South Carolina Electric & Gas Company

Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3

NND-14-0XYZ

Enclosure 1

License Amendment Request:

Auxiliary Building Structural Floor and Roof Details

(LAR 14-01)

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3. Technical Evaluation

Structure, System, Component and/or Analysis Description

The nuclear island structures consist of the containment, shield building, and auxiliary building. The functions of the nuclear island structures are to provide support, protection, and separation for the seismic Category I mechanical and electrical equipment located in the nuclear island.

The nuclear island structures provide protection for the safety-related equipment against the consequences of either a postulated internal or external event. The nuclear island structures are designed to withstand the effects of natural phenomena such as hurricanes, floods, tornados, tsunamis, and earthquakes without loss of capability to perform safety functions. The nuclear island structures are designed to withstand the effects of postulated internal events such as fires and flooding without loss of capability to perform safety functions. Some floors provide radiation shielding.

The floors in the auxiliary building are seismic Category I structures and provide support and anchorage for component and piping supports and other attachments. Some floor structures in the auxiliary building are constructed with metal decking supporting the wet concrete prior to the concrete setting. These floor structures in the auxiliary building are designed as composite slabs in accordance with AISC N690. Other floor structures in the auxiliary building are designed as reinforced concrete slabs with cast-in-place concrete placed on precast panels in accordance with ACI-349.

The design of headed reinforcement is consistent with the criteria for development of headed reinforcement which utilize ACI 318-11, Section 12.6 requirements and which have been previously approved and incorporated into UFSAR Subsections 3.8.3.5, 3.8.4.4.1, and 3.8.4.5.1 of the licensing basis.

Supporting Technical Details

The auxiliary building floors are seismic Category I structures and are designed for dead, live, thermal, pressure, safe shutdown earthquake, and loads due to postulated pipe breaks. The variation in these loads and in the geometry of the structure results in the variation of design details, including reinforcement arrangement, size of supporting beams, design of beam and panel supports, and the size of ribs from the use of corrugated metal decking. The licensing basis changes note that floors in the auxiliary building, other than the critical sections, vary in design details from the details shown in the UFSAR figures. The detail design changes do not change the design loads. The design of the floors, including those with variances with the details shown in the figures, remains in conformance with applicable requirements in ACI-349, AISC N690, and supplemental requirements in Section 3.8 of the UFSAR. These requirements were confirmed during the review of the design certification and provide a sufficient margin of safety to structural failure for the design basis loads. The editorial changes in reference to the table and figure numbers do not change the design or the design requirements.

The changes to the licensing basis in Appendix 3H more clearly separate the general description of the floor designs from the descriptions of the licensing basis critical sections. The changes clarify that the variances in design details do not apply to critical sections.

The addition of 2.5 inch metal decking to the design of the metal decking in a composite floor, concrete over metal decking, is based on the use of stronger, heavier metal decking where geometry considerations require longer spans between beams. The heavier decking is manufactured with thicker plate and shallower corrugations (ribs). There is no adverse impact on the floor design because the more shallow corrugations result in a thicker floor above the ribs. There is no change in the conformance of the design with the applicable codes and standards.

The design of the concrete and reinforcement in the floor sections satisfies the requirements of ACI 349 for flexural reinforcement. The reinforcement designs for floor sections other than the critical sections use many combinations of size and spacing of reinforcement bars depending on the loading conditions and geometry. In the vicinity of openings and penetrations the size and spacing of the reinforcement varies as necessary to satisfy ACI 349 requirements. The design information for the adjacent wall and floors shown in Figure 3H.5-8 is specific to the critical section. For other floor sections the designs for the adjacent walls and floors, including thickness, reinforcement design, and type of construction, are different based on design requirements and geometry for the wall or adjacent floor. In some locations the adjacent wall is a structural module. The differences in the wall and adjacent floor design do not change the design requirements for the floors.

The design of the supporting beams, beam supports, shear connectors, and the composite action of the floor of concrete on metal decking is evaluated according to the requirements of AISC N690. Predominately the beams used for the composite floor are W14x26 and W14x48. The range of beam sizes used in other locations is from W10 to W44. The smaller beams are used to provide clearance or for very short spans. The heavier beams are used because of heavier loads or longer spans of beams. In a few cases large beams are used where other beams tie into a large beam. The beams usually have a span of 15 to 25 feet with an overall range of spans of 2 feet 6 inches to 38 feet 6 inches. The beam spacing and beam to wall spacing is usually approximately 5 to 6 feet with an overall range of 3 to 8 feet. The variation in the length of spans and spacing between is generally required by the local geometry.

The beam supports and panel supports are shown with deformed wire anchors embedded in the concrete in the revised figures. The deformed wire anchors are used at the critical section as well as other floor sections. The embedment design satisfies the requirements of ACI 349 Appendix B and other sections of ACI 349 as required by Appendix B for deformed wire anchors. The number and spacing of the anchors can be different than that shown in the figure based on local loads. Headed shear studs can be used in lieu of deformed wire anchors. The design of the portion of the support exterior to the wall satisfies AISC N690 requirements. Gussets and supporting plates can have a different size or shape based on the local loading condition and orientation between the beam and wall. Additional plates or structural shapes not shown in the figure can be used. In some locations the beam and panel supports are connected to a structural wall module.

The changes in the design of the cast-in-place concrete over precast concrete panel type of floor replace the description of the design of the floor system. The original design includes precast panel reinforcement anchored in the wall. In this original design the full depth composite section is used in the longitudinal reinforcement design for the precast panel in the direction parallel with the reinforcement that extends out of the precast panel and is anchored into the wall. The new design is such that the flexural reinforcement for the cast-in-place portion of the floor is designed to resist the floor design loads. As explained below, although the capacity of the precast panels is neglected in the design of the floor reinforcement design, the precast panels and the cast-in-place concrete act together as a reinforced slab in the auxiliary building finite element analysis.

