

# TECHNICAL SPECIFICATIONS

Item C-105 - Mobilization

Item C-110 – Method of Estimating Percentage of Material  
Within Specification Limits (PWL) - Joint Density

Item P-209 – Crushed Aggregate Base Course

Item PMBP – Plant Mix Bituminous Pavements

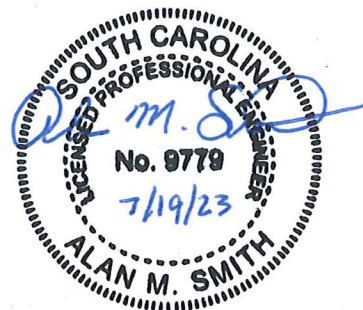
Item P-603 – Emulsified Asphalt Tack Coat

Item T-901 – Seeding

Item T-905 – Topsoil

Item T-908 – Mulching

Prepared By:  
Talbert & Bright Inc.  
Engineering and Planning Consultants  
4810 Shelley Drive  
Wilmington, NC 28411  
(910)763-5350



## ITEM C-105

### MOBILIZATION

- 105-1 Description.** This item of work shall consist of, but is not limited to, work and operations necessary for the movement of personnel, equipment, materials, and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

### METHOD OF MEASUREMENT AND PAYMENT

- 105-5.1 Mobilization.** Based upon the contract lump sum price for "Mobilization" partial payments will be allowed as follows:
- A.** With first pay request, 70%
  - B.** After Final Inspection, project clean-up, and delivery of all Project Closeout materials as required for the project, the final 30%.

### BASIS OF PAYMENT

- 105-6 Payment will be Made Under:**

Item C-105.6.1      Mobilization - per Lump Sum

**END OF ITEM C-105**

## ITEM C-110

### METHOD OF ESTIMATING PERCENTAGE OF MATERIAL WITHIN SPECIFICATION LIMITS (PWL) – JOINT DENSITY

**110-1 General.** When the specifications provide for acceptance of material based on the method of estimating percentage of material within specification limits (PWL), the PWL will be determined in accordance with this section. All test results for a lot will be analyzed statistically to determine the total estimated percent of the lot that is within specification limits. The PWL is computed using the sample average ( $\bar{X}$ ) and sample standard deviation ( $S_n$ ) of the specified number ( $n$ ) of sublots for the lot and the specification tolerance limits,  $L$  for lower and  $U$  for upper, for the particular acceptance parameter. From these values, the respective Quality index,  $Q_L$  for Lower Quality Index and/or  $Q_U$  for Upper Quality Index, is computed and the PWL for the lot for the specified  $n$  is determined from Table 1. All specification limits specified in the technical sections shall be absolute values. Test results used in the calculations shall be to the significant figure given in the test procedure.

There is some degree of uncertainty (risk) in the measurement for acceptance because only a small fraction of production material (the population) is sampled and tested. This uncertainty exists because all portions of the production material have the same probability to be randomly sampled. The Contractor's risk is the probability that material produced at an acceptable quality level is rejected or subjected to a pay adjustment. The Owner's risk is the probability that material produced at a rejectable quality level is accepted.

It is the intent of this section to inform the Contractor that, in order to consistently offset the Contractor's risk for material evaluated, production quality (using population average and population standard deviation) must be maintained at the acceptable quality specified or higher. In all cases, it is the responsibility of the Contractor to produce at quality levels that will meet the specified acceptance criteria when sampled and tested at the frequencies specified.

**110-2 Method for Computing PWL.** The computational sequence for computing PWL is as follows:

**A.** Divide the lot into  $n$  sublots in accordance with the acceptance requirements of the specification.

**B.** Locate the random sampling position within the subplot in accordance with the requirements of the specification.

**C.** Make a measurement at each location or take a test portion and make the measurement on the test portion in accordance with the testing requirements of the specification.

**D.** Find the sample average ( $\bar{X}$ ) for all subplot test values within the lot by using the following formula:

$$\bar{X} = (x_1 + x_2 + x_3 + \dots + x_n) / n$$

Where:  $\bar{X}$  = Sample average of all subplot test values within a lot

$x_1, x_2, \dots, x_n$  = Individual subplot test values

$n$  = Number of subplot test values

**E.** Find the sample standard deviation ( $S_n$ ) by use of the following formula:

$$S_n = [(d_1^2 + d_2^2 + d_3^2 + \dots + d_n^2)/(n-1)]^{1/2}$$

Where:  $S_n$  = Sample standard deviation of the number of subplot test values in the set  $d_1, d_2, \dots, d_n$  = Deviations of the individual subplot test values  $x_1, x_2, \dots$

from the average value  $\bar{X}$  that is:  $d_1 = (x_1 - \bar{X}), d_2 = (x_2 - \bar{X}) \dots d_n = (x_n - \bar{X})$

$n$  = Number of subplot test values

**F.** For single sided specification limits (i.e., L only), compute the Lower Quality Index  $Q_L$  by use of the following formula:

$$Q_L = (\bar{X} - L) / S_n$$

Where: L = specification lower tolerance limit

Estimate the percentage of material within limits (PWL) by entering Table 1 with  $Q_L$ , using the column appropriate to the total number ( $n$ ) of measurements. If the value of  $Q_L$  falls between values shown on the table, use the next higher value of PWL.

**G.** For double-sided specification limits (i.e., L and U), compute the Quality Indexes  $Q_L$  and  $Q_U$  by use of the following formulas:

$$Q_L = (\bar{X} - L) / S_n$$

and

$$Q_U = (U - \bar{X}) / S_n$$

Where: L and U = specification lower and upper tolerance limits



Estimate the percentage of material between the lower (L) and upper (U) tolerance limits (PWL) by entering Table 1 separately with  $Q_L$  and  $Q_U$ , using the column appropriate to the total number (n) of measurements, and determining the percent of material above  $P_L$  and percent of material below  $P_U$  for each tolerance limit. If the values of  $Q_L$  fall between values shown on the table, use the next higher value of  $P_L$  or  $P_U$ . Determine the PWL by use of the following formula:

$$\text{PWL} = (P_U + P_L) - 100$$

Where:  $P_L$  = percent within lower specification limit  
 $P_U$  = percent within upper specification limit

### EXAMPLE OF PWL CALCULATION

**Project:** Example Project

**Test Item:** Item P-401, Lot A.

#### A. PWL Determination for Mat Density.

1. Density of four random cores taken from Lot A.

$$A-1 = 96.60$$

$$A-2 = 97.55$$

$$A-3 = 99.30$$

$$A-4 = 98.35$$

$$n = 4$$

2. Calculate average density for the lot.

$$X = (x_1 + x_2 + x_3 + \dots + x_n) / n$$

$$X = (96.60 + 97.55 + 99.30 + 98.35) / 4$$

$$X = 97.95\% \text{ density}$$

3. Calculate the standard deviation for the lot.

$$S_n = \left[ \frac{((96.60 - 97.95)^2 + (97.55 - 97.95)^2 + (99.30 - 97.95)^2 + (98.35 - 97.95)^2)}{(4 - 1)} \right]^{1/2}$$

$$S_n = [(1.82 + 0.16 + 1.82 + 0.16) / 3]^{1/2}$$

$$S_n = 1.15$$

4. Calculate the Lower Quality Index  $Q_L$  for the lot. ( $L=96.3$ )

$$Q_L = (X - L) / S_n$$

$$Q_L = (97.95 - 96.30) / 1.15$$

$$Q_L = 1.4348$$

5. Determine PWL by entering Table 1 with  $Q_L = 1.44$  and  $n = 4$ .  $PWL = 98$

### **B. PWL Determination for Air Voids.**

1. Air Voids of four random samples taken from Lot A.

$$A-1 = 5.00$$

$$A-2 = 3.74$$

$$A-3 = 2.30$$

$$A-4 = 3.25$$

2. Calculate the average air voids for the lot.

$$X = (x_1 + x_2 + x_3 + \dots + x_n) / n$$

$$X = (5.00 + 3.74 + 2.30 + 3.25) / 4$$

$$= 3.57\%$$

3. Calculate the standard deviation  $S_n$  for the lot.

$$S_n = [((3.57 - 5.00)^2 + (3.57 - 3.74)^2 + (3.57 - 2.30)^2 + (3.57 - 3.25)^2) / (4 - 1)]^{1/2}$$

$$S_n = [(2.04 + 0.03 + 1.62 + 0.10) / 3]^{1/2}$$

$$S_n = 1.12$$

4. Calculate the Lower Quality Index  $Q_L$  for the lot. ( $L = 2.0$ )

$$Q_L = (X - L) / S_n$$

$$Q_L = (3.57 - 2.00) / 1.12$$

$$Q_L = 1.3992$$

5. Determine  $P_L$  by entering Table 1 with  $Q_L = 1.41$  and  $n = 4$ .  $P_L = 97$

6. Calculate the Upper Quality Index  $Q_U$  for the lot. ( $U = 5.0$ )

$$Q_U = (U - X) / S_n$$

$$Q_U = (5.00 - 3.57) / 1.12$$

$$Q_U = 1.2702$$

7. Determine  $P_U$  by entering Table 1 with  $Q_U = 1.29$  and  $n = 4$ .  $P_U = 93$

8. Calculate Air Voids PWL

$$PWL = (P_L + P_U) - 100$$

$$PWL = (97 + 93) - 100 = 90$$

### Example of Outlier Calculation (Reference ASTM E178)

**Project:** Example Project

**Test Item:** Item P-401, Lot A.

#### A. Outlier Determination for Mat Density.

1. Density of four random cores taken from Lot A arranged in descending order.

$$A-3 = 99.30$$

$$A-4 = 98.35$$

$$A-2 = 97.55$$

$$A-1 = 96.60$$

2. From ASTM E178, Table 1, for  $n=4$  an upper 5% significance level, the critical value for test criterion = 1.463.

3. Use average density, standard deviation, and test criterion value to evaluate density measurements.

4. For measurements greater than the average:

If  $(\text{measurement} - \text{average})/(\text{standard deviation})$  is less than test criterion, then the measurement is not considered an outlier. For A-3, check if  $(99.30 - 97.95) / 1.15$  is greater than 1.463.

Since 1.174 is less than 1.463, the value is not an outlier.

