WJE | ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

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February 22, 2001

Mr. Fred Tacker
Warren Environmental
Carvear Square, Suite 26
124 Main Street
Carver, MA 02330

Re: Compression Test Results on T-301 and P-301
Epoxy Systems
WJE No. 2000.4200

Dear Mr. Tacker:

In your February 1, 2001 letter to Wiss, Janney, Elstner Associates, Inc. (WJE), you instructed us to combine T-301 and P-301 epoxy systems with aggregate and a filler material. The filler material was provided by you and we were also to use available aggregates in stock in our laboratory.

Mr. Paul Krauss also spoke with you indicating that WJE would prepare small size cylinders to test first the compressive strength of the mixtures, resin content, and unit weight before measuring the other mechanical properties of the epoxy concrete.

This letter reports the results of the initial testing in our laboratory. Photographs in Figures 1, 2, and 3, respectively, show the filler, crushed Florida lightweight aggregate, and crushed Illinois limestone aggregates used with the epoxy mix proportions recommended in your letter of February 1, 2001. In all cases, the epoxy was mixed in the ratio of two parts of Part A to one part of Part B.

Small size, 2-in. diameter by 4-in. long cylinders were made for each of the six different combinations of aggregate and epoxy type. Figures 4 and 5 show the group of cylinders made from the different material combinations.

The following table lists the test results.

Epoxy type	Mix proportions				Approximate set time (minutes)	Maximum temperature	Resin content by wt (%)	Unit wt (lb/ft^3)	Compressive 7-day strength (psi)
	Part A (gm)	Part B (gm)	Aggregate Type	Aggregate Amount (gm)					
T-301	320	160	Filler	422	32	–	53	67	8225
T-301	380	190	Lightweight	923	39	–	38	102	9310
T-301	320	160	Limestone	888	40	155	35	115	11130
P-301	380	190	Filler	488	44	175	54	64	8235
P-301	320	160	Lightweight	918	51	178	34	106	10250
P-301	320	160	Limestone	1200	30	161	28	121	11200

The resin was combined and mixed by hand in plastic containers. The aggregate was then added until the batch became stiff but still workable. Due to its fineness, the filler material was difficult to mix and resulted in a resin content of slightly over 50 percent by weight. During curing, the P-301 and T-301 cylinders containing the filler expanded about ¼ in. or greater above the rim of the mold (see Figure 4). This excess material was cut off prior to testing the cylinders. The lightweight aggregate (aggregate size from 1/16 - 3/8 in.) resulted in a more workable mix and an average resin content of 36 percent by weight. The crushed limestone aggregate (aggregate size from ¼ - ½ in.) was coarser and resulted in a similar resin content as the lightweight aggregate (between 28 to 35 percent by weight). The mix with P-301 resin and limestone aggregate had a resin content of 28 percent by weight. This mix was considered to be slightly deficient in resin, and the top of the cylinders did not finish well.

The 7-day compressive strength of the two resins, T-301 and P-301, were similar; although the compressive strengths varied with the type of aggregate as follows:

	Average resin content (%)	**Average compressive strength (7 day)**
Filler	51	8,230 psi
Lightweight	36	9,780 psi
Limestone	32	11,165 psi

The filler material appears to be too fine for use with such a high viscosity resin system. It resulted in poor resin loading, expansion of the cylinders, and only moderate strength. The lightweight and limestone coarse aggregates resulted in more workable mixes, no significant expansion, and higher strength. Optimization of the aggregate grading could result in further improvements in aggregate loading, thereby, further reducing the resin content. Reducing the resin content reduces cost, but it also improves the thermal and shrinkage compatibility of the polymer concrete to the substrate concrete on which the polymer concrete is to bond.

Please contact us to discuss the next steps in this testing.

Very truly yours,

WISS, JANNEY, ELSTNER ASSOCIATES INC.

