APPENDIX G

Concrete Properties

Appendix G. Concrete Properties

This appendix includes laboratory data for the concrete core specimens obtained in the field.

Core sampling in the field was performed by MDOT personnel in accordance with ASTM C 42-94. In the laboratory, specimens were tested for compressive strength, split tensile strength, and elastic modulus. Prior to testing, the ends of the core samples had to be cut using a diamond blade saw to ensure plane and perpendicular surfaces. The compression cylinders were then capped with a sulfur compound in accordance with ASTM C 617-94.ASTM procedures followed were C 39-94 for compressive strength, C 496-94 for splitting tensile strength, and C 469-94 for elastic modulus.

It should be noted, though, that the procedure used for elastic modulus determination varied from the ASTM procedure as follows:

- 3 independent extensometers spaced at 120° intervals around the specimen perimeter were used to measure axial deformation. An average of the three values was reported.
- A chain gage extensometer was used to measure lateral expansion.
- The specimen was not repeatedly loaded. Instead, the specimen was preloaded to approximately 100 psi, followed by a regular compressive loading regime. Because the extensometers were applied directly to the specimen, and the specimen was subsequently preloaded, it was found that seating of the gages was not a factor in the measurements.

Three specimens from each site were tested for compressive strength and elastic modulus. Three other specimens were tested for splitting tensile strength. Specimens containing reinforcing steel and defects were avoided.

Compressive Strength & Elastic Modulus										
Test Section	Cylinder ID#	Station Location	Specimen Length (in)	Specimen Diameter (in)	L/D Ratio	L/D Correction Factor	Ultimate Load (kips)	Compressive Strength (psi)	Corrected Compressive Strength (psi)	Elastic Modulus (psi)
11017-32516A	M2	1790+49	11.5	5.9	1.95	0.99	176.7	6200	6140	4.52E+06
EB	M4	1793+52	11.5	5.9	1.95	0.99	186.6	6600	6530	4.63E+06
Section A	M6	1794+83	11.75	5.9	1.99	1	195.1	6900	6900	4.77E+06
	Average								6520	4.64E+06
11017-32516A	M2	1683+48	11.5	5.9	1.95	0.99	197.9	7239	7170	4.08E+06
EB	M3	1684+35	11.5	5.9	1.95	0.99	185.2	6774	6710	4.51E+06
Section C	M5	1687+01	11	5.9	1.86	0.985	206.5	7315	7210	
	Average								7030	4.30E+06
11017-32516A	M1	1783+39	11.25	5.9	1.91	0.99	154.1	5640	5580	4.12E+06
WB	M7	1788+11	11.75	5.9	1.99	1	155.6	5694	5690	4.02E+06
Section D	M13	1784+98	11.75	5.9	1.99	1	158.4	5795	5800	6.37E+06
	Average								5690	4.84E+06
19042-24680A	6M	279+10	9.5	6	1.58	0.97	157.6	5574	5410	4.10E+06
EB	8M	279+87	9.6	6	1.60	0.97	201.2	7116	6900	4.68E+06
Section B	9M	280+30	9.6	6	1.60	0.97	197.5	6985	6780	5.01E+06
	Average								6360	4.60E+06
19042-02233A	1M	527+68	8.9	6.1	1.46	0.95	195.6	6693	6360	4.62E+06
EB	9M	530+95	9	6	1.50	0.9605735	197.2	6975	6700	4.59E+06
Section C	11M	531+23	9.2	6.1	1.51	0.96	205.1	7018	6740	4.98E+06
	Average								6600	4.73E+06
19043-02234A	3M	137+42	8.8	6	1.47	0.95	234.9	8308	7890	4.98E+06
EB	7M	138+26	8.8	6	1.47	0.95	203.1	7183	6820	4.58E+06
	10M	138+62	8.9	6	1.48	0.96	194.6	6883	6610	6.12E+06
	Average								7110	5.23E+06
19043-02234A	1M	149+68	8.2	6.1	1.34	0.95	224	7665	7280	6.00E+06
WB	8M	148+60	8.25	6.125	1.35	0.95	214.9	7353	6990	5.71E+06
	13M	147+85	8.2	6.1	1.34	0.95	180.8	6187	5880	4.77E+06
	Average								6720	5.49E+06
25132-06582A	M1	660+19	8	5.9	1.36	0.955	169.7	6207	5930	5.66E+06
SB	M2	659+19	8.5	5.9	1.44	0.96	138.5	5068	4870	5.83E+06
	M4	655+56	8.75	5.9	1.48	0.97	175.3	6413	6220	5.57E+06
	Average								5670	5.69E+06
44044-18804A	3M	671+01	8.9	6.1	1.46	0.95	257.8	8821	8380	5.10E+06
WB	7M	669+35	9.1	6.125	1.49	0.96	196.1	6710	6440	4.04E+06
	9M	668+56	9	6	1.50	0.96	221.8	7845	7530	5.01E+06
	Average								7450	4.72E+06
47065-28215A	C3	700+00	10	5.9	1.69	0.98	139.9	4951	4850	3.65E+06
EB	C5	I-96 Bus.Lp.	10.75	5.9	1.82	0.985	123	4851	4780	3.36E+06
	C7	810+63	10.25	6	1.71	0.98	137.1	4351	4260	3.61E+06
	Average								4630	3.54E+06
47065-28215A	107		9.5	5.9	1.61	0.97	125.83	4605	4470	3.79E+06
WB	113		10	5.9	1.69	0.98	100.39	3674	3580	3.00E+06
	122		10	5.9	1.69	0.98	141.4	5175	5050	3.74E+06
	Average								4370	3.51E+06
77023-21586A	M1	1820+74	9	5.9	1.53	0.97	197.9	7239	7020	5.69E+06
EB	M8	1827+70	9.25	5.9	1.57	0.98	207.8	7602	7450	5.22E+06
	M10	1827+97	8.75	5.9	1.48	0.97	189.4	6930	6720	5.11E+06
	Average								7060	5.34E+06
77024-20821A	M0	83+64	9.1	6	1.52	0.96	199.5	7056	6770	5.49E+06
EB	M6	88+58	9	6	1.50	0.96	191.7	6780	6510	5.37E+06
Section A	M10	89+64	9.05	6	1.51	0.96	195.3	6907	6630	6.03E+06
	Average								6640	5.63E+06
77024-17988A	1M	408+14	9.1	6.1	1.49	0.96	196.5	6724	6460	4.34E+06
EB	6M	414+67	9.56	6.125	1.56	0.97	166.7	5658	5490	4.30E+06
Section B	9M	416+18	8.8	6	1.47	0.96	174.4	6168	5920	4.74E+06
	Average								5960	4.46E+06

