SEISMIC EVALUATION
Of

Beach Cities Health District

514 North Prospect Avenue & Central Plant
Redondo Beach, CA

Prepared for:

Beach Cities Health District
514 North Prospect Avenue, 1st Floor
Redondo Beach, CA 90277

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1.0 BUILDING DESCRIPTION

The former hospital building at 514 North Prospect was originally constructed in 1958 and consists of a 4-story tower (referred to hereinafter as the north tower) and single-story extension to the north. The south tower and elevator tower were added in 1967 and each consists of 4-stories. The north tower, elevator tower, and south tower have a single story basement. There are seismic joints that structurally separate the north low rise, north tower, elevator tower and south tower into four discrete structures. The central plant is a stand-alone single-story building. Refer to Figure 1 for an aerial view of the project site.

Figure 1 – Aerial View of 514 North Prospect and Central Plant

1.1 Gravity System

The gravity framing system for the north low rise, north tower, elevator tower, and south tower typically consists of concrete slabs 3-4 ½" thick supported by concrete joists and girders. The floor and roof framing is supported by concrete columns that extend down to the foundation.

The gravity framing system for the central plant consists of plywood sheathing at the roof supported by timber joists and girders. The timber girders are supported by steel pipe columns at the interior of the building and reinforced masonry walls along the perimeter.

1.2 Lateral System

The lateral force resisting system for the north tower consists primarily of concrete shear walls in both directions of the building. There are also deep concrete spandrels framing to concrete columns along the north and south sides of the building that act as moment frames (refer to figure 2). The floors and roof contain concrete slabs that form rigid diaphragms that distribute seismic induced forces to the walls and frames.

Figure 2 – View of South Side of North Tower

The lateral force resisting system for the east-west direction of the south tower consists of concrete shear walls located along the north and south sides of the building. In the north-south direction there are deep concrete spandrels framing to concrete columns (similar to the north tower) that act as moment frames. The floors and roof contain concrete slabs that form rigid diaphragms that distribute seismic induced forces to the walls and frames.

Both towers have a mechanical penthouse that sits on top of the roof that contains concrete shear walls around the perimeter. Most of the shear walls at both penthouses are discontinues and supported by concrete beams at the roof.

The lateral force resisting system for the north low rise building consists of multiple concrete shear walls in both directions of the building. The roof consists of a concrete slab that forms a rigid diaphragm that distributes seismic induced forces to the shear walls.

The lateral force resisting system for the elevator tower consists of concrete shear walls forming a core around the elevator that are continuous to the foundation.

The lateral force resisting system of the central plant consists of reinforced masonry shear walls around the perimeter of the building. The roof consists of a plywood diaphragm and anchors connecting the perimeter masonry walls to the timber framing (refer to figure 3).

Figure 3 –View of Central Plant

2.0 SEISMIC EVALUATION

A Tier 1 and deficiency only Tier 2 evaluation of the building's expected seismic performance was performed using ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings*. ASCE 41 is a national standard used to seismically evaluate existing buildings. The parameters used to for the evaluation are listed in Table 1. Assumed properties used in the evaluation were based on existing drawings and ASCE 41-13.

Table 1 – Evaluation Parameters

Performance Level	Life Safety Collapse Prevention
Seismic Hazard Level	BSE-1E (20% in 50 year event) BSE-2E (5% in 50 year event)
Level of Seismicity	High (S_{ds} > 0.5g and S_{d1} > 0.2g)
Building Type	C1 (Concrete Moment Frames) C2 (Concrete Shear Walls, Stiff Diaphragm) RM1 (Reinforced Masonry Bearing Walls, Flexible Diaphragm)
Soil Type	D
Seismic Parameters	$S_{XS,BSE-1E}$ = 0.762g $S_{X1,BSE-1E}$ = 0.419g $S_{XS,BSE-2E}$ = 1.192g $S_{X1,BSE-2E}$ = 0.660g

2.1 Identified Deficiencies

Based on the results of the analysis performed, extensive deficiencies were identified in both the north and south towers, and minor deficiencies were identified in the central plant. No deficiencies were identified for either the north low rise or elevator tower.

The identified deficiencies in the north tower include the following:

- The concrete beams at the roof that support the discontinuous shear walls in the penthouse above are overstressed in shear and flexure.
- Portions of the roof diaphragm are overstressed in shear.
- Two columns along the north side of the building at level 2 that support a discontinuous shear wall are overstressed.
- The deep concrete spandrels along the north and south sides of the building create captive columns that are susceptible to shear failure in a seismic event.
- Three concrete shear walls in the north-south direction have additional openings at the first and/or basement levels that result in the remaining wall being overstressed.

