APPENDIX C

PROJECT: HYATT REGENCY — HIRO McNULTY — PG 1 OF 11

NON-COMPOSITE PRELIMINARY ANALYSIS/DESIGN

TYPICAL BAY SIZES: 27' x 18'-6" (ROOMS) 27' x 24' (CORRIDOR)

f'_c = 3000psi / NORMAL WEIGHT

A992 STEEL BEAMS & COLUMNS

SERVICE LOADS
20 psf DL
80 psf LL (CORRIDOR)
40 psf LL (ROOMS)

3-SPAN

27'x24' BAY SIZE

1.0 C(CSV) DECKING - SUPERIMPOSED UNIFORM LOADING = 80 + 20 = 100psf

4'-0" CLEARSPAN REQUIRES 3" TOTAL SLAB DEPTH
W 6x6 W2.1xW2.1 W.W.F.
1.0 C26 = 31psf

5'-0" CLEARSPAN REQUIRES 3.5" TOTAL SLAB DEPTH
W 6x6 W2.9xW2.9 W.W.F.
1.0 C24 = 37psf

4'-6" CLEARSPAN REQUIRES 3.5" TOTAL SLAB DEPTH
W 6x6 W2.1xW2.1 W.W.F.
1.0 C24 = 37psf

1.5 C DECKING - SUPERIMPOSED UNIFORM LOADING = 100psf

4'-0" CLEARSPAN REQUIRES 3.5" TOTAL SLAB DEPTH
W 6x6 W2.9xW2.9 W.W.F.
1.5 C24 = 37psf

5'-0" CLEARSPAN REQUIRES 4" TOTAL SLAB DEPTH
W 6x6 W2.9xW2.9 W.W.F.
1.5 C24 = 43psf

4'-6" CLEARSPAN REQUIRES 3.5" TOTAL SLAB DEPTH
W 6x6 W2.9xW2.9 W.W.F.
1.5 C24 = 37psf

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27'x 18'-6" BAY SIZE

1.0 C (CSU) DECKING - SUPERIMPOSED UNIFORM LOADING = 40 + 20 = 80 psf

3'-6" CLEARSPAN REQUIRES 2½" SLAB DEPTH
W 6x6 W2.1xW2.1 W.W.F.
1.0 C 26 = 25 psf

4'-0" CLEARSPAN REQUIRES 3" SLAB DEPTH
W 6x6 W2.1xW2.1 W.W.F.
1.0 C 26 = 31 psf

4'-6" CLEARSPAN REQUIRES 3" SLAB DEPTH
W 6x6 W2.1xW2.1 W.W.F.
1.0 C 26 = 31 psf

5'-0" CLEARSPAN REQUIRES 3½" SLAB DEPTH
W 6x6 W2.9xW2.9 W.W.F.
1.0 C 24 = 37 psf

1.5 C DECKING - SUPERIMPOSED UNIFORM LOADING = 80 psf

4'-0" CLEARSPAN REQUIRES 3½" SLAB DEPTH
W 6x6 W2.9xW2.9 W.W.F.
1.5 C 24 = 37 psf

4'-6" CLEARSPAN REQUIRES 3½" SLAB DEPTH
W 6x6 W2.9xW2.9 W.W.F.
1.5 C 24 = 37 psf

5'-0" CLEARSPAN REQUIRES 4" SLAB DEPTH
W 6x6 W2.9xW2.9 W.W.F.
1.5 C 24 = 43 psf

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27' x 24' BAY (COMPOSITE DECKING)

1.5 VLR DECKING — SUPERIMPOSED UNIFORM LOADING = 80+20 = 100 psf

9'-0" CLEAR SPAN REQUIRES 3½"

1.5VLR 18 DECK, 38 psf

2.0 VLR DECKING — SUPERIMPOSED LOAD = 100 psf

9'-0" CLEAR SPAN REQUIRES 4"