Split Tensile Strength							
Test Section	Cylinder ID.	Station Location	Specimen Length (in)	Specimen Diameter (in)	Ultimate Load (kips)	Split Tensile Strength (psi)	Comments
11017-32516A EB Section A	M1	1790+17	12	5.9	65.61	635	
	M3	1790+80	11	5.9	68.6	655	
	M5	1794+53	11	5.9	64.43	635	
	Average					640	
11017-32516A EB Section C	M1	1682+90	11.25	5.9	67	645	
	M4	1685+41	11	5.9	59.02	580	
	M6	1689+10	11	5.9	56.02	525	
	Average					585	
11017-32516A WB Section D	M5	1786+53	11	5.9	57.03	560	
	M9	1789+70	11.25	5.9	60.02	575	
	M11	1791+27	11.75	5.9	58.02	535	
	Average					550	
19042-24680A EB Section B	2M	276+59	8.2	5.9	48.89	645	
	4M	277+82	8.8	5.9	48.52	595	
	10M	280+71	9.4	5.9	49.3	565	
	Average					600	
19042-02233A EB Section C	3M	527+96	8.5	5.9	51.56	655	
	6M	528+93	8.4	5.9	55.67	715	
	7M	529+14	8.4	5.9	47.7	615	
	Average					660	
19043-02234A EB	6M	137+91.5	8.8	5.8	38.36	480	
	12M	138+75.5	8.5	5.9	45.99	585	
	13M	138+82.5	8.9	6	49.2	580	Tested Dry
	Average					550	
19043-02234A WB	4M	149+17.6	7.8	5.9	42.89	595	
	6M	148+68.7	8.3	5.9	43.12	560	
	10M	148+22.4	8.1	5.9	46.18	615	
	Average					590	
25132-06582A SB	M3	657+20	8	5.9	53.03	720	
	M5	653+71	8.625	5.9	55.5	695	
	M7	650+10	9.125	5.9	52.5	620	
	Average					680	
44044-18804A WB	2M	671+21	8.8	6	46.08	555	Tested Dry
	12M	666+92	9.1	5.9	44.23	525	
	13M	666+23	8.6	5.8	45.32	580	
	Average					555	
47065-28215A EB	C2	670+00	9.25	6	47.5	545	
	C4	720+00	10.5	6	59.5	600	
	C6	788+24	10.5	6	62.5	630	
	Average					590	
47065-28215A WB	110		9.5	5.9	41.03	490	
	116		10	5.9	53.99	570	
	118		10	5.9	60.55	655	
	Average					570	
77023-21586A EB	M4	1822+93	8.75	5.9	55.5	685	
	M7	1825+10	9	5.9	60	720	
	M14	1834+50	9	5.9	63	770	
	Average					725	
77024-20821A Section A	M3	85+43	8.6	5.9	52.1	655	
	M4	87+05	8.8	5.9	61.72	755	
	M7	88+85	9	5.9	63.09	755	
	Average					720	
77024-17988A Section B	3M	409+47	8.9	5.9	53.25	645	
	8M	415+93	8.65	5.9	49.62	620	
	13M	418+17	8.7	5.9	45.7	565	
	Average					610	