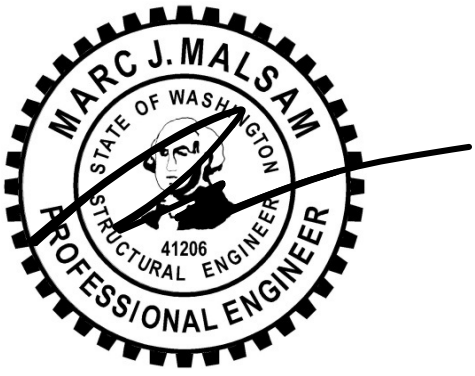
*SUPPLEMENTAL CALCULATIONS FOR:*

# KONERU RESIDENCE

6610 E MERCER WAY
MERCER ISLAND, WA

ARCHITECT: McCULLOUGH ARCH

MAY 30, 2024




MALSAM TSANG
STRUCTURAL ENGINEERING

122 S JACKSON ST | SUITE 210 | SEATTLE WA 98104 | 206.789.6038 T | 206.789.6042 F

# DESIGN CRITERIA IBC 2018

## DEAD LOADS

| FLAT ROOF | | FLOOR | |
|---|---|---|---|
| Rigid Insulation | 2 psf | 1-1/8Gyp+1/4tile | 18 psf |
| 3/4" Plywood | 2.4 psf | w/ hydro. tubing | - - |
| TJI @ 24" o.c. | 1.5 psf | 1 1/8" Plywood | 3.6 psf |
| Gyp Board (5/8") | 2.8 psf | Truss @ 16" o.c. | 4.0 psf |
| MEP | 1.5 psf | Gyp Board (5/8") | 2.8 psf |
| Solar panel | 4.5 psf | MEP | 1.5 psf |
| (where occurs) | - | | |
| Total | 14.7 psf | Total | 29.9 psf |
| Use | 15.0 psf (Typ. roof) | Use | 30.0 psf |

Use 30.0 psf (Lower roof w/ pea gravel)

| MISC. LOADS | |
|---|---|
| 16 Ga roof steel deck w/ 2" ave. pea gravel | 28 psf |
| (where: washed pea gravel=9.5 psf per inch thk) | - - |
| 3/4" Stucco (lath & plaster) wall fin. | 8 psf |

## LIVE LOADS/OCCUPANCY

| | | ROOF SNOW | FLOOR LIVE | DECK LIVE |
|---|---|---|---|---|
| Risk Category | II | Snow = 25 psf | Occupancy = 40 psf | Occupancy = 60 psf |
| Roof Deck | No | **Note:** 5 psf rain on snow | Stair/Corridor = 40 psf | |
| Common Access | No | surc. for rf slope 5deg or less | | |

## SEISMIC CRITERIA ASCE 7-16 Ch. 11 & Ch. 12

| | | | |
|---|---|---|---|
| Imp. Factor = | 1.00 | Seismic Ht, hn= | 28 ft |
| Site Class = | E | T, Building= | 0.24 |
| R Value = | 6.5 | Ts= | 0.63 |

**Geo. Ground Hazard?** **No w/ASCE 11.4.8 Excep's**

| | | | | | |
|---|---|---|---|---|---|
| $S_s$ = | 1.45 | | $F_a$ = | 1.200 | Table 11.4-1 |
| $S_1$ = | 0.5 | | $F_v$ = | 1.850 | Table 11.4-2 |
| $S_{ms}$ = | 1.740 | x 2/3 = | $S_{ds}$ = | **1.059** | Eqn. 11.4-3 |
| $S_{m1}$ = | 0.925 | x 2/3 = | $S_{d1}$ = | **0.567** | Eqn. 11.4-4 |

| | | |
|---|---|---|
| $C_{SULT}$ = | **0.163** | ASCE 7 12.8, ELF, procedure used. |
| $C_{SALL}$ = | **0.114** | ASCE 7 12.9, MRSA, procedure not used. |

T/Ts= 0.385 ≤ 1

Okay, Cs Eqn. 12.8-2

## SEISMIC WEIGHT ASCE 7-16 12.7.2

Partitions = 15 psf

*Roof weight = 1/2 Partition + Roof DL

*Floor weight = Full Partition + Floor DL

FLAT ROOF 22.5 psf ROOF=37.0 psf (w/ gravel)

FLOOR 45.0 psf

## SEISMIC DESIGN CATEGORY IBC 1613.2.5

Seismic DC= D

## WIND CRITERIA ASCE 7-16 Ch. 27 Directional Procedure

| | | | |
|---|---|---|---|
| V = | 110 mph | $K_d$ = | 0.85 |
| Exposure = | C | G = | 0.85 |
| h = | 28 ft | $K_{zt}$ = | 1.00 |

Roof Slope = FLAT : 12 = 0 °

### PRESSURE COEFFICIENTS (Cp)

| | | | |
|---|---|---|---|
| Windward Wall = | 0.8 | Windward Roof = | N/A |
| Leeward Wall = | -0.5 | Leeward Roof = | N/A |

