FMA and WRG Permit Application for

A Seasonal Boat Dock and Access Ramp

18418 Old River Landing, West Linn, OR

Project Description:

This project proposes the construction of a seasonal dock that will be held in place by an upstream ramp and a downstream arm and cables. Both the ramp and arm will be secured to the shoreline by concrete footings. From the Ordinary Low Water Mark the combined length of the ramp and dock would extend approximately 50 feet into the river. No vertical pilings are proposed. As a seasonal dock, both the dock and ramp will be towed away for storage off-site, typically between the months of October and May. A similar dock and anchoring configuration exists at the adjacent, downstream property located at 18414 Old River Landing.

Approval of the proposed seasonal dock requires City of West Linn Flood Management Area (FMA) and Willamette River Greenway (WRG) permits.

27.020 APPLICABILITY

A flood management area permit is required for all development in the Flood Management Area Overlay Zone. The standards that apply to flood management areas apply in addition to State or federal restrictions governing floodplains or flood hazard areas.

Comment: The proposed dock and access ramp are located within the Flood Management Area Overlay Zone so the standards of this chapter apply.

27.070 CONSTRUCTION MATERIALS AND METHODS

A. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage using methods and practices that minimize flood damage.

Comment: The dock materials are metal and floats that are designed for water-related use. These materials are resistant to flood damage. The dock is seasonal and it and the access ramp will be removed during winter months when flooding is most likely to occur.

B. Electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities shall be designed and/or otherwise elevated or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

Comment: No electrical, heating, ventilation, plumbing or air conditioning equipment are proposed for the dock or access ramp.

C. New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.

Comment: No water service is proposed for the dock or access ramp. No change to the existing home's water service is proposed.

D. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharge from the systems into flood waters.

Comment: No sewer service is proposed for the dock or access ramp. No change to the existing home's sewer service is proposed.

E. On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

Comment: No on-site waste disposal system is proposed.

F. All new construction and substantial improvements shall be anchored to prevent flotation, collapse, or lateral movement of the structure.

Comment: The dock and the access ramp will be secured to concrete pads placed on the shore line, as shown on the plans submitted with this application.

27.090 NON-RESIDENTIAL CONSTRUCTION

New construction and substantial improvement of any commercial, industrial, or other non-residential structure shall either have the lowest floor, including basement, elevated to at least one foot above the level of the base flood elevation; or, together with attendant utility and sanitary facilities, shall:

A. Be flood-proofed so that below the base flood level the structure is watertight with walls impermeable to the passage of water;

Comment: The dock is floating and will ride with the water level. There is no fixed structure that would have a lowest floor or basement.

B. Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy;

Comment: As noted elsewhere in this narrative, it is the intent of this dock that it will be seasonal in nature and will be removed from the property's river frontage prior to the wet season. However, as the City must be certain that the dock will meet the requirements of this section should the dock not be removed for some reason, or if an unusual set of conditions resulted in flood levels during the

summer season, the applicant has hired an engineer to address this section. The dock and ramp, because of the nature of the river bottom which precludes driving deep piling, are not themselves designed to resist the forces of the flood. However, a cable system will be employed to tether the dock and ramp to an anchor point on the shoreline so that they cannot break free and cause damage to downstream properties. Please refer to the attached engineer's report.

C. Be certified by a professional civil engineer licensed to practice in the State of Oregon that the design and methods of construction shall prevent seepage, collapse or cracking of basement walls, prevent buckling of basement floors, prevent backup of water from sewer lines, and have all openings located one foot above the base flood elevation. In addition, all protective features must operate automatically without human intervention;

Comment: Not applicable. The dock does not include walls, basement floors, water or sewer lines.

D. Non-residential construction that is elevated, but not flood-proofed (i.e., the foundation is not at least one foot above the 100-year flood elevation) shall also comply with the standards set forth in CDC 27.080. (Ord. 1522, 2005)

Comment: Not applicable. There is no foundation or fixed floor level. The dock and ramp will float and will rise with the water level. The tethering system will ensure that they cannot break free and damage downstream property.

28.030 APPLICABILITY

A. The Willamette and Tualatin River Protection Area is an overlay zone. The zone boundaries are identified on the City's zoning map, and include:

1. All land within the City of West Linn's Willamette River Greenway Area.

2. All land within 200 feet of the ordinary low water mark of the Tualatin River, and all land within the 100-year floodplain of the Tualatin River.

3. In addition to the Willamette Greenway and Tualatin River Protection Area boundaries, this chapter also relies on the HCA Map to delineate where development should or should not occur. Specifically, the intent is to keep out of, or minimize disturbance of, the habitat conservation areas (HCAs). Therefore, if all, or any part, of a lot or parcel is in the Willamette Greenway and Tualatin River Protection Area boundaries, and there are HCAs on the lot or parcel, a Willamette and Tualatin River Protection Area permit shall be required unless the development proposal is exempt per CDC 28.040.

B. At the confluence of a stream or creek with either the Tualatin or Willamette River, the standards of this chapter shall apply only to those portions of the lot or parcel fronting the river. Meanwhile, development in those portions of the property facing or adjacent to the stream or creek shall meet the transition, setbacks and other provisions of Chapter 32 CDC, Water Resource Area Protection.

C. All uses permitted under the provisions of the underlying base zone and within the Willamette and Tualatin River Protection Area zone are allowed in the manner prescribed by the base zone subject to applying for and obtaining a permit issued under the provisions of this chapter unless specifically exempted per CDC 28.040.

D. The construction of a structure in the HCA or the expansion of a structure into the HCA when the new intrusion is closer to the protected water feature than the pre-existing structure. (Ord. 1576, 2008; Ord. 1604 § 21, 2011; Ord. 1636 § 26, 2014)

Comment: The subject property is within the 100 year flood plain of the Willamette River and, therefore, is subject to the provisions of this chapter.

28.050 PROHIBITED USES

Comment: The proposed dock is not a prohibited use.

28.090 SUBMITTAL REQUIREMENTS: APPLICATION

A. An application for a protection area permit shall be initiated by the property owner or the owner's authorized agent. Evidence shall be provided to demonstrate that the applicant has the legal right to use the land above the OLW. The property owner's signature is required on the application form.

Comment: The applicant has filed for a Joint Permit with the US Army Corps of Engineers and Oregon Department of State Lands for the proposed dock. This application is pending review at this time.

B. A prerequisite to the filing of an application is a pre-application conference at which time the Planning Director shall explain the provisions of this chapter and provide appropriate forms as set forth in CDC 99.030(B).

Comment: A pre-application conference was held for the proposed use earlier this year (PA-18-11).

C. An application for a protection area permit shall include the completed application and:

1. *Narrative which addresses the approval criteria of CDC 28.110.*
2. *A site plan, with HCA boundaries shown and by low, moderate, high type shown (CDC 28.120).*
3. *A grading plan if applicable (CDC 28.130).*
4. *Architectural drawings if applicable (CDC 28.140).*
5. *A landscape plan if applicable (CDC 28.150).*
6. *A mitigation plan if applicable (CDC 28.160).*

Comment: This narrative addresses the criterial of CDC 28.110. A site plan is attached and shows HCA boundaries. No site grading is proposed. No architectural drawings or landscape plan are required.

D. The applicant shall pay the requisite fees.

Comment: The required fees have been paid.

E. The applicant shall be responsible for, and shall apply for, all applicable State and/or federal permits.

Comment: The DSL and Corps of Engineer permits have been filed and are in process of being reviewed.

