

July 25, 2024

Monica Suua, Chief Financial Officer
Beach Cities Health District
1200 Del Amo Street
Redondo Beach, CA 90277

RE: 510 North Prospect Avenue
Seismic Evaluation & Conceptual Strengthening (24112.00)

Dear Monica:

Nabih Youssef Associates (NYA) have evaluated and developed conceptual seismic strengthening for the 3-story medical office building located at 510 North Prospect Avenue in Redondo Beach. NYA previously evaluated the building in January 2020 and provided recommendations to improve seismic performance to meet the Basic Performance Objective for Existing Buildings (BPOE), as defined by ASCE 41-17, a national standard for the Seismic Evaluation and Retrofit of Existing Buildings.

NYA was requested to develop a conceptual seismic strengthening approach with reduced scope – excluding foundation work and strengthening of existing walls – focused on reducing risk of the pre-cast concrete portion of the building. This letter summarizes the findings and recommendations of this effort.

Building Description

The building was originally constructed in 1976 and a north wing was added in 1979. The original building and addition are 3-stories tall and are seismically separated by a 2-inch wide joint. The original building and addition were designed to the 1973 edition of the Uniform Building Code (UBC).

The roof and floors of the original building are constructed of pre-stressed Spancrete planks with concrete topping slabs that span to pre-cast concrete beams and reinforced CMU walls. The beams are supported by pre-cast concrete columns that are continuous to the foundation. The foundation system consists of shallow spread footings. The reinforced CMU walls resist seismic forces.

The 1979 Addition is constructed of a wood framed plywood roof and metal deck with concrete fill floors supported by wide flange steel beams and reinforced CMU walls. The steel beams are supported by wide flange steel columns that are continuous to the foundation. The foundation consists of shallow spread footings and grade beams. The lateral system consists of CMU shear walls.

Building Code Assessment

The City of Redondo Beach does not currently have a mandatory seismic retrofit ordinance for buildings with reinforced masonry walls with stiff/rigid diaphragm. Thus, mandatory seismic upgrade would only be triggered for change of use or occupancy, or significant structural alteration/addition. Retrofit to mitigate identified deficiencies and reduce seismic risk would be considered elective.

Identified Structural Deficiencies

The use of pre-stressed hollow core concrete planks (Spancrete) with concrete topping slab to construct roof and floors of buildings was popular in the 1960's and 1970's. The concrete planks acted as forms for the reinforced concrete topping slab saving time during construction. However, these planks do not participate in resisting seismic forces and the concrete topping slab acts as a structural diaphragm to distribute seismic forces to the vertical elements of the lateral force resisting system, e.g. walls and frames.

The reinforced concrete topping slabs for the 510 Prospect building are 3-inch thick resulting in limited strength capacity. The topping slab to CMU wall connection consists of #4 bent dowels spaced at 24". The

connection does not develop the full shear strength of the reinforced topping slab. The diaphragms are unable to deliver the expected magnitude of seismic forces to the CMU walls due to the deficient topping slab to wall connections and absence of collector elements.

The building was evaluated for collapse prevention performance at three seismic hazard levels – BSE-2E (975-year), BSE-1N (475-year) and BSE-1E (225-year). The design response spectral accelerations for the BSE-1E, BSE-1N and BSE-2E seismic hazard levels for the site, assuming soil type D, is provided in Table 1.

Table 1 – Design Response Spectral Acceleration for BSE-1E, BSE-1N & BSE-2E

Spectral Acceleration	BSE-1E	BSE-1N	BSE-2E
S _{X5}	0.817g	1.253g	1.407g
S _{X1}	0.454g	0.765g	0.880g

Results indicate the topping slab to CMU wall connections are the weakest link in the seismic load path and the diaphragms are severely overstressed at all seismic hazard levels. The CMU walls are overstressed in shear at the BSE-1N and BSE-2E hazard levels.

Conceptual Strengthening

Two conceptual strengthening approaches were developed focused on mitigating the diaphragm/collector and topping slab to wall connection deficiencies. Alternate 1 achieves collapse prevention performance at the BSE-1E seismic hazard level. Alternate 2 mitigates the topping slab to wall connection deficiency, but not the diaphragm/collector deficiency and does not meet collapse prevention performance at the BSE-1E. The proposed strengthening is preliminary and is intended to identify representative scope for planning, coordination, and rough order of magnitude estimate of cost.

Alternate 1 consists of adding new steel angle collectors to the underside of the hollow core planks at the roof and floors. The angles are connected to the planks and topping slabs with through-bolts to facilitate force transfer. The steel angle collectors are welded to steel “connection” plates that are welded to steel “wall” plates that are anchored to the CMU walls with through bolts. Figure 1 shows the conceptual detail of the steel angle collector to wall connection. Plan sketches and additional details of the approach are shown in Appendix A.

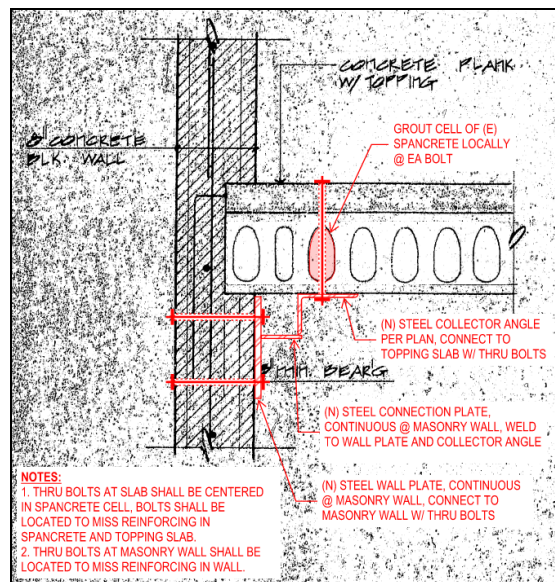


Figure 1 – Steel Collector to Wall Connection

The through bolts are offset from the CMU walls to avoid the adjacent light gauge metal stud walls and need to be centered in the hollow voids of the planks to avoid the pre-stressed tendons.

Alternate 2 consists of epoxying Fiber Reinforced Polymer (FRP) sheets to the topping slab and CMU wall and connecting the sheets to the walls and slab with FRP anchors. Figure 2 shows the conceptual detail of the FRP slab to wall connection. Plan sketches of the approach are shown in Appendix B.

