technical note technical note

Subgrade CBR Values for Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility

Gordon F. Hayhoe

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16. Abstract

Full-scale traffic test results from tests run at the Federal Aviation Administration National Airport Pavement Test Facility (NAPTF) in 2000, 2001, and 2002 with four-wheel and six-wheel landing gears have previously been combined with results from tests run by the U.S. Army Corps of Engineers in the early 1970s. The combined results were analyzed in a recent report, and updated alpha factor values were determined for four- and six-wheel gears at 10,000 coverages. The strength of the subgrades in the NAPTF test pavements was characterized by averages of CBR (California Bearing Ratio) measurements made at the surface of the subgrade before and after testing and CBR measurements made after testing at depths of one foot and two feet (30.48 cm and 60.96 cm) below the surface of the subgrade. A number of minor transcription and rounding errors were made in the original calculations of the average CBR values and, since publication of the previous report, results have become available from an additional trench opened in one of the test items. The average CBR values for the NAPTF tests are updated in this report, resulting in an increase in the computed four-wheel alpha factor of approximately 0.6 percent and a decrease in the computed six-wheel alpha factor of approximately 1.3 percent.

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LIST OF ACRONYMS

ACN	Aircraft Classification Number
CBR	California Bearing Ratio
CC1	Construction cycle 1
CC3	Construction cycle 3
FAA	Federal Aviation Administration
LFC	Low-strength flexible conventional
MFC	Medium-strength flexible conventional
MFS	Medium-strength flexible stabilized
MWHGL	Multiple-wheel heavy gear load
NAPTF	National Airport Pavement Test Facility

EXECUTIVE SUMMARY

An alpha factor is an empirically derived traffic volume factor used to adjust flexible pavement design thickness computed with the CBR (California Bearing Ratio) design procedure. Under the CBR design procedure, an alpha factor is a function of the number of wheels in the landing gear used for design and the number of load applications (coverages) to failure. As applied in the International Civil Aviation Organization Aircraft Classification Number (ACN)-Pavement Classification Number pavement load rating methodology for flexible pavements, the load rating (ACN) for an aircraft is calculated using the CBR methodology at a fixed 10,000 coverages to failure. The alpha factor for that aircraft is therefore a function of the number of wheels in the landing gear only. The recent introduction of heavy-load, triple-dual-tandem landing gears on the Boeing 777 and Airbus 380 aircraft has refocused interest on the ACN and associated alpha values for six-wheel landing gears. Full-scale traffic test results from tests run at the Federal Aviation Administration National Airport Pavement Test Facility (NAPTF) in 2000, 2001, and 2002 with four-wheel and six-wheel landing gears have been combined with results from tests run by the U.S. Army Corps of Engineers in the early 1970s. The combined results were analyzed in a recent report, and updated alpha factor values were determined for four- and six-wheel gears at 10,000 coverages. The strength of the subgrades in the NAPTF test pavements was characterized by averages of CBR measurements made at the surface of the subgrade before and after testing, and CBR measurements made after testing at depths of one foot and two feet (30.48 cm and 60.96 cm) below the surface of the subgrade. A number of minor transcription and rounding errors were made in the original calculations of the average CBR values and, since publication of the previous report, results have become available from an additional trench opened in one of the test items. The average CBR values for the NAPTF tests are updated in this report, resulting in an increase in the computed four-wheel alpha factor of approximately 0.6 percent and a decrease in the computed six-wheel alpha factor of approximately 1.3 percent.

INTRODUCTION

The report DOT/FAA/AR-06/7, "Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility," [1] includes average (nominal) subgrade CBR (California Bearing Ratio) values from measurements made at the National Airport Pavement Test Facility (NAPTF). The average CBR values were used in the calculation of alpha factors for four- and six-wheel landing gears. A number of minor transcription and rounding errors had occurred in the original calculation of the average subgrade CBR values, and measurements made in an additional posttraffic trench were not available for the original calculations. This technical note provides updated average CBR values to reflect correction of the errors and inclusion of the supplemental information.

