

**Project Title
Address
Municipality, PA**

Prepared for: Client, LLC



**Jacking Operations Procedures
&
Engineering Documentation**

Gridline 3 at SWI-053

HSE Project No. D-2210725-01

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Document Control

Jacking Operations Procedure

General Notes & Procedure

HSE Jacking Operations Procedure				Number: 2190542-01
Villanova Law School Parking Garage				Revision: 0
Created by: W. Lynes	Approved by:	W. Lynes	Effective Date:	2022-10-31

Purpose / Process Overview

The purpose of this document is to provide detail, direction, and procedures for jacking operations at the subject location. The scope of work to be performed by HSE includes jacking Girders G-129 and G-124, which support the double-tees that comprise the roof parking level, approximately 5" to correct deficient vertical clearance. Vertical shoring is installed in similar locations in the lower levels, providing a direct, vertical load path to the existing foundation.

All preparatory work – including but not limited to removing cast-in-place concrete wash, exposing and removing designated precast connections, removing and/or disconnecting utility conduits in the work area, and excavating and exposing the existing footing – shall be performed by others and prior to HSE operations.

General Notes

1. The Erector shall be responsible for verifying the weight of each lift and insuring the stability of each member during all phases of jacking.
2. No construction materials or equipment shall be allowed on parking deck while in supported condition.
3. This procedure is to be used only as a guide and may change due to actual site conditions. Foreman may substitute

Procedure

Step:

1. There shall be no live load, including but not limited to equipment and personnel, on the structure during lifting or lowering operations.
2. The concrete wash areas

Sketches

Estimated Quantities

Engineering

Project Location Map

General Notes & Overview of Jacking Operations

Summary

This document includes engineering calculations, sketches, and product technical specifications for the design of temporary shoring and a jacking system for the subject parking garage.

Terms and Conditions

1. The designs developed in the subsequent calculations reflect the available project information, including but not limited to plans, specifications, construction scheduling and sequencing, and measurements obtained during a site reconnaissance performed by the HSE Engineer on 8/2/2022.
2. Higher capacity rigging and equipment may be substituted within the specified parameters and without the approval of the HSE Engineer.
3. Deviation from the suggested bracing plan shall not be allowed without the express approval of the HSE Engineer.
4. All indicated utilities shall be removed by others prior to HSE performing work.
5. All indicated concrete wash areas shall be removed by other prior to HSE performing work.
6. All indicated connections shall be removed by others prior to HSE performing work.
7. All excavation, site preparation, and snow and ice accumulation in the project area and in the indicated areas shall be performed by others prior to HSE performing work.

Governing Design Specifications and Technical References

ACI. 2019. "Building Code Requirements for Structural Concrete." ACI 318-19.

AISC. 2017. "Steel Construction Manual, 15th Edition." AISC-15.

ASCE. 2022. "Minimum Design Loads and Associated Criteria for Buildings and Other Structures." ASCE 7-22.

ASCE. 2014. "Design Loads on Structures During Construction." ASCE 37-14.

High Concrete Group. For Construction Drawings, 5/25/2020.

Design Methodology

Design is in accordance with the Load and Resistance Factor Design (LRFD) methodology unless noted otherwise.

Analytical modeling for structural analysis is performed in the structural analysis software STAAD.pro CONNECT edition, Version 22.01.00.39.

The partially erected structure and falsework are considered Risk Category II as defined in ASCE 7-22.

The mapped Risk-Targeted MCE_R , 5 percent damped, spectral response acceleration parameter at a period of 1 second, $S_1 = 0.045 g < S_1 = 0.4 g$; \therefore earthquake loads are not considered (Ref: ASCE 37-14 § 6.5.1).

Loads, Load Factors, and Load Combinations

Notation

- D Dead load, self-weight of elements (5% surcharge included for fabrication variability)
 I Impact; $I := 30\%$ of dead load
 S Snow

Load Combinations - LRFD

Ref: ASCE 37-14 § 2.2.3

1. $1.4 D$
2. $1.2 D + 1.6 I + 0.5 S$
3. $1.2 D + I + 1.6 S$

Loading

Design Objective

Determine the dead loads due to self weight of concrete wash to remain and tees and the exposed roof snow loads applied to the Girders on Level 4. Obtain the girder reactions for further evaluation of jacking forces. The concrete wash shall be removed prior to HSE work.

Concrete Wash to Remain

Note that the concrete wash shall be removed by others prior to HSE work. The contractor performing the work may remove more than the indicated areas without adversely affecting HSE jacking operations. Only the areas required to expose the connections are demarcated for removal for the purposes of calculating worst-case loading.

