Chapter 300

Bases - 18

This chapter is not part of the Project's specifications, but is a guide for project personnel in interpreting CDOT specifications, understanding ASTM, AASHTO, and Colorado Procedures (CPs) for testing, and for completing CDOT forms.

The design and construction of a pavement structure may include one or more base courses. A base course is a layer of material below the wearing surface of a pavement. Bases may be constructed of gravels, mixtures of soil and aggregate, mixtures of asphalt and aggregate, mixtures of cement and aggregate or soil, or other innovative materials. Bases may be made of unbound materials, such as gravel, or bound materials, such as lime treated subgrade.

Base courses under concrete pavements provide a drainage layer, reduce pumping, provide protection against frost damage, and provide support for the heavy equipment used for placing concrete pavements. There is some increase in structural capacity when a base is placed under a concrete pavement, but it is typically not a significant amount.

Base courses under flexible pavements provide a significant increase in structural capacity. Pavement design of flexible pavement depends on the wheel loads being distributed over a greater area as the depth of the pavement structure increases. There are the added benefits of improved drainage and protection against frost damage.

ITEM 206 STRUCTURE BACKFILL
ITEM 304 AGGREGATE BASE COURSE

Compaction of unbound bases is important for the stability of the pavement it supports. The maximum dry density is established in the laboratory before construction. During construction measurements of the base dry density are compared to the maximum dry density. The requirements for compaction of aggregate base course (ABC) are shown in Subsection 304.06 of the Standard Specifications for Road and Bridge Construction. Structure Backfill has similar requirements as shown in Subsection 206.03.

Two methods to determine maximum dry density of soils are AASHTO T 99 and AASHTO T 180. AASHTO T 99 is similar to ASTM D 698 and is commonly referred to as the Proctor Test, as it was first proposed by R. R. Proctor in 1933. AASHTO T 99 uses a 5.5 lb. rammer dropped from 12 in. When a 4 in. mold is used, three layers are compacted with 25 blows on each layer. When a 6 in. mold is used, three layers are compacted with 56 blows on each layer. AASHTO T 99 results in a compactive effort of 12,400 ft-lbf/ft^3. AASHTO T 180 is similar to ASTM D 1557 and is commonly referred to as the Modified Proctor Test. AASHTO T 180 uses a 10 lb. rammer dropped from 18 in. When a 4 in. mold is used, five layers are compacted with 25 blows on each layer. When a 6 in. mold is used, five layers are compacted with 56 blows on each layer. This results in a compactive effort of 56,000 ft-lbf/ft^3. Comparing compactive efforts, AASHTO T 180 produces four and a half times the compactive effort than a sample receives compacted according to AASHTO T 99.

AASHTO T 99 is the appropriate standard for compaction of cohesive soils, particularly if there is the potential for swelling when saturated. AASHTO T 180 is appropriate for granular soils, such as aggregate base course and Structure Backfill, Class 1.

There are four methods of determining moisture-density relationships by AASHTO T 180:

- Method A uses a 4 in. mold and the fraction of the soil passing a No. 4 sieve. AASHTO states that this is applicable to soil mixtures that have 40% or less retained on a No. 4 sieve.

- Method B uses a 6 in. mold and the fraction of the soil passing a No. 4 sieve. AASHTO states that this is applicable to soil mixtures that have 40% or less retained on a No. 4 sieve.

- Method C uses a 4 in. mold and the fraction of the soil passing a 3/4 in. sieve. AASHTO

states that this is applicable to soil mixtures that have 30% or less retained on a 3/4 in. sieve.

- Method D uses a 6 in. mold and the fraction of the soil passing a 3/4 in. sieve. AASHTO states that this is applicable to soil mixtures that have 30% or less retained on a 3/4 in. sieve.

The gradation requirements for Class 1 Structure Backfill and ABC are shown in Subsections 703.08 and 703.03 respectively. A review of the gradation requirements shows that many granular materials will meet the gradation requirements and exceed the limits of application stated in AASHTO T 180.

Colorado has developed a rock correction formula in Colorado Procedure 23 (CP 23) when AASHTO T180 is used:

$$MDD = (P_f \times D_f + P_c \times 0.95\ D_c) / 100$$

The standard practice within the Department follows:

- 110 lbs. of granular material are sampled and sent to the laboratory before construction begins. This would typically require two standard sample bags.
- The material is separated into two fractions, material retained on a No. 4 sieve and material passing a No. 4 sieve.
- The specific gravity and absorption of the material retained on a No. 4 sieve is determined according to AASHTO T 85 Specific Gravity and Absorption of Coarse Aggregate.
- The maximum dry density and optimum moisture of the material passing a No. 4 sieve is determined according to AASHTO T 180, Method A.
- For bases with crushed concrete or reclaimed asphalt pavement (RAP), an accurate specific gravity determination is difficult to make. For these materials T 180, Method D is used.
- Method D may be used if more than 30% of the material is retained on the No. 4 sieve, but has 30% or less of the material retained on the ¾ inch sieve. When Method D is used, use the above procedure but substitute the 3/4 inch sieve for the No. 4 sieve.

During construction the control of compaction follows according to the plans, specifications, and the Frequency Guide Schedule for Minimum Materials Sampling, Testing and Inspection. Each field test must include a separation of the sample into the two fractions, material retained on a No. 4 sieve and material passing a No. 4 sieve. Percent relative compaction is determined according to CP 25. CP 23 is used to correct the maximum dry density and optimum moisture for soil-rock mixtures with more than 5% material retained on a No. 4 sieve.

ITEM 308 PORTLAND CEMENT & FLY ASH

Sources of portland cement and/or fly ash are listed on the Department's Approved Product List. To verify a specific cementitious material that may be considered for a project check if the supplier / manufacturer of the cement or fly ash is on the Approved Products List at the web site address of:

www.codot.gov/business/apl .

If a manufacturer wants to add a cement or fly ash source use the same web site and follow the instructions within Notice to Manufacturers and also follow all references within CP 11.

CDOT Forms - Applicable for Bases, Examples and Instructions

ATTENTION!

All of the referenced CDOT Materials Forms above, except those indicated as "*computer output*", have been revised in 2014. All of these forms state: *Previous editions are obsolete and may not be used*. The use of Materials Forms older than what is indicated in Appendix O of the FMM is not authorized!

The examples of completed forms will be revised as necessary and as time permits in future FMM's.