Data from construction cycle one (CC1) and construction cycle three (CC3) at the NAPTF are considered. The data for CC1 is discussed first, followed by a discussion of the data for CC3, tabulations of the raw data, updated tables for alpha factor calculations, and updated alpha factor charts. Detailed information on the procedures used to measure the structural and material properties of the test pavements is given in reference 2.

CONSTRUCTION CYCLE 1 SUBGRADE CBR CHARACTERIZATION.

For computing alpha factors, the strength of the CC1 subgrade was characterized by averaging the following CBR measurements:

1. Acceptance measurements for the final lift of subgrade construction (as-built values).

2. Posttraffic trench measurements made in the traffic paths at the surface of the subgrade, one CBR value for each traffic path. Each CBR value was calculated as the average of six measurements, with three penetrations per measurement.

3. Posttraffic pit measurements made at the center of the traffic paths at a depth of 12 inches (30.48 cm) below the surface of the subgrade, one CBR value for each traffic path. Each CBR value was calculated as the average of three measurements, with three penetrations per measurement.

4. Posttraffic pit measurements made at the center of the traffic paths at a depth of 24 inches (60.96 cm) below the surface of the subgrade, one CBR value for each traffic path. Each CBR value was calculated as the average of three measurements, with three penetrations per measurement.

The CBR of each traffic path at each trench location was characterized by taking the average of the four measurements above.

Test item medium-strength flexible conventional (MFC) failed uniformly along its length and within each traffic path. The CBR of each traffic path of test item MFC was therefore characterized as the average of two trench characterizations, west and east (MFC-W and MFC-E, respectively).

An early failure was experienced in the north (six-wheel) traffic path of test item medium-strength flexible stabilized (MFS), and these results were not used in the calculation of alpha factors.

The south (four-wheel) traffic path of test item MFS failed uniformly in only the western half of the test item. The CBR measurements made in the west trench of MFS (MFS-W) were therefore used to characterize the subgrade strength in the calculation of alpha factors.

The acceptance CBR of the final lift of the CC1 subgrade over the extent of test items MFC and MFS was 7.7. This value was used as the as-built value for both MFC and MFS for computing alpha factors.

Report DOT/FAA/AR-06/7 has CBR values listed for test items MFC and MFS, which were calculated as the average of measurements 2 through 4 on page 1. In addition, an error was made in transcribing the average CBR for the north side of trench MFC-E (the value for the south side of trench MFC-W was used instead). Corrected values are:

- Six-wheel CC1-MFC = 7.30 instead of 7.45
- Four-wheel CC1-MFC = 7.43 instead of 7.34
- Four-wheel CC1-MFS = 7.50 instead of 7.43

CONSTRUCTION CYCLE 3 SUBGRADE CBR CHARACTERIZATION.

For computing alpha factors, the strength of the CC3 subgrade was characterized by averaging the following CBR measurements:

1. Acceptance measurements for the final lift of subgrade construction (as-built values).

2. Posttraffic trench measurements made in the traffic paths at the surface of the subgrade, one CBR value for each traffic path. Each CBR value was calculated as the average of six measurements, with three penetrations per measurement.

3. Posttraffic pit measurements made at the center of the traffic paths at a depth of 12 inches (30.48 cm) below the surface of the subgrade, one CBR value for each traffic path. Each CBR value was calculated as the average of three measurements, with three penetrations per measurement.

4. Posttraffic pit measurements made at the center of the traffic paths at a depth of 24 inches (60.96 cm) below the surface of the subgrade, one CBR value for each traffic path. Each CBR value was calculated as the average of three measurements, with three penetrations per measurement.

The CBR of each traffic path at each trench location was characterized by taking the average of the four measurements on page 2.