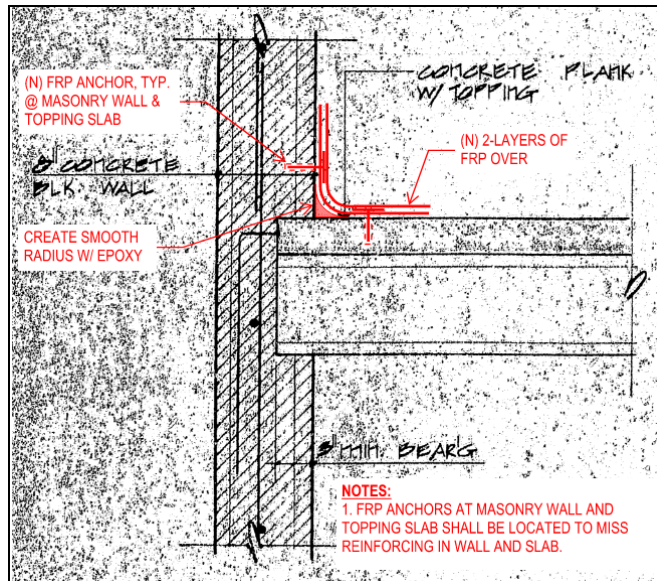


Figure 2 – FRP Slab to Wall Connection

Table 2 shows the average and maximum demand-to-capacity ratios (DCR) for the CMU shear walls, roof and floor diaphragms and topping slab to wall connections based on collapse prevention performance at the various seismic hazard levels for the existing, Alternate 1 and Alternate 2 conditions. DCR values less than or equal to 1.0 indicate acceptable performance. The reduction in DCR values from BSE-2E to BSE-1E hazard level is due to decreased seismic demand.

Table 2 – Demand-to-Capacity Ratio

		BSE-2E		BSE-1N		BSE-1E	
		Max DCR	Ave DCR	Max DCR	Ave DCR	Max DCR	Ave DCR
Existing	Shear walls	1.70	0.84	1.48	0.73	0.96	0.47
	Diaphragms	7.11	2.06	6.33	1.83	4.11	1.19
	Connections	10.67	3.09	9.50	2.75	6.18	1.79
Alternate 1	Shear walls	1.70	0.84	1.48	0.73	0.96	0.47
	Diaphragms	1.15	1.07	1.03	0.95	0.67	0.62
	Connections	1.72	1.60	1.53	1.42	1.00	0.93
Alternate 2	Shear walls	1.70	0.84	1.48	0.73	0.96	0.47
	Diaphragms	7.11	2.06	6.33	1.83	4.11	1.19
	Connections	7.11	2.06	6.33	1.83	4.11	1.19
*DCR's based on Collapse Prevention performance objective							
*Alternate 1 complies with BSE-1E at Collapse Prevention							
*Alternate 2 improves max DCR by 33%							

Alternate 2 is provided as a reduced scope more cost effective approach that improves the topping slab to wall connection deficiency, but does not fully mitigate it. Alternate 1 provides a minimum level of structural seismic resistance and is the recommended approach.

Sincerely,

NABIH YOUSSEF & ASSOCIATES “NYA”

