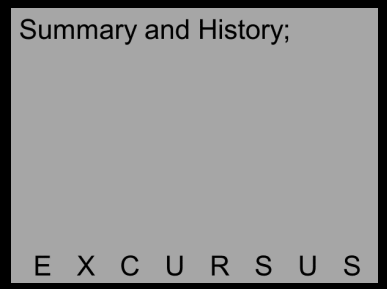
Creating Constructability Reviews that Consider Every Aspect of Design Risk and Set Up Teams for Success

Jeanette Shaw, AIA, RID, LEED AP
Director of Quality and Sustainability
Powers Brown Architecture

Bill Vandrovec, AIA, DBIA
Director of Quality Assurance
Kitchell Contractors, Inc

Lecture Keynotes



At the beginning of each deck, as brief overview or abstract along with a brief history of its origin date, first presentation or generation

Mid deck summaries of the main points for clarity & flow

Mid deck enhanced explanation of the details behind the main points for clarity and flow

E X C U R S U S

Summary and History;

Architects and General Contractors should collaborate on constructability reviews and hold them over the entire length of a project to create complete documents for construction. This presentation is a joint effort between Powers Brown Architecture and Kitchell Contractors sponsored by the CQEC and describes the proper procedures for performing constructability reviews:

- Determining up-front what to look for in creating a reliable, buildable set of drawings for even the most technical aspects of design
- Identifying and prioritizing critical risk features of the design that the designer and builder can proactively address in the workflow to avoid design rework
- Reviewing tools and technologies that collaboratively support the constructability process

E X C U R S U S

Bill is a registered architect with over 40 years of practice in the architectural and construction industry. As the Director of Quality Assurance, Bill leads the Quality Assurance group to advise and guide Kitchell teams from preconstruction services through project completion. Bill developed an innovative, dedicated Quality Assurance program for Kitchell, focusing on constructability, risk management, construction conformance, metrics and analytics. Kitchell is able to capitalize on historical intelligence - at significant financial benefit to all who touch the construction process

Jeanette is a licensed Architect and registered interior designer who has 16 years of experience working on a wide range of project types including industrial, office, interiors, laboratories, mixed use, and high-rise condominiums. She has spent the majority of her career at Powers Brown Architecture, starting as an intern, then a Project Architect, Project Manager, and currently as the Director of Quality and Sustainability. Jeanette has a passion for technical proficiency and commands a team that comprises one of the premier quality programs among architecture firms in the nation.

CQEC

The **Construction Quality Executives Council (CQEC)** is an organization composed of design and construction industry professionals dedicated to a cross-industry initiative to improve construction project delivery through enhanced documentation and communication.

ARCHITECTS MUST CREATE A RELIABLE, BUILDABLE SET OF DRAWINGS

DESIGN REVIEWS

STEP 1: START WITH THE RIGHT TEAM

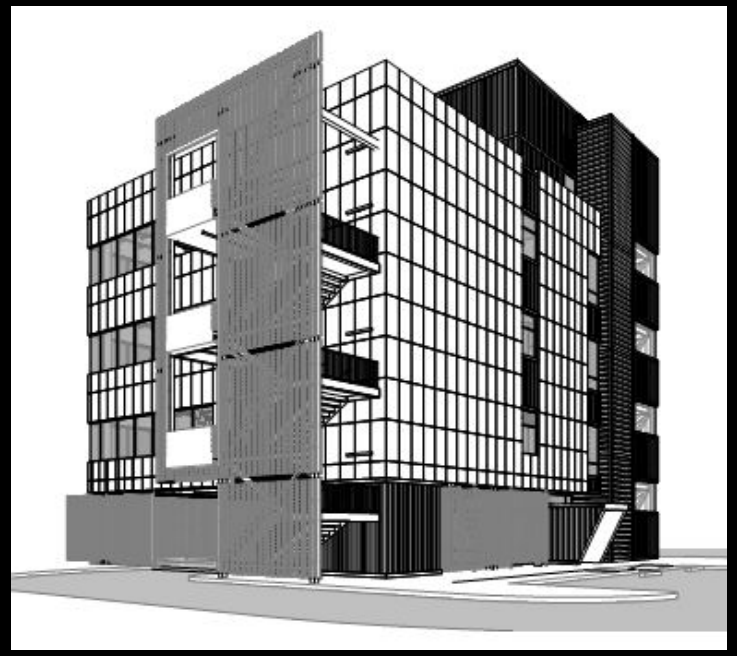
EXPERIENCE IS CRITICAL!!

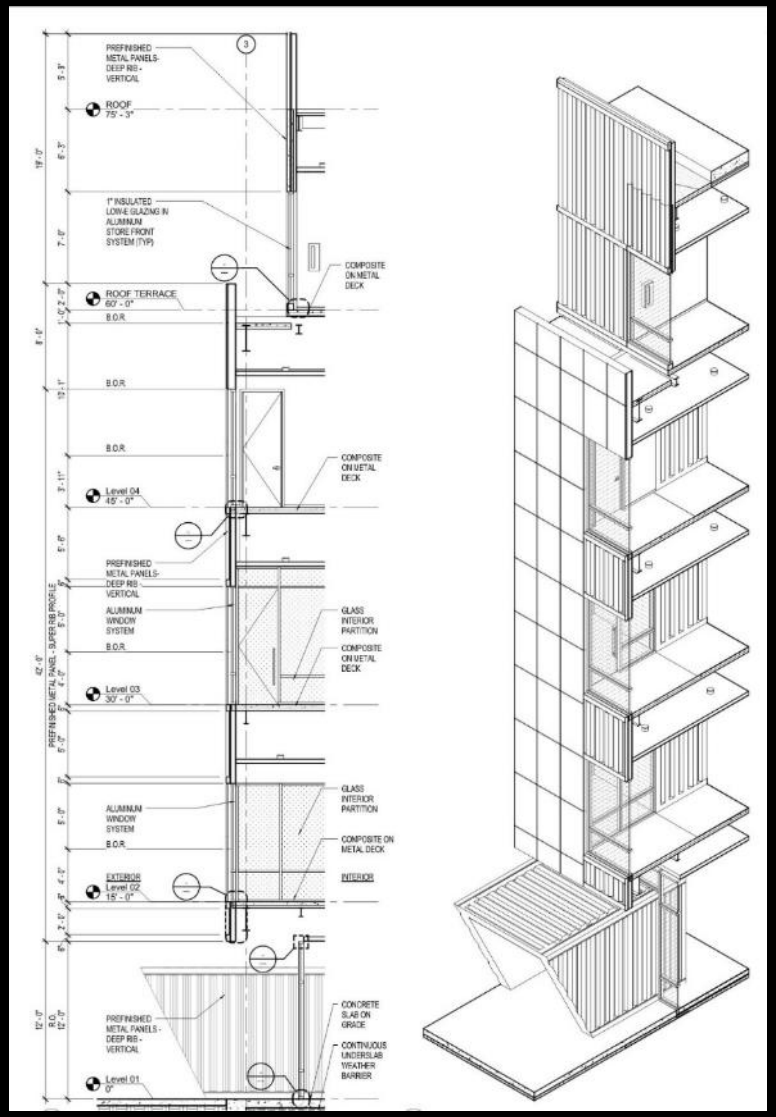
- Reviewers must understand construction type and methods
- Reviewers must understand building type to know about specific requirements of codes and inspections
- Attention to detail is critical