Instructions for *Manually Developing the Field Sheet Numbers for CDOT Forms* is presented in Appendix O. In Chapter 300 the forms that utilize a Field Sheet are bolded above.

COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☑ no

Region 1	Field sheet # 210352
Contract ID C18180	Date Submitted 03/17/2015
Project No. FBR 0404 050	
Project Location US 40 Over Sand Creek	

Material Type STRUCTURAL BACKFILL			Field Lab phone 719-555-2525	Cell Phone 719-555-5353
Material Code (LIMS) 703.08.01.00	Item 206	Class 1	Grading	Special Provisions ☐ yes
Previously used on Project No.:		Previous CDOT Form #157 F/S No.(s):	☑ CDOT Form #633 (sack) ☐ CDOT Form #634 (can)	

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided , etc.

SUBMITTING (2) CANVAS BAGS FOR TESTING

PHY PROP LAB	CHEMICAL LAB
CP 31, CP23, T85	CPL 2103
T89, T-90	CPL2104
T180	G51
	G57

User ID KOCHISL

Sample ID (#1) 153H150948	Sample ID (#2)	Sample ID (#3)
Sample ID (#4)	Sample ID (#5)	Sample ID (#6)

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☑ Maintenance ☐ Emergency ☐ — Date needed

Contractor HAMON CONTRACTORS, INC	Supplier AGGREGATE INDUSTRIES
Sampled from (Pit, roadway, windrow, stock, etc.) STOCKPILE	Pit name or owner BRIGHTON PIT

Quantity represented 1 PER SOURCE/PROJECT	Previous quantity 0	Total quantity to date 1 PER SOURCE/PROJECT

Sample submitted: ☑ Yes ☐ No	Shipped specified quantity to: 2 ☑ Central lab ___ ☐ Region lab	Via CDOT T. Mayhew	Date 03/18/2015

Sampled or inspected by (print name) LESLIE KOCHIS	Title EPST III	E-mail leslie.kochis@state.co.us
Supervisor (Pro./Res./Matls. Engr./Maint. Supt.) (print name) KARL LARSON	Title CEPM I	Residency LIMON

Distribution: White copy - CDOT Central Laboratory
(submit white copy only if sample or information is directed to Staff Materials)
Canary copy - Region Materials Engineer
Pink copy - Resident Engineer

CDOT Form #157 4/14

Previous editions are obsolete and may not be used.

CDOT Form #157 Note: Within Date needed, ASAP is not a date.

COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☑ no

Region: 1	Field sheet #: 210358
Contract ID: C18180	Date Submitted: 03/17/2015
Project No.: FBR 0404 050	
Project Location: US 40 Over Sand Creek	

Material Type: AGGREGATE, FILTER MATERIAL			Field Lab phone: 719-555-2525	Cell Phone: 719-555-5353
Material Code (LIMS): 703.09.01.01	Item: 206	Class: A	Grading:	Special Provisions ☐ yes
Previously used on Project No.:		Previous CDOT Form #157 F/S No.(s):		☑ CDOT Form #633 (sack) ☐ CDOT Form #634 (can)

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided , etc.

SUBMITTING (1) CANVAS BAG OF AGGREGATES

CP 31

User ID: KOCHISL

Sample ID (#1): 153J120948	Sample ID (#2):	Sample ID (#3):
Sample ID (#4):	Sample ID (#5):	Sample ID (#6):

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☑ Maintenance ☐ Emergency ☐ — Date needed

Contractor: HAMON CONTRACTORS	Supplier: MARTIN MARIETTA MATERIALS
Sampled from (Pit, roadway, windrow, stock, etc.): STOCKPILE ON PROJECT	Pit name or owner: RIVERBEND

Quantity represented: 1 PER SOURCE/PROJECT	Previous quantity: 0	Total quantity to date: 1 PER SOURCE/PROJECT

Sample submitted: ☑ Yes ☐ No	Shipped specified quantity to: 1 ☑ Central lab ___ ☐ Region lab	Via: CDOT T. Mayhew	Date: 03/18/2015

Sampled or inspected by (print name): LESLIE KOCHIS	Title: EPST III	E-mail: leslie.kochis@state.co.us
Supervisor (Pro./Res./Matls. Engr./Maint. Supt.) (print name): KARL LARSON	Title: CEPM I	Residency: LIMON

Distribution: White copy - CDOT Central Laboratory
(submit white copy only if sample or information is directed to Staff Materials)
Canary copy - Region Materials Engineer
Pink copy - Resident Engineer

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COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☑ no

Region: 1	Field sheet #: 210358
Contract ID: C18180	Date Submitted: 03/17/2015
Project No.: FBR 0404 050	
Project Location: US 40 Over Sand Creek	

Material Type: AGGREGATE BASE COURSE			Field Lab phone: 719-555-2525	Cell Phone: 719-555-5353
Material Code (LIMS): 703.03.06.00	Item: 304	Class: 6	Grading:	Special Provisions: ☑ yes
Previously used on Project No.:		Previous CDOT Form #157 F/S No.(s):	☑ CDOT Form #633 (sack) ☐ CDOT Form #634 (can)	

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided , etc.

SUBMITTING (5) CANVAS BAGS

PHY. PROP LAB	SOILS LAB
CP31, CP23, T 85	CP-L3101
T89, T90	
T96, T180	

User ID: KOCHISL

Sample ID (#1): 153J120948	Sample ID (#2):	Sample ID (#3):
Sample ID (#4):	Sample ID (#5):	Sample ID (#6):

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☑ Maintenance ☐ Emergency ☐ — Date needed:

Contractor: HAMON CONTRACTORS	Supplier: MARTIN MARIETTA MATERIALS
Sampled from (Pit, roadway, windrow, stock, etc.): STOCKPILE ON PROJECT	Pit name or owner: RIVERBEND

Quantity represented: 1 PER SOURCE/PROJECT	Previous quantity: 0	Total quantity to date: 1 PER SOURCE/PROJECT

Sample submitted: ☑ Yes ☐ No	Shipped specified quantity to: 1 ☑ Central lab ☐ Region lab	Via: CDOT T. Mayhew	Date: 03/18/2015

Sampled or inspected by (print name): LESLIE KOCHIS	Title: EPST III	E-mail: leslie.kochis@state.co.us
Supervisor (Pro./Res./Matls. Engr./Maint. Supt.) (print name): KARL LARSON	Title: CEPM I	Residency: LIMON

Distribution: White copy - CDOT Central Laboratory
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Canary copy - Region Materials Engineer
Pink copy - Resident Engineer

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COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☑ no

Region: 1	Field sheet #: 210365
Contract ID: C18180	Date Submitted: 04/17/2015
Project No.: FBR 0404 050	
Project Location: US 40 Over Sand Creek	

Material Type: AGGREGATE BASE COURSE			Field Lab phone: 719-555-2525	Cell Phone: 719-555-5353
Material Code (LIMS): 703.03.06.00	Item: 304	Class: 6	Grading:	Special Provisions: ☑ yes
Previously used on Project No.:		Previous CDOT Form #157 F/S No.(s):	☑ CDOT Form #633 (sack) ☐ CDOT Form #634 (can)	

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided , etc.

