14.0–16.0) A-1-a, 12%-200
25.0–39.0 Bn BEDROCK, soft(Chert)

TH91-09
24 SEP



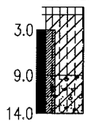
91-09
0.0– 0.5 ORG MAT
0.5– 4.0 Bn SILT, moist wet below 2.0
4.0–11.0 Bn Si Sa GRAVEL (Colluvium)
11.0–19.0 Bn-Gy BEDROCK, soft(Chert)

TH91-10
24 SEPT



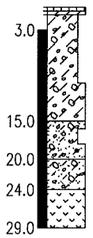
91-10
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0– 2.0 Bn Sa GRAVEL, moist
2.0– 3.0 Bn SILT, moist
3.0–14.0 Bn Si Sa GRAVEL SAMPLE 91-1282 (3.0–9.0) A-1-b, 19%-200
14.0–20.0 Bn Si Sa GRAVEL (Colluvium) SAMPLE 91-1283 (14.0–19.0) A-1-a, 14%-200 LL 17, PI NP
20.0–24.0 Bn BEDROCK, soft(Chert)

TH91-11
25 SEP



91-11
0.0– 1.0 ORG MAT
1.0– 9.0 Bn Org SILT wet to 3.0, tr Gr, Gy below 7.0 w/ visible ice 3.0– 9.0
9.0–14.0 Bn Org Sa Gr SILT w/ visible ice 9.0– 14.0

TH91-12
25 SEP

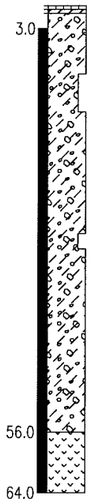


91-12
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–15.0 Bn sl Si GRAVEL moist to 3.0 SAMPLE 91-1284 (1.0–10.0) A-1-a, 10%-200 LA 29
15.0–20.0 Bn sl Si Sa GRAVEL SAMPLE 91-1285 (16.0–18.0) A-1-a, 9%-200
20.0–24.0 Gy Si Sa GRAVEL (Colluvium)
24.0–29.0 Gy BEDROCK, soft(Chert)

TH91-13
25 SEP

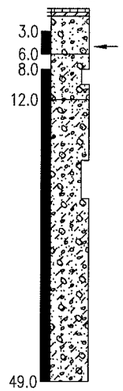
91-13
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–30.0 Bn Si Sa GRAVEL, loose moist to 3.0 SAMPLE 91-1286 (6.0–8.0) A-1-a, 15%-200 NM 5.1%
30.0–33.0 Gy BEDROCK, soft(Chert)

TH91-14
25 SEP



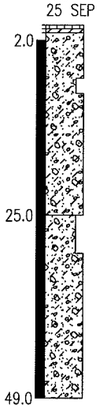
91-14
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–56.0 Bn sl Si GRAVEL moist to 3.0 SAMPLE 91-1287 (9.0–14.0) A-1-a, 7%-200 DEG 82 SAMPLE 91-1288 (30.0–32.0) A-1-a, 7%-200
56.0–64.0 Bn-Gy BEDROCK, soft(Chert)

TH91-15
25 SEP



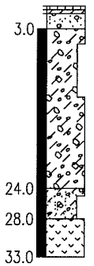
91-15
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0– 6.0 Bn Sa GRAVEL w/ Cobbles moist to 3.0
6.0–12.0 Bn Si Sa GRAVEL wet to 8.0 SAMPLE 91-1289 (8.0–10.0) A-1-a, 14%-200
12.0–49.0 Bn sl Si Sa GRAVEL SAMPLE 91-1290 (20.0–25.0) A-1-a, 10%-200

TH91-16
25 SEP



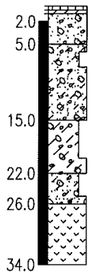
91-16
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–25.0 Bn Si Sa GRAVEL moist to 2.0 SAMPLE 91-1291 (7.0–9.0) A-1-b, 18%-200
25.0–49.0 Bn sl Si Sa GRAVEL SAMPLE 91-1292 (25.0–30.0) A-1-a, 10%-200 LA 30

TH91-17
25 SEP



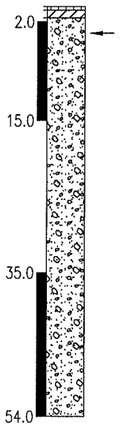
91-17
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0– 3.0 Bn Gr SAND, moist
3.0–24.0 Bn sl Si GRAVEL (colluvium) SAMPLE 91-1293 (5.0–12.0) A-1-a, 10%-200 DEG 81 SAMPLE 91-1294 (25.0–28.0) A-1-a, 11%-200 LL 17, PI 1
24.0–28.0 Bn Si Sa GRAVEL (Colluvium)
28.0–33.0 Bn-Gy BEDROCK, soft(Chert) clayey

TH91-18
25 SEP



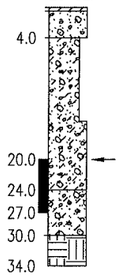
91-18
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0– 5.0 Bn Sa GRAVEL moist to 2.0
5.0–15.0 Bn Si Sa GRAVEL SAMPLE 91-1295 (6.0–8.0) A-1-b, 23%-200
15.0–22.0 Bn Si GRAVEL SAMPLE 91-1296 (15.0–20.0) A-1-a, 14%-200 LL 18, PI NP
22.0–26.0 Bn Si Sa GRAVEL SAMPLE 91-1297 (22.0–25.0) A-1-a, 13%-200
26.0–34.0 Bn BEDROCK, soft(Chert)

TH91-19
25 SEP



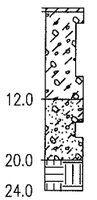
91-19
0.0– 0.5 ORG MAT
0.5– 1.5 Bn SILT, moist
1.5–54.0 Bn Sa GRAVEL w/ Cobbles moist to 2.0, moist 15.0–35.0

TH91-20
26 SEP



91-20
0.0– 0.5 Bn SILT, moist
0.5– 4.0 Bn Sa GRAVEL, moist
4.0–24.0 Bn sl Si Sa GRAVEL w/ Cobbles moist to 20.0 SAMPLE 91-1298 (4.0–10.0) A-1-a, 12%-200 SAMPLE 91-1299 (10.0–15.0) A-1-a, 11%-200
24.0–30.0 Gy Si Sa GRAVEL (Colluvium) wet 27.0–30.0
30.0–34.0 Gy BEDROCK, hard(Chert)

TH91-21
26 SEP



91-21
0.0– 0.5 Bn SILT, moist
0.5–12.0 Bn Si GRAVEL, moist SAMPLE 91-1300 (2.0–9.0) A-1-b, 16%-200 DEG 82
12.0–20.0 Bn Si Sa GRAVEL, moist wet 15.0–20.0 SAMPLE 91-1301 (15.0–17.0) A-1-b, 17%-200 NM 6.9%
20.0–24.0 Gy BEDROCK, hard(Chert)

Vert. 10– 0– feet

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
ENGINEERING GEOLOGY UNIT

DATA: GB, SJS, MD	LOST CREEK RIDGE MILE 6.2 MS 65-3-020-2
DRAWN: TAD, RDP	
APPROVED: SM	PROJECT NO. 64899
DATE: Jul 2006	U:\Geo\64899\DRAFTING\TH\ms_65-3-020-2-2

Jul 25, 2006 - 1:42pm

TT91-22
26 SEP

91-22

0.0–10.0 Bn Sa GRAVEL, moist
w/ Cobbles (<1% by visual inspection)
SAMPLE 91-1302
(0.0–5.0)
A-1-a, 6%-200
SSc 15.7, SSf 13.1
LA 36, DEG 62
SAMPLE 91-1303
(3.0–4.0)
NM 7.0%

TT91-23
30 SEP

91-23

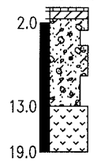
0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–10.0 Bn sl Si Sa GRAVEL
w/ Cobbles (<1% by visual inspection)
moist to 2.0
SAMPLE 91-1304
(3.0–6.0)
A-1-a, 12%-200
SSc 8.5, SSf 3.7
LA 34, DEG 70
SAMPLE 91-1305
(3.0–4.0)
NM 5.2%

TT91-24
30 SEP

91-24

0.0– 0.5 ORG MAT
0.5– 1.5 Bn SILT, moist
1.5– 9.0 Bn sl Si Sa GRAVEL
w/ Cobbles (<1% by visual inspection)
moist to 3.0
SAMPLE 91-1306
(4.0–7.0)
A-1-a, 7%-200
DEG 78

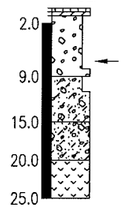
TH91-25
30 SEP



91-25

0.0– 0.5 ORG MAT
0.5– 1.5 Bn SILT, moist
1.5–13.0 Bn Si Sa GRAVEL
moist to 2.0
SAMPLE 91-1307
(3.0–5.0)
A-1-a, 13%-200
SAMPLE 91-1308
(9.0–13.0)
A-1-a, 13%-200
LL 20, PI 3
SAMPLE 91-1309
(10.0–11.0)
NM 9.1%
13.0–19.0 Bn-Gy BEDROCK, soft(Chert)

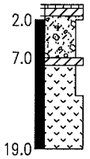
TH91-26
30 SEP



91-26

0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0– 9.0 Bn GRAVEL
w/ Cobbles
moist to 2.0
Gy below 5.0
SAMPLE 91-1310
(1.0–8.0)
A-1-a, 6%-200
DEG 75
9.0–15.0 Bn sl Si Sa GRAVEL
SAMPLE 91-1311
(9.0–11.0)
A-1-a, 12%-200
LL 19, PI 2
15.0–20.0 Gy Si Sa GRAVEL
(Colluvium)
20.0–25.0 Gy BEDROCK, soft(Chert)
hard @ 25.0