2VL122 DECK, 39 psf

27' x 18'-6" BAY — SUPERIMPOSED DEAD LOAD = 40+20 = 60 psf

1.5 VLR DECK — 9'-6" CLEARSPAN REQUIRES 3½"

1.5VLR 22 DECK, 38 psf

2VLR DECK — 9'-6" CLEAR SPAN REQUIRES 4"

2VLN 22 DECK, 39 psf

27'x24' BAY SIZE 4 OF 11

1.0C DECKING WITH 4'-0" CLEARSPAN

$w_u = [1.2(31+20)+1.6(80)]4' = 756.8\ plf = 0.757\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.757klf)(27')^2}{8} = 69.0\ ft\cdot k$

$V_u = \frac{w_u l}{2} = \frac{0.757(27')}{2} = 10.2\ k$

1.0C DECKING WITH 4'-6" CLEARSPAN

$w_u = [1.2(37+20)+1.6(80)]4.5' = 883.8\ plf = 0.884\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.884klf)(27')^2}{8} = 80.6\ ft\cdot k$

$V_u = \frac{w_u l}{2} = \frac{(0.884)(27')}{2} = 12.0\ k$

1.0 C DECKING WITH 5'-0" CLEARSPAN

$w_u = [1.2(37+20)+1.6(80)]5' = 982\ plf = 0.982\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.982klf)(27')^2}{8} = 89.5\ ft\cdot k$

$V_u = \frac{w_u l}{2} = \frac{(0.982)(27')}{2} = 13.3\ k$

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27' x 24' Bay Size

1.5 C Decking with 4'-0" clearspan

$w_u = [1.2(37+20) + 1.6(80)]\,4' = 785.6\ plf = 0.786\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.786)(27')^2}{8} = 71.6\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{(0.786)(27')}{2} = 10.6\ k$

1.5 C Decking with 4'-6" clearspan

$w_u = [1.2(37+20) + 1.6(80)]\,4.5' = 883.8\ plf = 0.884\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.884)(27')^2}{8} = 80.6\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{(0.884)(27')}{2} = 11.9\ k$

1.5 C Decking with 5'-0" clearspan

$w_u = [1.2(37+20) + 1.6(80)]\,5' = 1018\ plf = 1.02\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(1.02)(27')^2}{8} = 92.9\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{(1.02)(27')}{2} = 13.8\ k$

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27' x 18'-6" BAY SIZE

1.0C DECKING WITH 3'-6" CLEARSPAN

$w_u = \left[1.2(25+20)+1.6(80)\right] 3.5' = 655.2\ plf = 0.655\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.655)(27')^2}{8} = 59.7\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{0.655(27')}{2} = 8.8\ k$

1.0C DECKING WITH 4'-0" CLEARSPAN

$w_u = \left[1.2(31+20)+1.6(80)\right] 4' = 756.8\ plf = 0.757\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.757)(27')^2}{8} = 68.0\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{0.757(27')}{2} = 10.2\ k$

1.0C DECKING WITH 4'-6" CLEARSPAN

$w_u = \left[1.2(31+20)+1.6(80)\right] 4.5' = 823.5\ plf = 0.824\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.824)(27')^2}{8} = 75.1\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{(0.824)(27')}{2} = 11.1\ k$

1.0C DECKING WITH 5'-0" CLEARSPAN

$w_u = \left[1.2(37+20)+1.6(80)\right] 5' = 982\ plf = 0.982\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.982)(27')^2}{8} = 89.5\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{(0.982)(27')}{2} = 13.3\ k$

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27' x 18'-6" BAY S.2S

1.5C DECKING WITH 4'-0" CLEARSPAN

$w_u = [1.2(37+20) + 1.6(40)]4' = 529.6\ plf = 0.530\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.53)(27')^2}{8} = 48.3\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{(0.53)(27')}{2} = 7.2\ k$

