




U.S. Department
of Transportation
**Federal Highway
Administration**

Memorandum

Subject: CO PFH 81-1(4)
Tarryall Creek Road
Pavement Reinvestigation

To: Micah Leadford, Project Manager

Date: April 2, 2012

From: Charles G. Luedders
Pavements Team Leader 

The Value Engineering Review process for the Tarryall Creek Road Project determined the desire to reinvestigate the sub-grade properties of the remaining two phases of this project. The sampling for this work was performed on March 14, 2012. The laboratory testing was commenced on March 15, 2012 and reported on March 28, 2012.

The results of the testing supports the original reports 97-17 and 98-18 completed in 1997 and 1998 by Wayne Folkman. The R-values in his reports ranged from 17 to 77. The R-values from our testing range from 3 to 78. In both cases, the weakest soils are found on the south end of Phase Five. A spreadsheet containing all values is attached along with the laboratory testing results.

The data also supports reducing the base thickness from 8 inches to 6 inches in the two areas revised by email on February 22, 2012. These sections run from Station 1262+40 to 1375+00, milepost 17.55 to 19.68, and from Station 1573+00 to 1697+50, milepost 23.43 to 25.79.

The Phase Five Project should stay with the 8 inches of base. The R-values in this section range from 3 to 64. The design R-value is in the high 20's which is the value used in the original design.

This information provides you with the results of the additional investigation. Please contact the Pavement's Section if you require any additional information concerning the pavement structural design for the Tarryall Creek Road.

Attachments

cc: Steve Deppmeier, Pavements Engineer
Christine Black, Design Manager
Ron Andresen, Materials Staff

CO PFH 81 Tarryall Creek Road

Report 98-18 Begin at Jefferson

2012 Investigation

Milepost	R-Value	Soil Type		Milepost	R-Value	Soil Type
0.3	73	A-1-a(0)				
1.1	74	A-1-a(0)				
1.8	55	A-1-b(0)				
2.6	18	A-2-4(0)				
3.6	74	A-1-b(0)				
4.3	66	A-1-b(0)				
5.1	69	A-1-b(0)				
5.9	59	A-1-b(0)				
6.7	61	A-1-b(0)				
7.5	65	A-1-b(0)				
8.3	73	A-1-b(0)				
End of Phase Two / Begin Phase Three MP=8.607						
9.2	68	A-1-b(0)				
9.9	75	A-1-b(0)				
10.7	39	A-2-4(0)				
11.5	75	A-2-4(0)				
12.3	54	A-2-4(0)				
13.1	71	A-1-b(0)				
13.9	79	A-2-4(0)				
14.7	56	A-1-b(0)				
15.5	45	A-2-4(0)				
16.3	68	A-1-b(0)				
17.1	52	A-1-b(0)				
End of Phase Three / Begin Phase Four MP=17.547						
17.9	76	A-1-b(0)		17.5	76	A-1-b(0)
18.3	59	A-1-b(0)				
18.7	52	A-1-b(0)		18.5	78	A-1-b(0)
19.5	74	A-2-4(0)		19.4	46	A-2-4(0)
19.9	28	A-2-4(0)				
20.7	25	A-4(0)		20.4	60	A-2-4(0)
21.1	46	A-2-4(0)				
21.5	48	A-2-4(0)				
21.5	38	A-2-4(0)		21.3	49	A-1-b(0)
22.3	54	A-1-b(0)				
22.6	48	A-2-4(0)		22.4	76	A-1-b(0)
23.0	61	A-1-b(0)				
23.5	27	A-2-4(0)		23.4	75	A-2-4(0)
23.9	52	A-1-b(0)				
24.3	58	A-2-4(0)		24.4	60	A-2-4(0)
24.7	63	A-1-b(0)				
25.0	50	A-2-4(0)				
25.4	39	A-2-4(0)		25.4	70	A-1-a(0)
25.8	34	A-2-4(0)				
26.1	77	A-1-b(0)				
26.5	44	A-1-b(0)		26.4	64	A-1-b(0)
26.9	49	A-1-b(0)				
27.3	44	A-1-b(0)		27.4	47	A-2-4(0)
27.7	47	A-2-4(0)				
28.2	53	A-2-4(0)		28.4	21	A-8(1)
28.8	27	A-4(0)				
29.2	21	A-2-4(0)				
29.5	25	A-6(1)		29.4	29	A-2-4(0)
30.1	48	A-2-4(0)	58.1	30.4	47	A-2-4(0)
30.8	65	A-2-4(0)	59.25			