**PRESSURE (PSF)** $q = 0.00256 K_z K_{zt} K_d V^2$

| Ht | $K_z$ | $q_z$ | $0.6xq_z$[1] | $q_h$ | $P_{WW}$ | $P_{LW}$ | $P_{WALL}$ | $P_{ROOF}$ |
|---|---|---|---|---|---|---|---|---|
| 0-15 | 0.85 | 22.4 | 13.4 | | 9.1 | 6.6 | **15.7** | |
| 15-20 | 0.90 | 23.7 | 14.2 | | 9.7 | 6.6 | **16.2** | |
| 20-25 | 0.94 | 24.7 | 14.8 | | 10.1 | 6.6 | **16.7** | |
| 25-30 | 0.98 | 25.8 | 15.5 | 15.5 | 10.5 | 6.6 | **17.1** | N/A |
| 30-35 | 1.02 | 26.9 | 16.1 | | 11.0 | 6.6 | **17.5** | |
| 35-40 | 1.04 | 27.4 | 16.4 | | 11.2 | 6.6 | **17.8** | |
| 40-45 | 1.07 | 28.2 | 16.9 | | 11.5 | 6.6 | **18.1** | |
| 45-50 | 1.09 | 28.7 | 17.2 | | 11.7 | 6.6 | **18.3** | |

[1] Per IBC 2018 1605.3.1 Basic Load Combinations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KONERU RESIDENCE
Project
6610 E MERCER WAY
MERCER ISLAND, WA

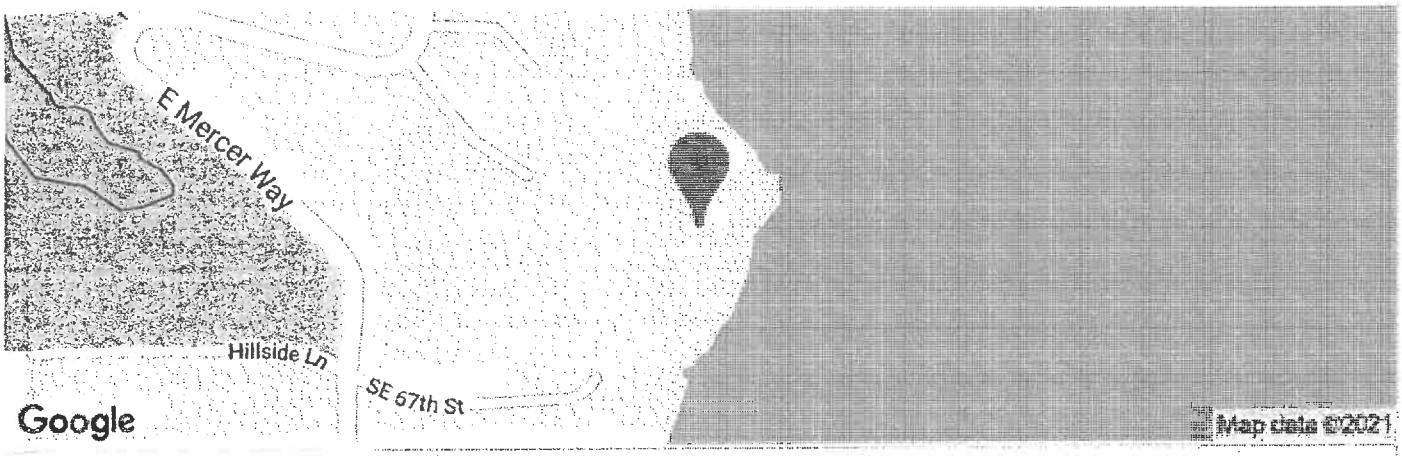
8/17/2022
Date
0426-2021-03-01
Proj. No.
JCM
Design
DC1
Sheet
STAIR REVIS.

OSHPD

# Koneru Residence

## 6610 E Mercer Way, Mercer Island, WA 98040, USA

**Latitude, Longitude: 47.5437445, -122.2093429**




| | |
|---|---|
| **Date** | 10/21/2021, 2:09:01 PM |
| **Design Code Reference Document** | ASCE7-16 |
| **Risk Category** | II |
| **Site Class** | E - Soft Clay Soil |