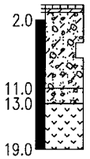
TH91-27
30 SEP



91-27

0.0– 0.5 ORG MAT
0.5– 1.5 Bn SILT, moist
1.5– 7.0 Bn Si Sa GRAVEL
moist to 2.0
SAMPLE 91-1312
(2.0–7.0)
A-1-a, 15%-200
7.0– 8.0 Bn SILT
8.0–19.0 Bn BEDROCK, soft(Chert)
(tested as Si Sa GRAVEL)
SAMPLE 91-1313
(8.0–12.0)
A-1-a, 13%-200
LL 21, PI 3
SAMPLE 91-1314
(10.0–11.0)
NM 4.1%

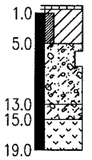
TH91-28
30 SEP



91-28

0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–11.0 Bn Si Sa GRAVEL
moist to 2.0
SAMPLE 91-1315
(5.0–7.0)
A-1-a, 13%-200
LL 21, PI 3
11.0–13.0 Bn Si Sa GRAVEL
(Colluvium)
13.0–19.0 Bn BEDROCK, soft(Chert)

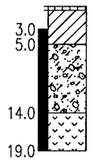
TH91-29
30 SEP



91-29

0.0– 0.5 ORG MAT
0.5– 5.0 Bn SILT
wet to 1.0
w/ visible ice 1.0– 5.0
5.0–13.0 Bn Si Sa GRAVEL
SAMPLE 91-1316
(6.0–8.0)
A-1-b, 18%-200
NM 9.5%
13.0–15.0 Bn Si Sa GRAVEL
(Colluvium)
15.0–19.0 Bn BEDROCK, soft(Chert)
clayey

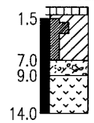
TH91-30
30 SEP



91-30

0.0– 0.5 ORG MAT
0.5– 5.0 Bn SILT, moist
wet 2.0–3.0
5.0–14.0 Bn Si Sa GRAVEL
(Colluvium)
14.0–19.0 Bn BEDROCK, soft(Chert)
weathered

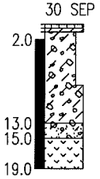
TH91-31
30 SEP



91-31

0.0– 1.0 ORG MAT
1.0– 7.0 Bn SILT
wet to 1.5, tr Gr
w/ visible ice 1.5– 7.0
w/chert frags 4.0–7.0
7.0– 9.0 Bn Si Sa GRAVEL
(Colluvium)
9.0–14.0 Bn BEDROCK, soft(Chert)

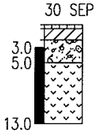
TH91-32
30 SEP



91-32

0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0–13.0 Bn sl Si GRAVEL
moist to 2.0
SAMPLE 91-1317
(1.0–8.0)
A-1-a, 10%-200
LA 28
13.0–15.0 Bn Si Sa GRAVEL
(Colluvium)
15.0–19.0 Bn BEDROCK, soft(Chert)

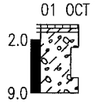
TH91-33
30 SEP



91-33

0.0– 0.5 ORG MAT
0.5– 2.0 Bn SILT, wet
2.0– 5.0 Bn Si Sa GRAVEL
(Colluvium)
wet to 3.0
5.0–13.0 Bn BEDROCK, soft(Chert)
Bn-Wh below 12.0

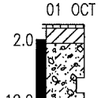
TT91-34
01 OCT



91-34

0.0– 0.5 ORG MAT
0.5– 1.0 Bn SILT, moist
1.0– 9.0 Bn sl Si GRAVEL
w/ Cobbles (1–2% by visual inspection)
moist to 2.0
SAMPLE 91-1318
(3.0–7.0)
A-1-a, 12%-200
SSc 11.4, SSf 7.6
LA 35, DEG 75
LL 19, PI NP
SAMPLE 91-1319
(4.0–5.0)
NM 6.1%

TT91-35
01 OCT



91-35

0.0– 0.5 ORG MAT
0.5– 2.5 Bn SILT
moist to 2.0
2.5–10.0 Bn sl Si Sa GRAVEL
w/ Cobbles (<1% by visual inspection)
SAMPLE 91-1320
(7.0–9.0)
A-1-a, 10%-200
LL 21, PI 3
DEG 50

Jul 25, 2006 - 1:42pm

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
ENGINEERING GEOLOGY UNIT

DATA: GB, SJS, MD	LOST CREEK RIDGE MILE 6.5 MS 65-3-020-2
DRAWN: TAD, RDP	
APPROVED: SM	PROJECT NO. 64899
DATE: Jul 2006	U:\Geo\64899\DRAFTING\TH\ms_65-3-020-2-3

Vert. feet: 10 – 0

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		Grab	90-01	90-02				
DEPTH (feet)		Surface	0.0-6.0	10.0-15.0				
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		90-1131	90-1132	90-1133				
DATE SAMPLED		9-Aug-90	9-Aug-90	9-Aug-90				
% Passing	**3"**	100						
	2"	99	100	100				
	1.0"	95	99	96				
Gravel	**0.75"**	90	94	90				
	0.5"	79	82	79				
	0.375"	68	72	72				
	#4	39	51	56				
	#10	24	32	40				
Sand	**#40**	16	20	23				
	#50	13	18	21				
	#100	9	15	16				
Silt/Clay	**#200**	7	12	12				
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		NV	20	NV				
PLASTIC INDEX		NP	NP	NP				
AASHTO CLASSIFICATION		A-1-a	A-1-a	A-1-a				
SOIL DESCRIPTION		slSiGr	slSiSaGr	slSiSaGr				
NATURAL MOISTURE								
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION		35						
DEGRADATION FACTOR		26						
SODIUM SULF. (CRSE)		11.3						
SODIUM SULF. (FINE)		12.3						
REMARKS:								

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		91-01	91-01	91-01	91-02	91-03	91-03	91-03
DEPTH (feet)		5.0-9.0	20.0-21.0	21.0-26.0	3.0-9.0	2.0-8.0	4.0-5.0	30.0-35.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		91-1267	91-1268	91-1269	91-1270	91-1271	91-1272	91-1273
DATE SAMPLED		24-Sep-91	24-Sep-91	24-Sep-91	24-Sep-91	24-Sep-91	24-Sep-91	24-Sep-91
% Passing	**3"**							
	2"	100		100	100	100		100
	1.0"	95		99	83	99		93
Gravel	**0.75"**	89		98	70	96		86
	0.5"	77		90	53	86		72
	0.375"	67		81	44	78		62
	#4	46		50	28	60		42
	#10	31		30	19	45		29
Sand	**#40**	18		18	11	31		18
	#50	16		16	10	29		17
	#100	13		13	8	26		13
Silt/Clay	**#200**	11		11	6	23		11
	0.02	8		8				
Hydro	**0.005**	4		6				
	0.002							
LIQUID LIMIT		NV		21	NV	19		NV
PLASTIC INDEX		NP		2	NP	NP		NP
AASHTO CLASSIFICATION		A-1-a		A-1-a	A-1-a	A-1-b		A-1-a
SOIL DESCRIPTION		slSiSaGr	(slSiGr)	slSiGr	Gr	SaSiGr	SaSiGr	slSiGr
NATURAL MOISTURE			9.3				5.9	
ORGANICS								
SP.GR. (FINE)		2.67		2.66				
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR					81			
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:								

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		91-04	91-04	91-06	91-06	91-06	91-06	91-08
DEPTH (feet)		8.0-12.0	18.0-20.0	1.0-8.0	4.0-5.0	20.0-22.0	33.0-35.0	2.0-9.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		91-1274	91-1275	91-1276	91-1277	91-1278	91-1279	91-1280
DATE SAMPLED		24-Sep-91	24-Sep-91	24-Sep-91	24-Sep-91	24-Sep-91	24-Sep-91	24-Sep-91
% Passing	**3"**							
	2"			100				100
	1.0"	100	100	93		100	100	91
Gravel	**0.75"**	99	99	84		99	99	82
	0.5"	95	90	67		90	92	68
	0.375"	89	82	57		80	86	58
	#4	70	57	38		56	59	41
	#10	51	34	26		36	34	26
Sand	**#40**	32	19	16		19	20	13
	#50	30	18	15		17	18	11
	#100	24	14	12		13	14	8
Silt/Clay	**#200**	20	11	9		11	11	6
	0.02			7			7	
Hydro	**0.005**			4			4	
	0.002							
LIQUID LIMIT		18	NV	NV		NV	NV	NV
PLASTIC INDEX		NP	NP	NP		NP	NP	NP
AASHTO CLASSIFICATION		A-1-b	A-1-a	A-1-a		A-1-a	A-1-a	A-1-a
SOIL DESCRIPTION		SiSaGr	slSiSaGr	slSiGr	slSiGr	slSiSaGr	slSiSaGr	SaGr
NATURAL MOISTURE			8.7		3.7	4.0		
ORGANICS								
SP.GR. (FINE)				2.65			2.66	
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION				29				
DEGRADATION FACTOR								81
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:								

Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		91-08	91-10	91-10	91-12	91-12	91-13	91-14
DEPTH (feet)		14.0-16.0	3.0-9.0	14.0-19.0	1.0-10.0	16.0-18.0	6.0-8.0	9.0-14.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		91-1281	91-1282	91-1283	91-1284	91-1285	91-1286	91-1287
DATE SAMPLED		24-Sep-91	24-Sep-91	24-Sep-91	25-Sep-91	25-Sep-91	25-Sep-91	25-Sep-91
% Passing	**3"**				100			
	2"	100	100	100	95		100	100
	1.0"	99	99	99	85	100	99	93
Gravel	**0.75"**	97	98	98	77	97	93	86
	0.5"	91	90	87	61	89	82	71
	0.375"	85	82	76	53	79	74	61
	#4	64	62	51	38	53	55	38
	#10	41	45	37	28	29	41	24
Sand	**#40**	21	29	24	15	16	24	13
	#50	19	26	21	14	14	22	12
	#100	15	22	17	12	11	18	9
Silt/Clay	**#200**	12	19	14	10	9	15	7
	0.02		12	10				
Hydro	**0.005**		6	4				
	0.002							
LIQUID LIMIT		NV	NV	17	NV	NV	NV	NV
PLASTIC INDEX		NP	NP	NP	NP	NP	NP	NP
AASHTO CLASSIFICATION		A-1-a	A-1-b	A-1-a	A-1-a	A-1-a	A-1-a	A-1-a
SOIL DESCRIPTION		slSiSaGr	SiSaGr	SiSaGr	slSiGr	slSiSaGr	SiSaGr	slSiGr
NATURAL MOISTURE							5.1	
ORGANICS								
SP.GR. (FINE)			2.64	2.66				
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION					29			
DEGRADATION FACTOR								82
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								

REMARKS:
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STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		91-14	91-15	91-15	91-16	91-16	91-17	91-17
DEPTH (feet)		30.0-32.0	8.0-10.0	20.0-25.0	7.0-9.0	25.0-30.0	5.0-12.0	25.0-28.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		91-1288	91-1289	91-1290	91-1291	91-1292	91-1293	91-1294
DATE SAMPLED		25-Sep-91	25-Sep-91	25-Sep-91	25-Sep-91	25-Sep-91	25-Sep-91	25-Sep-91
% Passing	**3"**							
	2"	100	100	100		100	100	100
	1.0"	96	99	97	100	99	91	98
Gravel	**0.75"**	94	97	94	98	96	84	96
	0.5"	76	88	84	92	88	68	83
	0.375"	61	79	76	84	80	58	72
	#4	31	60	54	65	59	39	45
	#10	19	44	32	47	38	27	30
Sand	**#40**	13	25	17	27	19	17	20
	#50	12	23	16	24	17	15	18
	#100	9	19	13	20	13	12	14
Silt/Clay	**#200**	7	14	10	18	10	10	11
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		NV	NV	NV	NV	NV	NV	17
PLASTIC INDEX		NP	NP	NP	NP	NP	NP	1
AASHTO CLASSIFICATION		A-1-a	A-1-a	A-1-a	A-1-b	A-1-a	A-1-a	A-1-a
SOIL DESCRIPTION		slSiGr	SiSaGr	slSiSaGr	SiSaGr	slSiSaGr	slSiGr	slSiGr
NATURAL MOISTURE								
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION						30		
DEGRADATION FACTOR							81	
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
REMARKS:								

Soil descriptions shown in parentheses are based on field determinations.
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STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		91-18	91-18	91-18	91-20	91-20	91-21	91-21
DEPTH (feet)		6.0-8.0	15.0-20.0	22.0-25.0	4.0-10.0	10.0-15.0	2.0-9.0	15.0-17.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		91-1295	91-1296	91-1297	91-1298	91-1299	91-1300	91-1301
DATE SAMPLED		25-Sep-91	25-Sep-91	25-Sep-91	26-Sep-91	26-Sep-91	26-Sep-91	26-Sep-91
% Passing	**3"**							
	2"	100	100	100	100	100	100	
	1.0"	99	95	99	99	98	98	100
Gravel	**0.75"**	99	85	95	97	95	93	99
	0.5"	94	69	83	92	83	86	91
	0.375"	86	59	73	87	74	76	82
	#4	65	43	49	68	55	51	61
	#10	46	33	33	45	38	35	44
Sand	**#40**	31	23	20	24	21	23	27
	#50	29	21	19	21	18	21	25
	#100	26	17	15	16	14	18	20
Silt/Clay	**#200**	23	14	13	12	11	16	17
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		NV	18	NV	NV	NV	NV	NV
PLASTIC INDEX		NP	NP	NP	NP	NP	NP	NP
AASHTO CLASSIFICATION		A-1-b	A-1-a	A-1-a	A-1-a	A-1-a	A-1-b	A-1-b
SOIL DESCRIPTION		SiSaGr	SiGr	SiSaGr	slSiSaGr	slSiSaGr	SiGr	SiSaGr
NATURAL MOISTURE								6.9
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR							82	
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								

REMARKS:
Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		91-22	91-22	91-23	91-23	91-24	91-25	91-25
DEPTH (feet)		0.0-5.0	3.0-4.0	3.0-6.0	3.0-4.0	4.0-7.0	3.0-5.0	9.0-13.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		91-1302	91-1303	91-1304	91-1305	91-1306	91-1307	91-1308
DATE SAMPLED		26-Sep-91	26-Sep-91	30-Sep-91	30-Sep-91	30-Sep-91	30-Sep-91	30-Sep-91
% Passing	**3"**	100		100		100		
	2"	98		99		98	100	
	1.0"	91		89		88	91	100
Gravel	**0.75"**	87		85		82	82	99
	0.5"	78		75		69	69	91
	0.375"	72		69		62	63	84
	#4	54		54		46	49	63
	#10	34		41		30	36	42
Sand	**#40**	17		25		13	22	23
	#50	11		18		11	20	21
	#100	8		14		9	14	16
Silt/Clay	**#200**	6		12		7	13	13
	0.02			8				
Hydro	**0.005**			3				
	0.002							
LIQUID LIMIT		NV		NV		NV	NV	20
PLASTIC INDEX		NP		NP		NP	NP	3
AASHTO CLASSIFICATION		A-1-a		A-1-a		A-1-a	A-1-a	A-1-a
SOIL DESCRIPTION		SaGr	SaGr	slSiSaGr	slSiSaGr	slSiSaGr	SiSaGr	SiSaGr
NATURAL MOISTURE			7.0		5.2			
ORGANICS								
SP.GR. (FINE)		2.64		2.63				
SP.GR. (COARSE)		2.63						
MAX DRY DENSITY		135.6						
OPTIMUM MOISTURE		5.9						
L.A. ABRASION		36		34				
DEGRADATION FACTOR		62		70		78		
SODIUM SULF. (CRSE)		15.7		8.5				
SODIUM SULF. (FINE)		13.1		3.7				

REMARKS:
Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA - NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY,9 Mile Hill-North
PROJECT #: 64899

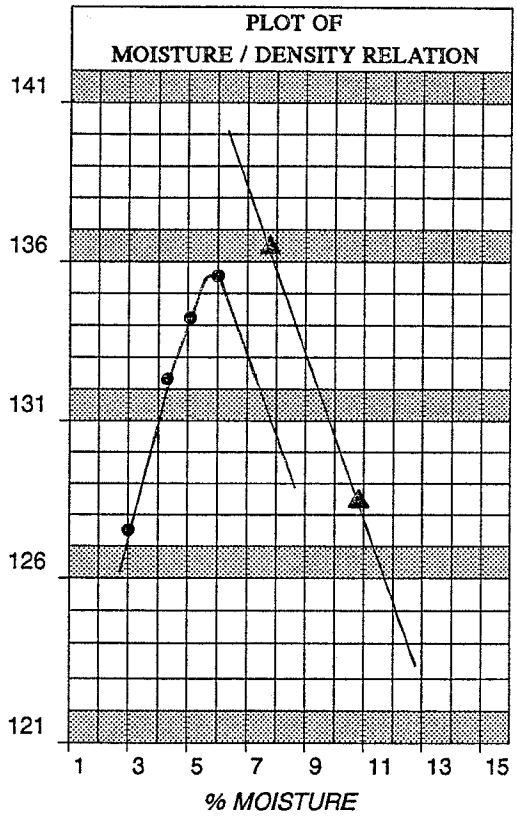
LAB #: 91-1302?
DATE SAMPLED: 9-26-91

TEST HOLE #: 91-22
SOURCE: M.S.65-3-0302
SAMPLED BY: GERARD

DEPTH: 0-5
STATION:
OFFSET:

SIEVE SIZE	% PASS
3"	100
2"	98
1 1/2"	95
1"	91
3/4"	87
1/2"	78
3/8"	72
#4	54
#8	38
#10	34
#16	27
#20	
#30	17
#40	
#50	11
#60	
#80	8
#100	8
#200	6

TEST	%	
OVERSIZE:		
DELETERIOUS:		
LL	NV	
PI	NP	
SP GR (APP)		
FINE AGG:	2.64	
COARSE AGG	2.63	
LA:	36	
DEG:	62	
		DEPTH
NATURAL MOISTURE:		
% ORGANICS:		



HYDRO	
.002mm	
.005mm	

	COARSE	FINE
Na2SO4 SOUNDNESS:	15.7	13.1

T-180D* TEST RESULT	REG. LAB	FIELD LAB
MAX DENSITY	135.6	
OPT MOIST	5.9	
ZAV SP GR	2.64	

* +3/4" MATERIAL REMOVED

ZAV POINT	128.4 @ 10.7 %
ZAV POINT	136.4 @ 7.8 %

AASHTO CLASS: A-1-a
TEXTURAL CLASS: SaGr
UNIFIED CLASS:

REMARKS:

MOLD NO.	1	2	3	4	5
DRY UNIT WT	127.5	132.3	134.2	135.6	
% MOISTURE	3.0	4.3	5.1	6.0	
FREE MOIST					

SIGNATURE: T.C. Harwood

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		91-25	91-26	91-26	91-27	91-27	91-27	91-28
DEPTH (feet)		10.0-11.0	1.0-8.0	9.0-11.0	2.0-7.0	8.0-12.0	10.0-11.0	5.0-7.0
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		91-1309	91-1310	91-1311	91-1312	91-1313	91-1314	91-1315
DATE SAMPLED		30-Sep-91	30-Sep-91	30-Sep-91	30-Sep-91	30-Sep-91	30-Sep-91	30-Sep-91
% Passing	**3"**							
	2"		100	100	100	100		100
	1.0"		80	98	96	98		98
Gravel	**0.75"**		67	93	91	96		94
	0.5"		48	80	78	85		85
	0.375"		39	69	68	75		77
	#4		24	48	48	54		57
	#10		18	34	37	37		38
Sand	**#40**		11	21	23	23		21
	#50		10	19	29	21		19
	#100		7	15	17	17		16
Silt/Clay	**#200**		6	12	15	13		13
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT			NV	19	NV	21		21
PLASTIC INDEX			NP	2	NP	3		3
AASHTO CLASSIFICATION			A-1-a	A-1-a	A-1-a	A-1-a		A-1-a
SOIL DESCRIPTION		SiSaGr	Gr	slSiSaGr	SiSaGr	SiSaGr	SiSaGr	SiSaGr
NATURAL MOISTURE		9.1					4.1	
ORGANICS								
SP.GR. (FINE)								
SP.GR. (COARSE)								
MAX DRY DENSITY								
OPTIMUM MOISTURE								
L.A. ABRASION								
DEGRADATION FACTOR			75					
SODIUM SULF. (CRSE)								
SODIUM SULF. (FINE)								
						(Bx)	(Bx)	

REMARKS:
Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA DEPARTMENT OF TRANSPORTATION - NORTHERN REGION
LABORATORY TESTING REPORT

PROJECT NAME: Dalton Highway 9 Mile Hill North
PROJECT NUMBER: F-065-2(03)
AKSAS NUMBER: 64899
SAMPLED BY: G. Brazo
SOURCE: MS 65-3-020-2

TEST HOLE NO.		91-29	91-32	91-34	91-34	91-35		
DEPTH (feet)		6.0-8.0	1.0-8.0	3.0-7.0	4.0-5.0	7.0-9.0		
STATION (LOCATION)								
OFFSET (feet)								
LAB NO.		91-1316	91-1317	91-1318	91-1319	91-1320		
DATE SAMPLED		30-Sep-91	30-Sep-91	1-Oct-91	1-Oct-91	1-Oct-91		
% Passing	**3"**		100	100		100		
	2"	100	96	95		95		
	1.0"	98	85	81		83		
Gravel	**0.75"**	96	77	73		78		
	0.5"	89	63	61		68		
	0.375"	81	54	54		62		
	#4	59	37	41		47		
	#10	41	27	31		35		
Sand	**#40**	26	16	21		18		
	#50	24	15	17		15		
	#100	20	12	14		12		
Silt/Clay	**#200**	18	10	12		10		
	0.02							
Hydro	**0.005**							
	0.002							
LIQUID LIMIT		NV	NV	19		21		
PLASTIC INDEX		NP	NP	NP		3		
AASHTO CLASSIFICATION		A-1-b	A-1-a	A-1-a		A-1-a		
SOIL DESCRIPTION		SiSaGr	slSiGr	slSiGr	slSiGr	slSiSaGr		
NATURAL MOISTURE		9.5			6.1			
ORGANICS								
SP.GR. (FINE)				2.65				
SP.GR. (COARSE)				2.63				
MAX DRY DENSITY				139.1				
OPTIMUM MOISTURE				5.7				
L.A. ABRASION			28	35				
DEGRADATION FACTOR				75		50		
SODIUM SULF. (CRSE)				11.4				
SODIUM SULF. (FINE)				7.6				

REMARKS:
Soil descriptions shown in parentheses are based on field determinations.
Gradation is based on material passing the 3" sieve, according to Alaska Test Method T-7.

STATE OF ALASKA - NORTHERN REGION
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
REGIONAL MATERIALS LAB

AGGREGATE TEST REPORT

PROJECT: DALTON HIGHWAY,9 Mile Hill-North
PROJECT #: 64899

LAB #: 91-1318
DATE SAMPLED: 10-1-91

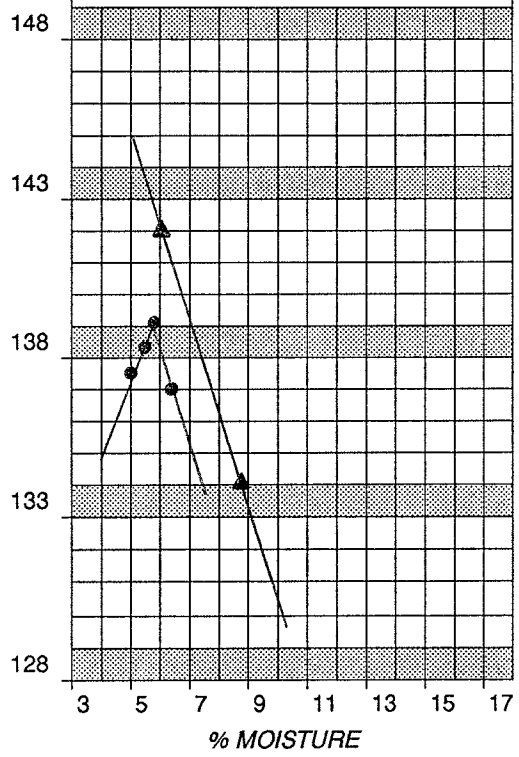
TEST HOLE #: 91-34
SOURCE: M.S.65-3-020-2
SAMPLED BY: G.Brazo

DEPTH: 3-7
STATION:
OFFSET:

SIEVE SIZE	% PASS
3"	100
2"	95
1 1/2"	91
1"	81
3/4"	73
1/2"	61
3/8"	54
#4	41
#8	33
#10	31
#16	28
#20	
#30	21
#40	
#50	17
#60	
#80	15
#100	14
#200	12

TEST	%	
OVERSIZE: DELETERIOUS:		
LL	19	
PI	NP	
SP GR (APP)		
FINE AGG:	2.65	
COARSE AGG	2.63	
LA:	35	
DEG:	75	
		DEPTH
NATURAL MOISTURE:		
% ORGANICS:		

PLOT OF
MOISTURE / DENSITY RELATION



HYDRO	
.002mm	
.005mm	

	COARSE	FINE
Na2SO4		
SOUNDNESS:	11.4	7.6

T-180D* TEST RESULT	REG. LAB	FIELD LAB
MAX DENSITY	139.1	
OPT MOIST	5.7	
ZAV SP GR	2.64	

* +3/4" MATERIAL REMOVED

ZAV POINT	134.0 @ 8.7 %
ZAV POINT	142.0 @ 6.1 %

AASHTO CLASS: A-1-a
TEXTURAL CLASS: sl.SiGr
UNIFIED CLASS:

REMARKS:

SIGNATURE:

TED C. HARWOOD
REGIONAL LAB SUPERVISOR

MOLD NO.	1	2	3	4	5
DRY UNIT WT	137.0	138.3	137.5	139.1	
% MOISTURE	6.3	5.5	5.0	5.7	
FREE MOIST	Hvy.Sw.			Sweat	

Table 4: Summary of material sites near the project area, Dalton Highway and Elliot Highway. Numbers in parentheses indicate the number of tests performed, %-200 is the percent passing the No. 200 sieve size, and PI is the plastic index.

Material Site	Highway, mile	Material description	Acreage	Access road / existing pit	Apparent land status	% -200	PI	LA Abrasion	Degradation
680-112-2[1]	Elliot, 71.1	highly fractured and weathered chert bedrock interlayered with limestone	34.4	yes / yes	permitted until 2009	2 – 33 (8)	NP (8)	23 – 29 (3)	4 – 84 (6)
680-105-2[1]	Elliot, 73.0	weathered chert bedrock	16.5	yes / yes	permitted until 2009	2 – 17 (12)	NP – 5 (12)	2 – 37 (8)	1 – 53 (7)
65-3-013-2[2]	Dalton, 19.2	shale and siltstone bedrock w/ granodioritic and gabbroic intrusions	89.6	yes / yes	permitted until 2014	---	---	13 – 25 (9)	0 – 52 (9)

[1] Additional information on these material sites can be found in Engineering Geology and Hydrology Report, Tolovana River to Livengood, Project No. S-0680(17) (1979), and Engineering Geology and Soils Report, Elliott Highway Snowshoe North, Mile 28 to Mile 73, Project No. F-065-1(6)/60208, Ledger Code No. 30148922 (Ondra, 1987).

[2] Additional information on this material site can be found in Engineering Geology and Soils Report, Dalton Highway 21 Mile Hill, Project No. 60362, Ledger Code No. 30164321 (Ondra, 1988).

References

Alaska Engineering Design Information System, https://m2.crrel.usace.army.mil/aedis/.

AASHTO, 1986, Standard Specifications for Highway Materials and Methods of Sampling and Testing, Parts I and II: American Association of State Highway and Transportation Officials, Washington, D.C., 14th Ed., 460 p.

Balvin, A. W., 1963, Route reconnaissance, Elliot Highway, Tatalina River to Tolovana River, Project No. S-0680 (15): Materials Section, Fairbanks District, Alaska Department of Highways, 4 p.

Brazo, G. M., 1991, Geotechnical report, Elliott Highway, mile 85, federal project number RS-0680(25), state project number 64658: Engineering Services, Northern Region, Alaska Department of Transportation and Public Facilities, 29 p.

Coulter, C. W., Hopkins, D. M., Karlstrom, T. N. V., Pewe, T. L., Warhaftig, C., Williams, J. R., 1965, Extent of Glaciation in Alaska, Map I-415: U.S. Geological Survey, Misc. Geological Investigations, 1 map.

Departments of the Army and the Air Force, 1988, Arctic and subarctic construction calculation methods for determination of depths of freeze and thaw in soils: Joint Departments of the Army and Air Force USA, Technical Manual TM 5-852-6 / AFR 88-19, Vol. 6.