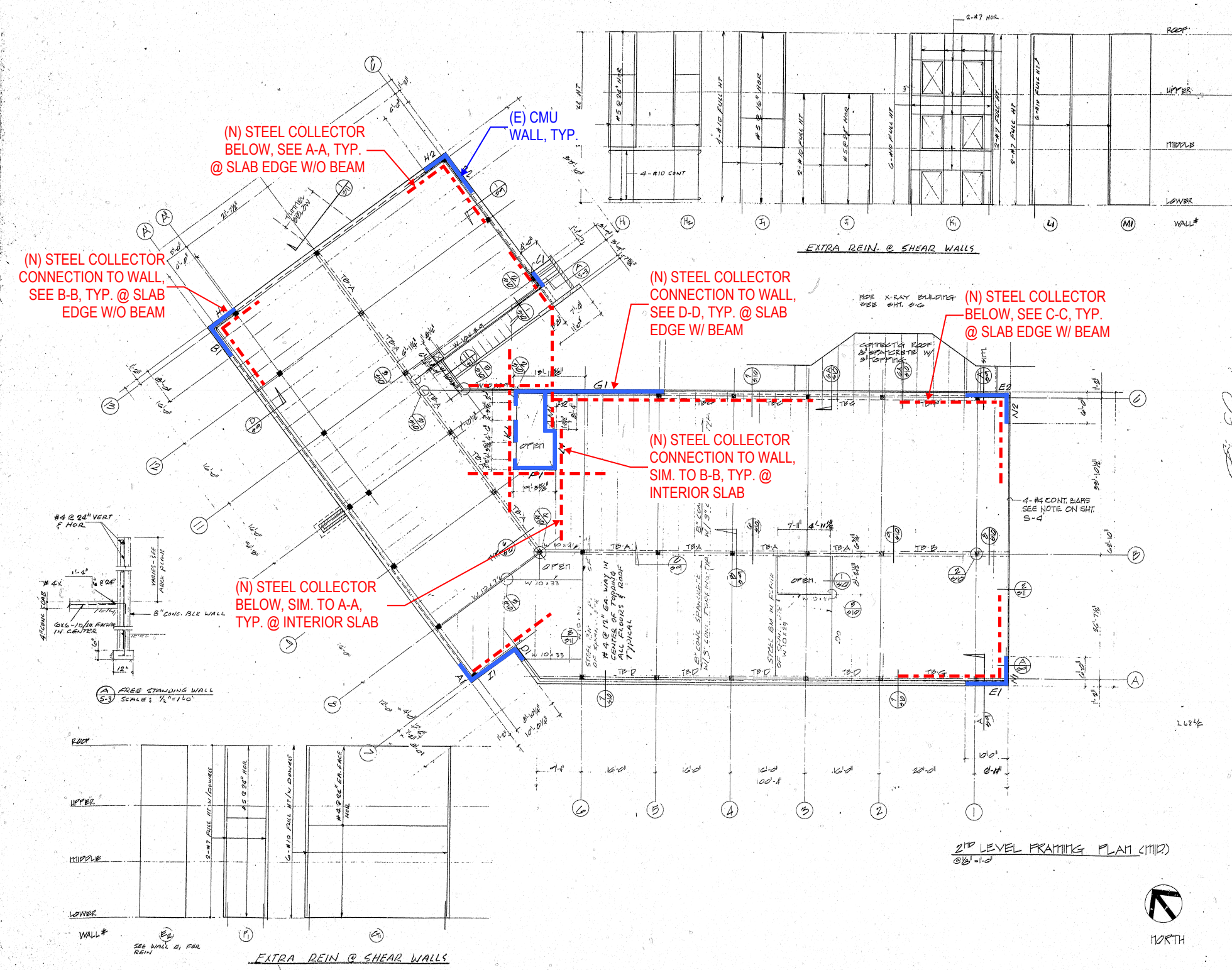



Owen Hata
Principal

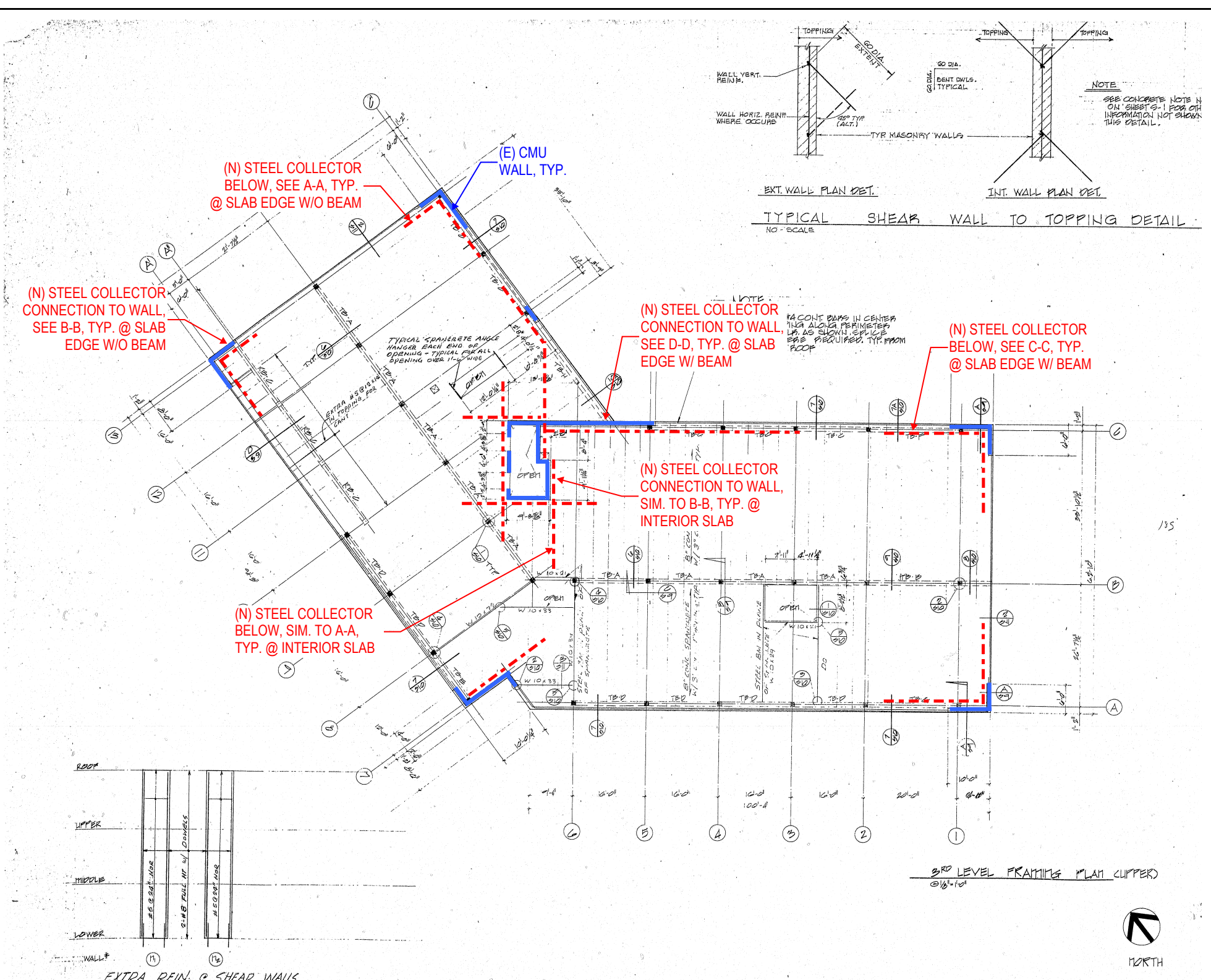
Cc: J. Reser, S. Stewart


Appendix A

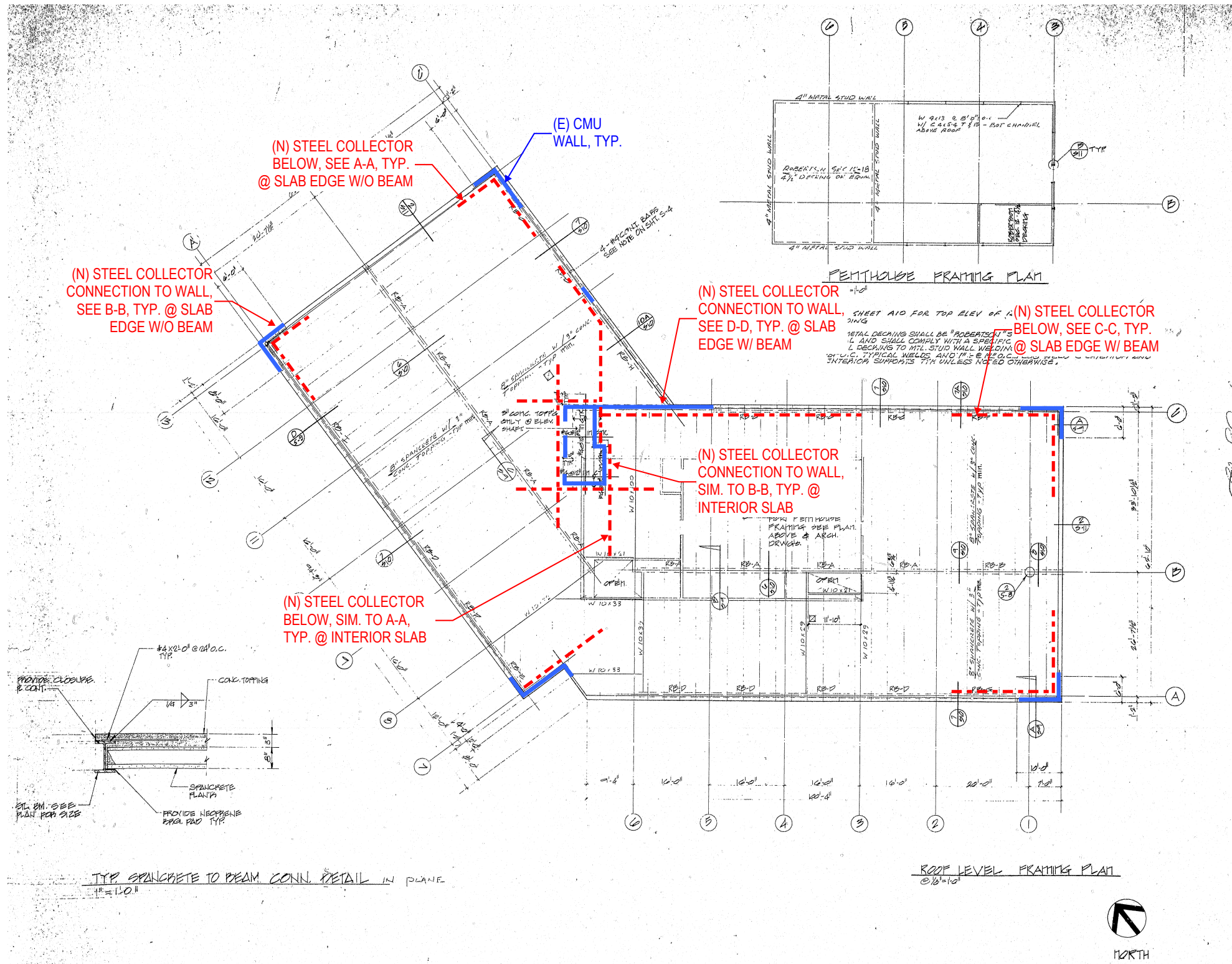
SKETCHES FOR ALT 1




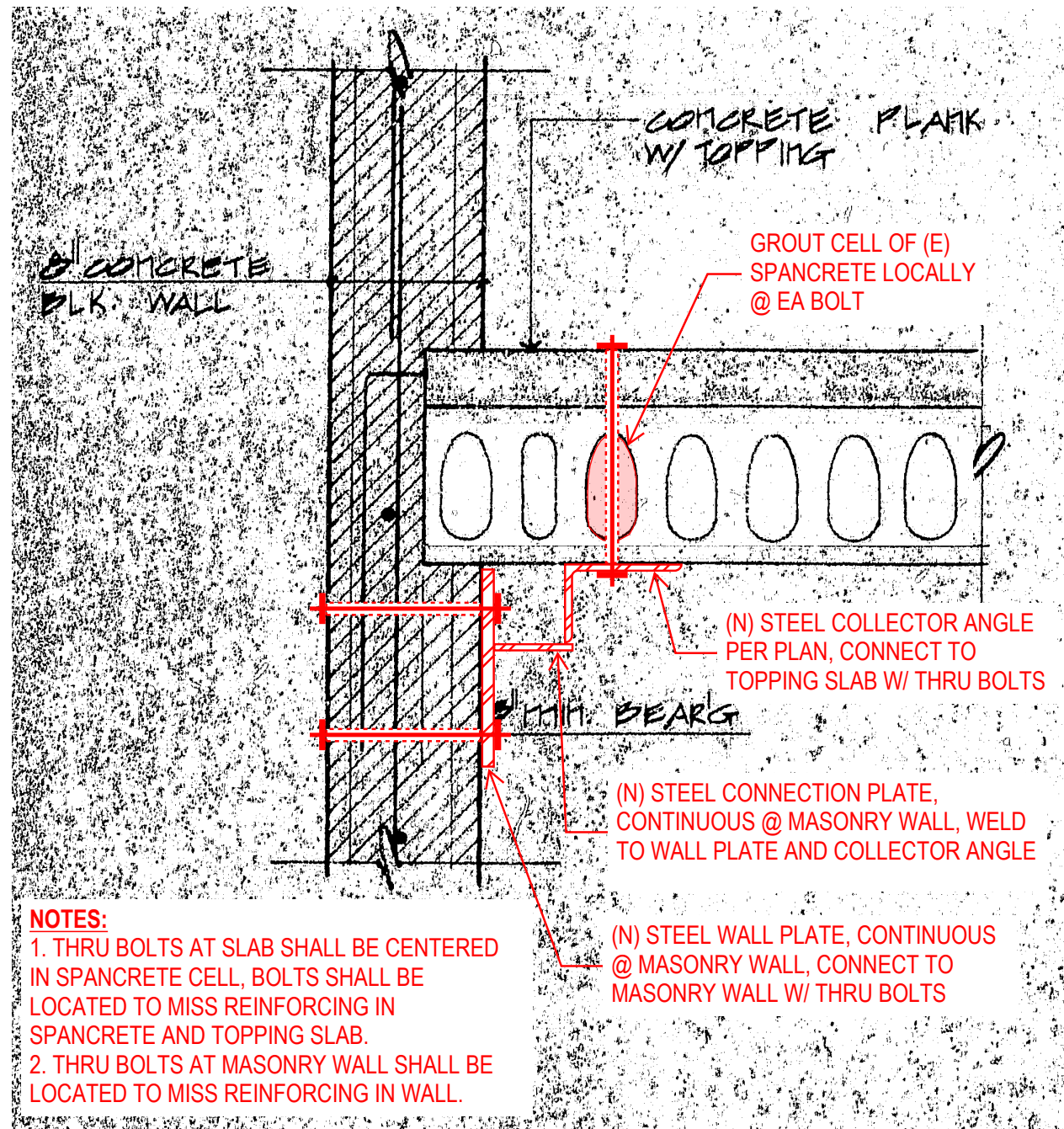
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Project: 510 N. Prospect Redondo Beach, CA	 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District		Job No. 24112.00	Rev. No. --	Sketch No. S-01



Title: 3rd Floor Strengthening - ALT 1		Scale: N.T.S.		
Project: 510 N. Prospect Redondo Beach, CA	 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District		Job No. 24112.00	Rev. No. --	Sketch No. S-02



