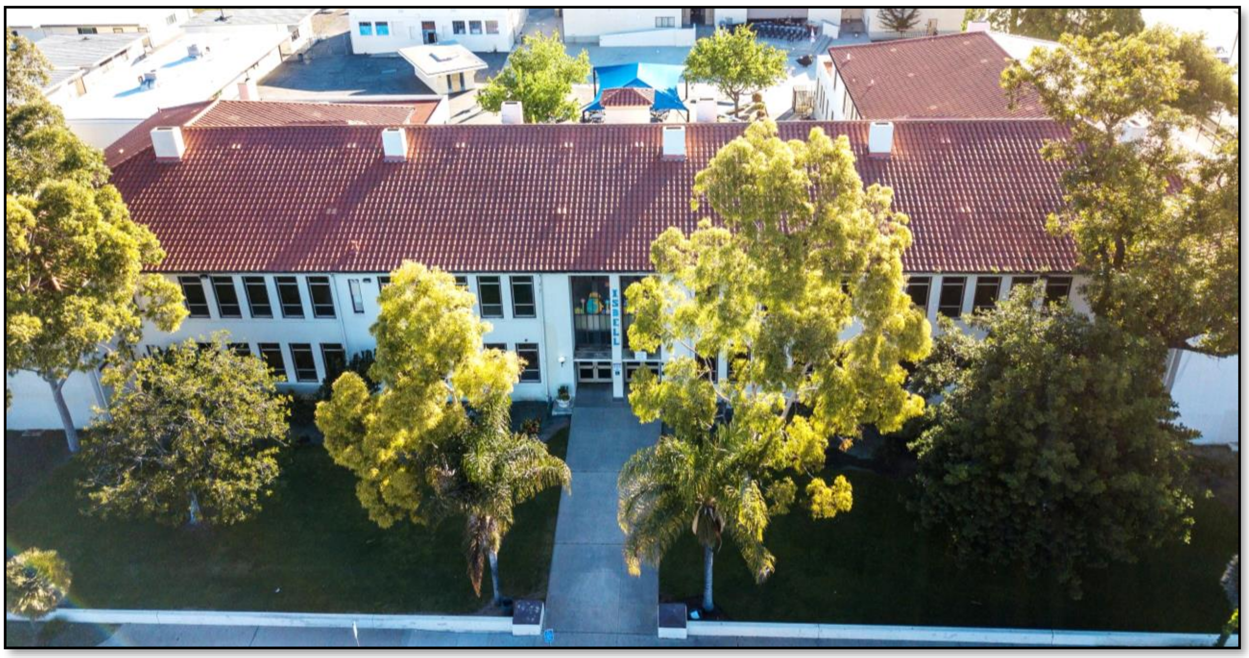
Seismic Evaluation & Conceptual Retrofit

Isbell Middle School - Building A

Dated: May 29, 2019



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Evaluation Team

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Executive Summary

Originally designed and constructed in 1925, prior to the 1933 Long Beach Earthquake, Building A on the Isbell Middle School Campus has been in service for nearly a century as a Classroom and Administration Building. Like many buildings of its time, before the Field Act created a statewide oversight on the construction of K-12 facilities with the creation of what is now known as the Division of State Architect (DSA), it was constructed with Unreinforced Masonry (URM). URM construction was desirable for several reasons including, thermal, fire resistance and availability of qualified labor. Unfortunately, as it turns out, none of those motives included seismic resistance.

After the Field Act became law, the building was identified as a dangerous construction type due to its similarities with several collapsed school buildings in the Los Angeles area during the Long Beach Earthquake. This prompted a reconstruction effort to begin in 1938 to assist in strengthening the building with techniques and knowledge available at that time. Since the reconstruction the building has undergone several updates, additions and modernizations, however none have addressed the seismic risk beyond the 1938 retrofit effort.

The Santa Paula Unified School District, knowing the construction type and history, has identified Building A on the Isbell Campus as a place for further structural evaluation. SSG Structural Engineers (SSG) was engaged to provide a complete Structural Evaluation of the subject building along with a targeted risk analysis. It is the desired outcome of the targeted risk analysis to provide the District with guidance on the difficult decision to rehabilitate or replace this Ventura County Historical Landmark.

A complete Tier 1 Seismic Evaluation of the existing building was completed per *ASCE 41-13 – Seismic Evaluation and Retrofit of Existing Buildings*. Through this process several structural deficiencies were identified, many of those deficiencies represent potentially significant safety risks in the event of a large, nearby earthquake. With these deficiencies in mind, as well as the need for a more robust lateral force resisting system, SSG created a conceptual retrofit design. The resulting engineers cost estimate based on the conceptual retrofit puts the Structural Retrofit costs around $10.7-million with associated upgrades to Access and Fire Life-Safety increasing that number to potentially between $15-million to $18-million.

The targeted risk analysis was completed using industry recognized tools, specifically HAZUS, a program first developed by the Federal Emergency Management Agency (FEMA), and improvements to HAZUS developed by the California Office of Statewide Health Planning and Development, which is in charge of hospital construction in the state. Using these tools with building structural characteristics and deficiencies as input, the risk analysis estimated the collapse risk of the existing building compared to that of a newly designed structure. The analysis results in a range of approximately one to five years where the accumulated risk to occupants in the existing building would be similar to that of occupants of a new building over a presumed 50-year design life. This provides a window of time over which the building could be completely retrofit, taken out of service or demolished to stay within the typically accepted accumulation of risk of a new building from this point in time.

Available Building Documentation:

Documentation was gathered from several sources for this culminating seismic evaluation of Building A on the Isbell Middle School Campus. Construction Documents and some As-Built plans were available in hardcopy or electronic format from the extensive District archives. Plan records that were only available in hardcopy were scanned in wide format and returned to the District via their online digital plan room. The State Archives in Sacramento contained several hundred documents from the 1939 reconstruction efforts. These documents included change orders, DSA paperwork, memos, inspection reports, and bills of sale among others. These documents remain in the State Archives but were made available for viewing and digital replication scanning at the Los Angeles regional office of DSA. Below Table 2 includes the list of documentation referenced in preparing this report.

Table 2 - Building Documentation

Title (DSA App No.)	Prepared By	Dated
Original Construction Drawings	Roy C. Wilson Architect	February 1925
As-Built Drawings	T.C.W. & C (Chain)	February 1938
Reconstruction Drawings (A-2766)	Roy C. Wilson & Geoffry N. Lawford, Architects Manley W. Sahlberg, Structural Engineer	November 30, 1938
Various DSA Documents from Reconstruction (A-2838)	Various	1939
Main Building Additions & Alteration Drawings (A-14646)	Robert S. Raymond, Architect	1956
Reconstruction Project (A-49554)	James B. Tremaine Architecture John D. Oeltman Structural Engineers	November 5, 1988
Modernization Phase I (A03-104873)	BFGC Architecture	October 25, 2001
Modernization Phase II (A03-106753)	BFGC Architecture	March 24, 2003
Literacy Center Renovation (A03-118716)	Flewelling & Moody	July 12, 2018

Building History and Context

The original construction of Building A occurred in 1925 and it is currently designated as Ventura County Historical Landmark #143. The coastal town of Santa Paula was a much different place nearly 100 years ago. Founded in 1872, the town had been established for several decades when Building A construction began. Currently a part of the Isbell Middle School campus, this building had housed the entire Olive Mann Isbell School, which was named after the California teacher who is credited with creating the first public school in the State of California. The construction generally followed design and techniques common to the era and geographic region.

Several events have affected the main building on Isbell Middle School's campus. The first beginning at nearly midnight on March 12, 1928 when the St. Francis Dam outside of Santa Clarita, California failed, and subsequently destroyed a good portion of the town of Santa Paula. Flooded by an approximately two-mile-wide wall of water it is expected that the building on campus was within the zone of influence. At the time of the dam failure there was no flood prevention berm around the school property. There was a berm added in 1939, which has since been removed almost in its entirety, but it is true nonetheless that the building survived this man-made disaster. Ultimately this event led to many changes in regulation of the practice of engineering, beginning with licensing qualified individuals to practice in 1929. Prior to this event the State of California only licensed practicing Land Surveyors. (Wikipedia Contributors, 2019)

On March 10, 1933 at almost 6:00 PM PST a 6.4M earthquake occurred just off the southern California coast near Long Beach. The damage was extensive across the region. This major event brought into sharp focus the need for codified design requirements for earthquake resistance in all buildings, especially those on school campuses. It was the infamous Field Act of 1933 that brought this as a first of its kind requirement in the United States. The significant portion of the Field Act related to the building under consideration is the creation of the Office of the State Architect (now known as the Division of the State Architect, or DSA). (Wikipedia Contributors, 2019)

Building A on the Isbell campus was constructed with unreinforced masonry bearing wall (URM) systems, the exact systems found to perform exceptionally poor in the 1933 Long Beach earthquake. Around 1937 this construction type was formally identified by the Office of the State Architect as potentially dangerous and required retrofit of all URM structures at public schools. In 1939 with funding and support from President Franklin D. Roosevelt's New Deal, these mitigation measures were constructed and are still in place today. Without these upgrades, it is possible that the building would have sustained significant damage from seismic events during its lifetime, including the 1952 Kern County earthquake.

As with most school buildings over the course of their service life, they undergo several modernization, additions and alterations. Building A at Isbell is no exception, it has seen DSA-certified changes in 1956, 1988, 2001, 2003 and 2018. These alterations did not include any upgrades to the existing lateral systems beyond the original 1939 retrofit effort.

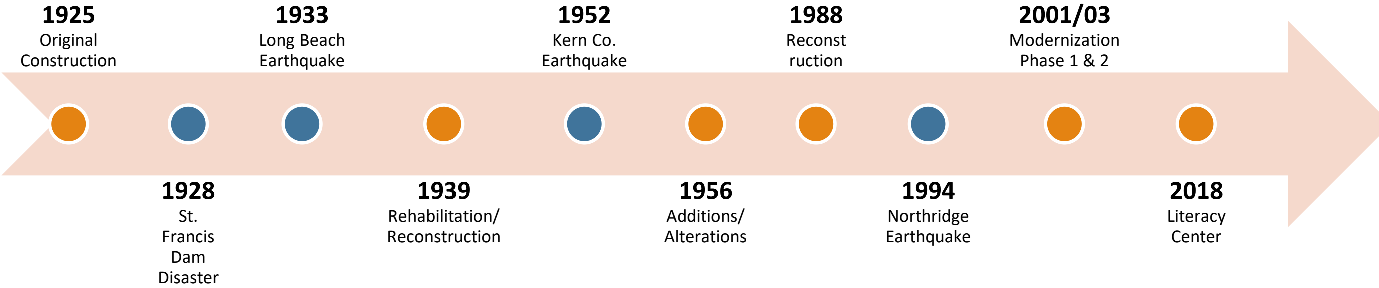

Figure 1 - Building A Timeline of Significant Events

As the building approaches its 100th birthday, it remains in service as a classroom and administration building. It has been through a myriad of both man-made and geologic events, even beyond those significant events noted. It's useful life to first the Santa Paula Elementary School District and now the Santa Paula Unified School District as a major cog in the wheel of student life is without a doubt remarkable. It stands as a testament to those craftspeople, inspectors, Architects and Engineers who spent time with this spectacular piece of history.

Figure 2 - Isbell Middle School Building A - c. 1930 (Nelson & Harris, S.E., 2009)

Project Overview

Purpose

The purpose of this report is to determine the remaining useful life in terms of Risk when compared to that of a comparable hypothetical new code-compliant building.

General Building Information

Building A is an existing two-story structure on the Isbell Middle School campus of the Santa Paula School District. It contains 24 classrooms as well as campus administration offices. An overhead view of the developed portion of the Isbell Middle School Campus is included in Figure 3 (Google, 2019). The structural elements of the building were primarily constructed of common materials for the time period. Materials include those identified in Table 3.

Table 3 - Materials of Construction

Structural Element	Material of Construction
Exterior Bearing Walls	Cast-in-place reinforced concrete
First Floor Interior Bearing Walls	Unreinforced masonry with reinforced gunite
Second Floor Interior Bearing Walls	Wood stud walls
Main and Lower Roofs	Timber Stick Framed
Second Floor	Concrete over steel joists
First Floor	1x sheathing over wood joists with concrete over steel joists in corridor
Foundation	Concrete continuous and spread footings

Physical Address:	221 South 4th Street Santa Paula, CA 93060	
Latitude, Longitude:	34.3491 N, -119.0669 W	
Approximate Building Area:	First Floor:	22,600 square feet
	Second Floor:	18,700 square feet
	Total:	41,300 square feet

Figure 3 - Overhead View of Isbell Middle School Campus (Google, 2019)

Evaluation Criteria

This structure was evaluated with ASCE 41-13 Tier 1 checklists (American Society of Civil Engineers, 2013), which require information gathering using several sources and as well as a site visit. The checklists are a tool to assist with providing seismic evaluation of existing structures in a thorough manner that will easily translate to conceptual retrofit. Documentation used by the team for Tier 1 checklists is provided in Table 2 and the References section of this report, while the checklists can be found in Appendix A.

Performance Objective

Building performance is a measure of how well a structure supports the needs of its users immediately after a disaster event. The Basic Performance Objective for Existing Buildings (BPOE) is the assignment of those performance expectations to the structure. Using ASCE 41-13 and a Risk Category of III, the minimum BPOE for this evaluation requires Tier 1 checklists for the *Life Safety* objective. When a structure is evaluated for *Life Safety*, the checks involved concern preservation of human life only. Because the Building A houses hundreds of students and is a Historical Landmark, it is appropriate to evaluate the structure to a higher BPOE. ASCE 41-13 Tier 1 checklists for the *Immediate Occupancy* objective were

thusly implemented. Structures evaluated for *Immediate Occupancy* should be operable immediately after a disaster event and the checklists are more comprehensive than that of *Life Safety* BPOE.
When the evaluation moves to Tier 2 and 3 phases, the minimum ASCE 41-13 objective for Building A will be defined as *Damage Control* BPOE. This objective defined as between *Life Safety* and *Immediate Occupancy*, however there are no associated Tier 1 checklists for this BPOE, therefore checklists for the higher *Immediate Occupancy* BPOE are utilized.

Targeted Risk Analysis

In addition to identifying specific structural deficiencies with respect to life safety and immediate occupancy, SSG and Reis Consulting estimated the life safety risk of the building relative to that of a new building designed to current requirements of the California Building Code. This was accomplished using the program HAZUS, developed by the Federal Emergency Management Agency, and refined by the California Office of Statewide Health Planning and Development (OSHPD) to prioritize the seismic retrofit of the state's hospitals based on their expected collapse probability.