Assumed unit weight of wash, $\gamma := 160 \text{ pcf}$

Assumed thickness of wash, $t := 3 \text{ in}$

Girder G-129

Self-weight

Length of girder ($\text{C} - \text{C}$ Bearings), $L := 41 \text{ ft} + 10 \text{ in} - 10 \text{ in} = 41 \text{ ft}$

Ship weight, $W_{\text{girder}} := (1 + 10\%) \cdot 43561 \text{ lbf} = 47917.1 \text{ lbf}$

Equivalent UDL, $w_{D,\text{girder}} := \frac{W_{\text{girder}}}{L} = 1.169 \frac{\text{kip}}{\text{ft}}$

Wash

Total area of wash, $A_{\text{wash}} := (54 + 257 + 54 + 636 + 75 + 35 + 46 + 72) \cdot \text{ft}^2 = 1229 \text{ ft}^2$

Equivalent UDL, $w_{D,\text{wash}} := \frac{A_{\text{wash}} \cdot \gamma \cdot t}{2 L} = 0.6 \frac{\text{kip}}{\text{ft}}$

Weights of Tees from Piece Tickets

Piece Mark	Ship Weight (lbs)	Design Weight (lbs)	Reaction Value (lbs)
7T26-225	60,817	66,899	33,449
7T26-220	65,772	72,349	36,175
7T26-224	56,531	62,184	31,092
7V26-252	42,002	46,202	23,101
7T26-231	64,288	70,717	35,358
7T26-236	64,574	71,031	35,516
Sum =			194,691

Table 1: Tabulation of Tee weights resisted by G-129

Equivalent UDL, $w_{D,\text{tees}} := \frac{W_{\text{tees}}}{L} = 4.749 \frac{\text{kip}}{\text{ft}}$

Snow

Tributary width of girder, $W_T := 60 \text{ ft}$ conservatively

Ground snow load, $p_g := 41 \text{ psf}$

Load duration factor, $C_d := 0.8$

Ref: ASCE 7 Online Hazard Tool

Ref: ASCE 37-14 § 6.4.1

Equivalent UDL, $w_s := C_d \cdot W_T \cdot p_g = 1.968 \frac{\text{kip}}{\text{ft}}$

Analysis Output

Service load governing reaction at South support, $R_o := 215 \text{ kip}$ (D+I+S)

Strength governing reaction at South support, $R_u := 265 \text{ kip}$ (1.2D+1.6I+S)

Girder G-124

Self-weight

Length of girder (¢ - ¢ Bearings), $L := 27 \text{ ft}$

Ship weight, $W_{girder} := (1 + 10\%) \cdot 28979 \text{ lbf} = 31876.9 \text{ lbf}$

Equivalent UDL, $w_{D_{girder}} := \frac{W_{girder}}{L} = 1.181 \frac{\text{kip}}{\text{ft}}$

Wash

Total area of wash, $A_{wash} := (639 + 38 + 32 + 54 + 77) \cdot \text{ft}^2 = 840 \text{ ft}^2$

Equivalent UDL, $w_{D_{wash}} := \frac{A_{wash} \cdot \gamma \cdot t}{2 L} = 0.622 \frac{\text{kip}}{\text{ft}}$

Weights of Tees from Piece Tickets

Piece Mark	Ship Weight (lbs)	Design Weight (lbs)	Reaction Value (lbs)
7T26-218	57,001	62,701	31,351
7T26-214	66,136	72,750	36,375
7T26-228	66,951	73,646	36,823
7T26-227	67,976	74,774	37,387
		Sum =	141,935

Table 2: Tabulation of Tee weights resisted by G-124

Equivalent UDL, $w_{D_{tees}} := \frac{W_{tees}}{L} = 5.257 \frac{\text{kip}}{\text{ft}}$

Snow

Tributary width of girder, $W_T := 60 \text{ ft}$ conservatively

Ground snow load, $p_g := 41 \text{ psf}$

Load duration factor, $C_d := 0.8$

Ref: ASCE 7 Online Hazard Tool

Ref: ASCE 37-14 § 6.4.1

Equivalent UDL, $w_S := C_d \cdot W_T \cdot p_g = 1.968 \frac{\text{kip}}{\text{ft}}$

Analysis Output

Service load governing reaction at South support, $R_o := 151 \text{ kip}$ (D+I+S)

Strength governing reaction at South support, $R_u := 186 \text{ kip}$ (1.2D+1.6I+S)

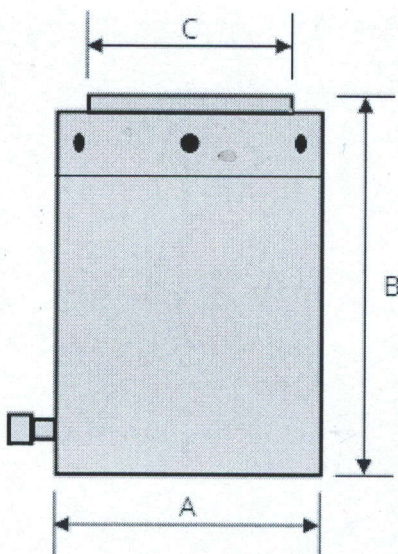
Jacking System Design

Appendices

Appendix A - ASCE Design Hazards Report

Appendix B - Jacks

W.B. EQUIPMENT SERVICE CO INC.
 127 OAK STREET
 WOOD RIDGE NJ 07075
 TEL: 201-438-7800 FAX: 201-438-7830



Single Acting w/Lock Nut *

MODEL	CAPACITY TONS	STROKE INCHES	AREA IN ²	WEIGHT LBS	A INCHES	B INCHES	C INCHES
WBLN1508G	150	8	30.78	203	8.07	15.20	6.26

CUSTOMER:		
DATE:	REFERENCE:	
BY:	REVISION:	

Appendix C - Rigging Hardware Information