F. The applicant shall include a map, approved or acknowledged by DSL, of the preference rights and authorized areas if a water surface structure is proposed. (Ord. 1576, 2008; Ord. 1622 § 11, 2014)

Comment: The applicant will provide a copy of the DSL approval once it is obtained.

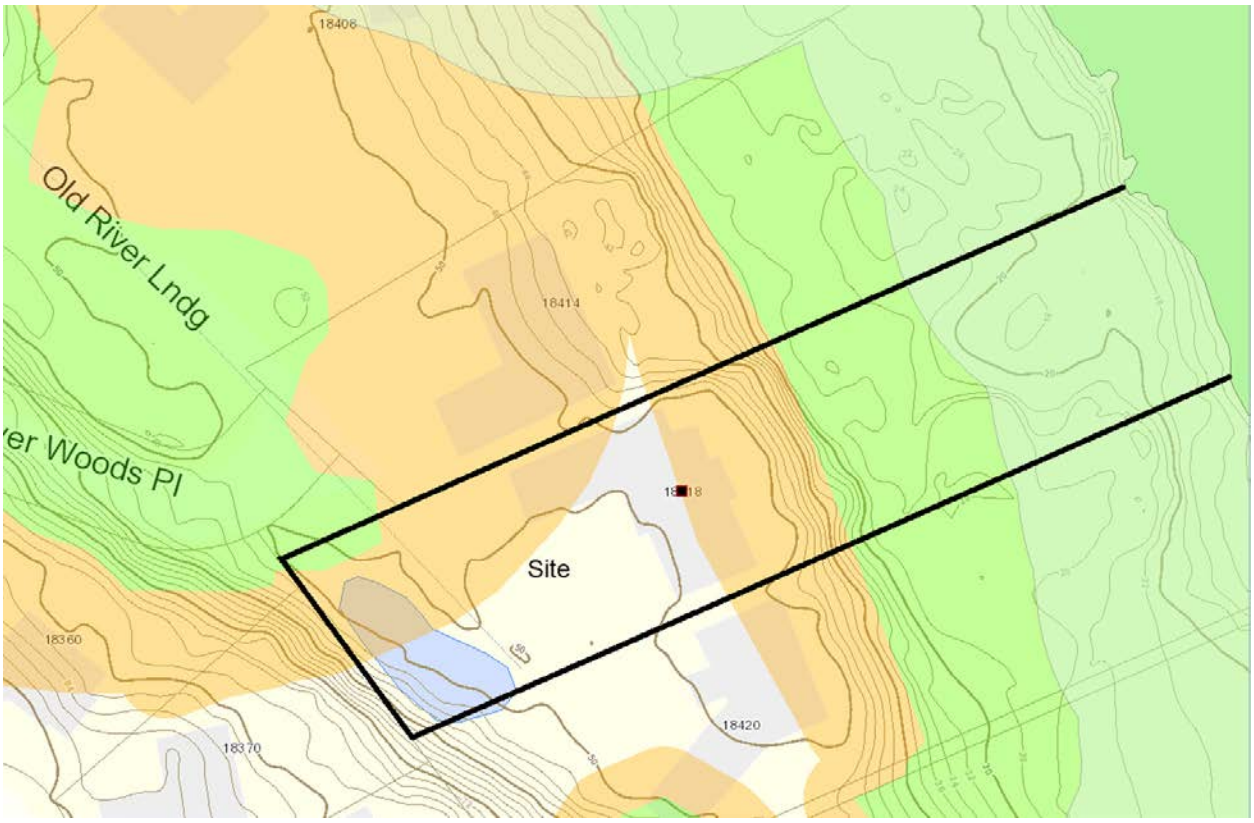
28.110 APPROVAL CRITERIA

No application for development on property within the protection area shall be approved unless the decision-making authority finds that the following standards have been met or can be met by conditions of approval. The development shall comply with the following criteria as applicable:

A. Development: All sites.

1. Sites shall first be reviewed using the HCA Map to determine if the site is buildable or what portion of the site is buildable. HCAs shall be verified by the Planning Director per CDC 28.070 and site visit. Also, "tree canopy only" HCAs shall not constitute a development limitation and may be exempted per CDC 28.070(A). The municipal code protection for trees and Chapters 55 and 85 CDC tree protection shall still apply.

Comment: The HCA is shaded in green on the map below. Only two small concrete pads will be permanently installed within the HCA. No structures are proposed within the HCA.



The aerial photograph of the site shown below demonstrates that the HCA is largely disturbed by landscaping and clearing associated with the home site on the property and provides little in the way of habitat resources.

2. HCAs shall be avoided to the greatest degree possible and development activity shall instead be directed to the areas designated "Habitat and Impact Areas Not Designated as HCAs," consistent with subsection (A)(3) of this section.

Comment: The disturbance of the HCA will be minimal, involving only the pouring of two small concrete pads on the shore. The dock and access ramp will be installed and removed seasonally from the river surface via barge and crane.

3. If the subject property contains no lands designated "Habitat and Impact Areas Not Designated as HCAs" and development within HCA land is the only option it shall be directed towards the low HCA areas first, then medium HCA areas and then to high HCA as the last choice. The goal is to, at best, avoid or, at least, minimize disturbance of the HCAs. (Water-dependent uses are exempt from this provision.)

Comment: The placement of the concrete anchor pads and the seasonal access ramp within the HCA is the only viable means of providing access to the proposed dock.

4. All development, including exempted activities of CDC 28.040, shall have approved erosion control measures per Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual, rev. 2008, in place prior to site disturbance and be subject to the requirements of CDC 32.070 and 32.080 as deemed applicable by the Planning Director.

Comment: Because of the means of placement of the access ramp and dock, there will be no disturbance of site vegetation that might otherwise require erosion control measures.

F. Access and property rights.

1. Private lands within the protection area shall be recognized and respected.

2. Where a legal public access to the river or elsewhere in the protection area exists, that legal public right shall be recognized and respected.

3. To construct a water-dependent structure such as a dock, ramp, or gangway shall require that all pre-existing legal public access or similar legal rights in the protection area be recognized and respected. Where pre-existing legal public access, such as below the OLW, is to be obstructed by, for example, a ramp, the applicant shall provide a reasonable alternate route around, over or under the obstruction. The alternate route shall be as direct as possible. The proposed route, to include appropriate height clearances under ramps/docks and specifications for safe passage over or around ramps and docks, shall be reviewed and approved by the Planning Director for adequacy.

4. Any public or private water-dependent use or facility shall be within established DSL-authorized areas.

5. Legal access to, and along, the riverfront in single-family residential zoned areas shall be encouraged and pursued especially when there are reasonable expectations that a continuous trail system can be facilitated. The City recognizes the potential need for compensation where nexus and proportionality tests are not met. Fee simple ownership by the City shall be preferred. The trail should be dimensioned and designed appropriate to the terrain it traverses and the user group(s) it can reasonably expect to attract. The City shall be responsible for signing the trail and delineating the boundary between private and public lands or access easements.

Comment: Access to the proposed dock will be from the access ramp placed on the subject property. No public access to the dock or access ramp is proposed.

I. Docks and other water-dependent structures.

1. Once the preference rights area is established by DSL, the property owner identifies where the water-dependent use will be located within the authorized portion of the preference rights area. The water-dependent use should be centered or in the middle of the preference rights/authorized area or meet the side yard setbacks of the underlying zone.