SUBMITTING (2) CANVAS BAGS

PHY. PROP LAB

CP31

T89, T90

User ID: KOCHISL

Sample ID (#1): 154J132156	Sample ID (#2):	Sample ID (#3):
Sample ID (#4):	Sample ID (#5):	Sample ID (#6):

APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:
APL/QML Acceptance: APL Ref. No.	Product name:	Date checked:

Preliminary ☐ Construction ☑ Maintenance ☐ Emergency ☐ Date needed

Contractor: HAMON CONTRACTORS	Supplier: MARTIN MARIETTA MATERIALS
Sampled from (Pit, roadway, windrow, stock, etc.): STOCKPILE ON PROJECT	Pit name or owner: GRANITE CANYON

Quantity represented: 1 PER SOURCE/PROJECT	Previous quantity: 0	Total quantity to date: 1 PER SOURCE/PROJECT

Sample submitted: ☑ Yes ☐ No	Shipped specified quantity to: 1 ☑ Central lab ___ ☐ Region lab	Via: CDOT T. Mayhew	Date: 04/18/2015

Sampled or inspected by (print name): LESLIE KOCHIS	Title: EPST III	E-mail: leslie.kochis@state.co.us
Supervisor (Pro./Res./Matls. Engr./Maint. Supt.) (print name): KARL LARSON	Title: CEPM I	Residency: LIMON

Distribution: White copy - CDOT Central Laboratory
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Pink copy - Resident Engineer

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COLORADO DEPARTMENT OF TRANSPORTATION

FIELD REPORT FOR SAMPLE IDENTIFICATION OR MATERIALS DOCUMENTATION

Metric units ☐ yes ☑ no

Region: 1	Field sheet #: 210352
Contract ID: C18180	Date Submitted: 03/17/2015
Project No.: FBR 0404 050	
Project Location: US 40 Over Sand Creek	

Material Type: Hydrated Lime			Field Lab phone: 719-555-2525	Cell Phone: 719-555-5353
Material Code (LIMS): 712.03.01.00	Item: 307	Class:	Grading:	Special Provisions ☐ yes
Previously used on Project No.:		Previous CDOT Form #157 F/S No.(s):		☐ CDOT Form #633 (sack) ☑ CDOT Form #634 (can)

- Sample Identification: Quantity & Unit of material submitted, describe tests required, precise location sample removed from (stationing), etc.
- Materials Documentation: Field inspected (describe appearance, weight/dimensions, model/serial number), COC &/or CTR provided , etc.

Submitting (1) plastic bag (>2 lbs.) Hydrated Lime for testing per CP-L4209.

Material used in Lime Treated Subgrade.

User ID: KOCHISL

Sample ID (#1): 153H150948	Sample ID (#2):	Sample ID (#3):
Sample ID (#4):	Sample ID (#5):	Sample ID (#6):

APL/QML Acceptance: APL Ref. No.: 3278-11	Product name: Hydrated Lime (Rapid City)	Date checked: 03/17/2015
APL/QML Acceptance: APL Ref. No.:	Product name:	Date checked:

Preliminary ☐ Construction ☑ Maintenance ☐ Emergency ☐ — Date needed:

Contractor: ARS, INC. Denver	Supplier: Pet Lien and Sons
Sampled from (Pit, roadway, windrow, stock, etc.): Delivery Tanker	Pit name or owner: Rapid City, ND

Quantity represented: 100 tons Lime	Previous quantity: 0	Total quantity to date: 100 Tons Lime

Sample submitted: ☑ Yes ☐ No	Shipped specified quantity to: 1 ☑ Central lab ___ ☐ Region lab	Via: CDOT T. Mayhew	Date: 03/18/2015

Sampled or inspected by (print name): LESLIE KOCHIS	Title: EPST III	E-mail: leslie.kochis@state.co.us
Supervisor (Pro./Res./Matls. Engr./Maint. Supt.) (print name): KARL LARSON	Title: CEPM I	Residency: LIMON

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Pink copy - Resident Engineer

CDOT Form #157 4/14

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COLORADO DEPARTMENT OF TRANSPORTATION

FIELD TESTS OF BASE AGGREGATES, FILLERS, PAVING AND MISCELLANEOUS AGGREGATES

User ID: KOCHISL

Contract ID	Region	Field sheet #
C18180	1	351885
Project No.		**Date Submitted**
FBR 0404-050		4/09/2015
Project Location		**Item**
US 40 Over Sand Creek		304 CL 6

SMM/LIMS Sampler ID (or Test # [Date])	Station	Tons (t) or Yards (m)	Field density	Lab max density	% Rel. Comp.	Total moist.		1"	3/4"	1/2"	#4	#8	#30	#50	#100	#200	L.L.	P.I.
15318084125	258+46	2000	134.1	138.0	97	6.8		100	100	95	63	47	23	15	10	8.5	NV	NP
15318092536	265+43	2000	135.2	138.0	98	6.6		100	100	95	64	46	25	16	11	8.9	NV	NP
15321110256	270+50	2000	133.9	138.0	97	6.1		100	100	94	62	42	26	14	9	7.7	NV	NP
15325132419	275+38	2000	132.5	138.0	96	5.5		100	100	100	65	45	26	15	11	8.5	NV	NP
1542095630	248+50	2000	129.6	134.3	97	5.5		100	100	88	48	35	25	9	6	3.4	NV	NP
1542132426	258+16	2000	128.5	134.3	96	5.0		100	100	87	59	45	28	11	9	8.1	NV	NP
1545142846	265+89	2000	129.9	134.3	97	5.9		100	100	90	60	44	30	14	6	7.9	NV	NP
1545150213	275+01	2000	128.4	134.3	96	6.0		100	100	88	58	45	30	15	8	8.5	NV	NP
	281+61	0	124.9	134.3	93	2.5												
15413142825	281+61	2000	128.9	134.3	96	6.5		100	100	91	62	51	28	18	10	8.5	NV	NP
	Sheet Total	18,000	Specifications:		>95	N/A			100		30-65	25-55				3-12	<30	
	Previous Total	0.0																
	Total to Date	18,000																