The precast panels are neglected in determining floor strength and load carrying capacity. That is, the longitudinal reinforcement in the cast-in-place portion of the floor is sized to resist the design loads on the floor without reliance on the longitudinal reinforcement in the precast panel. The floor reinforcement located in the cast-in-place portion of the floor is fully developed in the walls in accordance with ACI 349 Chapter 12 and Chapter 21. The design of the connection provides a fixed connection between the floor and wall. Out-of-plane shear forces from both the precast panel and cast-in-place concrete portions of the floor slab are transferred to the supporting wall by means of the horizontal floor slab reinforcement located within the cast-in-place portion of the floor. The floor reinforcement transfers the out-of-plane shear forces through shear friction in accordance with ACI 349 Section 11.7. The design of these floors, with the reliance on only the longitudinal reinforcement in the cast in-place concrete sized to resist design loads, is a conservative approach in conformance with applicable requirements in ACI-349 Section 17.2 which permits a portion of the member to be used for resisting shear and moment. The design of these floors also remains in conformance with supplemental requirements in Section 3.8 of the UFSAR. The floors with variations in the design details including the span, width, and thickness of the floor satisfy the design requirements for the floors.

The precast panel is part of the seismic Category I floor slab. The reinforcement in the precast panel is sized to support the weight of the panels and the weight of the wet concrete during construction. The precast panels are counted on for mass and stiffness in the structural analysis of the structure. The stiffness of the floor is based on the combined thicknesses of the concrete in the cast-in-place portion and the precast concrete panel. The shear reinforcement tying the precast and cast-in-place portions of the floor system together is detailed and analyzed for post-construction loading as a composite floor comprised of the precast panels and the cast-in-place concrete working together. Although it is not relied on for post construction loads, the reinforcement in the bottom of the precast panel is evaluated using ACI 349 Chapter 10 criteria for minimum and maximum reinforcement. The reinforcement in precast panel satisfies the ACI 349 limits. The precast panels are included in the floor thickness for evaluation of radiation protection.

ACI-349 Chapter 17, including requirements for shear stirrups and preparation of the surface of the precast panels, is followed in order to achieve the composite behavior between the precast panel and the cast-in-place concrete for analysis purposes. The behavior of the slab in the overall building structure is based on the composite action. The precast concrete panel is anchored to the cast-in-place concrete through the shear stirrups and is an essential structural element of the floor. Transfer of horizontal shear is accomplished through roughening of the precast panel top surface in accordance with ACI 349-01 Section 17.5.2.3 and shear ties provided in accordance with ACI 349-01 Sections 17.5 and 17.6. The precast panel is considered seismic Category I because of the composite behavior of the floor system and the effect on the structure response. The seats on which the precast panels are placed support the precast panel and the wet concrete loads but are not relied on for support of the floor system once the concrete is set.

The detail design includes a ½ inch wide gap between the precast panel and the walls and no reinforcement directly tying the precast panel to the walls. Along the sides of two precast panels placed next to each other will be a ½ inch gap equal in depth of the panels. The reinforcement in the precast panel running perpendicular to this gap is not continuous between two panels nor does it extend out of the panel into the wall parallel to the gap.

The auxiliary building floor response and design forces/moments are calculated from the building finite element analysis (FEA) model. Reinforced concrete structures are modeled with linear elastic uncracked properties; however, the modulus of elasticity is reduced to 80 percent of its value to represent the stiffness that reflects the observed behavior of concrete when stresses do not result in significant cracking. The floors constructed with precast panels are considered in the building FEA model as homogeneous units of thickness equivalent to the combination of the cast-in-place thickness plus the precast panel thickness. The presence of the gaps and discontinuity of reinforcement in the precast panels has an impact on the out-of-plane response of the floors. The one-way and two-way behavior is affected by the ½ inch gaps between the precast panels and the wall as well as the regions of undeveloped reinforcement at the edges of the precast panels. The two-way behavior is further affected by the ½ inch gap between precast panels because the gap occurs in a region where the precast panel is in tension due to two-way action, and the tension section is interrupted by the presence of the gaps and undeveloped reinforcement. In order for the response of the floor to remain rigid, the effect of the gaps and discontinuity of reinforcement must not degrade the floor response below 33 Hz. Therefore, justification is provided to demonstrate that (1) 80 percent effective modulus remains acceptable for predicting cracked concrete behavior for the design loads; and (2) the floor response is not degraded below 33 Hz.

Because there are several combinations of pre-cast panel thickness, span length, and aspect ratio for both the one-way and two-way floors, bounding conditions were chosen for evaluation. The bounding condition for one-way behavior was created by combining the longest span with the highest ratio of precast to cast-in-place thickness from all of the one-way spans. For two-way behavior, the additional effect of the ½ inch gap between panels was studied for the bounding section.

In order to demonstrate that the 80 percent effective modulus remains acceptable, various one-way and two-way floor FEA models were studied. Linear FEA were performed with a homogenous material property equivalent to an 80 percent effective modulus, and include the ½ inch gaps between the precast panels and the walls, and the ½ inch gap between adjacent precast panels. Non-linear FEA were also performed for comparison to the linear FEA.

The non-linear FEA models include both concrete and reinforcement modeled directly, with undeveloped reinforcing bar at the edges of the precast panels removed. The non-linear FEA uses a concrete cracking model to predict regions of concrete cracking due to tension. The non-linear FEA also includes the ½ inch gaps between the precast panels and the walls, and the ½ inch gap between adjacent precast panels. In order to predict the level of cracking, a uniform load combining dead load, live load, and seismic loads equivalent to 1.67 times SSE were applied to the non-linear FEA.

Displacement results between the linear and non-linear models were compared. For one-way action, the displacement due to the non-linear models predicting cracking was 12 percent less than the displacement from the linear model with 80 percent effective modulus. For two-way action, the displacement due to the non-linear models predicting cracking was 8 percent greater than the displacement from the linear model with 80 percent effective modulus. Therefore, because the displacements from the linear and cracked concrete model are substantially in agreement for both one-way and two-way action, the use of an 80 percent effective modulus in linear analysis remains appropriate for predicting the level of cracking for design loads.

The bounding level of "softening" (that is, a reduced effective section modulus) was determined by reducing the effective modulus of the linear one-way model with full composite section depth (i.e. no gaps) to achieve a displacement equivalent to the displacement from the model that includes the ½ inch gaps and concrete cracking. The bounding result is a 53 percent effective modulus, or an additional 34 percent reduction to the 80 percent effective modulus.