Private and public non-commercial docks are permitted where dredging is required so long as all applicable federal and State permits are obtained. Dredging is encouraged if deposits silt up under an existing dock. Dredging is seen as preferable to the construction of longer docks/ramps.

Comment: The proposed dock is centered in the area that has been requested for approval by DSL. Documentation of DSL approval will be provided to the City prior to placement of the dock.

2. Both joint and single use docks shall not extend into the water any further than necessary to provide four feet between the ship's keel or fixed propeller/rudder and the bottom of the water at any time during the water's lowest point.

Comment: The City has determined in file No. WRG-15-06/MIS-15-13 that Federal requirements to place docks in deeper water in order to protect fish habitat supersede this provision of the Community Development Code.

3. In no case except as provided in this section shall a private ramp and private dock extend more than 100 feet from OLW towards the center of the river or slough. In the case of L-shaped docks, the 100 feet shall be measured from the OLW to the furthest part of the private dock closest to the center of the river.

Comment: The proposed dock would extend only approximately 50 feet from OLW.

4. Docks on sloughs and similar channels shall not extend more than 30 percent of the distance between two land masses at OHW, such as between the mainland and an island or peninsula, measured in a lineal manner at right angle to the dominant shoreline. In no way shall a dock impede existing public usage or block navigation of a channel.

Comment: Not applicable. The site is not on a slough or similar channel.

5. Boat storage associated with a rail launch facility shall be located above the OHW, either vertically raised above the ordinary high water line or set back behind the OHW. Such boat storage structure will be natural wood colors or similar earth tones. Private railed launch facilities are permitted for individual boat owners. The onshore setback of the storage structure is equal distance on both sides as extended perpendicular to the thread of the stream, or seven and one-half feet, whichever is the greater setback.

Comment: Not applicable. No rail launch facility is proposed.

6. The width of each deck section shall be no more than 12 feet wide.

Comment: The proposed dock is composed of a 10' wide bow section and two 4' arms that provide for a boat slip. Since each section is less than 10' in width, the proposed dock complies with this requirement.

7. For only single-user and joint-user docks, pilings shall not exceed a maximum height of eight feet above the 100-year flood elevation.

Comment: No piling are proposed. This seasonal dock will be attached to concrete pads on the shoreline via the access ramp, a metal arm, and cross cables. The dock will be removed seasonally prior to high water events

8. A single user non-commercial dock shall not exceed 400 square feet in deck area. The boat slip is not included in the calculation of this square footage limitation.

Comment: The proposed dock is approximately 381 sq. ft. in deck area.

9. Private non-commercial boat houses are allowed but only if they are within 50 feet of OLW and/or in locations sufficiently screened from view so that they do not have a significant visual impact on views from adjacent and nearby homes. Building and roof colors shall be brown, gray, beige, natural or similar earth tones. Non-commercial boat houses shall not exceed 12 feet in height measured from the boat house deck level to the roof peak. The size of the boat house shall be sized to accommodate one boat only and shall not exceed a footprint greater than 500 square feet. Boatlifts are permitted within the boat house. The above provisions also apply to open-walled boat shelters with or without boatlifts.

Comment: Not applicable. No boat house is proposed in conjunction with the dock.

J. Joint docks.

Comment: Not applicable. No joint use of the dock is proposed.

K. Non-conforming docks and other water-related structures. Pre-existing non-conforming structures, including docks, ramps, boat houses, etc., as defined in this chapter may remain in place. Replacement in kind (e.g., replacement of decking and other materials) will be allowed provided the replacement meets the standards of this chapter. However, if any non-conforming structure that is damaged and destroyed or otherwise to be replaced to the extent that the rebuilding or replacing (including replacement in kind) would exceed 50 percent of the current replacement cost of the entire structure, the owner shall be required to meet all the standards of this chapter.

Comment: Not applicable. There are no non-conforming docks or other water-related structures on the property or the adjoining river area.

L. Roads, driveways, utilities, or passive use recreation facilities. Roads, driveways, utilities, public paths, or passive use recreation facilities may be built in those portions of HCAs that include wetlands, riparian areas, and water resource areas when no other practical alternative exists but shall use water-permeable materials unless City engineering standards do not allow that. Construction to the minimum dimensional standards for roads is required. Full mitigation and revegetation is required, with the applicant to submit a mitigation plan pursuant to CDC32.070 and a revegetation plan pursuant to CDC 32.080. The maximum disturbance width for utility corridors is as follows:

1. For utility facility connections to utility facilities, no greater than 10 feet wide.

2. For upgrade of existing utility facilities, no greater than 15 feet wide.

3. For new underground utility facilities, no greater than 25 feet wide, and disturbance of no more than 200 linear feet of water quality resource area, or 20 percent of the total linear feet of water quality resource area, whichever is greater.

Comment: Not applicable. No such facilities, roads, driveways, or utilities are proposed.

M. Structures. All buildings and structures in HCAs and riparian areas, including all exterior mechanical equipment, should be screened, colored, or surfaced so as to blend with the riparian environment. Surfaces shall be non-polished/reflective or at least expected to lose their luster within a year. In addition to the specific standards and criteria applicable to water-dependent uses (docks), all other provisions of this chapter shall apply to water dependent uses, and any structure shall be no larger than necessary to accommodate the use.

Comment: The ramp will be non-polished aluminum.

N. Water-permeable materials for hardscapes. The use of water-permeable materials for parking lots, driveways, patios, and paths as well as flow-through planters, box filters, bioswales and drought tolerant plants are strongly encouraged in all "a" and "b" land classifications and shall be required in all "c" and "d" land classifications. The only exception in the "c" and "d" classifications would be where it is demonstrated that water-permeable driveways/hardscapes could not structurally support the axle weight of vehicles or equipment/storage load using those areas. Flow through planters, box filters, bioswales, drought tolerant plants and other measures of treating and/or detaining runoff would still be required in these areas.

Comment: Not applicable. No parking lots, driveways, patios, and paths, etc. are proposed.

O. Signs and graphics. No sign or graphic display inconsistent with the purposes of the protection area shall have a display surface oriented toward or visible from the Willamette or Tualatin River. A limited number of signs may be allowed to direct public access along legal routes in the protection area.

Comment: Not applicable. No signs or graphics are proposed.

P. Lighting. Lighting shall not be focused or oriented onto the surface of the river except as required by the Coast Guard. Lighting elsewhere in the protection area shall be the minimum necessary and shall not create off-site glare or be omni-directional. Screens and covers will be required.

Comment: Not applicable. No lighting is proposed.

Q. Parking. Parking and unenclosed storage areas located within or adjacent to the protection area boundary shall be screened from the river in accordance with Chapter 46 CDC, Off-Street Parking, Loading and Reservoir Areas. The use of water-permeable material to construct the parking lot is either encouraged or required depending on HCA classification per CDC 28.110(N)(4).

Comment: Not applicable. No parking is proposed in conjunction with the dock.

R. Views. Significant views of the Willamette and Tualatin Rivers shall be protected as much as possible as seen from the following public viewpoints: Mary S. Young Park, Willamette Park, Cedar Oak Park, Burnside Park, Maddox Park, Cedar Island, the Oregon City Bridge, Willamette Park, and Fields Bridge Park.

Where options exist in the placement of ramps and docks, the applicant shall select the least visually intrusive location as seen from a public viewpoint. However, if no options exist, then the ramp, pilings and dock shall be allowed at the originally proposed location.