Test item low-strength flexible conventional (LFC)1 was 20 feet (6.1 m) shorter than the other test items, and only one trench was opened in it to characterize the strength of the subgrade. A slight rounding error occurred in the calculation of the CBR value for the four-wheel traffic path of LFC1.

Test item LFC2 failed uniformly along its length and within each traffic path. The CBR of each traffic path of test item LFC2 was therefore characterized as the average of two trench characterizations (west and east). Report DOT/FAA/AR-06/7 has CBR values listed for test item LFC2, which were calculated as the average of only one trench (LFC2-W). Averaging the CBR values calculated for both trenches in LFC2 gives the following corrected values:

- Six-wheel CC3-LFC2 = 4.24 instead of 4.38
- Six-wheel CC3-LFC3 = 4.24 instead of 4.38
- Four-wheel CC3-LFC1 = 4.33 instead of 4.32
- Four-wheel CC3-LFC2 = 4.37 instead of 4.32
- Four-wheel CC3-LFC3 = 4.37 instead of 4.32

Acceptance of the CC3 subgrade construction was based on four CBR measurements in each wheel track over 300 feet (91.4 m) of constructed subgrade. Each CBR measurement consisted of three penetrations within a circle of approximately 1-foot (0.3 m) radius.

Although the elevation of the finished grade of the subgrade for each of the four test items within CC3 was different, the new subgrade was built up in four equal lifts to the finished grades simultaneously over the full 300 feet (91.4 m). The starting grade of the newly constructed subgrade was also reworked to the target strength, giving five effective newly constructed lifts. The strength of the starting grade of the subgrade before rework was significantly higher than the target strength, as was the strength of the lower layers. The strength of the existing subgrade before reconstruction was not measured in a systematic manner.

Acceptance CBRs of the final lift of the new subgrade were 3.16 for the north lane and 3.17 for the south lane, each number being the average of four CBR measurements. The range of the measurements was 0.9 in the north lane and 1.3 in the south lane. The measurements were made with one measurement in each of the four test items for each traffic lane. However, it is not reasonable to characterize over 700 square feet (65 m^2) of subgrade using a single CBR measurement. Also, the lower newly constructed lifts all had strengths less than 3 CBR, and the existing subgrade had significantly greater strength. In view of the variation of the subgrade strengths and the sparsity of the data, the average of the top lift was rounded down to 3.1 and used to characterize the strength of the entire subgrade for use as a component in the effective subgrade strength for calculating alpha factors.

RAW DATA TABULATIONS AND REDUCTION TO AVERAGE VALUES

Tables 1 through 23 present the individual CBR measurements (three penetrations per measurement) and the results of reduction to average (nominal) values according to the procedures described in the previous two sections.

Table 1. CBR Measurements for Surface of Trench CF1-MFC-E

Test Number	4-Wheel Traffic Path	6-Wheel Traffic Path	Nontrafficked Area
1	5.15	5.20	6.90
2	5.80	5.75	7.23
3	4.90	5.30	6.33
4	5.50	5.20	5.23
5	5.65	5.23	5.50
6	5.10	5.57	5.17
7			5.60
8			6.40
9			5.10
10			5.15
11			5.60
12			5.60
13			6.20
14			6.30
15			5.80
16			8.00
Average	5.35	5.38	6.01
Std. Deviation	0.35	0.23	0.83
Covariance, %	6.58	4.28	13.80

Table 2. All CBR Measurements for Trench CC1-MFC-E

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path	Nontrafficked Area
Average Surface Acceptance	7.70	7.70	7.70
Average Surface Trench	5.35	5.38	6.01
6 (15.24) Trench	6.70	6.60	5.70
12 (30.48) Trench	8.40	9.20	8.80
18 (45.72) Trench	6.90	7.20	6.00
24 (60.96) Trench	7.80	6.20	6.60

Table 3. CBR Measurements From Trench CC1-MFC-E Used in Alpha Factor Calculations