Departments of the Army and the Air Force, 1987, Arctic and subarctic construction and general provisions: Joint Departments of the Army and Air Force USA, Technical Manual TM 5-852-1 / AFR 88-19, Vol. 1.

Esch, D. C., 1982, Prethawing by surface modifications: Alaska Department of Transportation and Public Facilities, Report No. FHWA-AK-RD-83-23, 40 p.

Goering, D. J., 1997, Air convection embankment experimental feature design, phase I: U.S. Department of Transportation, Federal Highway Administration, Report No. INE/TRC 97.06, AK-RD-98-01, 76 p.

Green, J. G., 2004, Alaska Department of Transportation and Public Facilities standard specifications for highway construction: Alaska Department of Transportation and Public Facilities, 432 p.

Hartman, C. W., and Johnson, P. R., 1984, Environmental atlas of Alaska (2nd ed): Institute of Water Resources, University of Alaska Fairbanks, Fairbanks, Alaska, 95 p.

Morrison, L. L. 1964, Preliminary soils investigation, Elliot Highway, Globe Creek to Eureka and Tatlina River to Tolovana River Section, project no. S-0680(15): Materials Section, Fairbanks District, Alaska Department of Highways, 5 p.

Ondra, P., 1988, Engineering geology and soils report, Dalton Highway 21 mile hill (project no. 60362, ledger code no. 30164321): Alaska Department of Transportation and Public Facilities, Northern Region Design and Construction, Fairbanks, Alaska.

Ondra, P., 1987, Engineering geology and soils report, Elliott Highway Snowshoe north, mile 28 to mile 73 (project no. F-065-1(6)/60208, ledger code no. 30148922): Alaska Department of Transportation and Public Facilities, Northern Region Design and Construction, Fairbanks, Alaska.

Romanovsky, V. E., 2004, How rapidly is permafrost changing and what are the impacts of these changes? Retrieved from: http://www.arctic.noaa.gov/essay_romanovsky.html.

Saunders, R. L., 1971, Engineering geology and soils report, Elliott Highway Snowshoe north, mile 28 to mile 73, project no. 065-1(6)/60208: Technical Services Section, Northern Region Design and Construction, Alaska Department of Transportation and Public Facilities, 36 p.

Saunders, R. L., 1971, Engineering geology and hydrology report, Elliot Highway, Tolovana River to Livengood, project no. F-065-1(2): Materials Section Fairbanks District, Alaska Department of Transportation, 104 p.

Staff (in progress), Geotechnical report, Dalton Highway MP 11-18 reconstruction, project no. NH-065-2(12)/62196: Alaska Department of Transportation and Public Facilities, Northern Region.

Staff, 2003, Alaska Geotechnical Procedures Manual: Alaska Department of Transportation and Public Facilities.

Wahrhaftig, C., 1965, Physiographic divisions of Alaska: U.S. Geological Survey Professional Paper 482, U.S. Government Printing Office, Washington D.C. 52 p., 6 pl.

Appendix A:

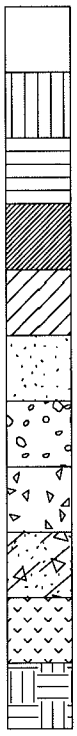
Symbols and definitions

Textural soils descriptions

AASHTO soils classification

SYMBOLS AND DEFINITIONS

BASIC MATERIAL SYMBOLS



ASPHALT

ORGANICS (Org)

CLAY (Cl)

ICE

SILT (Si)

SAND (Sa)

GRAVEL (Gr)

ANGULAR FRAGMENTS (Ang Frags)

COLLUVIUM (Coll) ④

BEDROCK (Bx), soft(Type)

BEDROCK (Bx), hard(Type)

SOFT OR HARD BASED ON DRILLING RATE

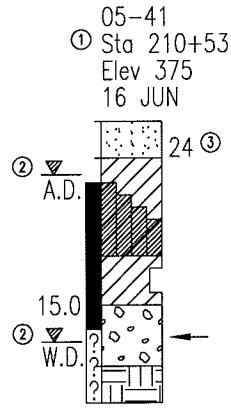
NOTE

MAIN COMPONENT (UPPER CASE..SOLID LINES)

MINOR COMPONENT (lower case..DASHED LINES)

④ MIXTURE OF ROCK FRAGMENTS IN SILT & SAND MATRIX

TYPICAL LOG



① Station value may also be on centerline e.g. Sta 210+53, CL or lat–long format e.g. N64.56789, W145.67890

② W.D.= WHILE DRILLING, A.D.= AFTER DRILLING

③ "N VALUE" INDICATES STANDARD PENETRATION TEST (1.4" I.D., 2.0" O.D. SAMPLER DRIVEN WITH 140 LB. HAMMER, 30" FREE FALL) AND IS SUM OF 2nd AND 3rd 6" OF PENETRATION.

PLAN VIEW SYMBOLS

POWER AUGER TEST HOLE (TH)

HAND AUGER TEST HOLE (TH)

EXPOSED MATERIAL

PROBE

HAND DUG TEST PIT (TP)

DOZER/BACKHOE TEST TRENCH (TT)

BODY OF WATER

FLOW DIRECTION

WASTE BERM

BANK

SWAMP

TREELINE

AASHTO SIZE DEFINITIONS

BOULDERS (Boulders)	12"+
COBBLES (Cobbles)	3" TO 12"
GRAVEL	#10 TO 3"
ANGULAR FRAGMENTS	#10 +
SAND	#200 TO #10
SILT	.002 mm TO #200
CLAY	MINUS .002 mm

SOIL DENSITY/CONSISTENCY DESCRIPTORS

NON–COHESIVE		COHESIVE	
RELATIVE DENSITY	BLOWS/FOOT (N) VALUE	CONSISTENCY	BLOWS/FOOT (N) VALUE
VERY LOOSE	< 4	VERY SOFT	< 2
LOOSE	5–10	SOFT	2–4
MEDIUM DENSE	11–30	FIRM	5–8
DENSE	31–50	STIFF	9–15
VERY DENSE	> 50	VERY STIFF	16–30
		HARD	> 30

TEST RESULTS

_._%–200	= % PASSING #200 SIEVE
NM _._%	= NATURAL MOISTURE
ORG _._%	= ORGANIC CONTENT
SSc _	= SODIUM SULFATE LOSS(coarse)
SSf _	= SODIUM SULFATE LOSS(fine)
LA _	= LOS ANGELES ABRASION
DEG _	= DEGRADATION
LL _	= LIQUID LIMIT (NV = no value)
PI _	= PLASTIC INDEX (NP = non–plastic)

COLOR

Bk = BLACK	Gy = GRAY	Tn = TAN
Bl = BLUE	Or = ORANGE	Wh = WHITE
Bn = BROWN	Rd = RED	Yw = YELLOW
Gn = GREEN		

MISC.

Tr	= TRACE
sl	= SLIGHTLY
hi	= HIGHLY
w/_	= WITH UNSPECIFIED AMOUNT
X'tls	= CRYSTALS
TH	= TEST HOLE
TT	= TEST TRENCH
TP	= TEST PIT