DESIGN REVIEWS

STEP 2: REVIEW THE PROJECT ELEMENTS

- Understand design intent…..
- CRITICAL TO DO THE HARDEST THINGS FIRST

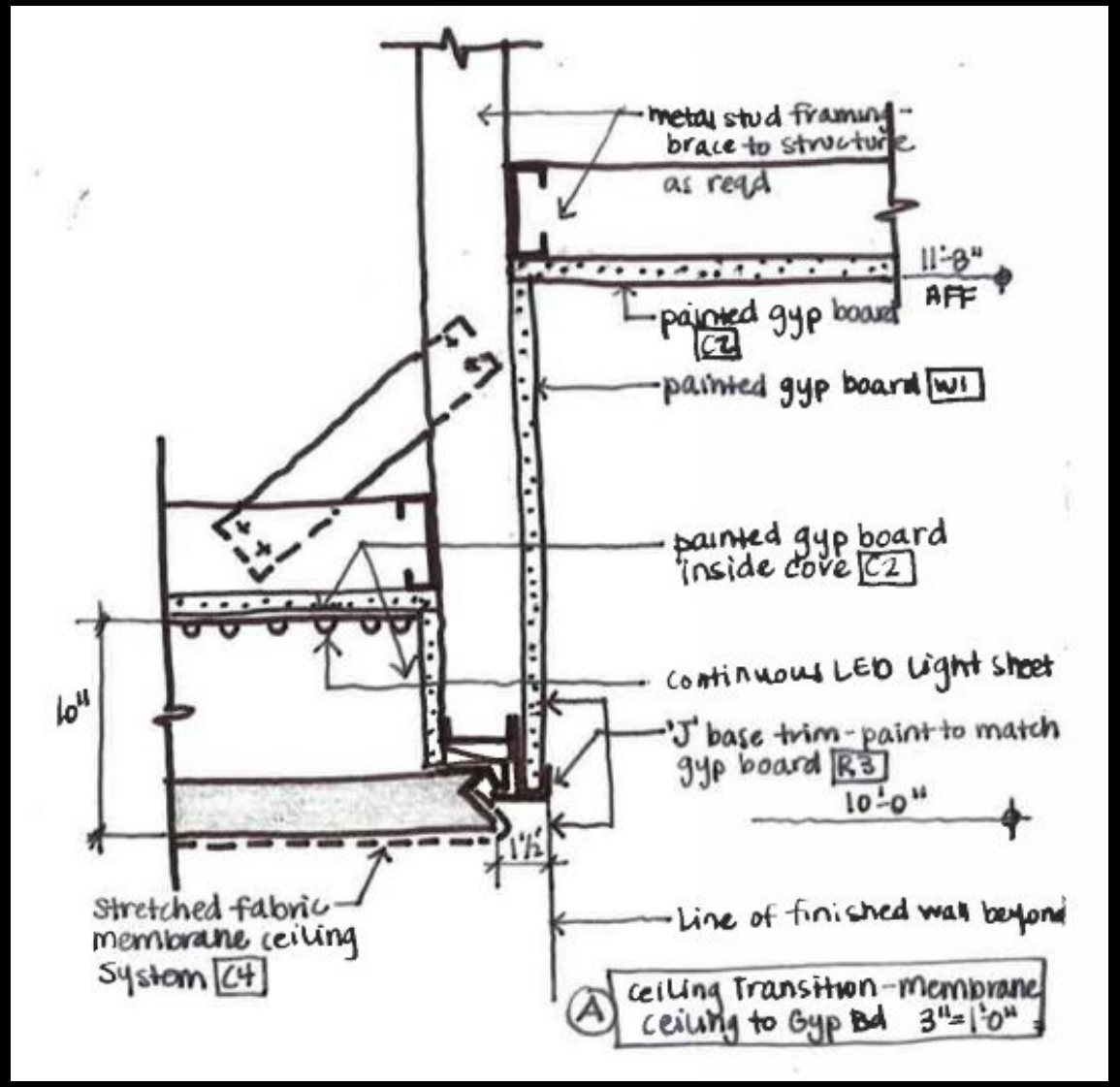




DESIGN REVIEWS

STEP 3: IDENTIFY/PRIORITIZE DEFINABLE FEATURES OF THE WORK

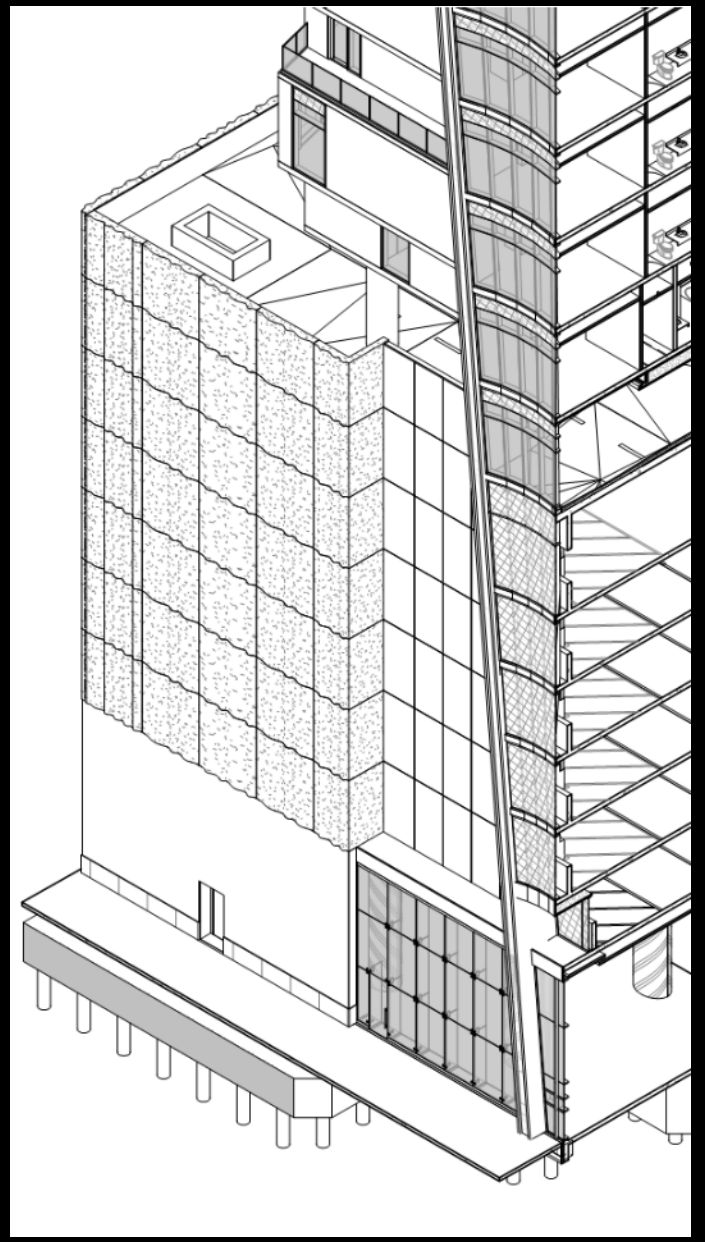
- Reviews should occur daily, but also at established project milestones
- It is critical to establish an Expected Level of Detail at each deliverable milestone



DESIGN REVIEWS

STEP 4: IDENTIFY / DEFINE THE HIGHEST RISK ELEMENTS OF THE PRIMARY SYSTEMS

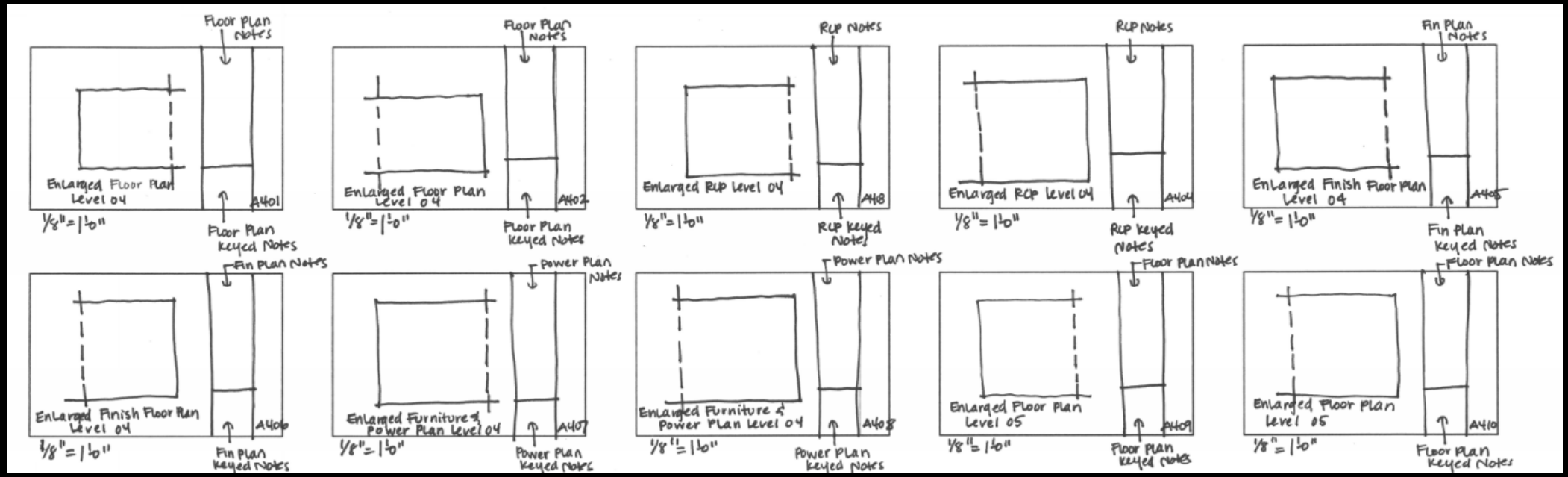
- List the Highest Risk features of the Design
- Determine if Special Expertise will be needed
- Prioritize those areas for an in-depth, detailed review first



DESIGN REVIEWS

STEP 5: PLAN WHAT YOU ARE GOING TO DRAW

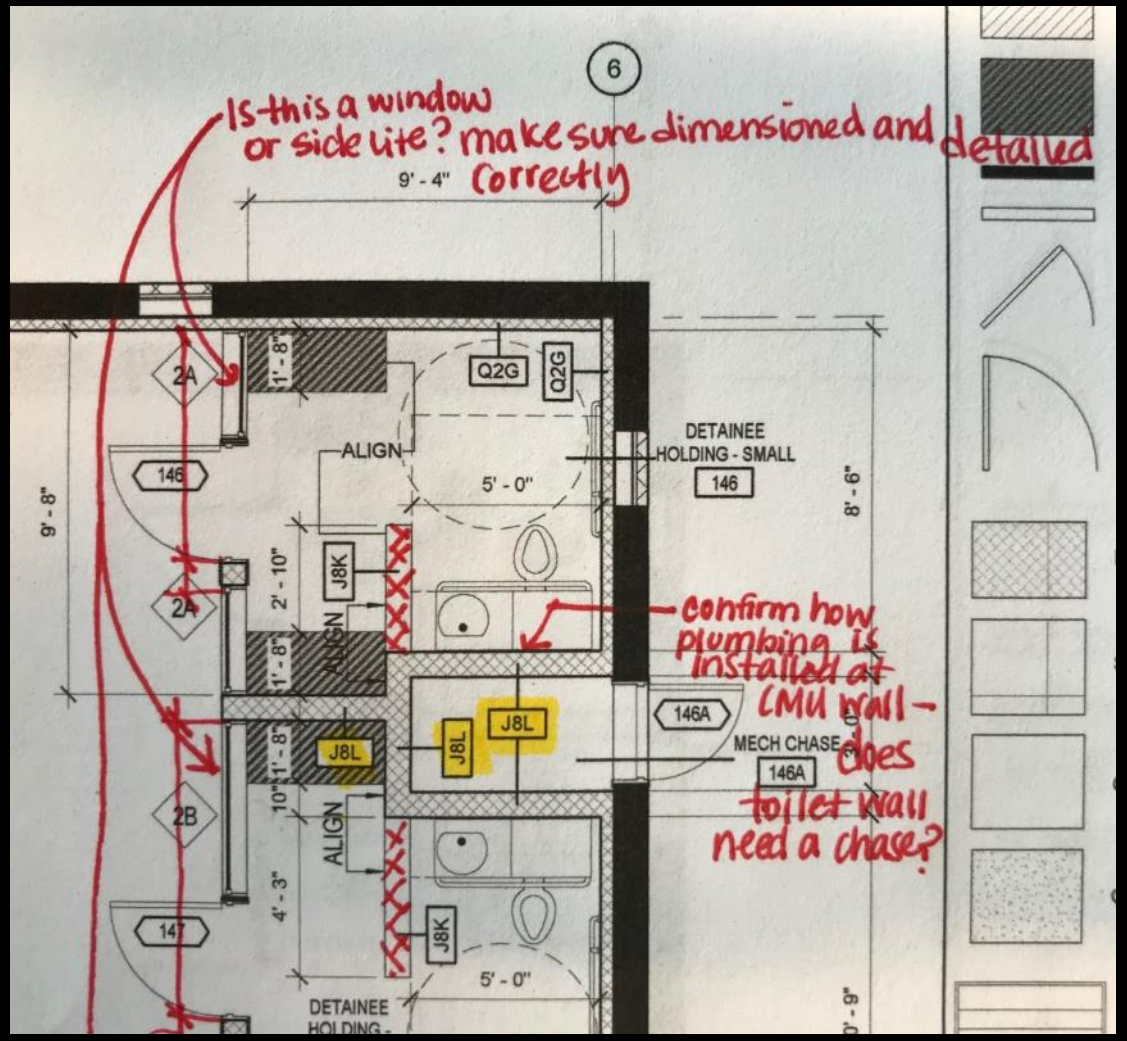
- Create cartoon sets
- Review the most complex areas and systems for detailing focus
- Assign project team members based on level of experience