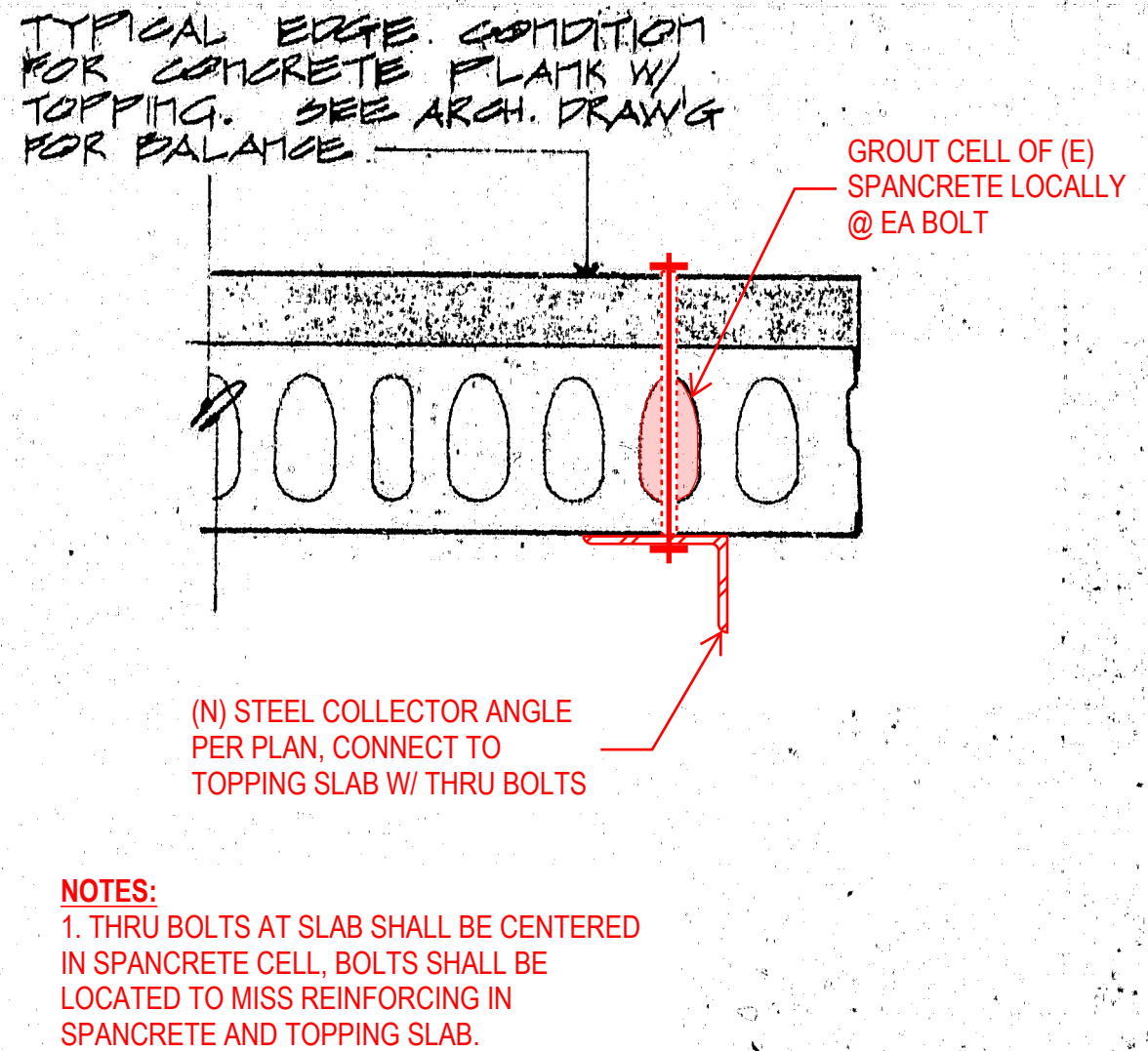
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Project: 510 N. Prospect Redondo Beach, CA	 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District		Job No. 24112.00	Rev. No. --	Sketch No. S-03



(N) COLLECTOR TO WALL CONNECTION

N.T.S.

B-B
S-04

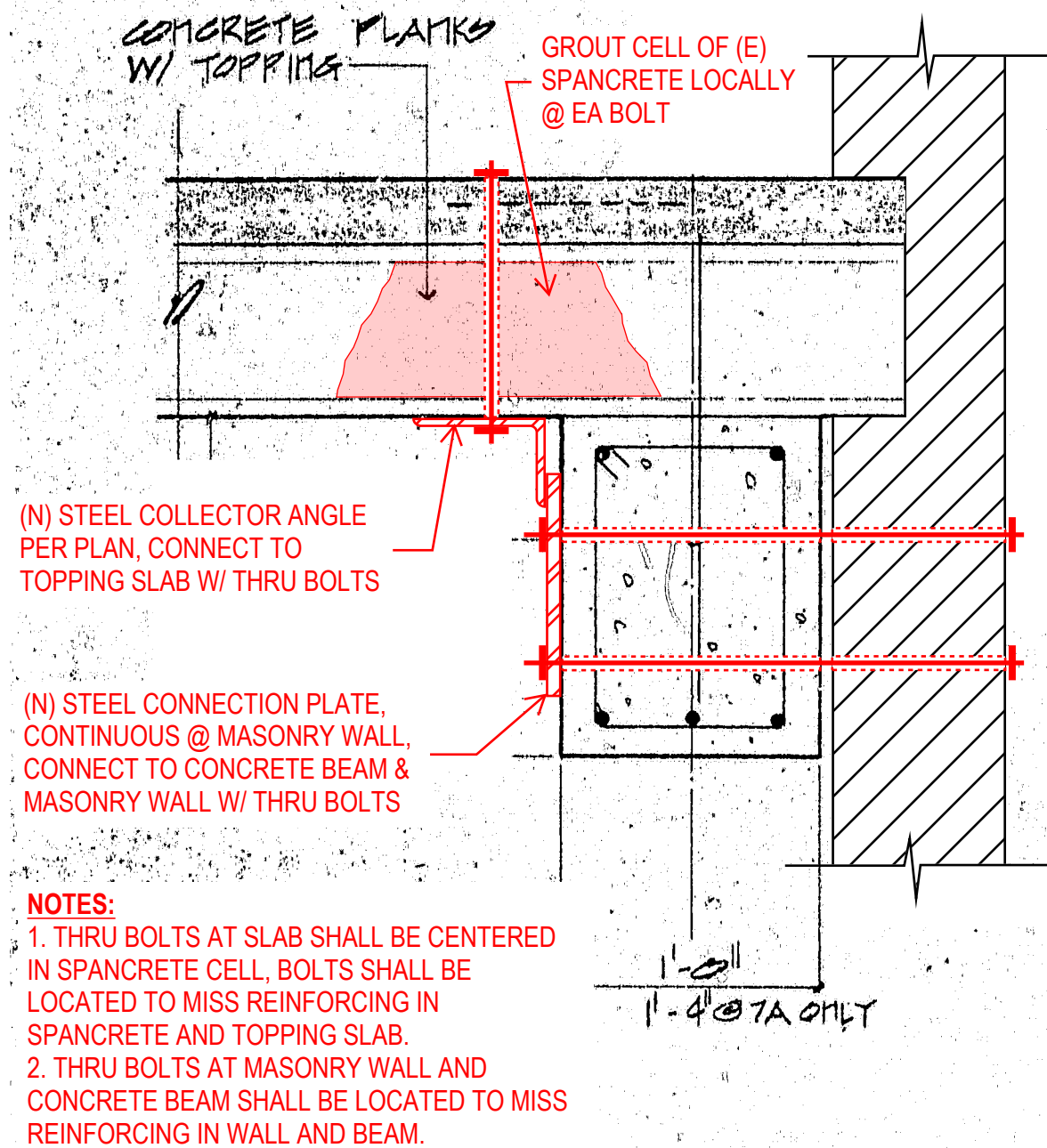


(N) STEEL ANGLE COLLECTOR

N.T.S.

