

# Interface of Construction Documents and Submittals for Roofing

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*Figure 1 – Case Study 1 – Proper fastening.*

**P**roject submittals are a key piece of the construction process that sometimes are minimized in importance, rubber stamped, or not reviewed by staff with adequate knowledge of the material(s) and its application by both design and construction consultants. Submittals contain the information provided by the contractor to the design professional for approval of equipment, materials, and installation details before they are utilized at the project site. Submittals can be given in varying formats, such as shop drawings, product data, and material samples.

The agreement documents contain provisions for the information the contractor is required to submit to the design professional for review or to correct misunderstandings. The most commonly used documents by design professionals for detailing submittal requirements are the American Institute of Architects' (AIA's) A201, "General Conditions of the Contract for Construction," and the Engineers Joint Contract Document Committee's (EJCDC's) C-700, "Standard General Conditions of the Contract" for design-bid-build projects.

For design-build projects, the document used is AIA's A141, "Standard Form of Agreement Between Owner and Design-Builder."

Paragraph 6.17.C.1 of EJCDC C-700 requires that shop drawings include information such as "quantities, dimensions, specified performance and design criteria, and similar data." Section 3.12.1 of AIA's A201 defines shop drawings as "drawings, diagrams, schedules, and other data specially prepared for the work."

These documents include a broad "catch-all" provision allowing the design professional to request any other additional information necessary to adequately verify that the equipment or material included in a submittal meets the intent of the contract.

The EJCDC C-700 document says, "Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction" (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the contract documents) "or to safety precautions or programs incident thereto. ...The review and approval of a separate item as such will not indicate approval of

the assembly in which the item functions."

The AIA A141 design-build document notes for submittals that "the Design-Builder represents to the owner that it has (1) reviewed and approved them, (2) determined and verified materials, field measurements, and field construction criteria related thereto or will do so and (3) checked and coordinated the information contained within such Submittals with the requirements of the Work and of the Design-Build Documents."

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occur during the submittal phase is that the submittal review process is done by staff that are not familiar with the intricacies of the project requirements. This can lead to inadequate or missing information to show that the project requirements are being met.

The third-party consultant can either be under contract with the design-build general contractor or with the building owner. In the case of the design-build general contractor, the intent is to provide independent review of the roof construction operations to verify the roof membrane manufacturer's requirements—as well as applicable building code requirements—are met. The building owner can also hire a third-party consultant to review the construction process to supplement the design professional's duties for construction phase services and provide another set of knowledgeable eyes on the project.

The following two case studies describe where a project consultant was engaged as a third-party consultant for submittal review and construction observation for the building enclosure elements. They illustrate the importance of critical review of submittals for proper conformance of the design intent by the design professional.

#### CASE STUDY #1

A design-build contractor employed the project consultant to review submittals and perform periodic observation of the roof assembly installation being performed by a local subcontractor. The building itself was an office/storage area with approximately 18,422 m<sup>2</sup> (198,400 sq. ft.) of roof area. The roof assembly consisted of structurally sloped metal deck, a layer of 50-mm- (2-in.-) thick polyisocyanurate (iso), and a second layer of 48-mm- (1.9-in.-) thick iso. See *Figure 1* for insulation installation. A 1-mm- (45-mil-) thick thermoplastic polyolefin (TPO) membrane was installed using the heat induction method.

The heat induction process used metal plates coated with a TPO resin with fasteners penetrating the insulation. Fasteners were placed in a pattern to provide the required wind uplift resistance for the assembly. The fastener pattern was designed so that no more than 914 mm (36 in.) was between any two fasteners. The overlying TPO membrane sheet was then welded to each of those plates.

A special induction heater, placed over each attachment plate in turn, heated the plate for five seconds. A weighted magnet was placed above the plate for approximately 20 seconds, and the membrane and plate became welded together. The seams of the membrane sheets were then heat-welded together as is done with a TPO membrane. See *Figure 2*.

The submittal provided to the third-party consultant included a comprehensive list of technical information sheets of all the materials to be utilized for the project from the roof membrane and insulation manufacturer (a single entity). The submittal was noted by the designer of record (DOR) as "reviewed for design intent only," and the following was stamped on the submittal: "Reviewed for general compliance. Not reviewed for performance or compliance with any codes/energy standards/testing standards." Even though the statement



Figure 2 – Case Study 1 – Heat induction welding.

notes “not reviewed for compliance with any codes,” the DOR’s professional duty is that the documents must comply with applicable building and energy codes.

The third-party consultant also analyzed the roof membrane/insulation manufacturer’s system installation information. This information neither appeared to have been requested by the DOR from the roofing contractor, nor provided to the DOR in the submittal process. The third-party consultant’s review of the membrane/

insulation manufacturer’s system installation information indicated the fastener density for the 1.2- x 2.4-m (4- x 8-ft.) specified board insulation should be six fasteners in the field of the roof, 10 in the perimeter, and 16 for corner areas. Neither the plan set nor submittal documents contained any information about the board insulation fastening density or requirements for wind uplift performance. These criteria are noted in the building code to be included in the design documents.

A pre-construction meeting was not scheduled or conducted for the project. The third-party consultant was notified that the roofing operation had started, and the consultant arrived on site to discover the roofing contractor was only installing six fasteners for the 1.2- x 2.4-m (4- x 8-ft.) insulation boards in the corner and perimeter areas. A call from the third-party consultant to the roofing contractor’s project superintendent relayed that this fastener density was not per the manufacturer’s specifications. The contractor proceeded to contact the local manufacturer’s representative to independently verify the fastener density for the project and then began installing the fasteners as recommended.