31.6	38	A-2-4(0)	60.45	31.3	34	A-2-4(0)
32.2	66	A-2-4(0)	61.5	32.3	64	A-1-b(0)
33.2	58	A-1-b(0)	63	33.1	43	A-2-4(0)
33.8	68	A-2-4(0)	64.05			
34.2	25	A-2-4(0)	64.7	33.9	3	A-7-6(14)
34.8	17	A-2-7(3)	65.65			

End Phase Four / Begin Phase One MP=34.540

35.2	35	A-2-6(0)	66.2
35.5	32	A-2-4(0)	66.7
36.1	28	A-2-4(0)	67.7
36.7	48	A-6-2(0)	68.6
37.0	28	A-2-4(0)	69.1
37.3	33	A-4(0)	69.6
37.8	71	A-2-4(0)	70.5
38.4	38	A-2-6(1)	71.4
39.1	56	A-2-4(0)	72.6
39.7	50	A-2-4(0)	73.55
40.1	36	A-4(0)	74.2
40.8	26	A-2-4(0)	75.3
41.1	25	A-4(0)	75.8
41.4	25	A-4(0)	76.3

End Phase One MP=41.8



U.S. Department
of Transportation
Federal Highway
Administration

Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



Report of Soil or Aggregate Tests

Project: Colorado PFH 81-1(4) Tarryall Creek

Submitted By: Steve Deppmeier

Date Reported: 3/28/2012

Sample Number	Lab Number	12-148-RV	12-149-SB	12-150-RV	12-151-RV	12-152-SB
	Boring Number	B-1	B-1	B-1	B-2	B-2
Sample Location	Station	1267+00	1267+00	1267+00	1322+00	1322+00
	Milepost	17.5	17.5	17.5	18.5	18.5
	Lane	Left	Left	Left	Left	Left
	Depth	0.25-3 Feet	3-18 Inches	3-5 Feet	0.17-1.1 Feet	2-6 Inches
AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm				100
	3/4"	19.0 mm	100		100	99
	1/2"	12.5 mm	99		98	95
	3/8"	9.5 mm	97		97	90
	#4	4.75 mm	92		91	77
	#8	2.36 mm				
	#10	2.00 mm	77		73	59
	#16	1.18 mm	61		58	50
	#30	600 µm				
	#40	425 µm	33		29	31
	#50	300 µm				
	#100	150 µm	17		11	16
	#200	75 µm	11		6.0	11
	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %		4.3			3.9
AASHTO T 89 & T 90	Liquid Limit	NV		NV	NV	
	Plasticity Index	NP		NP	NP	
Soil Classification	AASHTO M 145	A-1-b (0)		A-1-b (0)	A-1-b (0)	
	ASTM D 2487	SW-SM		SW-SM	SP-SM	
AASHTO T 190	R - Value	75		77	78	
AASHTO T 288	Min. Resistivity, ohm x cm					
AASHTO T 289	pH					
AASHTO Method	Optimum Moisture, %					
	Maximum Dry Density, pcf					

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements **Chuck Luedders**
 Materials Mike Peabody

Remarks:

Reported By:

 Darrell Harding
 Laboratory Manager



U.S. Department
of Transportation
Federal Highway
Administration

Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



Report of Soil or Aggregate Tests

Project: Colorado PFH 81-1(4) Tarryall Creek

Submitted By: Steve Deppmeier

Date Reported: 3/28/2012

Sample Number	Lab Number	12-153-RV	12-154-SB	12-155-RV	12-156-SB	12-157-SB
	Boring Number	B-3	B-3	B-4	B-4	B-4
Sample Location	Station	1370+00	1370+00	1422+00	1422+00	1422+00
	Milepost	19.4	19.4	20.4	20.4	20.4
	Lane	Left	Left	Right	Right	Right
	Depth	0.08-5 Feet	4-18 Inches	0.08-5 Feet	12-48 Inches	48-60 Inches
AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm				
	3/4"	19.0 mm			100	
	1/2"	12.5 mm	100		99	
	3/8"	9.5 mm	99		98	100
	#4	4.75 mm	96		95	99
	#8	2.36 mm				
	#10	2.00 mm	86		86	96
	#16	1.18 mm	78		80	94
	#30	600 µm				
	#40	425 µm	64		65	84
	#50	300 µm				
	#100	150 µm	40		38	52
	#200	75 µm	28		22	26
	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %		8.6		6.6	8.2
AASHTO T 89 & T 90	Liquid Limit	NV		NV		NV
	Plasticity Index	NP		NP		NP
Soil Classification	AASHTO M 145	A-2-4 (0)		A-2-4 (0)		A-2-4 (0)
	ASTM D 2487	SM		SM		SM
AASHTO T 190	R - Value	46		60		
AASHTO T 288	Min. Resistivity, ohm x cm					
AASHTO T 289	pH					
AASHTO Method	Optimum Moisture, %					
	Maximum Dry Density, pcf					