Final report: yes ☐ no ☑

Spec. deviations: yes ☑ no ☐

Items:
206 Structure Backfill Class 1 _____
206 Filter Material Class _____
304 ABC Class 6 _____
307 Treated Subgrade _____
403 HMA Grading _____
403 SMA _____
409 Cover Coat _____
Other Material:

P=_____% for lot # _____

Remarks

FAILING DENSITY AREA WAS REWORKED AND RETESTED.

Action take

Source (pit)
ON-SITE PRODUCED BY CONTRACTOR

Project Tester (print name)	Title
LESLIE KOCHIS	EPST III
PE Approved by (print name)	Title
KARL LARSON	CEPM I

Distribution: Original - Project File

Previous editions are obsolete and may not be used

CDOT Form #6 4/14

COLORADO DEPARTMENT OF TRANSPORTATION

FIELD TESTS OF BASE AGGREGATES, FILLERS, PAVING AND MISCELLANEOUS AGGREGATES

Project No. IM 0253-151 | Field sheet # 120777

Project code (SA#) 11925 | Region 4 | Item # (Check appropriate item below) 304

Proj. location I-25, SH 7 to WCR 16 | Date 12/27/03

Test #	Date 20___	Station taken	Tons (t) or Yards (m)	Field density	Lab max density	% Rel. Comp.	Total moist.	2" (50mm)	1½" (37.5mm)	1" (25.0mm)	¾" (19.0mm)	#4	#8	#30	#50	#100	#200	L.L.	P.I.
1	12/20	100+05	2000	123.9	130.0	95.3	2.5												
2	12/26	400+95	2000	124.1	130.0	95.5	2.7												

Sheet Total	4000
Previous Total	0
Total to Date	4000

Specifications:

Final report: ☐ yes ☒ no

Spec. deviations: ☐ yes ☐ no

P=_____% for lot # _____

Items:
206 Structure Backfill Class 1 _____
206 Filter Material Class _____
304 ABC Class 6
307 Filler Type _____
403 HBP Grading _____
409 Cover Coat _____
410 Plant Mix SC Type _____
Other Material:

Remarks

Action taken:

Source (pit): **Varra**

Tester: F. Gonzalez | Title: E/PS Tech III

Approved by: C. Stewart | Title: P.E. I

Distribution: Original - Project File

Previous editions are obsolete and may not be used

CDOT Form #6 4/04

Colorado Department of Transportatio
AGGREGATE TEST REPORT

Field Sheet No: 149102
Date Submitted 12/23/2003
Item Number: 304

Project ID: 11925
Project: IM 0253-151
Location: SH 7 to WCR 16
Date Sent: 12/24/2003
Pit Owner: DUNES PARK
Region: 04

Aggregate Test Report

Sampled From: WINDROW
Materials Description: CLASS 3 ABC
Central Lab Test No.: 2003937X
Project ID:

(Grading AASHTO - T27)				SPECIFICATIONS			
Passing	6	Inch	100%		6	Inch	(152.4 mm)
Passing	4	Inch	100%		4	Inch	(101.6 mm)
Passing	3	Inch	100%		3	Inch	(76.2 mm)
Passing	2 1/2	Inch	100%		2 1/2	Inch	(63.5 mm)
Passing	2	Inch	86%		2	Inch	(50.8 mm)
Passing	1 1/2	Inch	80%		1 1/2	Inch	(38.1 mm)
Passing	1	Inch	72%		1	Inch	(25.4 mm)
Passing	3/4	Inch	67%		3/4	Inch	(19.0 mm)
Passing	1/2	Inch	61%		1/2	Inch	(12.7 mm)
Passing	3/8	Inch	57%		3/8	Inch	(9.51 mm)
Passing	#4		47%		#4		(4.75 mm)
Passing	#8		35%		#8		(2.36 mm)
Passing	#16		23%		#16		(1.18 mm)
Passing	#30		14%		#30		(600 mu)
Passing	#50		7%		#50		(300 mu)
Passing	#100		4%		#100		(150 mu)
Passing	#200		3.3%	20 MAX.	#200		(75 mu)

Fractured Faces (CP45):
Abrasion (%Wear) (T96)::
Liquid Limit (T89): NV
Plastic Limit (T90):
Plastic Index (T90): NP
"R" Value (T190):

* Indicates Deviation from Specification Requirements.

Fine Aggregate	Bulk sp.g.:	App. sp.g.:	% Abs.:
Course Aggregate	Bulk sp.g.:	App. sp.g.:	% Abs.:

Remarks:

cc:
Central Laboratory
Regional Materials Engineer

Glenn Frieler
Concrete/ Physical Properties Program Manager

CDOT FORM # 38
1/2000

CDOT Form # 38

COLORADO DEPARTMENT OF TRANSPORTATION
STRUCTURE BACKFILL DENSITY REPORT

Project No.	IM 0253-151
Proj. location	I-25, SH 7 to WCR 16
Date	2/14/03
Region	4
Project code (SA#)	11925

Major Structures

Number of Structures: (1 test/200 cu. yds.; minimum 1/structure) 2	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 1910	1350	7	560	3

Cross Drains

Number of Cross Drains: (1 test/200 cu. yds.; minimum 1/structure) 8	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 1800	1800	10		

Side Drains

Number of Side Drains: (1 test/200 cu. yds.; minimum 1/structure) 6	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests
Total cu. yds. structure backfill: 750	450	6	300	6

Other

	Class 1 (cu. yds.)	No. of tests	Class 2 (cu. yds.)	No. of tests

Remarks

Signed	Title
Fidel Gonzalez	E/PS Tech III

☐ Resident Engineer, ☐ Materials & Geotechnical Branch (Documentation Unit)