Using the HAZUS and OSHPD process, we are able to estimate the probability of collapse of a building built to current code standards and a building with structural deficiencies such as those identified in this study. We can estimate the number of years that the existing building can remain unretrofitted before it accumulates the same risk as a new building, providing SPUSD with an approximate window of time in which retrofitting or replacing the building places the occupants at a similar risk as being in a new building over a life of 50 years.

Soils and Seismicity

Soils

The latest geotechnical and geohazards report for the Isbell campus was completed on November 15, 2016 (Earth Systems Southern California, 2016). It was assembled for the seismic rehabilitation of the Shower and Locker Building, which was a project that used ASCE 41 Tier 3 retrofit guidelines as well as the 2013 California Building Code for new elements. This report gives the following parameters in Table 4:

Table 4 - Soils Design Information

Soil Site Class	Sesimic Design Catergory (SDC)
D	E

Seismicity

The spectral response parameters from the United States Geological Society (USGS) used in the Tier 1 checks are included in Table 5: (California Building Standards Commission, 2016)

Table 5 - Spectral Response Values

Spectral Response, *2016 CBC*	
S_S = 2.810g	S_1 = 1.113g
S_{DS} = 1.873g	S_{D1} = 1.113g
Spectral Response, *ASCE 41-13*	
$S_{S, BSE-1N}$ = 2.810g	$S_{1, BSE-1N}$ = 1.113g
$S_{xs, BSE-1N}$ = 1.873g	$S_{X1, BSE-1N}$ = 1.113g
$S_{S, BSE-1E}$ = 0.996g	$S_{1, BSE-1E}$ = 0.361g
$S_{xs, BSE-1E}$ = 1.097g	$S_{X1, BSE-1E}$ = 0.606g
$S_{S, BSE-2E}$ = 2.137g	$S_{1, BSE-2E}$ = 0.812g
$S_{xs, BSE-2E}$ = 1.218g	$S_{X1, BSE-2E}$ = 1.218g

Based on the values in Table 5, Isbell Middle School is in a location with a *High* level of seismicity according to ASCE 41-13.

Geohazards

Geohazards reports for the Isbell Middle School Campus were completed by Earth Systems Southern California on June 19, 2015 (Earth Systems Southern California, 2015) and November 15, 2016 (Earth Systems Southern California, 2016). They have previously been reviewed and approved by the California Geological Survey (CGS).

The ASCE 41-13 Tier 1 Basic Checklist investigates three distinct geologic site hazards: liquefaction, slope failure, and surface fault rupture. On this site, only liquefaction exceeds the ASCE 41-13 compliance threshold. Liquefaction is investigated in the geohazards reports by Earth Systems. In their evaluation of the site, they conclude that the risk of ground surface damage from liquefaction-related soils failure is low, but that differential settlement is likely.

The report investigates other geohazards that should be noted because of their importance to DSA and the District. Specifically, seismic shaking is included in DSA PR 08-03 as a line item based on ground acceleration and flooding is a major concern in this area.

- Seismic Shaking – The Geohazards Report states that “The school site, like any other site in the region, is subject to relatively severe ground shaking in the event of a maximum earthquake on a nearby fault.” Seismic shaking is mitigated through the use of appropriate ground acceleration values and code requirements for the Design Category. This hazard is of course the main purpose of the evaluation under consideration for the purpose of this report.
- Flooding – FEMA Flood Zone A99 (FEMA, 2010). This FEMA flood zone has not had a flood elevation set; the City of Santa Paula is currently working on this issue. Flood protection for this structure was included as a part of the 1939 Rehabilitation, and the perimeter flood wall remains today on the west side of the building. The rest of the structure is not protected at this time. At the time of future retrofit work, flood mitigation must be incorporated into the design. DSA procedure PR 14-01 should be followed, including Section 1.3 “Establishment of Flood Hazard in Areas Where Flood Elevations are Undetermined”.

Building Description

Building A was originally constructed in 1925 with URM exterior and interior bearing walls, a wood-framed roof and wood partition walls. The second floor was concrete over metal lath and steel joists. The first floor was a mix of steel joists and wood joists and the building was supported by conventional concrete foundations.

The 1939 rehabilitation of Building A incorporated several changes to the structure that remain today. All exterior walls at the ground level and most of the exterior walls at the second level are reinforced concrete. Second floor walls at corridor ends are typically reinforced gunite shot on 2x wood stud walls, while the rest of the corridor is wood shear walls with a few 1x diagonal braces. First floor corridor walls are a combination URM with reinforced gunite system, see Figure 4.

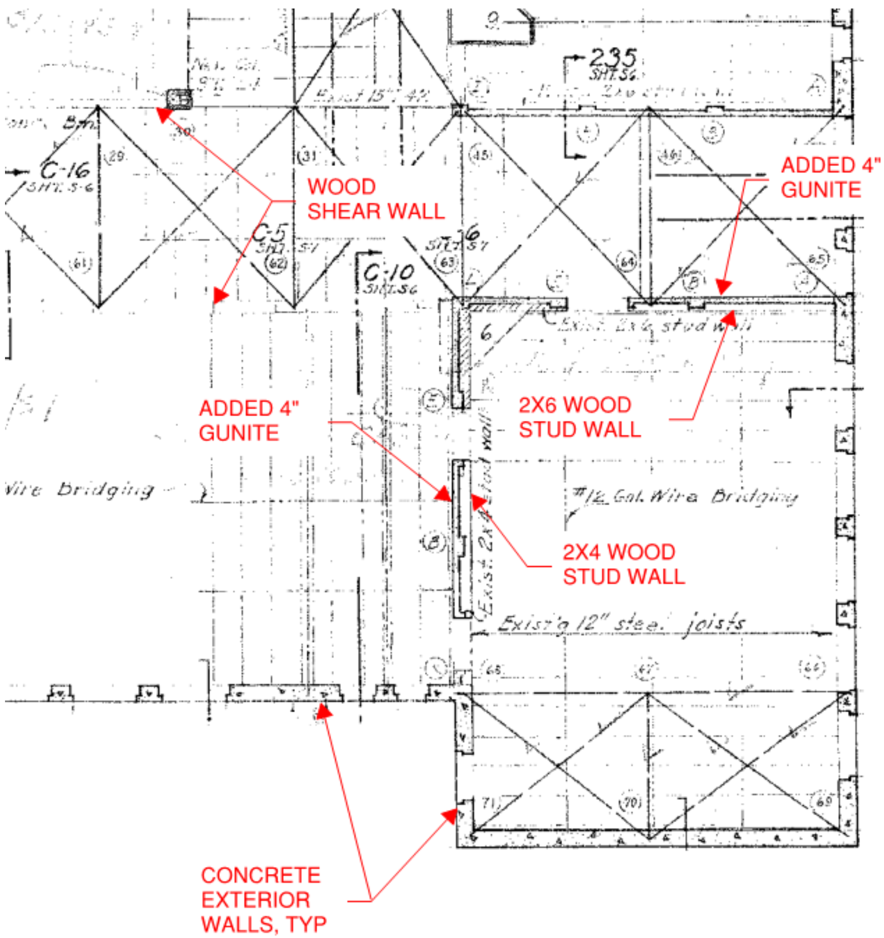

Figure 4 - Second Floor Partial Framing Plan - Sheet S-3 of 1939 Rehabilitation Set

The original straight-sheathed 1x6 roof diaphragm remains and is supplemented by a steel and wood strut and bracing system at the second-floor ceiling level, see Figure 5. The second floor is strengthened in a similar manner.

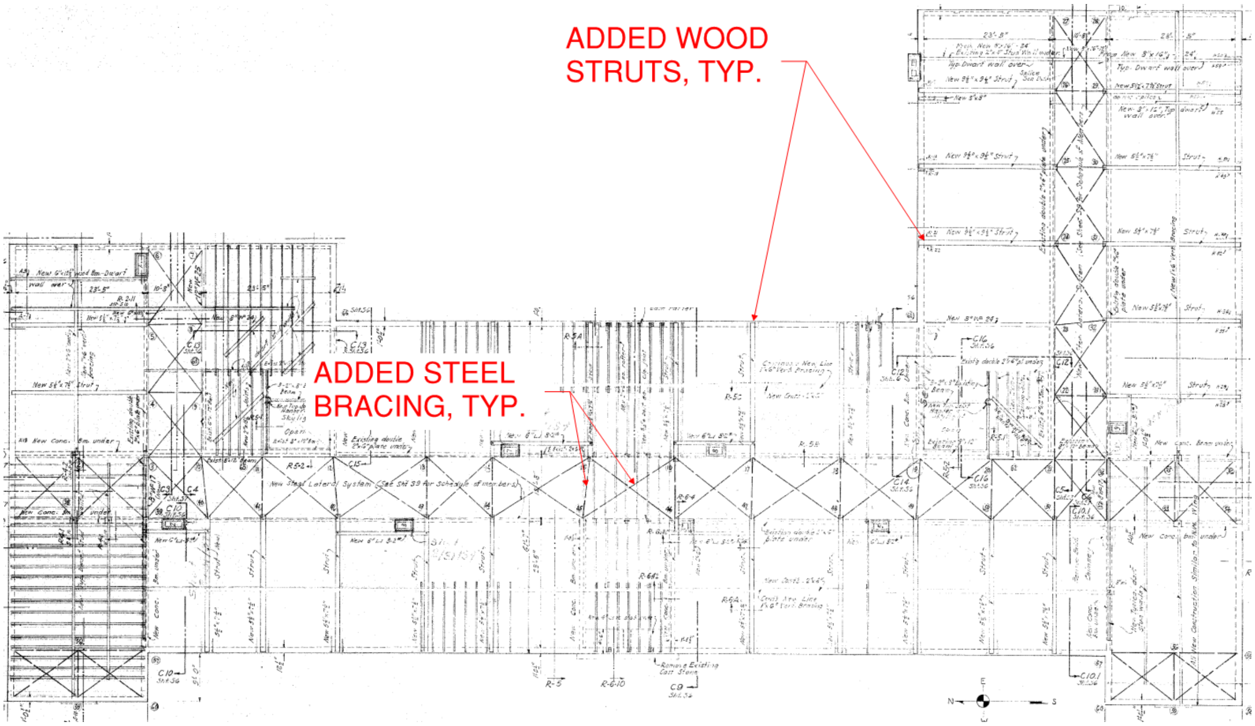

Figure 5 - Second Floor Ceiling Framing Plan - Sheet S-4 of 1939 Rehabilitation Set

Gravity Load Resisting System

The gravity system at the roof is 1x6 straight wood sheathing over 2x8 rafter framing with 2x6 bottom chords that also serve as ceiling joists. The rafters are anchored to the top of the concrete exterior walls and bear on the wood corridor walls. The second-floor gravity loads are supported by 2-inches of plain concrete over 24-gage HyRib metal lath. 16-gage, 12-inch steel joists support the lath and concrete system. At perimeter walls, the joists were welded to the wall reinforcement and cast in place. At interior corridor walls, the joists bear on top of the walls. The first floor is a raised floor system, with 1x6 diagonal sheathing over 2x10 joists in the classroom and administration areas and 3.5-inches of concrete over steel joists in the corridors.

Exterior walls are 12.5-inches of reinforced concrete full height. Interior walls at the second floor vary between wood stud bearing walls and reinforced gunite over wood stud walls. Interior walls at the first floor are 4-inches of reinforced gunite over 8.5-inch URM. The foundation system is conventional, with continuous and spread concrete footings with no evidence of connecting grade beams, see Figure 6.

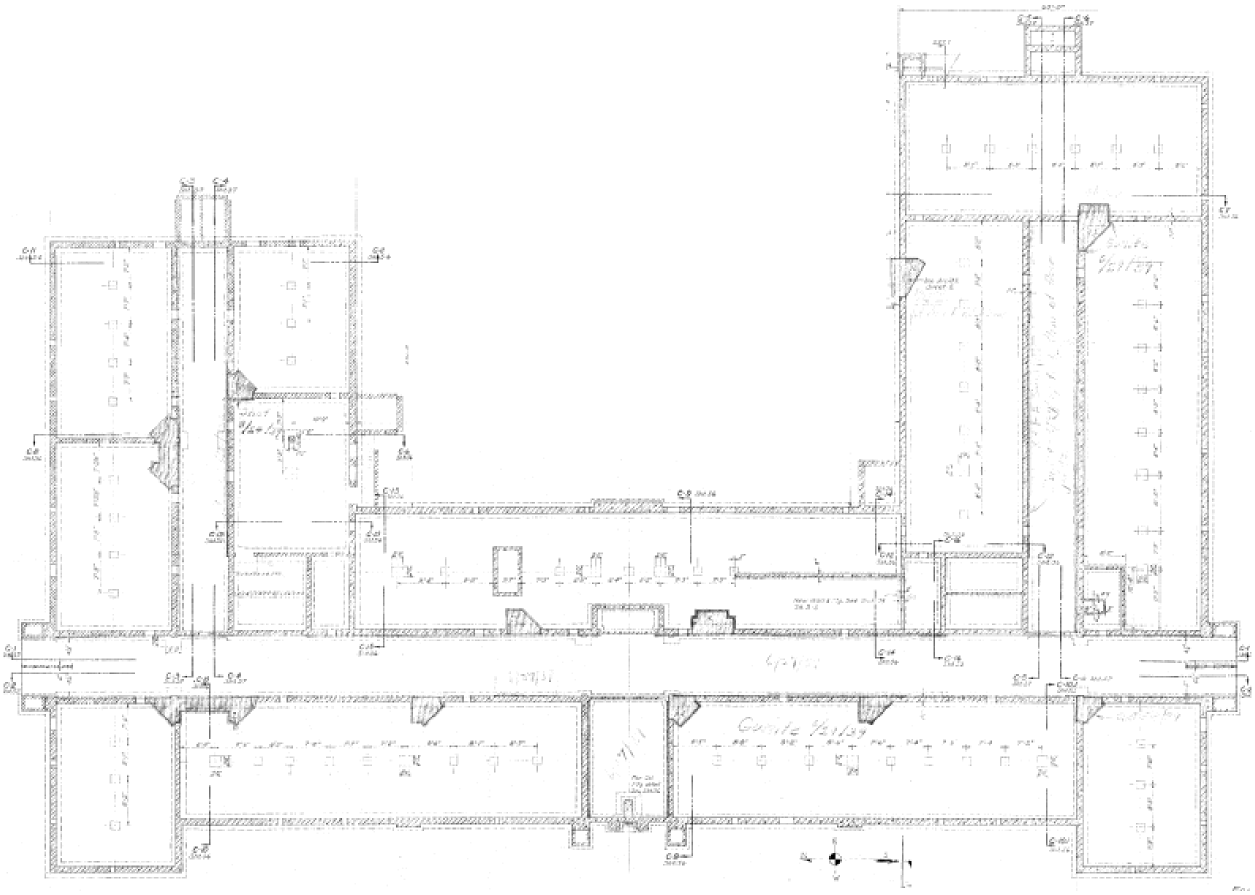

Figure 6 - Foundation Plan, Sheet S-1 of 1939 Rehabilitation Set

Lateral Load Resisting System

The roof diaphragm system is 1x6 straight sheathing over the rafters and with wood struts to steel braces over the corridors. The strut and bracing system serves to transfer out-of-plane diaphragm loads to shear walls below. The main shear walls at the second level are reinforced gunite walls at the ends of corridors. The rehabilitation also included application of 1x6 diagonal bracing to wood corridor walls in the attic (Figure 7) and at the second floor.