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Chuck Luedders
 Materials Mike Peabody

Remarks:

Reported By:

 Darrell Harding
 Laboratory Manager



U.S. Department
of Transportation
Federal Highway
Administration

Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



Report of Soil or Aggregate Tests

Project: Colorado PFH 81-1(4) Tarryall Creek

Submitted By: Steve Deppmeier

Date Reported: 3/28/2012

Sample Number	Lab Number	12-158-RV	12-159-SB	12-160-SB	12-161-RV	12-162-SB
	Boring Number	B-5	B-5	B-5	B-6	B-6
Sample Location	Station	1471+50	1471+50	1471+50	1524+00	1524+00
	Milepost	21.3	21.3	21.3	22.4	22.4
	Lane	Right	Right	Right	Right	Right
	Depth	0.15-5 Feet	1.75-18 Inches	48-60 Inches	0.04-5 Feet	0.5-18 Inches
AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm	100			
	3/4"	19.0 mm	99		100	
	1/2"	12.5 mm	98		98	
	3/8"	9.5 mm	96		100	96
	#4	4.75 mm	88		99	88
	#8	2.36 mm				
	#10	2.00 mm	70		91	70
	#16	1.18 mm	58		81	57
	#30	600 µm				
	#40	425 µm	42		56	33
	#50	300 µm				
	#100	150 µm	31		34	16
	#200	75 µm	21		23	9.7
	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %		4.4	2.5		4.7
AASHTO T 89 & T 90	Liquid Limit	24		NV	NV	
	Plasticity Index	5		NP	NP	
Soil Classification	AASHTO M 145	A-1-b (0)		A-2-4 (0)	A-1-b (0)	
	ASTM D 2487	SC-SM		SM	SP-SM	
AASHTO T 190	R - Value	49			76	
AASHTO T 288	Min. Resistivity, ohm x cm					
AASHTO T 289	pH					
AASHTO Method	Optimum Moisture, %					
	Maximum Dry Density, pcf					

Distribution: Num. / Project File
Laboratory Darrell Harding
Pavements Chuck Luedders
Materials Mike Peabody

Remarks:

Reported By:

Darrell Harding
Darrell Harding
Laboratory Manager



U.S. Department
of Transportation
Federal Highway
Administration

Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



Report of Soil or Aggregate Tests

Page 4 of 8

Project: Colorado PFH 81-1(4) Tarryall Creek

Submitted By: Steve Deppmeier

Date Reported: 3/28/2012

Sample Number	Lab Number	12-163-RV	12-164-SB	12-165-RV	12-166-SB	12-167-RV
	Boring Number	B-7	B-7	B-8	B-8	B-9

Sample Location	Station	1578+20	1578+20	1634+00	1634+00	1684+00
	Milepost	23.4	23.4	24.4	24.4	25.4
	Lane	Right	Right	Right	Right	Left
	Depth	0.04-5 Feet	0.5-18 Inches	0.21-4.5 Feet	2.5-18 Inches	0.04-5 Feet

AASHTO T 11, T 27 & T 88	3"	75.0 mm					
	1 1/2"	37.5 mm					
	1"	25.0 mm					
	3/4"	19.0 mm	100		100	100	
	1/2"	12.5 mm	99		98	99	
	3/8"	9.5 mm	99		97	95	
	#4	4.75 mm	97		91	73	
	#8	2.36 mm					
	Washed Sieve	#10	2.00 mm	89		80	50
		#16	1.18 mm	77		70	41
	Analysis % Passing	#30	600 µm				
		#40	425 µm	51		53	29
		#50	300 µm				
		#100	150 µm	30		36	21
		#200	75 µm	20		25	15
		20 µm					
	2 µm						
	1 µm						
AASHTO T 255	Moisture, %		4.9		6.1		
AASHTO T 89 & T 90	Liquid Limit	NV		NV		NV	
	Plasticity Index	NP		NP		NP	
Soil Classification	AASHTO M 145	A-2-4 (0)		A-2-4 (0)		A-1-a (0)	
	ASTM D 2487	SM		SM		SM	
AASHTO T 190	R - Value	75		60		70	
AASHTO T 288	Min. Resistivity, ohm x cm						
AASHTO T 289	pH						
AASHTO Method	Optimum Moisture, %						
	Maximum Dry Density, pcf						