1.5C DECKING WITH 4'-6" CLEARSPAN

$w_u = [1.2(37+20) + 1.6(40)]4.5' = 595.8\ plf = 0.596\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.596)(27')^2}{8} = 54.3\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{(0.596)(27')}{2} = 8.0\ k$

1.5C DECKING WITH 5'-0" CLEARSPAN

$w_u = [1.2(43+20) + 1.6(40)]5' = 648\ plf = 0.698\ klf$

$M_u = \frac{w_u l^2}{8} = \frac{(0.698)(27')^2}{8} = 63.6\ ft\text{-}k$

$V_u = \frac{w_u l}{2} = \frac{(0.698)(27')}{2} = 9.4\ k$

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1.5 VLR 18

$w_u = [1.2(38+20) + 1.6(80)]\,9' = 1778\ plf = 1.8\ klf$

$M_u = \frac{(1.8klf)(27')^2}{8} = 164'^k$

$V_u = \frac{(1.8)(27)}{2} = 24.3^k$

2VL122 $w_u = [1.2(39+20) + 1.6(80)]\,9' = 1789 = 1.8klf$

$M_u = 164'^k$ [AS PREVIOUS]

$V_u = 24.3^k$

1.5VLR22 $w_u = [1.2(38+20) + 1.6(40)]\,9.5' = 1269\ plf = 1.3klf$

$M_u = \frac{(1.3klf)(27')^2}{8} = 118.5'^k$

$V_u = \frac{(1.3)(27')}{2} = 17.6^k$

2.0VL122 $w_u = [1.2(39+20) + 1.6(40)]\,9.5 = 1281\ plf\ 1.3klf$

$M_u = 118.5'^k$

$V_u = 17.6^k$

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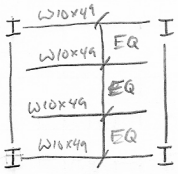
COMPOSITE DECK YIELDS FAR FEWER BEAMS (9'-0"-9'-6" SPACING RATHER THAN 5'-0" SPACING)

FOR L_b = 27'-0" & M_u = 164'k FOR 27'x24' BAY

USE W10x49 BEAMS
- LOW DEPTH
- GOOD CAPACITY

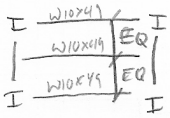
BEST OPTION

27'x 24' BAY



W10x49 BEAMS EQ SPACING
WITH 1.5 VLR 18 DECK & CONC (3½" THICKNESS)

27'x 18'-6" BAY



W10x49 BEAMS EQ SPACING
WITH 1.5 VLR 22 (USE 1.5 VLR 18 FOR SIMPLICITY IN LABOR)

1.5 VLR 18 DECK & CONC
3½" THICKNESS

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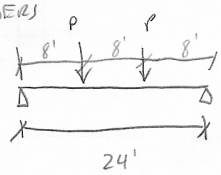
GIRDER



$W_t = 8'$

$W_u = \left[1.2(20+38) + 1.6(80)\right]8' + 1.2(49)$

$= 1639.6\ plf = 1.64\ klf$

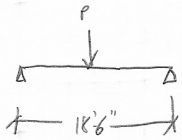
$M_u = \frac{(1.64)(27')^2}{8} = 149.4'^k \leq \phi_b M_r = 164'^k$

$V_u = \frac{1.64(27')}{2} = 22.1^k \leq \phi_b V_n = 91.6^k$

$P = V_n = 22.1^k$

$M_u = 22.1^k(8') = 176.8'^k$

$V_n = \frac{P}{\ell}(L-a+b) = \frac{22.1^k}{24'}(24'-8'+8') = 22.1^k$



$W_t = 9'-3"$

$W_u = \left[1.2(20+38) + 1.6(40)\right]9.25' + 1.2(49)$

$= 1295\ plf = 1.30\ klf$

$M_u = \frac{(1.30)(27')^2}{8} = 118.5'^k \leq \phi_b M_r = 164'^k$

$V_u = \frac{1.3(27)}{2} = 17.6^k$

$P = V_u = 17.6$

$M_u = \frac{P\ell}{4} = \frac{17.6(18.5)}{4} = 81.4'^k$

$V_u = \frac{P}{2} = \frac{17.6}{2} = 8.8^k$

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$M_u = 177^{k}$ $L_s = 24'$ TRY W10X49

