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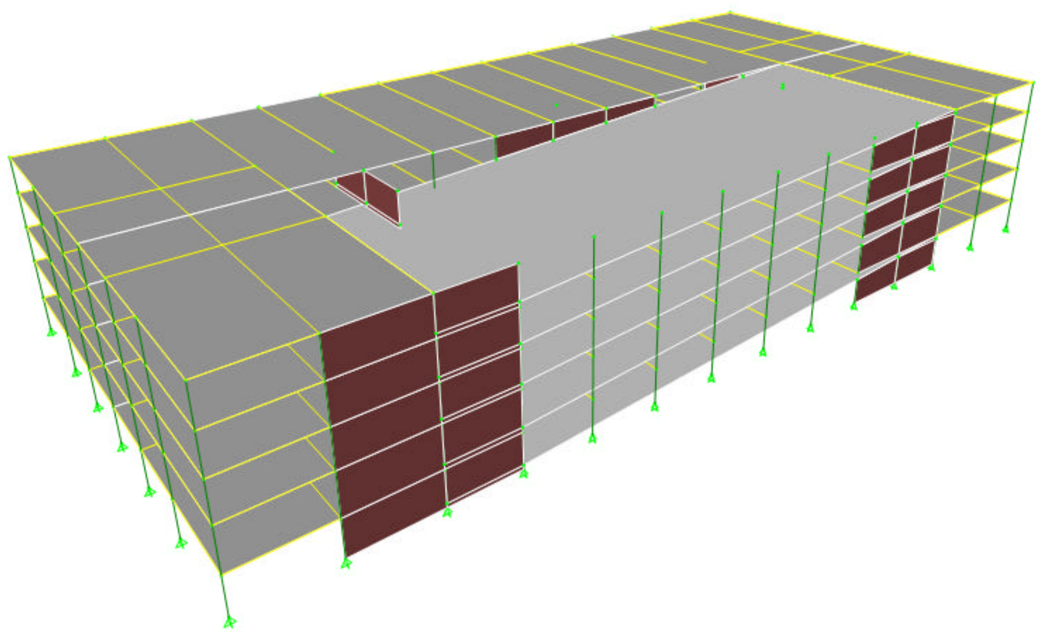
SCOPING DOCUMENTS
(BASIS OF DESIGN)

FOR

LOS ANGELES COUNTY
HALL OF JUSTICE – NEW PARKING STRUCTURE

LOS ANGELES, CA

NYA # 09335.00



AUGUST, 2010

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1. Project Description and Summary

The structure is a 10 level cast-in-place post-tensioned concrete parking structure. It includes 5 levels below grade and 5 levels above grade. The structure is rectangular in plan and measures 132'-4" in the short direction and 272'-0" in the long direction. It includes two bays of parking, one flat bay and one ramped bay. The façade of the structure will consist of Pre-cast (P/C) Concrete wall panels mounted to the Cast-in-place concrete structure.

2. Governing Codes and Standards

2.1 Governing Codes

The project will conform to the 2008 Los Angeles County Building Code, LACBC, which is based on the 2007 California Building Code (Title 24, Part 2, California Code of Regulations) which is also based on the 2006 International Building Code.

2.2 Referenced Standards

ASCE 7-05, Minimum Design Loads for Buildings and Other Structures
ACI 318-05, Building Code Requirements for Structural Concrete
ACI 530-05, Building Code Requirements for Masonry Structures
AISC Manual of Steel Construction, 13^{th} Edition
Post-Tensioning Manual, Latest Edition

2.3 Referenced Documents

- Geotechnical Investigation Report #03-31-102 -01 as prepared by Converse Consultants and dated May 5, 2003.
- Architectural Drawings Prepared by Nadel Architects and Dated July 7, 2010.

3. Analysis and Design Procedures

3.1 Gravity Framing System

3.1.1 General

- 5-1/2” thick Post-tensioned, PT, cast-in-place concrete slab spanning between beams. Due to the below grade construction, the slab shall be anchored at the perimeter and tensioned from the center delay strip.
- The typical beam size is 16” wide x 36” deep PT cast-in place concrete beams, which are spaced at 20’-0” on center and supported by cast-in-place concrete columns or PT concrete transfer girders. Due to the sub-grade construction, the beams shall be stressed from the south end. At the ramp, the beams shall be stressed at the center. Special attention shall be given to the post tensioning sequencing at transition between the ramps. Additional delay pockets and shoring will be required to allow for tensioning and anchorage from the top of the deck for constructability.
- Transfer girders will be required at the turning bays. The typical girder size is 24” wide x 36” deep PT cast-in place concrete beams. Due to the sub-grade construction the girders shall be stressed at the interior ends. Additional delay pockets and shoring will be required for constructability.
- There are three rows of square columns spaced at 20’-0” on center. The typical columns will be 24” square. Below Level 1, the interior columns will increase to 36” x 24”. These columns extend down to the foundation level.
- The columns are continuous to the lowest basement level and supported on shallow spread footings.