DESIGN REVIEWS

STEP 6: FOCUS ON COORDINATION ITEMS

- Reviews should consider coordination items to be addressed with consultants
- Proposed systems must be vetted and reviewed by all parties



Explainer

Even if a firm does the best that they can to follow the previously defined steps, performing proper constructability reviews can be difficult….there are often many challenges to creating complete and buildable documents….

Let’s discuss some common obstacles and possible solutions to overcome them….

E X C U R S U S

OBSTACLES and OPPORTUNITIES

Design, Bid, Build Delivery

Obstacles

- GC not involved during design – no input with the design, details or costs of the systems
- Post review creates excessive back and forth (RFI's), implementation issues
- Bidders reluctant to bring issues forward due to handicapping themselves against other bidders
- Estimators are the "reviewers" but priority is costing and cost opportunities - not buildability
- Bid documents are often incomplete and missing scope items

Opportunities

- Conduct a high level internal review during the bidding process of major features of work
- Issue post constructability comments in a team mind-set as "prescriptive" RFI's – not "gotcha's"
- Bid strategy based on total cost and effort review – maybe not bid?
- Balance pricing with value by engaging a qualified reviewer that will take the project into construction

CMAR Delivery

Obstacles

- GC's participation/comments at only design milestones
- GC's lack of qualified staff due to conflicting workload during normal design meetings
- Design team's reliance (or assumption) on the GC completing or interpreting incomplete documents
- Limited or no Trade input on definable features of work
- Constructability at the end of a milestone creating "design rework"
- Poor communication and follow-up of review comments

Opportunities

- Continuous feedback at all meetings, submissions and reviews – meet owners expectations
- Schedule the right people at the right time – all projects have deliverable schedules
- "Call it like you see it" – lack of information cannot be addressed if it's not brought up
- For critical systems – consider design assist or design build options
- Detail the review process at the design-kick-off and follow it

Design/Build Delivery

Obstacles

- GC and Design Team do not understand the D/B delivery and expectations of each party
- GC's participation/comments at only design milestones (treating D/B like a CMAR)
- GC's lack of qualified staff and time commitments required of a continual, proactive review
- The Designer's assumption that less detail and explanation of the work is necessary - GC will fill-in the missing pieces
- Schedule compression, both in design and constructability review leading too poor results

Opportunities

- Must conduct a teaming meeting(s) and clearly define the protocol for pro-active reviews
- Pre-schedule "detailing charrettes" of the definable features of work and manage to those schedule points
- Get Trades on-board early for the major definable features of work and/or buy the expertise
- Constructability is a reflection of the quality of the design documents. If they are difficult to understand, the project will be difficult to build
- Target the critical features of work first and not all features of work

Value Engineering

Obstacles

- Items are often not vetted through the design team before going to the owner
- Substituting products that are NOT equal to the specification
- Major system replacements without allowing time to properly detail the changes
- Substitute different systems in situations where they aren't recommended
- Removing items from an assembly as "belt and suspenders", impacting performance and reliability

Opportunities

- Work as a team to evaluate proper cost saving items and the impact on constructability.
- Evaluate products for compliance with codes, sequencing, performance and maintainability before bringing up to the owner
- Ensure that the Owner understands that accepting cost savings related to major system overhauls has an impact on the schedule
- Determine the overall impact on deleting items from an assembly – often they are for maintainability or reliability

Compressed Schedules

Obstacles

- Cluttered and incomplete drawings
- Coordination gets missed – developing drawings in a vacuum
- Poor oversight by available Senior Staff of more junior/inexperienced staff
- Inability to engage Trades for constructability input prior to bidding
- Inability to finish the constructability in a value added way

Opportunities

- Focus on the things that are the most complex
- Focus on areas where you typically have holes based on experience
- Pre-plan hard milestones with senior staff of critical features and stick with them
- If possible, utilize design assist Trades for the critical features
- Continue with the major features even after the review period is over – plan how to incorporate latter – even with an RFI

Process

Obstacles

- No defined and/or vetted Review Process
- No universally available collaboration review tools between the review team
- Lack of resolution to conflicting or contradictory comments
- No follow-up of review comments, lack of accountability
- No prioritization of comments, importance or cost of the comment

Opportunities

- Predefine the process that fits the schedule, scope and complexity of the project with ALL reviewers
- Define tools that reviewers can provide comments that are visible real time
- Appoint an “editor” to make the final calls
- Comments must be responded to and carried forward to the next review if not
- Review kick-off where critical features are prioritized by system, difficulty and an associated ranking

Design and Constructability Reviews

Design Review

- The Documents are Clear and Accurate to describe the Design
- The Documents are fully Coordinated between disciplines
- The Documents are Technically Correct and Complete
- Eliminates Ambiguity and Inconstancies that contribute to Scope Gaps
- Affirmation of Client Goals by the technical design (measures of acceptability)
- Performed by the Design Team, GC, Specialist

Constructability Review

- Proactively Identifies Obstacles before Construction
- Confirms that the Design is Buildable as shown
- Ensures the Design is Biddable with Minimal Clarifications or Modifications
- Risk Reduction and Risk Management
- Time savings (both Design and Construction)
- Cost Savings (can be 1.25% cost of construction)
- Performed by the GC, Trade Partners, Specialist, Design Team

Explainer

It is critical to establish and enforce a PROCESS for constructability reviews. You can select tools to make the process easier, but it is most important to adopt tools that will enhance the process for the way you work

Things to consider:

- Are the teams using BIM or not? This includes the design and engineering teams as well as the construction teams, including the field

- Is your team experienced with technology or better with simple tools?

- These technologies can be expensive – consider who needs them and how in depth they would be used company way before committing to any one program

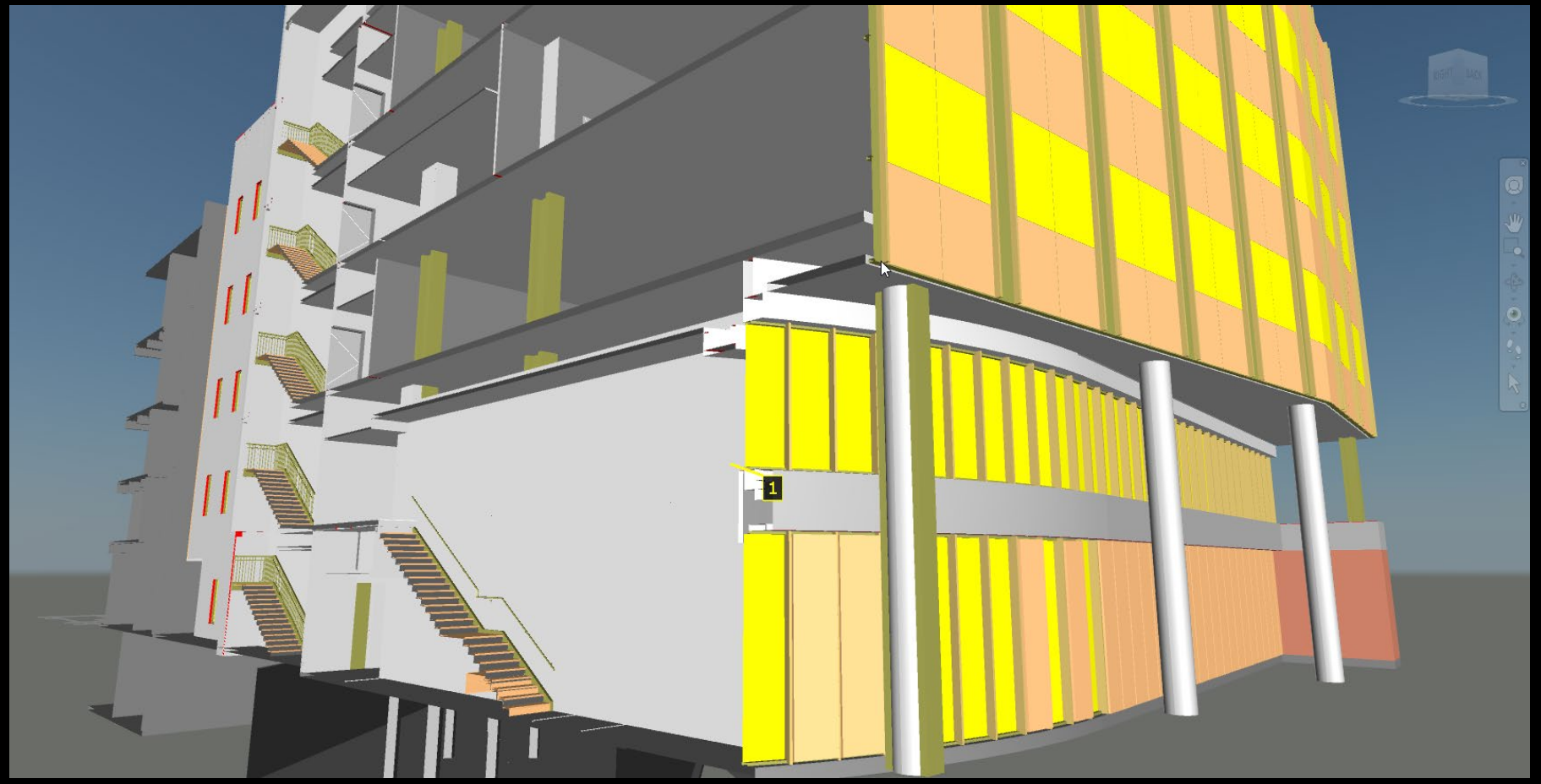
Regardless of technological capabilities, the most important factor in proper collaboration is COMMUNICATION…..