CDOT Form #194 3/04

CDOT Form #194

COLORADO DEPARTMENT OF TRANSPORTATION
SOILS AND AGGREGATES SIEVE ANALYSIS WHEN SPLITTING ON THE No. 4 SIEVE

Project no. IM 0253-151
Project code (SA#) 11925
Item 304 Class 1

Pit name Goose Haven | Station 385+80 | Test no. 3 | Sample weight 49.70 | Date 10/10/03

Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs
2 1/2	——	——	0.0		100.0	100
2	——	——	0.0		100.0	95-100
1 1/2	1.92	1.87	3.9		96.1	
1	10.28	10.01	20.8		75.3	
3/4	4.26	4.15	8.6		66.7	
1/2	4.24	4.13	8.6		58.1	
3/8	1.57	1.53	3.2		54.9	
+ #4	4.83	4.70	9.8		45.1	30-60
- #4	22.60	21.67	45.1	# 8	40.2	
Total	49.70	48.06	100.0	# 50	17.5	
				#200	9.3	5-12

Liquid limit NV
Plastic limit NP
Plastic index NP
Soil class. N/A
"R" value 80
Sampled by
Tested by

Moisture correction
Plus #4 moisture sample
Wet weight 1587.0
Dry weight 1545.0
Loss 42.0
% moisture 2.7
Minus #4 moisture sample
Wet weight 584.0
Dry weight 560.0
Loss 24.0
% moisture 4.3

Minus #4 wash

Wet weight (grams)

Sieve	Weight (grams)	Individual percentage		Percent passing
# 8	61	10.9		89.1
# 50	282	50.3		38.8
#200	101	18.1		20.7
- #200	116	20.7		
Total	560	100.0		

Dry weight (grams) 560

Weighing Individually

NOTE: Save all material until calculations are completed in case a check is necessary

Pit name | Station | Test no. 3 | Sample weight 49.70 | Date 10/10/03

Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs
2 1/2	——	——	0.0		100	100
2	——	——	0.0		100	95-100
1 1/2	1.92	1.87	3.9		96.1	
1	12.20	11.88	24.7		75.3	
3/4	16.46	16.03	33.3		66.7	
1/2	20.70	30.16	41.9		58.1	
3/8	22.27	21.68	45.1		54.9	
+ #4	27.10	26.39	54.9		45.1	30-60
- #4	22.60	21.67	45.1	#	40.2	
Total	49.70	48.06	100	#	17.5	
				#200	9.3	5-12

Liquid limit NV
Plastic limit NP
Plastic index NP
Soil class. N/A
"R" value 80
Sampled by
Tested by

Moisture correction
Plus #4 moisture sample
Wet weight 1587.0
Dry weight 1545.0
Loss 42.0
% moisture 4.3
Minus #4 moisture sample
Wet weight 584
Dry weight 560
Loss 24
% moisture 4.3

Minus #4 wash

Wet weight (grams)

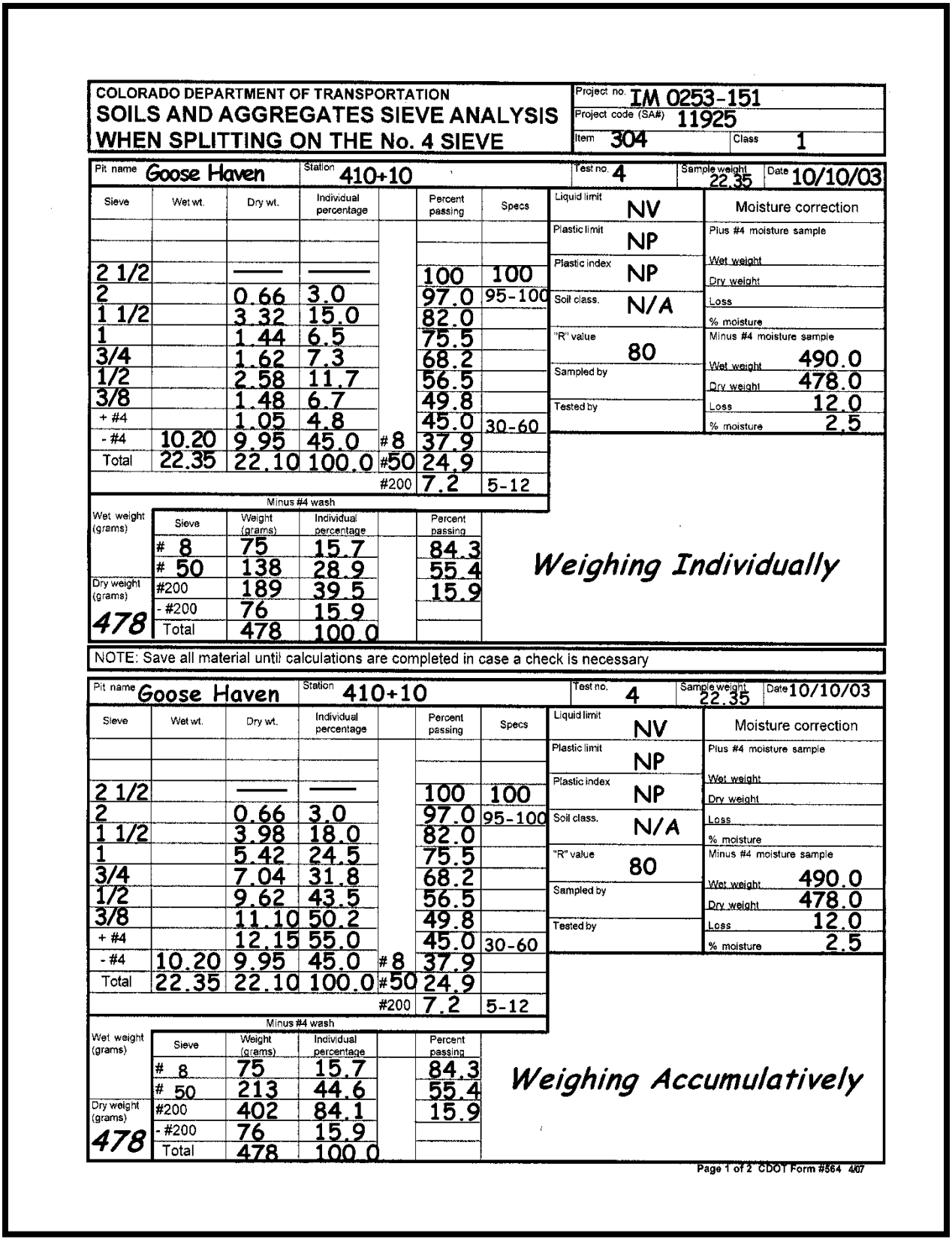
Sieve	Weight (grams)	Individual percentage		Percent passing
# 8	61	10.9		89.1
# 50	343	61.2		38.8
#200	444	79.3		20.7
- #200	116	20.7		
Total	560	100.0		

Dry weight (grams) 560

Weighing Accumulatively

Page 1 of 2 CDOT Form #564 4/07

CDOT Form # 564 Dry (Note: Page 2 of 2 is not depicted.)



