TEC ASSOCIATES CONSULTING ENGINEERS

23 March 2004

Mr. Michael Nugent
Building Inspector
City of Portland
389 Congress Street
Portland, ME 04101

Re: Flatbread Wharf LLC
Structural Repairs to Second Floor

Dear Mr. Nugent:

The second floor live load for the above reference project was 100 psf for open assembly areas per BOCA Code. The second floor dead load was determined to be 76 psf after taking several core samples and determining that 4 ½ inches of concrete had been uniformly poured there. Calculations are attached.

TEC Associates will monitor all work via periodic inspection. We will also be present for the entire operation to change floorbeam 4 in panel 1. A report will be prepared upon completion of the work.

Please call with any questions.

Very truly yours,
TEC ASSOCIATES

Wayne W. Duffett, P.E.

Enclosure

cc: Kim Suhr (w/o enclosures)
John Meehan (w/o enclosures)

46 Sawyer Street South Portland, Maine 04106
207/767-6068 FAX 207/767-7125

Flatbroof 5trs 9½ K 11, 5.75' TRIBUTARY WIDTH.

Wood deck 1"	=	4.17 lb/sf
2×6 sleepers @ 12"	=	4.17 lb/sf
4½" concrete	=	56.25 lb/sf
2(5/8) decking	=	10.42 lb/sf
1" cork	=	1.05 lb/sf
		76.01 lb/sf DL

12/23/03

STRENGTHEN SPANS 1-4 19'-0" Face to Face 1 of 5

Clear span + 6" = 19'-6" for bending

9 1/4 x 11 beams Unknown species, heavy horizontal splits, some knots. Assume Douglas Fir #3

$S = \frac{(9.25)(11)^2}{6} = 186.5\ in^3$ Per AREMA $F_b = 650(1.11) = 721$ psi

$A = (9.25)(11.0) = 101.75\ in^2$ $F_v = 85(1.11) = 94$ psi

$M = (186.5\ in^3)(721\ lb/in^2)\frac{1}{12} = 11,205$ lb ft

$V = \frac{2}{3}(94\ lb/in^2)(101.75\ in^2) = 6,376$ lb

$M_D = \frac{(35\ lb/ft)(19.5\ ft)^2}{8} = 1664$ lb ft

$V_D = \frac{(35\ lb/ft)(19\ ft)}{2} = 332$ lb.

$M_{ALLOW} = 11,205 - 1664 = 9541$ lb ft

$V_{ALLOW} = 6,376 - 332 = 6,044$ lb.

6 3/4 x 10 3/4 beams Same species as above.

$S = \frac{(6.75)(10.75)^2}{6} = 130.0\ in^3$

$A = (6.75)(10.75) = 72.56\ in^2$

$M = (130.0\ in^3)(721\ lb/in^2)\frac{1}{12} = 7,811$ lb ft

$V = \frac{2}{3}(94\ lb/in^2)(72.56\ in^2) = 4,547$ lb.

$M_D = \frac{(25\ lb/ft)(19.5\ ft)^2}{8} = 1,188$ lb ft

$V_D = \frac{(25\ lb/ft)(19\ ft)}{2} = 238$ lb

$M_{ALLOW} = 7,811 - 1,188 = 6,623$ lb ft

$V_{ALLOW} = 4,547 - 238 = 4,309$ lb.

$w = \frac{(7811\ lb ft)(8)}{(19.5\ ft)^2} = 164.3\ lb/ft$

$\frac{(164.3)(19.5)}{2} = 1602$ end reaction

2 of 6

7 x 12 PSL Parallam PSL F_b = 2900 lb/in²

F_v = 210 lb/in²

$S = \frac{(7)(11\frac{7}{8})^2}{6} = 164.5\ in^3$

$A = (7)(11\frac{7}{8}) = 83\ in^2$ wt = 27 lb/ft

$M = (164.5\ in^3)(2900\ lb/in^2)\frac{1}{12} = 39{,}754$ lb ft

$V = \frac{2}{3}(83\ in^2)(210\ lb/in^2) = 11{,}620$ lb

$M_D = \frac{(27\ lb/ft)(19.5\ ft)^2}{8} = 1283$ lb ft

$V_D = \frac{(27\ lb/ft)(19\ ft)}{2} = 256$ lb

$M_{ALLOW} = 39{,}754 - 1283 = 38{,}471$ lb ft

$V_{ALLOW} = 11{,}620 - 256 = 11{,}364$ lb.

FLOOR LOAD FROM R1-R4:

Live Load	100 psf
Dead Load	76 psf
Total	176 psf

(Panel 1&3 = 19.5 feet)

$w = (176\ lb/ft)(20\ ft) = 3520$ lb/ft (Panel 2 = 20 feet)

$M = \frac{(3520\ lb/ft)(19.5\ ft)^2}{8} = 167{,}310$ lb ft

$V = \frac{(3520\ lb/ft)(19.0\ ft)}{2} = 33{,}440$ lb

Note - Clear span is 19.0 feet.

Span for moment is clear + 6" per AREMA

3 OF 6

PANEL 2 CAPY IN SPAN 2-4

M_{REQD}	167,310 16ft
− (3) 9¼×11 = (3)(9,541 16ft)	28,623
− (2) 6¾×10¾ = (2)(6,623 16ft)	13,246
	125,441 16ft (shortage)

$\frac{125,441 \text{ 16ft}}{38,471 \text{ 16ft}} = 3.26$ 7"×12" PSL REQD

V_{REQD}	33,440 16
− (3) 9¼×11 = (3)(6,044 16)	18,132 16
− (2) 6¾×10¾ = (2)(4,309 16)	8,618
	6,690 16 (shortage)

$\frac{6690 \text{ 16}}{111,364 \text{ 16}}$ = 7"×12" PSL REQD

PANEL 1+3 CAPY IN SPAN 2-4

REDUCE TRIBUTARY WIDTH TO 19'-6", IGNORE EXTERIOR WALL CAPT.