The bounding change to the floor response was calculated by performing a modal analysis of the bounding floor. The bounding floor vertical response at 80 percent effective modulus is 45 Hz. After "softening" to 53 percent effective modulus, the bounding floor vertical response is 37 Hz, a 17 percent reduction in vertical response. The vertical floor response remains well within the rigid range of response. The change in seismic demand due to "softening" was studied by comparison of floor and adjacent wall demand from the original building response spectra analysis and from the building response spectra analysis that includes "softened" floors constructed with precast panels. The comparison of demand demonstrates that the additional softening of the floors constructed with precast panels results in insignificant change to the seismic force demand.

Further conservatism is achieved by considering only the cast-in-place portion of the floors for comparison of strength to demand in the code evaluation. For one-way floors, the precast panels are detailed to be effective in carrying demand, but are neglected in the design. For two-way floors, the presence of the gaps between the precast panels and regions of undeveloped reinforcement in the precast panels reduces their effectiveness in one direction, and their strength contribution is neglected in both directions in the code evaluation.

The effect of the ½ inch gaps on the membrane stiffness of the floors is also evaluated. The change in the in-plane axial and in-plane shear stiffness is evaluated by comparing a FEA model including the ½ inch gaps to a FEA model without the gaps. The resulting change in stiffness is less than 1 percent. Therefore, global effects due to the presence of the ½ inch gaps, concrete cracking, and undeveloped reinforcement at the edges of the precast panels is acceptably represented in the building FEA by the 80 percent effective modulus.

The mass of the precast panel is considered in the seismic analysis of the floor and is not significantly changed with the inclusion of the gap between the precast panel and the wall. The impact of the mass change in the finite element model is insignificant.

As outlined above, the capacity of the reinforced concrete floor system is provided by design in conformance with ACI-349. Composite action assumed in the evaluation of the seismic response of the structure is provided by conformance with ACI 349 Chapter 17. The change in stiffness is not significant, and the change in mass of the floor system is not significant. Therefore, the existing seismic analysis finite element model is not significantly impacted by this design change.

The changes in the description of the cast-in-place concrete over precast concrete panel type of floor identify possible differences in the details for this type of floor design including the thickness of the precast panels. This is a clarification that there are variances in the floor design for sections in locations other than the critical sections from the design details shown for the critical section. As noted above the floor designs with the design variances are in conformance with ACI 349.

The change to Figure 3H.5-1 is an administrative change so that the labels on the figure conform to the Item numbers in the list In UFSAR Subsection 3H.5-1. This change does not change the definition of critical sections, technical information, design requirements, or conformance with regulatory information.

The proposed changes include implementation of requirements for development of headed reinforcement. These changes include, changing the term “Anchor Plates” to “T-Heads”, extending the lengths of the reinforcement into the walls, and adding a note to the drawing identifying the requirements for development of headed reinforcement on Figure 3H.5-8. These requirements are based on requirements in ACI 318-11, Section 12.6. The use of these requirements was approved in a previous license amendment and incorporated into Subsections 3.8.3.5, 3.8.4.4.1, and 3.8.4.5.1 of the licensing basis. See SCE&G COL Amendments 2 and 5 (Adams Accession Numbers ML13056A183 and ML13149A314, respectively).

The proposed changes to the reinforcement in UFSAR Figure 3H.5-8 are incorporated to provide reinforcement in the cast-in-place concrete consistent with the analysis to resist the loads in the cast-in-place concrete without relying on the flexural reinforcement in the precast panels. The figure is also revised to make a minor change to be consistent with drawing convention. The revised design is in conformance with ACI 349. The drafting convention changes do not change design information or design requirements. The proposed changes to the detail design of the auxiliary building floors do not change the function, design, or operation of the systems and components supported by the floors in the auxiliary building. The proposed changes do not change the function, design, or operation of the containment vessel and passive containment cooling system. The proposed changes do not affect the prevention and mitigation of abnormal events, e.g., accidents, anticipated operational occurrences, earthquakes, floods and turbine missiles, or their safety or design analyses. The proposed changes do not involve, nor interface with, any structure, system or component accident initiator or initiating sequence of events, and thus, the probabilities of the accidents evaluated in the UFSAR are not affected.

The detail design changes to the floors in the auxiliary building do not interface with or affect safety-related equipment or a fission product barrier. No system or design function or equipment qualification would be adversely affected by the proposed changes. The changes do not result in a new failure mode, malfunction or sequence of events that could adversely affect a radioactive material barrier or safety-related equipment. The proposed changes do not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

The proposed changes do not adversely affect any safety-related system or component, equipment, design code, design code allowable value, function or design analysis, nor do they adversely affect any safety analysis input or result, or design/safety margin.

The proposed activity has no adverse effect on the ex-vessel severe accident. The design, geometry, and strength of the containment internal structures are not changed.

The design and material selection of the concrete floor beneath the reactor vessel is not altered. The response of the containment to a postulated reactor vessel failure, including direct containment heating, ex-vessel steam explosions, and core concrete interactions is not altered by the changes to the detail design of floors in the auxiliary building. The design of the reactor vessel and the response of the reactor vessel to a postulated severe accident are not altered by the changes to the detail design of floors in the auxiliary building.

The proposed activity has no impact on the Aircraft Impact Assessment. The changes described to the floors are internal to the structures and do not impact the design or response of the containment vessel and shield building. The changes to the auxiliary building do not change the thickness or strength of the shield building roof. There is no change to protection of plant structures, systems, and components against aircraft impact provided by the design of the shield building. There is no change to the design of any of the key design features described in UFSAR Appendix 19F. The activity described does not change the overall design or construction of the shield building.

The proposed changes associated with this license amendment request include a change in the detail design of floors in the auxiliary building. The changes are internal to the structures and the configuration, thickness, and density of the structures are not changed. The proposed changes do not affect the radiological source terms (i.e., amounts and types of radioactive materials released, their release rates and release durations) used in the accident analyses, thus, the consequences of accidents are not affected. These changes do not affect the containment, control, channeling, monitoring, processing or releasing of radioactive and non-radioactive materials. The location and design of penetrations and the permeability of the concrete structures is not changed. No effluent release path is affected. The types and quantities of expected effluents are not changed. The functionality of the design and operational features that are credited with controlling the release of effluents during plant operation is not diminished. Therefore, neither radioactive nor non-radioactive material effluents are affected.