3.1.2 Dead Loads

In addition to the self weight of the structure include:

Mechanical/Electrical/Plumbing: 5 pounds per square foot (psf)

3.1.3 Live Loads

Minimum Distributed Live Loads as per Table 4-1 of ASCE 7-05

Garages:	40 psf or 3000 pounds acting on a 4.5” x 4.5” footprint

3.1.4 Basic Gravity Load Combinations.

1.4D

1.2D + 1.6L + 1.6H + 0.5L_r

1.2D + 1.6L_r + L

3.2 Seismic Framing System

3.2.1 General

- The 5-1/2” thick concrete slab acts as a structural diaphragm to transfer seismic inertial forces to the lateral force resisting elements of the structure.
- Reinforced concrete shearwalls provide the primary lateral resistance of the structure in the long (east/west) direction. A dual system, including concrete shearwalls and special reinforced moment frames provide the primary lateral force resistance of the structure in the short direction. The interior shearwalls are continuous to the foundation. The exterior walls and frames are supported by the perimeter basement walls. The basement walls transfer the loads to the foundations.
- A shallow foundation resists seismic forces including wall shears and overturning forces.

3.2.2 Seismic Design Criteria

Soil Site Class:	C
Occupancy Category	I
MCE Spectral Response Acceleration Parameters:	S_S = 2.235g S_1 = 0.759g
Site Coefficients	F_a = 1.0

$F_v = 1.3$

Adjusted MCE Spectral Response Acceleration Parameters: $S_{MS} = 2.235g$

$S_{M1} = 0.987g$

Design Spectral Response Acceleration Parameters: $S_{DS} = 1.49g$

$S_{D1} = 0.66g$

Seismic Design Category: E

Lateral Load Resisting System: East/West: Building Frame System - Special Reinforced Concrete Shearwalls

Response Modification Coefficient: $R = 6$

System Over-strength Factor: $O_o = 2.5$

Deflection Amplification Factor: $C_d = 5$

Importance Factor: $I = 1.0$

Redundancy: $?_{E/W} = 1.0$

Approximate Period: $T_a = C_t \cdot h_n^{0.75} = 0.02 \cdot 51.33\text{ ft}^{0.75} = 0.38\text{ sec}$

Coefficient for Upper Limit on calculated period: $C_u = 1.4$

$C_u T_a = 0.54\text{ sec}$

Calculated Period: $T_{E/W} = 0.261\text{ sec}$

Fundamental Period: $T = 0.261\text{ sec}$

Seismic Response Coefficient: $C_S = 0.248$

ASCE 7-05 Section 12.8

Design Base Shear: $V = 0.248\text{ W}$

Lateral Load Resisting System: North/South: Dual System - Special Reinforced Concrete Shearwalls and Special Reinforced Concrete Moment Frames

Response Modification Coefficient: $R = 7$

System Over-strength Factor: $O_o = 2.5$

Deflection Amplification Factor: $C_d = 5.5$

Importance Factor: $I = 1.0$

Redundancy: ?$_{N/S}$ = 1.0

Approximate Period: $T_a = C_t \cdot h_n^{0.75} = 0.02 \cdot 51.33\ ft^{0.75} = 0.38$ sec

Coefficient for Upper Limit on calculated period: $C_u = 1.4$

$C_uT_a = 0.54$ sec

Calculated Period: $T_{N/S} = 0.564$ sec

Fundamental Period: T = 0.54 sec

Seismic Response Coefficient: $C_S = 0.213$

ASCE 7-05 Section 12.8

Design Base Shear: V = 0.213 W

3.2.3 Seismic Analysis Procedure

The structure will be analyzed using the structural analysis software E-TABS using the Equivalent Lateral Force Analysis Procedure as allowed by Table 12.6-1 of ASCE 7-05. A 3-dimensional model of the structure will be created and will include the sloping ramps as well as the horizontal soil loads at the first level of the structure. The seismic base of the building is assumed to occur at BP-1.

3.2.4 Seismic Performance Objectives

The performance objective of the building design is "Life Safety" and to comply with all requirements of the 2008 LACBC.

3.2.5 Consideration of Gravity Loads

The 3-d ETABS model includes the gravity loads to the lateral load resisting elements. The ETABS model includes P-Δ effects to lateral resisting elements.

3.2.6 Diaphragm Modeling Parameters

The 3-d ETABS model will assume a semi-rigid diaphragm. The material properties and thickness have been included in the model.

3.2.7 Diaphragm Design Procedure

The diaphragm will be designed based on the results of the ETABS models including chord and collector elements. Collector elements will be amplified by the system overstrength factor, Ω_o, as required by code.