B. For measurements less than the average:

If  $(\text{average} - \text{measurement})/(\text{standard deviation})$  is less than test criterion, then the measurement is not considered an outlier. For A-1, check if  $(97.95 - 96.60) / 1.15$  is greater than 1.463.

Since 1.174 is less than 1.463, the value is not an outlier.

**Note:** In this example, a measurement would be considered an outlier if the density were:

Greater than  $(97.95 + 1.463 \times 1.15) = 99.63\%$

OR

less than  $(97.95 - 1.463 \times 1.15) = 96.27\%$ .



**Table 1. Table for Estimating Percent of Lot Within Limits (PWL)**

Percent Within Limits (P <sub>L</sub> and P <sub>U</sub> )	Positive Values of Q (Q <sub>L</sub> and Q <sub>U</sub> )							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4717	1.4829	1.4914
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653
87	1.0597	1.1100	1.1173	1.1192	1.1199	1.1204	1.1208	1.1212
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990
83	0.9939	0.9900	0.9785	0.9715	0.9671	0.9643	0.9624	0.9610
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686
70	0.6787	0.6000	0.5719	0.5582	0.5504	0.5454	0.5419	0.5394
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537
66	0.5563	0.4800	0.4545	0.4424	0.4355	0.4310	0.4280	0.4257
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4030	0.4001	0.3980
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705

Percent Within Limits (P <sub>L</sub> and P <sub>U</sub> )	Positive Values of Q (Q <sub>L</sub> and Q <sub>U</sub> )							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2093
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566
55	0.1806	0.1500	0.1406	0.1363	0.1338	0.1322	0.1312	0.1304
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1049	0.1042
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0793	0.0786	0.0781
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260
50	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



Percent Within Limits (P <sub>L</sub> and P <sub>U</sub> )	Negative Values of Q (Q <sub>L</sub> and Q <sub>U</sub> )							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304
44	-0.2164	-0.1800	-0.1688	-0.1636	-0.1607	-0.1588	-0.1575	-0.1566
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4355	-0.4310	-0.4280	-0.4257
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105
30	-0.6787	-0.6000	-0.5719	-0.5582	-0.5504	-0.5454	-0.5419	-0.5394
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282
26	-0.7904	-0.7200	-0.6921	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8245	-0.8214	-0.8192
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212

Percent Within Limits (P <sub>L</sub> and P <sub>U</sub> )	Negative Values of Q (Q <sub>L</sub> and Q <sub>U</sub> )							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4717	-1.4829	-1.4914
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5871	-1.6127	-1.6313	-1.6454
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6993	-1.7235	-1.7420
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8053	-1.8379	-1.8630
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362

### REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### ASTM International (ASTM)

ASTM E178            Standard Practice for Dealing with Outlying Observations

**END OF ITEM C-110**



## ITEM P-209

### CRUSHED AGGREGATE BASE COURSE

#### DESCRIPTION

**209-1.1** This item consists of a base course composed of crushed aggregate base constructed on an existing prepared base course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans. The existing base course has been tested for density and proof rolled.

#### MATERIALS

**209-2.1 Crushed Aggregate Base.** Crushed aggregate shall consist of clean, sound, durable particles of crushed stone, crushed gravel, and shall be free from coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate portion, defined as the portion passing the No. 4 sieve shall consist of fines from the coarse aggregate crushing operation. The fine aggregate shall be produced by crushing stone, gravel that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in the following table.

#### Crushed Aggregate Base Material Requirements

Material Test	Requirement	Standard
<b>Coarse Aggregate</b>		
Resistance to Degradation	Loss: 45% Maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss After 5 Cycles: 12% Maximum Using Sodium Sulfate - or - 18% Maximum Using Magnesium Sulfate	ASTM C88
Percentage of Fractured Particles	Minimum 90% by Weight of Particles With at Least Two Fractured Faces and 98% With at Least One Fractured Face <sup>1</sup>	ASTM D5821
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% Maximum, by Weight, of Flat, Elongated, or Flat and Elongated Particles <sup>2</sup>	ASTM D4791
Clay Lumps and Friable Particles	Less Than or Equal to 3 Percent	ASTM C142
<b>Fine Aggregate</b>		
Liquid Limit	Less Than or Equal to 25	ASTM D4318

Material Test	Requirement	Standard
Plasticity Index	Not More than Five (5)	ASTM D4318

<sup>1</sup> The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

<sup>2</sup> A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

**209-2.2 Gradation Requirements.** The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

**Gradation of Aggregate Base**

Sieve Size	Design Range Percentage by Weight passing	Contractor's Final Gradation	Job Control Grading Band Tolerances <sup>1</sup> (Percent)
2 inches	100		0
1-1/2 inch	95-100		±5
1 inch	70-95		±8
3/4 inch	55-85		±8
No. 4	30-60		±8
No. 40 <sup>2</sup>	10-30		±5
No. 200 <sup>2</sup>	0-10		±3

<sup>1</sup> The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

<sup>2</sup> The fraction of material passing the No 200 sieve shall not exceed two-thirds the fraction passing the No 40 sieve.

**209-2.3 Sampling and Testing.**

**A. Aggregate Base Materials.** The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in



Paragraph 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

**B. Gradation Requirements.** The Contractor shall take at least two aggregate base samples per day in the presence of the RPR/ENGINEER and complete gradation testing to check the final gradation. Sampling shall be per ASTM D75 and gradation testing shall per ASTM C117 and ASTM C136. Material shall meet the requirements in Paragraph 209-2.2. The samples shall be taken from the in-place, un-compacted material at sampling points and intervals designated by the ENGINEER.

**209-2.4 Separation Geotextile.** Not used.

### CONSTRUCTION METHODS

**209-3.1 Control Strip.** The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR/ENGINEER, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR/ENGINEER must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted or removed and replaced at the Contractor's expense. Full operations shall not continue until the control strip has been accepted by the ENGINEER. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved by the ENGINEER.

**209-3.2 Preparing Underlying Existing Base Course.** The existing base course has been tested for density and proof rolled. The Contractor shall scarify the existing base course and add sufficient aggregate base course to meet proposed grade. The new base course shall be graded and compacted in accordance with the requirements of this specification.

**209-3.3 Production.** The aggregate shall be uniformly blended and, when at a satisfactory moisture content per Paragraph 209-3.5, the approved material may be transported directly to the placement.

**209-3.4 Placement.** The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the ENGINEER, to a uniform thickness and width. The equipment shall have

positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course shall be constructed in lifts as established in the control strip, but not less than 4 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications at the Contractor's expense.

**209-3.5 Compaction.** Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the base material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D1557. The moisture content of the material during placing operations shall be within  $\pm 2$  percentage points of the optimum moisture content as determined by ASTM D1557. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

**209-3.6 Weather Limitations.** Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

**209-3.7 Maintenance.** The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor's expense.



**209-3.8 Surface Tolerances.** After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown by the Contractor. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR/ENGINEER. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompact to grade until the required smoothness and accuracy are provided to and approved by the ENGINEER. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

**A. Smoothness.** The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

**B. Grade.** The grade and crown shall be measured at 50 foot stations with shots taken at centerline, 18 feet from centerline, and at pavement edge and shall be within +0 and -1/2 inch of the specified grade.

**209-3.9 Acceptance Sampling and Testing.** Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 1200 square yards. Sampling locations will be determined on a random basis per ASTM D3665.

**A. Density.** The ENGINEER shall perform all density tests for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D1557. The in-place field density shall be determined per ASTM D1556 or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompact and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

#### **METHOD OF MEASUREMENT**

**209-4.1** The quantity of crushed aggregate base course will be determined by measurement of the number of cubic yards of material actually constructed and accepted by the ENGINEER as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities

## **BASIS OF PAYMENT**

**209-5.1** Payment shall be made at the contract unit price per cubic yard for crushed aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-209-5.1 Crushed Aggregate Base Course - per Cubic Yard

## **REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

### **ASTM International (ASTM)**

ASTM C29	Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> (2700 kN-m/m <sup>3</sup> ))

ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4751	Standard Test Methods for Determining Apparent Opening Size of a Geotextile
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

**American Association of State Highway and Transportation Officials (AASHTO)**

M288 Standard Specification for Geosynthetic Specification for Highway Applications

**END OF ITEM P-209**



## ITEM PMBP

### PLANT MIX BITUMINOUS PAVEMENTS

#### DESCRIPTION

- 1.1 This item shall consist of a surface course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. Each course shall be constructed to the depth, typical section, or elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course. All materials, mix design requirements, production methods, construction methods, and acceptance testing shall be in accordance with Sections 401 "Asphalt Pavements"; Section 403 "HMA Surface Course"; Supplemental Technical Specification for Hot-Mix Asphalt Material Properties, SCDOT Designation SC-M-402; and Supplemental Technical Specification for Hot Mix Asphalt Quality Assurance SCDOT Designation SC-M-400 of the SCDOT Standard Specifications for Highway Construction unless otherwise modified by this specification.

#### MATERIALS

- 2.1 All aggregates, bituminous materials, and filler shall be provided in accordance with SCDOT Standard Specifications for Highway Construction Section 401 "Asphalt Pavement", Subsection 401.2 and Supplemental Technical Specification SC-M-402.

#### COMPOSITION

- 3.1 **COMPOSITION OF MIXTURE.** The bituminous plant mix shall be composed of a mixture of aggregate, filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula.
- 3.2 **JOB MIX FORMULA.** No bituminous mixture for payment shall be produced until a job mix formula has been approved by the ENGINEER. The formula shall be submitted in writing by the Contractor to the ENGINEER at least 7 days prior to the start of paving operations and shall indicate the definite percentage of each sieve fraction of aggregate, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. All test data used to develop the job mix formula shall also be submitted. The job mix formula for each mixture shall be in effect until modified in writing by the ENGINEER. Should a change in sources of materials be made, a new job mix formula must be established before the new material is used.



The bituminous mixture for the surface course shall meet all of the requirements of the South Carolina Department of Transportation requirements for Hot Mix Asphalt Surface Course Type B as defined in the Supplemental Technical Specification for Hot-Mix Asphalt Material Properties SCDOT Designation: SC-M-402.