COLORADO DEPARTMENT OF TRANSPORTATION
SOILS AND AGGREGATES SIEVE ANALYSIS
WHEN SPLITTING ON THE No. 4 SIEVE

Project no. IM 0253-151
Project code (SA#) 11925
Item 304 Class 1

Pit name Goose Haven | Station 410+10 | Test no. 4 | Sample weight 22.35 | Date 10/10/03

Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs
2 1/2		——	——		100	100
2		0.66	3.0		97.0	95-100
1 1/2		3.32	15.0		82.0	
1		1.44	6.5		75.5	
3/4		1.62	7.3		68.2	
1/2		2.58	11.7		56.5	
3/8		1.48	6.7		49.8	
+ #4		1.05	4.8		45.0	30-60
- #4	10.20	9.95	45.0	#8	37.9	
Total	22.35	22.10	100.0	#50	24.9	
				#200	7.2	5-12

Liquid limit: NV
Plastic limit: NP
Plastic index: NP
Soil class.: N/A
"R" value: 80
Sampled by:
Tested by:

Moisture correction
Plus #4 moisture sample
Wet weight:
Dry weight:
Loss:
% moisture:
Minus #4 moisture sample
Wet weight: 490.0
Dry weight: 478.0
Loss: 12.0
% moisture: 2.5

Minus #4 wash

Wet weight (grams):

Sieve	Weight (grams)	Individual percentage		Percent passing
# 8	75	15.7		84.3
# 50	138	28.9		55.4
#200	189	39.5		15.9
- #200	76	15.9		
Total	478	100.0		

Dry weight (grams): 478

Weighing Individually

NOTE: Save all material until calculations are completed in case a check is necessary

Pit name Goose Haven | Station 410+10 | Test no. 4 | Sample weight 22.35 | Date 10/10/03

Sieve	Wet wt.	Dry wt.	Individual percentage		Percent passing	Specs
2 1/2		——	——		100	100
2		0.66	3.0		97.0	95-100
1 1/2		3.98	18.0		82.0	
1		5.42	24.5		75.5	
3/4		7.04	31.8		68.2	
1/2		9.62	43.5		56.5	
3/8		11.10	50.2		49.8	
+ #4		12.15	55.0		45.0	30-60
- #4	10.20	9.95	45.0	#8	37.9	
Total	22.35	22.10	100.0	#50	24.9	
				#200	7.2	5-12

Liquid limit: NV
Plastic limit: NP
Plastic index: NP
Soil class.: N/A
"R" value: 80
Sampled by:
Tested by:

Moisture correction
Plus #4 moisture sample
Wet weight:
Dry weight:
Loss:
% moisture:
Minus #4 moisture sample
Wet weight: 490.0
Dry weight: 478.0
Loss: 12.0
% moisture: 2.5

Minus #4 wash

Wet weight (grams):

Sieve	Weight (grams)	Individual percentage		Percent passing
# 8	75	15.7		84.3
# 50	213	44.6		55.4
#200	402	84.1		15.9
- #200	76	15.9		
Total	478	100.0		

Dry weight (grams): 478

Weighing Accumulatively

Page 1 of 2 CDOT Form #564 4/07

CDOT Form # 564 (Note: Page 2 of 2 is not depicted.)

CDOT FORM # 565 INSTRUCTIONS

This form is a field work sheet for use when testing aggregates in accordance with CP 31 when the maximum nominal particle size is less than 3/4 in.

This procedure allows for the total dry weight (mass) of the specimen, before washing, to be determined by either drying the total specimen or correcting it to dry weight (mass) using a moisture specimen of the same gradation and approximate weight (mass) as the specimen for wash.

Example No. 1 illustrates using a separate moisture specimen to correct the wet weight (mass) of the wash specimen to dry weight (mass).
Example No. 2 illustrates drying the total specimen to be washed and sieved. The percent moisture may be calculated if desired.

When correcting to dry weight (mass) by the use of a moisture specimen, it is very important that the specimen for wash and the specimen for moisture be taken and weighed at the same time. It is also important that the samples be as nearly identical in weight (mass) and gradation as possible.

NOTE: CDOT Form #565 was revised on 01/2013. The example still depicts the previous revision date of 4/07.

COLORADO DEPARTMENT OF TRANSPORTATION

SIEVE ANALYSIS FOR AGGREGATES NOT SPLIT ON THE No. 4 SIEVE

Project no. IM 0253-151 | Project code (SA#) 11925

Proj. location I-25 SH 7 to WCR 16

Pit name Goose Haven

Item 203 | Class R-50 (spec)

Station	2588+15 13' lt.	Test #	13
Specimen wt (dry) B	772.2	Date	6/5/02

Sieve	Weight	Percent retained	Percent passing	Specs
2"1				
1 1/2"				
1"				
3/4"				
1/2"				
3/8"				
#4	0.3	0	100	
#10	39.8	5.2	94.8	
#16	84.8	11.0	89.0	
#40	258.2	33.4	66.6	
#50	379.0	49.1	50.9	
#100	577.9	74.8	25.2	
#200	668.6	86.6	13.4	
-#200	5.7			
TOTAL	674.3			

	Gradation Sample	Moisture Sample
Pan ID		
Pan weight		
Wet weight + Pan		
Wet weight	A	702.6
Dry weight + Pan		
Dry weight	B	650.6
Dry wash weight / H_2O Loss		52.0
-#200 / % H_2O		8.0