Comment: Not applicable. No significant view of the Willamette River would be impacted by the proposed dock and access ramp.

S. Aggregate deposits. Extraction of aggregate deposits or dredging shall be conducted in a manner designed to minimize adverse effects on water quality, fish and wildlife, vegetation, bank stabilization, stream flow, visual quality, noise and safety, and to promote necessary reclamation.

Comment: Not applicable. No extraction of aggregate or dredging is proposed.

T. Changing the landscape/grading.

Comment: No changing of the landscape or grading is proposed.

U. Protect riparian and adjacent vegetation. Vegetative ground cover and trees upon the site shall be preserved, conserved, and maintained according to the following provisions:

Comment: As discussed previously, the ramp and dock will be brought seasonally to the site via barge from the river. The access ramp will be placed from the river via crane. Using this method will minimize the disturbance of the riparian area to only the immediate site of the concrete pads and access ramp.

28.160 MITIGATION PLAN

If any HCA is permanently disturbed as a result of the proposed development of any uses or structures, the applicant shall prepare and implement a revegetation and mitigation plan pursuant to the provisions of CDC 32.070 and 32.080. (Ord. 1576, 2008)

Comment: Because the ramp and dock will be brought and placed via barge and crane from the river, there will be negligible impact to the HCA. As a result, no mitigation plan is required.

Munzing
structural engineering

May 28, 2019

Eric Dye
Ken's Floatation Services, Inc.

RE: Neubo Dock Epoxy anchors

Eric:

This letter is in response to your request for a safety cable anchor system used to connect the dock at the above referenced address to the existing bedrock in the event of a 100-year flood. The dock shall be connected by a stainless-steel cable and anchored to the existing bedrock using (4) ¾" diameter threaded rods, embedded 15" minimum with Simpson SET-XP epoxy. We have evaluated the connection based on the hydrodynamic load resulting in a 44' rise in water height, representing a 100-year flood based on FEMA flood insurance data, with a 2' draft, and have determined a maximum tensile load capacity of the connection to be 4.4 kips.

The contractor shall perform an in-field pull test/special inspection on the anchor assembly to verify safe working capacity. Pull test requirements are as follows:

- Pull test shall be performed by a certified special inspection agency.
- Anchor assemblies shall be loaded in tension to 200% of the tension load noted above.
- The load shall be held for 10 minutes. (4.4 x 2 = 8.8 kips test load)
- If no movement of the anchor occurs, then the test is to be considered acceptable.
- If any movement of the anchor shall occur, the pull test shall be considered invalid and the engineer of record shall be contacted for further instruction.

If you have any questions, please do not hesitate to call.

Sincerely,

Munzing Structural Engineering

Jeremy Gavelin

Attachments:
Structural calculations
Structural details

Munzing
structural engineering

STRUCTURAL CALCULATIONS

The Neubo Dock
18418 Old River Landing, West Linn, Oregon

Ken's Floation

LIMITATIONS

Engineer was retained in a limited capacity for this project. Design is based upon information provided by the client who is solely responsible for accuracy of same. No responsibility and/or liability is assumed by or is to be assigned to engineer for items beyond that shown on these sheets.

Project No. 19-197
May 28th, 2019

ELEVATION (FEET NAVD 88)

-120 -100 -80 -60 -40 -20 20 40 60

110,000 114,000 118,000 122,000 126,000 130,000 134,000

I J K L M N O P Q R

CLACKAMAS COUNTY
CITY OF WEST LINN

CITY OF WEST LINN
CITY OF GLADSTONE

CLACKAMAS RIVER

CITY OF GLADSTONE
CITY OF OREGON CITY

LEGEND

0.2% ANNUAL CHANCE FLOOD

1% ANNUAL CHANCE FLOOD

2% ANNUAL CHANCE FLOOD

10% ANNUAL CHANCE FLOOD

STREAM BED

CROSS SECTION LOCATION

STREAM DISTANCE IN FEET ABOVE MOUTH

150P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLACKAMAS COUNTY, OR

AND INCORPORATED AREAS

FLOOD PROFILES

WILLAMETTE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NAVD)		
WILLAMETTE RIVER								
A	91,661	964/460[2]	58,628	6.4	34.7	34.7	35.4	0.7
B	94,161	985/390[2]	63,554	5.9	35.3	35.3	36.0	0.7
C	96,691	815/220[2]	51,043	7.3	35.6	35.6	36.3	0.7
D	98,381	1,325/500[2]	85,767	4.4	36.3	36.3	37.0	0.7
E	100,861	1,519/1,020[2&3]	63,590	5.9	36.4	36.4	37.0	0.6
F	104,979	955	52,697	7.1	36.7	36.7	37.4	0.7
G	105,719	778	47,756	7.9	36.7	36.7	37.4	0.7
H	106,469	1,005	62,300	6.0	37.4	37.4	38.1	0.7
I	110,312	895	43,115	8.7	37.6	37.6	38.1	0.5
J	111,912	550	44,879	8.4	38.1	38.1	38.9	0.8
K	113,540	520	31,029	12.1	39.3	39.3	40.0	0.7
L	115,130	820	54,496	6.9	42.7	42.7	43.4	0.7
M	118,034	578	37,630	10.0	44.0	44.0	44.7	0.7
N	122,034	1,440	64,809	5.8	46.1	46.1	46.8	0.7
O	125,434	800	46,296	8.1	46.2	46.2	46.9	0.7
P	126,834	1,370	55,501	6.8	46.8	46.8	47.5	0.7
Q	129,034	1,230	52,785	7.1	47.2	47.2	47.9	0.7
R	131,034	1,335	48,241	7.8	47.7	47.7	48.4	0.7
S	143,020	888	42,725	8.0	74.5	74.5	74.7	0.2
T	145,970	1,040	47,541	7.2	74.9	74.9	75.1	0.2
U	149,170	1,050	51,473	6.6	75.2	75.2	75.3	0.1
V	165,070	665	31,973	10.3	84.3	84.3	85.3	1.0
W	168,300	1,450	66,319	4.9	86.4	86.4	87.3	0.9
X	170,950	1,057	47,397	6.9	86.6	86.6	87.5	0.9
Y	174,825	1,100	52,109	6.3	87.5	87.5	88.4	0.9
Z	176,685	705	37,988	8.6	87.5	87.5	88.4	0.9

[1] Stream distance in feet above mouth

[2] Width/width within study area

[3] Values calculated from original model prior redelineation

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLACKAMAS COUNTY, OR

AND INCORPORATED AREAS

FLOODWAY DATA

WILLAMETTE RIVER

Floodway Loading

Design per 2012 International Building Code as modified by the State of Oregon

Neubo Dock

FEMA CCM Equation 8.8 - Hydrodynamic Load (for All Flow Velocities)

$$F_{dyn} = (1/2)\, C_d \rho V^2 A \qquad \text{Eq. 8.8}$$

where:

F_{dyn}	=	horizontal drag force (lb) acting on the stillwater mid-depth (half way between the stillwater level and the eroded ground surface)
C_d	=	drag coefficient (recommended coefficient are 2.0 for square or rectangular piles and 1.2 for round piles; for other obstructions, see Table 8-2)
ρ	=	mass density of fluid (1.94 slugs/ft^2 for fresh water and 1.99 slugs/ft^2 for saltwater)
V	=	Velocity of water (ft/sec); see Equation 8.2
A	=	surface area of obstruction normal to flow (ft^2) = (w)(d_s) if object is not fully immersed, see figure 8-13 or (w)(h) if the object is completely immersed
h	=	the height of the object (ft) if the object is completely immersed in water
d_s	=	stillwater flood depth of the water (ft) if the object is not fully immersed