- 3.2.1 **GRADATION AND JOB MIX FORMULA.** The bituminous concrete aggregate gradation and job mix formula shall meet the requirements of the current South Carolina Department of Transportation requirements for **Hot Mix Asphalt Surface Course Type B** as defined in the Supplemental Technical Specification for Hot-Mix Asphalt Material Properties SCDOT Designation: SC-M-402.

### CONSTRUCTION METHODS

- 4.1 The Hot Mix Asphalt Surface Course - Type B shall be constructed, in accordance with the South Carolina Department of Transportation Standard Specifications, Section 401 "Asphalt Pavements", Subsection 401.4. This work shall include plant mixing, hauling, placement, compaction, and acceptance testing and all other incidentals required to provide a complete bituminous base course and surface course as required by Section 401 "Asphalt Pavements", Subsection 401.4, unless otherwise modified by this Specification.
- 4.2 **WEATHER LIMITATIONS.** The bituminous mixture shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 5. The temperature requirements may be waived, but only at the discretion of the ENGINEER.

**Table 5. Base Temperature Limitations**

Mat Thickness	Base Temperature (Minimum Degrees F)
Greater than 1 inch	45
1 inch or less	50

- 4.3 **BITUMINOUS MIXING PLANT.** Plants used for the preparation of bituminous mixtures shall conform to the requirements of ASTM D 995 with the following changes:

**a. Requirements for All Plants.**

- (1) **Truck Scales.** The bituminous mixture shall be weighed on approved scales furnished by the Contractor, or on public scales at the Contractor's expense. Such scales shall be inspected and sealed as often as the ENGINEER deems necessary to assure their accuracy. Scales shall conform to the requirements of Section 90.

(2) **Testing Laboratory.** The Contractor or producer shall provide laboratory facilities for control and acceptance testing functions during periods of mix production, sampling, and testing and whenever materials subject to the provisions of these specifications are being supplied or tested. The laboratory shall provide adequate equipment, space, and utilities as required for the performance of the specified tests.

(3) **Inspection of Plant.** The ENGINEER, or his/her authorized representative, shall have access at all times to all parts of the plant for checking adequacy of equipment and inspecting operation of the plant: verifying weights, proportions, and character of materials, and checking the temperatures maintained in the preparation of the mixtures.

(4) **Storage Bins and Surge Bins.** Paragraph 3.9 of ASTM D 995 is deleted. Instead, the following applies. Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:

(1) The bituminous mixture may be stored in surge bins for period of time not to exceed 3 hours,

(2) The bituminous mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours, provided an inert gas atmosphere is maintained in the bin during the storage period.

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

If the ENGINEER determines that there is an excessive amount of heat loss, segregation, or oxidation of the mixture due to temporary storage, no overnight storage will be allowed.

4.4 **HAULING EQUIPMENT.** Trucks used for hauling bituminous mixtures shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated, and covers shall be securely fastened.

4.5 **BITUMINOUS PAVERS.** Bituminous pavers shall be self-contained, power-propelled units with an activated screed or strike-off assembly, heated if necessary, and shall be capable spreading and finishing courses of bituminous plant mix material which will meet the specified thickness, smoothness, and grade. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant mix material in widths



shown on the plans.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be capable of operating at forward speeds consistent with satisfactory laying of the mixture.

An automatic grade control device shall be used, and the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated by mechanical sensors and a reference line.

The controls shall be capable of working in conjunction with any of the following attachments:

- a. Taut stringline (wire) set to grade.
- b. Ski-type device of not less than thirty (30') feet in length or as directed by the ENGINEER.
- c. Short ski or shoe.

If during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemished areas in the pavement that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued and satisfactory equipment shall be provided by the Contractor.

- 4.6** **ROLLERS.** Rollers of the vibratory, steel wheel, or pneumatic-tired type may be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

The use of equipment which causes excessive crushing of the aggregate will not be permitted.

- 4.7** **PREPARATION OF BITUMINOUS MATERIAL.** The bituminous material shall be heated in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles but shall not exceed 325° F.



**4.8 PREPARATION OF MINERAL AGGREGATE.** The aggregate for the mixture shall be dried and heated to the temperature designated by the job formula within the job tolerance specified. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

**4.9 PREPARATION OF BITUMINOUS MIXTURE.** The aggregates and the bituminous material shall be weighed or metered and introduced into the mixer in the amount specified by the job mix formula.

The combined materials shall be mixed until the aggregate obtains a uniform coating of bitumen and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture. It shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, and approved by the ENGINEER for each individual plant and for each type of aggregate used. The minimum mixing time shall be 25 seconds. The mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. *The moisture content of the mix shall not exceed 1.0%.*

**4.10 TRANSPORTING, SPREADING, AND FINISHING.** The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Section 4.4. Deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's run can be completed during daylight. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

Immediately before placing the bituminous mixture, the underlying course shall be cleared of all debris with power blowers, power brooms, or hand brooms as directed.

*The Contractor will be required to use automatic grade control sensors for this project.* On the first paving lane for the runway, the Contractor shall use a taut stringline (wire) on both sides of the paver. On the remaining lanes the Contractor shall use a shoe on the previously placed paving lane and a stringline (wire) on the other side of the paver. The stringline (wire) shall have grade pins at twenty-five (25') feet on center (maximum).

The mix shall be placed at a temperature of not less than 250° F. Upon arrival, the mixture shall be spread to the full width by an approved bituminous paver. It

shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the bituminous mat. Unless otherwise directed, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 except where edge lanes require less width to complete the area. The longitudinal joint in one layer shall offset that in the layer immediately below by at least 1 foot however, the joint in the top layer shall be at the centerline of the pavement. Transverse joints in one layer shall be offset by at least two (2') feet from transverse joints in the previous layer. Transverse joints in adjacent lanes shall be offset a minimum of ten (10') feet.

Edges of existing bituminous pavement abutting the new work shall be saw cut and carefully removed as shown on the drawings and painted with bituminous tack coat before new material is placed against it.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted by hand tools.

**4.11** **COMPACTION OF MIXTURE.** After spreading, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor.

The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until all roller marks are eliminated, the surface is of uniform texture and true to grade and cross section, and the required field density is obtained.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.

Any mixture that becomes loose and broken, mixed with dirt, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be



done at the Contractor's expense. *Skin patching shall not be allowed.*

*The Contractor shall provide at his own expense a density gauge and an experienced operator to help establish the rolling pattern during all paving operations. This exercise will not serve as a density verification for determination of acceptance or payment, but only aids the Contractor in establishing the rolling pattern required to obtain the specified density.*

- 4.12 JOINTS.** The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course. All joints shall have the same texture, density, and smoothness as other sections of the course.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. In both methods all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

- 4.13 ACCEPTANCE SAMPLING AND TESTING OF BITUMINOUS MIXTURE (DENSITY).** Bituminous concrete will be accepted for density on a random test location basis. Quality Assurance Testing shall be completed in accordance with Supplemental Technical Specification for Hot Mix Asphalt Quality Assurance, SCDOT Designation SC-M-400, Section 3 General, Section 4 Acceptance for Mainline Paving for *Hot Mix Asphalt Surface Course – Type B* and Section 5 Acceptance Low Tonnage Paving for *Hot Mix Asphalt Base Course – Type A*.

- 4.14 JOINT DENSITY.** One core centered over the longitudinal joint shall be taken for each subplot that has a longitudinal joint. Core locations will be determined by the ENGINEER in accordance with ASTM D3665. The bulk specific gravity of each core sample will be determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each joint density sample by the average TMD for the lot. The TMD used to determine the joint density at joints formed between lots will be the lower of the average TMD values from the adjacent lot.

Acceptance of each lot of plant produced asphalt for joint density will be based on the PWL in accordance with Item C-110 - Method of Estimating Percentage of Material Within Specification Limits (PWL) – Joint Density. If the PWL of the



lot is equal to or exceeds 90%, the lot will be considered acceptable. If the PWL is less than 90%, the Contractor shall evaluate the reason and act accordingly. If the PWL is less than 80%, the Contractor shall cease operations and until the reason for poor compaction has been determined. If the PWL is less than 71%, the pay factor for the lot used to complete the joint will be reduced by five (5) percentage points. This lot pay factor reduction will be incorporated and evaluated in accordance with Paragraph 6.1.

**4.15 SAMPLING PAVEMENT.** Samples for determination of thickness and density of completed pavements shall be obtained by the Contractor at no extra cost. The size, number, and locations of the samples will be as directed by the ENGINEER. Samples shall be neatly cut with a core drill, or other approved equipment. The Contractor shall furnish all tools, labor, and materials for cutting samples and replacing pavement.

All laboratory tests necessary to determine conformance with requirements specified herein will be performed without cost to the Contractor.

Samples shall be removed by the Contractor and delivered by the Contractor to the OWNER'S laboratory technician within four hours after the final rolling operation over the pavement from which the sample was taken, unless the Resident Project Representative authorizes the samples to be delivered the following day. Prior to the cutting of samples, the area of pavement from which the samples will be taken shall be cooled with ice or by other appropriate means so that the removal will not damage the sample. The samples shall be delivered to the laboratory technician in an undamaged condition. If the Resident Project Representative authorizes delivery of a sample the following day, the sample shall be delivered to the laboratory technician prior to 9:00 a.m. All samples shall be appropriately marked or identified so that the exact location from which the sample was taken can be readily recorded by the laboratory technician. The tests conducted shall include stability, flow, unit weight, voids in the total mix and percent voids filled with bitumen. Tolerances cited previously are allowable for the continuation of plant production.

When directed by the ENGINEER, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced, or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

**4.16 THICKNESS.** The thickness of each lift of surface course will be evaluated by the ENGINEER for compliance to the requirements shown on the plans after any necessary corrections for grade. Measurements of thickness will be made using the cores extracted for each subplot for density measurement. The maximum allowable deficiency at any point will not be more than 1/4 inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, will not be less than the indicated thickness. Where the thickness

tolerances are not met, the lot or subplot shall be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the ENGINEER to circumscribe the deficient area.

**4.17 SURFACE TESTS.** Tests for conformity with the specified crown and grade shall be made by the Contractor immediately after initial compaction. Any variation shall be corrected by the removal or addition of materials and by continuous rolling.