E X C U R S U S

TOOLS AND TECHNOLOGIES

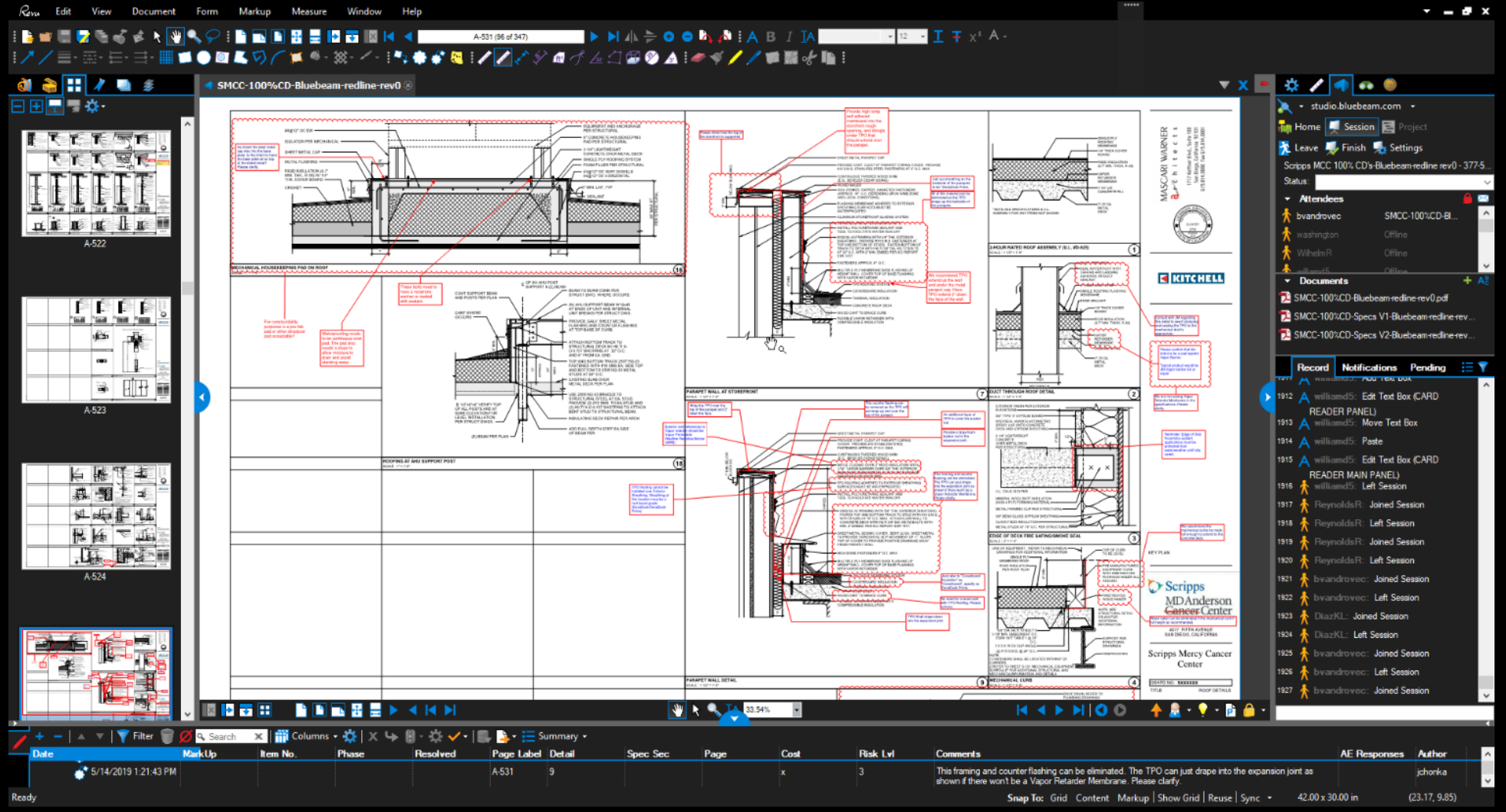
Tools and Technologies

3D Modeling



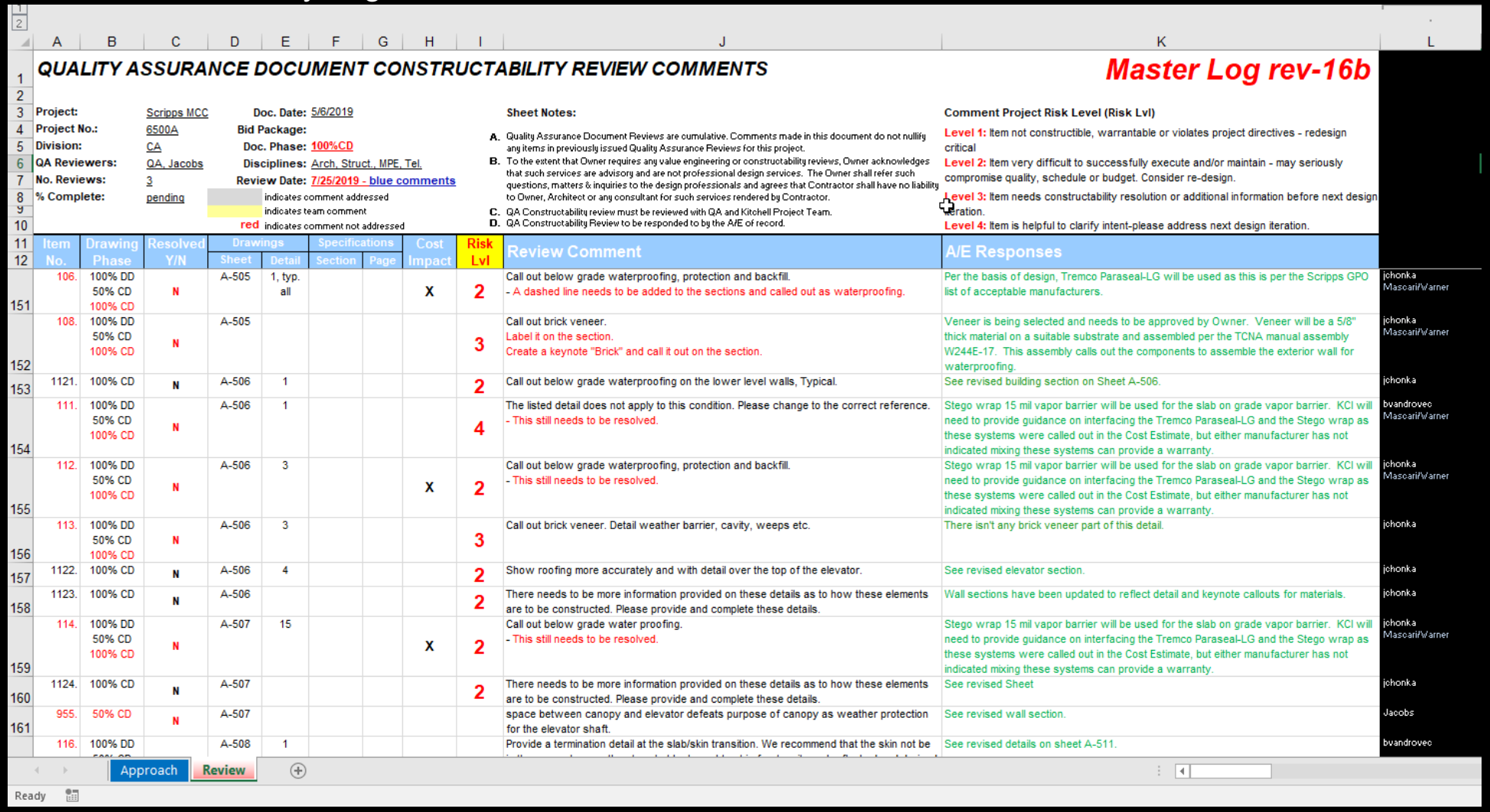
Tools and Technologies

Bluebeam



Tools and Technologies

Master Constructability Log



QUALITY ASSURANCE DOCUMENT CONSTRUCTABILITY REVIEW COMMENTS — **Master Log rev-16b**

Project:	Scripps MCC
Project No.:	6500A
Division:	CA
QA Reviewers:	QA, Jacobs
No. Reviews:	3
% Complete:	pending
Doc. Date:	5/6/2019
Bid Package:	
Doc. Phase:	100%CD
Disciplines:	Arch, Struct., MPE, Tel.
Review Date:	7/25/2019 - blue comments

indicates comment addressed
indicates team comment
red indicates comment not addressed

Sheet Notes:

A. Quality Assurance Document Reviews are cumulative. Comments made in this document do not nullify any items in previously issued Quality Assurance Reviews for this project.
B. To the extent that Owner requires any value engineering or constructability reviews, Owner acknowledges that such services are advisory and are not professional design services. The Owner shall refer such questions, matters & inquiries to the design professionals and agrees that Contractor shall have no liability to Owner, Architect or any consultant for such services rendered by Contractor.
C. QA Constructability review must be reviewed with QA and Kitchell Project Team.
D. QA Constructability Review to be responded to by the A/E of record.