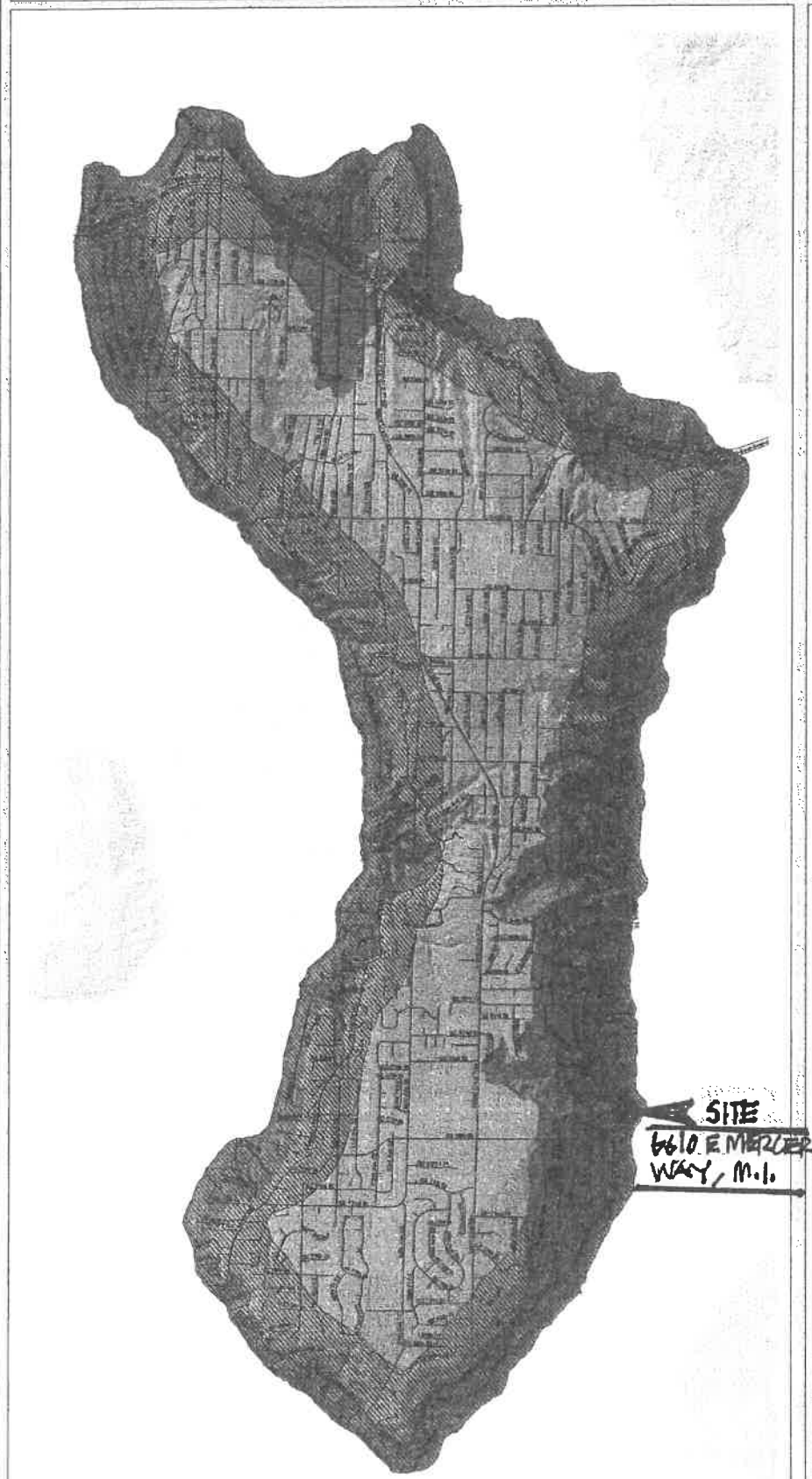
| Type | Value | Description |
|---|---|---|
| $S_S$ | 1.448 | $MCE_R$ ground motion. (for 0.2 second period) |
| $S_1$ | 0.501 | $MCE_R$ ground motion. (for 1.0s period) |
| $S_{MS}$ | null -See Section 11.4.8 | Site-modified spectral acceleration value |
| $S_{M1}$ | null -See Section 11.4.8 | Site-modified spectral acceleration value |
| $S_{DS}$ | null -See Section 11.4.8 | Numeric seismic design value at 0.2 second SA |
| $S_{D1}$ | null -See Section 11.4.8 | Numeric seismic design value at 1.0 second SA |

| Type | Value | Description |
|---|---|---|
| SDC | null -See Section 11.4.8 | Seismic design category |
| $F_a$ | null -See Section 11.4.8 | Site amplification factor at 0.2 second |
| $F_v$ | null -See Section 11.4.8 | Site amplification factor at 1.0 second |
| PGA | 0.62 | $MCE_G$ peak ground acceleration |
| $F_{PGA}$ | 1.1 | Site amplification factor at PGA |
| $PGA_M$ | 0.682 | Site modified peak ground acceleration |
| $T_L$ | 6 | Long-period transition period in seconds |
| SsRT | 1.448 | Probabilistic risk-targeted ground motion. (0.2 second) |
| SsUH | 1.606 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration |
| SsD | 4.294 | Factored deterministic acceleration value. (0.2 second) |
| S1RT | 0.501 | Probabilistic risk-targeted ground motion. (1.0 second) |
| S1UH | 0.558 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration. |
| S1D | 1.643 | Factored deterministic acceleration value. (1.0 second) |
| PGAd | 1.425 | Factored deterministic acceleration value. (Peak Ground Acceleration) |
| $C_{RS}$ | 0.902 | Mapped value of the risk coefficient at short periods |
| $C_{R1}$ | 0.899 | Mapped value of the risk coefficient at a period of 1 s |

DC2
STAIR REVIS.

# Mercer Island Wind Exposure and Wind Speed-Up (Topographic Effect)

by Development Services Group (DSG), City of Mercer Island
April 2009




0 0.5 1 Kilometers 1:12,000
0 0.5 1 Miles
TN

WIND EXPOSURE CATEGORIES & WIND SPEED-UP FACTORS
(ICC Section 1609 & ASCE 7-05 Chapter 6)

It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the Kzt factor to be utilized for each specific project. The Kzt factors and wind exposure categories indicated on this map are the minimum values accepted by the City of Mercer Island without requiring the design professional to submit additional calculations and supporting topographic documentation (to verify the values utilized in their wind load determination).

Please note – The Kzt values indicated on this map are approximations based upon periodic calculations of representative samplings around Mercer Island. These values are intended for City of Mercer Island's plan review purposes only.