The finished surface shall not vary more than  $\frac{1}{4}$  inch for the surface course when tested with a twelve (12') foot straightedge applied parallel with, or at right angles to, the centerline. Prior to beginning paving operations, the Contractor shall provide a twelve (12') foot straightedge to be used in performing the surface tests.

**A. Smoothness for Contractor Quality Control.** The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than  $\frac{1}{4}$  inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR/ENGINEER. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues.

The Contractor may use a 12-foot "straightedge, a rolling inclinometer meeting the requirements of ASTM E2133, or rolling external reference device that can simulate a 12-foot straightedge approved by the ENGINEER. Straight-edge testing shall start with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Testing shall be continuous across all joints. The surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface in the area between the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using either the FAA profile program, ProFAA, or FHWA ProVal, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the plans.

**(1) Transverse Measurements.** Transverse measurements shall be taken for each day's production placed. Transverse measurements shall be taken



perpendicular to the pavement centerline each 50 feet or more often as determined by the ENGINEER. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

- (2) **Longitudinal Measurements.** Longitudinal measurements shall be taken for each day's production placed. Longitudinal tests shall be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the third points of paving lanes when widths of paving lanes are 20 feet or greater. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch shall be corrected with diamond grinding per Paragraph 4.17.D or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in Paragraph 4.16. Areas that have been ground shall be sealed with a surface treatment in accordance with Item P-608R – Rapid Cur Seal Coat of the FAA Standard Specifications. To avoid the surface treatment creating any conflict with runway or taxiway markings, it may be necessary to seal a larger area.

Control charts shall be kept to show the area of each day's placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor's machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day's production, production shall be stopped until corrective measures are implemented by the Contractor.

**B. Grade.** Grade shall be evaluated daily to allow adjustments to paving operations when grade measurements do not meet specifications. Grade shall be evaluated prior to and after the placement of all pavement lifts and after placement of the surface lift.

Measurements will be taken at appropriate grade lines (as a minimum at center and edges of paving lane) and longitudinal spacing of 50-feet. The final surface of the pavement will not vary from the grade line elevations and cross-sections shown on the plans by more than 1/2 inch vertically. The documentation will be provided by the Contractor to the ENGINEER within 24 hours.

Areas with humps or depressions that exceed grade or smoothness criteria and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch less than the thickness specified on the plans. Grinding shall be in accordance with Paragraph 4.E



below.

The Contractor shall repair low areas or areas that cannot be corrected by grinding by removal of deficient areas to the depth of the final course plus ½ inch and replacing with new material. Skin patching is not allowed.

**C. Final Finish Grade.** The final finished surface of the pavement shall be surveyed by the Contractor to verify that the grade elevations and cross-sections shown on the plans do not deviate more than 1/2 inch vertically.

Cross-sections of the pavement shall be taken at a minimum 50-foot longitudinal spacing, at all longitudinal grade breaks, and at start and end of each lane placed. Minimum cross-section grade points shall include grade at centerline, at joint lines, and edge of taxiway or apron pavement.

**E. Diamond Grinding.** Diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive.

Diamond grinding shall be performed with a machine designed specifically for diamond grinding capable of cutting a path at least 3 feet wide. The saw blades shall be 1/8-inch wide with a sufficient number of blades to create grooves between 0.090 and 0.130 inches wide; and peaks and ridges approximately 1/32 inch higher than the bottom of the grinding cut. The actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Equipment or grinding procedures that cause ravels, aggregate fractures, spalls, or disturbance to the pavement will not be permitted. Contractor shall demonstrate to the ENGINEER/RPR that the grinding equipment will produce satisfactory results prior to making corrections to surfaces. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. The Contractor shall apply a surface treatment per P-608 to all areas that have been subject to grinding.

## METHOD OF MEASUREMENT

- 5.1** Plant mix bituminous concrete pavement shall be measured by the number of tons of bituminous mixture used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

There will be no separate payment for asphalt binder. The cost for the asphalt binder shall be included in the per ton unit prices for Hot Mix Asphalt Base Course (Type A) and Hot Mix Asphalt Surface Course Type B.

## BASIS OF PAYMENT

- 6.1** Payment for an accepted bituminous concrete pavement shall be made at the

full or adjusted contract unit price per ton. The price shall be full compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

For each lot accepted, the adjusted contract unit price shall be the product of the lot pay factor for the lot and the contract unit price. Payment shall be subject to the total project payment limitation specified in paragraph below, Payment in excess of 100% for accepted lots of asphalt shall be used to offset payment for accepted lots of asphalt pavement that achieve a lot pay factor less than 100%.

The total project payment for plant mix bituminous pavement shall not exceed 100 percent of the product of the contract unit price and the total number of tons of bituminous mixture used in the accepted work.

**Payment.** Payment will be made under:

Item PMBP 6.1 Hot Mix Asphalt Surface Course - SCDOT Type 'B' -  
per Ton

**END OF ITEM PMBP**

## ITEM P-603

### EMULSIFIED ASPHALT TACK COAT

#### DESCRIPTION

- 603-1.1** This item shall consist of preparing and treating an asphalt or concrete surface with asphalt material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

#### MATERIALS

- 603-2.1 Asphalt Materials.** The asphalt material shall be an emulsified asphalt as specified in ASTM D3628 as an asphalt application for tack coat appropriate to local conditions. The emulsified asphalt shall not be diluted. The Contractor shall provide a copy of the Manufacturer's Certificate of Analysis (COA) for the asphalt material to the ENGINEER before the asphalt material is applied for review and acceptance. The furnishing of COA for the asphalt material shall not be interpreted as a basis for final acceptance. The Manufacturer's COA may be subject to verification by testing the material delivered for use on the project.

#### CONSTRUCTION METHODS

- 603-3.1 Weather Limitations.** The tack coat shall be applied only when the existing surface is dry, and the atmospheric temperature is 50°F or above; the temperature has not been below 35°F for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the ENGINEER.
- 603-3.2 Equipment.** The Contractor shall provide equipment for heating and applying the emulsified asphalt material. The emulsion shall be applied with a Manufacturer-approved computer rate-controlled asphalt distributor. The equipment shall be in good working order and contain no contaminants or diluents in the tank. Spray bar tips must be clean, free of burrs, and of a size to maintain an even distribution of the emulsion. Any type of tip or pressure source is suitable that will maintain predetermined flow rates and constant pressure during the application process with application speeds under eight (8) miles per hour or seven hundred (700) feet per minute.

The equipment will be tested under pressure for leaks and to ensure proper set-up before use to verify truck set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application, spray-bar height and pressure and pump speed, evidence of triple-overlap spray pattern, lack of leaks, and any other factors relevant to ensure the truck is in good working order before use.



The distributor truck shall be equipped with a minimum 12-foot spreader spray bar with individual nozzle control with computer-controlled application rates. The distributor truck shall have an easily accessible thermometer that constantly monitors the temperature of the emulsion and have an operable mechanical tank gauge that can be used to cross-check the computer accuracy. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

The distributor truck shall be equipped to effectively heat and mix the material to the required temperature prior to application as required. Heating and mixing shall be done in accordance with the Manufacturer's recommendations. Do not overheat or over mix the material.

The distributor shall be equipped with a hand sprayer.

Asphalt distributors must be calibrated annually in accordance with ASTM D2995. The Contractor must furnish a current calibration certification for the asphalt distributor truck from any State or other agency as approved by the ENGINEER.

A power broom and/or power blower suitable for cleaning the surfaces to which the asphalt tack coat is to be applied shall be provided.

**603-3.3 Application of Emulsified Asphalt Material.** The emulsified asphalt shall not be diluted. Immediately before applying the emulsified asphalt tack coat, the full width of surface to be treated shall be swept with a power broom and/or power blower to remove all loose dirt and other objectionable material.

The emulsified asphalt material shall be uniformly applied with an asphalt distributor at the rates appropriate for the conditions and surface specified in the table below. The type of asphalt material and application rate shall be approved by the ENGINEER prior to application.

#### Emulsified Asphalt

Surface Type	Residual Rate, gal/SY	Emulsion Application Bar Rate, gal/SY
New Asphalt	0.02-0.05	0.03-0.07
Existing Asphalt	0.04-0.07	0.06-0.11
Concrete	0.03-0.05	0.05-0.08

After application of the tack coat, the surface shall be allowed to cure without being disturbed for the period of time necessary to permit drying and setting of

the tack coat. This period shall be determined by the ENGINEER. The Contractor shall protect the tack coat and maintain the surface until the next course has been placed. When the tack coat has been disturbed by the Contractor, tack coat shall be reapplied at the Contractor's expense

**603-3.4 Freight and Waybills** The Contractor shall submit waybills and delivery tickets during progress of the work. Before the final statement is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

### **METHOD OF MEASUREMENT**

**603-4.1** The emulsified asphalt material for tack coat shall be measured by the gallon. Volume shall be corrected to the volume at 60°F in accordance with ASTM D1250. The emulsified asphalt material paid for will be the measured quantities used in the accepted work, provided that the measured quantities are not 10% over the specified application rate. Any amount of emulsified asphalt material more than 10% over the specified application rate for each application will be deducted from the measured quantities, except for irregular areas where hand spraying of the emulsified asphalt material is necessary. Water added to emulsified asphalt will not be measured for payment.

### **BASIS OF PAYMENT**

**603.5-1** Payment shall be made at the contract unit price per gallon of emulsified asphalt material. This price shall be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-603-5.1 Emulsified Asphalt Tack Coat - per Gallon

### **REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### **ASTM International (ASTM)**

ASTM D1250 Standard Guide for Use of the Petroleum Measurement Tables

ASTM D2995 Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors

ASTM D3628 Standard Practice for Selection and Use of Emulsified Asphalts

**END ITEM P-603**



**ITEM T-901**

**SEEDING**

**DESCRIPTION**

**901-1.1** This item shall consist of soil preparation, seeding, fertilizing, and liming the areas shown on the plans or as directed by the ENGINEER in accordance with these specifications.

**MATERIALS**

**901-2.1 Seed.** The species and application rates of grass, legume, and cover-crop seed furnished shall be those stipulated herein. Seed shall conform to the requirements of Federal Specification JJJ-S-181, Federal Specification, Seeds, Agricultural.