Comment Project Risk Level (Risk Lvl)

Level 1: Item not constructible, warrantable or violates project directives - redesign critical
Level 2: Item very difficult to successfully execute and/or maintain - may seriously compromise quality, schedule or budget. Consider re-design.
Level 3: Item needs constructability resolution or additional information before next design iteration.
Level 4: Item is helpful to clarify intent-please address next design iteration.

Item No.	Drawing Phase	Resolved Y/N	Drawings: Sheet	Drawings: Detail	Specifications: Section	Specifications: Page	Cost Impact	Risk Lvl	Review Comment	A/E Responses	
106. 151	100% DD 50% CD 100% CD	N	A-505	1, typ. all			X	2	Call out below grade waterproofing, protection and backfill. - A dashed line needs to be added to the sections and called out as waterproofing.	Per the basis of design, Tremco Paraseal-LG will be used as this is per the Scripps GPO list of acceptable manufacturers.	jchonka MascariWarner
108. 152	100% DD 50% CD 100% CD	N	A-505					3	Call out brick veneer. Label it on the section. Create a keynote "Brick" and call it out on the section.	Veneer is being selected and needs to be approved by Owner. Veneer will be a 5/8" thick material on a suitable substrate and assembled per the TCNA manual assembly W244E-17. This assembly calls out the components to assemble the exterior wall for waterproofing.	jchonka MascariWarner
1121. 153	100% CD	N	A-506	1				2	Call out below grade waterproofing on the lower level walls, Typical.	See revised building section on Sheet A-506.	jchonka
111. 154	100% DD 50% CD 100% CD	N	A-506	1				4	The listed detail does not apply to this condition. Please change to the correct reference. - This still needs to be resolved.	Stego wrap 15 mil vapor barrier will be used for the slab on grade vapor barrier. KCI will need to provide guidance on interfacing the Tremco Paraseal-LG and the Stego wrap as these systems were called out in the Cost Estimate, but either manufacturer has not indicated mixing these systems can provide a warranty.	bvandrovec MascariWarner
112. 155	100% DD 50% CD 100% CD	N	A-506	3			X	2	Call out below grade waterproofing, protection and backfill. - This still needs to be resolved.	Stego wrap 15 mil vapor barrier will be used for the slab on grade vapor barrier. KCI will need to provide guidance on interfacing the Tremco Paraseal-LG and the Stego wrap as these systems were called out in the Cost Estimate, but either manufacturer has not indicated mixing these systems can provide a warranty.	jchonka MascariWarner
113. 156	100% DD 50% CD 100% CD	N	A-506	3				3	Call out brick veneer. Detail weather barrier, cavity, weeps etc.	There isn't any brick veneer part of this detail.	jchonka
1122. 157	100% CD	N	A-506	4				2	Show roofing more accurately and with detail over the top of the elevator.	See revised elevator section.	jchonka
1123. 158	100% CD	N	A-506					2	There needs to be more information provided on these details as to how these elements are to be constructed. Please provide and complete these details.	Wall sections have been updated to reflect detail and keynote callouts for materials.	jchonka
114. 159	100% DD 50% CD 100% CD	N	A-507	15			X	2	Call out below grade water proofing. - This still needs to be resolved.	Stego wrap 15 mil vapor barrier will be used for the slab on grade vapor barrier. KCI will need to provide guidance on interfacing the Tremco Paraseal-LG and the Stego wrap as these systems were called out in the Cost Estimate, but either manufacturer has not indicated mixing these systems can provide a warranty.	jchonka MascariWarner
1124. 160	100% CD	N	A-507					2	There needs to be more information provided on these details as to how these elements are to be constructed. Please provide and complete these details.	See revised Sheet	jchonka
955. 161	50% CD	N	A-507						space between canopy and elevator defeats purpose of canopy as weather protection for the elevator shaft.	See revised wall section.	Jacobs
116.	100% DD		A-508	1					Provide a termination detail at the slab/skin transition. We recommend that the skin not be	See revised details on sheet A-511.	bvandrovec

Approach | Review

Ready

The big idea here is;

Considering the guidelines provided, let’s explore some examples of the constructability reviews in action….

E X C U R S U S

CONSTRUCTABILITY REVIEWS IN ACTION

CASE STUDY:

Let’s explore constructability reviews on a real-life example

This is ARABELLA – a 34 story residential condominium tower in Houston, TX

Arabella has some unique and challenging features inherent with it’s design:

1) The building contains 99 condo units with 75 unique floor plans – there is no stacking
2) Floors 16 and up are all different sizes and shapes, with many unique cantilevers which create unique balconies
3) Value engineering created some very difficult challenges, along with the experience of the subcontractors which we will discuss

OBSTACLE: VALUE ENGINEERING

ORIGINAL: 100% CURTAINWALL

VE: REPLACE SECTIONS WITH EIFS

PRODUCT SUBSTITUTIONS

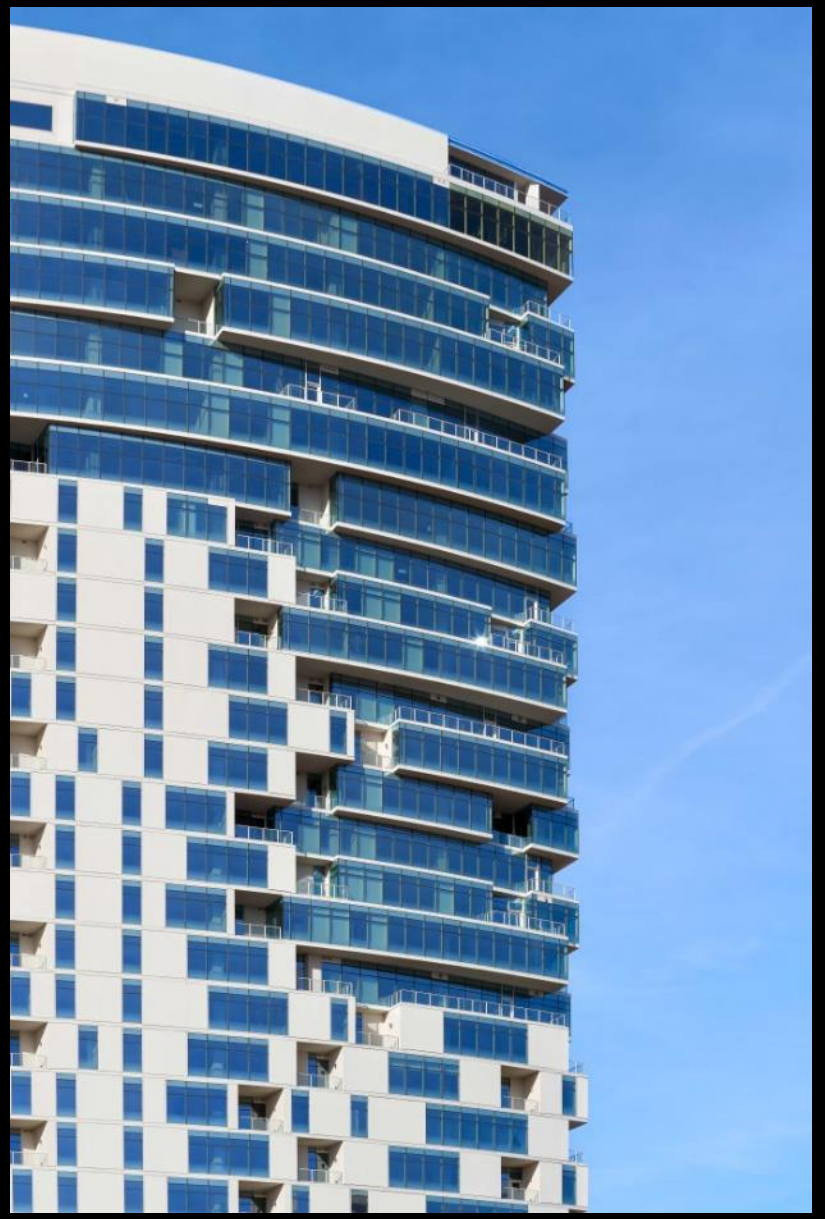
- Specification proposes EIFS system by Parex – complete system with all fire ratings, standard details provided, proper warranties, systems tested for compatibility with waterproofing, sealants, etc.
  - Substituted products that were not part of a system – sheathing, waterproofing, foam, coatings, sealants are not part of a complete warrantied system
  - Could not provide fire testing for the system – walls required 2 HR rating
  - Could not provide pull tests for waterproofing membrane to adhesives and sealant
  - Could not provide proper drainage layer built-in – applied in the field

DESIGN REVIEW:

Identify the definable features of work – what will be the most challenging elements on the building to coordinate and detail?