The thickness of the floors and the density of the concrete are not changed; therefore, there is no adverse change to the shielding provided by the floors. There is no change to plant systems or the response of systems to postulated accident conditions. There is no change to the predicted radioactive releases due to normal operation or postulated accident conditions. Plant radiation zones, controls under 10 CFR Part 20, and expected amounts and types of radiologically controlled materials are not affected by the proposed changes. Therefore, individual and cumulative radiation exposures do not change.

The change activity has no impact on the emergency plans or the physical security evaluation since there are no changes to the external configuration of the roof, walls, doors, or access to the Nuclear Island.

Summary

The proposed changes revise Tier 2* information and associated Tier 2 information in the UFSAR in regard to requirements for detail design of floors in the auxiliary building. These changes include design changes to the cast-in-place concrete and precast concrete panels, the rearrangement of reinforcement bars to make the design practicable, and the size of metal decking supporting wet concrete. Changes to the licensing basis text and figures identify design variations of similar floor sections. The proposed changes also incorporate the requirements for development and anchoring of headed reinforcement previously approved. The proposed changes do not adversely affect the strength or response of the nuclear island seismic Category I structures.

The above proposed changes do not adversely affect any safety-related equipment or function, design function, radioactive material barrier or safety analysis.

South Carolina Electric & Gas Company

Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3

NND-14-0XYZ

Enclosure 2

Proposed Changes to Licensing Basis Documents

(LAR 14-01)

UFSAR Subsection 3H.1, Introduction – Revise the second paragraph as shown below.

S~~s~~ubsections 3H.2 through 3H.4~~5~~ include a general description of the auxiliary building and shield building, a summary of the design criteria and the global analyses. Subsection 3H.5 describes the design of types of structures in the auxiliary building and shield building and the design of critical sections. ~~Examples of~~ The 3H.5 figures referenced in the descriptions show the structural designs ~~are shown~~ for ~~14~~ critical sections which are identified in subsection 3H.5 and shown in Figure~~s~~ 3H.5-1 (3 sheets). The exact locations of the critical sections related to the shield building cylinder shown in Figure 3H.5-16. Representative design details are provided for these structures in subsection 3H.5.]*

UFSAR Subsection 3H.5, Structural Design of Critical Sections – Revise the first paragraph as shown below.

[*This subsection summarizes the structural design of representative seismic Category I structural elements in the auxiliary building and shield building. The~~se structures~~ critical sections are listed below and the corresponding location numbers are shown on Figure 3H.5-1 for twelve of the critical sections. Items 13 and 14 in the list below are located in the shield building cylinder and are discussed in APP-GW-GLR-602 (Reference 1). The basis for their selection to this list is also provided for each structure.*

UFSAR Subsection 3H.5.2, Composite Structures (Floors and Roof) – Revise the first and second paragraphs, as shown below.

The floors consist of a concrete slab on metal deck, which rests on structural steel floor beams. Several floors in the auxiliary building are designed as one-way reinforced concrete slabs supported continuously on steel beams. Typically, the beams span between two reinforced concrete walls. The beams are designed as composite with formed metal deck spanning perpendicular to the members. Unshored construction is used. For the floors, beams are ~~typically~~ predominately spaced at about 5- to 6-feet intervals and spans are between ~~16~~ 15 feet and 25 feet. Based on local geometry considerations, the intervals and spans are outside these ranges in a limited number of locations. The spacing between the beams or between beams and walls is as small as 3 feet and as large as 8 feet. The span of the beams is as small as 2 feet, 6 inches and as large as 38 feet, 6 inches. The designs of the beams satisfy the requirements in AISC N690 for composite structures.]*

Structural Description

[*A typical layout of these floors is shown in Figure 3H.5-6. The metal deck rests on the top flange of the structural steel floor beam, with the longitudinal axes of the metal deck ribs and floor beams placed perpendicular to each other. Figure 3H.5-6 shows the key structural elements in composite floors. The reinforcement size and spacing are based on loads and spans for this type of floor and are determined at each location based on the requirements in ACI 349 for flexural reinforcement. The development of the floor reinforcement in the walls can be either headed reinforcement or standard hooks. The beam size and spacing and beam support designs are based on loads and spans for this type of floor as noted on the figure. The beam support designs include beam seats or shear plates connected to the web of the beam. The detail design of the support for the beam, including the portion embedded in the concrete wall, is based on the load and structural system configuration as noted on the figure. The designs of these floors are in conformance with AISC N690 and ACI 349. The depth of the ribs for 9-inch concrete floor slabs, 9.5-inch concrete floor slabs, and 15-inch deep concrete roof slabs are 3 inches, 2.5 inches, and 4.5 inches respectively. The concrete slab is tied to the structural steel floor beam by shear connectors, which are welded to the top flange of the floor beam. The concrete slab and the floor beams form a composite floor system. For the design loads after hardening of concrete, the transformed section is used to check the stresses.*

UFSAR Subsection 3H.5.2.2, Floor at Elevation 135'-3", Area 1 (Between Column Lines M and P) – Revise the Tier 2* text in the first paragraph and add a second paragraph, as shown below.

[*The design of a typical composite floor is shown in Figure 3H.5-6. The design summary for the floor between column lines M and P at elevation 135'-3" is shown in Table 3.H.5-11. The concrete slab is 9 inches thick, plus 3-inch deep metal deck ribs. The floor beam size ~~are~~ is shown on the figure. ~~typically W14x26.~~*

UFSAR Subsection 3H.5.3, Reinforced Concrete Slabs - Revise Tier 2* information in the paragraph to include revised information in the locations shown below.

[*Reinforced concrete floors in auxiliary building are 24 inch or 36 inch thick. These floors are constructed with ~~16" or 28" of~~ reinforced concrete placed on the top of 8 to 12 inch thick precast concrete panels. The ~~8" thick~~ precast concrete panels are installed at the bottom to serve as the formwork and withstand the load of wet concrete slab. The spans of the floors are predominately 13 feet to 20 feet, and the precast panels are predominately 7 to 14 feet wide. Based on local geometry considerations, the widths and spans are outside these ranges in a limited number of locations. The spans of the floor are as small as 5 feet and as large as 21 feet. The width of the precast panels is as small as 4 feet and as large as 19 feet. The number of side-by-side precast panels ranges from one to eight.*

Examples of such floors are the Operations Work Area (Tagging Room) ceiling slab at elevation 135'-3' in Area 2, and the Area 5/6 elevation 100'-0" slab between column lines 1 & 2.