Seed shall be furnished separately or in mixtures in standard containers labeled in conformance with the Agricultural Marketing Service (AMS) Seed Act and applicable state seed laws with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the ENGINEER duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within six (6) months of date of delivery. This statement shall include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed. Wet, moldy, or otherwise damaged seed will be rejected.

Seeds shall be applied as follows:

**Permanent Seed Mixes**

<b>Seed Mixture</b>	<b>Minimum Seed Purity (Percent)</b>	<b>Minimum Germination (Percent)</b>	<b>Rate of Application lb/acre (or lb/1,000 S.F.)</b>	<b>Seeding Dates</b>
Common Bermudagrass (Hulled)	80%	70%	70	March 1 – July 31
Common Bermudagrass (Unhulled)	80%	70%	70	August 1 – February 28
Rye (Grain)	80%	70%	120	

### Temporary Seed Mixtures

Seed Mixture	Minimum Seed Purity (Percent)	Minimum Germination (Percent)	Rate of Application lb/acre (or lb/1,000 S.F.)	Seeding Dates
Rye (Grain)	76%	70%	120	August 1 – February 28
Common Bermudagrass (Hulled)	80%	70%	70	March 1 – July 31

**901-2.2 Lime.** Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such fineness that 90% will pass through a No. 20 mesh sieve and 50% will pass through a No. 100 mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provisions on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime shall contain at least 10% of magnesium oxide. Lime shall be applied at the rate of 4,000 pounds per acre. All liming materials shall conform to the requirements of ASTM C602.

**901-2.3 Fertilizer.** Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

- A.** A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader; or
- B.** A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
- C.** A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be commercial fertilizer and shall be spread at the rate of 1,000 pounds per acre. For rye grass, use a starter fertilizer such as 18-24-6. For bermudagrass, use a turf grade fertilizer with a ration of 3-1-2 or 4-1-2.

**901-2.4 Soil for Repairs.** The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the ENGINEER before being placed.

## **CONSTRUCTION METHODS**

**901-3.1 Advance Preparation and Cleanup.** After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded shall be raked or otherwise cleared of stones larger than 2 inches in any diameter, sticks, stumps, and other debris that might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage include filling gullies, smoothing irregularities, and repairing other incidental damage.

An area to be seeded shall be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches as a result of grading operations and, if immediately prior to seeding, the top 3 inches of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.

When the area to be seeded is sparsely sodded, weedy, barren, and unworked, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches. Clods shall be broken, and the top 3 inches of soil shall be worked into a satisfactory seedbed by discing, or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

**901-3.2 Dry Application Method.**

**A. Liming.** Lime shall be applied separately and prior to the application of any fertilizer or seed and only on seedbeds that have previously been prepared as described above. The lime shall then be worked into the top 3 inches of soil after which the seedbed shall again be properly graded and dressed to a smooth finish.

**B. Fertilizing.** Following advance preparations and cleanup fertilizer shall be uniformly spread at the rate that will provide not less than the minimum quantity stated in Paragraph 901-2.3.



**C. Seeding.** Grass seed shall be sown at the rate specified in Paragraph 901-2.1 immediately after fertilizing. The fertilizer and seed shall be raked within the depth range stated in the special provisions. Seeds of legumes, either alone or in mixtures, shall be inoculated before mixing or sowing, in accordance with the instructions of the Manufacturer of the inoculant. When seeding is required at other than the seasons shown on the plans or in the special provisions, a cover crop shall be sown by the same methods required for grass and legume seeding.

**D. Rolling.** After the seed has been properly covered, the seedbed shall be immediately compacted by means of an approved lawn roller, weighing 40 to 65 pounds per foot of width for clay soil (or any soil having a tendency to pack), and weighing 150 to 200 pounds per foot of width for sandy or light soils.

### **901-3.3 Wet Application Method.**

**A. General.** The Contractor may elect to apply seed, fertilizer, and lime by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified in the special provisions.

**B. Spraying Equipment.** The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

The unit shall also be equipped with a pressure pump capable of delivering 100 gallons per minute at a pressure of 100 pounds / square inch. The pump shall be mounted in a line that will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipelines shall be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

The nozzle pipe shall be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and inclined vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There shall be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles shall be supplied so that mixtures may be properly sprayed over distance varying from 20 to 100 feet. One shall be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-

range jet nozzle. For case of removal and cleaning, all nozzles shall be connected to the nozzle pipe by means of quick-release couplings.

In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet in length shall be provided to which the nozzles may be connected.

**C. Mixtures.** Lime, if required, shall be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than 220 pounds of lime shall be added to and mixed with each 100 gallons of water. Seed and fertilizer shall be mixed together in the relative proportions specified, but not more than a total of 220 pounds of these combined solids shall be added to and mixed with each 100 gallons of water.

All water used shall be obtained from fresh water sources and shall be free from injurious chemicals and other toxic substances harmful to plant life. The Contractor shall identify to the ENGINEER all sources of water at least two (2) weeks prior to use. The RPR/ENGINEER may take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor shall not use any water from any source that is disapproved by the ENGINEER following such tests.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures shall be used within two (2) hours from the time they were mixed, or they shall be wasted and disposed of at approved locations.

**D. Spraying.** Lime, if required, shall be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime shall be worked into the top 3 inches, after which the seedbed shall again be properly graded and dressed to a smooth finish.

Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which the lime, if required, shall already have been worked in. The mixtures shall be applied by means of a high-pressure spray that shall always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in such a manner as might produce erosion or runoff.

Particular care shall be exercised to ensure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area.



Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or pans over the area at intervals and observing the quantity of material deposited thereon.

On surfaces that are to be mulched as indicated by the plans or designated by the ENGINEER, seed and fertilizer applied by the spray method need not be raked into the soil or rolled. However, on surfaces on which mulch is not to be used, the raking and rolling operations will be required after the soil has dried.

**901-3.4 Maintenance of Seeded Areas.** The Contractor shall protect seeded areas against traffic or other use by warning signs or barricades, as approved by the ENGINEER. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding as directed. The Contractor shall mow, water as needed or directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the work.

When either the dry or wet application method outlined above is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the ENGINEER. A grass stand shall be considered adequate when bare spots are one square foot or less, randomly dispersed, and do not exceed 3% of the area seeded.

#### **METHOD OF MEASUREMENT**

**901-4.1** The quantity of seeding to be paid for shall be the number of square yards measured on the ground surface, completed, and accepted.

#### **BASIS OF PAYMENT**

**901-5.1** Payment shall be made at the contract unit price per square yard, which price and payment shall be full compensation for furnishing and placing all material and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item..

Payment will be made under:

Item 901-5.1      Seeding – per Square Yard

#### **REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.



**ASTM International (ASTM)**

ASTM C602 Standard Specification for Agricultural Liming Materials

**Federal Specifications (FED SPEC)**

FED SPEC JJJ-S-181, Federal Specification, Seeds, Agricultural

**Advisory Circulars (AC)**

AC 150/5200-33C Hazardous Wildlife Attractants on or Near Airports

**FAA/United States Department of Agriculture**

**Wildlife Hazard Management at Airports, A Manual for Airport Personnel**

**END OF ITEM T-901**

## ITEM T-905

### TOPSOIL

#### DESCRIPTION

- 905-1.1** This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the ENGINEER.

#### MATERIALS

- 905-2.1 Topsoil.** Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (2 inches or more in diameter), and clay lumps or similar objects. Brush and other vegetation that will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sod and herbaceous growth such as grass and weeds are not to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means, shall be removed. The topsoil or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the Association of Official Agricultural Chemists in effect on the date of invitation of bids. The organic content shall be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction). There shall be not less than 20% nor more than 80% of the material passing the 200 mesh sieve as determined by the wash test in accordance with ASTM C117.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

#### CONSTRUCTION METHODS

- 905-3.1 General.** Areas to be topsoiled shall be shown on the plans. If topsoil is available on the site, the location of the stockpiles shall be shown on the plans.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the ENGINEER before the various operations are started.

- 905-3.2 Preparing the Ground Surface.** Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth

harrows, or by other means approved by the ENGINEER, to a minimum depth of 2 inches to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and compacted condition to prevent the formation of low places or pockets where water will stand.

**905-3.3 Obtaining Topsoil.** Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the ENGINEER. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated stockpile areas as directed by the ENGINEER. The topsoil shall be spread on areas already tilled and smooth-graded in areas as shown on the plans. Topsoil that has been stockpiled on the site by others, and is required for topsoil purposes, shall be removed, and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

**905-3.4 Placing Topsoil.** The topsoil shall be evenly spread on the prepared areas to grades shown on the plans or to a uniform depth of 2 inches after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turving operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. After spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the ENGINEER. The compacted topsoil surface shall conform to the required lines, grades, and cross-sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.



**905-3.4 Shoulder Grading.** Areas of "Shoulder Grading" shall have topsoil placed in accordance with this specification at the locations designated in the project plans. Topsoil for "Shoulder Grading" shall be obtained from existing soil stockpiles located across the abandoned runway from the project site.

### **METHOD OF MEASUREMENT**

**905-4.1** Topsoiling shall be considered as incidental to site construction. There will be no direct measurement for payment for topsoiling. The cost of topsoiling shall be included in the cost of related bid items. The price included shall be full compensation for furnishing and spreading of all materials and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

**905-4.2** The quantity of Shoulder Grading to be paid for shall be the number of square yards of topsoil placed for shoulder grading completed and measured in its final position.

### **BASIS OF PAYMENT**

**152-4.1** For "Shoulder Grading", payment shall be made at the contract unit price per square yard. This price shall be full compensation for placing topsoil from onsite stockpiles and all other materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item T-905-5.1 Shoulder Grading - per Square Yard

### **REFERENCES**

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### **ASTM International (ASTM)**

ASTM C117	Materials Finer than 75 $\mu\text{m}$ (No. 200) Sieve in Mineral Aggregates by Washing
-----------	--

**Advisory Circulars (AC)**

AC 150/5200-33C

Hazardous Wildlife Attractants on or Near  
Airports

**FAA/United States Department of Agriculture**

**Wildlife Hazard Management at Airports, A Manual for Airport Personnel**

**END OF ITEM T-905**

## ITEM T-908

### MULCHING

#### DESCRIPTION

- 908-1.1** This item shall consist of furnishing, hauling, placing, and securing mulch on surfaces indicated on the plans or designated by the ENGINEER.