WIND EXPOSURE CATEGORIES:

| Wind Exposure Category | |
|---|---|
| | Exposure 'C' (1500 feet from Lake) |
| | Exposure 'B' (all other areas) |

WIND SPEED-UP (TOPOGRAPHIC EFFECT) - $K_zt$ Factor:

| $K_zt$ Factor | |
|---|---|
| | $K_zt = 1.0$ |
| | $K_zt = 1.3$ |
| | $K_zt = 1.6$ |
| | $K_zt = 1.9$ |

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

This map is the Wind Exposure Category and Wind Speed-up (Topographic Effects) Map for the City of Mercer Island. This map shows the minimum wind exposure category and the minimum wind speed-up, "Kzt" factor, which will be accepted without site specific documentation and calculation.

Other wind speed phenomena may occur on Mercer Island that is not specifically indentified on this map. It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the appropriate design wind speed and exposure category for their specific project and location.

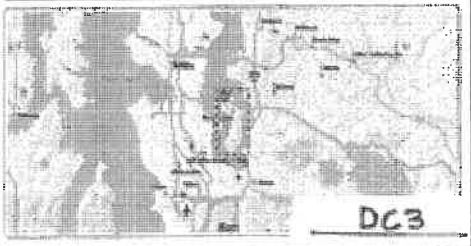
This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically evaluated and there may be locations that are not correctly represented on this map. It is the responsibility of individual property owners and map users to evaluate risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island with this map.

Information about data used for the map, references, and data limitation are all described the associated "Read Me" document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island website.

The City of Mercer Island is using guidance provided within ICC Section 1609 & ASCE 7-05 Chapter 6 regarding definitions used when creating this map.

DEFINITIONS:

| | |
|---|---|
| $K_zt$ factor | The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7. |
| Exposure B | The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3. |
| Exposure C | The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3. |
| Wind Speed | Minimum 85 mph 3-second gust per IRC Figure R301.2(4) |




STAIR REVIS.

# LATERAL ANALYSIS AND DESIGN:

## ① WIND ANALYSIS: – BOTH DIRECTIONS/EXPOSURES:

| LEVEL | TRIB. HT (FT.) | $V_{WIND\,ALLOW}$ – FULL WIND (PLF) | $V_{WIND\,ALLOW}$ – W/INDWARD (PLF) |
|---|---|---|---|
| ROOF DIAP. | 2.75 + 1 + 10/2 = 8.75' | = 17.1 * 2.75' + 16.7 * 5' + 10.2 * 1 = 146.7 #/' | = 10.6 * 2.75 + 10.1 * 5' + 9.7 * 1 = 89.0 #/' |
| UPPER FLR. DIAP. | 10/2 + 2 + 12/2 = 13.0' | = 16.2 * 4' + 15.7 * 9' = 206.1 #/' | = 9.7 * 4' + 9.1 * 9' = 120.7 #/' |

## ② SEISMIC ANALYSIS:

| LEVEL | AREA (#) | WT. (K) | HT (FT) | $W_i H_i$ (K-FT) | DISTRIB. | # LVL FL (ALLOW.) DIAP. DES. FORCE (K) |
|---|---|---|---|---|---|---|
| ROOF DIAP. | 5580 * 26 PSF + 1250 * 18.5 PSF | 168.0 K | 22 | 3695 | 0.55 | 26.00 ✓ |
| UPPER FLOOR & LOWER ROOF DIAP. | 4385 * 45 PSF + 760 * 37 PSF + 515 * 38 PSF + 140 * 15 + 100 K (17/2 + 2) * 8 | 250.0 K | 12 | 3000 | 0.45 | 21.50 |
| | | $\Sigma W_i$ = 418.0 K | | $\Sigma$ = 6695 | | |

$V_{SX\,ULT.} = 0.163\,(418.0) = 68.0$

$V_{SX\,ALLOW.} = 0.114\,(418.0) = 47.5$

ASCE 12.10.1;

INERTIAL DIAP DES. FORCE

(EQN. 12-10.2)

$F_{px} = 0.2\,S_{DS}\,I_e * W_{px}$ – (ULT.)

$= 0.2 * 1.054 * 1.0 * W_{px} / 1.4$

$F_{px} = 0.15\,W_{px}$ – (ALLOW.)

ROOF DIAP. ——— 25.35 K – N/C

UPPER FLOOR & LOWER RF. DIAP ——— ✓ 37.75 K > 21.50

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PROJECT: KONERU RES.

DATE: 10/22/21

PROJECT NO: 0426-2021-03

DESIGN: JCM

SHEET: L-1-A

STAIR REVS.

LOADS IMPOSED TO BRIDGE FRMG. AND INTO SHEARWALLS;

↳ LOAD ANALYSIS BY STAIR DESIGNER (BY-OTHERS)

**Stringer Loads Imposed On Structure**

| Node | Result Case | FX K | FY K | FZ K |
|---|---|---|---|---|
| N425 | D | 0.1494 | -0.1584 | -0.9386 |
| N425 | E+X | 0.8704 | -0.3717 | 0.652 |
| N425 | E+Z | 0.2433 | -0.1618 | 0.4731 |
| N425 | L | 0.1601 | -0.183 | -0.8396 |
| N428 | D | 0.0266 | -1.6159 | 1.6438 |
| N428 | E+X | 0.3228 | 0.0694 | -0.406 |
| N428 | E+Z | 0.0735 | -0.2608 | 0.4346 |
| N428 | L | -0.0154 | -1.3484 | 1.4407 |
| N435 | D | -0.1166 | -1.2904 | -0.9334 |
| N435 | E+X | 0.3339 | 0.7396 | 1.2794 |
| N435 | E+Z | -0.0877 | 0.1726 | 0.5654 |
| N435 | L | -0.1467 | -0.966 | -0.6938 |
| N436 | D | 0.0178 | -0.2135 | 0.3191 |
| N436 | E+X | 0.6469 | -0.864 | -1.4044 |
| N436 | E+Z | -0.093 | 0.6418 | 1.0782 |
| N436 | L | 0.0787 | -0.3496 | 0.1891 |