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Chuck Luedders
 Materials Mike Peabody

Remarks:

Reported By:

Darrell Harding
 Darrell Harding
 Laboratory Manager



U.S. Department
of Transportation
Federal Highway
Administration

Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



Report of Soil or Aggregate Tests

Page 5 of 8

Project: Colorado PFH 81-1(4) Tarryall Creek

Submitted By: Steve Deppmeier

Date Reported: 3/28/2012

Sample Number	Lab Number	12-168-SB	12-169-RV	12-170-SB	12-171-RV	12-172-SB
	Boring Number	B-9	B-10	B-10	B-11	B-11

Sample Location	Station	1684+00	1741+50	1741+50	1791+50	1791+50
	Milepost	25.4	26.4	26.4	27.4	27.4
	Lane	Left	Right	Right	Left	Left
	Depth	0.5-18 Inches	0.06-3 Feet	0.75-18 Inches	0.13-5 Feet	1.5-18 Inches

AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm				100
	3/4"	19.0 mm		100		98
	1/2"	12.5 mm		98		95
	3/8"	9.5 mm		95		84
	#4	4.75 mm		84		72
	#8	2.36 mm				
	#10	2.00 mm		61		57
	#16	1.18 mm		52		50
	#30	600 µm				
	#40	425 µm		37		38
	#50	300 µm				
	#100	150 µm		25		28
	#200	75 µm		18		18
	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %	6.1		6.7		6.0
AASHTO T 89 & T 90	Liquid Limit		NV		25	
	Plasticity Index		NP		8	
Soil Classification	AASHTO M 145		A-1-b (0)		A-2-4 (0)	
	ASTM D 2487		SM		SC	
AASHTO T 190	R - Value		64		47	
AASHTO T 288	Min. Resistivity, ohm x cm					
AASHTO T 289	pH					
AASHTO Method	Optimum Moisture, %					
	Maximum Dry Density, pcf					

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Chuck Luedders
 Materials Mike Peabody

Remarks:

Reported By:

Darrell Harding
 Laboratory Manager



U.S. Department
of Transportation
Federal Highway
Administration

Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



Report of Soil or Aggregate Tests

Project: Colorado PFH 81-1(4) Tarryall Creek

Submitted By: Steve Deppmeier

Date Reported: 3/28/2012

Sample Number	Lab Number	12-173-RV	12-174-SB	12-175-SB	12-176-RV	12-177-SB
	Boring Number	B-12	B-12	B-12	B-13	B-13
Sample Location	Station	1844+00	1844+00	1844+00	1896+00	1896+00
	Milepost	28.4	28.4	28.4	29.4	29.4
	Lane	Left	Left	Left	Right	Right
	Depth	0.04-5 Feet	0.5-18 Inches	18-60 Inches	0.08-4 Feet	1-18 Inches
AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm	100			100
	3/4"	19.0 mm	99		100	99
	1/2"	12.5 mm	99		99	98
	3/8"	9.5 mm	96		96	92
	#4	4.75 mm	85		91	83
	#8	2.36 mm				
	#10	2.00 mm	80		86	73
	#16	1.18 mm	77		83	67
	#30	600 µm				
	#40	425 µm	69		73	54
	#50	300 µm				
	#100	150 µm	50		53	33
	#200	75 µm	37		38	22
	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %		3.0	11.7		6.0
AASHTO T 89 & T 90	Liquid Limit	29		27	23	
	Plasticity Index	12		10	4	
Soil Classification	AASHTO M 145	A-6 (1)		A-4 (0)	A-2-4 (0)	
	ASTM D 2487	SC		SC	SC-SM	
AASHTO T 190	R - Value	21			29	
AASHTO T 288	Min. Resistivity, ohm x cm					
AASHTO T 289	pH					
AASHTO Method	Optimum Moisture, %					
	Maximum Dry Density, pcf					

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Chuck Luedders
 Materials Mike Peabody

