LAFAYETTE
ENGINEERING COMPANY
Civil and Environmental Engineering Services

740 High Street # 319 AEC | Easton, Pennsylvania 18042
Tel: (610) 330-5437 | Fax: (610) 330-5437 | www.ce.lafayette.edu

PROPOSED

LAFAYETTE COLLEGE

CEERC

Civil & Environmental Engineering Research Center

-

Report 8

Parking Garage – Structural Design Report

Site
Former Hummel Lumber Supply at 900 Bushkill Drive

City of Easton, Northampton County, Pennsylvania

– this page intentionally left blank –

Parking Garage Structural Design Table of Contents

I. Parking Garage Analysis

I.1 Introduction

The proposed garage will be a sloping floor-two-way circulation design (see Figure I.1) made up of pre-cast sections for ease of construction and cheaper cost. The size of the garage is 186' by 125'. The parts of the system designed in this report are the beams, double tees, columns, spandrels, and foundation. Parts of this system outside of the scope of this report include retaining walls and shear walls. The retaining wall will cover the entire north face of the structure and wrap around to other faces as well. It is 31' high at the highest point.

I.2 Dead Load

	Unit weight
1. 128-S precast double tee	46 psf
2. Inverted Tee Beams	775 plf
3. ELL Beams	613 plf
4. Columns	267 plf
5. Spandrels	450 plf
6. Total Estimated Dead Weight of Structure	**7328 kips**

*All component dimensions estimated using ACI Table 9.5a

I.3 Live Load

	Unifom (psf)	Concentrated (lbs)
1. Parking Levels	40	3000*
2. Stairs, Landings, and Lobbies	100	300**
3. Bumper Impact load	-	6000***

*Concentrated wheel load acting on an area of 4.5 in. by 4.5 in.

**Concentrated load on stair treads acting on an area of 2 in. by 2 in. and is to be applied nonconcurrent with the uniform load

***Bumper impact load at 18 in. A.F.F. or 27 in. A.F.F. acting on an area not to exceed 12 in. by 12 in.

I.4 Snow Load

1.	Ground snow load, p_g	30 psf
2.	Terrain category	B
3.	Exposure factor, C_e	0.9
4.	Thermal factor, C_t	1.2
5.	Importance factor, I_s	1.0
6.	Flat roof snow load, $pf = 0.7\ C_e\ C_t\ I_s\ p_g$	23 psf

I.5 Wind Load

1.	Basic wind speed, V	115 mph
2.	Wind directionality factor, K_d	0.85
3.	Exposure category	B
4.	Topographic factor, K_{zt}	1.0
5.	Gust effect factor, G_f	0.85
6.	Enclosure classification	Open
7.	Importance factor, I_w	1.0
8.	Internal pressure coefficient, GC_{pi}	0.0
9.	Wind design pressure, P	varies with height

I.6 Seismic Load

1.	Seismic importance factor, I_e	1.0
2.	Mapped acceleration parameters, S_s	0.204 g
	S_1	0.063 g
3.	Site class	D
4.	Design spectral acceleration parameters, S_{DS}	0.217 g
	S_{D1}	0.101 g
5.	Approximate period, T_a	.376 sec
6.	Seismic design category	B
7.	Seismic force resisting system -The seismic force resisting system shall be classified as a bearing wall system with intermediate precast shear walls	
8.	Response modification factor, R	4
9.	Seismic response coefficient, Cs	.0365

10. Design base shear, V 438 kips

11. Analysis procedure used
    -Equivalent lateral force procedure

*Parameters found using USGS design maps

II. Parking Garage Design

II.1 Final Design

	Quantity of Members
1. 128-S precast double tee	186 sections
2. Inverted Tee Beams	450 lf
3. ELL Beams	1860 lf
4. Spandrels	1250 lf
5. Columns	15
6. Foundation- 6’ Diameter Drilled Shafts	9, L=50’
7. Shear Wall (outside of scope)	-
8. Retaining Wall (outside of scope)	-

Figures and Tables

I.1 Sloping Floor-Two-Way Circulation