Calculation

Input:

C_d	=	1.25		
ρ	=	1.94	slugs/ft^2	
V	=	10.00	ft/sec	from Eq. 8.2
w	=	18.00	ft	
h	=		ft	Leave blank if object is not completely immersed.
d_s	=	2.00	ft	

Output:

A	=	36	ft^2	(A = d_s*w or h*w)
$\boldsymbol{F_{dyn}}$	=	**4365.00**	lb	Eq. 8.8

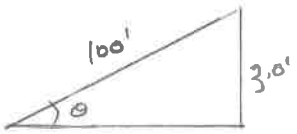
Munzing
structural engineering

Project No.	Sheet No.
19-179	

Project	Date
NEUBO Dock	5/28/2019
Subject	**By**
Dock Anchorage	JG

LOAD = 4.365 KIPS

FLOOD ELEVATION = 44 FEET
ANCHOR ELEVATION = 14 FEET



RISE = 30 ft
CABLE LENGTH = 100 ft

$\theta = \sin^{-1}(30/100) = 17.46°$

HORIZONTAL FORCE = $4.365 \cos(17.46°) = 4.163$ KIPS
VERTICAL FORCE = $4.365 \sin(17.46°) = 1.31$ KIPS

ALSO CHECK. LOAD AT 45°

HORIZONTAL FORCE = $7.517 \cos(45°) = 3.09$ KIPS
VERTICAL FORCE = $7.517 \sin(45°) = 3.09$ KIPS

PROVIDE CABLE & EYE NUT W/ WORKING LOAD = 10,000 lbs MIN

SEE FOLLOWING CALCULATIONS FOR ANCHORAGE REQUIREMENTS

Company:	Munzing Structural Engineeri	Date:	5/28/2019
Engineer:	JG	Page:	1/6
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-11
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 15.000
Code report: ICC-ES ESR-2508
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 18.75
c_{ac} (inch): 27.65
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 24.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: Yes

Base Plate
Length x Width x Thickness (inch): 12.00 x 12.00 x 0.75
Yield stress: 36000 psi

Profile type/size: Pipe1/2STD

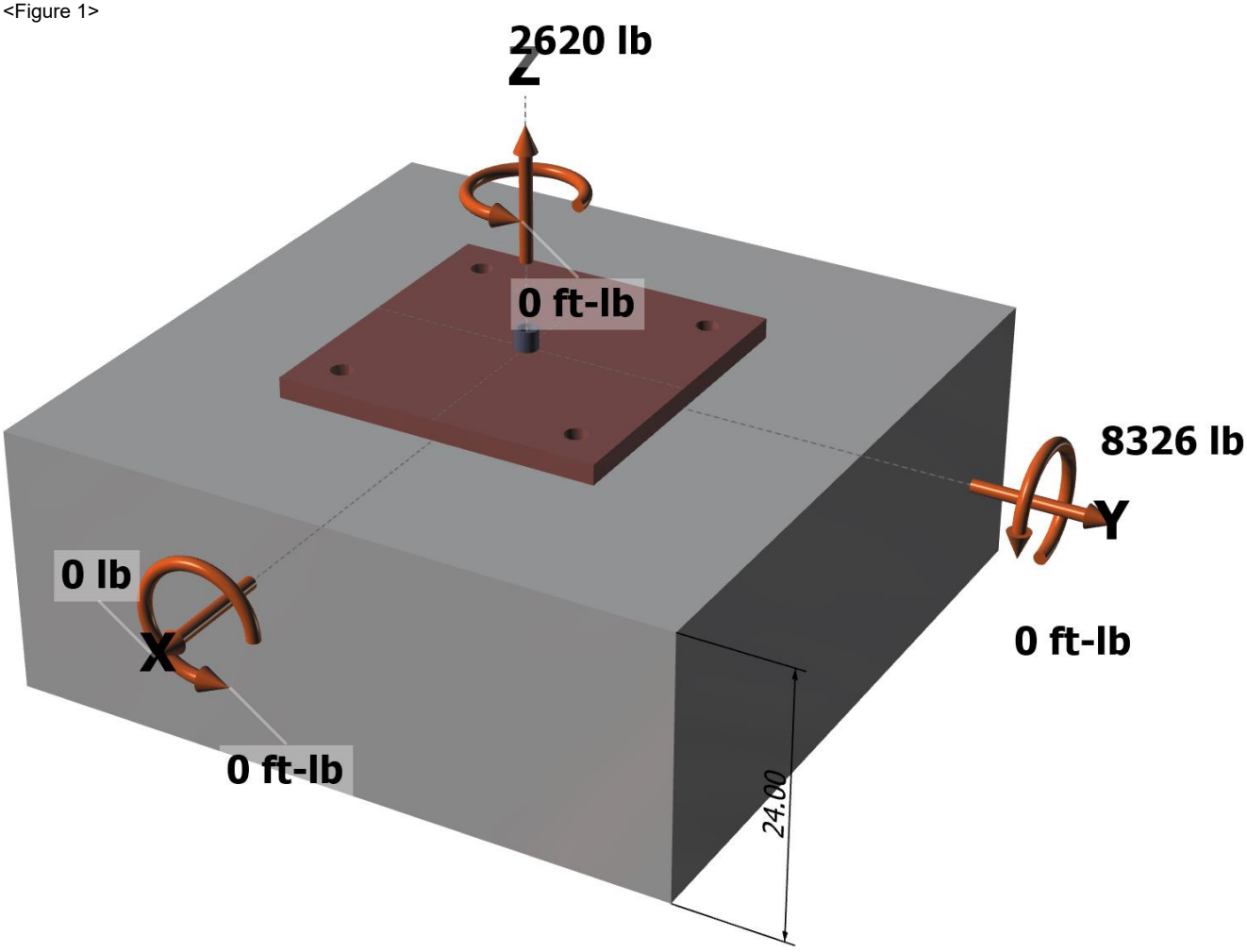
Recommended Anchor
Anchor Name: SET-XP® - SET-XP w/ 3/4"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-2508

Load and Geometry
Load factor source: ACI 318 Section 9.2
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: No
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

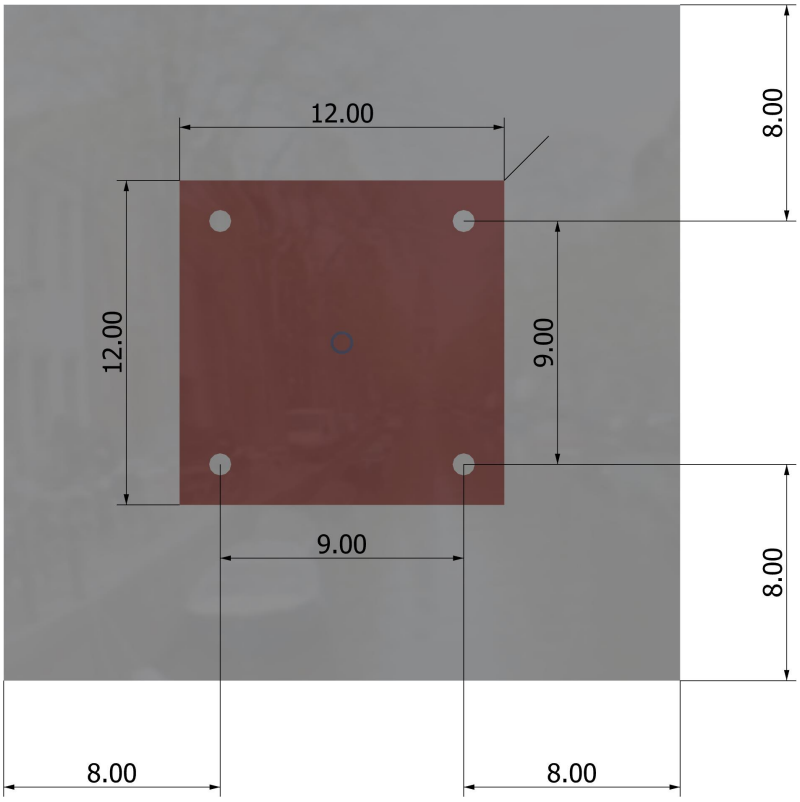
Strength level loads:

N_{ua} [lb]: 2620
V_{uax} [lb]: 0
V_{uay} [lb]: 8326
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

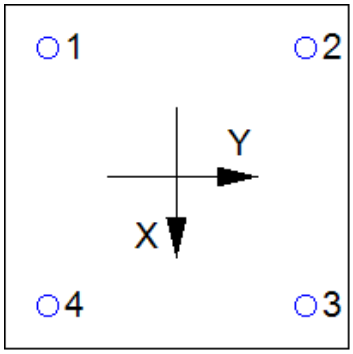


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	655.0	0.0	2081.5	2081.5
2	655.0	0.0	2081.5	2081.5
3	655.0	0.0	2081.5	2081.5
4	655.0	0.0	2081.5	2081.5
Sum	2620.0	0.0	8326.0	8326.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 2620
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. D.5.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
19370	0.75	14528

5. Concrete Breakout Strength of Anchor in Tension (Sec. D.5.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. D-6)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	5.333	10469

$\phi N_{cbg} = \phi \, (A_{Nc} / A_{Nco}) \, \Psi_{ec,N} \, \Psi_{ed,N} \, \Psi_{c,N} \, \Psi_{cp,N} N_b$ (Sec. D.4.1 & Eq. D-4)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
625.00	256.00	8.00	1.000	1.000	1.00	1.000	10469	0.65	16614

6. Adhesive Strength of Anchor in Tension (Sec. D.5.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\tau_{k,cr}$ (psi)
385	1.00	1.00	385

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. D-22)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	385	0.75	15.000	13607

$\phi N_{ag} = \phi \, (A_{Na} / A_{Na0}) \, \Psi_{ec,Na} \, \Psi_{ed,Na} \, \Psi_{cp,Na} N_{ba}$ (Sec. D.4.1 & Eq. D-19)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba}(lb)	ϕ	ϕN_{ag} (lb)
532.95	198.41	7.04	8.00	1.000	1.000	1.000	13607	0.65	23758

8. Steel Strength of Anchor in Shear (Sec. D.6.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
11625	0.8	0.65	6045

9. Concrete Breakout Strength of Anchor in Shear (Sec. D.6.2)

Shear perpendicular to edge in y-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. D-33 & Eq. D-34)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
6.00	0.750	1.00	2500	16.00	28800

$\phi V_{cbgy} = \phi\,(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. D.4.1 & Eq. D-31)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
600.00	1152.00	1.000	0.800	1.000	1.000	28800	0.70	8400

Shear parallel to edge in y-direction:

$V_{bx} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. D-33 & Eq. D-34)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
6.00	0.750	1.00	2500	8.00	10182

$\phi V_{cbgy} = \phi\,(2)(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. D.4.1 & Eq. D-31)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgy} (lb)
300.00	288.00	1.000	1.000	1.000	1.000	10182	0.70	14849

10. Concrete Pryout Strength of Anchor in Shear (Sec. D.6.3)

$\phi V_{cpg} = \phi \min|k_{cp}N_{ag};\ k_{cp}N_{cbg}| = \phi \min|k_{cp}(A_{Na} / A_{Na0})\,\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba};\ k_{cp}(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (Sec. D.4.1 & Eq. D-41)

k_{cp}	A_{Na} (in^2)	A_{Na0} (in^2)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	532.95	198.41	1.000	1.000	1.000	13607	36550

A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
625.00	256.00	1.000	1.000	1.000	1.000	10469	25560	0.70

ϕV_{cpg} (lb)
35784

11. Results

Interaction of Tensile and Shear Forces (Sec. D.7.)

Tension	Factored Load, N_{ua} (lb)	Design Strength, øN_n (lb)	Ratio	Status
Steel	655	14528	0.05	Pass
Concrete breakout	**2620**	**16614**	**0.16**	**Pass (Governs)**
Adhesive	2620	23758	0.11	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	2082	6045	0.34	Pass
T Concrete breakout y+	**8326**	**8400**	**0.99**	**Pass (Governs)**

|| Concrete breakout x-	**4163**	**14849**	**0.28**	**Pass (Governs)**
Pryout	8326	35784	0.23	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. D.7..2	0.00	0.99	99.1%	1.0	Pass

SET-XP w/ 3/4"Ø F1554 Gr. 36 with hef = 15.000 inch meets the selected design criteria.

Base Plate Thickness

Required base plate thickness: 0.387 inch

12. Warnings

- When cracked concrete is selected, concrete compressive strength used in concrete breakout strength in tension, adhesive strength in tension and concrete pryout strength in shear for SET-XP adhesive anchor is limited to 2,500 psi per ICC-ES ESR-2508 Section 5.3.

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Company:	Munzing Structural Engineeri	Date:	5/28/2019
Engineer:	JG	Page:	1/6
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-11
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 15.000
Code report: ICC-ES ESR-2508
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 18.75
c_{ac} (inch): 27.65
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 24.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: Yes

Base Plate
Length x Width x Thickness (inch): 12.00 x 12.00 x 0.75
Yield stress: 36000 psi