Paul D. Krauss, P.E.
Project Consultant

Donald F. Meinheit, P.E., S.E.
Project Manager
Attachments
rv/160862

Figure 1. Filler aggregate received from Warren Environmental

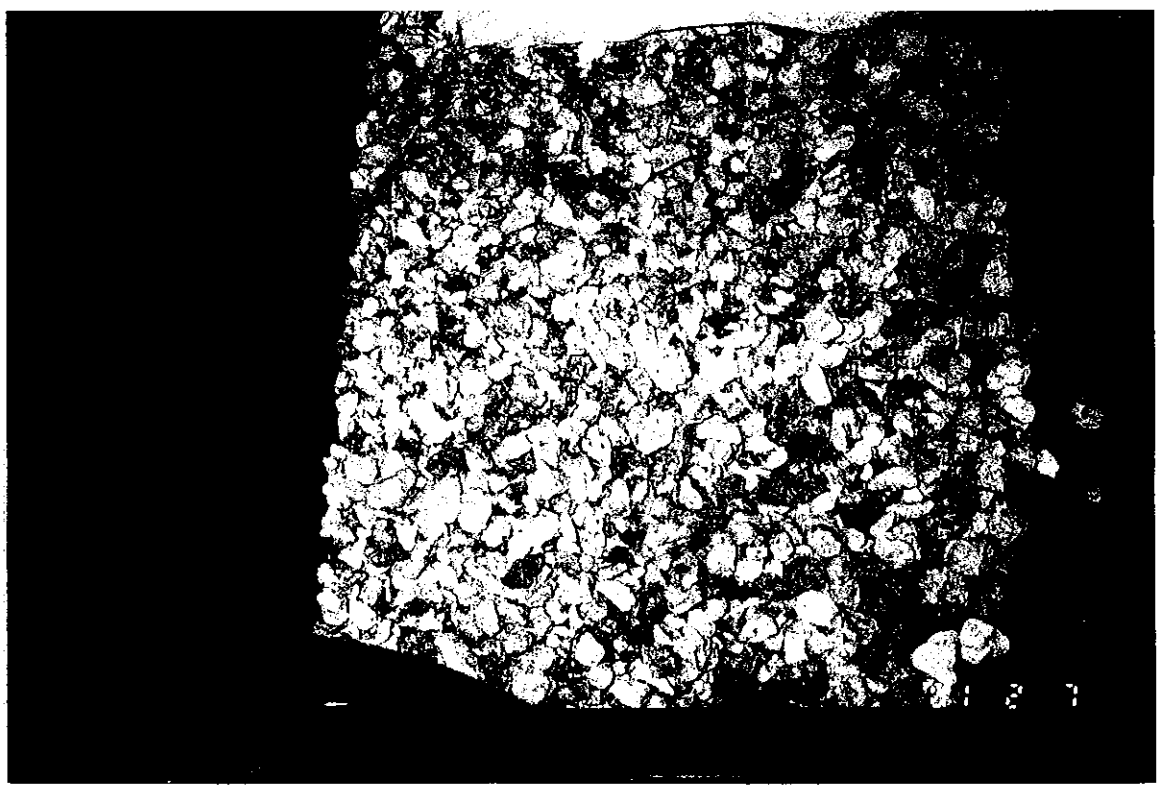

Figure 2. Crushed Florida lightweight aggregate

Figure 3. Crushed glacial stone - mostly limestone

Figure 4. View of polymer concrete cylinders

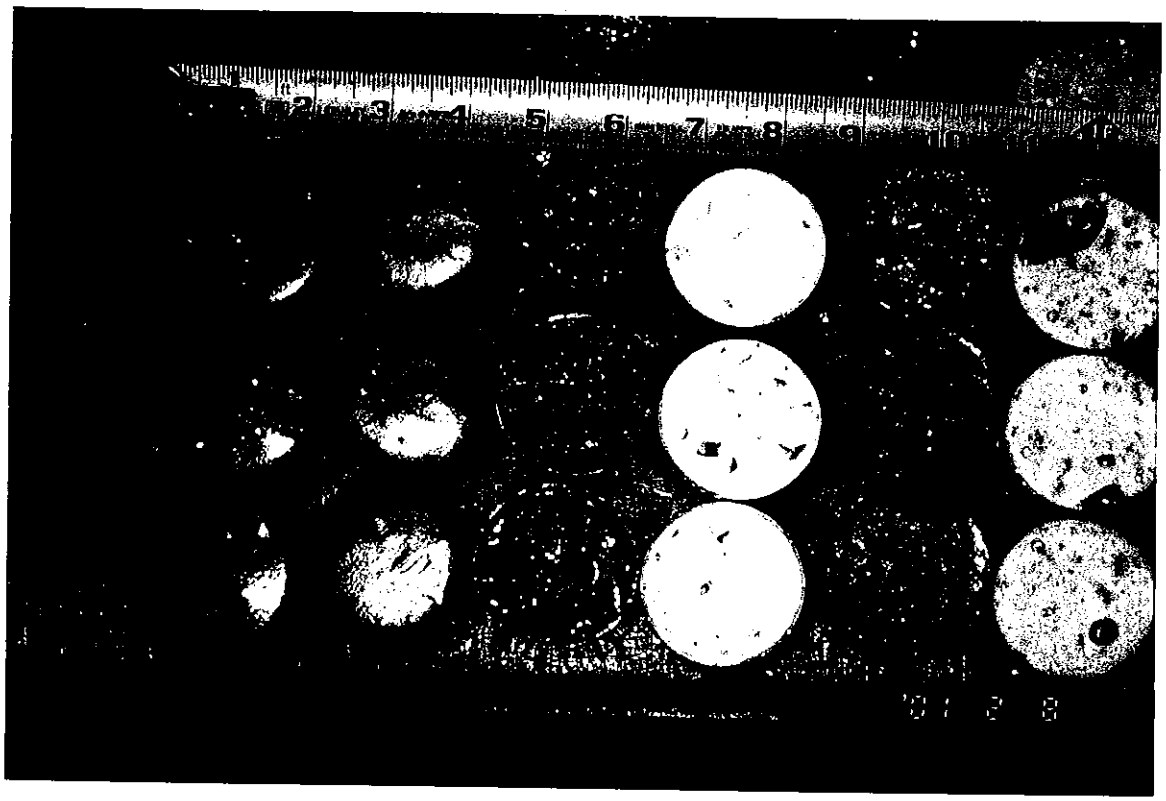

Figure 5. View of surface of cylinders shown in Figure 4