#### MATERIALS

- 908-2.1 Mulch Material.** Acceptable mulch shall be the materials listed below or any approved locally available material that is similar to those specified. Mulch shall be free from noxious weeds, mold, and other deleterious materials. Mulch materials, which contain matured seed of species that would volunteer and be detrimental to the proposed over seeding, or to surrounding farm land, will not be acceptable. Straw or other mulch material which is fresh and/or excessively brittle, or which is in such an advanced stage of decomposition as to smother or retard the planted grass, will not be acceptable.

**A. Hay.** Hay shall be native hay in an air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

**B. Straw.** Straw shall be the stalks from threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

**C. Hay Mulch Containing Seed.** Hay mulch shall be mature hay containing viable seed of native grasses or other desirable species stated in the special provisions or as approved by the ENGINEER. The hay shall be cut and handled so as to preserve the maximum quantity of viable seed. Hay mulch that cannot be hauled and spread immediately after cutting shall be placed in weather-resistant stacks or baled and stored in a dry location until used.

**D. Manufactured Mulch.** Cellulose-fiber or wood-pulp mulch shall be products commercially available for use in spray applications.

**E. Asphalt Binder.** Asphalt binder material shall conform to the requirements of ASTM D977, Type SS-1 or RS-1.

- 908-2.2 Inspection.** The ENGINEER shall be notified of sources and quantities of mulch materials available, and the Contractor shall furnish him with representative samples of the materials to be used 30 days before delivery to the project. These samples may be used as standards with the approval of the



ENGINEER and any materials brought on the site that do not meet these standards shall be rejected.

## CONSTRUCTION METHODS

**908-3.1 Mulching.** Before spreading mulch, all large clods, stumps, stones, brush, roots, and other foreign material shall be removed from the area to be mulched. Mulch shall be applied immediately after seeding. The spreading of the mulch may be by hand methods, blower, or other mechanical methods, provided a uniform covering is obtained.

Mulch material shall be furnished, hauled, and evenly applied on the area shown on the plans or designated by the ENGINEER. Straw or hay shall be spread over the surface to a uniform thickness at the rate of 2 to 3 tons per acre to provide a loose depth of not less than 1-1/2 inches nor more than 3 inches. Other organic material shall be spread at the rate recommended by the Manufacturer. Mulch may be blown on the slopes and the use of cutters in the equipment for this purpose will be permitted to the extent that at least 95% of the mulch in place on the slope shall be 6 inches or more in length. When mulches applied by the blowing method are cut, the loose depth in place shall be not less than one inch nor more than 2 inches.

**908-3.2 Securing Mulch.** The mulch shall be held in place by light discing, a very thin covering of topsoil, pins, stakes, wire mesh, asphalt binder, or other adhesive material approved by the ENGINEER. Where mulches have been secured by either of the asphalt binder methods, it will not be permissible to walk on the slopes after the binder has been applied. When an application of asphalt binder material is used to secure the mulch, the Contractor must take every precaution to guard against damaging or disfiguring structures or property on or adjacent to the areas worked and will be held responsible for any such damage resulting from the operation.

If the "peg and string" method is used, the mulch shall be secured by the use of stakes or wire pins driven into the ground on 5-foot centers or less. Binder twine shall be strung between adjacent stakes in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be firmly driven nearly flush to the ground to draw the twine down tight onto the mulch.

**908-3.3 Care and Repair.**

**A.** The Contractor shall care for the mulched areas until final acceptance of the project. Care shall consist of providing protection against traffic or other use by placing warning signs, as approved by the ENGINEER, and erecting any barricades that may be shown on the plans before or immediately after mulching has been completed on the designated areas.

**B.** The Contractor shall be required to repair or replace any mulch that is defective or becomes damaged until the project is finally accepted. When, in the judgment of the ENGINEER, such defects or damages are the result of poor workmanship or failure to meet the requirements of the specifications, the cost of the necessary repairs or replacement shall be borne by the Contractor.

**C.** If the “asphalt spray” method is used, all mulched surfaces shall be sprayed with asphalt binder material so that the surface has a uniform appearance. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons per 1,000 square feet, or as directed by the ENGINEER, with a minimum of 6 gallons and a maximum of 10 gallons per 1,000 square feet depending on the type of mulch and the effectiveness of the binder securing it. Asphalt binder material may be sprayed on the mulched slope areas from either the top or the bottom of the slope. An approved spray nozzle shall be used. The nozzle shall be operated at a distance of not less than 4 feet from the surface of the mulch and uniform distribution of the asphalt material shall be required. A pump or an air compressor of adequate capacity shall be used to ensure uniform distribution of the asphalt material.

**D.** If the “asphalt mix” method is used, the mulch shall be applied by blowing, and the asphalt binder material shall be sprayed into the mulch as it leaves the blower. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons per 1,000 square feet or as directed by the ENGINEER, with a minimum of 6 gallons and a maximum of 10 gallons per 1,000 square feet depending on the type of mulch and the effectiveness of the binder securing it.

#### **METHOD OF MEASUREMENT**

**908-4.1** Mulching shall be measured in square yards on the basis of the actual surface area acceptably mulched.

#### **BASIS OF PAYMENT**

**908-5.1** Payment will be made at the contract unit price per square yards for mulching. The price shall be full compensation for furnishing all materials and for placing and anchoring the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item T-908-5.1 Mulching – per Square Yard

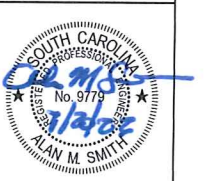




THIS DRAWING AND THE DESIGN SHOWN IS THE PROPERTY OF TALBERT & BRIGHT, INC. THE REPRODUCTION OR USE OF THIS DRAWING WITHOUT THEIR WRITTEN CONSENT IS PROHIBITED.  
 TALBERT & BRIGHT, INC.  
 © 2023

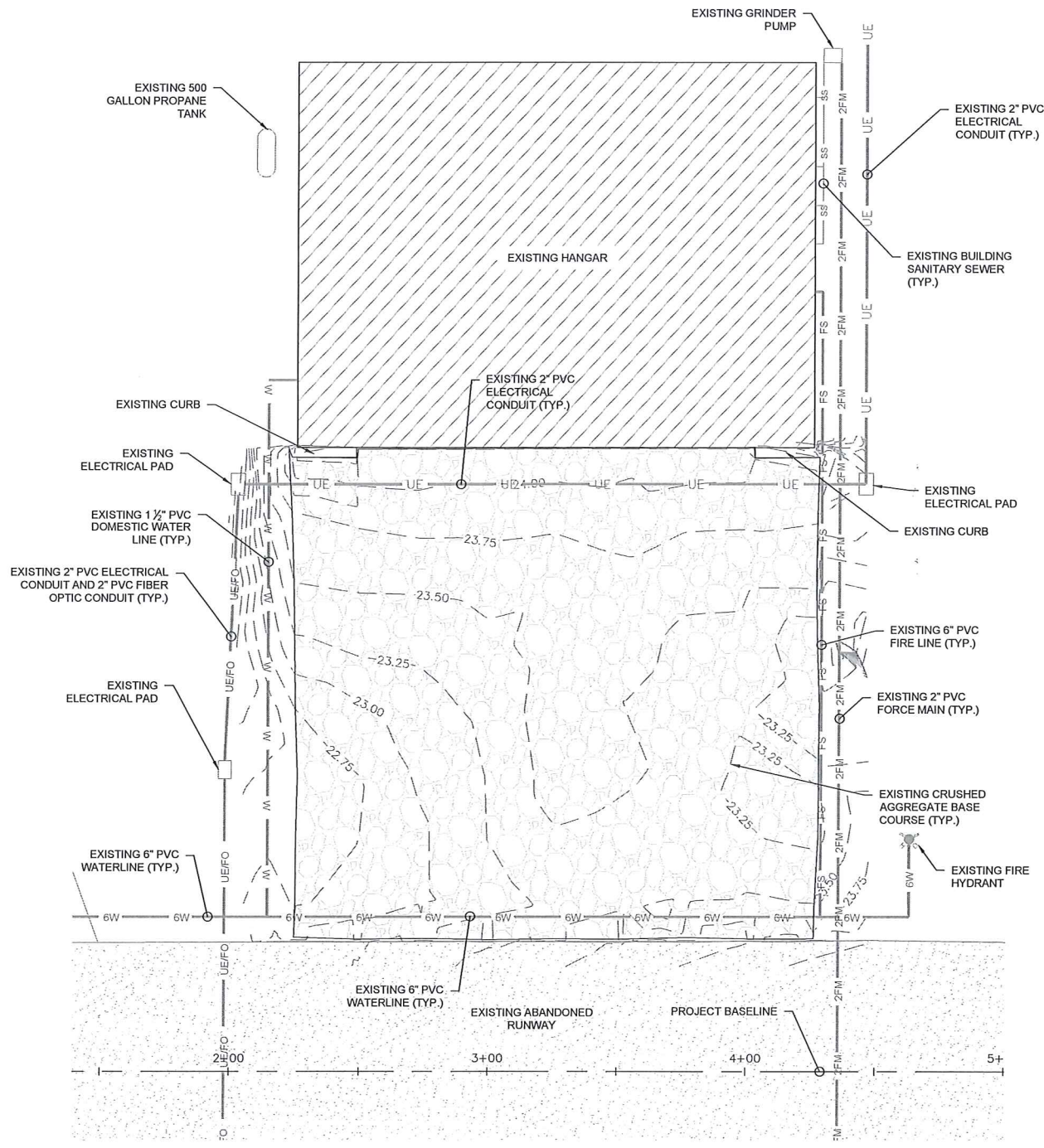
REV. NO.	DESCRIPTION	DATE

GEORGETOWN COUNTY AIRPORT  
 GEORGETOWN, SOUTH CAROLINA  
**APRON PAVING - SHERPA HANGAR**  
 EXISTING CONDITIONS AND GRADING PLAN



Date	JULY 2023
Scale	1" = 30'
Drawn	NT
Checked	AMS
Project No.	---
Sheet No.	1

NOTE 'A': CONTRACTOR SHALL USE EXTREME CAUTION WHEN PAVING ADJACENT TO HANGAR STRUCTURE OR SLAB. THE CONTRACTOR SHALL PROTECT THE HANGAR SLAB SURFACE FROM ASPHALT TACK COAT AND ASPHALT MIX SPILLAGE.