A-A
S-04

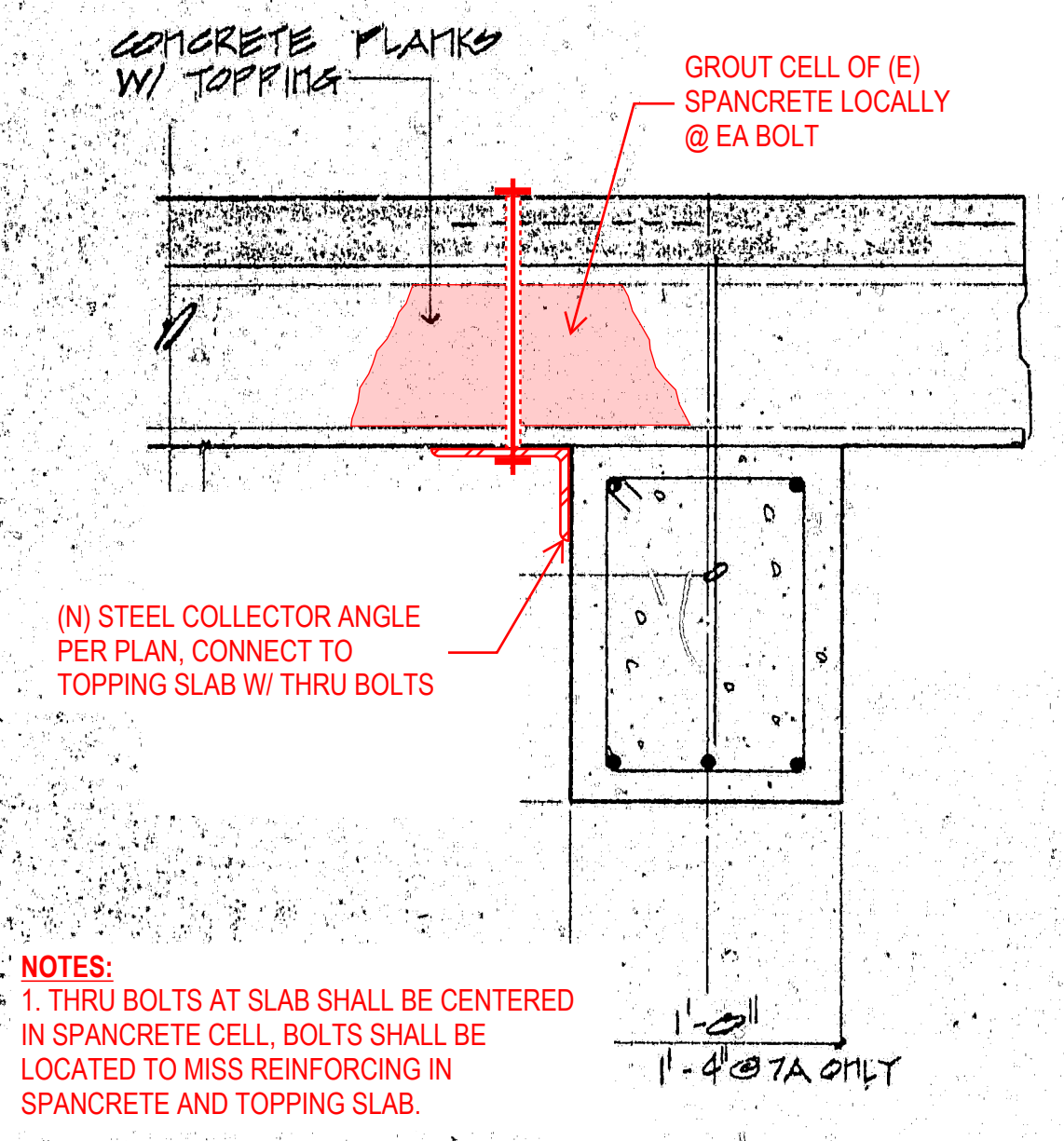
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Project: 510 N. Prospect Redondo Beach, CA	 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District		Job No. 24112.00	Rev. No. --	Sketch No. S-04



(N) COLLECTOR TO WALL CONNECTION

N.T.S.


D-D
S-05



(N) STEEL ANGLE COLLECTOR AT BEAM

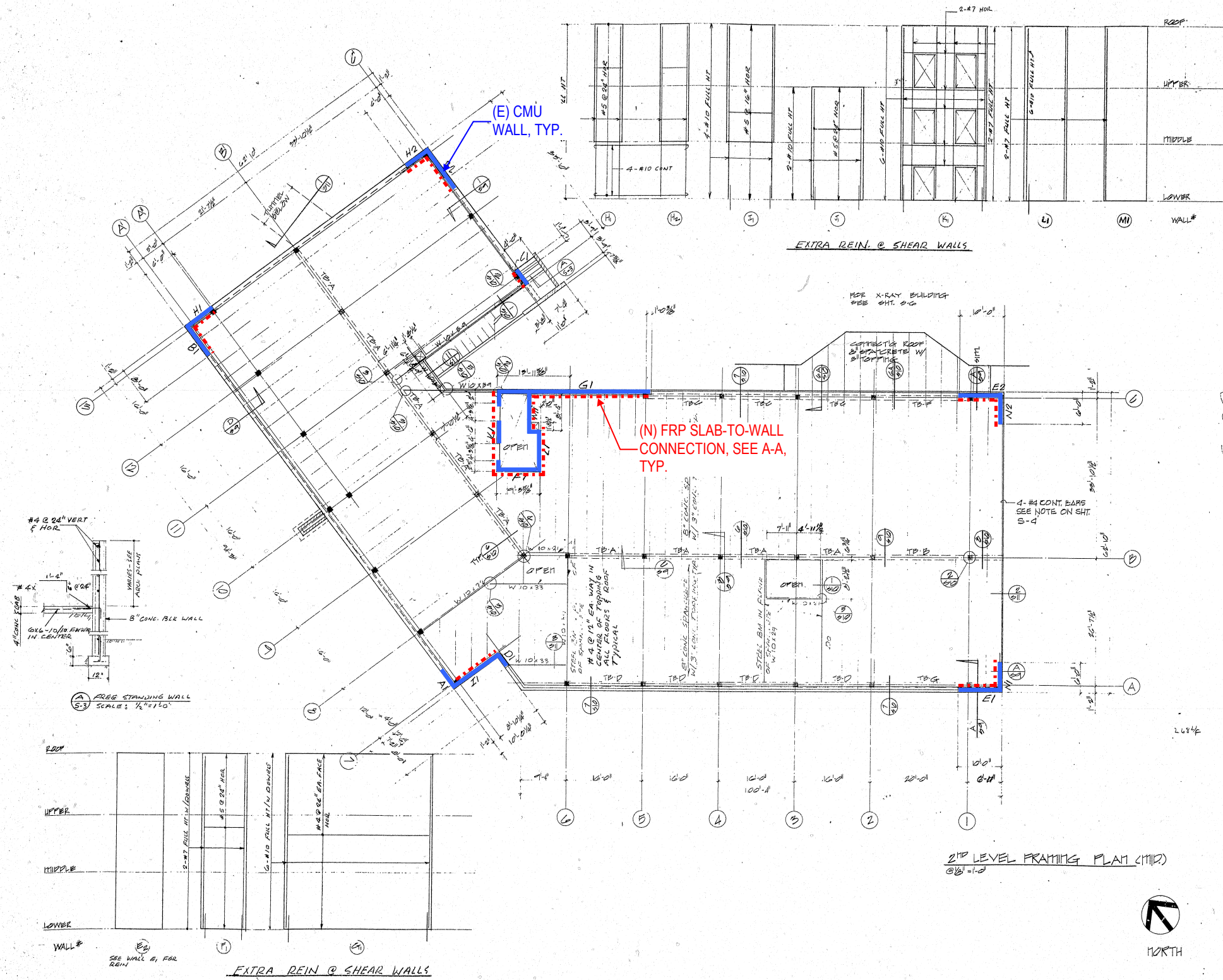
N.T.S.