The second-floor diaphragm is 2-inches of concrete over metal lath. The steel bracing system serves to transfer the diaphragm loads to the shear walls. Most of the shear walls are along the interior corridors and consist of 4-inches of reinforced gunite over 8.5-inches of URM. Although the exterior walls are reinforced concrete, they cannot resist lateral loads effectively due to extensive window and door openings.

Figure 7 - Added 1x6 Braces Over Corridor Walls in Attic

Structural Evaluation

SSG and Reis Consulting conducted an on-site investigation of the Isbell Middle School Building A structure on February 2, 2019. The team had access to several areas of the structure, including the entire attic, second level staff room (Room 218), first level science classroom and storage closets (Rooms 107, 108 and 109), as well as the basement level under the boy's restroom. The south rooms of the south east wing were under construction for a new Literacy Center (Room 130) and some areas of framing were exposed at the time of the visit.

Existing Conditions

At the time of the site observation, the condition of the structure was considered good given its age, history and use. In general, it was observed to conform to a majority of the plans and details for the 1939 structural rehabilitation. The roof sheathing showed some signs of water intrusion and limited dryrot (Figure 8). Concrete in the basement level has several cracked locations. These are minorly displaced out of plane (Figure 9).

Figure 8 - Evidence of Water Intrusion in Attic

Figure 9 - Crack in Basement Wall

Tier 1 Deficiencies

Deficiencies listed below are representative of the non-compliant items found with the Tier 1 reports. See Appendix A for more information.

Wall Anchorage (16.1IO, 16.10IO, 16.16IO)

Wall anchors do exist at the roof and the second floor. Where framing is perpendicular to the concrete walls, it is generally anchored at every joist or every other rafter. Where framing is parallel to the concrete walls, anchor points are infrequent. For example, the NW and SW exterior walls are anchored in the middle of the wall length in one location. This anchor needs to resist 12.5-feet of out-of-plane forces, and does not have adequate strength to resist the ASCE 41-13 Quick Check forces. See Figure 10.

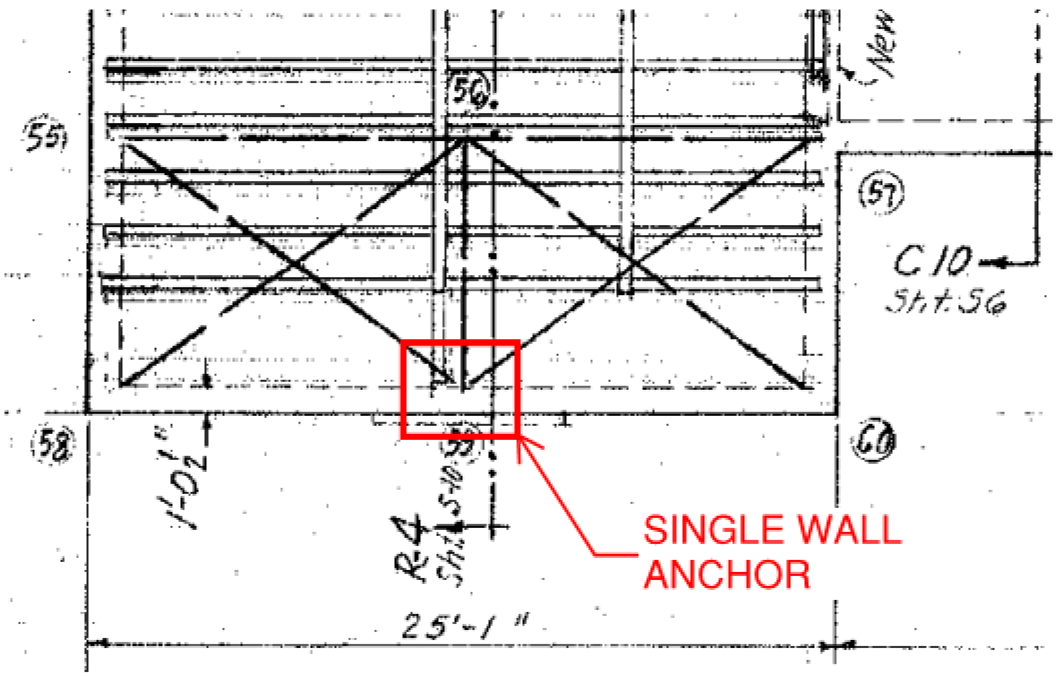

Figure 10 - Floor Framing in NW Corner of Structure

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Adjacent Buildings (16.1IO)

Tier 1 requires that adjacent structures have a gap between them equal to at least 4% of the height of the shorter building. The elevator building adjacent to Building A is just over 26-feet tall. The gap between the buildings is 6-inches. 4% of 26-feet is about 11.5-inches. Since 6-inches is less than 11.5-inches, this item is non-compliant.

Liquefaction (16.1IO)

Liquefiable soils are not allowed within the first fifty feet of foundation soils under the building. According to the geohazards report by Earth Systems (Earth Systems Southern California, 2015), liquefiable soils exist between 45-feet and 50-feet in a different area on this site. The soil layers are relatively uniform across the site, and it has been assumed that liquefaction may occur under Building A.

Ties Between Foundation Elements (16.1IO)

Foundation systems in Site Class D soils should have ties between foundation elements if a slab on grade or other restraints are not present. There are no grade beams between long foundation elements supporting Building A.

Foundation Dowels (16.10IO)

This check requires that all vertical wall reinforcement continue to the footing supporting the wall. The dowels provided at gunite wall locations are equal to about half of the wall reinforcement and do not meet this requirement.

Deflection Compatibility (16.10IO)

Secondary components of the lateral system are required to have the shear capacity to develop the flexural strength of the component. The column ties in the gunite and concrete walls are spaced at 6-inches or 8-inches on center, and do not meet these requirements.

Coupling Beams (16.10IO)

There are no coupling beams within Building A. Concrete beams over exits are detailed as a “collar beam” with limited longitudinal reinforcement and ties.

Confinement Reinforcing (16.10IO)

Confinement reinforcement assists with resisting large compression forces at the ends of shear walls and within columns that are part of a lateral force resisting system. Details from the Rehabilitation plans show that there is not enough confinement reinforcement within columns and shear walls.

Shear Stress Check (16.10IO, 16.16IO)

ASCE 41 Tier 1 checks give maximum shear stress values for concrete (gunite) and URM. The Tier 1 check compares the maximum shear stress value to the calculated shear stress in any shear wall. SSG examined two cases:

1. Existing URM and gunite walls work together in a seismic event. This is how the structure would behave with no retrofit
2. Gunite resists all loads; URM has no seismic load capacity. This is how DSA requires the structure to be designed

Both cases failed the check. In the first case, the shear stress in the URM is greater than the Tier 1 minimum but the shear stress in the gunite is acceptable. In the second case, the shear stress in the gunite is greater than the Tier 1 minimum.

Masonry Layup (16.16IO)

The quality of the original construction is such that voids can be seen in the collar joints, which makes this item non-compliant, see Figure 11.

Figure 11 - Collar Joint at Door to Room 125

Openings at Shear Walls (16.10IO, 16.16IO)

Diaphragm openings adjacent to shear walls are allowed to be 15% or less of the total shear wall length. Stair openings in the main wing are 15-feet long and located next to 76-foot shear walls, which is approximately 20% the wall length.

Plan Irregularities (16.10IO, 16.16IO)

Plan sheet S-2, S-3, and S-4 do not show any specific diaphragm strengthening in the two re-entrant corner areas.

Diaphragm Reinforcement at Openings (16.16IO)

The stair opening widths in the N-S direction are greater than 50% of the diaphragm width. No extra reinforcement appears to be present around the opening. Diaphragm concrete is not reinforced with rebar or wire mesh. The added diaphragm system does not address this opening.

Straight Sheathing (16.10IO, 16.16IO)

Straight 1x6 sheathing was specified to be removed in the rehabilitation plans, but can be observed in the attic (see Photo 1).

Spans (16.10IO, 16.16IO)

Roof diaphragm is sheathed with 1x6 straight sheathing and spans more than the 12-feet allowed in Tier 1.

Stiffness of Wall Anchors (16.16IO)

Wall anchors must engage with less than ⅛-inch of movement in the structure. Since the added struts are made up of a wood and steel bolt configuration, it has been assumed that the structure is not rigid enough to be compliant.

Tier 1 Unknown Information

The unknown item listed below is the only unknown item found with the Tier 1 reports. See Appendix A for more information.

Transfer to Shear Walls (16.10IO)

The method of shear load transfer to the second-floor diaphragm at parallel framing conditions is unknown. There is no rehabilitation detail to address this condition, nor was this connection observed in the field.

Targeted Risk Analysis Results

In addition to identifying specific structural deficiencies with respect to life safety and immediate occupancy, SSG and Reis Consulting estimated the life safety risk of the building relative to that of a new building designed to current requirements of the California Building Code. This was accomplished using the program HAZUS, developed by the Federal Emergency Management Agency. HAZUS estimates the probability of collapse of a building under earthquake forces based on the building's age of construction, height, location and structural system. In 2010, the California Office of Statewide Health Planning and Development (OSHPD) developed a process by which the probability of collapse using HAZUS could be refined based on the presence of specific major deficiencies. This process has been used to prioritize the seismic retrofit of the state's hospitals based on their expected collapse probability. Both HAZUS and OSHPD's refinement contain uncertainties, as any estimate of the performance of a structure in a future earthquake would, but the process has been widely used as a way to provide an estimate of life safety risk for the purposes of prioritizing retrofit or replacement.

Generally, a code designed building is evaluated with respect to the intensity of an earthquake that occurs on average about every 500 years. Over an assumed 50 year building life, that typically assumed in today's building codes, there would be approximately a 10% chance that an earthquake with this intensity or larger would occur. Using the HAZUS and OSHPD process, we are able to estimate the probability of collapse of a building built to current code standards when subject to an earthquake with this intensity level.

We are also able to estimate the collapse probability of a building with structural deficiencies such as those identified above through the ASCE 41-13 Tier 1 analysis. Under the same code level (500 year or 10% in 50 year) shaking a building with significant deficiencies would expect to have a higher collapse probability.

To establish a meaningful comparison of the risk between the existing building and the building as it would be assumed to perform if it were retrofitted to comply with current codes, we can use the collapse probability of a new building under the 10% in 50-year event shaking as an assumed level of "acceptable" risk. Using that probability, we can estimate the number of years that the existing building can remain unretrofitted before it accumulates the same risk. This provides SPUSD with an approximate window of time in which retrofitting or replacing the building places the occupants at a similar risk as being in a new building over a life of 50 years.

The deficiencies identified in the Tier 1 assessment above that are considered particularly significant with respect to the probability of collapse are:

- Wall to Roof Anchorage
- Deflection Incompatibility

In addition to these deficiencies, the age of the building and the fact that the properties of the existing materials are unknown at this point, may add to its risk.

Based on these characteristics, we estimate that the building will accumulate a similar amount of risk of collapse as a new building would in 50 years in approximately one to five years.

Recommendations

Conceptual Structural Retrofit Scheme

A graphical representation of the proposed structural retrofit scheme is presented in Appendix B. Below is a list of the major highlights of that proposed scheme as outlined and included in the Engineer's Estimate of Probable Cost.

- Roof diaphragm - remove second level ceiling plaster and install steel truss diaphragm at the underside of ceiling joists
- Second floor diaphragm - remove existing steel bracing, connect to walls for out-of-plane and in-plane forces where framing runs parallel, install new steel truss diaphragm
- Upper shear walls - add 6-inch shotcrete shear walls where noted on the plans
- Lower shear walls - add 6-inch shotcrete shear walls where noted on the plans
- Footings - tie footings together with grade beams and enlarge as needed to accommodate gravity and lateral load cases
- Exposed URM - remove unreinforced masonry that is not bound by shotcrete or gunite on each face. This occurs primarily at the stairwells
- Establish a testing and data collection program based on ASCE 41 and DSA requirements

Conceptual Nonstructural Retrofit Scheme

- Remove and reinstall roof tile to secure it to roof sheathing in a code-compliant manner with copper wire and properly sized anchors
- Update acoustical ceiling systems, which at a minimum includes adding wire ties and compression struts as needed so that ceiling grid meets current code for gravity and lateral design
- Review all non-structural components attached to the building (water heaters, HVAC equipment, etc.) and brace to structure in proper manner
- Review all non-structural components that connect the 1988 elevator building to Building A. Provide utility connections capable of withstanding seismic movement

Additional Recommendations

- Remove the fireplaces and associated chimneys where feasible and patch floors and ceilings accordingly
- Pursue final designation of flood plain elevation and seek funding to add protection either for the whole campus or specific buildings

Engineers Estimate of Probable Cost

The cost provided in this report is an engineer's estimate, and as such, is limited in scope. It is not intended to replace a construction estimate or statement of probable cost completed by a professional estimator.

An effective method of understanding construction costs is to use an established estimating and comparison scheme. California's Office of Public-School Construction (OPSC) has one such procedure defined through the Seismic Mitigation Program. This program requires a construction cost estimate compiled with data from Saylor Cost Manuals. The total cost estimate is then compared to the annually-adjusted replacement cost published by OPSC. This is the method used in this report.

Replacement Cost

The 2019 OPSC Replacement Cost of Isbell Middle School Building A is $16.9-million, and a breakdown of that estimate is given in Table 6.

Table 6 - 2019 OPSC Replacement Cost Breakdown

Area Type	Area	OPSC	Replacement Cost
Restrooms	*1,273 sf*	*$717 / sf*	*$912,741*
All Other	*40,027 sf*	*$398 / sf*	*$15,930,746*
Total	***41,300 sf***	**-**	***$16,843,487***

Structural Retrofit Cost

As presented in Appendix C, an engineer's estimate of the structural retrofit work using the Saylor Remodeling/Repair Construction Costs and Saylor Current Construction Costs manuals is $10.7-million including a 25% contingency and cost escalation allowance on construction cost.