BALCONIES AT CONDO UNITS

ENVELOPE DETAILS – INCLUDING EIFS, POOLS AND TERRACES, GLASS RAILING INTERFACE

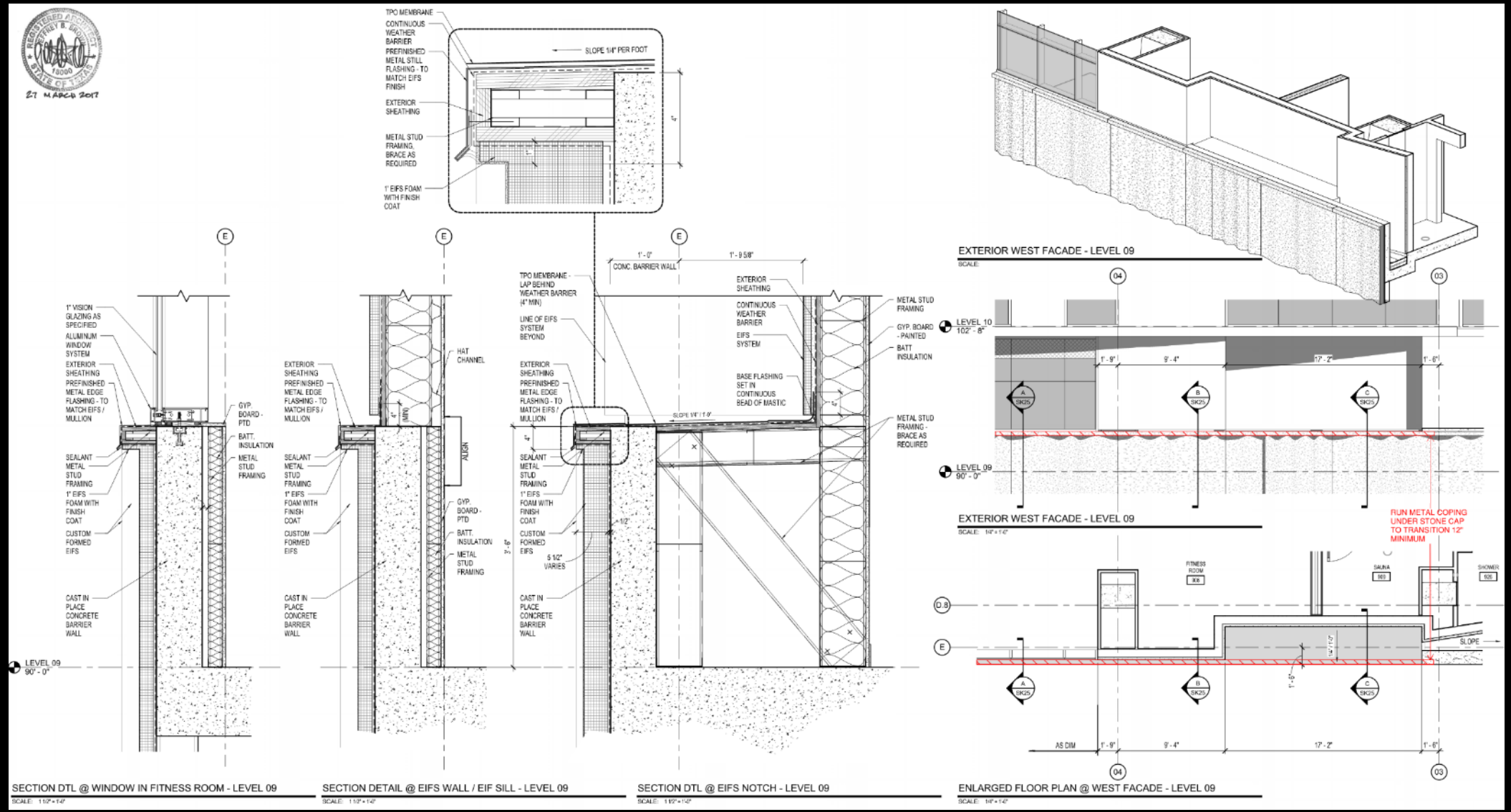


EIFS TRANSITION DETAILS:

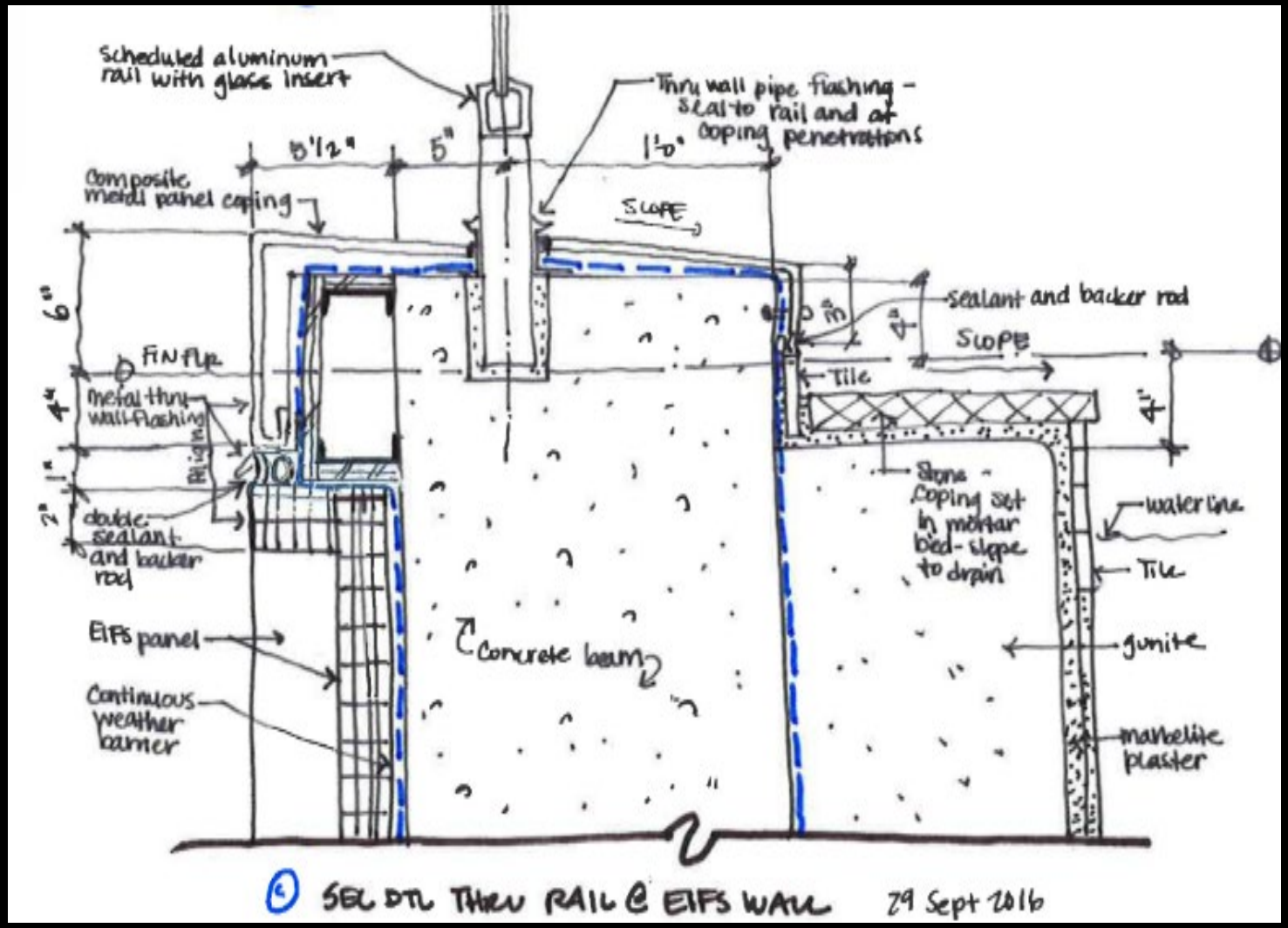
- We set out to isolate the most complex transition details for the EIFS system – focusing on system details that were not manufacturer standard

Where EIFS meets the sloping balcony
Ribbed EIFS caps at the pool level rail

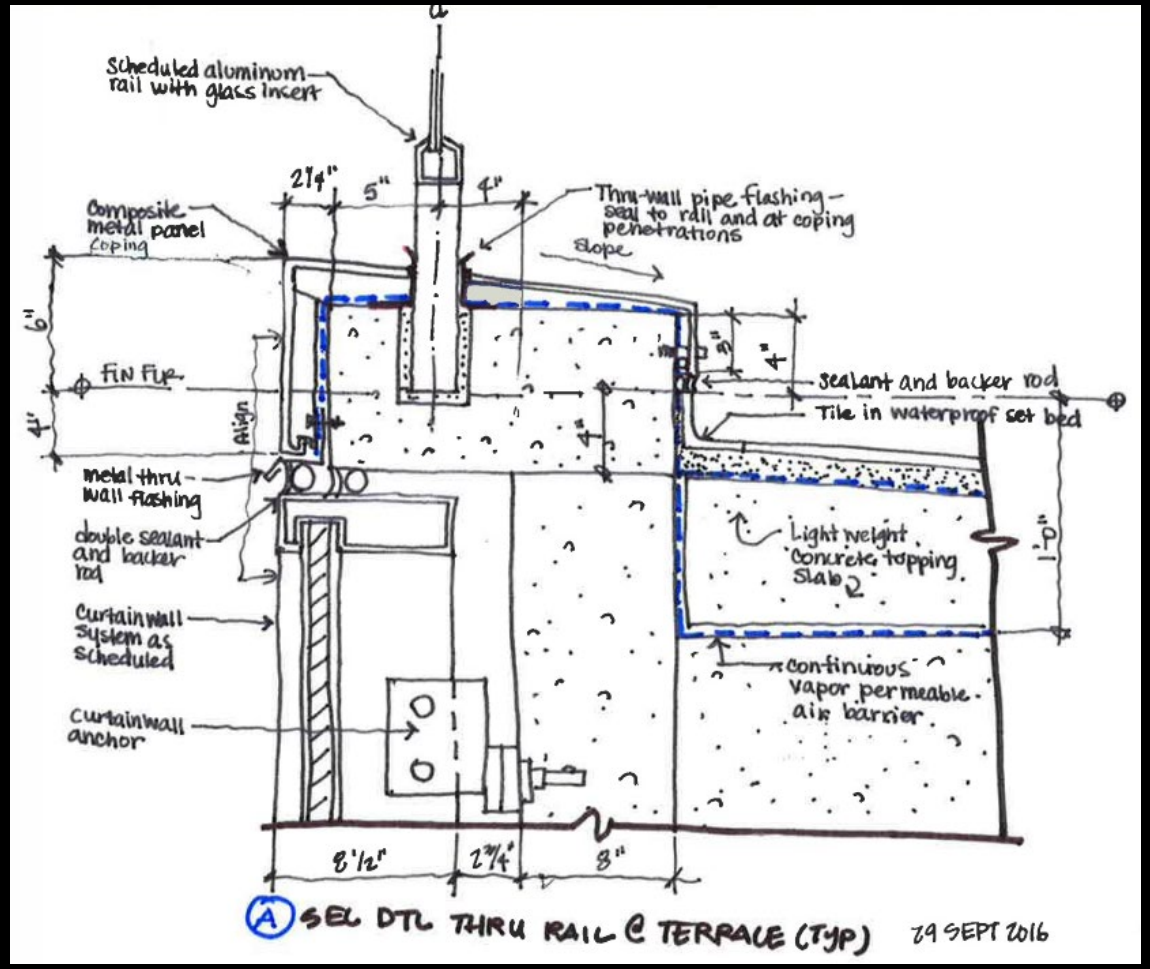
EIFS AT PARAPETS:

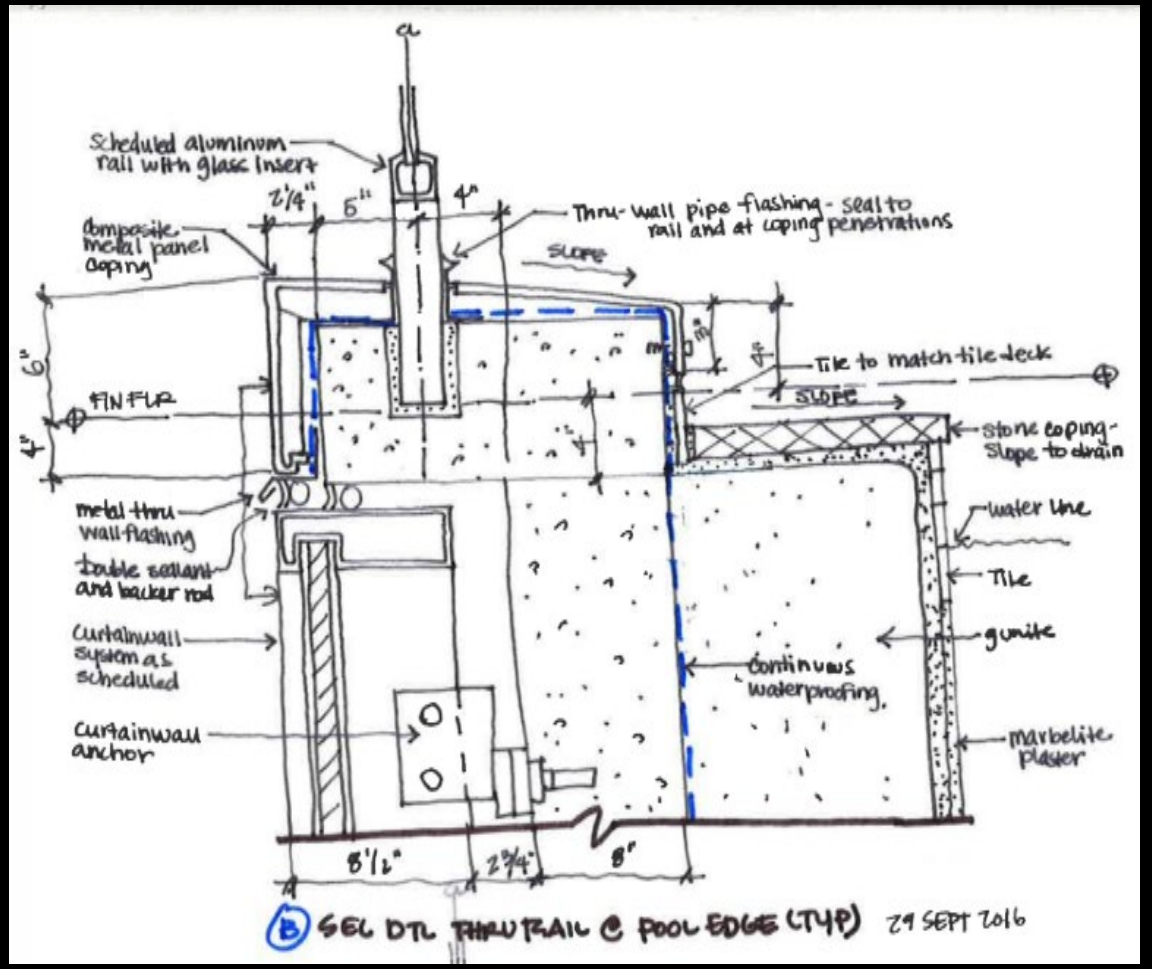


EIFS AT POOL RAILS:



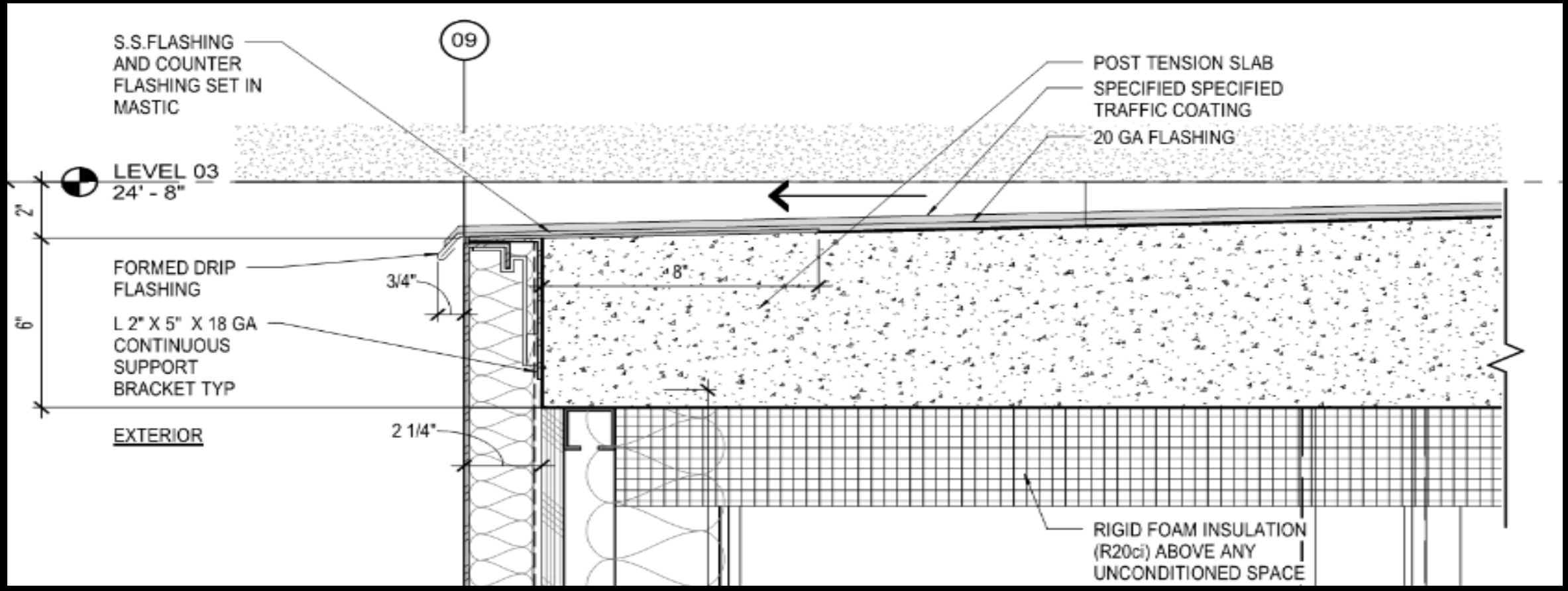
CURTAINWALL AT POOL RAILS:





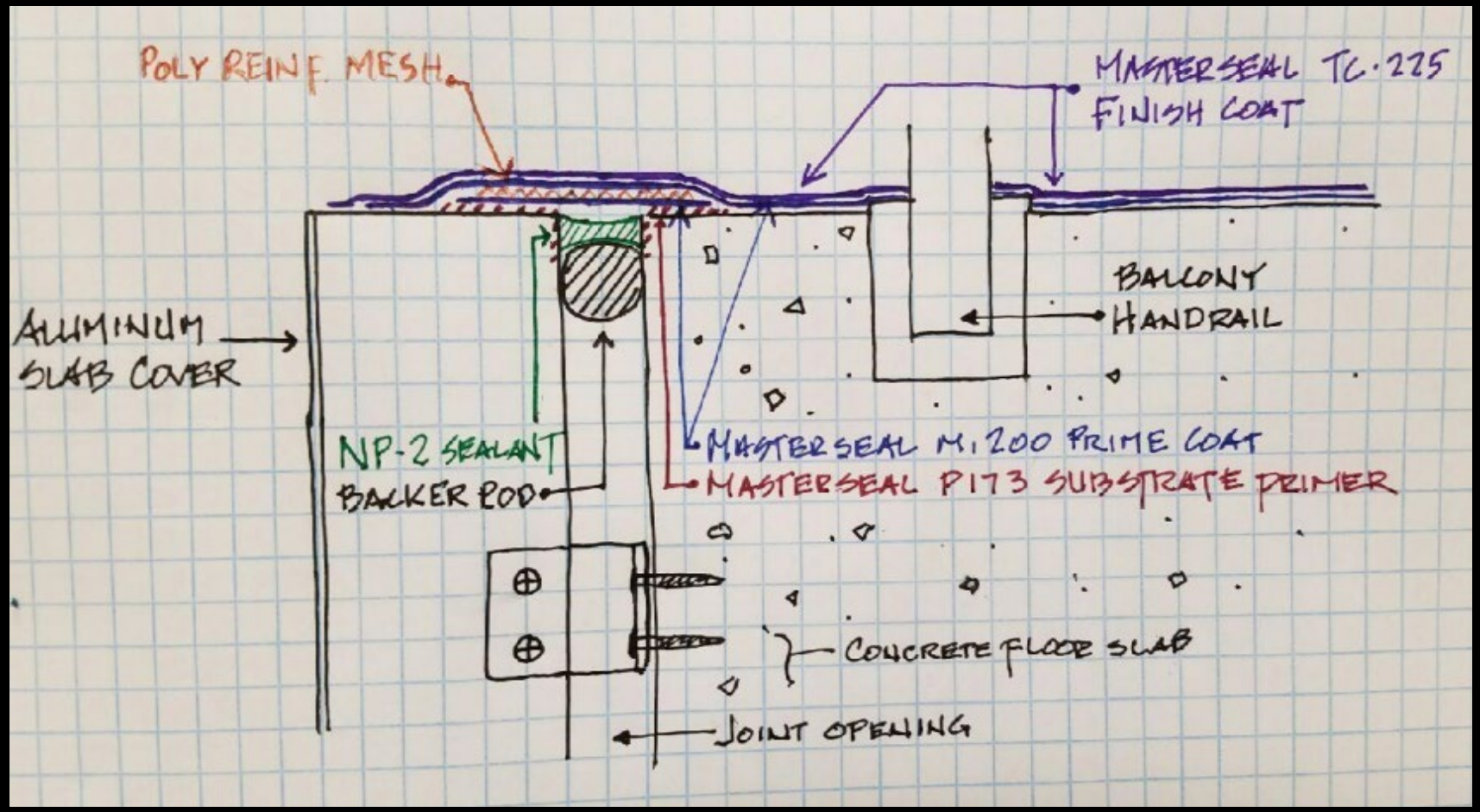
METAL SLAB EDGE COVERS:

One of the value engineering options on the building was to eliminate the tile on all of the terraces. The details in the construction documents relied on a tile flooring to cover up the slab flashing at the metal slab edge cover, but with the removal of the tile, we were faced with a challenging transition between a traffic coating terrace finish and the metal slab edge cover.



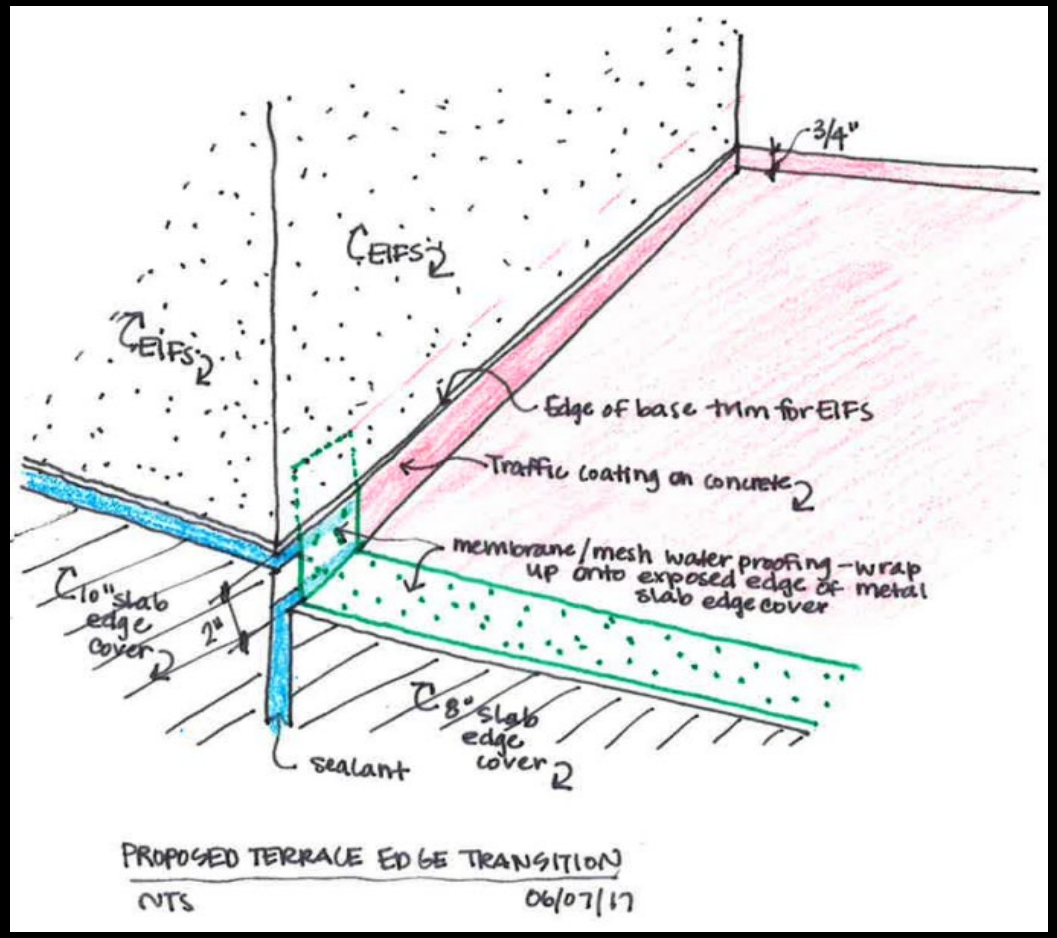
METAL SLAB EDGE COVERS:

This detail was resolved with all of the trades involved, including the roofer, EIFS installer, curtainwall sub who was installing the slab edge cover, and the envelope consultant. All proposed products were reviewed by the manufacturers, and compatibility letters were provided, including pull tests

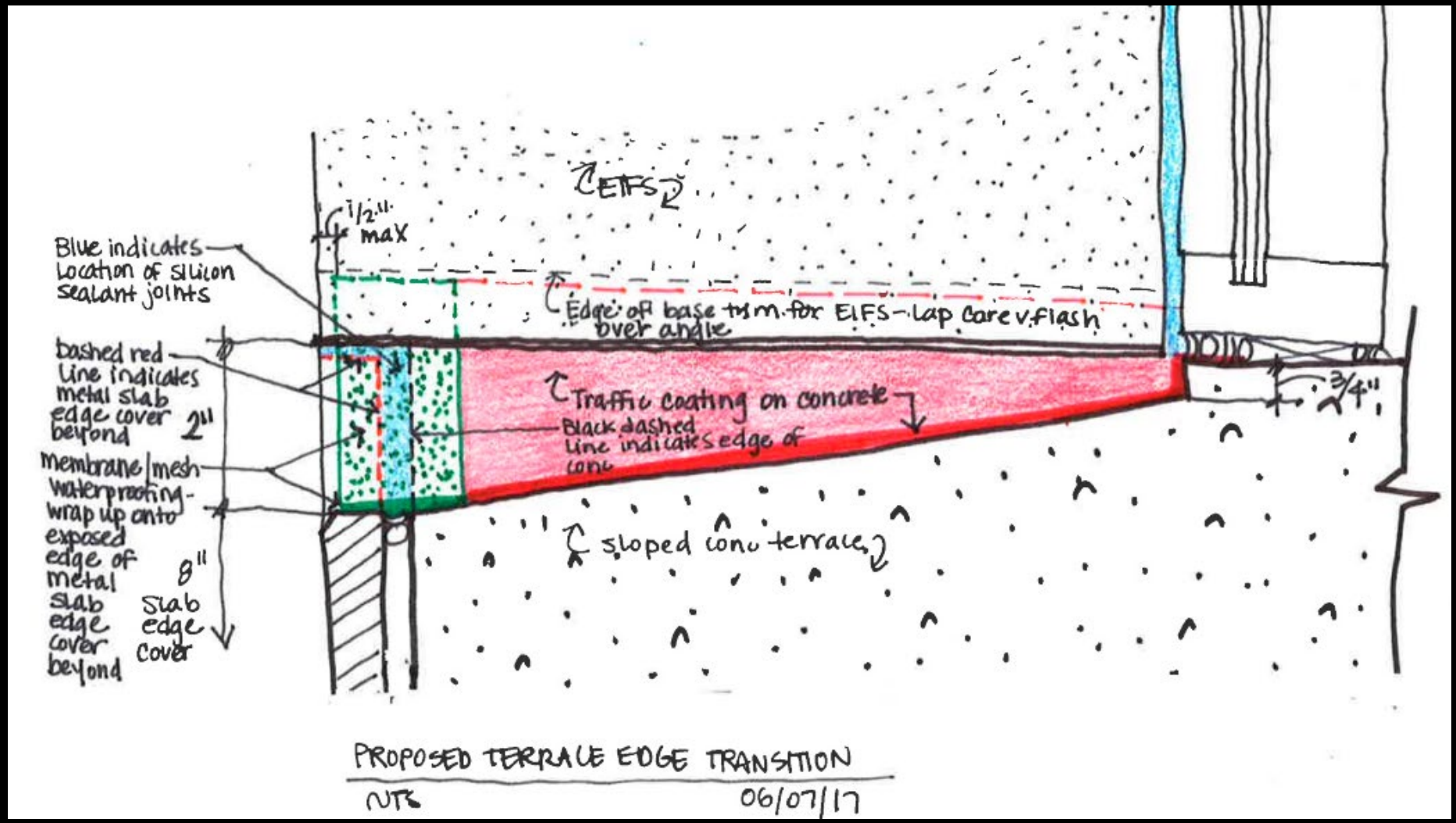


METAL SLAB EDGE COVERS:

But we also had to review the proposed detail in 3 dimensions – including how the mesh tape ended at the vertical edge walls of the terraces. Not only did this research affect the system relationships, it also gave the gc a sequencing requirement so that the trades and installation of systems could be properly coordinated



METAL SLAB EDGE COVERS:



Design and Constructability Reviews

Top Five Rules

1. Build the Project - Don't Focus only on the Problems
2. Review the Interfaces
3. Keep Comments Constructive, Instructive
4. Stay Focused on the Important Items
5. Take the Time to Complete a Thorough Review

excerpts from Jason G. Smith, Principal Construction Analysis and Planning, LLC. Updated 08-10-2016.
Published by WBDG

Keys to a Successful Project:

Constructability reviews

1. Happy client is most important
2. Everyone makes $$$
3. Good team relationship – everyone works together and wants to work together again

Questions?