IBC 2021 - EQN 16-22;

☑ LAT. LOAD; D + E/1.4 ; (E+Z)

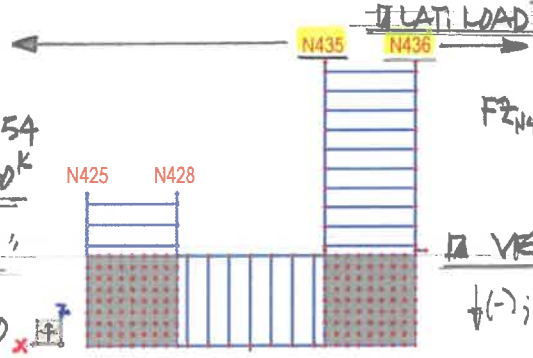
$FZ_{N435} = (-)\,\cancel{0.9334}^{\,0} + 0.5654$

$\simeq 0.5654^K \simeq \underline{0.60^K}$

☑ VERT. LOAD; D+L+E/1.4 ;

$\downarrow(-);\ FY_{N435} = 1.29 + 0.966 + \sim 0$

$= \underline{2.25^K}$




PLAN VIEW - KEY

☑ LAT. LOAD; D + E/1.4 ; (E+Z)

$FZ_{N436} = 0.3191 + 1.0782$

$= 1.3973^K \simeq \underline{1.40^K}$

☑ VERT. LOAD; D+L+E/1.4 ;

$\downarrow(-);\ FY_{N436} = 0.2135 + 0.3496 + 0.864$

$= 1.43^K$

REV'D: 5/29/24

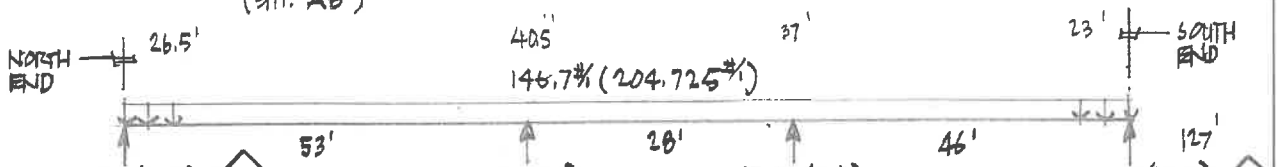
KONERU RES. — STAIR REVIS.

SHEET L-1-B

## LATERAL DESIGN ; EAST-WEST EXPO. ; SEISMIC LOAD IN PARENTHESIS !

### UPPER FLR. RF. DIAP. / UPPER FLR. SW ; (SHT. A8)

PL = 10'



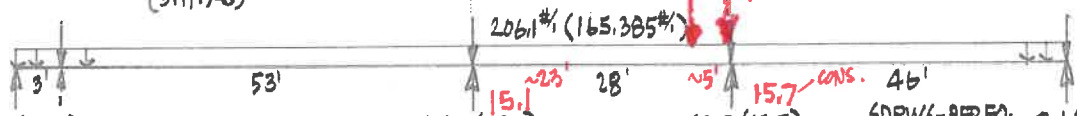

| | | | | |
|---|---|---|---|---|
| R (K) ; | 3.9 (5.4) ① | 5.94 (8.3) | 5.43 (7.5) | 3.37 (4.7) ② |
| ℓ (FT) ; | ✓ 9+3 = 12 | ✓ 8+9+21 = 38 | 23.5+21 = 44.5 | ✓ 3.5+4.5 = 8 |
| V (PLF) ; | 325 (450) | 156 (218) | 122 (171) | ✓ 421 (588) |
| SW ; | SW3-2 | ✓ ~~SW6~~ SW4 | ~~SW6~~ SW4 | SW3-2 |
| OT (K) ; | ✓ 3.2 (4.5) | 1.5 (2.1) | 1.2 (1.7) | 4.2 (5.8) |
| HD ; | ✓ (3) CS16 OR MSTC66B3 | (2) CS16 | CS16 | ✓ (4) CS16 HDU8 |
| H/L ; | (2×450)×2×3/10 = 540#/' — OK! | N/A | N/A | ✓ (2×450) 2×3.5/10 = 630#/' OK! |

### UPPER FLR. DIAP. / MAIN FLR. SW (SHT. A6)

PL = 12' UNO

STAIR LAT. IMPOSED LOAD

$F_{Z_{N435}} = 0.6^K$ $F_{Z_{N436}} = 1.40^K$




| | | | | | |
|---|---|---|---|---|---|
| R ; | 10 (10.3) | 14.30 (~~15.0~~ 15.1) ~23' | 13.0 (~~13.7~~ 15.7) CONS. | SDPWS-PERFO. SW-TAB.4.3.3.5 | 8.1 (8.5) ③ |
| ℓ ; ✓ | 5+10.5+6 = 21.5 | 13+16 = 29 | 13.5+24 = 37.5 | | C6 (3.5+5)+8 = 16.5 1.0 |
| V ; ✓ | 465 (479) | 493 (~~517~~ 521) | 347 (~~365~~ 419) | | 490+515 |
| SW ; ✓ | SW2 | SW2 ✓ OK! | ~~SW3~~ SW2 ✓ OK! | | SW2 |
| OT ; ✓ | 5.5 (5.6) — UNSTACK | 5.9 (~~6.2~~ 6.25) | 4.1 (~~4.3~~ 5.8) — UNSTACK<br>5.3 (~~6.0~~ 6.8) — STACK | | 5.8 (6.1) |
| HD ; ✓ | HDU5 | HDU8 ✓ OK! | HDU8 — OK! | | HDU8 |
| H/L ; ✓ | 600×2×5/12 = 500#/' — OK! | N/A | N/A | | N/A |