This estimate does not include currently unknown scope for Access upgrades, Fire Life Safety upgrades, flood upgrades, mechanical upgrades, energy upgrades or other modernizations. While it is difficult to assess costs for scopes that are undefined at this point in time, a rough order of magnitude for seismic strengthening projects to include the minimum requirements for Accessibly and Fire and Life Safety is approximately 1 to 1. Meaning that based on prior projects to include minimum upgrades and patch and repair work, the complete retrofit project is estimated between $15-million and $18-million. It should be noted that many factors can contribute to this number, including building age, previous upgrades, construction climate and overall economy health. At the low end of the estimate, the retrofit effort would far exceed the 50% threshold for replacement per DSA Procedure 08-03, should Seismic Mitigation Program funds be sought. [$15M/$16.9M = 89% > 50%] While this is not yet an official number, it's a good indication that reaching a 50% threshold with OPSC concurrence is conceivable.

The District's in-progress FEMA grant application through the California Office of Emergency Services requires a professional Statement of Probable Cost to be prepared. This will further refine the validity and accuracy of the Structural Retrofit estimate. This information was not available at the time of this report.

Statement and Exclusions

This evaluation includes only the review of the subject building. It does not include and specifically excludes, destructive investigation of the existing building, testing of any nature (either destructive or non-destructive), and detailed specific inspection of the subject property outside the limits of the included descriptions contained herein.

Results of this analysis and opinions expressed are based on examination of the documentation available and the visible observations at the project site on February 2, 2019. We believe our observations and interpretations are within the current applicable engineering techniques and principles practiced in California.

Exclusions:

- Accessibility Survey or Findings
- Review of Fire Life Safety Items, Including Fire Alarm Components
- Mechanical Systems Review
- Electrical Systems Review
- Information Technology Systems Review
- Facilities Condition Assessment of Non-Structural items
- Technical Review of Previous Structural Assessments
- Energy Compliance Review or Assessments
- Items not specifically outlined in the body of this report

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Appendix Contents

Project Name Isbell Building A
Project Number S19042

ASCE 41-13 Tier 1 Checklists

FIRM:	SSG Structural Engineering, LLP
PROJECT NAME:	Isbell Building A
SEISMICITY LEVEL:	High
PROJECT NUMBER:	S19042
COMPLETED BY:	Jessica Napier, SE
DATE COMPLETED:	April 29, 2019
REVIEWED BY:	Evan Reis, SE
REVIEW DATE:	May 3, 2019

NONCOMPLIANT ITEMS:
WALL ANCHORAGE
ADJACENT BUILDINGS
LIQUEFACTION
TIES BETWEEN FOUNDATION ELEMENTS

UNKNOWN ITEMS:
NONE

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

16.1 Basic Checklist

Very Low Seismicity

Structural Components

RATING				DESCRIPTION	COMMENTS
C ☒	NC ☐	N/A ☐	U ☐	LOAD PATH: The structure shall contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	Full lateral load path, although components may be undersized.
C ☐	NC ☒	N/A ☐	U ☐	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	Anchors do exist. Where floor framing is parallel to walls, anchor points are infrequent. For example, the NW and SW exterior walls are anchored in the middle of the wall length in one location. This anchor needs to resist 12.5-ft of out-of-plane forces.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

16.1.2IO Immediate Occupancy Basic Configuration Checklist

Very Low Seismicity

Building System

General

C	NC	N/A	U	DESCRIPTION	COMMENTS
☒	☐	☐	☐	LOAD PATH: The structure shall contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	There is full lateral load path, although components may be undersized.
☐	☒	☐	☐	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement need not apply for the following building types: W1, W1A, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)	Elevator Building height = 23.875-ft at top of roof adjacent to Building A- Building A height at eave = 26.375ft 4% of Elevator Building ht = 11.5-in separation = 6-in 6-in < 11.5-in, therefore this seperation is non-compliant
☐	☐	☒	☐	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)	No interior mezzanines

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name: Isbell Building A
Project Number: S19042

Building Configuration

RATING				DESCRIPTION	COMMENTS
C ☒	NC ☐	N/A ☐	U ☐	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction shall not be less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)	First story is much stronger in each direction, due to gunite/URM shear walls in corridors at this level. Corridor walls at the second level are wood shear walls.
C ☒	NC ☐	N/A ☐	U ☐	SOFT STORY: The stiffness of the seismic-force-resisting system in any story shall not be less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)	No soft story condition
C ☒	NC ☐	N/A ☐	U ☐	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)	All shear walls are continuous to the foundation.
C ☒	NC ☐	N/A ☐	U ☐	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)	If the second floor corridor walls are assumed to be shear walls, there is not much change in the net horizontal dimension of the SFRS magnitude.

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U		
☐	☐	☒	☐	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)	There is a light roof system (wood framing) and one floor system to consider, so this check does not need to be completed.
C	NC	N/A	U		
☒	☐	☐	☐	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)	Plan is well-balanced with SFRS members.

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Project Name Isbell Building A
Project Number S19042

Low Seismicity

Geologic Site Hazards

RATING				DESCRIPTION	COMMENTS
C ☐	NC ☒	N/A ☐	U ☐	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)	Per geohazards report by Earth Systems, dated June 19, 2015, liquefiable soil is present at 45-ft to 50-ft. In their evaluation of this soil, they came to the conclusion that the likelihood of ground damage (sand boils, ground cracks, etc.) is very low. The potential for differential settlement, however, is high.
C ☒	NC ☐	N/A ☐	U ☐	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)	Per geohazards report by Earth Systems, dated June 19, 2015, risk of slope failure is considered nil at this site.
C ☒	NC ☐	N/A ☐	U ☐	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)	Per geohazards report by Earth Systems, dated June 19, 2015, risk of surface fault rupture is considered low at this site.

Moderate and High Seismicity

Foundation Configuration

RATING				DESCRIPTION	COMMENTS
C ☒	NC ☐	N/A ☐	U ☐	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$. (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)	Least horizontal dimension of SFRS at the foundation level is 25'-1". Building height in these locations is approximately 28'-1.5" (top of grade to top of concrete at roof). horiz dim/vert dim = 0.89 0.6Sa = 0.6*1.097 = 0.658 0.89 > 0.658 OK

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name ____________

Project Number ____________

C	NC	N/A	U		
☐	☒	☐	☐	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)	Continuous footing system is tied at each bearing wall line. Max span of a continuous footing, when loaded laterally, is 106-ft at the east wall of the main wing. Soil is classified as Site Class D by Earth Systems Pacific geotechnical report dated November 15, 2016.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Project Name Isbell Building A
Project Number S19042

ASCE 41-13 Tier 1 Checklists

FIRM:	SSG Structural Engineering, LLP
PROJECT NAME:	Isbell Building A
SEISMICITY LEVEL:	High
PROJECT NUMBER:	S19042
COMPLETED BY:	Jessica Napier, SE
DATE COMPLETED:	April 29, 2019
REVIEWED BY:	Evan Reis, SE
REVIEW DATE:	May 3, 2019

NONCOMPLIANT ITEMS:
WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS
FOUNDATION DOWELS
DEFLECTION COMPATIBILITY
COUPLING BEAMS
CONFINEMENT REINFORCING
OPENINGS AT SHEAR WALLS
PLAN IRREGULARITIES
DIAPHRAGM REINFORCEMENT AT OPENINGS
STRAIGHT SHEATHING
SPANS

UNKNOWN ITEMS:
TRANSFER TO SHEAR WALLS

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Project Name Isbell Building A
Project Number S19042

16.10IO Immediate Occupancy Structural Checklist for Building Types C2: Concrete Shear Walls with Stiff Diaphragms and C2a: Concrete Shear Walls with Flexible Diaphragms

Very Low Seismicity

Seismic-Force-Resisting System

RATING				DESCRIPTION	COMMENTS
C ☒	NC ☐	N/A ☐	U ☐	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)	Complete concrete gravity frames occur when columns are reinforced within the walls below concrete beams. The 1939 drawings indicate that most concrete and steel beams do have column reinforcement within the walls supporting them.
C ☒	NC ☐	N/A ☐	U ☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	All exterior walls are shear walls, as well as all corridor walls.
C ☒	NC ☐	N/A ☐	U ☐	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in.^{2} or $2\sqrt{f'_c}$. (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)	2*SQRT(f'c)=44.7-psi => use 100-psi At grid 6 (south wall of main entry): Shear stress assuming gunite acts with URM is 89-PSI to gunite. OK Shear stress assuming gunite takes all shear is 282-PSI. No Good.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U		
☒	☐	☐	☐	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. The spacing of reinforcing steel is equal to or less than 18 in. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)	In the 12.5-in concrete wall, reinforcement is #4 @ 12-in o.c., each way, each face. This is a reinforcement ratio of 0.40-in^2 / 150-in^2 = 0.0027 OK In the 4-in gunite wall, reinforcement is #3@11-in o.c., each way, each face. This is a reinforcement ration of 0.24-in^2 / 48in^2 = 0.005 OK

Connections

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U		
☐	☒	☐	☐	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec.A.5.1.1. Tier 2: Sec. 5.7.1.1)	Anchors do exist. Where floor framing is parallel to walls, anchor points are infrequent. For example, the NW and SW exterior walls are anchored in the middle of the wall length in one location. This anchor needs to resist 12.5-ft of out-of-plane forces. See Joint 70, sheet S-8 and Anchor #5, sheet S-9.
C	NC	N/A	U		
☐	☐	☐	☒	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of loads to the shear walls, and the connections are able to develop the lesser of the shear strength of the walls or diaphragms. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	Shear strength of the floor diaphragm is unknown where joists are parallel to shear wall. Where joists are perpendicular, each joist is pocketed into wall and welded to horizontal rebar. See detail 230, 232, and 235, S-6.
C	NC	N/A	U		
☐	☒	☐	☐	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation, and the dowels are able to develop the lesser of the strength of the walls or the uplift capacity of the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)	Section A.5.3.5 discusses doweling of all wall vertical steel into foundation. Wall vertical reinforcement at exterior walls is #4@12-in o.c., each face (0.40in^2/ft). The dowel is #6@27-in o.c., in center of wall (0.196in^2/ft). See section 105/S-2. Interior gunite dowels are similarly spaced, see section 100/S-2. Since the dowels do not match the wall verticals, this is noncompliant.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

Foundation System

RATING				DESCRIPTION	COMMENTS
C ☐	NC ☐	N/A ☒	U ☐	DEEP FOUNDATIONS: Piles and piers are capable of transferring the seismic forces between the structure and the soil. (Commentary: Sec. A.6.2.3.)	There are no piles or piers supporting this structure.
C ☐	NC ☐	N/A ☒	U ☐	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story high. (Commentary: Sec. A.6.2.4)	Site does not slope more than a couple of feet.

Low, Moderate, and High Seismicity

Seismic-Force-Resisting System

RATING				DESCRIPTION	COMMENTS
C ☐	NC ☒	N/A ☐	U ☐	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components and are compliant with the following items: COLUMN-BAR SPLICES, BEAM-BAR SPLICES, COLUMN-TIE SPACING, STIRRUP SPACING, and STIRRUP AND TIE HOOK in the Immediate Occupancy Structural Checklist for Building Type C1. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)	All concrete wall and beam components are considered to be a part of the SLRS. The concrete column adjacent to each stair is original to the building, and the tie size and spacing is unknown. See detail for joint 19 and 30/S-8. The columns ties in the gunite shear walls are spaced at 6-in or 8-in o.c., and do not meet these requirements. See column details on S-6.
C ☒	NC ☐	N/A ☐	U ☐	FLAT SLABS: Flat slabs or plates not part of seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)	There is a small concrete slab over the main entry, see detail 234/S-6. It does contain bottom steel that extends into the supporting walls and through the column.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U		
☐	☒	☐	☐	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than d/2 and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. Coupling beams have the capacity in shear to develop the uplift capacity of the adjacent wall. (Commentary: Sec.A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)	Exits have either steel wide flange beams as headers, or a continuation of the perimeter collar beam. See section 221/S-3 for an example of this beam. Stirrups are spaced at 8-in o.c., while d = 11-in. 8-in > d/2, therefore this check fails. The hooks are 90-degree hooks in all cases, so this check fails as well. These small beams cannot resist uplift.
☒	☐	☐	☐	OVERTURNING: All shear walls have aspect ratios less than 4-to-1. Wall piers need not be considered. (Commentary: Sec. A.3.2.2.4. Tier 2: Sec. 5.5.3.1.4)	No shear wall aspect ratios greater than 4-to-1.
☐	☒	☐	☐	CONFINEMENT REINFORCING: For shear walls with aspect ratios greater than 2-to-1, the boundary elements are confined with spirals or ties with spacing less than $8d_b$. (Commentary: Sec. A.3.2.2.5. Tier 2: Sec. 5.5.3.2.2)	10-ft long x 12.5-in wide shear walls at NW and SW areas have an aspect ratio of 2.9. Re-entrant wall end has a tied column with 1/4-in dia. ties at 8-in o.c. (detail K/S-6). 8db = 2-in, 2-in < 8-in o.c., no good External corner wall end does not have a boundary element.
☒	☐	☐	☐	WALL REINFORCING AT OPENINGS: There is added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall. (Commentary: Sec. A.3.2.2.6. Tier 2: Sec. 5.5.3.1.5)	5/8-in diameter trim bars are included on sheet S-1 in the "Typical Trimmer Bar For All Wall Openings" detail.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U		
☒	☐	☐	☐	WALL THICKNESS: Thicknesses of bearing walls is not less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 in. (Commentary: Sec. A.3.2.2.7. Tier 2: Sec. 5.5.3.1.2)	Unsupported wall height = 13.33-ft (1st to 2nd floor) Unsupported wall length = 12-ft (NW and SW walls) Thickness = 12.5" 12.5/13.33*12 = 0.070 (1/14.2) OK 12.5/12*12 = 0.087 (1/11.5) OK *this calculation assumes that the URM contributes to the bearing wall strength. If URM is not used, this check fails.

Connections

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U		
☐	☐	☒	☐	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps; the pile cap reinforcement and pile anchorage are able to develop the tensile capacity of the piles. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)	No pile caps exist.

Diaphragms (Flexible or Stiff)

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U		
☒	☐	☐	☐	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and shall not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	There are no split-level floors. Where low roof areas frame into 2-story walls, there is diaphragm support on all sides of the roof and all sides of the floor. Therefore, there is no split-level effect within the diaphragms.
C	NC	N/A	U		
☐	☒	☐	☐	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	Stair openings are 15-ft long next to 76-ft shear walls, which is approximately 20% of the wall length.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U	Description	Comments
☐	☒	☐	☐	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities. (Commentary: Sec. A.4.1.7. Tier 2: Sec. 5.6.1.4)	Plan sheet S-2, S-3, and S-4 do not show any specific diaphragm strengthening in the two re-entrant corner areas.
☐	☒	☐	☐	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5)	The stair opening widths in the N-S direction are > 50% of the diaphragm width. No extra reinforcement appears to be present around the opening. Diaphragm concrete is not reinforced with rebar or wire mesh. The added diaphragm system does not address this opening.