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path
Average Surface Acceptance	7.70	7.70
Average Surface Trench	5.35	5.38
12 (30.48) Trench	8.40	9.20
24 (60.96) Trench	7.80	6.20
Average	7.31	7.12

Table 4. CBR Measurements for Surface of Trench CC1-MFC-W

Test Number	4-Wheel Traffic Path	6-Wheel Traffic Path	Nontrafficked Area
1	5.80	6.73	5.77
2	7.67	6.40	5.73
3	6.30	7.03	6.20
4	5.90	5.53	6.33
5	7.03		5.63
6			7.23
Average	6.54	6.43	6.15
Std. Deviation	0.79	0.65	0.60
Covariance, %	12.15	10.09	9.75

Table 5. All CBR Measurements for Trench CC1-MFC-W

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path	Nontrafficked Area
Average Surface Acceptance	7.70	7.70	7.70
Average Surface Trench	6.54	6.43	6.15
6 (15.24) Trench	8.60	9.80	9.00
12 (30.48) Trench	8.80	9.80	8.80
18 (45.72) Trench	7.70	7.90	5.70
24 (60.96) Trench	6.10	7.00	7.00

Table 6. CBR Measurements From Trench CC1-MFC-W Used in Alpha Factor Calculations

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path
Average Surface Acceptance	7.70	7.70
Average Surface Trench	6.54	6.43
12 (30.48) Trench	8.80	9.80
24 (60.96) Trench	6.10	7.00
Average	7.29	7.73

Table 7. Average CBR Measurements From Trenches CC1-MFC-E and MFC-W Used in Alpha Factor Calculations

	6-Wheel Traffic Path	4-Wheel Traffic Path
Average for MFC-E	7.31	7.12
Average for MFC-W	7.29	7.73
Average for Both Trenches	7.30	7.43

Table 8. CBR Measurements for Surface of Trench CC1-MFS-E

Test Number	4-Wheel Traffic Path	6-Wheel Traffic Path	Nontrafficked Area
1	6.93	8.33	10.00
2	7.00	5.73	10.07
3	7.00	5.80	9.60
4	7.80	5.90	9.20
5	7.57	5.10	6.97
6	6.00		8.60
7			9.07
8			9.40
9			10.13
10			8.97
11			6.70
12			6.97
13			7.20
14			7.07
Average	7.05	6.17	8.57
Std. Deviation	0.62	1.25	1.30
Covariance, %	8.86	20.21	15.20

Table 9. All CBR Measurements for Trench CC1-MFS-E

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path	Nontrafficked Area
Average Surface Acceptance	7.70	7.70	7.70
Average Surface Trench	7.05	6.17	8.57
6 (15.24) Trench	10.90	7.30	10.50
12 (30.48) Trench	7.20	8.90	7.40
18 (45.72) Trench	5.80	7.50	6.40
24 (60.96) Trench	6.70	8.00	7.10

Table 10. CBR Measurements From Trench CC1-MFS-E at Three Depths

Depth, inch (cm)	6-Wheel Traffic Path*	4-Wheel Traffic Path*
Average Surface Acceptance	7.70	7.70
Average Surface Trench	7.05	6.17
12 (30.48) Trench	7.20	8.90
24 (60.96) Trench	6.70	8.00
Average	7.16	7.69

* The CBR measurements from trench CC1-MFS-E were not used in the alpha factor calculations because of premature failure in the subbase of the six-wheel traffic path at this location. Trafficking was stopped in the four-wheel traffic path at the east end of CC1-MFS at the same time as trafficking was stopped in the six-wheel traffic path. The results are shown here for reference and comparison only.