MOISTURE

dry	= < OPTIMUM*	DUSTY, DRY TO THE TOUCH
moist	~ OPTIMUM*	DAMP, NO VISIBLE WATER
wet	= > OPTIMUM*	VISIBLE FREE WATER

* OPTIMUM MOISTURE FOR MAXIMUM DENSITY

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ALASKA DEPARTMENT OF TRANSPORTATION TEXTURAL SOIL DESCRIPTION

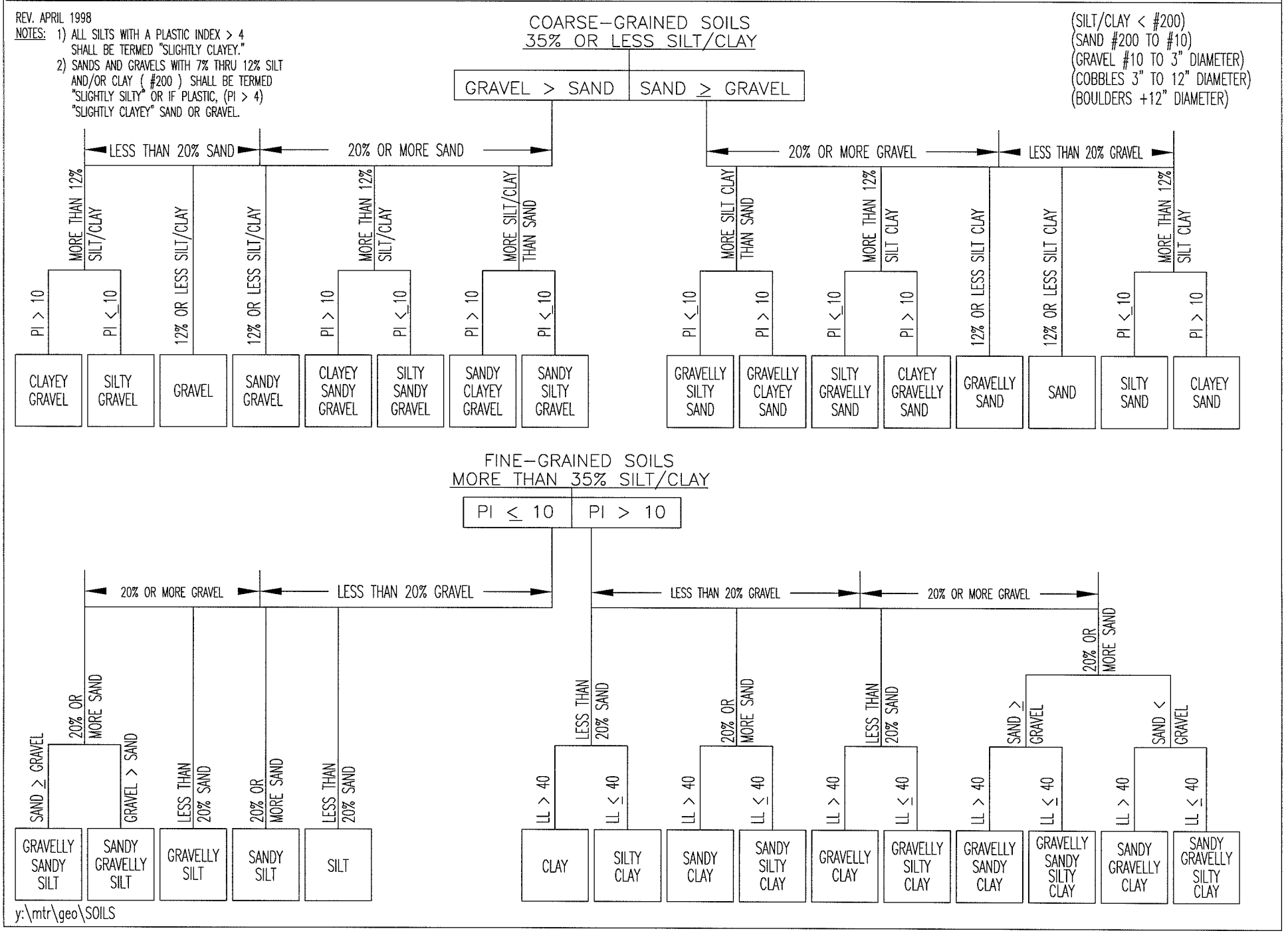

FIGURE 3

TABLE E-1. CLASSIFICATION OF SOILS AND SOIL AGGREGATE MIXTURES (AASHTO, 1991)

GENERAL CLASSIFICATION	GRANULAR MATERIALS 35% OR LESS PASSING No. 200 (0.075 mm)							SILT-CLAY MATERIALS MORE THAN 35% PASSING No. 200 (0.075 mm)			
	A-1			A-2							A-7
GROUP CLASSIFICATION	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-5 A-7-6
SIEVE ANALYSIS: % PASSING No. 10 (2.00 mm) No. 40 (0.425 mm) No. 200 (0.075 mm)	50 MAX. 30 MAX 15 MAX.	— 50 MAX. 25 MAX.	— 51 MAX. 10 MAX.	— — 35 MAX.	— — 35 MAX.	— — 35 MAX.	— — 35 MAX.	— — 36 MIN.	— — 36 MIN.	— — 36 MIN.	— — 36 MIN.
CHARACTERISTICS OF FRACTION PASSING No. 40 (0.425 mm) LIQUID LIMIT PLASTICITY INDEX	— 6 MAX.		— N.P.	40 MAX. 10 MAX.	41 MIN. 10 MAX.	40 MAX. 11 MIN.	41 MIN. 11 MIN.	40 MAX. 10 MAX.	41 MIN. 10 MAX.	40 MAX. 11 MIN.	41 MIN. 11 MIN.[1]
USUAL TYPES OF SIGNIFICANT CONSTITUENT MATERIAL	STONE FRAGMENTS, GRAVEL, & SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS	
GENERAL RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR			

[1] PLASTICITY INDEX OF A-7-5 SUBGROUP IS EQUAL TO OR LESS THAN LL MINUS 30.
PLASTICITY INDEX OF A-7-6 SUBGROUP IS GREATER THAN LL MINUS 30.

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Appendix B:

Dalton 9 Mile Hill 2004 seismic refraction summary
Written by: J. Reinikainen

Dalton 9 Mile Hill 2004 seismic refraction summary

Seismic Data Limitations

The seismic refraction survey conducted for this project has inherent and site specific limitations. First, the soil and rock materials intercepted cannot be described as a simple horizontal layer-cake structure. The rock strata are bedded and variably oriented at steeply dipping angles. Layered velocity models created from the seismic data do not indicate soil or rock material layers. Rather, the calculated velocities indicate "layers" based on changes in the way the soil and rock transmits seismic waves. The "layers" of different velocity may coincide with material type in some cases, but not where steeply dipping beds are present, as on this project. The estimated depths or thicknesses of "layers" do not represent abrupt changes from soil to rock, or soft rock to hard rock. The boundaries to the "layers" may be a zone many feet or tens of feet thick. Second, the presence of frozen soil and rock at the project site affects the apparent seismic velocities of soil and rock. If high-velocity layers occur over lower velocity layers, the calculated velocities may be inaccurate. This can be the case where frozen materials occur, as on this project. Third, the test holes used to help validate the seismic velocity results were drilled about fifteen years ago. While it is unlikely the soil and rock types have changed, there may have been changes in the state of the frozen zones and water content that affect seismic velocity. In addition, the drilled test holes were advanced using auger techniques; no cores were taken. Our understanding of the geological and engineering characteristics of the soil and rock is limited by the lack of samples to observe and analyze. The differentiation among rock materials was made in reliance on the rate of auger penetration into the formation and divided into just two categories: soft rock and hard rock.

Summary

Northern Region Materials Section (NRMS) personnel conducted a seismic refraction survey for the Dalton Highway 9 Mile Hill North Project. The purpose of the investigation was to investigate a proposed "through-cut" near the beginning of project where drilling data is limited, and a material source. At the request of Tiff Vincent, project manager, NRMS personnel conducted a limited seismic investigation during August 2004. The layout consisted of three seismic refraction lines at proposed highway cuts near Station "L_2" 28+00 and Station "L_2" 46+20, and one control line in MS 65-3-012-2.

Table B-1 contains a summary of the results of the seismic refraction survey. As per the Caterpillar Performance Handbook (24^{th} edition), unfrozen material with a seismic velocity above 6500 fps is considered marginally rippable or non-rippable with a Caterpillar D9N or equivalent ripper in good condition. Frozen material with lower seismic velocities may not be rippable.

Table B-1: Results of the 2004 seismic refraction survey

Seismic line	Location	Direction	Seismic Layer	Velocity (fps)	Estimated thickness (ft)
1	Proposed cut near Station "L_2" 28+00	SE-NW	1	1980	20
			2	6590	90-110
			3	11610	---
2	Proposed cut near Station "L_2" 28+00	SW-NE	1	5440	40-60
			2	11710	---
3	MS 65-3-012-3	SW-NE	1	9310	---
4	Proposed cut near Station "L_2" 46+20	SW-NE	1	6430	60-100
			2	12860	---

Methods

NRMS personnel mobilized to the site of Dalton Highway 9 Mile Hill North for two days, between 8/27/04 and 8/28/04. J. Reinikainen, engineering assistant, directed the field investigation. NRMS staff, S. Schlichting and J. Reinikainen, carried out the seismic survey in the field and interpreted the results in the office.

A Strataview NZ48 was used for this project. It is a 48-channel seismograph. The seismograph and the phone/cables are available directly from the Geometrics, Inc. Typical systems include geophones, cables, striker plate, and trigger extension cables. Seismic refraction surveying requires a two-person crew. The geophones are set in place at regular intervals (usually between 20 and 35 ft). A seismic source (10-lb. hammer striking metal plate) creates direct compression waves and refracted waves that are sensed by the array of geophones. The seismograph records the time of arrival of all waves, using the moment the hammer hits the ground as time zero. The seismograph is linked to a laptop computer. A user plots the travel time against the source to geophone distance to produce a time/distance (T/D) plot. Finally, line segments, slope, and break points in the T/D plot can be analyzed to identify the number of layers and depths to each layer. SeisImager software (Pickwin v. 2.84 and Plotrefra v. 2.66) was used for this project. Data files were read into the software, and first breaks were identified and saved into a file. Velocity models were constructed using the time-term method of analysis.

Seismic lines No. 1 and No. 2

Seismic line No. 1 was located near Station"L_2" 28+00. The line was on the south side of the road, parallel with the Dalton Highway along the ditch line. The ground at this location has been disturbed by construction of the highway. Seismic line No. 2 also was located near Station"L_2" 28+00 on the south side of the highway. The line was positioned perpendicular with the highway in undisturbed ground. The vegetation consisted of thickets of stunted spruce, birch, and willow. In the locations where geophones were placed, the organic mat was a foot and a half thick, and the soil typically was frozen below the organic mat.

Two test holes from the 1990 and 1991 geotechnical investigations were drilled at this station on the north side of the highway. Test Hole 90-08 was drilled through the shoulder of the existing embankment, and consisted of 11.0 ft of broken chert fill underlain by silt to 14.0 ft, which was the total depth of the test hole. Frozen ground was intercepted at 12.0 ft below the highway surface. Test Hole 91-01 was drilled 50 ft to the right of the proposed alignment. Below a 0.5-ft

thick organic mat, the foundation soils consisted of 4.5 ft of silt, underlain by 2.0 ft of silty sandy gravel on top of chert bedrock. Drilling rates indicated that the bedrock was soft to the depth drilled (i.e., 29 ft). Frozen ground was intercepted at 1.0 ft beneath the surface, and the silt layer contained up to 50% visible ice.

Seismic line No. 3

Seismic line No. 3 was setup as a control line to gain an understanding about the seismic velocity of chert in MS 65-3-012-2. The control line was in the floor of the pit in MS 65-3-012-2. Several geophones were hard to place in the ground due to rocky terrain where there was little granular soil. None of the 1990 test holes were drilled in the immediate vicinity of this seismic line. We refer the reader to the section on MS 65-3-012-2 for logs of test holes drilled in other areas of the material site.

