Cemak Trucking, DBA Vac-Lite Materials
3252 East 70th Street
Long Beach, CA 90805

Attn: Steve Lode
(310) 764-4086

RESEARCH REPORT: RR 23908
(CSI #03050)

Expires: November 1, 2016
Issued Date: September 1, 2014
Code: 2014 LABC

GENERAL APPROVAL – Renewal - Vac-Lite and Agg-Lite Structural Lightweight concrete aggregates.

DETAILS

Vac-Lite Structural Lightweight Concrete Aggregate is a treated pumice aggregate obtained from open-pit mines located near Little Lake, California. The pumice aggregate is vacuum treated to stabilize moisture content and to enhance qualities for pumping though hoses. The pumice aggregate is of volcanic origin and is formed when volcanic gases within ejected rock expand and then suddenly cool, resulting in a porous glass aggregate. The aggregate is light gray in color and is available in ½-inch maximum aggregate size.

The approval is subject to the following conditions:

1. The aggregates shall conform to ASTM C330 and ASTM C332.

2. Physical property requirements for aggregates are as following:

Property	Test Method	Allowable Values
Dry Unit Weight	ASTM C29	25-28 pcf
Absorption	ASTM C127	20-30 Percent
Moisture Content (Vacuum Treated)	ASTM C566	82-87 Percent
Special Gravity (Vacuum Treated)	ASTM C127	1.47 Maximum

3. Monthly laboratory reports, on gradation and dry loose unit weight, of the current production shall be submitted to Engineering Research Section upon renewal and at the Department's request.

4. Where the aggregates are used for prestressed concrete construction, loss of prestress due to elastic shortening, creep and shrinkage of the concrete shall be determined by tests and approved by the Department prior to use.

5. For design purposes, the value of Fsp, tensile splitting ratio, shall be 3.5 for concrete having a dry unit weight of 85 pcf, and 5.0 for concrete having a dry unit weight of 112 pcf. For determining Fsp for concrete between these two unit weights, straight line interpolation is allowed.

6. The aggregate shall be identified by its trade name, type, research report (RR) number, and processing and storage location on the "Statement of Mix Design" on the concrete mixing truck "trip tickets" required at the job sites per ASTM C94.

7. Fire resistance of VAC-LITE and AGG-LITE concrete shall be equal to that allowed for lightweight aggregates in the Code.

8. Approval for composite floor slab and diaphragm action is limited to the decks described in Table 1 and Table 2.

9. Minimum size of deck to be used in either the composite or diaphragm design shall be (20 gage).

10. The maximum allowable span measured center-to-center of supports shall be 12 ft. - 1⅜-inches.

11. Use of the light weight aggregate as structural concrete fill over decks for diaphragm action shall be as follows:

    1 When used with a 3 inch deep steel deck identified as Verco type W-3 Form lock (L.A. City RR #23789) or BHP Type 3W and 3WF (L.A. City RR #23783), the value for allowable diaphragm shear described in the above reports shall be reduced to 70% of such values.

    2 Flexibility coefficients shall be the same as described in the above Los Angeles City Research Reports.

    3 The steel deck configurations and its connection to the supporting members shall be as described in the above Los Angeles City Research Reports.

12. A two-hour fire rating is accorded to a restrained (see discussion) floor-ceiling assembly consisting of 2-inch deep Verco Type W-2, W-3 (20 gage) unit or BHP Type 2W, 2WF, 3W, 3WF (20 gage) units overlain by a 3-¼ inch thick topping (above the flutes) of

VAC-LITE pumice, aggregate concrete (dry unit weight of 113 pcf) reinforced with 6x6-W2.1 x W2.1 welded wire fabric.

Restrained floor-ceiling assemblies constructed as above but with deeper or heavier gage steel decks or equivalent steel decks of other manufacturers may also be considered to have a two-hour fire rating. Conditions for use shall be as specified in following Los Angels City Reports:

Research Report No. 23789	Types W-2, W-3
Research Report No. 23784	Types 2W, 2WF, 3W, 3WF

13. If the aggregate is supplied to an offsite fabricator, then that fabricator must have a City of Los Angeles licensed fabricator approval from Materials Control Section.

DISCUSSION

The report is in compliance with the 2014 City of Los Angeles Building Code.

The approval is based on tests per ASTM C330, except that the drying shrinkage test is per California Division of Highways Test Method No. California 537-A.

Allowable values for composite design and reduction ratio for diaphragm shear were established through design calculations and analysis prepared by S.B. Barnes and Associates (Report No. 84-12, dated July 18, 1984 revised January 21, 1986 and Report No. 84-13, dated July 31, 1984 revised September 5, 1984).

The fire resistance is based on tests reports from the National Bureau of Standards of the United States Department of Commerce, and Underwriters Laboratories, Inc. for the steel deck assemblies (Report for Project 84 NK 11003, File NC 745 and Project 84 NK 19482, File NC 750, dated October 25, 1985).