Figure 3H.5-8 shows the key structural elements in reinforced concrete floor slabs. The precast panels and the cast-in-place concrete are designed to act together as a composite reinforced slab so that the floor dynamic response is consistent with the auxiliary building finite element analysis. However, the precast panels are neglected in determining floor strength and load carrying capacity. The reinforcement size and spacing are determined for each location, based on specific loads and spans, and satisfy the requirements in ACI 349 for flexural reinforcement. The floor thickness and precast panel thickness for this type of floor are based on specific loads and spans as noted on the figure. The type and thickness of adjacent walls and floors vary as noted on the figure. The main reinforcement is provided in the cast-in-place concrete. Reinforcement is placed in both the top and bottom layers of the cast-in-place concrete in both directions. For the design of the reinforcement in the cast-in-place floors, post-construction loads are conservatively assumed to be resisted only by the cast-in-place concrete and the reinforcement placed within it. The reinforcement in the cast-in-place portion is fully developed into supporting adjacent walls such that the connection is assumed to be a fixed connection. The development of the floor reinforcement in the walls is achieved using either headed reinforcement or standard hooks

The precast panel reinforcement is designed to resist the weight of the panel and the wet weight of the cast-in-place concrete during construction. Reinforcement is placed within the precast panel portion in both top and bottom layers in both directions. The precast panel reinforcement is contained within the panel. The reinforcement is discontinuous with a design gap between adjacent precast panels and between precast panels and walls. There is also a design gap between precast panels and precast panels and walls. The precast panels ~~which~~ are connected to the concrete placed above ~~it~~ them by shear reinforcement, which satisfies the requirements of ACI 349 Chapter 17. The precast panels and the cast-in-place concrete are made to act together as a composite reinforced concrete slab by roughening the top surface of the precast panel and providing shear ties between the two elements. The detail designs of the supports for the precast panels are based on the loading and design requirements. The design of these floors is in conformance with AISC N690 and ACI 349. ~~Examples of such floors are the Operations Work Area (Tagging Room) ceiling slab at elevation 135 ft 3 inches in Area 2, and the Area 5/6 elevation 100'-0" slab between column lines 1 & 2.~~

The structural model used for finite element analysis of the auxiliary building seismic response assumes a homogenous thickness of concrete for the floor system. The detail design of the floor system departs from this assumption by including a small gap between the precast panel and the wall and by not extending the precast panel reinforcement in the wall. Consideration of the floor system design detail is not a significant effect on the design and analysis of the auxiliary building structure as explained below. The structural model of the auxiliary building includes floor-to-wall connections for the reinforced concrete floor that are fixed over the full thickness of the floor system. Although the gap between the precast panels and the wall reduces the thickness of the floor in direct contact with the wall, the design of the floor system satisfies the requirements, including fully developing the floor reinforcement in the wall, for seismic design in ACI 349, Chapter 21. The design of the floor system and the connection with the wall provide a fixed connection that transfers forces and moments from the floor to the wall.

Detailed finite element analysis of the floor system with the connection detail design, including the gap between the precast panel and wall, shows a reduced stiffness of the floor system compared to the assumptions in the structural model. There is a reduction in stiffness in the floor due to the gap between the panel and wall and due to the gaps between adjacent panels. The difference in the stiffness does not have significant effect on the floor demand. Because the precast panel and the cast-in-place concrete act together as a composite floor system, much of the stiffness provided by the precast panel acts in the composite system. The reduction in the stiffness of the floor system is not significant because the floors are rigid with a natural frequency well above 33 Hz. Consideration of the gap and discontinuous reinforcement does not reduce the natural frequency of the floor below 33 Hz.]*

UFSAR Subsection 3H.5.3.1, Operations Work Area (Tagging Room) Ceiling - Revise subsection as shown below.

The tagging room (room number 12401) location is shown on *Figure 1.2-8*. [*Figure 3H.5-8 shows the typical cross section and reinforcement. The design summary for this location is shown in ~~Table 3.H.5-12~~ Table 3H.5-12. Design dimensions of the Operations Work Area (Tagging Room) Ceiling are as follows:*

UFSAR Chapter 3, Appendix 3H, Figure 3H.5-1 (Sheet 1 of 3), [*Nuclear Island Critical Sections Plan at El. 135'-3"*]* - Revise critical section indications to better match Subsection 3H.5.

UFSAR Chapter 3, Appendix 3H, Figure 3H.5-1 (Sheet 2 of 3), [*Nuclear Island Critical Sections Plan at El. 180'-0"*]* - Revise critical section indications to better match Subsection 3H.5.

UFSAR Chapter 3, Appendix 3H, Figure 3H.5-1 (Sheet 3 of 3), [*Nuclear Island Critical Sections Section A-A*]* - Revise critical section indications to better match Subsection 3H.5. This figure contains Security-Related information and is to be withheld from public disclosure under 10 CFR 2.390.

UFSAR Chapter 3, Appendix 3H, Figure 3H.5-6, [*Auxiliary Building Typical Composite Floor*]* - Revise Tier 2* information as shown in the figures following this page. A separate sheet displaying the notes proposed to be added to this figure is provided to aid in review of the proposed changes.

UFSAR Chapter 3, Appendix 3H, Figure 3H.5-8, [*Auxiliary Building Operations Work Area (Tagging Room) Ceiling*]* - Revise Tier 2* information as shown in the figures following this page. A separate sheet displaying the notes proposed to be added to this figure is provided to aid in review of the proposed changes.