## CASE STUDY #2

This project involved a third-party consultant review of a five-story residential living/retail space facility. Services included review of design documents and submittals, performance of periodic observation of the roof assembly installation, a penetration firestop inspection, water testing of select aluminum storefront sections, and air and water testing of selected vinyl windows.

During review of the design documents, the third-party consultant noted the following specification:

Mechanically fastened insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in Factory Mutual Global’s (FMG’s) “Approval Guide” for the specified windstorm resistance classification. [No specific windstorm resistance classification per FMG was noted in the design documents.]
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

The third-party consultant noted in the review letter, “The project is not insured by FMG; recommend change to conform to the current International Building Code (IBC) and American Society of Civil Engineers (ASCE) 07, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*, requirements for wind classification.”

The consultant added, “Revise fastening of insulation to meet current IBC and ASCE guidelines for attachment, especially since



Figure 3 – Case Study 2 – No insulation over OSB decking.



Figure 4 – Case Study 2 – No insulation.

roof height is over 18 m (60 ft.). Recommend provide fastening pattern for insulation fastening based on wind uplift calculations for roof at field, perimeter, and corners.” (See Figures 3 and 4.)

During construction, the third-party consultant reviewed submittals for the roof assembly. The building code for the project was the 2012 IBC. The building occupancy classification group was noted as R-2 (III-A) for the area covered by the roof assembly per the code summary on the plans.

The submittal for the roof assembly was provided to the third-party consultant four days before construction was scheduled to start. It was also given to the local roofing subcontractor and reviewed by the general contractor and DOR. Dated June 13, 2018, the DOR’s feedback said, “Reviewed exceptions noted” and “refer to comments throughout.” Actual roof installation started July 3, 2018. The third-party consultant’s post-review response included:

Roofing X-section shows new ethylene propylene diene monomer (EPDM) directly over oriented strand board (OSB) deck. Revise to include new 13-mm- (½-in.-) thick insulation board to meet UL [Underwriters Laboratories] Class B rating per building code per “third-party consultant” e-mail dated 7-3-18. [It] should provide fastener spacing/layout for insulation board to decking also for IBC/ASCE wind uplift requirements. Tapered insulation information for parking garages do [sic] not provide any information for insulation adhesive bead spacing to be used for field, perimeter, and corner areas.

A similar comment was not on the submittal from the DOR. The detail in the submittal showed the installation of a single-ply EPDM membrane directly over OSB decking. The roof decking is over an attic space with batt insulation in the cavity to provide the code-required thermal resistance value.

The third-party consultant tried to contact the general contractor's project superintendent by phone and left a voice message that the roof assembly needed to meet UL's fire rating classification (Class B) per the building code. The consultant also traveled to the site the same day to inform him of the situation. The project superintendent noted the roofing subcontractor had already started installation work but indicated he would get confirmation from the DOR on the third-party consultant's assessment and on what needed to be done to meet a UL rating. Later that day, the DOR agreed with the third-party consultant's assessment.


The manufacturer's list of approved insulation for an adhered 1.5-mm (60-mil) EPDM for a Class B roof assembly rating, according to the American

National Standards Institute's ANSI/UL 790, *Standard for Standard Test Methods for Fire Tests of Roof Coverings*, has these three listings:

- Minimum 48-mm (1.9-in.) layer of the EPDM manufacturer's iso high-density composite,
- Minimum 35-mm (1.4-in.) layer of any UL-classified EPDM manufacturer's iso insulation, and
- Minimum 25-mm (1-in.) layer of EPDM manufacturer's iso combustible deck insulation.

The number of listings meeting the UL Class A rating includes 15 systems. The installation system agreed upon was 6.4-mm- (1/4-in.-) thick gypsum-based insulation over OSB. This system is listed in the membrane manufacturer's UL Class A listing for combustible decks. The insulation board was to be attached with 16 fasteners per 1.2- x 2.4-m (4- x 8-ft.) board. The number of fasteners also met the wind uplift requirements for the roof system and wind zone area.

## CONCLUSION

These two case studies showcase the importance of timely and thorough submittal review. Lack of proper review can lead to installations not meeting the design intent and, possibly, building code requirements. Submittals are a key part of the construction process and need to be addressed accordingly. 

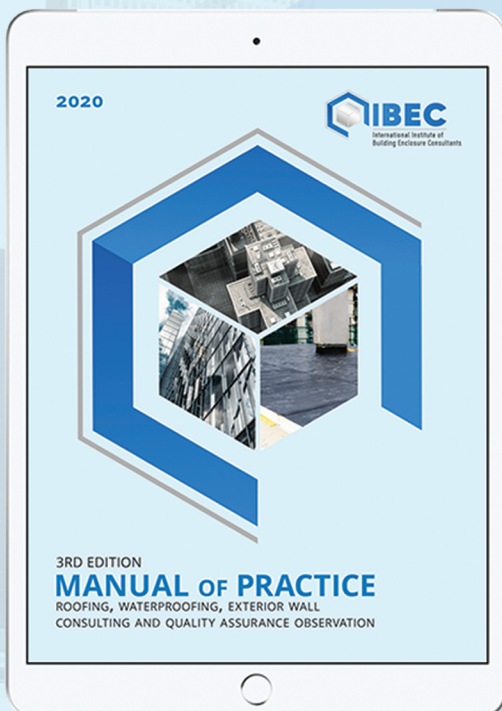


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