C-C
S-05

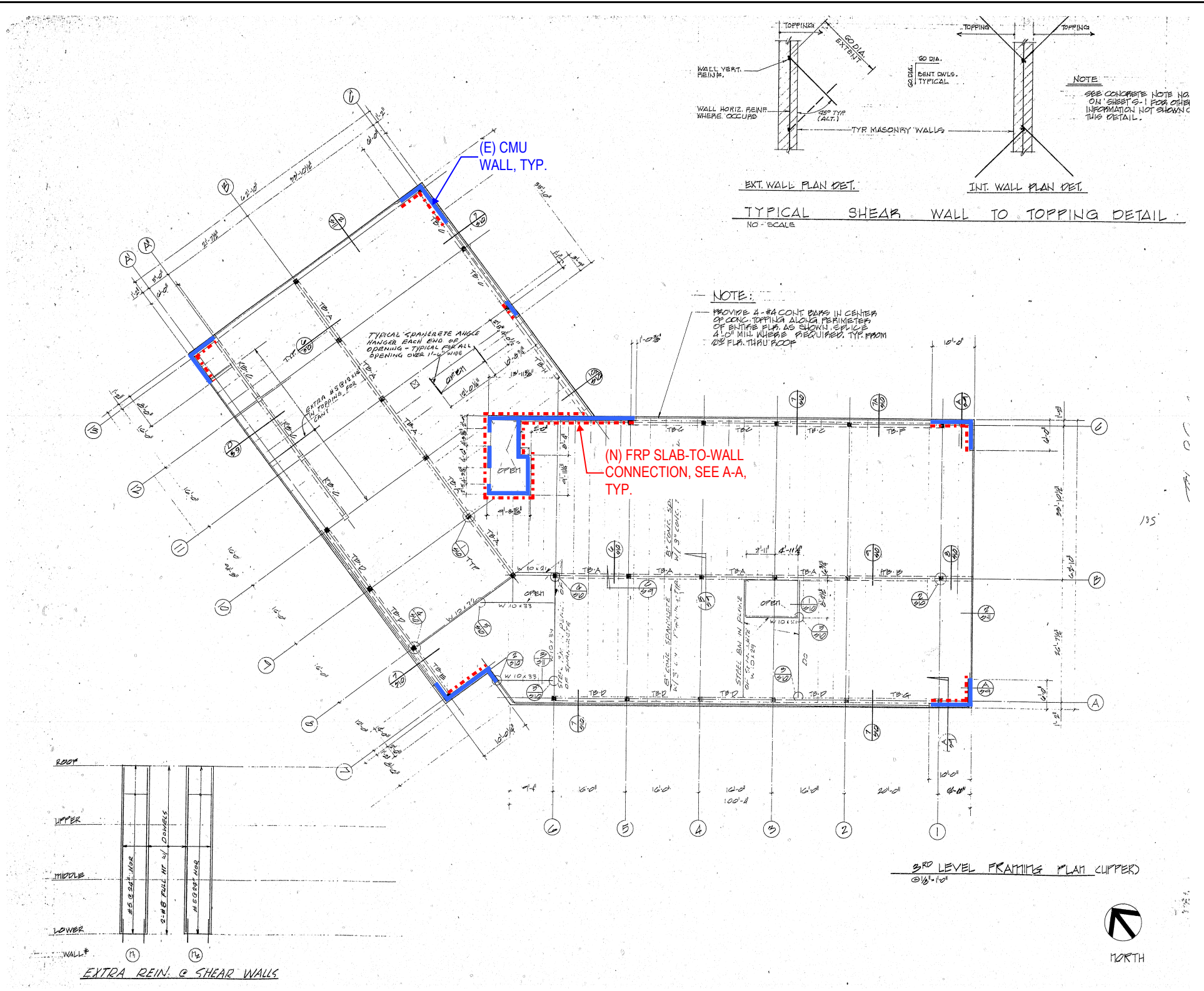
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Project: 510 N. Prospect Redondo Beach, CA	 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District		Job No. 24112.00	Rev. No. --	Sketch No. S-05