In 1990, NRMS personnel, under the direction of G. Brazo, conducted a seismic refraction survey in MS 65-3-012-2. The data was gathered using a Nimbus Model ES-125 Signal Enhancement seismograph, equipped with one geophone. Data was collected in the field and processed in the office using graphical solutions. At the time of the survey, data was collected only in one direction. Reverse lines are necessary for determining the presence of a dipping layer and generally validate the survey as the total times of arrival can be compared. Due to these factors, the seismic velocities computed and presented have inherent ambiguities. These seismic velocities ranged between 1700 fps to 20,000 fps.

Seismic line No. 4

Seismic line No. 4 was located near Station "L_2" 46+20 on the north side of the highway. The line was positioned perpendicular with the highway in undisturbed ground. The vegetation consisted of thickets of stunted spruce and dwarf birch. The previous drilling programs in 1990 and 1991 did not investigate in the immediate vicinity of seismic line No.4. In the locations where geophones were placed, the organic mat was a foot and a half thick, and the soil typically was frozen below the organic mat.

References

Redpath, B. B., 1973, Seismic Refraction Exploration for Engineering Site Investigations.

Roethlisberger, H., 1972, Seismic Exploration in Cold Regions, CRREL Monograph 11-A2a.

Tubbs, D. W., Koloski, J. W., and Schwarz, S. D., 1989, Geotechnical Properties of Geologic Materials, Washington Division of Geology and Earth Resources Bulletin 78, 1989.

DOT&PF Design and Reconnaissance Section, 1990, Dalton Highway Improvements 9 Mile Hill North, 21 Mile Hill F-065-2(3)/64899, 60362.

Appendix C:

April 2, 1992 Memorandum
December 20, 1993 Memorandum

MEMORANDUM

State of Alaska
Department of Transportation & Public Facilities

To: Joe Keeney
Project Manager
Northern Region

Date: April 2, 1992

From: Hal Livingston
Sr Engineering Geologist
Northern Region

Re: Preliminary Geotechnical Recommendations, Dalton Highway 9 Mile Hill North, F-065-2(3)/64899, "L_1" and "L_2" lines

The 9 Mile Hill realignment begins at about Mile 7 on the existing highway, diverges northwest at about Mile 8, touches the highway at Mile 9.2, continues northwest (east of the highway) and rejoins the highway at about Mile 11. The L_2 line is approximately in the middle of the proposed realignment on a relatively flat ridge. The location of the L_2 line avoids a steep cross slope and a 70-foot high fill on the L_1 line.

Vegetation along the realignment is generally 1 to 6-inch diameter black spruce trees on 1 to 10-foot centers. Aspen trees from 2 to 12 inches in diameter on 5 to 25-foot centers predominate in some of the larger draws.

GENERAL COMMENTS AND RECOMMENDATIONS

1. Six inches of surfacing is planned for this project.

2. Use Selected Material, Type C, Modified, with a maximum of 30 percent P-200 for the embankment. Using a Type C Modified material will allow chert bedrock to be placed in the embankment and will preclude the use of silt within 48 inches of the road surface.

3. Use a minimum fill thickness of 48 inches. Include the surfacing in this thickness. Any additional fill, below this 48-inch layer of Selected Material, Type C Modified, may be Selected Material, Type C.

4. For quantity calculations, use a 10 percent shrink factor on the chert bedrock.

5. Waste all silt, organic silt, ice rich soils and ice through-out the project where cutting is necessary. The silt may be placed outside the 1½:1 fill slopes for flattening or in stabilizing berms to provide lateral support in fill areas.

The following are based on the preliminary gradelines, L_1 and L_2 provided by the designer.

STATION TO STATION DESCRIPTIONS AND RECOMMENDATIONS

STATION L_1 10+00 (BOP) TO STATION L_2 47+00

DESCRIPTIONS

A 15 to 40-foot deep cut is planned for this interval. Foundation materials include broken chert in the existing fill, silt, colluvium and chert bedrock.

Ice-rich silt and colluvium, 3 to 6 feet thick, were noted over the bedrock in undisturbed areas.

RECOMMENDATIONS

1. Use the existing fill and chert bedrock from this proposed cut for Selected Material, Type C, Modified.

2. Use one foot of Selected Material, Type C, Modified, through the above cut, beneath the surfacing material.

3. Deepen and/or widen this cut for useable excavation.

4. For quantity calculations, expect negligible settlements through this cut.

STATION L_2 47+00 TO STATION L_2 55+00

DESCRIPTION

A 50-foot high fill is proposed for this interval. Foundation materials are silt, ice and colluvium over bedrock which is 3.5 to 18 feet beneath the surface.

RECOMMENDATIONS

1. Use a benched foundation between Stations L_2 47+00 and L_2 50+00 and L_2 53+00 and L_2 55+00. Bench to bedrock, about 5 feet beneath the surface.

2. Use 3:1 fill slopes or toe stabilizing berms left and right between Stations L_2 50+00 and L_2 and 53+00.

3. For quantity calculations, expect negligible settlements.

STATION L_2 55+00 TO STATION L_2 99+00

DESCRIPTION

This interval is a fill section with a left side ditch cut to Station L_2 65+00. A 3 to 12-foot deep cut is proposed between Stations L_2 65+00 and L_2 70+50. The remainder of the interval is a 5 to 25-foot high fill. Ice and silt are the foundation materials over bedrock which is 5 to 50 feet beneath the surface.

RECOMMENDATIONS

OPTION 1

1. Raise the grade, 3 to 5 feet to avoid ditch cutting up to Station L_2 65+00. This will require increasing the fill height back station.

2. With the grade raise, use a 4-inch thick layer of board insulation placed 36 inches beneath the road surface between Stations L_2 55+00 to L_2 81+00, Stations L_2 86+00 to L_2 90+00 and Stations L_2 95+50 to L_2 99+00. Use a 12-inch thick leveling layer of Selected Material, Type C, Modified, beneath

the board insulation.

3. With the grade raise, use 3:1 fill slopes or toe stabilizing berms on the right and left between Stations L_2 81+00 to L_2 86+00 and Stations L_2 90+00 to L_2 95+50 where the fill height exceeds 10 feet.

OPTION 2

1. Subexcavate between Stations L_2 55+00 to L_2 80+00 to provide room for a minimum 10-foot thickness of Selected Material, Type C, Modified. A special backslope design will be used in the ice and silt.

2. Use insulation board ahead of Station L_2 86+00 as recommended in Option 1.2 and the 3:1 fill slopes toe stabilizing berms recommended in Option 1.3.

OPTION 3

1. Lower the grade between Stations L_2 55+00 and L_2 93+00 to place the new road on bedrock up to Station L_2 79+00. The grade lowering would be about 15 feet at L_2 61+00, 50 feet at L_2 70+00, 45 feet at L_2 79+00, 20 feet at L_2 89+00 and 25 feet at L_2 99+00. A special backslope design will be used in the ice and silt.

2. With the lower grade in Option 3.1, use 4 inches of board insulation, as described in Option 1.2, between Stations L_2 79+00 and L_2 99+00.

3. As an alternative to Option 3.2, subexcavate to provide room for 10 feet of Selected Material, Type C, Modified between Stations L_2 79+00 and L_2 99+00.

For quantity calculations, expect 6 inches of settlement with Option 3.3 and negligible settlement with the other options.

STATION L_2 99+00 TO STATION L_2 118+00

DESCRIPTION

The proposed grade is a 15 to 35-foot deep full cut. Foundation materials are ice and silt over bedrock which is 36 to 70 feet beneath the ground surface and 5 to 35 feet beneath the proposed grade.

RECOMMENDATIONS

OPTION 1

Lower the proposed grade 5 to 25 feet and place the roadway on bedrock. This option could provide some useable excavation.

OPTION 2

With the proposed grade, subexcavate 10 feet as described in Option 2.1 in the previous interval.

OPTION 3

With the proposed grade, use the insulated embankment design discussed in Option 1.2 in the previous interval.

OPTION 4

Raise the grade sufficiently to avoid the cut. This will create 45 to 75-foot high fills back and ahead of the cut.

Options 1,2, and 3 will require a special back slope design in the ice and silt.

Expect 6 inches of settlement with Option 2 and negligible settlements with the other options.

STATION L_2 118+00 TO STATION L_2 164+00 (EOP)

DESCRIPTION

A 3 to 15-foot high fill section is proposed here and would remain a fill with all of the above options. Foundation materials are ice and silt.

RECOMMENDATIONS

OPTION 1

1. With the proposed grade, use 3:1 fill slopes or toe stabilizing berms on the left and right of Stations L_2 118+00 to L_1 127+50, and L_2 143+00 to L_2 158+00 and on the right only, Stations L_2 158+00 to L_2 164+00.

2. With the proposed grade use an insulated embankment design, as discussed above, between Stations L_2 127+50 to 143+00.

3. Raise the grade sufficiently to avoid ditch cutting between Stations L_2 132+00 and 142+00.

OPTION 2

With the proposed grade and as an alternative to options 8.2 and 8.3, subexcavate sufficiently to provide room for a total embankment thickness of 10 feet between Stations L_2 127+50 and L_2 143+00.

Expect negligible settlements with both options.

BORROW SITES

MS 65-3-012-2

This site is located on a hilltop about a quarter of a mile east of Mile 7.5 Dalton Highway. The site has been extensively excavated; chert bedrock is exposed throughout. Drill reaction indicated the chert is generally soft with

harder layers. Seismic data indicates velocities in excess of 6700 feet per second from 14 to 25 feet beneath the surface of the pit. Blasting may be necessary to remove the harder bedrock.

Laboratory test results of materials sampled from this site indicated, the chert bedrock meets the requirements for Selected Material, Type C, Modified and Selected Material, Type C. The bedrock is not recommended for surfacing materials.