3.2.8 Seismic Weight Determination

The ETABS model will calculate the seismic weight of the structural elements. In addition line masses will be added at the perimeter to account for the pre-cast concrete wall panels and a superimposed dead load of 5 psf will be added uniformly to account for any additional MEP loads.

3.2.9 Torsion Considerations

A 5 % accidental torsion will be provided as required by section 12.8.4.2 of the ASCE 7-05. The structural system does not have any structural irregularities as defined by Table 12.3-1 and 12.3-2 of ASCE 7-05 therefore an amplification of accidental torsional moment is not required.

3.2.10 Drift Calculations

The design story drift shall be computed as the difference of the deflections at the center of mass at the top and bottom of the story under consideration. The deflection shall be calculated by multiplying the deflection calculated by elastic analysis and amplifying by the deflection amplification factor C_d.

3.2.11 Structural Irregularities

None

3.2.12 Redundancy

The redundancy factor has been taken as 1.0.

3.3 Wind Loads and Design Parameters

3.3.1 Wind Speed Parameters

Basic Wind Speed:	100 mph 3-second wind gust
Exposure Category:	B

Wind Directionality Factor:	$K_d = 0.85$
Importance Factor:	$I = 1.0$
Design Wind Load:	$p = qG_fC_p$

4. Foundation System

4.1 General

The foundation design is based on the geotechnical investigation report #03-31-102 -01 as prepared by Converse Consultants and dated May 5, 2003.

4.2 Soils Report Recommendations

Shallow Foundations

Allowable Bearing Pressure - Continuous Footing:	7000 psf
Allowable Bearing Pressure - Isolated Footing:	9000 psf
Coefficient of Friction:	$\mu = 0.3$
Passive Pressure	350 pcf; 3500 psf, maximum

Bearing Pressures may be increase by 1/3 for short duration loads including wind and seismic loads.

Retaining Walls

At-rest Pressure:	55H (triangular distribution) or 26H (uniform distribution)
Surcharge Pressure:	135 psf (upper 10 feet)
Dynamic Earth Pressure:	20 pcf (inverse triangular distribution)

The above referenced design criteria for the foundation is based on the information provided by Converse Consultants in their report dated May 5, 2003. This report was based on the 2001 California Building Code. The design team needs to design the basement wall for additional Earth Pressures, as required by the latest code and an updated Geotechnical Investigation Report. Thicker basement walls will most likely be required.

5. Miscellaneous Building Features

5.1 Seismic Demands

Precast Concrete Façade Panels and connections shall be designed to resist the seismic design force F_p applied at the components center of gravity.

5.2 Impact to Structure

Seismic mass of the precast wall elements will be accounted for in design of the structure.

6. Special Considerations

6.1 Vehicle Barriers

Vehicle barrier systems for passenger cars shall be designed to resist a single 6000 lb load applied horizontally in any direction to the barrier system and shall have anchorage or attachments capable of transferring this load to the structure. The load shall be assumed to act 18" above the floor or ramps surface on an area not to exceed 1foot square. The precast concrete spandrel panels shall be used as the vehicle barrier at the exterior and post tensioned steel cable shall be used between ramps.

6.2 LEED Requirements

Structural materials shall included appropriate recycled content to meet the LEED silver certification criteria.

7. Minimum Structural Material Properties

Concrete

All new structural concrete shall have a minimum compressive strength at 28 days as follows:

Footings	f'c = 4000 psi (150 pcf)
Slab-on-grade	f'c = 4000 psi (150 pcf)
Retaining Walls	f'c = 4000 psi (150 pcf)
All other Concrete	f'c = 5000 psi (150 pcf)

Masonry

All new masonry shall have the following minimum material properties.

Block	ASTM C90 (f'cb = 1500 psi)
Cement (Low Alkali, Type I or II):	ASTM C150
Grout	ASTM C476 (f'm = 2000 psi)

Reinforcement

All new reinforcement shall conform to:

Typical Reinforcement	ASTM A615, Grade 60 (Fy = 60 ksi)
Welded Rebar	ASTM A706 (Fy = 60 ksi)
W.W.F. (Cold Drawn Wire)	ASTM A185 (Fy = 65 ksi)

Structural Steel

All new structural steel shall conform to the following:

Plates	ASTM A572, Grade 50 (A992)
Structural Tubing	ASTM A500, Grade B (Fy = 46 ksi)
Pipe Columns	ASTM A53, Grade B (Fy = 42 ksi)
Anchor Bolts	F1554 Anchor Bolts (Gr. 36 or 50)
All Other Structural Sections	ASTM A572, Grade 50 (A992)

Welding

Electrode Strength	E80XX (Reinforcing Steel)
	E70XX (Structural Steel)