$M_u = 176.8^{k}$ + SELF WT

$M_s = \frac{\frac{1.2(49)}{1000}(24)^2}{8} = 4.2^{k}$

$M_u = 176.8 + 4.2 = 181^{k} \geq \phi_b M_r = 164^{k}$ X

BRACING REQUIRED

$M_u = 81.4^{k}$ $L_b = 18.5'$ TRY W10X33

$M_u = 81.4^{k}$ + SELF WT

$M_s = \frac{\frac{1.2(33)}{1000}(18.5)^2}{8} = 1.7^{k}$

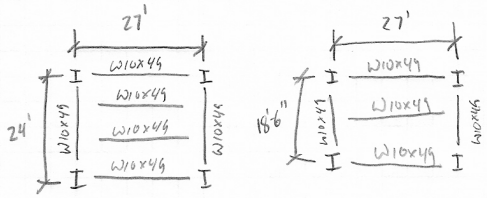
$M_u = 81.4 + 1.7 = 83.1^{k} \leq \phi_b M_r = 105^{k}$

COULD USE W10X49 FOR CONTINUITY

$M_s = \frac{\frac{1.2(49)}{1000}(18.5)^2}{8} = 2.52^{k}$

$M_u = 81.4 + 2.52 = 84^{k} \leq \phi_b M_r = 164^{k}$

OK

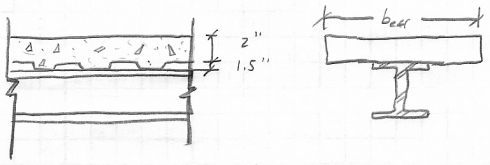


WITH 3½" 1.5ULR18 DECK & CONC

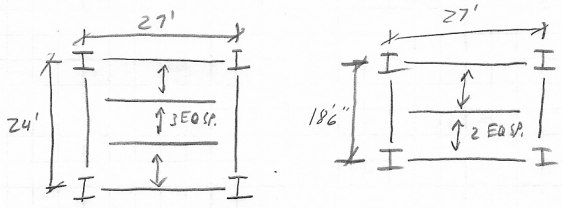
PROJECT: HYATT REGENCY | Hiro McNulty | PG 1 OF 5

Composite Steel Preliminary Analysis / Design

From Non-composite analysis, 1.5 VLR 18 deck & concrete required for 8' & 9'3" beam spacing



Typical Bays



Beams spaced at 8' & 9'5"

b_{eff} = $\frac{1}{4}$ (span) = $\frac{1}{4}$ (27'(12"/1')) = 81"

= spacing = 9'3(12"/1') = 111"
8'(12"/1') = 96"

∴ b_{eff} = 81"

f'_c = 3ksi

f_y = 50ksi

FOR 27' x 18'6" BAY

$W_{@L} = 20_{psf}$
$W_{LL} = 40_{psf}$
$W_D = 33_{psf}$ + BEAM SELF WT. (WILL CHECK)