**EXISTING CONDITIONS**

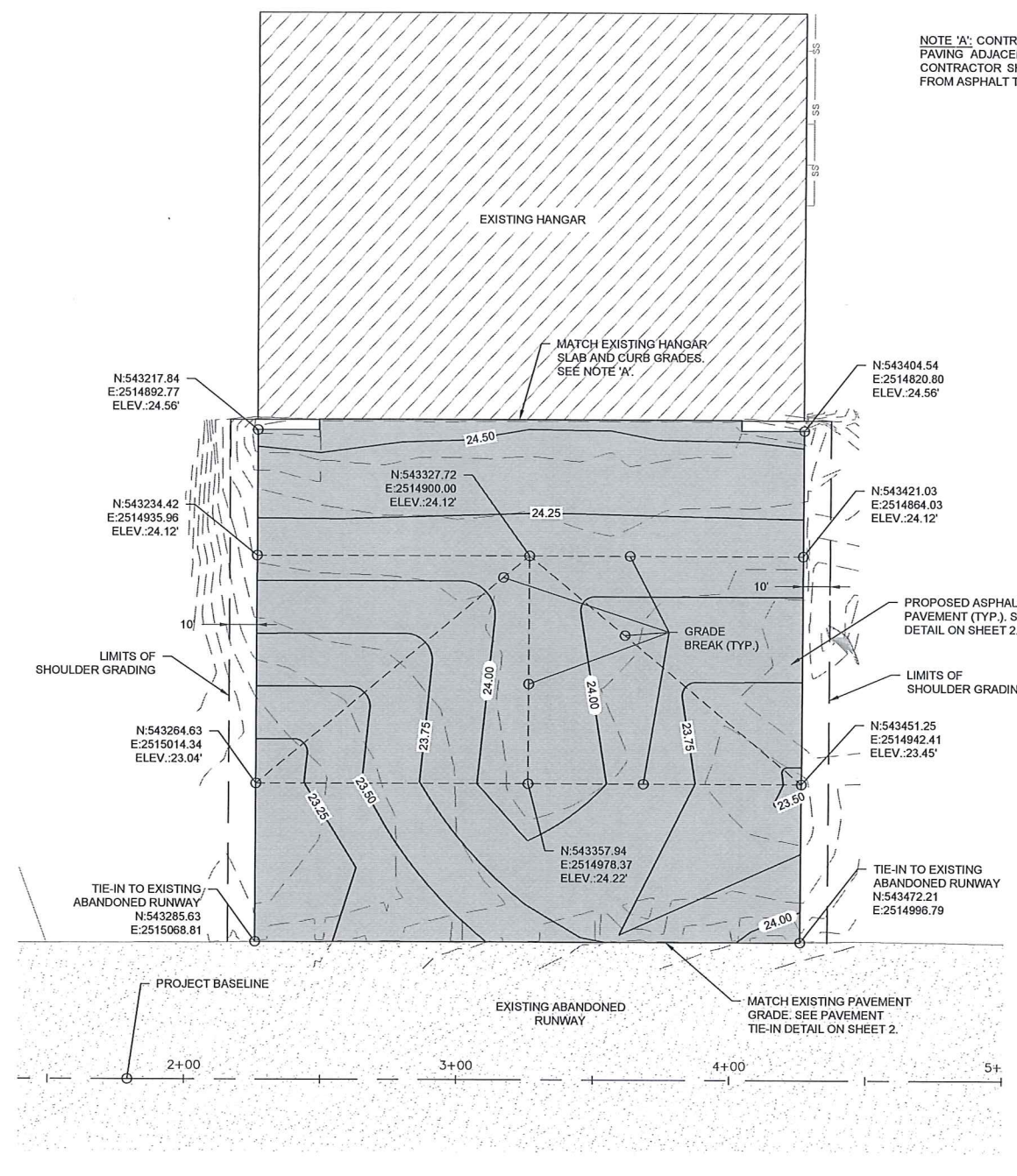
- GENERAL NOTES:**
- CONTRACTOR IS RESPONSIBLE FOR MAINTAINING VERTICAL AND HORIZONTAL CONTROL FOR THE DURATION OF THE PROJECT. BENCHMARKS AND CONTROL POINTS COORDINATES AND ELEVATIONS ARE SHOWN ON THIS SHEET.
  - CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING IN THE VICINITY OF EXISTING UNDERGROUND CABLES AND UTILITIES TO PREVENT DAMAGE. ANY DAMAGE CAUSED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE.
  - TOPOGRAPHY IS BASED ON GROUND SURVEY PERFORMED BY PARKER LAND SURVEYING, LLC, DATED JULY, 2023.
  - ALL BEARINGS AND COORDINATES ARE BASED ON SOUTH CAROLINA STATE PLANE COORDINATE SYSTEM 1983. ELEVATIONS AREA BASED ON NAVD88.
  - ALL DEBRIS AND EXCESS SOIL REMOVED SHALL BE DISPOSED OFF AIRPORT PROPERTY IN A PROPERLY PERMITTED LOCATION.
  - CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UNDERGROUND CONDUITS, CIRCUITS, AND UTILITIES PRIOR TO BEGINNING CONSTRUCTION. THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION AND USE HAND EXCAVATION IN THE VICINITY OF EXISTING INSTALLATIONS TO REMAIN IN SERVICE. CONTRACTOR SHALL PROTECT ALL FACILITIES AND OTHER IMPROVEMENTS WHETHER OR NOT THEY ARE SHOWN ON THE PLANS.
  - SEE SHEET 2 FOR PAVEMENT DETAILS AND SECTIONS.

**TEMPORARY CONSTRUCTION CONTROL POINTS/BENCHMARKS**

#	DESCRIPTION	COORDINATES	ELEVATION
1	CP 20 TIE	N: 542949.93 E: 2515182.91	20.70'
2	CP 22 TIE	N: 543878.29 E: 2514829.10	26.11'

**BASELINE COORDINATES**

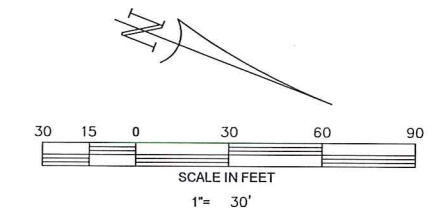
DESCRIPTION	START STATION: NORTHING: EASTING:	END STATION: NORTHING: EASTING:
PROJECT BASELINE	STA. 0+00.00 N:543093.32 E:2515197.19	STA. 5+00.00 N:543559.86 E:2515017.36



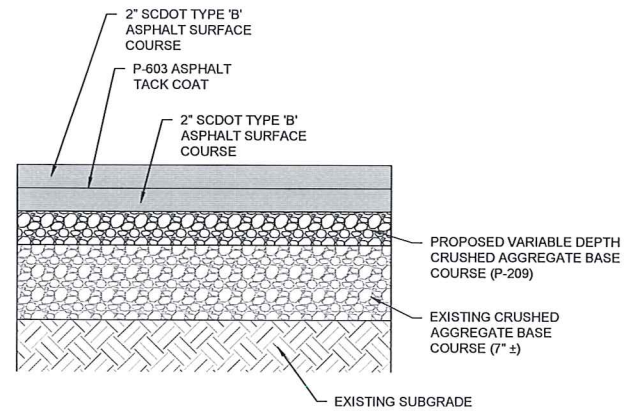
**PROPOSED GRADING**

**LEGEND**

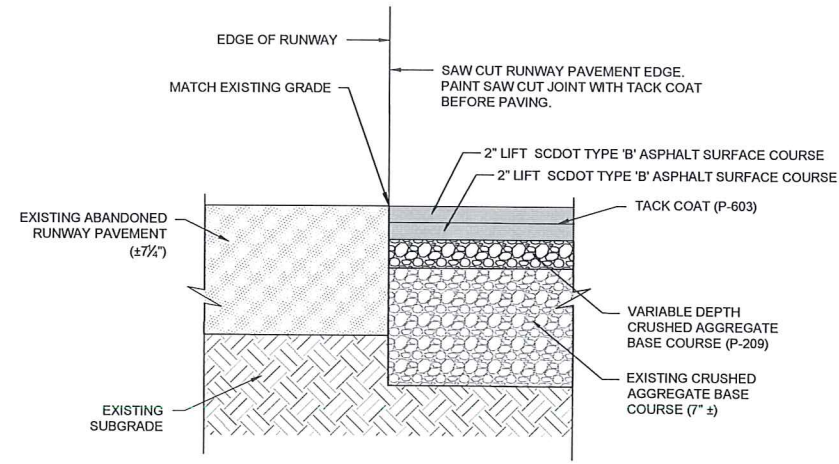
	EXISTING BITUMINOUS PAVEMENT
	EXISTING BUILDING
	EXISTING CRUSHED AGGREGATE BASE COURSE
	PROPOSED ASPHALT PAVEMENT
	EXISTING CONTOUR
	PROPOSED CONTOUR