Remarks:

Reported By:

 Darrell Harding
 Laboratory Manager



U.S. Department
of Transportation
Federal Highway
Administration

Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



Report of Soil or Aggregate Tests

Project: Colorado PFH 81-1(4) Tarryall Creek

Submitted By: Steve Deppmeier

Date Reported: 3/28/2012

Sample Number	Lab Number	12-178-RV	12-179-SB	12-180-RV	12-181-SB	12-182-RV
	Boring Number	B-14	B-14	B-15	B-15	B-16
Sample Location	Station	1949+00	1949+00	2002+50	2002+50	2054+00
	Milepost	30.4	30.4	31.3	31.3	32.3
	Lane	Right	Right	Left	Left	Left
	Depth	0.06-3 Feet	0.75-18 Inches	0.08-5 Feet	1-18 Inches	0.08-1.5 Feet
AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	3"	75.0 mm				
	1 1/2"	37.5 mm				
	1"	25.0 mm				
	3/4"	19.0 mm	100		100	100
	1/2"	12.5 mm	99		99	98
	3/8"	9.5 mm	98		98	95
	#4	4.75 mm	94		94	84
	#8	2.36 mm				
	#10	2.00 mm	88		87	67
	#16	1.18 mm	84		82	58
	#30	600 µm				
	#40	425 µm	70		69	43
	#50	300 µm				
	#100	150 µm	38		44	28
	#200	75 µm	20		29	19
		20 µm				
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %		7.7		5.8	
AASHTO T 89 & T 90	Liquid Limit	NV		24		NV
	Plasticity Index	NP		5		NP
Soil Classification	AASHTO M 145	A-2-4 (0)		A-2-4 (0)		A-1-b (0)
	ASTM D 2487	SM		SC-SM		SM
AASHTO T 190	R - Value	47		34		64
AASHTO T 288	Min. Resistivity, ohm x cm					
AASHTO T 289	pH					
AASHTO Method	Optimum Moisture, %					
	Maximum Dry Density, pcf					

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Chuck Luedders
 Materials Mike Peabody

Remarks:

Reported By:

 Darrell Harding
 Laboratory Manager



U.S. Department
of Transportation
Federal Highway
Administration

Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



Report of Soil or Aggregate Tests

Project: Colorado PFH 81-1(4) Tarryall Creek

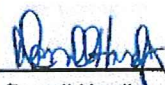
Submitted By: Steve Deppmeier

Date Reported: 3/28/2012

Sample Number	Lab Number	12-183-SB	12-184-RV	12-185-SB	12-186-RV	12-187-SB
	Boring Number	B-16	B-17	B-17	B-18	B-18
Sample Location	Station	2054+00	2096+00	2096+00	2138+00	2138+00
	Milepost	32.3	33.1	33.1	33.9	33.9
	Lane	Left	Right	Right	Right	Right
	Depth	1-18 Inches	0.08-3 Feet	1.75-18 Inches	0.10-2 Feet	1.25-18 Inches
AASHTO T 11, T 27 & T 88 Washed Sieve Analysis % Passing	3"	75.0 mm				
	1 1/2"	37.5 mm			100	
	1"	25.0 mm		100	99	
	3/4"	19.0 mm		99	99	
	1/2"	12.5 mm		96	97	
	3/8"	9.5 mm		94	95	
	#4	4.75 mm		87	86	
	#8	2.36 mm				
	#10	2.00 mm		73	77	
	#16	1.18 mm		65	72	
	#30	600 µm				
	#40	425 µm		52	62	
	#50	300 µm				
	#100	150 µm		36	49	
	#200	75 µm		24	41	
	20 µm					
	2 µm					
	1 µm					
AASHTO T 255	Moisture, %	7.7		3.9		12.0
AASHTO T 89 & T 90	Liquid Limit		21		72	
	Plasticity Index		3		54	
Soil Classification	AASHTO M 145		A-2-4 (0)		A-7-6 (14)	
	ASTM D 2487		SM		SC	
AASHTO T 190	R - Value		43		3	
AASHTO T 288	Min. Resistivity, ohm x cm					
AASHTO T 289	pH					
AASHTO Method	Optimum Moisture, %					
	Maximum Dry Density, pcf					

Distribution: Num. / Project File
 Laboratory Darrell Harding
 Pavements Chuck Luedders
 Materials Mike Peabody

Remarks:

Reported By:

 Darrell Harding
 Laboratory Manager