The identified deficiencies in the south tower include the following:

- The concrete beams at the roof that support the discontinuous shear walls in the penthouse above are overstressed in shear and flexure.
- One column along the north side of the building at the basement level that supports a discontinuous shear wall is overstressed.
- Many interior concrete columns have insufficient confinement reinforcement for seismic drift induced forces (i.e. deformation compatibility).
- The deep concrete spandrels along the east and west sides of the building create captive columns that are susceptible to shear failure in a seismic event. These frames are the only existing lateral system in the north-south direction of the south tower and are highly overstressed in flexure and shear.

The identified deficiencies in the central plant include the following:

- The existing ties between the perimeter reinforced masonry walls and plywood diaphragm are deficient.

3.0 RECOMMENDATIONS

Recommended seismic improvements have been developed based on the assessment of the existing building seismic performance using ASCE 41-13 criteria. The proposed strengthening is conceptual and is intended to identify representative scope for rough order of magnitude estimate of cost.

Recommended seismic strengthening for the north tower includes:

- Strengthen concrete beams below the discontinuous penthouse walls.
- Strengthen overstressed portions of the roof diaphragm.
- Strengthen columns at discontinuous shear walls.
- Slot cut the deep spandrel beams along the north and south sides of the building.
- Infill select openings in the north-south concrete shear walls.
- Strengthen foundations below the infilled concrete shear walls.

Recommended seismic strengthening for the south tower includes:

- Strengthen concrete beams below the discontinuous penthouse walls.
- Add new braced frames in the north-south direction. Two bays of braced frames at both the east and west sides of the building (four bays total) just outboard of the existing concrete frames recommended.
- Strengthen columns at new braced frames.
- Add new collectors along the east and west sides of the building to drag load into the new braced frames.
- Add fiber reinforced polymer (FRP) wrap around interior concrete columns.
- Slot cut the deep spandrel beams along the east and west sides of the building.
- Strengthen foundations below new braced frames.

Recommended seismic strengthening for the central plant includes:

- Add new Simpson straps and blocking at the roof to brace the perimeter reinforced masonry.

MAIN BUILDING IMPROVEMENTS SUMMARY

Element		Total	$ /sf
A) Shell (1-3)		**$13,472,136**	**$84.57**
1 Structural Modifications		$9,859,636	$61.89
2 Exterior Cladding (Repairs to existing)		$3,332,500	$20.92
3 Roofing and Waterproofing (Repairs to existing)		$280,000	$1.76
B) Interiors (4-5)		**$9,199,136**	**$57.75**
4 Interior Partitions, Doors and Glazing		$4,466,642	$28.04
5 Floor, Wall and Ceiling Finishes		$4,732,494	$29.71
C) Equipment and Vertical Transportation (6-7)		**$3,702,240**	**$23.24**
7 Function Equipment and Specialties		$3,442,240	$21.61
8 Stairs and Vertical Transportation		$260,000	$1.63
D) Mechanical and Electrical 8-11)		**$23,388,027**	**$146.82**
9 Plumbing Systems		$3,863,333	$24.25
10 Heating, Ventilation and Air Conditioning		$8,142,639	$51.11
11 Electrical Lighting, Power and Communications		$10,681,132	$67.05
12 Fire Protection Systems		$700,924	$4.40
E) Building Prep & Demo (12-13)		**$4,214,218**	**$26.45**
13 Building Preparations & Protection			
14 Selective Demolition		$2,340,218	$14.69
15 Site Impacts		$1,874,000	$11.76
Subtotal - Direct Trade Costs		**$53,975,758**	**$338.83**
General Conditions	9.00%	$4,857,818	$30.49
Subtotal		$58,833,576	$369.32
General Requirements	5.00%	$2,941,679	$18.47
Subtotal		$61,775,255	$387.79
Bonds	1.00%	$539,758	$3.39
Subtotal		$62,315,012	$391.18
Liability Insurance	1.00%	$623,150	$3.91
Subtotal		$62,938,162	$395.09
General Contractor Fee	4.00%	$2,517,526	$15.80
Subtotal		**$65,455,689**	**$410.89**
Phasing/Work In Occupied Building Premium			
Subtotal		$65,455,689	$410.89
Design / Estimating Contingency	12.00%	$7,854,683	$49.31
Subtotal		$73,310,371	$460.20
Escalation	18.00%	$13,195,867	$82.84
TOTAL ESTIMATED CONSTRUCTION COST		**$86,506,239**	**$543.04**