## ⊛ — REDUNDANCY FACTOR, ρ CHECK ;

① ~ WORST CASE ;

$$\frac{5.4 \times 1/2}{(5.4+8.3)} \times 100 = 20\% << 33\% \quad \text{— PER C12.3.4.2}$$

② $$\frac{4.7 \times 1/2}{(7.6+4.7)} \times 100 = 18\% << 33\%$$

∴ ρ = 1.0 ALL CASES !

③ — BY INSPN. — ρ = 1.0

REVD: 5/29/24
REVD: 7/1/22
REVD: 4/27/22

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PROJECT: KONERU RES. — STAIR REVISION

DATE: 10/29/21

PROJECT NO: 0426-2021-03

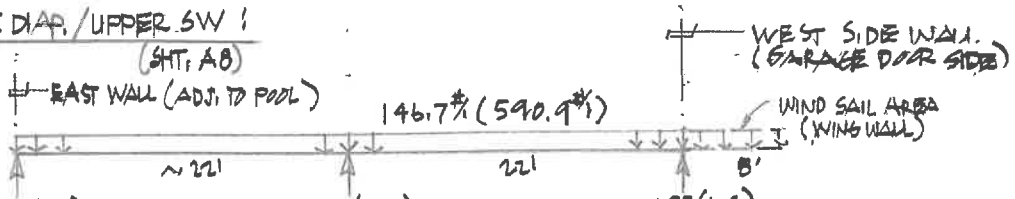
DESIGN: JCM

SHEET: L-2

## II LATERAL DESIGN ; NORTH-SOUTH EXPO. ;

### UPPER FLR. RF. DIAP. / UPPER SW ;

PL = 10' (SHT. A8)

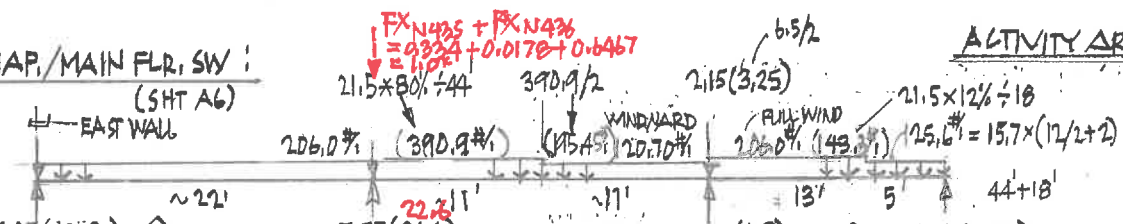



| | | | |
|---|---|---|---|
| R ; | 1.6(6.5) | 3.23(13.0) | 2.77(6.5) |
| X ; | ✓ 9+6 = 15.0' | ✓ 13+8.5+12.8+7.5+12.5=54.3 | ✓ 23+6+11.4 = 40.4 |
| V ; | ✓ 107(433) | ✓ 59(239) | ✓ 69(161) |
| SW ; | ✓ ~~SW3~~ SW2 | ✓ SW4 | SW6 |
| OT ; | ✓ 1.05(4.30) | ✓ N/C (2.3) | ✓ N/C (1.6) |
| HD ; | ✓ (3) CS16 OR HDU4 | (2) CS16 | CS16 |
| H/L ; | N/A | N/A | N/A |

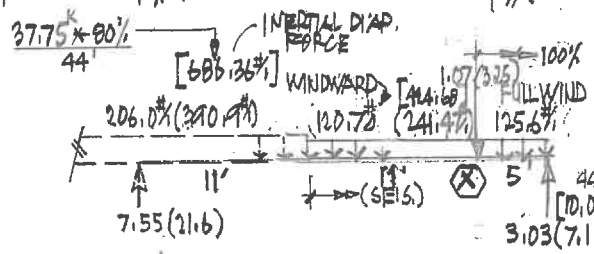
### UPPER FLR. DIAP. / MAIN FLR. SW ;

PL = 12' (SHT A6)

ACTIVITY AREA




| | | | | |
|---|---|---|---|---|
| R ; | 3.87(10.8) ④ | 7.55(~~21.6~~ 22.6) | ✓ 5.45(6.7) ⑤ | 1.45(1.30) |
| X ; | 4.5+9*2+5.3=27.8 | 14.5+10+22.5+21 = 68 | ✓ 10 | 33 |
| V ; | 139(388) | 111(~~318~~ 332) | ✓ 545(670) | 44(40) |
| SW ; | SW2 | SW4 — OK! | ✓ SW2-2 | SW6 |
| OT ; | 1.6(4.6) UNSTACK ; 2.6(8.6) STACK | 1.3(~~3.8~~ 4.0) — UNSTACK | STACK — 7.2(9.6) | N/CRIT |
| HD ; | HDU5 HDU11 | HDU5 — OK! | HDU8 + HDU5 ON 6X | – |
| H/L ; | 600*2×4.5/12 = 450#/1 | N/A | N/A | – |




| | |
|---|---|
| R ; | 3.03(7.1) |
| X ; | ✓ 9.5+6.5=16 |
| V ; | ✓ 190(444) |
| SW ; | ✓ ~~SW3~~ SW2 |
| OT ; | ✓ 2.2(5.3) |
| HD ; | ✓ HDU5 |
| H/L ; | N/A |

### GARAGE + MECH. + SERV. AREA

SEIS. ; $V_s = \left[\frac{390.9\#/1}{2} \times 11' + 21.5^k \times 8\%\right] \div 16$

$= (241.87\#/1)$ — E.L.F.