Table 11. CBR Measurements for Surface of Trench CC1-MFS-W

Test Number	4-Wheel Traffic Path	6-Wheel Traffic Path	Nontrafficked Area
1	5.83	8.43	7.73
2	5.83	7.00	7.80
3	6.17	6.27	7.00
4	6.57	5.93	7.57
5	6.67		7.50
Average	6.21	6.91	7.52
Std. Deviation	0.39	1.11	0.31
Covariance, %	6.34	16.07	4.19

Table 12. All CBR Measurements for Trench CC1-MFS-W

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path	Nontrafficked Area
Average Surface Acceptance	7.70	7.70	7.70
Average Surface Trench	6.21	6.91	7.52
6 (15.24) Trench	6.50	9.50	7.90
12 (30.48) Trench	7.20	7.70	7.90
18 (45.72) Trench	6.20	8.80	6.10
24 (60.96) Trench	5.50	7.70	6.70

Table 13. CBR Measurements From Trench CC1-MFS-W Used in Alpha Factor Calculations

Depth, inch (cm)	6-Wheel Traffic Path*	4-Wheel Traffic Path
Average Surface Acceptance	7.70	7.70
Average Surface Trench	6.21	6.91
12 (30.48) Trench	7.20	7.70
24 (60.96) Trench	5.50	7.70
Average	6.65	7.50

* The CBR measurements from the six-wheel traffic path of trench CC1-MFS-W were not used in the alpha factor calculations because of premature failure in the subbase of the six-wheel traffic path at this location. The results are shown here for reference and comparison only.

Table 14. CBR Measurements for Surface of Trench CC3-LFC1

Test Number	4-Wheel Traffic Path	6-Wheel Traffic Path	Nontrafficked Area
1	3.73	3.87	4.10
2	3.00	3.00	3.80
3	2.20 (Outlier)	3.37	3.70
4	3.27	3.33	3.43
5	3.03	3.47	2.83
6	2.87	3.47	3.17
7			3.33
8			3.17
9			3.60
10			3.20
11			3.40
12			3.03
13			3.37
14			3.00
15			3.47
Average	3.18	3.42	3.37
Std. Deviation	0.34	0.28	0.33
Covariance, %	10.73	8.18	9.85

Table 15. All CBR Measurements for Trench CC3-LFC1

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path	Nontrafficked Area
Average Surface Acceptance	3.10	3.10	3.10
Average Surface Trench	3.18	3.42	3.37
6 (15.24) Trench	3.97	4.17	4.20
12 (30.48) Trench	4.00	5.00	4.80
18 (45.72) Trench	4.40	5.30	5.40
24 (60.96) Trench	4.60	5.80	5.20

Table 16. CBR Measurements From Trench CC3-LFC1 at Three Depths

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path
Average Surface Acceptance	3.10	3.10
Average Surface Trench	3.18	3.42
12 (30.48) Trench	4.00	5.00
24 (60.96) Trench	4.60	5.80
Average	3.72	4.33

Table 17. CBR Measurements for Surface of Trench CC3-LFC2-E

Test Number	4-Wheel Traffic Path	6-Wheel Traffic Path	Nontrafficked Area
1	4.27	4.33	3.70
2	3.67	5.37	4.13
3	4.13	4.30	3.43
4	3.40	4.77	4.43
5	3.80	4.60	4.07
6		3.93	3.37
7			3.63
8			4.07
9			4.37
10			3.20
11			3.87
12			3.75
13			3.57
14			3.25
15			3.55
Average	3.85	4.55	3.76
Std. Deviation	0.35	0.49	0.39
Covariance, %	9.11	10.79	10.30

Table 18. All CBR Measurements for Trench CC3-LFC2-E

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path	Nontrafficked Area
Average Surface Acceptance	3.10	3.10	3.10
Average Surface Trench	3.85	4.55	3.76
6 (15.24) Trench	-	-	-
12 (30.48) Trench	5.20	4.80	4.50
18 (45.72) Trench	-	-	-
24 (60.96) Trench	4.20	5.20	5.90

Table 19. CBR Measurements From Trench CC3-LFC2-E Used in Alpha Factor Calculations

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path
Average Surface Acceptance	3.10	3.10
Average Surface Trench	3.85	4.55
12 (30.48) Trench	5.20	4.80
24 (60.96) Trench	4.20	5.20
Average	4.09	4.41

