



RCSC Annual Meeting

Thursday, June 5, 2025
The University of Cincinnati
College of Engineering and Applied Science
Rhodes Hall 801A-C
Cincinnati, OH 45219

Approved June 4, 2026

10:00 am EDT Welcome - Call to order (Shaw)

Official call to order at 10:18 am EDT

▪ Attendance List

Members: Toby Anderson, Jones Barton, David Bornstein, Derrick Castle, Jason Chadee, Chris Curven, James DiPasquale, Alana Fossa, Mike Gase, Bill Germuga, Ted Goldstein, Quentin Greiner, Matthew Haaksma, Mark Holland, Lawrence Kruth, Alyssa Kumfer, Chad Larson, John Marvin, Carly McGee, Jonathan McGormley, Helen McKay, Ronnie Medlock, Timothy Melander, James Neeley, Lee Pielaet, Sahil Prabhudesai, David Rank, Gian Rassati, Matthew Reynolds, Clinton Rex, Thomas Ringelstetter, Vincent Sagan, Thomas Schlafly, Rachel Shanley, David Sharp, Robert Shaw Jr, Daniel Smith, Carlos Gallardo, James Swanson, Donny Thompson, Christopher Tribble, Todd Ude, Carmen Vertullo, Dan Wroblewski, and Doug Yates (please notify us if you were in attendance and your name is not recorded)

Guests: Mike Desch, Chris Garrell, Larry Housel, Don Laro, John O'Brien, Margaret Sullivan-Miller, and Kara Stall (please notify us if you were in attendance and your name is not recorded)

Recognition of Meeting Hosts, Announcements (Shaw)

Many thanks were extended to the organizing team from UC –

- Dr. Jim Swanson,
- Dr. G.A. Rassati,
- Christine Cheevers,
- Margaret (Maggie) Sullivan-Miller, and
- Kara Stall

Recognition of Sponsors for Annual Meeting (Shaw, UC team)

Five sponsors at \$1,000 each have been designated "Pretensioned" sponsors by the UC Team.

- High Steel Structures, LLC
- Hytorc
- Skidmore-Wilhelm
- Nucor Fastener
- Steel Structures Technology Center, Inc.



Three sponsors at \$500 each have been designated “Snug Tightened” sponsors by the UC Team.

- Bay Bolt
- Bracken Companies
- St Louis Screw and Bolt

Thanks were extended to all sponsors. Sponsor contributions help fund the work of the Council, in addition to helping fund the Annual Meeting.

Mission Statement Review (Shaw)

The RCSC Mission was read, followed by a reading of the text used for the AISC’s NASCC program and kiosk in March. Members were reminded to keep the RCSC’s scope in mind during the meeting.

Introduction of Members and Guests (all)

Members and guests introduced themselves.

Roll Call of Voting Members, Establish Quorum (Prabhudesai)

Quorum was established with 44 voting members present. Only 15 are required for quorum. See the attendance list.

Ten (10) guests were in attendance. See the attendance list.

Proxy voting was previously established for the following members:

- for Justin Ocel – Dave Sharp
- for Brad Porter – Toby Anderson
- for Ted Goldstein – GA Rassati

It was announced that those who leave early can assign a proxy and give it to Shaw, Prabhudesai, or Rassati to continue the satisfaction of quorum.

Approval of the Meeting Agenda (Shaw)

After review, motion was made and seconded (Rassati, Anderson) to approve the meeting agenda. Motion passed without objection.

Approval of June 2024 Annual Meeting minutes from Pittsburgh (Prabhudesai)

Minutes had been emailed out to the membership in October. Motion was made and seconded (Anderson, Rassati) to approve the minutes. Motion passed without objection with one abstention.

Secretary/Treasurer’s Report on Membership and Classifications (Prabhudesai)

The membership roster was circulated around the meeting room for members to update contact information, confirm voting status, and for members/guests to sign in.