$w = (176 \text{ 16/FT})(19.5 \text{ FT}) = 3432 \text{ 16/ft}$

$M = \frac{(3432 \text{ 16/ft})(19.5 \text{ ft})^2}{8} = 163,127 \text{ 16ft}$

$V = \frac{(3432 \text{ 16/ft})(19.0 \text{ ft})}{2} = 32,604 \text{ 16.}$

M_{REQD}	163,127 16ft
− (2) 9¼×11 = (2)(9541 16ft)	19,082
− (1) 6¾×10¾ = (1)(6623 16ft)	6623
	137,422 16ft (shortage)

$\frac{137,422 \text{ 16ft}}{38,471 \text{ 16ft}} = 3.57$ 7"×12" PSL REQD

PANEL 2 CAPY IN SPAN 1

M_{REQD} 177,767 16ft

$-(3)(9626)$ 28,878

148,889 16ft (shortage)

$\frac{148,889 \text{ 16ft}}{39,382 \text{ 16ft}} = 3.78$ 7"x12" PSL REQD

PANEL 1+3 CAPY IN SPAN 1

M_{REQD} 173,299 16ft

$-(2)(9626)$ 19,252

154,047 16ft (shortage)

$\frac{154,047 \text{ 16ft}}{39,382 \text{ 16ft}} = 3.91$ 7"x12" PSL REQD.

∴ (4) 7"x12" PARALLAM PSL PER PANEL/SPAN (20'x20' block) WILL PROVIDE 100 psf LL CAPY AT RI-RA's.

ASSUME FOUR PSL's CARRY ALL SHEAR FORCE

$\frac{35,570 \text{ lb}}{4} = 8882 \text{ lb}$ PER BEAM CONNECTION

FOR A307 ALLOWABLE SHEAR 5/8 ϕ = 3.1 K

3/4 ϕ = 4.4 K

EXAMINE WOOD BREAKOUT IN 11½x17½ MAIN BEAM

1/9/04

CHECK DEFLECTION OF NEW 7x12 PSL

PANEL 2 SPAN 2-4

(4) 7x12 PSL PROVIDE 125,441 lb ft

$\frac{125,441}{4}$ = 31,360 lb/ft each

= 376,323 lb in

$w = \frac{31,360 \text{ lb ft}(8)}{(19.5 \text{ ft})^2}$ = 660 lb/ft = 55 lb/in

POST TENSION
660
+ 27
687 lb/ft
$\frac{(687)(19.5)}{2}$ = 6698 lb.

$V = \frac{(660 \text{ lb/ft})(19.5 \text{ ft})}{2}$ = 6435 lb.

$= \frac{bh^3}{12}$

$\frac{(11.875)^3}{12} = 977 \text{ in}^4$

$\Delta = \frac{(5)(55 \frac{lb}{in})(234 \text{ in})^4}{384(2,000,000 \frac{lb}{in^2})(977 \text{ in}^4)}$ = 1.1 in

$\frac{L}{240} = \frac{228}{240}$ = 0.95 close enough.

PANEL 1,3 SPAN 2-4

(4) 7X12 PSL PROVIDE 137,422 lb ft

$\frac{137,422}{4}$ = 34,355 lb ft

$w = \frac{34,355 \text{ lb ft}(8)}{(19.5 \text{ ft})^2}$ = 723 lb/ft ⇒ 60 lb/in

$V = \frac{(723 \text{ lb/ft})(19.5 \text{ ft})}{2}$ = 7049 lb,

$\Delta = \frac{(5)(60 \text{ lb/in})(234 \text{ in})^4}{384(2,000,000 \text{ lb/in}^2)(977 \text{ in}^4)}$ = 1.2 close enough

POST TENSION
723
+ 27
750

DESIGN CONNECTIONS FOR V = 7049 lb,

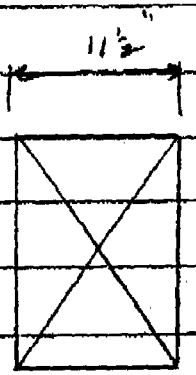
$\frac{750(19.5)}{2}$ = 7312

1/9/04

DESIGN CONNECTION FOR 7x12 PSL 6 OF 6

SHEAR LOAD IS 7049 lb

DOUG FIR # 2 $F_{c_\perp}$ = 625 (WCLIB)
= 375 (AREA)



BEARING AREA OF (4) 2 5/8" x 1/2" SHEAR PLATES (4)(2.625)(.5) = 5.25 in²

BEARING AREA OF (4) 3/4" BOLTS W/ 2" TRIB. LENGTH (4)(0.75)(2.0) = 6.00 in²

11.25 in²

(11.25 in²)(625 lb/in²) = 7031 lb OK

USING CHART (4)(1990 lb) = 7960 lb OK

TEC ASSOCIATES CONSULTING ENGINEERS

46 SAWYER STREET, SOUTH PORTLAND MAINE 04106

TEL: (207) 767-6068
FAX: (207 767-7125

DATE: 3/23/04

TRANSMITTED TO: Mike Nugent

FAX #: _____ **FIRM:** _____

FROM: Wayne Duffett

REGARDING: Flatbread Wharf LLC

TOTAL NUMBER OF PAGES, INCLUDING COVER: 2

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