MS 65-3-020-2, LOST CREEK RIDGE

Test holes and test trenches were dug in this north-south trending ridge situated above Lost Creek at Mile 6 Dalton Highway. Slightly silty sandy gravel is exposed in a full road cut there. The thickness of the gravels increases from about 9 feet some 1000 feet north of the road to at least 62 feet some 1100 feet south of the road. Laboratory test results of materials sampled from this site indicate the slightly silty sandy gravels generally meet the requirements for crushed subbase and Selected Material, Type A, B, and C.

GMB/mjb

xc: Paul W. Misterek, P.E., Northern Region
Monte K. Weaver, Chief of Geotechnical Services

MEMORANDUM

State of Alaska
Department of Transportation & Public Facilities

To: Joe Keeney
Project Manager
Northern Region

Date: December 20, 1993

Telephone No. 451-2232

Thru: Hal Livingston
Sr. Engineering Geologist
Northern Region

From: Gary Brazo
Engineering Geologist
Northern Region

Re: Preliminary Geotechnical Recommendations, Dalton Highway, 9 Mile Hill

The following comments and recommendations have been excerpted from a preliminary geotechnical report and are intended as a guide in the preliminary design of this project. The proposed grade involves several full cut sections through the ice and silt. Several options for designing a relatively stable embankment over these materials are discussed below.

GENERAL COMMENTS AND RECOMMENDATIONS

1. Station to station recommendations are based on a preliminary gradeline.

2. A six-inch thick layer of crushed surfacing is planned for this project.

3. Use Selected Material, Type C, Modified, with a maximum of 30 percent P-200 for the embankment. Using a Type C, Modified material will allow chert bedrock to be placed in the embankment and will preclude the use of silt within 48 inches of the road surface.

4. Use a minimum fill thickness of 48 inches, including the crushed surfacing. Any fill, below this 48-inch layer of Selected Material, Type C, Modified, may be Selected Material, Type C.

5. In bedrock cuts, use a minimum fill thickness of 18 inches which includes the crushed surfacing.

6. For quantity calculations, use a 10 percent shrink factor on the chert bedrock.

7. Waste all silt, organic silt, ice-rich soils and ice throughout the project where cutting is necessary. The silt may be placed outside the 1½:1 fill slopes for flattening or in stabilizing berms to provide lateral support in the fill areas. A 5 foot thick layer of rock may be necessary on the face of the waste piles to provide stability and prevent siltation as they thaw.

8. A number of full cuts in ice and frozen silt are planned but should be avoided if possible. Where they are unavoidable, several options are possible:

OPTION 1 is to lower the grade, e.g., increase the cut depth, and place the embankment directly on bedrock.

OPTION 2 is to excavate 10 feet beneath the proposed grade and use a 10-foot thick embankment to minimize thaw beneath the road.

OPTION 3 is to excavate 4 feet beneath the proposed grade and use a 4-foot thick embankment with a 4-inch thick layer of board insulation placed 3 feet beneath the final grade to reduce thaw beneath the road.

9. With all of the above options, a special cut slope in the ice and silt is required to provide for the thaw and stabilization of the backslope materials. The ditch width, W, is 0.75 of the vertical cut height, H; W = 0.75 H.

10. Use cut slopes no steeper than 1½:1 in the colluvium and chert bedrock.

11. Seed all fill slopes.

12. Hand clearing is recommended beneath all fill sections and 10 feet beyond the cut face in ice and silt. A Hydro-Ax or equivalent may be substituted for hand tools provided the natural ground is sufficiently frozen to support the equipment.

Take note that Options 2 and 3 will reduce but not eliminate the amount of thaw beneath the embankment when compared to the thaw beneath a 4-foot uninsulated embankment.

STATION TO STATION DESCRIPTIONS, COMMENTS AND RECOMMENDATIONS

Vegetation along the realignment is generally 1 to 5-inch diameter black spruce trees on 1 to 10-foot centers. Aspen trees, from 2 to 12 inches in diameter on 5 to 25-foot centers, predominate in some of the larger draws. Willow and alder shrubs to 10 feet high grow among the trees. Low ground cover includes cranberry, blueberry, and labrador tea shrubs and moss. Grass grows in some of the draws and on some hillsides.

STATION L_1 10+00 (BOP) TO STATION L_2 47+00

DESCRIPTIONS AND COMMENTS

A 15 to 40-foot deep cut is planned for this interval. Foundation materials include broken chert in the existing fill and ice-rich silt and colluvium, 3 to 6 feet thick, over bedrock in uncleared areas.

RECOMMENDATIONS

1. Laboratory test results of sampled materials indicate the existing fill and the chert bedrock from the proposed cut generally meet the requirements for Selected Material, Type C, Modified.

2. Use one foot of Selected Material, Type C, Modified, over the bedrock. Surface with 0.5 foot of crushed surfacing.

3. Deepen and/or widen this cut for useable bedrock excavation.

4. For quantity calculations, expect negligible settlements.

STATION L_2 47+00 TO STATION L_2 55+00

DESCRIPTION AND COMMENTS

A 50-foot high fill is proposed for this interval. Foundation materials include a 3.5 to 18-foot thick layer of silt, ice, and colluvium over bedrock.

RECOMMENDATIONS

1. Use a benched foundation between Stations L_2 47+00 and L_2 50+00 and L_2 53+00 and L_2 55+00. Bench to bedrock, approximately 5 feet beneath the surface.

2. Use 3:1 fill slopes or stabilizing berms left and right between Stations L_2 50+00 and L_2 53+00.

3. For quantity calculations, expect negligible settlements.

STATION L_2 55+00 TO STATION L_2 99+00

DESCRIPTION AND COMMENTS

This interval includes a fill section with a left side ditch cut to Station L_2 65+00 and a 3 to 12-foot deep cut between Stations L_2 65+00 and L_2 70+50. The remainder of the interval is a 5 to 25-foot high fill. Ice and silt are the foundation materials with bedrock 5 to 50 feet beneath the surface.

RECOMMENDATIONS
OPTION 1

1. Raise the grade 3 to 5 feet up to Station L_2 65+00 to avoid ditch cutting. This will require increasing the fill height back station.

2. With the grade raise, use a 4-inch thick layer of board insulation placed 36 inches beneath the road surface between Stations L_2 55+00 and L_2 81+00, Stations L_2 86+00 and L_2 90+00, and between Stations L_2 95+00 and L_2 99+00.

3. With the grade raise, use 3:1 fill slopes or stabilizing berms on the right and left from Stations L_2 81+00 to L_2 86+00 and Stations L_2 90+00 to L_2 95+50 where the height of the fill at the shoulder exceeds 10 feet.

OPTION 2

1. With the proposed grade subexcavate between Stations L_2 55+00 and L_2 80+00 to provide room for a minimum 10-foot embankment thickness. A special backslope design will be needed in the ice and silt.

2. Use insulation board ahead of Station L_2 86+00 as recommended in Option

1.2. Use the 3:1 fill slopes or stabilizing berms where recommended in Option 1.3.

OPTION 3

1. Lower the grade between Stations L_2 55+00 and L_2 93+00 and place the new road on bedrock up to Station L_2 79+00. The grade would be about 15 feet lower at L_2 61+00, 50 feet lower at L_2 70+00, 45 feet lower at L_2 79+00, 20 feet lower at L_2 89+00, and 25 feet lower at L_2 99+00. A special backslope design will be needed in the ice and silt.

2. With the lower grade in Option 3.1, use 4 inches of board insulation, between Stations L_2 79+00 and L_2 99+00.

3. As an alternative to Option 3.2, subexcavate to provide room for 10 feet of embankment between Stations L_2 79+00 and L_2 99+00.

For quantity calculations, expect 0.5 feet of settlement with Option 3.3 and negligible settlement with the other options.

STATION L_2 99+00 TO STATION L_2 118+00
DESCRIPTION

The proposed grade is a 15 to 35-foot deep cut. Foundation materials are ice and silt over bedrock 36 to 70 feet beneath the ground surface and 5 to 35 feet beneath the proposed grade.

RECOMMENDATIONS
OPTION 1

Lower the proposed grade to place the roadway on bedrock. This option may provide some useable bedrock excavation.

OPTION 2

With the proposed grade, subexcavate to provide room for 10 feet of embankment.

OPTION 3

With the proposed grade, subexcavate 4 feet and use the insulated embankment design.

OPTION 4

Raise the grade sufficiently to avoid the cut. This will create 45 to 75-foot high fill sections back and ahead of the cut.

For quantity calculations, expect 0.5 feet of settlement with Option 2 and negligible settlements with the other options.

STATION L_2 118+00 TO STATION L_1 164+00 (EOP)

DESCRIPTION

A 3 to 15-foot high fill section is proposed for this interval with all of the above options for the previous interval.

RECOMMENDATIONS

OPTION 1

1. With the proposed grade, use 3:1 fill slopes or stabilizing berms on the left and right of Stations L_2 118+00 to L_1 127+50, and L_1 143+00 to L_1 158+00 and on the right only, Stations L_1 158+00 to L_1 164+00.

2. With the proposed grade use the insulated embankment design between Stations L_1 127+50 and $L_1$143+00.

3. Raise the grade sufficiently to avoid ditch cutting between Stations L_1 132+00 and $L_1$142+00.

OPTION 2

With the proposed grade and as an alternative to options 1.2 and 1.3, subexcavate sufficiently to provide room for an embankment thickness of 10 feet between Stations L_1 127+50 and L_1 143+00.

For quantity calculations, expect negligible settlements with both options.

MATERIAL SITES

Two material sites were investigated. MS 65-3-012-2 is a permitted chert bedrock source east of Mile 7.5 of the Prudhoe Bay Highway (Dalton Hwy). MS 65-3-020-2 is an alluvial sand and gravel source at Mile 6 that is being applied for at this time.

mb

cc: Paul Misterek, Technical Services Engineer