Flexible Diaphragms

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U		
☒	☐	☐	☐	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	Continuous cross ties were added as a part of the 1939 rehabilitation. See S-3 and S-4.
☐	☒	☐	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	Roof is straight-sheathed as seen in the field. Diaphragm ratio of roof is greater than 1:1 in most cases.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U	Statement	Comment
☐	☒	☐	☐	SPANS: All wood diaphragms with spans greater than 12 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	Roof diaphragm is sheathed with 1x6 straight sheathing and does span more than 12-ft.
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft and aspect ratios less than or equal to 3-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	No diagonally sheathed or wood structural panel diaphragms
☐	☐	☒	☐	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft and have aspect ratios less than 4-to-1. (Commentary: Sec. A.4.3.1. Tier 2: Sec. 5.6.3)	No nonconcrete filled or untopped metal deck diaphragms
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	Roof diaphragm is wood, floor diaphragm is concrete over Hy-Rib metal lath deck. Diaphragm strengthening members are wood and steel.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

ASCE 41-13 Tier 1 Checklists

FIRM:	SSG Structural Engineers, LLP
PROJECT NAME:	Isbell Building A
SEISMICITY LEVEL:	High
PROJECT NUMBER:	S19042
COMPLETED BY:	Jessica Napier, SE
DATE COMPLETED:	April 29, 2019
REVIEWED BY:	Evan Reis, SE
REVIEW DATE:	May 3, 2019

NONCOMPLIANT ITEMS:
SHEAR STRESS CHECK
WALL ANCHORAGE
MASONRY LAYUP
OPENINGS AT SHEAR WALLS
PLAN IRREGULARITIES
DIAPHRAGM REINFORCEMENT AT OPENINGS
STRAIGHT SHEATHING
SPANS
STIFFNESS OF WALL ANCHORS

UNKNOWN ITEMS:
NONE

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Project Name Isbell Building A
Project Number S19042

16.16IO Immediate Occupancy Structural Checklist for Building Types URM: Unreinforced Masonry Bearing Walls with Flexible Diaphragms and URMA: Unreinforced Masonry Bearing Walls with Stiff Diaphragms

Very Low Seismicity

Seismic-Force-Resisting System

C	NC	N/A	U	DESCRIPTION	COMMENTS
☒	☐	☐	☐	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	All exterior walls are shear walls, as well as all corridor walls.
☐	☒	☐	☐	SHEAR STRESS CHECK: The shear stress in the unreinforced masonry shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than 30 lb/in.^{2} for clay units and 70 lb/in.^{2} for concrete units. (Commentary: Sec. A.3.2.5.1. Tier 2: Sec. 5.5.3.1.1)	Shear stress to the URM, assuming gunite takes a portion of the load, is 64-PSI at URM. No good.

Connections

C	NC	N/A	U	DESCRIPTION	COMMENTS
☐	☒	☐	☐	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	Out-of-plane wall anchorage connects concrete to diaphragm; see C2a Tier 1 for this item.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Commentary: Sec. A.5.1.2. Tier 2: Sec. 5.7.1.4)	Main roof diaphragm is attached through a sill plate on top of the wall. Low roof diaphragms are also typically connected through a sill plate. Detail 221/S-3 does show a possible cross-grain bending condition at the 2x4 stud next to the parapet.
☐	☐	☒	☐	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	Diaphragm load transfer to shear walls occurs at diaphragm connections to concrete; see C2a Tier 1 for this item.
☒	☐	☐	☐	GIRDER–COLUMN CONNECTION: There is a positive connection using plates, connection hardware, or straps between the girder and the column support. (Commentary: Sec. A.5.4.1. Tier 2: Sec. 5.7.4.1)	Beams and girders at the second floor and roof are most likely positively connected to gunite and concrete columns. Not all details are provided. See joint details 3, 34, 45,and 72/S-8.

Foundation System

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U		
☐	☐	☒	☐	DEEP FOUNDATIONS: Piles and piers are capable of transferring the seismic forces between the structure and the soil. (Commentary: Sec. A.6.2.3.)	There are no piles or piers supporting this structure.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U	DESCRIPTION	COMMENTS
☐	☐	☒	☐	SLOPING SITES: The difference in foundation embedment depth from one side of the building to another does not exceed one story high. (Commentary: Sec. A.6.2.4)	Site does not slope more than a couple of feet.

Low, Moderate, and High Seismicity

Seismic-Force-Resisting System

RATING				DESCRIPTION	COMMENTS
C ☐	NC ☐	N/A ☒	U ☐	PROPORTIONS: The height-to-thickness ratio of the shear walls at each story is less than the following (Commentary: Sec. A.3.2.5.2. Tier 2: Sec. 5.5.3.1.2): Top story of multi-story building 9 First story of multi-story building 15 All other conditions 13	Gunite added to all URM wall thickness in 1939.
C ☐	NC ☒	N/A ☐	U ☐	MASONRY LAYUP: Filled collar joints of multi-wythe masonry walls have negligible voids. (Commentary: Sec. A.3.2.5.3. Tier 2: Sec. 5.5.3.4.1)	Where URM is currently sawcut in literacy area (for project under construction), many voids are visible in the collar joint.

Diaphragms (Flexible or Stiff)

RATING				DESCRIPTION	COMMENTS
C ☐	NC ☒	N/A ☐	U ☐	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 15% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	Stair openings are 15-ft long next to 76-ft shear walls, which is approximately 20% of the wall length.

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U	Description	Comments
☒	☐	☐	☐	OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry shear walls are not greater than 4 ft long. (Commentary: A.4.1.6. Tier 2: Sec. 5.6.1.3)	There are no openings adjacent to exterior URM/Gunite shear walls.
☐	☒	☐	☐	PLAN IRREGULARITIES: There is tensile capacity to develop the strength of the diaphragm at reentrant corners or other locations of plan irregularities. (Commentary: Sec. A.4.1.7. Tier 2: Sec. 5.6.1.4)	Plan sheet S-2, S-3, and S-4 do not show any specific diaphragm strengthening in the two re-entrant corner areas.
☐	☒	☐	☐	DIAPHRAGM REINFORCEMENT AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50% of the building width in either major plan dimension. (Commentary: Sec. A.4.1.8. Tier 2: Sec. 5.6.1.5)	The stair opening widths in the N-S direction are > 50% of the diaphragm width. No extra reinforcement appears to be present around the opening. Diaphragm concrete is not reinforced with rebar or wire mesh. The added diaphragm system does not address this opening.

Flexible Diaphragms

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U		
☒	☐	☐	☐	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	Continuous cross ties were added as a part of the 1939 rehabilitation. See S-3 and S-4.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U	Statement	Comments
☐	☒	☐	☐	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 1-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	Roof is straight-sheathed as seen in the field. Diaphragm ratio of roof is greater than 1:1 in most cases.
☐	☒	☐	☐	SPANS: All wood diaphragms with spans greater than 12 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	Roof diaphragm is sheathed with 1x6 straight sheathing and does span more than 12-ft.
☐	☐	☒	☐	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 30 ft and aspect ratios less than or equal to 3-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	No diagonally sheathed or wood structural panel diaphragms.
☐	☐	☒	☐	NONCONCRETE FILLED DIAPHRAGMS: Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete consist of horizontal spans of less than 40 ft and have aspect ratios less than 4-to-1. (Commentary: Sec. A.4.3.1. Tier 2: Sec. 5.6.3)	No nonconcrete filled or untopped metal deck diaphragms.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

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Project Name Isbell Building A
Project Number S19042

C	NC	N/A	U		
☒	☐	☐	☐	OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	Roof diaphragm is wood, floor diaphragm is concrete over Hy-Rib metal lath deck. Diaphragm strengthening members are wood and steel.

Connections

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U		
☐	☒	☐	☐	STIFFNESS OF WALL ANCHORS: Anchors of concrete or masonry walls to wood structural elements are installed taut and are stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 in. before engagement of the anchors. (Commentary: Sec. A.5.1.4. Tier 2: Sec. 5.7.1.2)	Roof anchorage in the strengthened diaphragm uses bolted wood details which would not provide this stiffness.
C	NC	N/A	U		
☒	☐	☐	☐	BEAM, GIRDER, AND TRUSS SUPPORTS: Beams, girders, and trusses supported by unreinforced masonry walls or pilasters have independent secondary columns for support of vertical loads. (Commentary: Sec. A.5.4.5. Tier 2: Sec. 5.7.4.4)	Beams and girders at the second floor and roof are generally supported by tied concrete or gunite columns.

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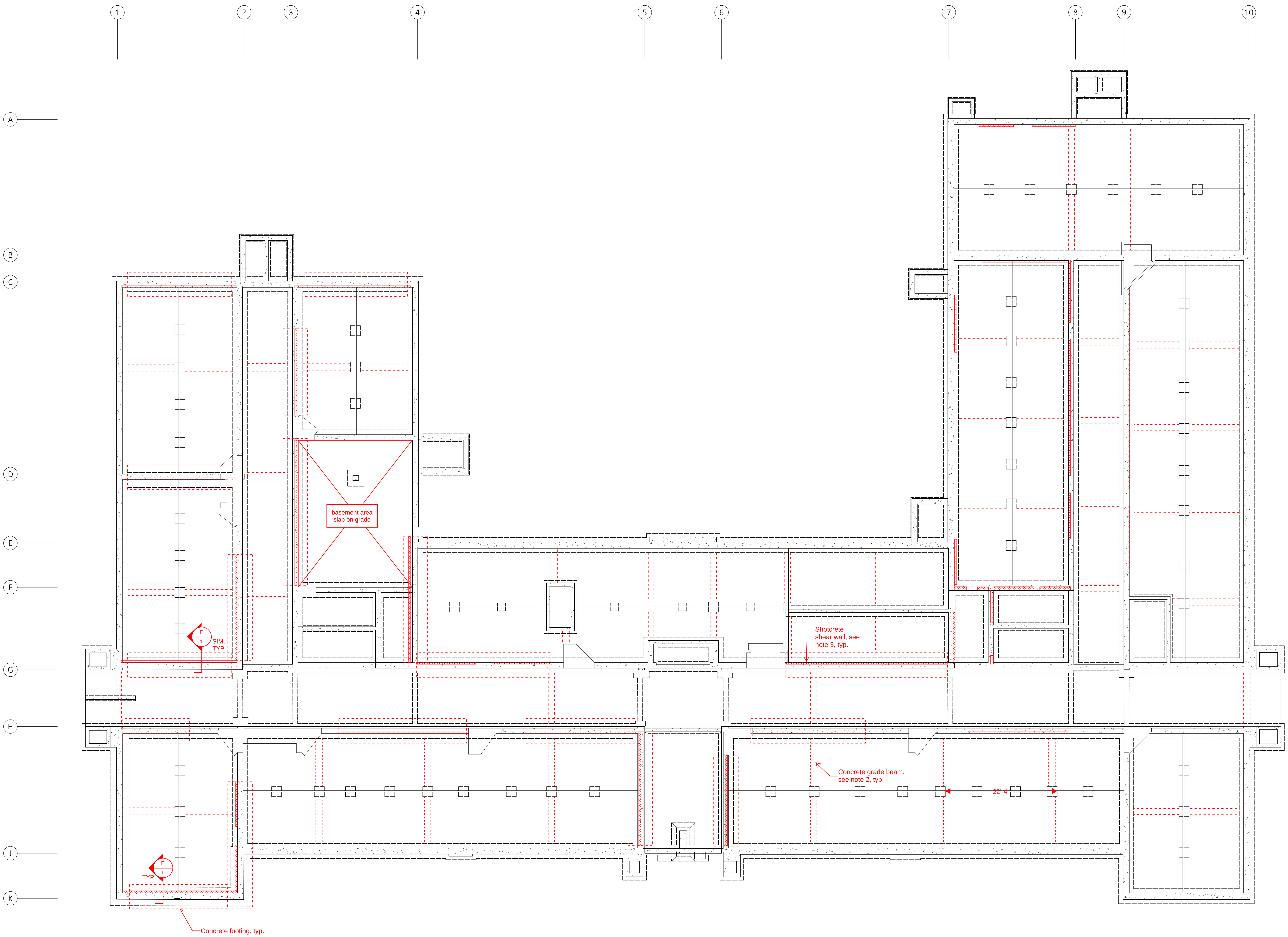

need footings under shear walls on this sheet

FOUNDATION PLAN

SCALE: 1/8" = 1'-0"

(VERIFY ALL DIMENSIONS WITH ARCHITECTURAL PLANS AND EXISTING CONDITIONS)

N

FOUNDATON PLAN NOTES:

1. All added concrete and shotcrete shall be f'c=4-ksi.
2. 16"x16" Concrete grade beams w/ 8-#6 longitudinal bars and #4 closed ties @ 12" o.c. Dowel and epoxy longitudinal bars into (E) concrete footings 6" with Hilti HITRE 500 V3 (ESR-3814).
3. 12" shotcrete shear wall at this level. Reinforce with #4@12" o.c. each face.