Table 20. CBR Measurements for Surface of Trench CC3-LFC2-W

Test Number	4-Wheel Traffic Path	6-Wheel Traffic Path	Nontrafficked Area
1	4.00	3.60	4.50
2	3.50	3.70	3.60
3	3.40	3.60	2.30
4	3.70	3.00	2.20
5	3.10	4.30	1.80
6	4.10	3.80	4.30
7			4.10
8			2.90
9			2.90
10			2.80
11			3.80
12			3.30
13			3.60
Average	3.63	3.67	3.24
Std. Deviation	0.38	0.42	0.84
Covariance, %	10.40	11.40	25.97

Table 21. All CBR Measurements for Trench CC3-LFC2-W

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path	Nontrafficked Area
Average Surface Acceptance	3.10	3.10	3.10
Average Surface Trench	3.63	3.67	3.24
6 (15.24) Trench	5.40	4.60	4.50
12 (30.48) Trench	4.90	5.10	5.50
18 (45.72) Trench	3.60	4.50	4.20
24 (60.96) Trench	5.90	5.40	5.80

Table 22. CBR Measurements From Trench CC3-LFC2-W Used in Alpha Factor Calculations

Depth, inch (cm)	6-Wheel Traffic Path	4-Wheel Traffic Path
Average Surface Acceptance	3.10	3.10
Average Surface Trench	3.63	3.67
12 (30.48) Trench	4.90	5.10
24 (60.96) Trench	5.90	5.40
Average	4.38	4.32

Table 23. Average CBR Measurements From Trenches CC3-LFC2-E and LFC2-W Used in Alpha Factor Calculations

	6-Wheel Traffic Path	4-Wheel Traffic Path
Average for LFC2-E	4.09	4.41
Average for LFC2-W	4.38	4.32
Average for Both Trenches	4.24	4.37

UPDATED TABLES FOR CALCULATION OF ALPHA FACTORS

Tables 24 and 25 are updated versions of tables 8 and 9 in report DOT/FAA/AR-06/7.

Table 24. Summary of NAPTF Flexible Pavement Full-Scale Test Results

Wheel Configuration	Test Item	Wheel Load, lb[1]	Repetitions to Failure	Coverages to Failure	Design Thickness		Subgrade CBR[3]
					in.	cm	
6-Wheel	CC3-LFC1	55,000	90	57.3	29	73.7	3.72
	CC3-LFC2	55,000	1,584	1,009	37	94.0	4.24
	CC3-LFC3	65,000	20,000	12,739	47	119.4	4.24[4]
	CC1-MFC	45,000	13,000	8,280	25	63.5	7.30
4-Wheel	CC3-LFC1	55,000	132	55.9	29	73.7	4.33
	CC3-LFC2	55,000	2,970	1,258	37	94.0	4.37
	CC3-LFC3	65,000	40,000[2]	16,949	47	119.4	4.37[4]
	CC1-MFC	45,000	12,000	5,825	25	63.5	7.43
	CC1-MFS	45,000	19,000	9,223	18.5	47.0	7.50

Notes to Table 8.
1. 45 kips = 200 kN, 55 kips = 244 kN, 65 kips = 289 kN.
2. Repetitions to failure for LFC3 – 4-wheel is from extrapolated rut depth curve.
3. CBR computed as the average of the following measurements: acceptance surface, trench surface, and trench pits 12 and 24 inches (30.5 and 61.0 cm) from the surface of the subgrade.
4. Trench not opened in LFC3. The CBR values for LFC3 have been given the same values as those in LFC2.