$= \left[\frac{686.36}{2} \times 11' + 37.75 \times 8\%\right] \div 16$

$= [424.68\#/1]$ — INERTIAL DIAP. FORCE

REVD: 5/29/24
REVD: 6/20/23
REVD: 3/6/23

KONERU RES. — STAIR REVIS.

PROJECT

11/2/21
DATE

0426-2021-03
PROJECT NO

JCM
DESIGN

L-3
SHEET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## ☑ CHKG BRIDGE CONNECTION DUE TO STAIR LATERAL LOAD IMPOSED:

IMPOSED LOAD from STAIR IN N/S DIREC.:

$FX_{TOT.} \simeq 1000^{\#}$

EA. BRIDGE BEAM LOAD $= 1000^{\#}/2$
$= 500^{\#}$

BLOCKED DIAP. REQ'D LENGTH $= 500^{\#}/360^{\#}/'$
$= 1.4'$
BUT CONS. TO BLOCK
(3) JOIST BAYS' – 4' IN LENGTH

DTT2Z CAP. $= 2.145^{K}$ – OK!

## ☑ RECHK BRIDGE BEAM W/ IMPOSED STEELSTAIR LOAD:

PER SHT. L-1-B:

○ WORST CASE LOAD COMB.; FY:

AT NODE N435: (D+L+E+X) ↓(−), ↑(+)

$FY_{TOT.} = (-)1.2904 + (-)0.966 + \cancel{0.7396} \sim 0$

$= 2.25^{K}$ ↓(−)

AT NODE N436: (D+L+E+X) ↑(+); ↓(−)

$= (-)0.2135 + (-)0.3496 + (-)0.864$

$= 1.43^{K}$ ↓(−)

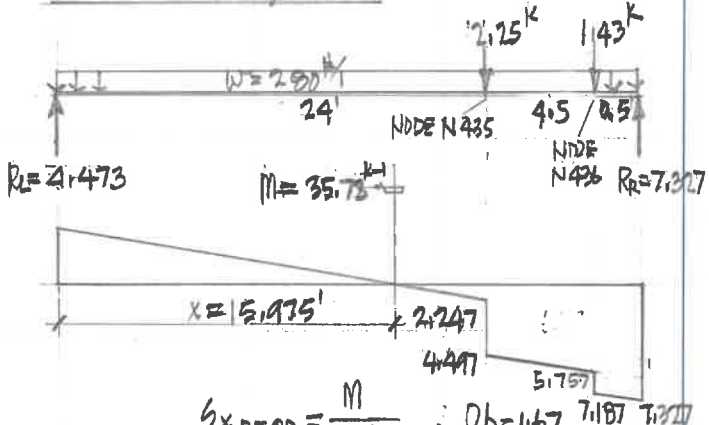
○ UNIFORM LOAD ON BRIDGE BEAM:

DL (FRMG): HSS 6×3×1/4 — $13.88^{\#}/' \times 5' \times 7 = 485$ lbs
HSS 12×4×3/8 — $37.61^{\#}/' \times 29 \times 2 = 2190$ lbs
3/8" PL × 16.5" — $15.3^{\#}/ft^2 \times \frac{16.5}{12} \times 29' \times 2 = 1220$ lbs
$\Sigma WT = 3900/5 \times 29 = 26.9$ PSF

DL (FLR) +
HARDWOOD O/ 1/4" GYPCRETE = 18 PSF
1 1/8" FLR. SHTG. = 3.6 PSF
T & G 2X = 5.0 PSF
$\Sigma = 26.6$ PSF

$\therefore W_{TL} = (\overset{LL}{40} + \overset{DL\ FRMG}{26.9} + \overset{DL\ FLR}{26.6})\,5/2 + \overset{RAILING}{15 \times 3}$
$= 278.75^{\#}/' \simeq 280^{\#}/'$

BRIDGE BEAM; (C-4):




$S_{x\,REQ'D} = \frac{M}{F_y/\Omega_b}$ ; $\Omega_b = 1.67$, $F_y = 50$

$S_{x\,REQ'D} = 14.3\ IN^3$ — NOT CRIT!

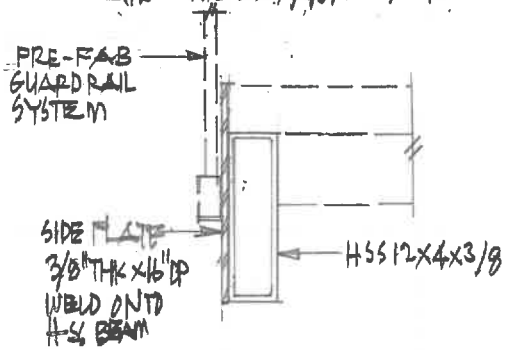
HSS 12×4×3/8:

$I_x = 168\ in^4$ ; $S_x = 28\ IN^3$

SIDE PLATE 3/8" THK — CONSIDERING ONLY 12" DEPTH:

$I_x \simeq 54\ in^4$ ; $S_x \simeq 9\ in^3$

$\Delta_{TL} = 0.8'' \sim \lambda/407 > \lambda/240$ — OK!