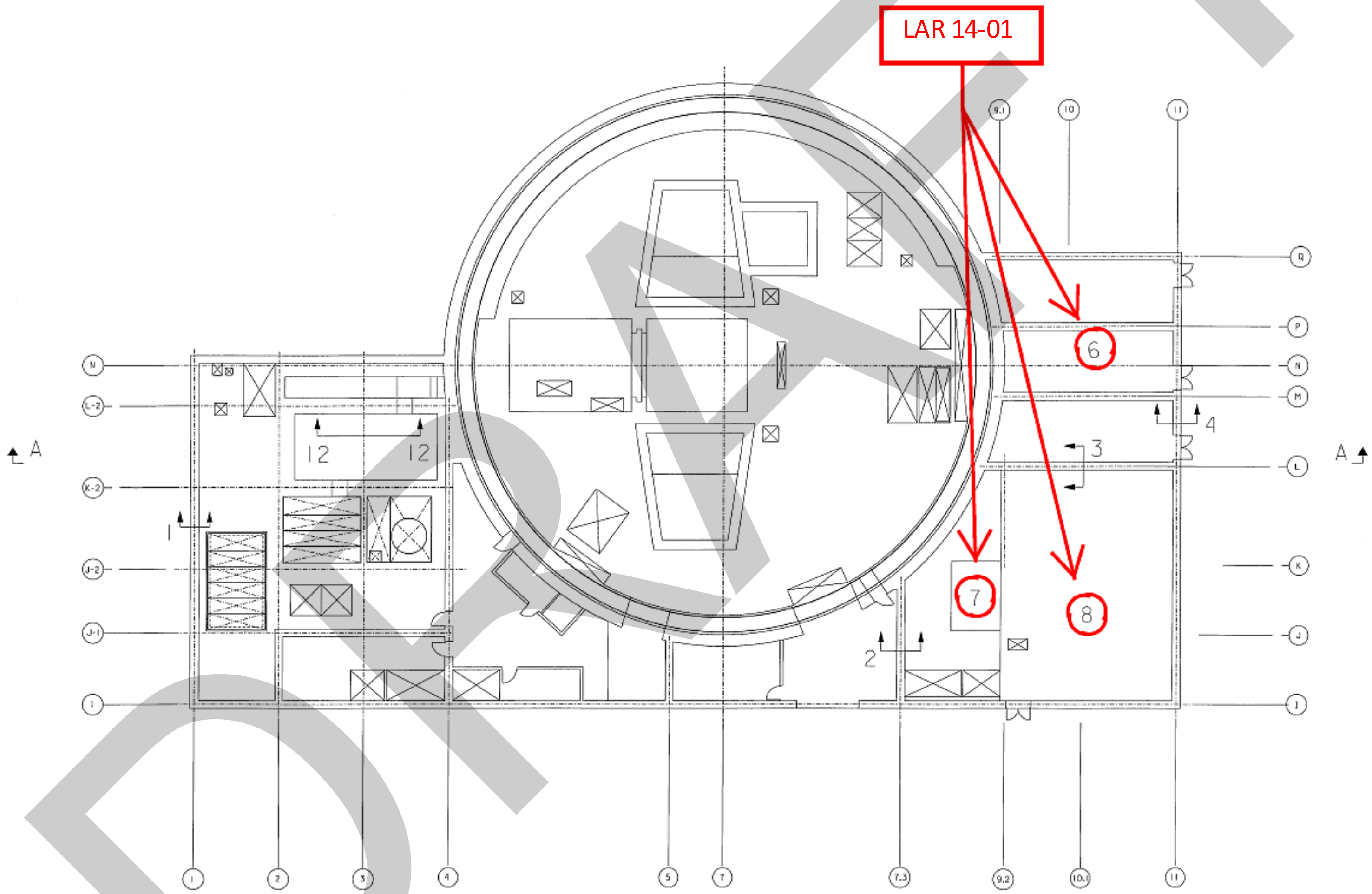
Notes proposed to be added to Figure 3H.5-6:

1) Detail shown is specific to the composite floor at El. 135′ -3″ at intersection with Wall M. Refer to Subsection 3H.5.2 and other notes for additional information about design details for other floor sections.
2) [Previous Note 1 renumbered to Note 2.]
3) Floor beam size and spacing are designed based on floor load and geometry to satisfy AISC N690 requirements. The beam sizes used are predominately W14x26 and W14x48. The range of beam sizes is from W10 to W44. The spacing between the beams is predominately in a range of 5 to 6 feet.
4) The reinforcement shown is for locations away from openings, penetrations, embedments, and other obstructions.
5) Reinforcement size and spacing are based on the requirements in ACI 349 for flexural reinforcement.
6) The adjacent wall may be designed as a structural wall module.
7) The detail design, location and embedment of the beam supports are designed to the requirements of AISC N690 and ACI 349 as applicable. Support configuration, including the use of plates, structural shapes, and stiffeners, is based on loading and local geometry considerations. The design of embedment anchorage including type, size, and spacing satisfies the requirements of Appendix B as well as other applicable sections of ACI 349.