There are currently 93 members. That is up from 73 members at this time in 2024. In 2023, the membership consisted of 82 members. The current roster has been uploaded to the RCSC website. (See **Appendix A.**)

Some concern was expressed about producers/distributors outnumbering other membership classifications, but it was confirmed that it isn't currently an issue, but is being monitored. (See **Appendix B, page 6.**)

Welcomed new members to the council (**See Appendix B, page 6.**)

Members with classification changed:

- James DiPasquale to General Interest
- Jason Chadee to User

Members Removed

- Curtis Mayes (succeeded by Clinton Rex)
- Lee Shoemaker (succeeded by Vincent Sagan)
- Tate Nickerson (succeeded by Alyssa Kumfer)

Members Passed, recognized with a moment of silence

- Douglas Ferrel

Members to be removed due to non-payment of Research Contribution

- Rich Brown
- Robert J Connor
- Noah Dorsey
- Winston Sturge

Members to be removed if their Research Contribution is not paid within 30 days of invoicing

- Kenneth Damiao
- Lucky Damiao
- Michael Musselwhite
- Steven Putnam

Financial Reports (2024 year-end, current financial condition, approval of 2024 financial reports) (Prabhudesai)

Reviewed RCSC Financial Report with a January 1, 2024, starting balance of \$ 419,296.69, and a December 31, 2024, ending balance of \$ 451,540.92. Research contributions totaled \$ 40,800.00. Total expenses were \$ 26,518.57. See item 13 in the attached meeting presentation for additional details. Motion made by Larry Kruth, seconded by Dr. GA Rassati. Motion passed without objection.

The IRS Form 990-PF has been filed.

First Quarter 2025 Financials

- Wells Fargo account through AISC is eligible for interest-bearing CD accounts, with higher interest rates to recover some loss due to inflation. However, such a CD must be done in person, not remotely, which has been a challenge

- A new Finance Committee was created by the Board of Directors to address this and other finance issues.
- It is requested to focus on the delivery dates of research to avoid costing money unnecessarily.

Chair's Annual Report (Shaw)

For a current list of members of the Board of Directors, Committee Chairs, Task Group Chairs, and Staff Support from AISC, see Item 23 of the presentation. The Ad Hoc Committee on Meetings will be disbanded.

The Board of Directors has met six times since the 2024 Annual Meeting and also met on June 5, prior to this Annual Meeting, as noted in item 25 of the presentation.

The Membership has been reviewed by the Secretary/Treasurer.

Since last year's meeting, we have gained seven (7) General Interest members, eight (8) user members, two (2) Distributor Members, and four (4) Producer members. See item 26.

Membership growth was driven by three factors:

- Kiosk at AISC NASCC 2025 in Louisville, KY. The location was not heavily trafficked but was visited, and as a result, was successful in outreach/recruitment
- Personal visits to exhibitors related to RCSC work by the Chair, resulting in new members, with several still listed as interested
- Recruitment efforts by Membership Chair Jason Chadee

The Board of Directors has formed three Committees of the Board, under the provisions of By-law Article 6:

- Executive Committee – Shaw (chair), Rassati, Prabhudesai
- Finance Committee – Prabhudesai (chair), Wroblewski, Medlock
- Governance Committee – Rassati (chair), Anderson, McGee

It is hoped that the Financial Committee will not only provide oversight of financial activities but also serve as training for the next Treasurer.

It was inquired whether there were requirements for an independent audit of our finances. Whether or not it is required, we are audited regularly as a nonprofit organization, with funds managed by AISC, and our audits are conducted by the same firm that audits AISC. It was also questioned whether the financial audit report was reviewed and made available. Currently, it is not reviewed, but the Finance Committee will consider this.

Operating Procedures to replace the old By-laws, as well as adding new items, has been slow in developing. Development of these OPs will rest with the Governance Committee, using materials supplied by the previous task group working on this, bringing them forward for approval of the Board. It has also been noted that some items of the By-laws need to be clarified.

It was asked if RCSC has an antitrust policy. There is currently none adopted, but there is a draft for the Operating Procedures. There is currently a Conflict of Interest Policy separate from the old By-laws. Other items to be addressed include a Code of Conduct. All these items are part of the work of the Governance Committee.