A restrained condition in fire tests is one in which expansion at the supports of a load-carrying element resulting from the effects of the fire is resisted by forces external to the element. An unrestrained condition is one in which the load-carrying element is free to expand and rotate at its supports. Therefore, single spans or simply supported end spans of multiple bay steel deck assemblies with a continuous structural concrete topping are classified as unrestrained where supported by bearing walls, exterior wall face spandrel beams or large interior opening edge beams. Interior spans of multiple bay steel deck assemblies are considered restrained when a continuous structural concrete topping is provided, but unrestrained when the continuous structural concrete topping is omitted or substantially interrupted.

This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this Approval have been met in the project in which it is to be used.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

_____

ALLEN PEERY, Chief
Engineering Research Section
201 N. Figueroa St., Room 880
Los Angeles, CA 90012
Phone - 213-202-9812
Fax - 213-202-9943

VC
RR23908/MSWord2010
R06/07/2014
3A1/ACI 318, 3.3.1

Table 1
Allowable Superimposed Load in Pounds Per Square Foot For BHP
3W36 Deck with Concrete Fill [1,2,4,5,6,7,8]

Total Slab Depth and Type[3]	Deck Thickness In Inches	No. of Spans	Span of Composite Deck							
			8-0'	9-0'	10-0'	11-0'	12-0'	13-0'	14-0'	15-0'
5" PUMICE AGGREGATE GALVANIZED DECK	0.030 (22 Gauge)	1	53	128	109	95	64	55	47	41
		2	53	128	109	95	64	55	47	41
		3 or More	53	128	109	95	83	74	47	41
	0.036 (20Gauge)	1	72	144	123	107	94	64	55	48
		2	72	144	123	107	94	64	55	48
		3 or More	72	144	123	107	94	83	74	48
	0.048 (18 Gauge)	1	209	176	150	130	114	101	71	62
		2	209	176	150	130	114	101	90	62
		3 or More	209	176	150	130	114	101	90	82
	0.060 (16 Gauge)	1	224	205	175	151	133	118	105	75
		2	224	205	175	151	133	118	105	95
		3 or More	224	205	175	151	133	118	105	95
5½" PUMICE AGGREGATE GALVANIZED DECK	0.030 (22 Gauge)	1	157	140	119	82	70	59	51	44
		2	157	140	119	104	70	59	51	44
		3 or More	157	140	119	104	91	59	51	44
	0.036 (20Gauge)	1	188	158	135	117	102	70	60	52
		2	188	158	135	117	102	70	60	52
		3 or More	188	158	135	117	102	91	60	52
	0.048 (18 Gauge)	1	228	191	163	141	124	110	77	67
		2	228	191	163	141	124	110	98	67
		3 or More	228	191	163	141	124	110	98	89
	0.060 (16 Gauge)	1	265	222	189	164	144	128	92	81
		2	265	222	189	164	144	128	114	103
		3 or More	265	222	189	164	144	128	114	103

Table 1 (Continued)
Allowable Superimposed Load in Pounds Per Square Foot For BHP
3W36 Deck with Concrete Fill [1,2,4,5,6,7,8]

6¼" PUMICE AGGREGATE GALVANIZED DECK	0.030 (22 Gauge)	1	191	160	136	94	79	67	58	50
		2	191	160	136	94	79	67	58	50
		3 or More	191	160	136	118	79	67	58	50
	0.036 (20Gauge)	1	214	180	153	133	92	79	68	59
		2	214	180	153	133	92	79	68	59
		3 or More	214	180	153	133	117	103	68	59
	0.048 (18 Gauge)	1	259	217	185	160	141	100	86	75
		2	259	217	185	160	141	125	86	75
		3 or More	259	217	185	160	141	125	112	75
	0.060 (16 Gauge)	1	299	251	214	185	163	144	104	91
		2	299	251	214	185	163	144	129	116
		3 or More	299	251	214	185	163	144	129	116

1.The BHP 3W36 deck is recognized in LARR # 23783 and has a minimum yield strength of 40 ksi.
2.The concrete fill must have a minimum compressive strength *f* of 3000 psi.
3.Total slab depth is measured from top of concrete to bottom of steel deck.
4.Concrete must be reinforced with minimum 6 x 6 - W1.4 x W1.4 welded wire fabric placed at the center of fill over top flange. Where total slab depth exceeds 6¼ inches welded wire fabric with an area equal to 0.01 times the concrete fill depth measured from the top of concrete to top flange of steel deck.
5.Shoring is required at midspan for values to the right of the heavy line.
6.Shoring calculations are based on deck supporting dead load plus either 20 psf uniform construction load or 150 plf concentrated construction load for flexure. Dead load deflections limited to 1/ 180 of span length or 3/4 inch whichever is less.
7.Composite sections must not be used to resist loads which are predominately vibratory.
8.Superimposed loads tabulated meet the deflection criteria set forth in Table No. 1604.3 of the code and the first second and fourth limitations in Table No. 9.5 (b) of ACI 318-05 Building Code Requirements for Reinforced Concrete. To meet the third limitation in Table No. 9.5 (b) special calculations are required.