Table 25. NAPTF Flexible Pavement Equivalent Thicknesses and Alpha Factors

Wheel Configuration	Test Item	SQS = 1.6 × CA			SQS = 1.4 × CA		
		Equivalent Thickness[1]		Alpha Factor	Equivalent Thickness[2]		Alpha Factor
		in.	cm		in.	cm	
6-Wheel	CC3-LFC1	36.5	92.7	0.527	35.5	90.2	0.517
	CC3-LFC2	46.1	117.1	0.654	45.1	114.6	0.645
	CC3-LFC3	58.1	147.6	0.701	57.1	145.0	0.693
	CC1-MFC	31.7	80.5	0.753	30.7	78.0	0.736
4-Wheel	CC3-LFC1	36.5	92.7	0.647	35.5	90.2	0.634
	CC3-LFC2	46.1	117.1	0.755	45.1	114.6	0.745
	CC3-LFC3	58.1	147.6	0.813	57.1	145.0	0.803
	CC1-MFC	31.7	80.5	0.836	30.7	78.0	0.818
	CC1-MFS	30.9	78.5	0.827	28.2	71.6	0.774

Notes to Table 9.

All NAPTF structures were converted to equivalent structures to be compatible with multiple-wheel heavy gear load (MWHGL) pavements:

- MWHGL = 3 inches (7.6 cm) of asphalt, 6 inches (15.2 cm) of crushed aggregate base, and balance of uncrushed subbase.
- NAPTF P-401 converted to crushed aggregate base with 1.6 equivalent thickness factor.
- NAPTF P-154 converted to uncrushed aggregate subbase with 1.2 equivalent thickness factor.

1. NAPTF P-209 converted to uncrushed aggregate subbase with 1.6 equivalent thickness factor.
2. NAPTF P-209 converted to uncrushed aggregate subbase with 1.4 equivalent thickness factor.

SQS = Standard quality subbase

CA = Crushed aggregate

UPDATED ALPHA FACTOR CHARTS

Figures 1 and 2 are updated versions of figures 5 and 6 in report DOT/FAA/AR-06/7.