The Board discussed four proposed new work items on Tuesday. See item 28. It was determined that the Stainless Steel Bolting work should start with an ad-hoc group of people interested in the topic, gathering other participants currently not a part of RCSC, and studying the marketplace. Thermal Break Joints, Bolting Personnel Qualification, and Anchor Rod Tensioning were topics that should have Task Groups formed. Each will be further discussed in this Annual Meeting.

The RCSC has a new, functioning LinkedIn page as Research Council on Structural Connections. Members are encouraged to link to the page, and to submit material for posting to the page.

Nominating Committee Report / Election of Directors (Kruth)

The nominating committee consisted of Larry Kruth (Chair), Carmen Vertullo, and Matt Haaksma.

The nominating Committee recommended that Salim Brahimi and Jason Chadee continue their service on the Board for another three-year term.

A motion was made and seconded to accept the recommendations of the Nominating Committee, and the motion passed unanimously.

2025 RCSC Specification – approval

Larry Kruth, Chair of the Specifications Committee, reported that the Specifications Committee had completed its task in resolving all ballot comments for the 2025 RCSC Specification for Structural Joints Using High-Strength Bolts. Kruth moved, and Chad Larson, having served two consecutive terms as the leader of TG4 on Installation, seconded the motion. The motion carried unanimously, with no abstentions. The date for the Specification will be June 5, 2025.

Kruth thanked the five Task Group Chairs for their dedication and service, who received a round of applause from the membership:

- Task Group 1 - General Requirements: G.A. Rassati
- Task Group 2 - Products and Parts: Toby Anderson
- Task Group 3 - Design: James Swanson
- Task Group 4 - Installation: Chad Larson
- Task Group 5 - Inspection: Tom Schlafly

Larry also presented the schedule for the RCSC Specification 2031. (See **Appendix C.**)

Technical Presentation – Stainless Steel Bolting (Jason Provines, Virginia Transportation Research Council)

Jason presented remotely, as he was unable to attend the meeting in person. (See **Appendix D** for presentation materials.)

The Design Guide (DG) for Structural Joints using Stainless Steel Bolts was jointly funded by AISC and RCSC. The Steel Construction Institute (UK) is the lead contractor, with Francisco Meza and Nancy Baddoo. The Virginia Transportation Research Center is a subcontractor with Jason Provines. The Objective is to develop a stainless steel bolting design guide, covering the same main topics as the RCSC Specification.

The DG covers commonly available Austenitic, Duplex, and PH (Precipitation Hardening) Alloy stainless steels. It also includes dissimilar metal connections. The DG is based on AISC 370 and AISC Design Guide 27, 2nd Ed. They included discussions with bolt manufacturers, bolting engineers, designers, metallurgists, and other relevant stakeholders. There was no additional research performed to prepare the Guide.

Work commenced on October 30, 2023, and the final deliverables are scheduled to be submitted to AISC on July 19, 2025. They are working through last remaining comments. They received 291 comments on the 100% draft from AISC and RCSC. They are planning to provide responses to all the comments. One of the notable differences from the RCSC Specification is the use of “should” rather than “shall.”

There were numerous challenges:

- No single ASTM for all stainless bolts, due to various different alloys/strengths, increasing the challenge of specification creation
- Both high-strength and non-high-strength bolts
- Both structural and non-structural bolting assemblies, including architectural connections, where strength isn’t the main/biggest concern
- No ASTM for stainless steel washers
- Problems with galling and various types of lubrication
- Corrosion concerns, and therefore alloy selection guidance
- Faying surfaces for slip-critical – considered grit blasted only based on limited research outside of grit-blasted surfaces
- Different slip coefficients
- Dissimilar metal connections
- Design equations
- No tabulated pretension parameters, based on limited test data
- Rotational capacity testing requirements

Things to consider when developing RCSC Specification for Structural Joints Using Stainless Steel Bolts:

- High strength vs. non-high strength bolts - Recommendation: Decide which “high-strength” SS bolts to include
- Consider ISO bolts for Duplex bolts
- Move non-high-strength bolts to an appendix or a separate document
- For tabulated pre-installation parameters, there is a limited dataset on torqued tension testing of SS bolts, which adds complications and becomes cumbersome
- Pre-installation Verification (PIV) Testing is needed, as installation relies on PIV results
- Rocap is needed. Recommendation to support research to conduct torque-tension testing on high-strength SS bolts in the Guide
- No ASTM for SS washers. Currently spec SS washers based on alloy designation to match bolt alloy designation, with a hardness of 2 HRC greater than the bolt’s specified maximum hardness. Work with ASTM on the development of ASTM SS washer specification (currently underway). Advocate for washer hardness limits.
- Dissimilar Metal Bolted Connections. There are two options: (1) Insulating gaskets and (2) coatings. Recommendations: Support research on both corrosion and structural performance of isolation systems. Consider isolation materials and coatings (G10/G11 glass epoxy, teflon, neoprene, etc). Consider insulating washers in slip-critical connections and slip-coefficient of coated fraying surfaces in contact with SS Faying surfaces.

- Limited research conducted only on grit-blasted faying surfaces. Recommendation: Support research to evaluate SS faying surfaces blasted with SS shot. Roughness evaluated using common methods, in combination with coated faying surfaces.
- Galling. Much guidance based on lubrication, performance testing (PIV & RoCap), and experience. No existing guidance on How to know when it is occurring during tensioning. Consider other mitigation strategies, such as mixing alloys (e.g. 316 nut with 304 bolt). Recommendations: Support research or experience-based investigation into galling, how to know when it is occurring, and other mitigation strategies, consider allowance or banning of impact tools, and their effect on galling.
- Resistance Factor for PH bolts. Lack of experimental data on shear and tensile tests on PH bolts prevents reliability analysis, resulted in 10% reduction in resistance factors. Recommendation: Support research for additional experimental testing of PH (Precipitation hardening) bolts in shear and tension.

Questions and Comments:

- Larry Kruth: Regarding the recommendations for research throughout the presentation, is there a way to consolidate those research needs/requests and place them all in one location for people to reference and then advertise?
- A copy of the presentation to include in the meeting minutes was requested.
- Any update on the uptick of SS in one market or another (e.g. bridges)? Is it still in the pilot project stage, or have some states progressed beyond it? Answer: Still at the promotion level, due to the limited guidance. AASHTO/NSBA task group working on welding/bolting/etc. specifications, so not quite at the “pilot” phase.
- Ronnie Medlock: AASHTO ballot was passed this morning, credit to Jason and Nancy.
- Mark Holland: SS bolts used for modular nuclear reactors.
- Pleased that RCSC is considering inclusion of SS in a design guide and/or spec
- Let design guide exist for a while and see where it leads regarding a specification.
- Request for input on what to prioritize on this larger list of research recommendations/requests

Technical Presentation – Anchor Rod Tensioning (Justin Ocel, Federal Highway Administration)

Justin presented remotely, as he was unable to attend the meeting in person. His presentation was “unbranded” from his personal perspective and was not to be considered on behalf of FHWA. (See **Appendix E** for presentation material.)

Justin stated that there is a need for anchor rod specifications, particularly regarding the tightening of anchor rods for various applications.

Focusing on Transportation Sector Specifications, addressing anchor rods:

- AASHTO Standards are what Justin usually works on, including AASHTO SLTS (Structural Supports for Highway Signs), and there is also an LRFD version; and AASHTO Bridge Spec (BDS)

Anchorage types include:

- Single nut connection — Grout pad/concrete/non-steel material between foundation and steel base plate
- Stool connection — Usually on high mast towers; provides a larger grip length
- Double Nut Connection — Anchor rods end up being rather large; includes a leveling nut, base plate, then top nut (base plate sandwich); grip is approx. 1:1 ratio

Anchor rod materials:

- Limitations to Grade 80 and higher due to concrete strength, so not really allowed in BDS