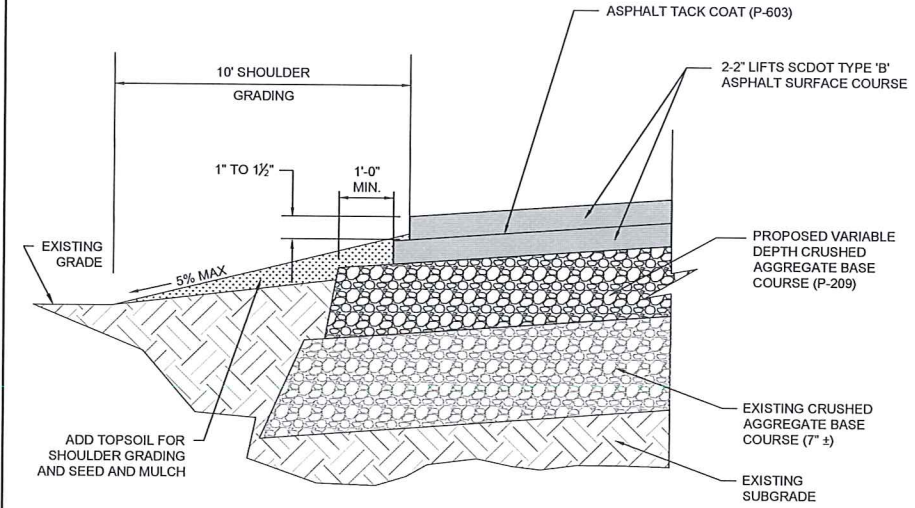




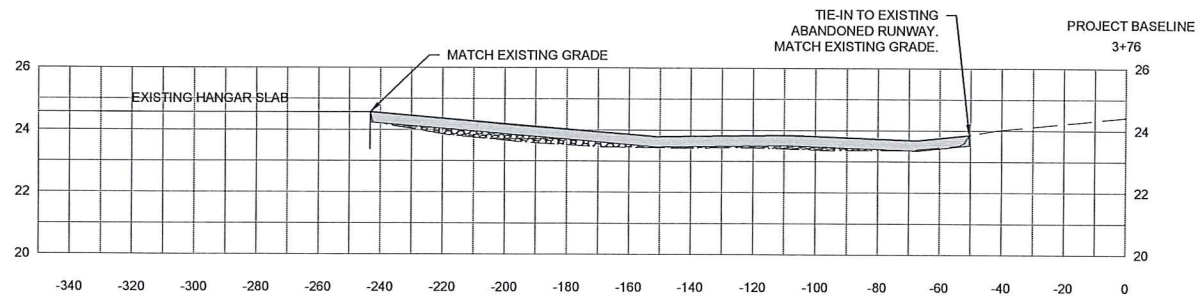
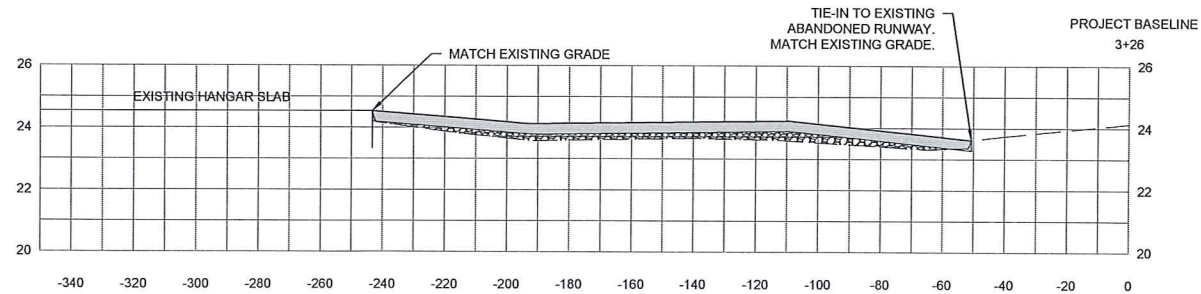
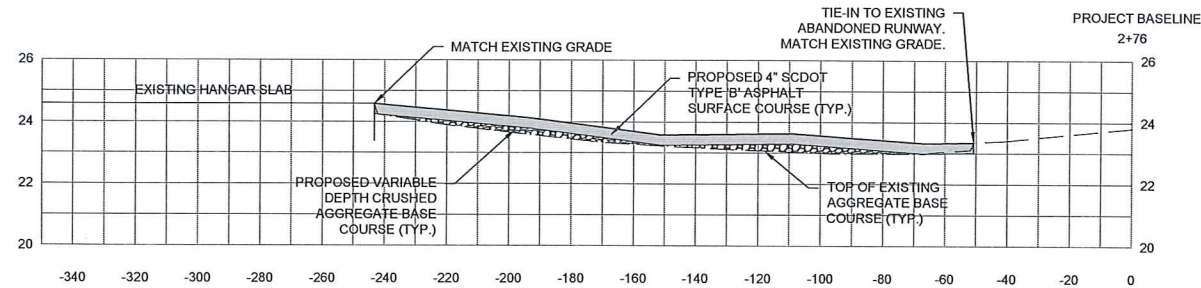
TYPICAL APRON PAVEMENT SECTION  
NOT TO SCALE



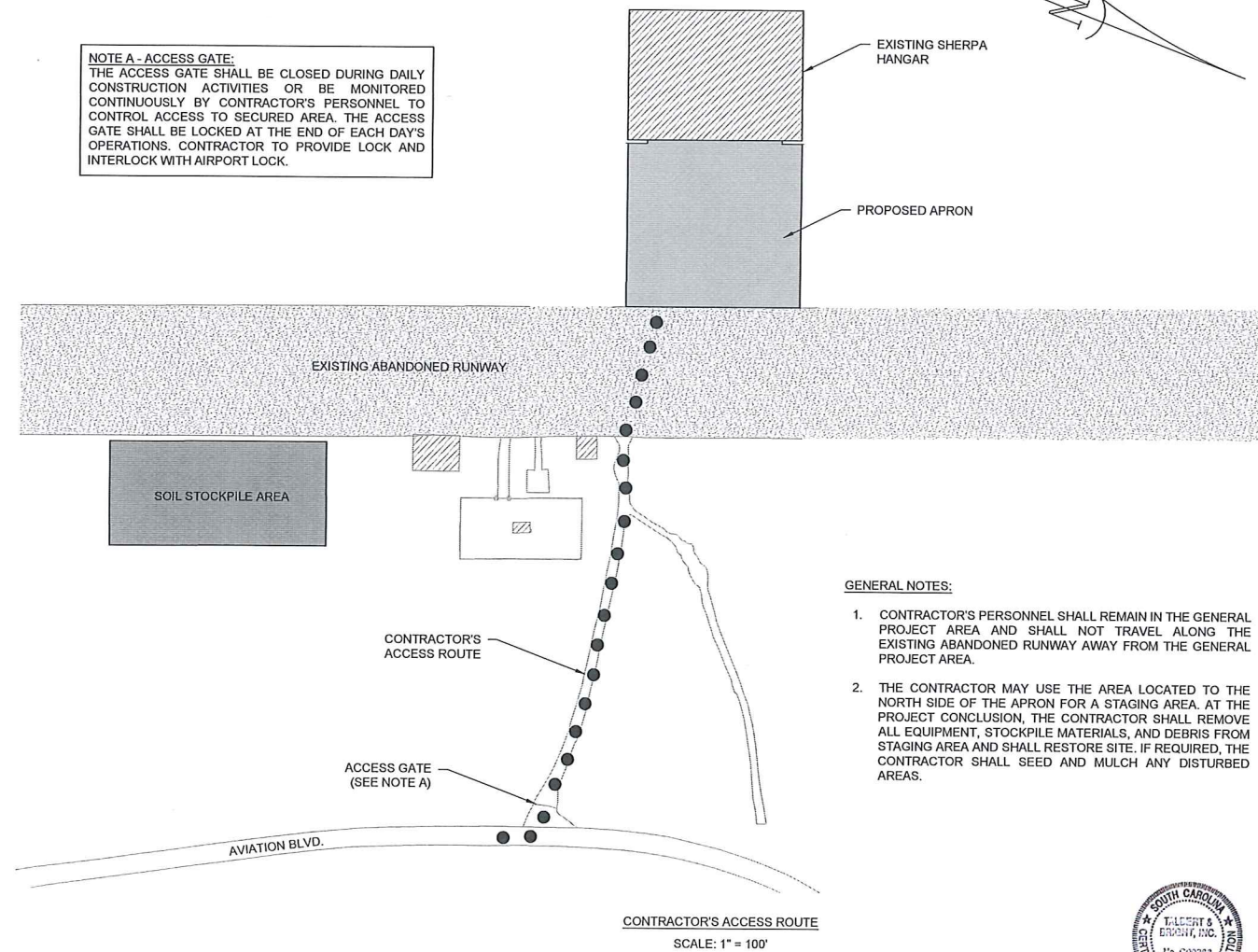
TYPICAL PAVEMENT TIE-IN DETAIL  
NOT TO SCALE



TYPICAL SHOULDER SECTION  
NOT TO SCALE



APRON CROSS SECTIONS  
SCALE: H:1" = 30' V:1" = 3'



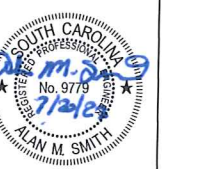
- GENERAL NOTES:
- CONTRACTOR'S PERSONNEL SHALL REMAIN IN THE GENERAL PROJECT AREA AND SHALL NOT TRAVEL ALONG THE EXISTING ABANDONED RUNWAY AWAY FROM THE GENERAL PROJECT AREA.
  - THE CONTRACTOR MAY USE THE AREA LOCATED TO THE NORTH SIDE OF THE APRON FOR A STAGING AREA. AT THE PROJECT CONCLUSION, THE CONTRACTOR SHALL REMOVE ALL EQUIPMENT, STOCKPILE MATERIALS, AND DEBRIS FROM STAGING AREA AND SHALL RESTORE SITE. IF REQUIRED, THE CONTRACTOR SHALL SEED AND MULCH ANY DISTURBED AREAS.

**TALBERT & BRIGHT**  
ENGINEERING & PLANNING CONSULTANTS  
4810 SHELLEY DRIVE  
WILMINGTON, NC 28405  
PHONE: 910-763-5350  
FAX: 910-762-6281  
SC LICENSE NO. C00386  
EMAIL: TBILL@TB&B.COM

THIS DRAWING AND THE DESIGN SHOWN IS THE PROPERTY OF TALBERT & BRIGHT, INC. THE REUSE OR REPRODUCTION OF THIS DRAWING WITHOUT THEIR WRITTEN CONSENT IS PROHIBITED.  
TALBERT & BRIGHT, INC.  
© 2023

REV. NO.	DESCRIPTION	DATE

GEORGETOWN COUNTY AIRPORT  
GEORGETOWN, SOUTH CAROLINA  
APRON PAVING - SHERPA HANGAR  
PAVEMENT SECTIONS AND MISCELLANEOUS DETAILS



Date	JULY 2023
Scale	AS SHOWN
Drawn	NT
Checked	AMS
Project No.	---
Sheet No.	---