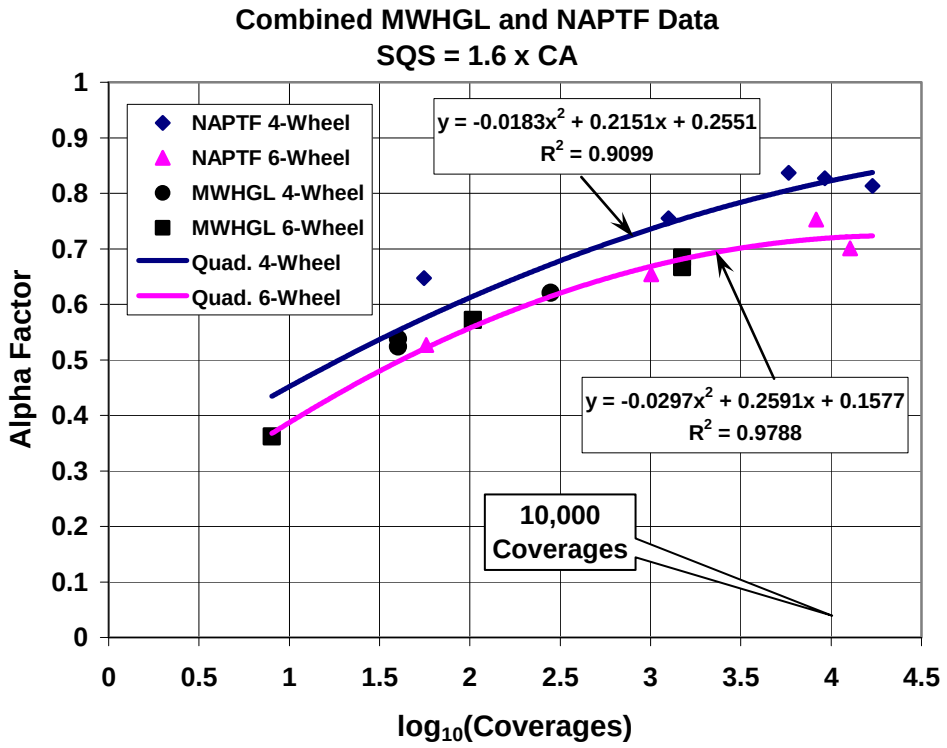

Figure 1. Alpha Factor Plots With Combined MWHGL and NAPTF Full-Scale Test Data Points, Quadratic Curve Fits, SQS = 1.6 x CA
(4-Wheel curve crosses 10,000 coverages at $\alpha = 0.8227$
6-Wheel curve crosses 10,000 coverages at $\alpha = 0.7189$
Ratio of 6-wheel: 4-wheel = 0.8738 at 10,000 coverages)

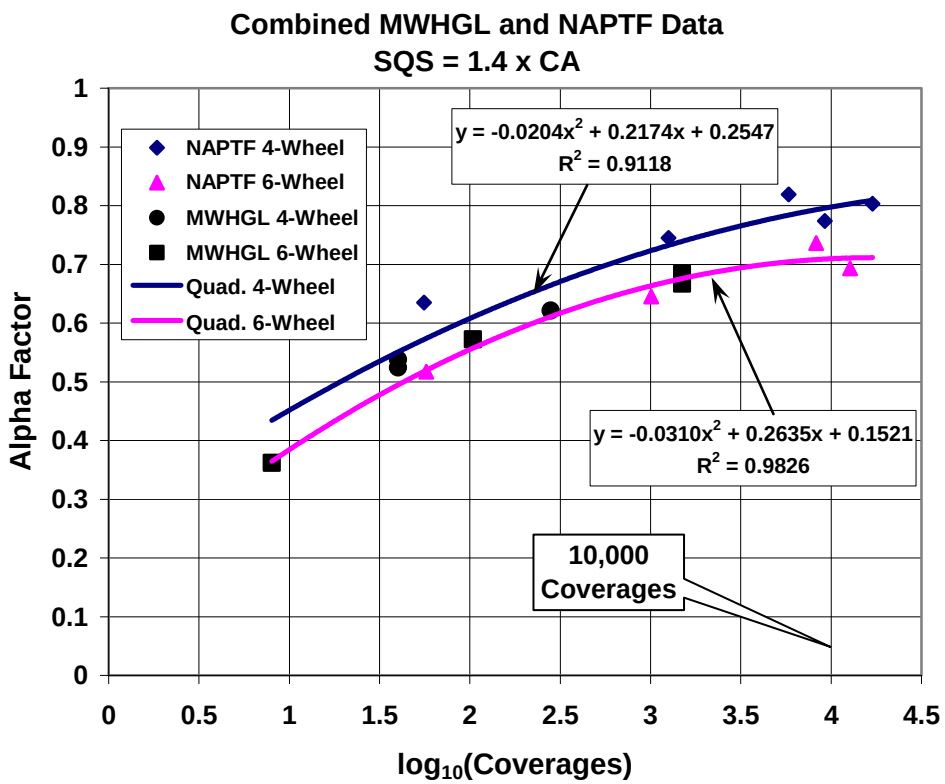

Figure 2. Alpha Factor Plots With Combined MWHGL and NAPTF Full-Scale Test Data Points, Quadratic Curve Fits, SQS = 1.4 x CA
(4-Wheel curve crosses 10,000 coverages at $\alpha = 0.7979$
6-Wheel curve crosses 10,000 coverages at $\alpha = 0.7101$
Ratio of 6-wheel: 4-wheel = 0.8900 at 10,000 coverages)

REFERENCES

1. Hayhoe, Gordon F., "Alpha Factor Determination Using Data Collected at the National Airport Pavement Test Facility," FAA report DOT/FAA/AR-06/7, March 2006.

2. Garg, Navneet, "Posttraffic Testing at the National Airport Pavement Test Facility: Test Item MFC," FAA report DOT/FAA/AR-TN01/49, September 2001.