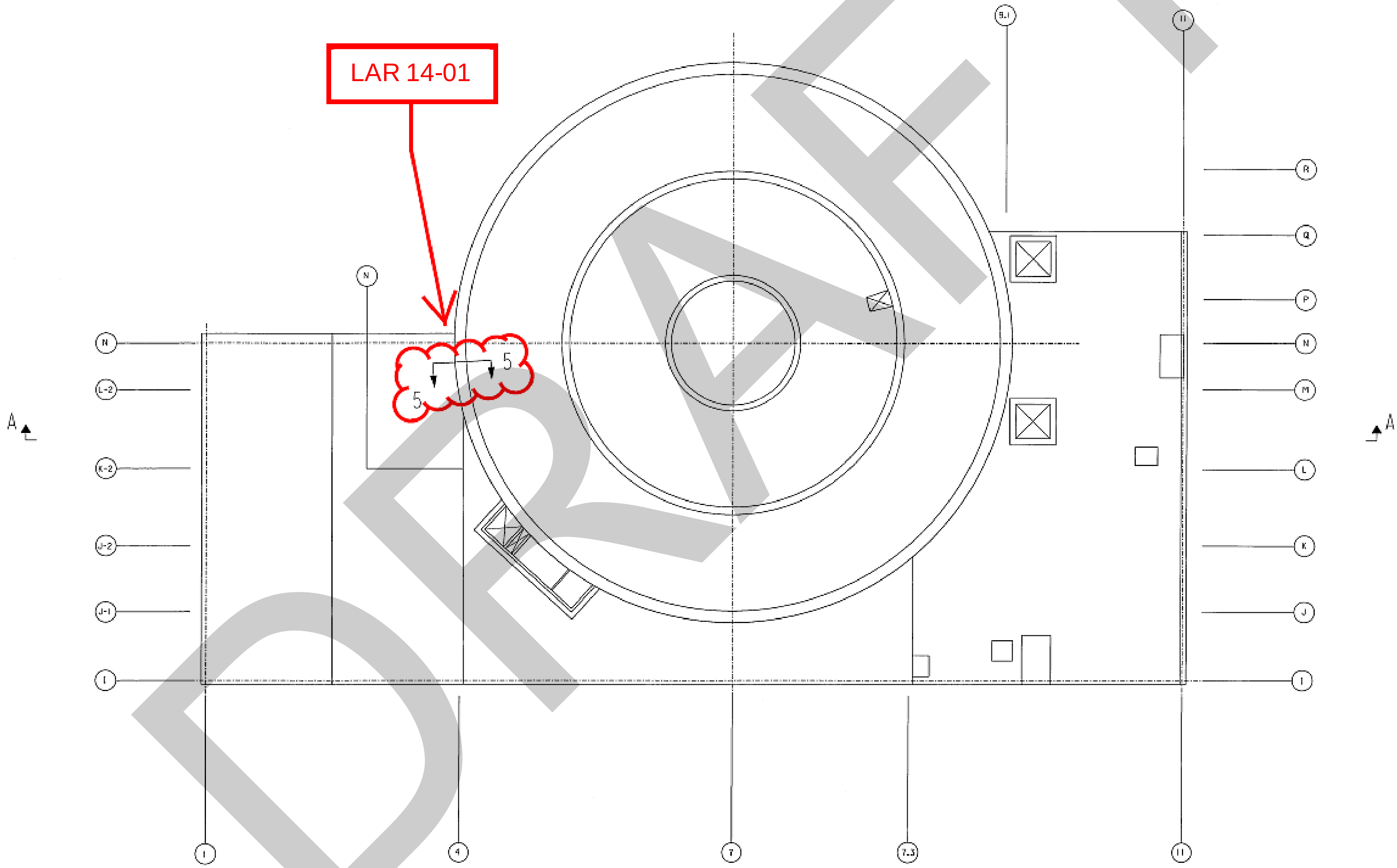
Notes proposed to be added to Figure 3H.5-8:

1) Detail shown is specific to the reinforced concrete floor at El. 135’-3” (operations work area ceiling). Refer to Subsection 3H.5.3 and other notes for additional information about design details for other floor sections.
2) Refer to Subsection 3.8.4.4.1 for the requirements for development of headed reinforcement.
3) The precast panel thicknesses are nominally 8, 10, and 12 inches.
4) The overall floor thicknesses are nominally 24 and 36 inches
5) The thicknesses of the cast-in-place concrete are nominally 14, 16, 24, and 28 inches.
6) Reinforcement size and spacing for the precast panel are based on the requirements in ACI 349 for flexural reinforcement.
7) The reinforcement shown is for locations away from openings, penetrations, embedments, and other obstructions.
8) Reinforcement size and spacing in the cast-in-place concrete are based on the requirements in ACI 349 for flexural reinforcement.
9) The size and spacing of the shear stirrups satisfy ACI 349 reinforcement requirements for in plane shear and to provide for composite action.
10) The detail design, location, and embedment of the panel supports are designed to the requirements of AISC N690 and ACI 349 as applicable. Support configuration, including the use of plates, structural shapes, and stiffeners, is based on loading and local geometry considerations. The design of embedment anchorage, including type, size, and spacing satisfies the requirements of Appendix B as well as other applicable sections of ACI 349.
11) The thickness of the adjacent wall is based on the wall design requirements and location.
12) The adjacent wall may extend above the elevation of the floor.
13) The adjacent wall may be designed as a structural wall module.
14) The designs of the adjacent floors are based on the floor design requirements.
15) The elevation of the top of concrete is based on location and design requirements for the floors.
16) The width and numbers of the precast panels is determined by local geometry.
17) The top of concrete elevation for the precast panels is based on the floor design requirements and location.