$W_u = 1.2(33+20) + 1.6(40) = 127.6_{psf}$

$M_u = \frac{[(127_{psf})(9'3")](27')^2}{8} = 107.0 ft\text{-}k$

$V_u = \frac{127(9'3")(27)}{2} = 15,9k$

FROM NON-COMPOSITE, W10 x 49 WORKS, TRY

A W8 SECTION TO REDUCE DEPTH OF SECTION (ASSUME FULLY BRACED) W8x48 $A_s = 14.1 in^2$

$C_c = 0.85(3ksi)(81")(2") = 413.1^k$

$T_s = A_s F_y = (14.1 in^2)(50ksi) = 705^k$

$C_q = 0$ = fully composite

$T_s - C_c = 705^k - 413.1^k = 291.9^k$

$291.9^k = A_{sc}(50)(2)$

$A_{sc} = 2.919 in^2$

$t_f = 0.685 in$ $b_f = 8.11 in$

$x = \frac{2.919 in^2}{8.11 in} = 0.36 in < t_f$ ✓

$M_n = 413.1(3.5-1) + 705(\frac{8.5}{2}) - 291.9(\frac{0.36}{2}) = 3976.5 in\text{-}k$
$= 331.4 ft\text{-}k$

SHEAR STUD STR RED. FACTOR (3/4" ϕ, 3" STUDS)

$\frac{0.85}{\sqrt{2}}(3/1.5")[3"/1.5" - 1] \leq 1.0$ (FOR 2 STUD/RIB)

$1.2 \leq 1.0$

NO RED. FACTOR

$C = Q = 413.1^k$ TO TRANSFER STRESS

for $f'_c = 3\,ksi$, NWC $\frac{3}{4}$" STUD

$Q_n = 21.0^k$

$\#_{studs} = \frac{2(413.1^k)}{21^k} = 39.3 \rightarrow 40$ SHEAR STUDS

$b_f = 8.11in$ $t_f = 0.685in$

$\phi_{stud} \leq 2.5(0.685in) = 1.71in$ ✓

SPACING LONGITUDINALLY $\geq 6d_s = 6(3/4) = 4\frac{1}{2}$"

SPACING TRANSVERSE $\geq 4d_s = 4(3/4) = 3$"

CHECK WITH SELF WT. $w_u = 1.2\left[(33+20)(9'3") + 48\right] + 1.6\left[(40)(9'5")\right]$

$w_u = 1.2\,k/ft$

$M_u = \frac{1.2(27)^2}{8} = 109.4\,ft\text{-}k$

$\phi M_n = 0.85(331.4\,ft\text{-}k) = 281.7\,ft\text{-}k \geq M_u$ ✓

$V_u = \frac{1.2(27)}{2} = 16.2^k$

$h/t_w = 15.9 \leq 2.45\sqrt{\frac{29000}{50}} = 59$ ✓

$\phi V_n = 0.9(50)(8.5)(0.4) = 153^k \geq V_u$ ✓

USE COMPOSITE W8X48 WITH 1.5 VLR IN W/ 40, $\frac{3}{4}$" ø SHEAR STUDS

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For 27' x 24' BAY

$w_{DL} = 20_{psf}$
$w_{LL} = 80_{psf}$
$w_D = 33_{psf}$ + BEAM SELF WT. (TO CHECK)

$w_u = 1.2(33+20) + 1.6(80) = 191.6_{psf}$

$M_u = \frac{(0.1916\,k/sf)(8')(27')^2}{8} = 139.7\,ft\text{-}k$

$V_u = \frac{(0.1916\,k/sf)(8')(27')}{2} = 20.7\,k$

From NON-COMPOSITE, W10x45 WAS USED
TRY W8 x48 AS WITH THE OTHER BAY SIZE

$w_u = 1.2[(33+20)(8)+48_{plf}] + 1.6(80)(8) = 1.59\,k/ft$

$M_u = \frac{(1.59)(27)^2}{8} = 144\,ft\text{-}k$

$\phi M_n = 281.7\,ft\text{-}k \geq M_u$ ✓

$V_u = \frac{1.59(27)}{2} = 21.5\,k$

$\phi V_n = 153^k \geq V_u$ ✓

USE COMPOSITE W8x48 W
1.5 VLR 18 W 40 3/4" ø SHEAR STUD

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REDUCTION IN THE NUMBER OF SAFAR STUDS CAN BE DETERMINED IN FURTHER CALCULATIONS