Appendix B

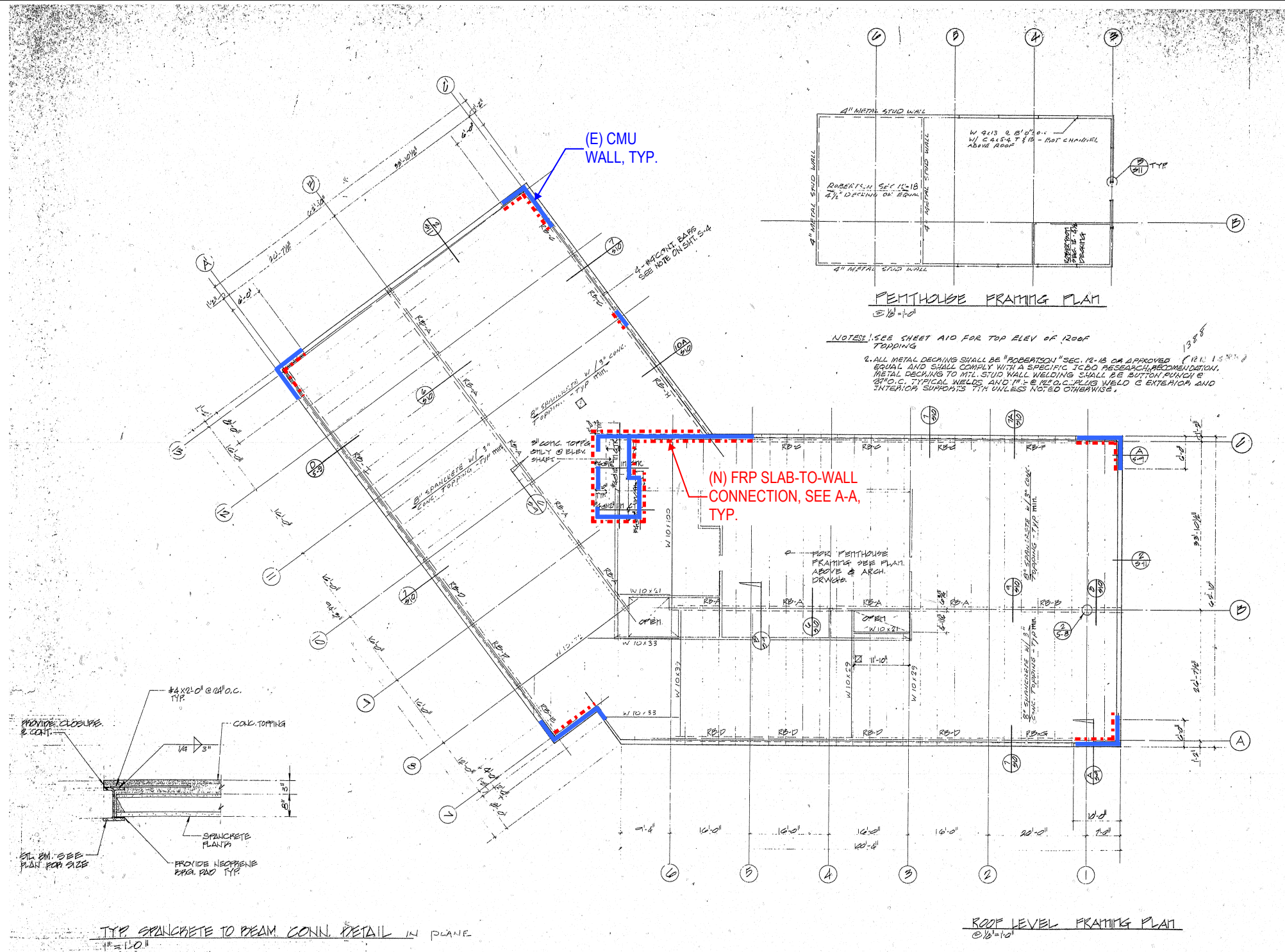
SKETCHES FOR ALT 2




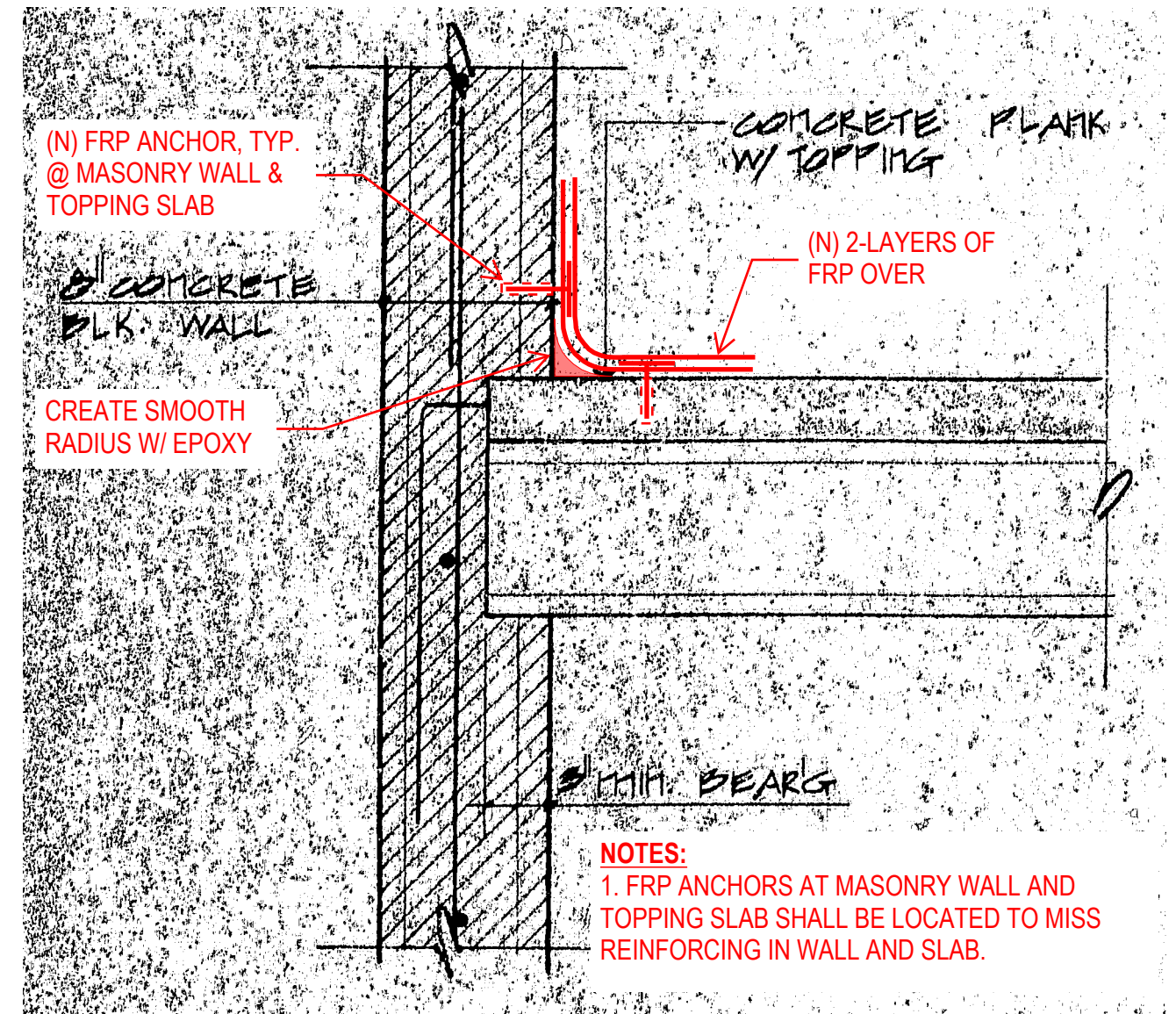
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Project: 510 N. Prospect Redondo Beach, CA		 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District			Job No. 24112.00	Rev. No. --	Sketch No. S-01



Title: 3rd Floor Strengthening - ALT 2		Scale: N.T.S.		
Project: 510 N. Prospect Redondo Beach, CA	 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District		Job No. 24112.00	Rev. No. --	Sketch No. S-02




Title: Roof Strengthening - ALT 2		Scale: N.T.S.		
Project: 510 N. Prospect Redondo Beach, CA	 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District		Job No. 24112.00	Rev. No. --	Sketch No. S-03



(N) FRP TOPPING SLAB TO WALL CONNECTION

N.T.S.

A-A
S-04

Title: Conceptual Strengthening Details - ALT 2		Scale: N.T.S.		
Project: 510 N. Prospect Redondo Beach, CA	 <p>NABIH YOUSSEF ASSOCIATES STRUCTURAL ENGINEERS 550 S. HOPE ST, SUITE 1700, LOS ANGELES, CA 90071 T: 213.362.0707 • F: 213.688.3099 • WWW.NYASE.COM LOS ANGELES • SAN FRANCISCO • ORANGE COUNTY • CHARLESTON</p>	Date: 7/25/2024	RFI No. --	DWG No.
Client: Beach Cities Health District		Job No. 24112.00	Rev. No. --	Sketch No. S-04