Table 2
Allowable Superimposed Load in Pounds Per Square Foot For VERCO
3W36 Deck with Concrete Fill [1,2,4,5,6,7,8]

Total Slab Depth and Type[3]	Deck Thickness In Inches	No. of Spans	Span of Composite Deck							
			8-0'	9-0'	10-0'	11-0'	12-0'	13-0'	14-0'	15-0'
5" PUMICE AGGREGATE GALVANIZED DECK	0.029 (22 Gauge)	1	170	139	86	69	56	45	36	29
		2	170	139	117	69	56	45	36	29
		3 or More	170	139	117	100	56	45	36	29
	0.033 (21Gauge)	1	188	155	130	80	65	53	43	35
		2	188	155	130	111	65	53	43	35
		3 or More	188	155	130	111	96	53	43	35
	0.035 (20 Gauge)	1	197	162	136	116	69	57	47	38
		2	197	162	136	116	100	57	47	38
		3 or More	197	162	136	116	100	88	47	38
	0.042 (19 Gauge)	1	228	187	157	134	116	70	59	49
		2	228	187	157	134	116	102	59	49
		3 or More	228	187	157	134	116	102	90	49
	0.047 (18 Gauge)	1	250	205	172	147	127	111	67	56
		2	250	205	172	147	127	111	98	56
		3 or More	250	205	172	147	127	111	98	88
	0.059 (16Gauge)	1	301	247	207	177	153	134	86	74
		2	301	247	207	177	153	134	118	105
		3 or More	301	247	207	177	153	134	118	105
5½" PUMICE AGGREGATE GALVANIZED DECK	0.029 (22 Gauge)	1	186	153	94	75	60	48	39	31
		2	186	153	128	75	60	48	39	31
		3 or More	186	153	128	109	60	48	39	31
	0.033 (21 Gauge)	1	206	169	142	86	70	57	46	37
		2	206	169	142	121	70	57	46	37
		3 or More	206	169	142	121	102	57	46	37
	0.035 (20 Gauge)	1	216	177	149	92	75	61	50	41
		2	216	177	149	127	75	61	50	41
		3 or More	216	177	149	127	110	61	50	41
	0.042 (19Gauge)	1	249	205	172	146	127	76	63	52
		2	249	205	172	146	127	76	63	52
		3 or More	249	205	172	146	127	111	98	52
	0.047 (18 Gauge)	1	272	224	188	160	139	86	72	60
		2	272	224	188	160	139	121	72	60
		3 or More	272	224	188	160	139	121	107	60

Table 2 (Continued)
Allowable Superimposed Load in Pounds Per Square Foot For VERCO
3W36 Deck with Concrete Fill 1 2 4 5 6 7 8

	0.059 (16 Gauge)	1	326	268	225	192	166	145	92	78
		2	326	268	225	192	166	145	128	78
		3 or More	326	268	225	192	166	145	128	114
6¼" PUMICE AGGREGATE GALVANIZED DECK	0.029 (22 Gauge)	1	213	134	106	84	67	54	43	34
		2	213	175	106	84	67	54	43	34
		3 or More	213	175	147	84	67	54	43	34
	0.033 (21 Gauge)	1	235	193	121	97	79	64	51	41
		2	235	193	162	97	79	64	51	41
		3 or More	235	193	162	138	79	64	51	41
	0.035 (20 Gauge)	1	246	202	170	104	84	68	56	45
		2	246	202	170	145	84	68	56	45
		3 or More	246	202	170	145	125	68	56	45
	0.042 (19 Gauge)	1	283	233	195	167	103	85	70	58
		2	283	233	195	167	144	85	70	58
		3 or More	283	233	195	167	144	126	70	58
	0.047 (18 Gauge)	1	309	254	213	182	157	96	80	67
		2	309	254	213	182	157	96	80	67
		3 or More	309	254	213	182	157	138	122	67
	0.059 (16 Gauge)	1	370	304	255	217	188	122	103	87
		2	370	304	255	217	188	165	145	87
		3 or More	370	304	255	217	188	165	145	130

1.The VERCO 3W36 deck is recognized in LARR # 23789 and has a minimum yield strength of 40 ksi.
2.The concrete fill must have a minimum compressive strength *f* of 3000 psi.
3.Total slab depth is measured from top of concrete to bottom of steel deck.
4.Concrete must be reinforced with minimum 6 x 6 - W1.4 x W1.4 welded wire fabric placed at the center of fill over top flange. Where total slab depth exceeds 6¼ inches welded wire fabric with an area equal to 0.01 times the concrete fill depth measured from the top of concrete to top flange of steel deck.
5.Shoring is required at midspan for values to the right of the heavy line.
6.Shoring calculations are based on deck supporting dead load plus either 20 psf uniform construction load or 150 plf concentrated construction load for flexure. Dead load deflections limited to 1/ 180 of span length or 3/4 inch whichever is less.
7.Composite sections must not be used to resist loads which are predominately vibratory.
8.Superimposed loads tabulated meet the deflection criteria set forth in Table No. 1604.3 of the code and the first second and fourth limitations in Table No. 9.5 (b) of ACI 318-05 Building Code Requirements for Reinforced Concrete. To meet the third limitation in Table No. 9.5 (b) special calculations are required.