UFSAR Figure 3H.5-1 (Sheet 1 of 3) markups



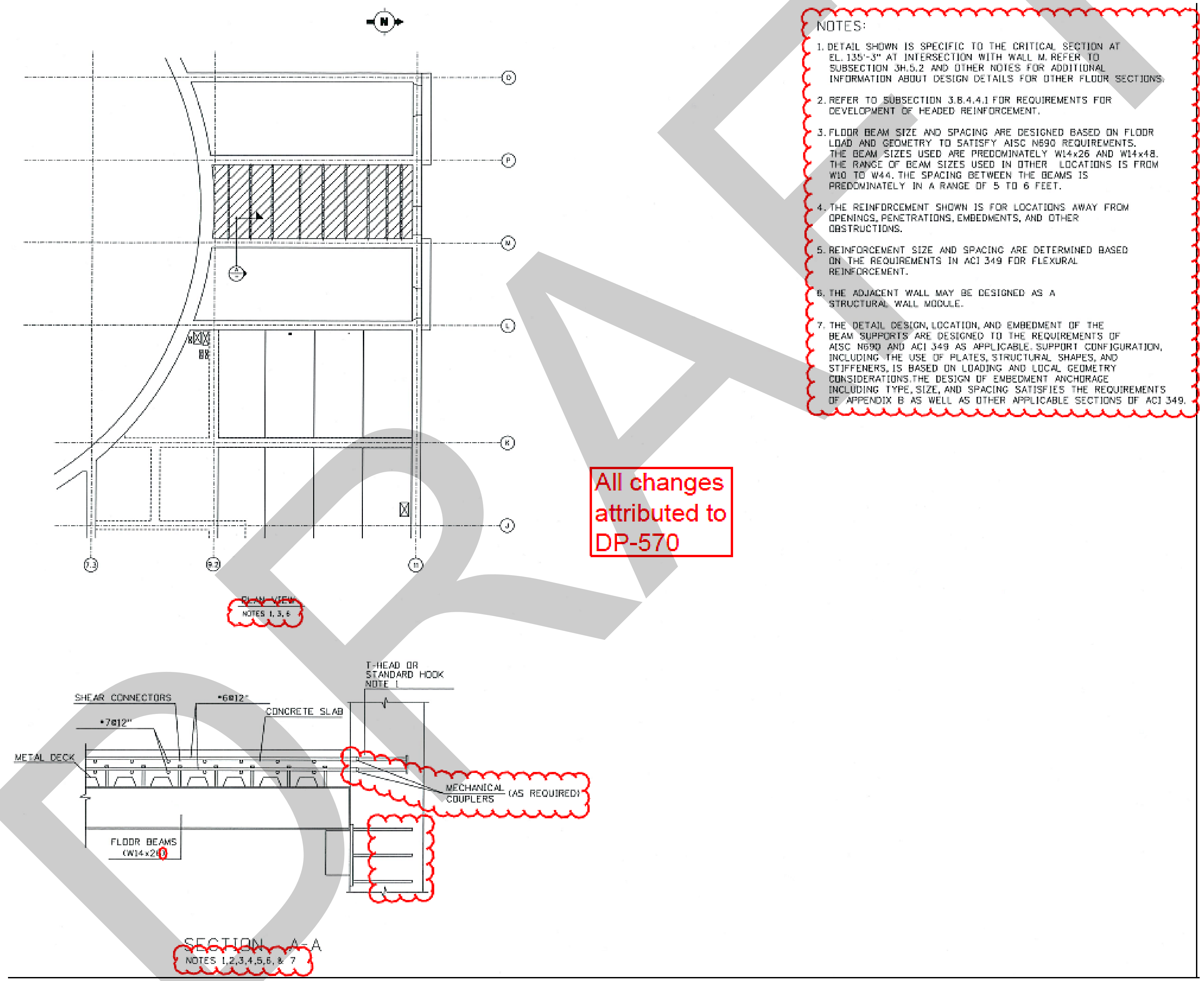
UFSAR Figure 3H.5-1 (Sheet 2 of 3) markups



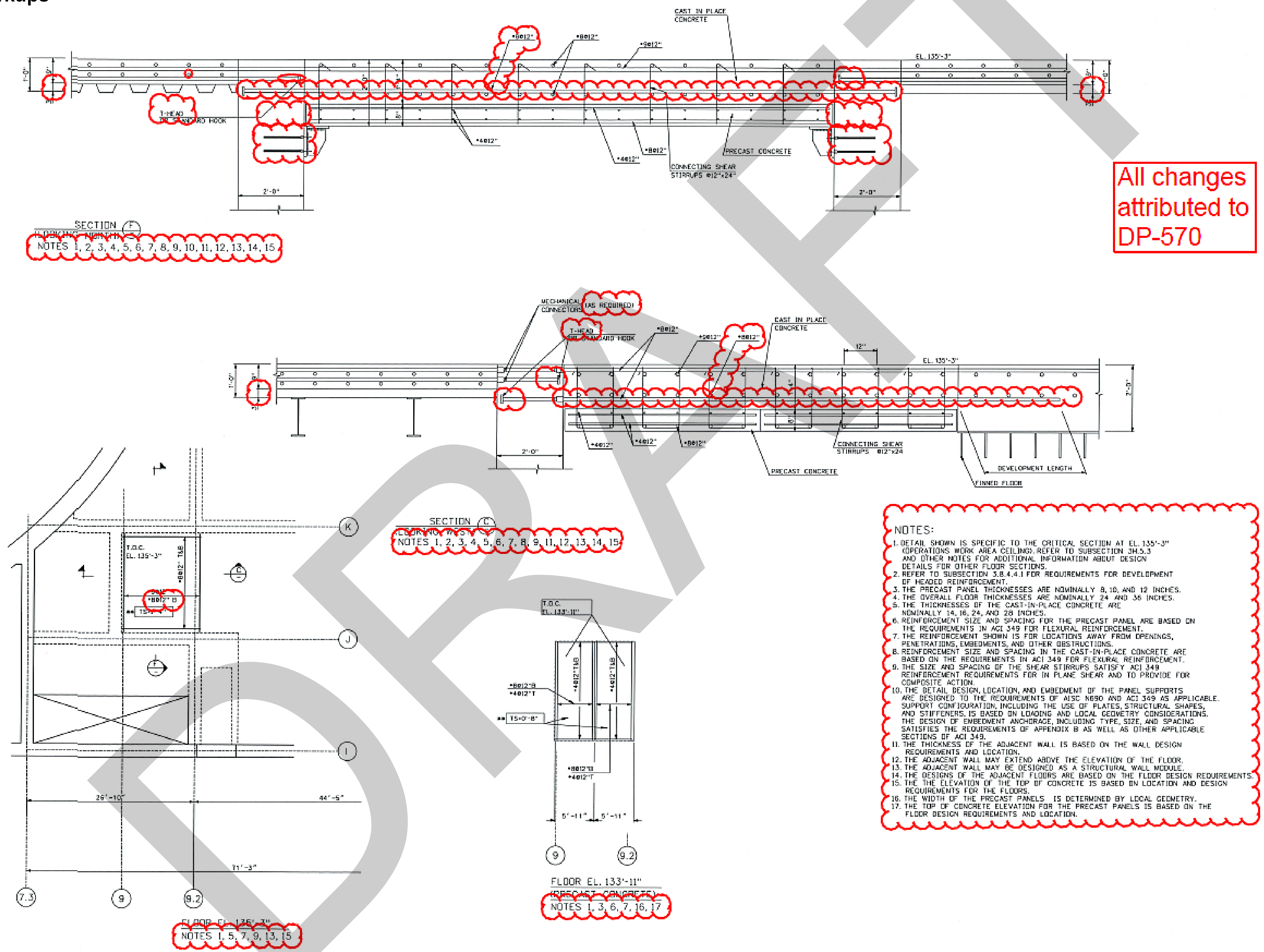
UFSAR Figure 3H.5-1 (Sheet 3 of 3) markups

Withheld from Public Disclosure Under 10 CFR 2.390d

UFSAR Figure 3H.5-6 markups



UFSAR Figure 3H.5-8 markups



All changes attributed to DP-570