Wet weight ÷ (100 + % H_2O) x 100 = Dry weight

A 834.0 ÷ (100 + 8.0) x 100 = B 772.2

Sampled by Dave Buck | Tested by John Assad

Station	3000+00 5' rt	Test #	14
Specimen wt (dry) B	15962.9	Date	6/5/03

Sieve	Weight	Percent retained	Percent passing	Specs
2"1	341.1	2.1	97.9	
1 1/2"	758.1	4.7	93.3	
1"	1617.7	10.1	89.9	
3/4"	2103.2	13.2	86.8	
1/2"	2698.7	16.9	83.1	
3/8"	2967.9	18.6	81.4	
#4	3503.7	21.9	78.1	
#10	4150.4	26.0	74.0	
#16	4868.7	30.5	69.5	
#40	7662.2	48.0	25.0	
#50	9609.7	60.2	39.8	
#100	12818.2	80.3	19.7	
#200	14286.8	89.5	10.5	
-#200	10.5			
TOTAL	14297.3			

	Gradation Sample	Moisture Sample
Pan ID		
Pan weight		
Wet weight + Pan		
Wet weight	A	702.2
Dry weight + Pan		
Dry weight	B	650.1
Dry wash weight / H_2O Loss		52.1
-#200 / % H_2O		8.0

Wet weight ÷ (100 + % H_2O) x 100 = Dry weight

A 17239.9 ÷ (100 + 8.0) x 100 = B 15962.9

Sampled by Dave Buck | Tested by John Assad

NOTE: Save all material until calculations are complete in case check is necessary.

Page 1 of 2 CDOT Form #565 4/07

CDOT Form # 565 (Note: **The current form of 4/16 must be used.** Page 2 of 2 is not depicted.)

CDOT Form #633, Materials Sample Tag
Revision Date 05/2013
Actual required size 8" x 2 5/8" with a detachable stub and with a wire tie through a reinforced hole located on left side of the tag so as to attach to cans, bags, etc.
Paper stock as used in the past.

The example below is not to scale.

Contract ID # (Project Code) **11925** Material Code **403.02.0121**	Contract ID # **11925**
Sample ID # FS # **120027** Test # **4A**	Sample ID #
Lab Ref. #	FS # **120027** Test # **4A**
Item # **403** Container **1** of **8**	Station **Cooley Morrison Quarry 3/4 Rock**
COLORADO DEPARTMENT OF TRANSPORTATION	Depth **5'**
Materials & Geotechnical Branch	Item # **403**
4670 N. Holly St. Denver, Unit A	Container **1** of **8**
Denver, CO 80216-6408 CDOT Form# 633 05/2013	***DETACH STUB AND PLACE IN CONTAINER***

CDOT Form #633 (**Note**: Use Revision 4/16 after the 05/2013 tags are depleted.)

COLORADO DEPARTMENT OF TRANSPORTATION
STABILOMETER RECORD OF ITEM 304 ABC

Project No. IM 0253-151 | Region 4
Project code (SA#) 11925
Proj. location I-25 SH 7 to WCR 16

Pit name: Goose Haven | Date: 3/21/01 | Field sample #: 130152 | Lab#: 13A
Represents: 304 | LL: NV | PL: | PI: NP | SE: | Class: 6

GRADATION

Seive size	As run % passing	Scalp	Set up
4"			
3"			
2½"			
2"			
1½"			
1"			
3/4"	100	100	
1/2"	89	89	11 %
3/8"	73	73	27 %
#4	47	47	53 %
#8	36		
#16	29		
#50	18		
#100	13		
#200	9		

Stabilometer "R" value: 78

% moisture at	lbs. per cu. ft.
% Moisture - #4 Material	0.85 X
Weight of - #4 Material	=
Weight of H_2O	+
Initial H_2O added	50 =
Total initial H_2O	(A)

COMPACTION

Cylinder #	3	4	5
H_2O added (B)	65	75	70
Exudation pressure, lbs	10000	2960	5700
Exudation pressure, PSI	796	236	454
Ht. of briquette (H)	2.41	2.40	2.42
Wt. cylinder & wet sample	3275	3282	3281
Cylinder tare	2115	2117	2116
Wet wt. of sample (W_w)	1160	1165	1165
[1] Weight of H_2O (C)			
[2] Dry wt. (D)			
[3] % Moisture (M)			
[4] Density			
Height correction by wt.			

Set up weights

-3/4" + 1/2"	121
-1/2" + 3/8"	297
-3/8" + #4	583
- #4	1100

[1] (A) + (B) = (C)
[2] (Ww) - (C) = (D)
[3] (C) + (D) = (M)
[4] $\frac{(W_w) \times 30.3}{(100 + M) \times H}$

STABILOMETER

Total load	PSI			
1000	80			
2000	160	15	23	16
Displacement turns		5.52	4.38	5.24
"R" value		81(80)	77(76)	81(80)
Drainage				
Exp. pressure dial reading				

CDOT Form #1126 3/04

CDOT Form # 1126

COLORADO DEPARTMENT OF TRANSPORTATION
Granular Material Moisture - Density Report

Project ID	11925	**Location**	SH 7 TO WCR 16		
Project	IM 0253-151	**Source**	GOOSE HAVEN	**Report Date**	
F.S. #	98765	**Region**	04	**Construction**	3200
Engineer	Glenn Frieler, Concrete/ Physical Properties Program Manager				
Comments	304 CLASS 6 ABC				

Lab #	Sp. G.	Absorption
2002-0522	2.57	1.3

Lab Tests: Method: T180A

Test	#1	#2	#3	#4	#5
Moisture	4.7	6.7	9.2	11.5	
Dry Density	126.4	130.2	131.1	125.6	

Moisture Chart:

%H2O	Dry Density	%H2O	Dry Density	%H2O	Dry Density	%H2O	Dry Density
5.0	127.1	7.2	130.9	9.4	130.8		
5.1	127.3	7.3	131.0	9.5	130.7		
5.2	127.6	7.4	131.1	9.6	130.6		
5.3	127.8	7.5	131.1	9.7	130.5		
5.4	128.0	7.6	131.2	9.8	130.3		
5.5	128.2	7.7	131.3	9.9	130.1		
5.6	128.4	7.8	131.3	10.0	129.9		
5.7	128.6	7.9	131.4	10.1	129.8		
5.8	128.8	8.0	131.4	10.2	129.6		
5.9	129.0	8.1	131.4	10.3	129.3		
6.0	129.2	8.2	131.4	10.4	129.1		
6.1	129.4	8.3	131.4	10.5	128.9		
6.2	129.5	8.4	131.4	10.6	128.6		
6.3	129.7	8.5	131.4	10.7	128.3		
6.4	129.9	8.6	131.4	10.8	128.1		
6.5	130.0	8.7	131.4	10.9	127.8		
6.6	130.2	8.8	131.3				
6.7	130.3	8.9	131.3				
6.8	130.4	9.0	131.2				
6.9	130.6	9.1	131.1				
7.0	130.7	9.2	131.1				
7.1	130.8	9.3	131.0				