Profile type/size: Pipe1/2STD

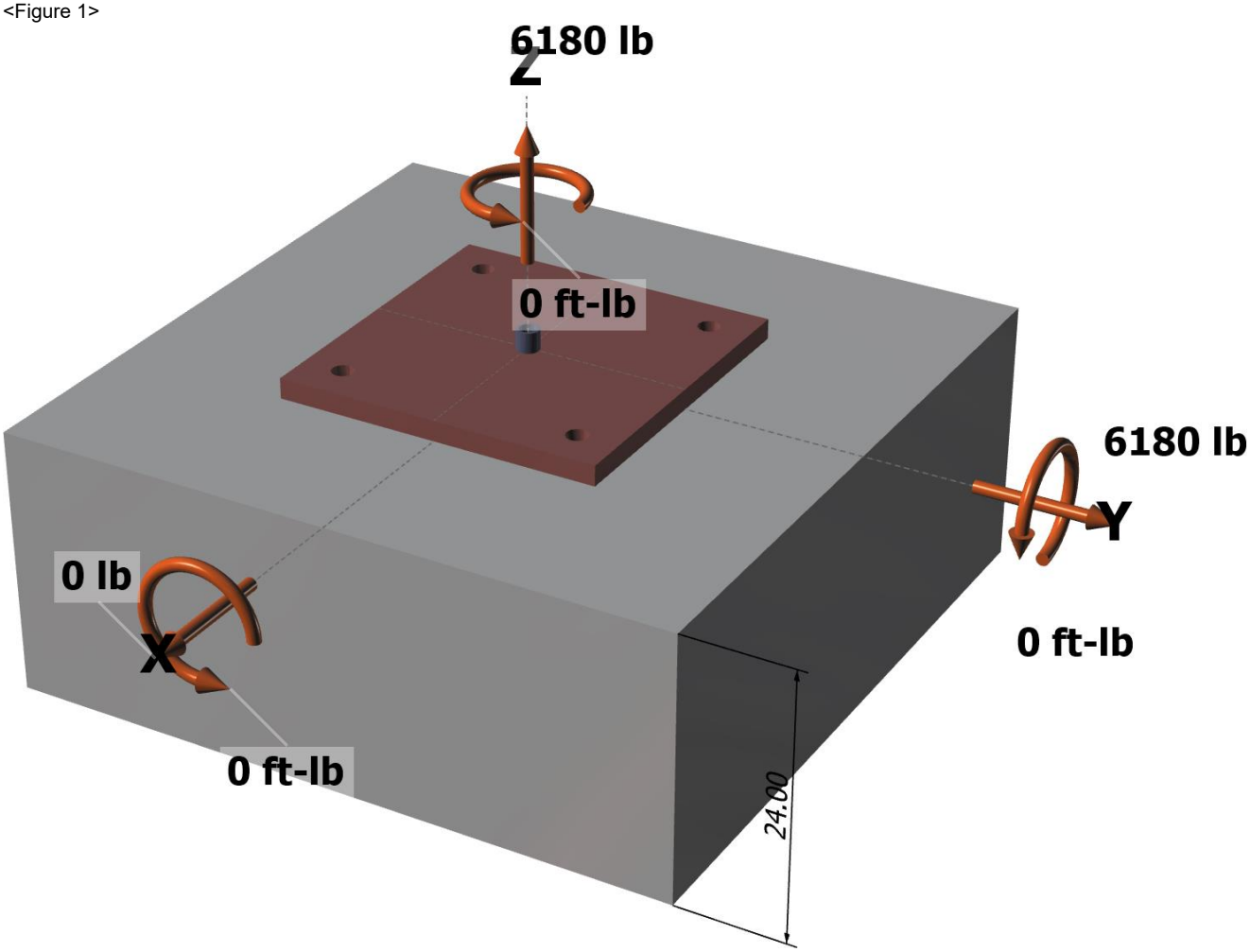
Recommended Anchor
Anchor Name: SET-XP® - SET-XP w/ 3/4"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-2508

Load and Geometry
Load factor source: ACI 318 Section 9.2
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: No
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

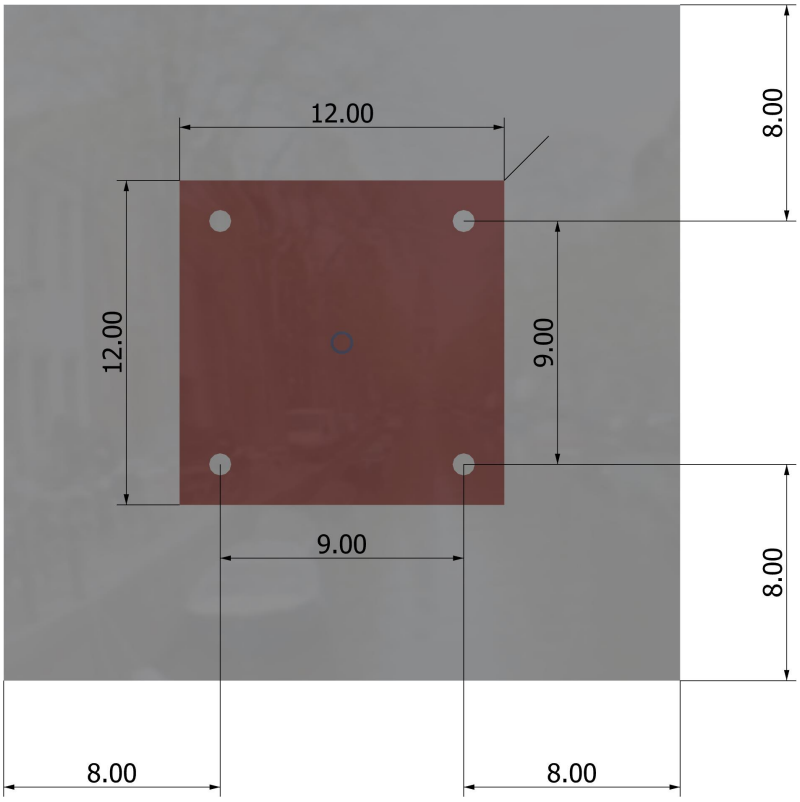
Strength level loads:

N_{ua} [lb]: 6180
V_{uax} [lb]: 0
V_{uay} [lb]: 6180
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

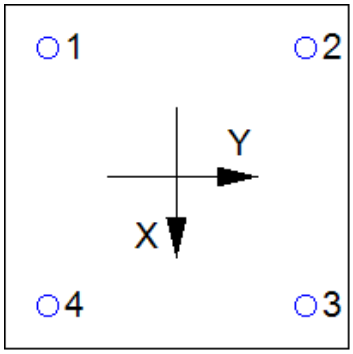


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	1545.0	0.0	1545.0	1545.0
2	1545.0	0.0	1545.0	1545.0
3	1545.0	0.0	1545.0	1545.0
4	1545.0	0.0	1545.0	1545.0
Sum	6180.0	0.0	6180.0	6180.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 6180
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. D.5.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
19370	0.75	14528

5. Concrete Breakout Strength of Anchor in Tension (Sec. D.5.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. D-6)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	5.333	10469

$\phi N_{cbg} = \phi \, (A_{Nc} / A_{Nco}) \, \Psi_{ec,N} \, \Psi_{ed,N} \, \Psi_{c,N} \, \Psi_{cp,N} N_b$ (Sec. D.4.1 & Eq. D-4)

A_{Nc} (in²)	A_{Nco} (in²)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
625.00	256.00	8.00	1.000	1.000	1.00	1.000	10469	0.65	16614

6. Adhesive Strength of Anchor in Tension (Sec. D.5.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\tau_{k,cr}$ (psi)
385	1.00	1.00	385

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. D-22)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	385	0.75	15.000	13607

$\phi N_{ag} = \phi \, (A_{Na} / A_{Na0}) \, \Psi_{ec,Na} \, \Psi_{ed,Na} \, \Psi_{cp,Na} N_{ba}$ (Sec. D.4.1 & Eq. D-19)

A_{Na} (in²)	A_{Na0} (in²)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba}(lb)	ϕ	ϕN_{ag} (lb)
532.95	198.41	7.04	8.00	1.000	1.000	1.000	13607	0.65	23758

8. Steel Strength of Anchor in Shear (Sec. D.6.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
11625	0.8	0.65	6045

9. Concrete Breakout Strength of Anchor in Shear (Sec. D.6.2)

Shear perpendicular to edge in y-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. D-33 & Eq. D-34)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
6.00	0.750	1.00	2500	16.00	28800

$\phi V_{cbgy} = \phi\,(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. D.4.1 & Eq. D-31)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
600.00	1152.00	1.000	0.800	1.000	1.000	28800	0.70	8400

Shear parallel to edge in y-direction:

$V_{bx} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. D-33 & Eq. D-34)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
6.00	0.750	1.00	2500	8.00	10182