Overall Building Area	159,301	gsf
Approximate Impacted Area:	159,301	gsf

MAIN BUILDING IMPROVEMENTS SUMMARY - STRUCTURAL MODIFICATIONS

Element		Total	$ /sf
A) Shell (1-3)		**$9,800,636**	**$61.52**
1 Structural Modifications		$9,704,636	$60.92
2 Exterior Cladding (Repairs to existing)		$96,000	$0.60
3 Roofing and Waterproofing (Repairs to existing)		w/ Renovations	
B) Interiors (4-5)			
4 Interior Partitions, Doors and Glazing		w/ Renovations	
5 Floor, Wall and Ceiling Finishes		w/ Renovations	
C) Equipment and Vertical Transportation (6-7)			
7 Function Equipment and Specialties		w/ Renovations	
8 Stairs and Vertical Transportation		w/ Renovations	
D) Mechanical and Electrical 8-11)			
9 Plumbing Systems		w/ Renovations	
10 Heating, Ventilation and Air Conditioning		w/ Renovations	
11 Electrical Lighting, Power and Communications		w/ Renovations	
12 Fire Protection Systems		w/ Renovations	
E) Building Prep & Demo (12-13)		**$99,200**	**$0.62**
13 Building Preparations & Protection		w/ Renovations	
14 Selective Demolition		$99,200	$0.62
15 Site Impacts			
Subtotal - Direct Trade Costs		**$9,899,836**	**$62.15**
General Conditions	9.00%	$890,985	$5.59
Subtotal		$10,790,821	$67.74
General Requirements	5.00%	$539,541	$3.39
Subtotal		$11,330,362	$71.13
Bonds	1.00%	$98,998	$0.62
Subtotal		$11,429,361	$71.75
Liability Insurance	1.00%	$114,294	$0.72
Subtotal		$11,543,654	$72.46
General Contractor Fee	4.00%	$461,746	$2.90
Subtotal		**$12,005,400**	**$75.36**
Phasing/Work In Occupied Building Premium (NONE)			
Subtotal		$12,005,400	$75.36
Design / Estimating Contingency	12.00%	$1,440,648	$9.04
Subtotal		$13,446,048	$84.41
Escalation	18.00%	$2,420,289	$15.19
TOTAL ESTIMATED CONSTRUCTION COST		**$15,866,337**	**$99.60**

Overall Building Area	159,301	gsf
Approximate Impacted Area:	159,301	gsf

MAIN BUILDING IMPROVEMENTS SUMMARY - INTERIOR AND MEP RENOVATIONS

Element		Total	$ /sf
A) Shell (1-3)		**$3,671,500**	**$23.05**
1 Structural Modifications		$155,000	$0.97
2 Exterior Cladding (Repairs to existing)		$3,236,500	$20.32
3 Roofing and Waterproofing (Repairs to existing)		$280,000	$1.76
B) Interiors (4-5)		**$9,199,104**	**$57.75**
4 Interior Partitions, Doors and Glazing		$4,466,610	$28.04
5 Floor, Wall and Ceiling Finishes		$4,732,494	$29.71
C) Equipment and Vertical Transportation (6-7)		**$3,702,240**	**$23.24**
7 Function Equipment and Specialties		$3,442,240	$21.61
8 Stairs and Vertical Transportation		$260,000	$1.63
D) Mechanical and Electrical 8-11)		**$23,388,057**	**$146.82**
9 Plumbing Systems		$3,863,333	$24.25
10 Heating, Ventilation and Air Conditioning		$8,142,639	$51.11
11 Electrical Lighting, Power and Communications		$10,681,161	$67.05
12 Fire Protection Systems		$700,924	$4.40
E) Building Prep & Demo (12-13)		**$4,115,018**	**$25.83**
13 Building Preparations & Protection			
14 Selective Demolition		$2,241,018	$14.07
15 Site Impacts		$1,874,000	$11.76
Subtotal - Direct Trade Costs		**$44,075,920**	**$276.68**
General Conditions	9.00%	$3,966,833	$24.90
Subtotal		$48,042,752	$301.58
General Requirements	5.00%	$2,402,138	$15.08
Subtotal		$50,444,890	$316.66
Bonds	1.00%	$440,759	$2.77
Subtotal		$50,885,649	$319.43
Liability Insurance	1.00%	$508,856	$3.19
Subtotal		$51,394,506	$322.63
General Contractor Fee	4.00%	$2,055,780	$12.91
Subtotal		**$53,450,286**	**$335.53**
Phasing/Work In Occupied Building Premium			
Subtotal		$53,450,286	$335.53
Design / Estimating Contingency	12.00%	$6,414,034	$40.26
Subtotal		$59,864,320	$375.79
Escalation	18.00%	$10,775,578	$67.64
TOTAL ESTIMATED CONSTRUCTION COST		**$70,639,898**	**$443.44**

Overall Building Area	159,301	gsf
Approximate Impacted Area:	159,301	gsf