Glenn Frieler

Optimum Moisture : 8.3 **Maximum Dry Density : 131.4**

(CDOT #1296 - 9/2002)

CDOT Form # 1296

COLORADO DEPARTMENT OF TRANSPORTATION

Granular Material Moisture - Density Report

Rock Correction Chart: -4 Material

%+4	%H2O	Dry Density	%+4	%H2O	Dry Density	%+4	%H2O	Dry Density
0	8.3	131.4	20	6.9	134.0	40	5.5	136.6
1	8.2	131.6	21	6.8	134.2	41	5.4	136.7
2	8.2	131.7	22	6.8	134.3	42	5.4	136.9
3	8.1	131.8	23	6.7	134.4	43	5.3	137.0
4	8.0	132.0	24	6.6	134.5	44	5.2	137.1
5	8.0	132.1	25	6.6	134.7	45	5.2	137.2
6	7.9	132.2	26	6.5	134.8	46	5.1	137.4
7	7.8	132.3	27	6.4	134.9	47	5.0	137.5
8	7.8	132.5	28	6.4	135.1	48	4.9	137.6
9	7.7	132.6	29	6.3	135.2	49	4.9	137.8
10	7.6	132.7	30	6.2	135.3	50	4.8	137.9
11	7.5	132.9	31	6.1	135.4	51	4.7	138.0
12	7.5	133.0	32	6.1	135.6	52	4.7	138.1
13	7.4	133.1	33	6.0	135.7	53	4.6	138.3
14	7.3	133.3	34	5.9	135.8	54	4.5	138.4
15	7.3	133.4	35	5.9	136.0	55	4.5	138.5
16	7.2	133.5	36	5.8	136.1	56	4.4	138.7
17	7.1	133.6	37	5.7	136.2	57	4.3	138.8
18	7.1	133.8	38	5.7	136.3	58	4.2	138.9
19	7.0	133.9	39	5.6	136.5	59	4.2	139.0

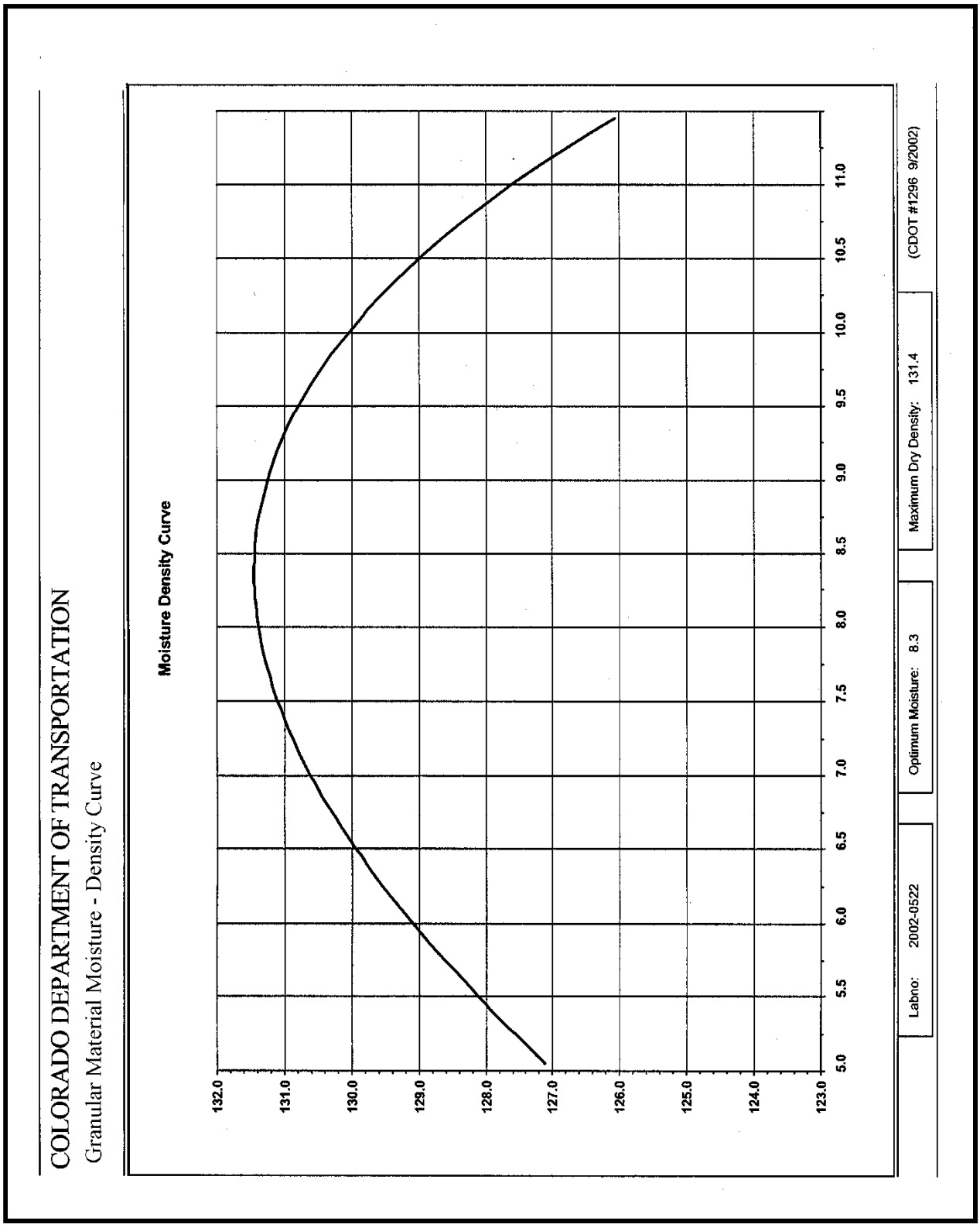
Optimum Moisture: 8.3

Maximum Dry Density: 131.4

Page 2 of 2

(CDOT #1296 - 9/2002)

CDOT Form # 1296



CDOT Form # 1296

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