$\phi V_{cbgy} = \phi\,(2)(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. D.4.1 & Eq. D-31)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgy} (lb)
300.00	288.00	1.000	1.000	1.000	1.000	10182	0.70	14849

10. Concrete Pryout Strength of Anchor in Shear (Sec. D.6.3)

$\phi V_{cpg} = \phi \min|k_{cp}N_{ag};\ k_{cp}N_{cbg}| = \phi \min|k_{cp}(A_{Na} / A_{Na0})\,\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba};\ k_{cp}(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (Sec. D.4.1 & Eq. D-41)

k_{cp}	A_{Na} (in^2)	A_{Na0} (in^2)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	532.95	198.41	1.000	1.000	1.000	13607	36550

A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
625.00	256.00	1.000	1.000	1.000	1.000	10469	25560	0.70

ϕV_{cpg} (lb)
35784

11. Results

Interaction of Tensile and Shear Forces (Sec. RD.7)

Tension	Factored Load, N_{ua} (lb)	Design Strength, øN_n (lb)	Ratio	Status
Steel	1545	14528	0.11	Pass
Concrete breakout	**6180**	**16614**	**0.37**	**Pass (Governs)**
Adhesive	6180	23758	0.26	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	1545	6045	0.26	Pass
T Concrete breakout y+	**6180**	**8400**	**0.74**	**Pass (Governs)**

|| Concrete breakout x-	**3090**	**14849**	**0.21**	**Pass (Governs)**
Pryout	6180	35784	0.17	Pass

Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. RD.7	0.19	0.60	79.2%	1.0	Pass

SET-XP w/ 3/4"Ø F1554 Gr. 36 with hef = 15.000 inch meets the selected design criteria.

Base Plate Thickness

Required base plate thickness: 0.593 inch

12. Warnings

- When cracked concrete is selected, concrete compressive strength used in concrete breakout strength in tension, adhesive strength in tension and concrete pryout strength in shear for SET-XP adhesive anchor is limited to 2,500 psi per ICC-ES ESR-2508 Section 5.3.

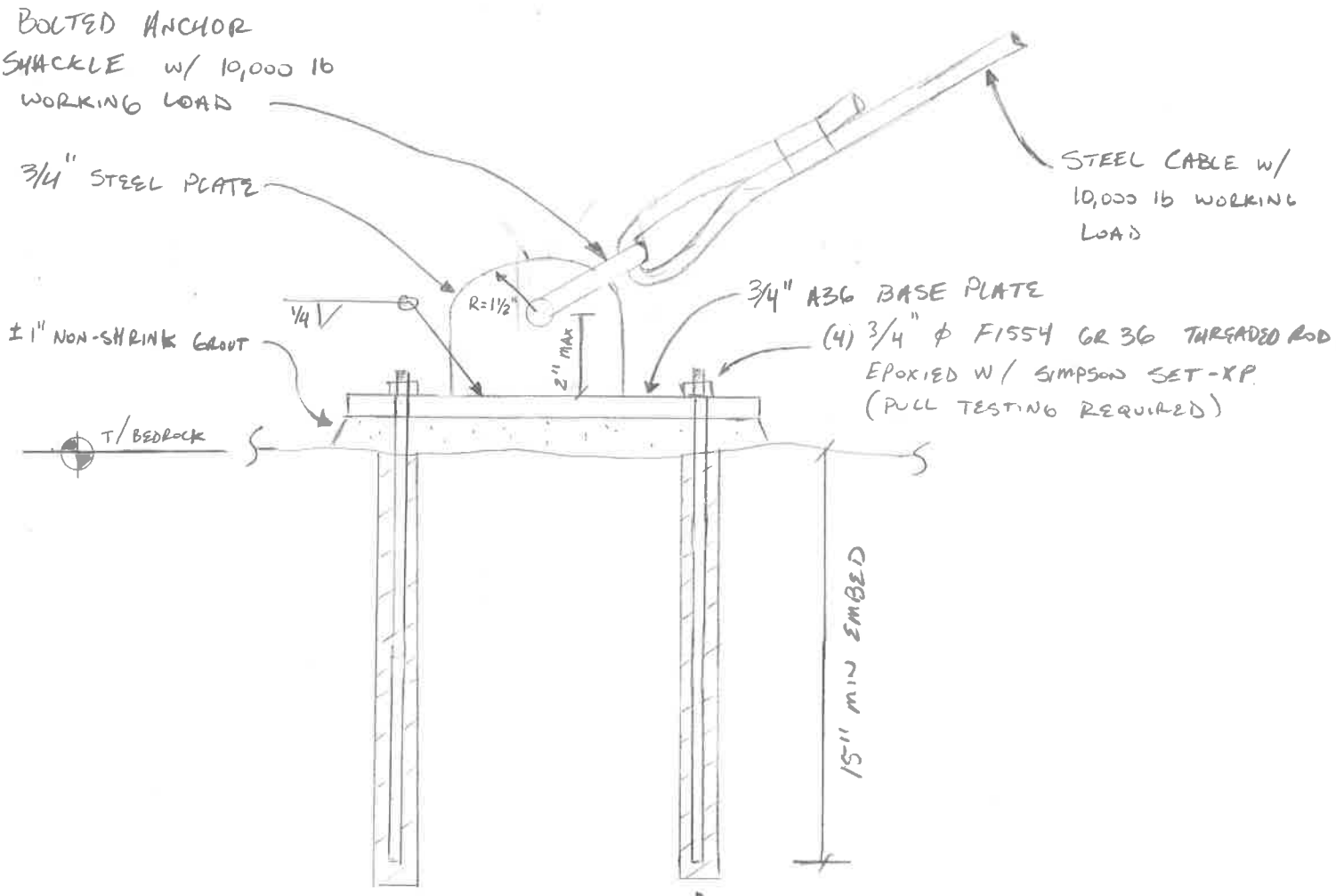
- Designer must exercise own judgement to determine if this design is suitable.

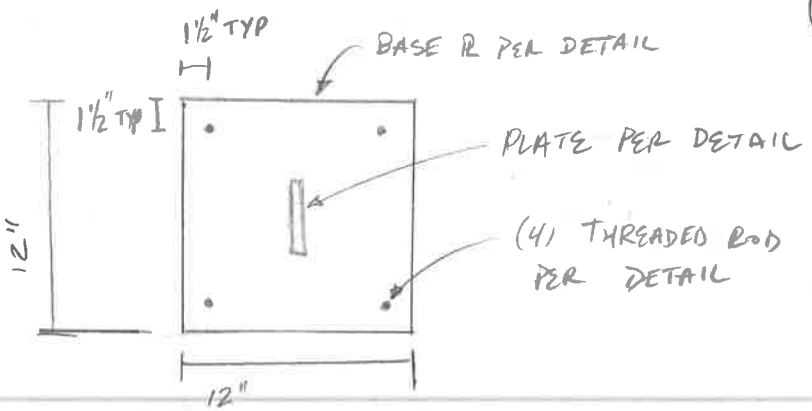
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Munzing
structural engineering

Project No.	Sheet No.
19-179	

Project	Date
NEUBO Dock	5/28/2019
Subject	**By**
Dock Anchorage Detail	JG





SECTION A-A

REGISTERED PROFESSIONAL ENGINEER
79303PE
OREGON
JUNE 14, 2007
MICHAEL R. MUNZING

EXPIRES: 12/31/20