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REVISIONS: BY:

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CLIENT:

SANTA PAULA UNIFIED SCHOOL DISTRICT
201 SOUTH STECKEL DRIVE
SANTA PAULA, CA 93060

PROJECT:

ISBELL MIDDLE SCHOOL BUILDING A REHABILITAION
221 SOUTH 4th STREET
SANTA PAULA, CA 93060

SHEET TITLE:

FOUNDATION PLAN

DATE: 2019-05-22
SCALE: AS NOTED
JOB #: S19042
DRAWN: JR
DESIGNED: JEN
CHECKED: JEN

SHEET:

S2.0

1st FLOOR FRAMING PLAN

SCALE: 1/8" = 1'-0"

(VERIFY ALL DIMENSIONS WITH ARCHITECTURAL PLANS AND EXISTING CONDITIONS)

FIRST FLOOR PLAN NOTES:
1. All added shotcrete shall be f'c=4-ksi.
2. 6" shotcrete shear wall, reinforce with #4@12" o.c. each way

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CLIENT:

SANTA PAULA
UNIFIED SCHOOL
DISTRICT

201 SOUTH STECKEL DRIVE
SANTA PAULA, CA 93060

PROJECT:

ISBELL MIDDLE
SCHOOL
BUILDING A
REHABILITAION

221 SOUTH 4th STREET
SANTA PAULA, CA 93060

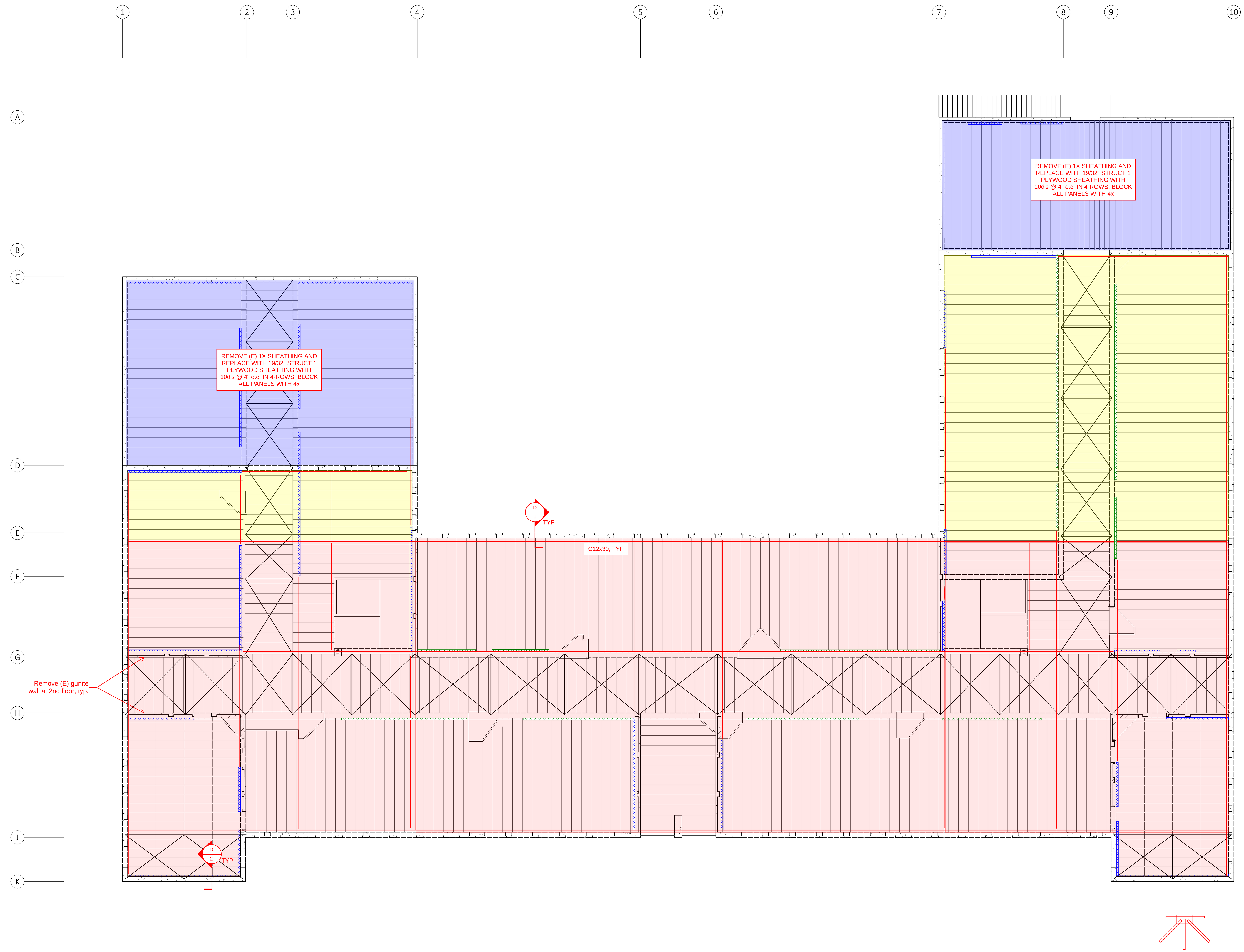
SHEET TITLE:

1st FLOOR
FRAMING PLAN

DATE: 2019-05-22
SCALE: AS NOTED
JOB #: S19042
DRAWN: JR
DESIGNED: JEN
CHECKED: JEN

SHEET:

S2.1



SECOND FLOOR PLAN NOTES:
1. All added shotcrete shall be f'c=4-ksi.
2. 6" shotcrete shear wall, reinforce with #4@12" o.c. each way

SHEAR WALL LEGEND:
- INDICATES WOOD SHEAR WALL FROM 2ND FLOOR TO 2ND FLOOR CEILING. USE (E) STUD WALL, ADD 5/8" STRUCT 1 SHEATHING WITH 10d @ 4"-12" o.c.
- INDICATES 6" SHOTCRETE SHEAR WALL FROM 2ND FLOOR TO 2ND FLOOR CEILING, SEE PLAN NOTE 2.

DIAPHRAGM LEGEND:
- INDICATES HSS6X6X1/4 TRUSSED DIAPHRAGM WITH NODES AT APPROXIMATELY 6'-0" O.C.
- INDICATES L6X6X1/4 TRUSSED DIAPHRAGM WITH NODES AT APPROXIMATELY 6'-0" O.C.
- INDICATES SHEATHED DIAPHRAGM, SEE PLAN

2nd FLOOR FRAMING PLAN

SCALE: 1/8" = 1'-0"

(VERIFY ALL DIMENSIONS WITH ARCHITECTURAL PLANS AND EXISTING CONDITIONS)

N

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201 SOUTH STECKEL DRIVE
SANTA PAULA, CA 93060

PROJECT:

ISBELL MIDDLE SCHOOL BUILDING A REHABILITAION
221 SOUTH 4th STREET
SANTA PAULA, CA 93060

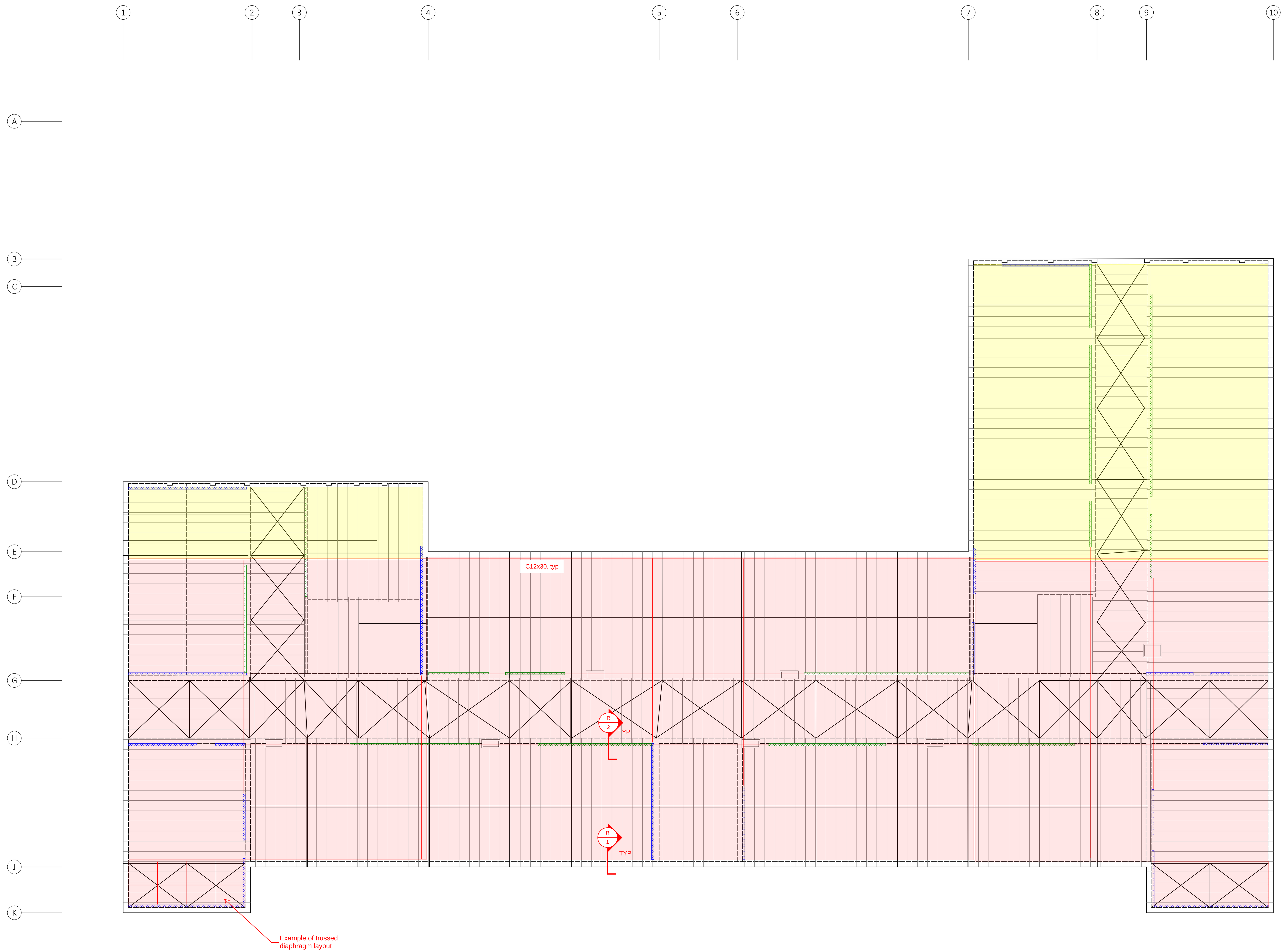
SHEET TITLE:

2nd FLOOR FRAMING PLAN

DATE: 2019-05-22
SCALE: AS NOTED
JOB #: S19042
DRAWN: JR
DESIGNED: JEN
CHECKED: JEN

SHEET:

S2.2



2nd FLOOR CEILING FRAMING PLAN

SCALE: 1/8" = 1'-0"

(VERIFY ALL DIMENSIONS WITH ARCHITECTURAL PLANS AND EXISTING CONDITIONS)

SHEAR WALL LEGEND:

- INDICATES WOOD SHEAR WALL FROM 2ND FLOOR CEILING TO ROOF. USE (E) STUD WALL, ADD 5/8" STRUCT 1 SHEATHING WITH 10d @ 4"-12" o.c.
- INDICATES 6" SHOTCRETE SHEAR WALL FROM 2ND FLOOR TO 2ND FLOOR CEILING, SEE PLAN NOTE 2.

DIAPHRAGM LEGEND:

- INDICATES HSS6X6X1/4 TRUSSED DIAPHRAGM WITH NODES AT APPROXIMATELY 6'-0" O.C.
- INDICATES L6X6X1/4 TRUSSED DIAPHRAGM WITH NODES AT APPROXIMATELY 6'-0" O.C.
- INDICATES SHEATHED DIAPHRAGM, SEE PLAN

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PROJECT:

ISBELL MIDDLE SCHOOL BUILDING A REHABILITAION
221 SOUTH 4th STREET
SANTA PAULA, CA 93060

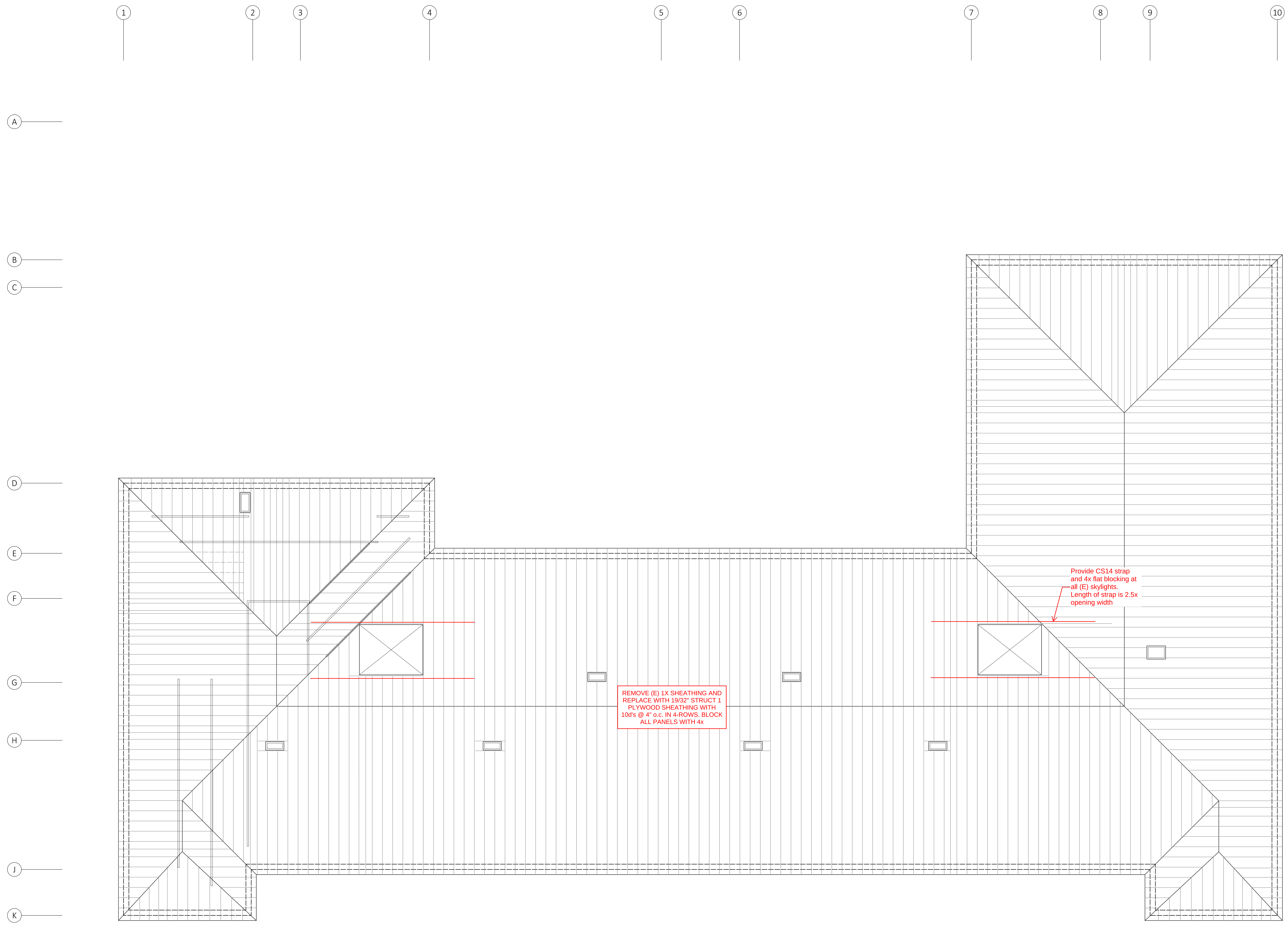
SHEET TITLE:

2nd FLOOR CEILING FRAMING PLAN

DATE: 2019-05-22
SCALE: AS NOTED
JOB #: S19042
DRAWN: JR
DESIGNED: JEN
CHECKED: JEN

SHEET:

S2.3



ROOF FRAMING PLAN

SCALE: 1/8" = 1'-0"

(VERIFY ALL DIMENSIONS WITH ARCHITECTURAL PLANS AND EXISTING CONDITIONS)

N

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CLIENT:

SANTA PAULA UNIFIED SCHOOL DISTRICT

201 SOUTH STECKEL DRIVE
SANTA PAULA, CA 93060

PROJECT:

ISBELL MIDDLE SCHOOL BUILDING A REHABILITAION

221 SOUTH 4th STREET
SANTA PAULA, CA 93060

SHEET TITLE:

ROOF FRAMING PLAN

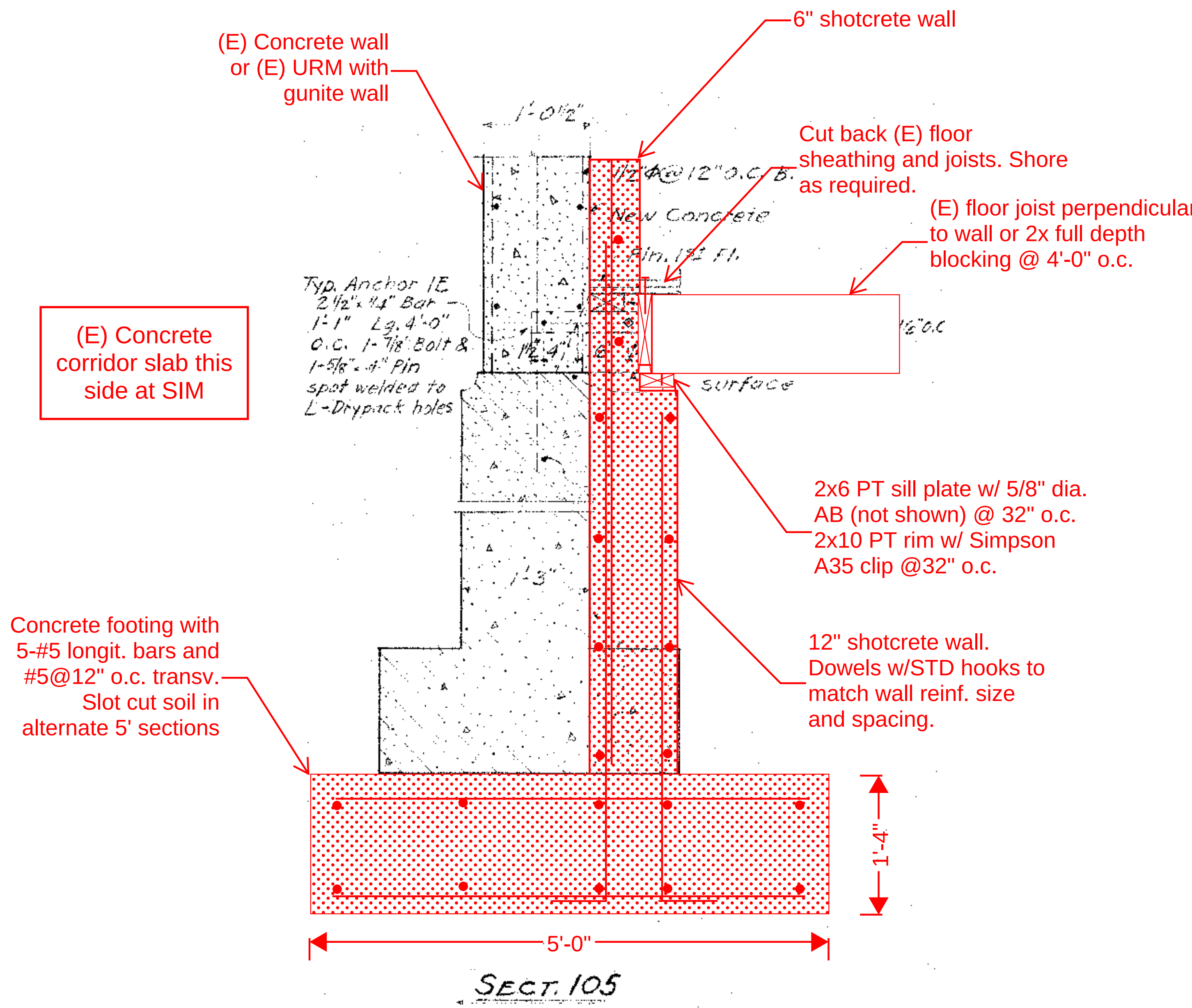
DATE: 2019-05-22
SCALE: AS NOTED
JOB #: S19042
DRAWN: JR
DESIGNED: JEN
CHECKED: JEN

SHEET:

S2.4

BY JN DATE 5-27-2019 Retrofit Detail F-1 JOB NAME Isbell Building A

REV. BY DATE Appendix B JOB NO. S19042 SHEET

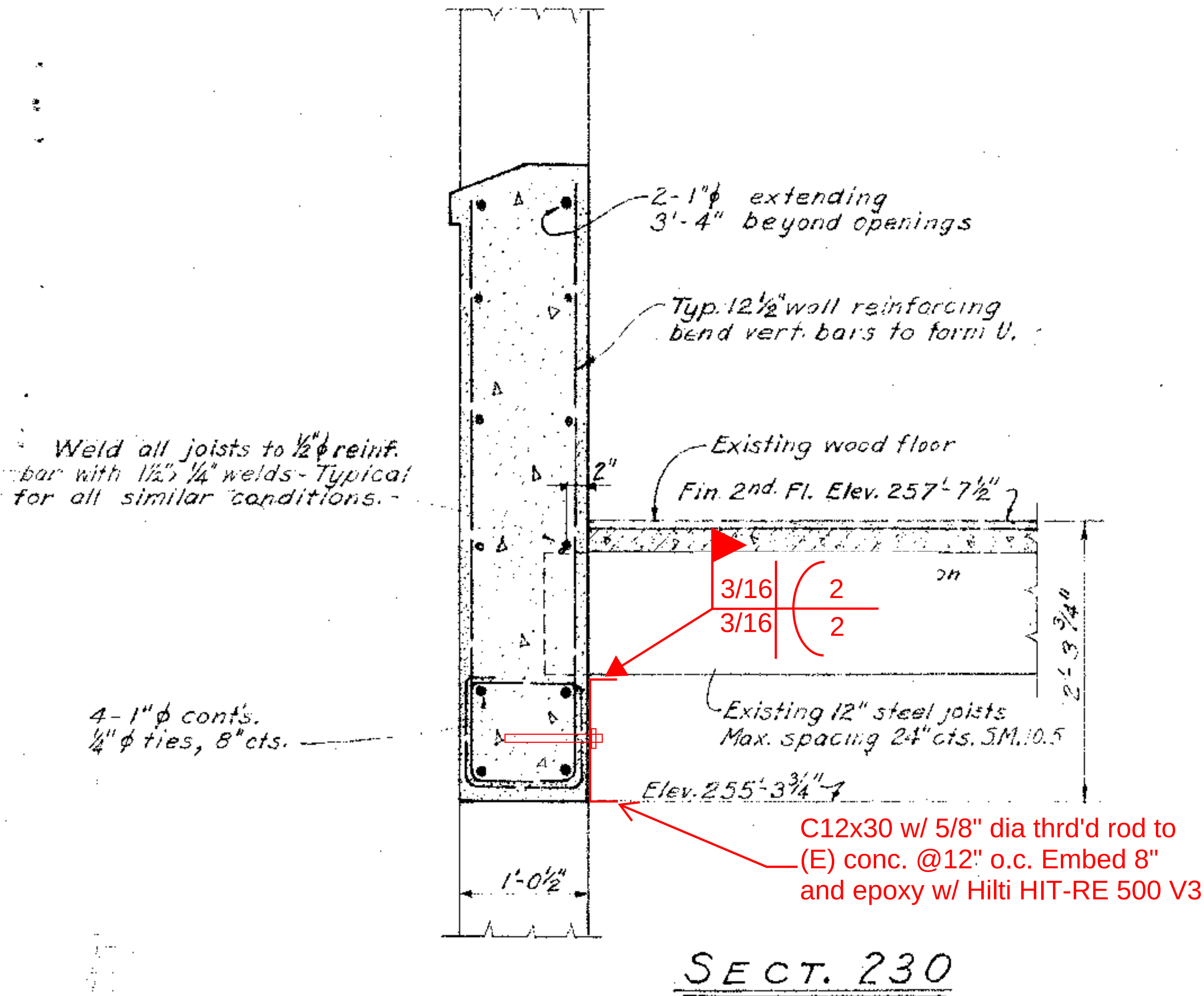


Detail F-1
Foundation Retrofit

from 105/S-2 of 1939 Rehabilitation drawings

BY JN DATE 5-27-2019 Retrofit Detail D-1 JOB NAME Isbell Building A

REV. BY DATE Appendix B JOB NO. S19042 SHEET

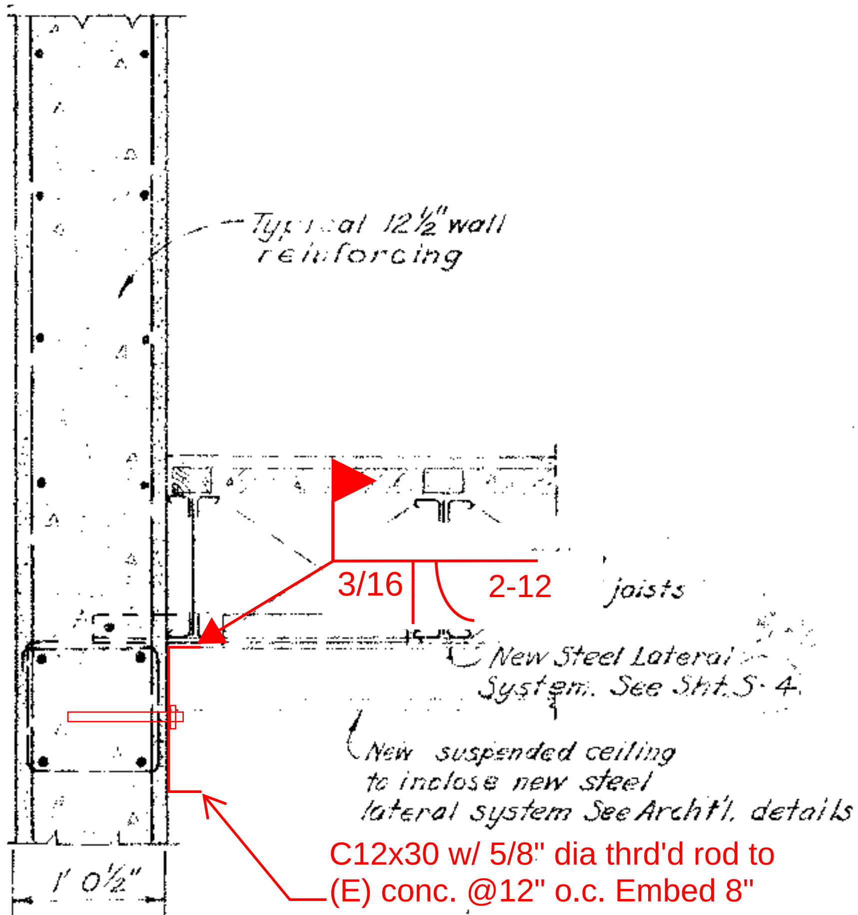


Detail D-1
2nd Floor Retrofit

from 230/S-6 of 1939 Rehabilitation drawings

BY JN DATE 5-27-2019 Retrofit Detail D-2 JOB NAME Isbell Building A

REV. BY DATE Appendix B JOB NO. S19042 SHEET



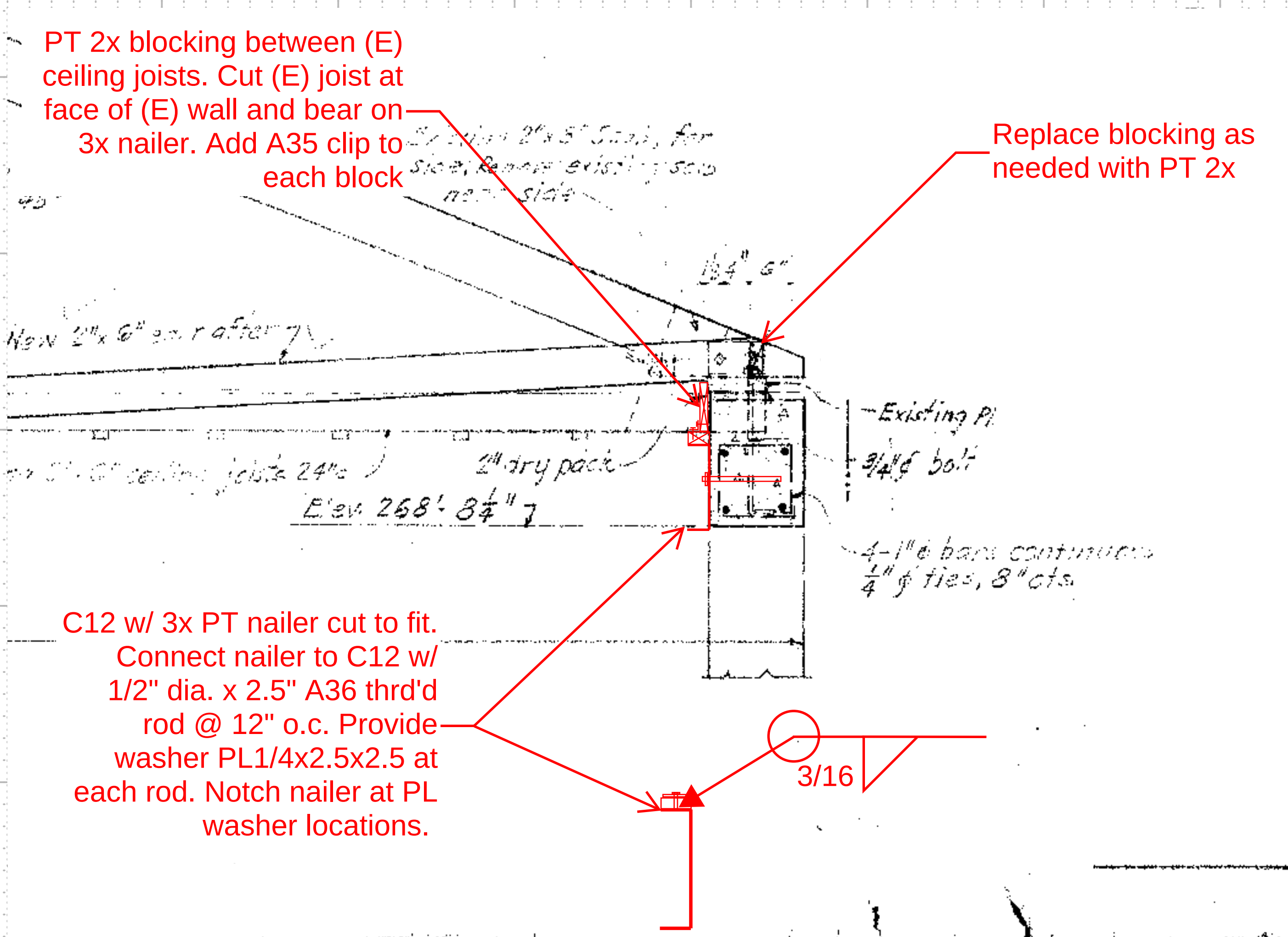
SECT. 232

Detail D-2
2nd Floor Retrofit

from 232/S-6 of 1939
Rehabilitation drawings

BY JN DATE 5-27-2019 Retrofit Detail R-1 JOB NAME Isbell Building A

REV. BY ____ DATE ____ Appendix B JOB NO. S19042 SHEET ____

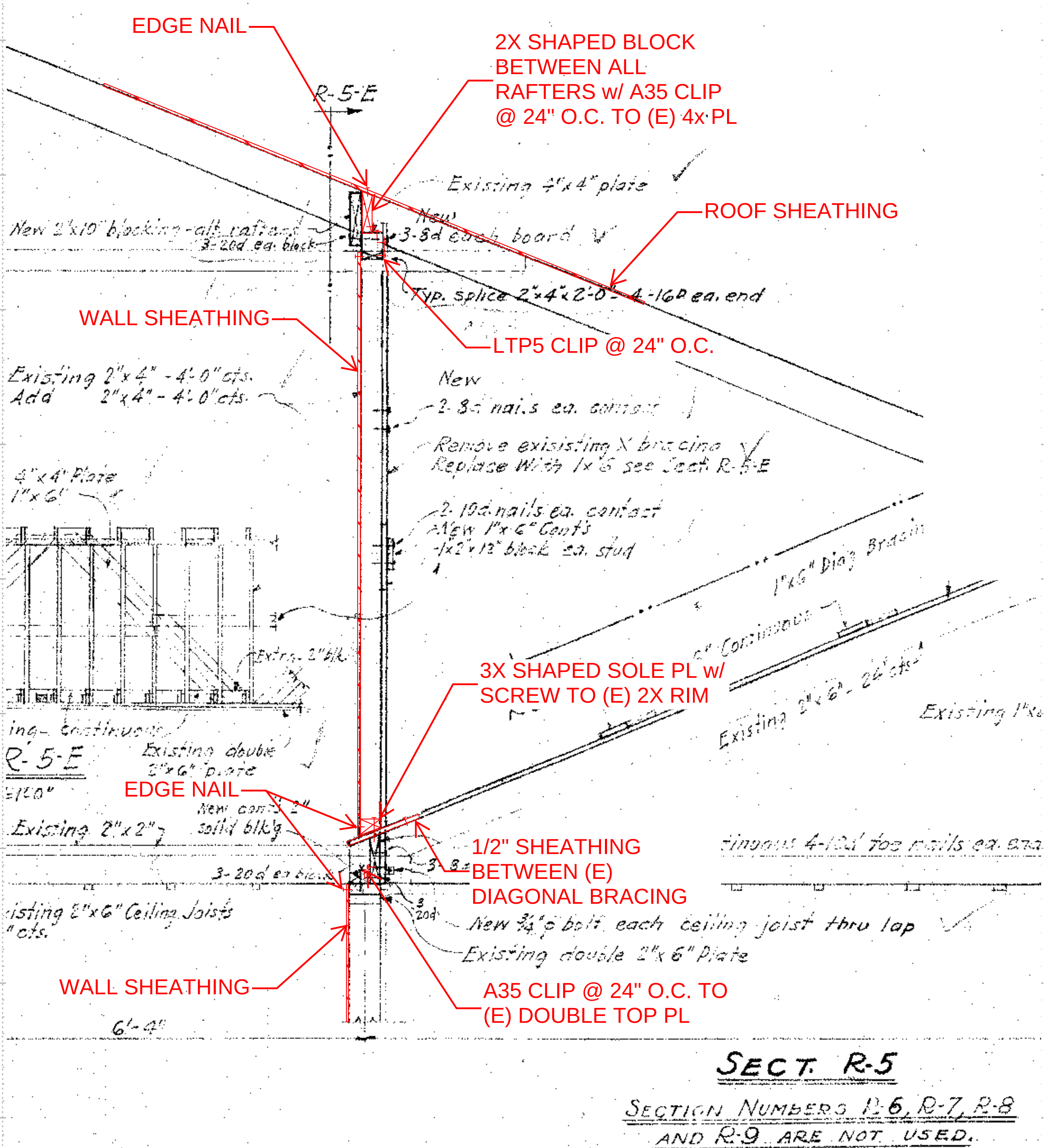


Detail R-1
Roof Retrofit

from Sect R-4/S-4 of 1939
Rehabilitation drawings

BY JN | DATE 5-27-2019 | Retrofit Detail R-2 | JOB NAME Isbell Building A

REV. BY | DATE | Appendix B | JOB NO. S19042 | SHEET



Detail R-2
Roof Retrofit

from Sect R-4/S-4 of 1939 Rehabilitation drawings

S19042
May 27, 2019

OPSC Middle School Replacement Estimate
Isbell Middle School Building A

	Area		OPSC ($/SF)	Estimate ($)
Replacement Cost				
Restroom	1,273	SF	717.00	912,741
Other	40027	SF	398.00	15,930,746
TOTAL Replacement Estimate	**41,300**	**SF**		**$ 16,843,487**

Seismic Rehabilitation Estimate
Isbell Middle School Building A

	Qty	Unit	Unit Cost ($)	Saylor Column F4 Est ($)	Comments	Saylor Section Number
Soft Costs						
General Conditions - Institutional Structure	12	%	$ 7,716,605	925993	12% of Rehabilitation Cost	01.1000 000
Mobilization	7	%	$ 7,716,605	540162	7% of Rehabilitation Cost	01.1010 000
Supervision (GC)	0.84	%	$ 7,716,605	64819	0.84% of Rehabilitaton Cost	01.1020 000
DSA Class Inspector	3	%	$ 7,716,605	231498	3% of Rehabilitation Cost	
Special Inspections - Third Party	2	%	$ 7,716,605	154332	2% of Rehabilitation Cost	
Design Fees	12	%	$ 7,716,605	925993	6% of Rehabilitation Cost	
Agency Fees	1	EA	$ 125,000.00	125000	DSA Online Filing Fee Calculator	
Subtotal Soft Costs				**2,967,797**		
Building Structural						
Roof						
Remove Roof Tile	300	HR	67.30	20,190	Demolition Laborer	2016 Union Wage Rate
Remove roofing	195	SQ	194.76	37,912	built-up on plywood	02.1203.011
Add modified asphalt underlayment	195	SQ	1,100.53	214,229	1/16" self seal bituthane, incl flashing	07.3007 051
Add copper wire	195	SQ	308.64	60,080	wire only	07.3002 061
Replace Roof Tile	195	SQ	2,096.04	408,015	labor only	07.3002 011
Roof Framing						
Remove 1x6 sheathing	300	HR	67.30	20,190	Demolition Laborer	2016 Union Wage Rate
Assessment of existing rafters	6	HR	150.00	900	$150/hour labor and report	Professional Engineer
Remove 2x rafters and ceiling joists as needed	24	HR	67.30	1,615	* 2% removal	2016 Union Wage Rate
Install 2x8 rafters as needed	0.285	MBF	22,175.91	6,316	* 2% replacement	06.1204 031
Install 2x6 ceiling joists as needed	0.209	MBF	9,474.88	1,979	* 2% replacement	06.1205 021
Remove wood struts	32	HR	67.30	2,154	Demolition Laborer	2016 Union Wage Rate
Install 3/4" Struct I Plywood	21.08	MSF	9,858.11	207,761	1.2*1.2*1.25	06.1406 081
2nd Floor Ceiling Framing						
Remove Lath & Plaster	18,700	SF	6.60	123,420		02.1202 011
Remove Acoustical Tile and Supports	18,700	SF	1.56	29,172		02.1202 031
Remove steel brace system	3,819	SF	32.56	124,347	steel framed building	02.1201 081
Add Acoustical Tile, 2x4, 5/8"	18,700	SF	10.52	196,724		09.5002 051
2nd Floor Framing						
Remove Lath & Plaster	22,600	SF	6.60	149,160		02.1202 011
Remove Acoustical Tile and Supports	22,600	SF	1.56	35,256		02.1202 031
Remove steel brace system	2,639.00	SF	32.56	85,926	steel framed building	02.1201 081
Add Acoustical Tile, 2x4, 5/8"	22,600	SF	10.52	237,752		09.5002 051
Low Roof Framing						
Remove roofing and sheathing	913	SF	13.26	12,106		02.1201 011
Assessment of existing rafters	4	HR	150.00	600	$150/hour labor and report	Professional Engineer
Remove 2x rafters and ceiling joists as needed	8	HR	67.30	538	* 2% removal	2016 Union Wage Rate
Install 2x rafters and ceiling joists as needed	0.050	MBF	9,474.88	474	* 2% replacement, 1.25 institutional	06.1205 021
Install 4x6 blocking	1.460	MBF	12,970.64	18,934	*1.25 institutional	06.1201 011
Install sheathing	0.913	MSF	9,858.11	9,000	1.2*1.2*1.25 struct gr, shear nail, inst	06.1406 081
Install roofing	913		9,858.11			
Foundation						
Remove asphalt for pachometer testing of footings	32	SF	0.99	32	remove 4-SF at each ext. location	02.1101 011
Replace asphalt	32	SF	4.78	153		02.6001 011
Pachometer testing @ 8 locations	4	HR	150.00	600	$150/hour labor and report	Professional Engineer
Core Sample Test	16	HR	150.00	2,400	$150/hour labor and report	Professional Engineer
Grade Beams						
4 dowels each end, drill and epoxy	488	EA	23.25	11,344	20-min for install by General Laborer	2016 Union Wage Rate
Hilti Hit-RE 500 V3 epoxy	300	EA	61.00	18,300	11.1oz tube	Home Depot
concrete	37	CY	1,313.54	48,278		03.0501.051
Footings at shotcrete walls						
16"x5'-0" footing	100	CY	1,313.54	131,483	1-story school	03.0501.051
Walls						
Remove URM at stairs	742	SF	22.99	17,059		02.1208 061
Remove gunite 2nd-Roof	3,250	SF	15.91	51,708		02.1208 011
Pachometer Testing 48-SF @ 12 locations	16	HR	150.00	2,400	$150/hour labor and report	Professional Engineer
Pachometer Testing entire perimeter at anchors	80	HR	150.00	12,000	$150/hour labor and report	Professional Engineer
Core Sample Tests	8	EA	150.00	1,200	$150/hour labor and report	Professional Engineer
12" shotcrete stem wall FDN-1st	60	CY	2,518.35	151,288	10", 12' or less ht	03.0502.031
6" shotcrete shear walls 1st-2nd	105	CY	3,167.36	332,983	8", 12' or more ht	03.0501.051
6" shotcrete shear walls 2nd-roof	44	CY	3,167.36	140,772	8", 12' or more ht	03.0501.051
Cut Gunite/URM at (E) fireplaces for C12's	108	LF	189.86	20,505		02.1204 021
C12x30 chord installation at all walls, 2 levels	28,392	LB	2.75	78,078	10" shape	05.1004 41
Wood shear walls						
attic	4	MSF	9,094.54	39,288		06.1405 041
Foundation Retrofit						
cut (E) floor sheathing and joists	420	LF	64.40	27,046	1287.91/20ft = 64.40/ft	02.1204 041
2x6 PT sill plate	420	LF	30.26	12,710	*1.25 for institutional	06.1201 011
2x10 PT rim	0.486	MBF	8,035.36	3,902	*1.25 for institutional	06.1201 031
A35 clip	158	EA	0.36	57	Home Depot	
A35 clip installation	158	EA	11.62	1,836	10-min for install by General Laborer	2016 Union Wage Rate
5/8" dia x 8" A.B. @ 32" o.c.	158	EA	25.01	3,939		06.1104 071
Second Floor Retrofit						
C12 noted above in walls area						
PL1/2x8x12 splice @ 20' o.c.	1,333	LB	4.23	5,638		005.1103 021
1/4" fillet, 3 sides shop, 3 sides field	3,360	LF	76.78	257,981	14" total weld each end of plate	05.1105 041
5/8" dia bolt to (E) concrete						
5/8" dia x 9" A36 rod @ 12" o.c.	1,546	LB	23.25	35,950		2015 order
drill and epoxy installation	1,960	EA	23.25	45,563	20-min for install by General Laborer	2016 Union Wage Rate
Hilti Hit-RE 500 V3 epoxy	1,661	EA	61.00	101,341	11.1oz tube	Home Depot
3/16" flare bevel, 2" long, ea side of (E) joist flange	600	LF	76.78	46,068	4" total each connection	05.1105 041
trussed diaphragm						
HSS6x6x1/4 diagonals and chords, 6' panels	208,065	LB	3.31	688,695		05.1003 051
L6x6x3/8 diagonals and chords	46,480	LB	2.87	133,398		05.1003 041
Second Floor Ceiling Retrofit						
C12 noted above in walls area						
PL1/2x8x12 splice @ 20' o.c.	1,333	LB	4.23	5,638		005.1103 021
1/4" fillet, 3 sides shop, 3 sides field	3,360	LF	76.78	257,981	14" total weld each end of plate	05.1105 041
5/8" dia bolt to (E) concrete						
5/8" dia x 9" A36 rod @ 12" o.c.	1,546	LB	23.25	35,950		2015 order
drill and epoxy installation	1,960	EA	23.25	45,563	20-min for install by General Laborer	2016 Union Wage Rate
Hilti Hit-RE 500 V3 epoxy	1,661	EA	61.00	101,341	11.1oz tube	Home Depot
3x nailer						
3x PT nailer	1,661	LF	61.00	101,341		
trussed diaphragm						
HSS6x6x1/4 diagonals and chords, 6' panels	208,065	LB	3.31	688,695	does not include slotting for tubes	05.1003 051
Welds at diaphragm nodes						
1/4" fillet 4 sides ea, 6" ea. end, 12" @ chord	4,040	LF	76.78	310,191		05.1105 041
PL1/2x24x24	8,080	LB	4.23	34,178		005.1103 021
L6x6x3/8 diagonals and chords	46,480	LB	2.87	133,398		05.1003 041
Welds at diaphragm nodes						
1/4" fillet 4 sides ea, 4" ea. end, 8" @ chord	383	LF	76.78	29,403		05.1105 041
PL1/2x16x16	203	LB	4.23	859		05.1103 021
Subtotal Structure				**6,173,284**		
25% Contingency & Cost Escalation				**1,543,321**		
TOTAL STRUCTURAL REHABILITATION ESTIMATE				**7,716,605**		
TOTAL REHABILITATION ESTIMATE + GENERAL CONDITIONS + SOFT COSTS				**10,684,402**		

Ratio of Seismic Rehabilitation Estimate to OPSC Replacement Estimate
Isbell Middle School Building A

	Estimate Totals
Total Replacement Estimate	16,843,487
Total Rehabilitation Estimate	10,684,402
Ratio of Rehabilitation to Replacement	**63.4%**