BRIDGE BEAM SEC.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PROJECT: KONERU RES. – STAIR REVIS.
BRIDGE BEAM RECHK.

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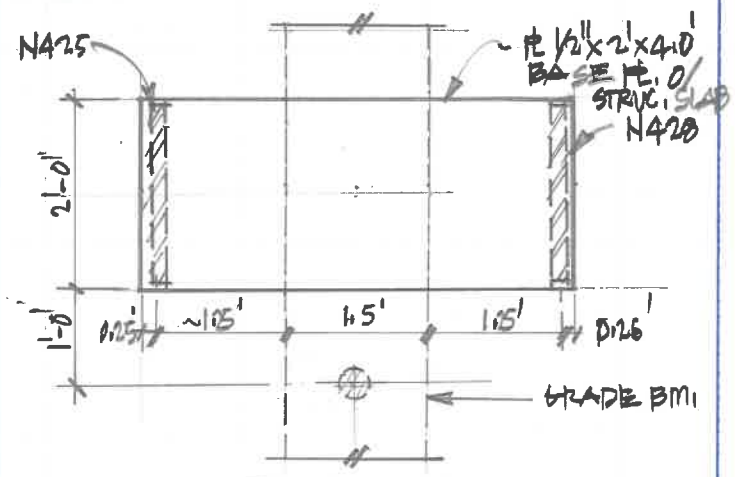
DESIGN: JCM

SHEET: BRIDGE-V-1

## ☒ STAIR STRINGER BASE LOAD CHK.:

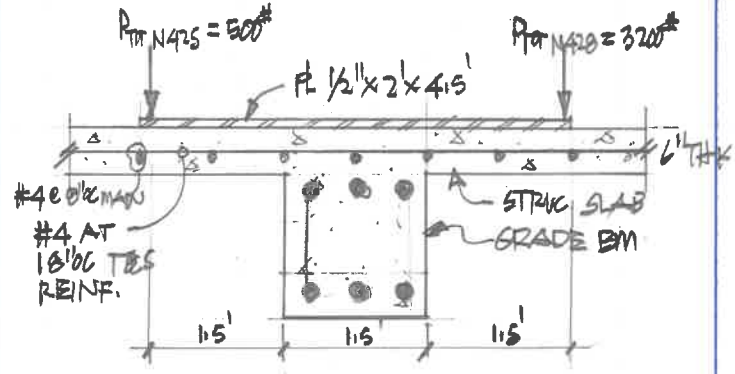



PLAN VIEW-KEY

↓(-) ; ↑(+) ; D+L+ $E_{XORZ}$

ALLOW. $P_{TOT\,N425} = FY = (-)\,0.1584 + (-)\,0.183 + (-)\,0.1618 = 0.50^{k}$ ↓(-)

ALLOW. $P_{TOT\,N428} = FY = (-)\,1.6159 + (-)\,1.3484 + (-)\,0.2608 = 3.20^{k}$ ↓(-)




SECTION VIEW

CONSIDERING COMBINED CAP. OF STEEL PL AND STRUCT. SLAB USING #4 AT 18"OC TBCS FOR BENDING BARS;

$M_{NET\ AT\ GR.\ BEAM} = 3200^{\#} \times 1.5' - 500 \times 1.5' = 4050^{\#-'}$

## UTILIZING BENDING CAP. OF STL. PL:

$b = 24''$ ; $d = 0.5''$ ; USE STL. PL 36 KSI

$I_x = 0.25\ IN^4$ ; $\Omega_b = 1.67$

$S_x = 1.0\ in^3$

$f_b = \frac{M}{S_x}$ ; $f_b = \frac{f_b}{\Omega_b} = 21.6\ KSI$

$M_{CAP} = 21.6\ KSI * 1.0\ in^3 = 21.6\ K\text{-}IN / 12'' = 1.80^{K-'} = 1800^{\#-'}$

CHK CAP. OF 6" STRUCT. SLAB W/ RESIDUAL LOAD NET $= 4.05 - 1.8 = 2.25^{K-'}$

WHERE: $f_y = 60\ KSI$ ; $f'_c = 2500\ PSI$

$\phi = 0.90$ ; $d = 3.25''$ ; $b = 2'$

$$14.12\rho^2 - \rho + \frac{M}{\phi f_y b d^2} = 0$$

$U_{FACTOR} \simeq (1.2+1.6)/2$

$$14.12\rho^2 - \rho + \frac{1.4 * 2250^{\#-'}}{0.9(60000)(2)(3.25)^2} = 0$$

0.0028

BY Q.F.: $\rho = 0.0029$

$A_{S\ REQD} = \rho b d = 0.22\square'' < 0.2 * 24/18 < \simeq 0.267\square''$

OK!

$V_{u\ CAP.} = 0.75 * 2 * \sqrt{2500}\,(24)(3.25) = 5850^{\#} >> 3150^{\#-'}/1.5' = 2{,}100^{\#}$.

OK!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PROJECT: KONERU RES. – STAIR REVIS.

STAIR STRINGER BASE SUPPORT

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