Anchor rod problems

- Wind creates structural resonance/vibration
- Anchor rods are the highest pain point in cantilevered structure types; can result in cantilevered structures falling onto the roadway
- Highway signage is built IN THE RIGHT OF WAY, especially cantilevered signage
- No federal mandate to inspect these structures/anchor rods
- Loosening occurs in both leveling and top nut for double nut connections
- Cantilevered/mast structure and moment calculation/resolution at the base
- Lack of correct tensioning in anchor rods can result in large increase in stress distribution on anchor rod/base plate

History of tensioning procedures

- Till and Lefke, 1994, The Relationship between Torque, Tension, and Nut Rotation of Large Diameter Anchor Bolts
- James et.al., 1997, Tightening Procedures for Large-Diameter Anchor Bolts
- AASHTO, 2001, Inclusion of fatigue in design in prevention of nuts loosening; Dexter and Ricker, 2002, “combined” method
- AASHTO, 2013,
 - Trying to bring in a simplified Dexter version
 - Changes from Dexter
- Hoisington and Hamel, 2014, Investigation of Anchor Nut Loosening in High-Mast Light Poles Using Field Monitoring and Finite Element Analysis (PacTrans)
- Chen et.al., 2018, Re-tightening the Large Anchor Bolts of Support Structures for Signs and Luminaires (Minnesota DOT)
- Singh and Hebdon, 2021 ASCE Journal of Structural Engineering, 147/10, October 2021
-

Ongoing FHWA research

- Looking at 2-4” diameter rods, grades 36, 55, 105, HDG and plain finish
- Plate thickness – rod diameter
- beeswax lubrication
- triplicate specimens
- various test types
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What about bridges?

- Unsure of torqued tension for bridges
 - Much larger anchor rods generally
 - Much larger grip lengths
- Preferred direct tensioning/post-tensioning
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RCSC 2003 Ballot for Specification for Steel-to-Concrete Joints using ASTM F1554 Smooth Anchor Rods...

- Failed
- Considered ballot to be premature
- Too “sign structure”-centric
- Didn’t address seismic

Future work scope – Specification re: anchor rod design

- Desire to focus only on the top nut, leveling nut, and non-embedded portion of the anchor rod
- Need to address:
 - Applications requiring tensioning
 - Materials
 - Joint selection
 - Installation
 - Tensioning (calibrated wrench, combined, DTI, and direct tensioning)
- Do not address:
 - Design of base plate
 - Design of concrete anchorage

Questions, Responses, and Comments:

- Comment on the use of RCSC to help bolster the argument for more regulation/guidance on anchor rods with states
- Tom: all of this to avoid loosening/fatigue problems of the nut itself, is that correct?
 - Yes, EOR has to design the stress range itself, but there's a problem with the dramatic increase in stress distribution
- Tom: Can we just require locking in the nut a different way?
 - Jamb nuts are used in some cases, but are not considered the best idea
- Tom: Nylon nuts?
 - Thought to get rid of this detail altogether and just embed everything into concrete to begin with, but AASHTO not buying into it
- Carmen: TBRW, Last illustration, one thing we like to see to keep bolts tight w/o ancillary locking mechanisms is a large grip, but that isn't seen in the last detail. Is that something we can incorporate?
 - No reason to go for/against it currently, but it might be expensive to fabricate
- Carmen: All metal locking nuts instead of jamb nuts, has AASHTO considered those?
 - Definitely other ways to attack the issue, but still need to make sure applied moment/loading doesn't overtake the available strength. It's not just about the nut loosening
- Comment: Current design-build project using various DOT specs, this research and attention to detail is appreciated
- Comment: Request for copy of presentation
 - No branding, so it should be okay
- Comment: on tolerances, the resulting residual moment/force load as a result of imperfectly plumb rods and base plate flatness increase moment/force load

Lunch Break

New work item proposals – Bob Shaw

Shaw reviewed previous new work item proposals (from past RCSC meeting in Chicago, 2022). Specific discussion on these and additional work items followed.

Specification for Structural Joints Using High-Strength Bolts 2031

- Larry Kruth presented the proposed calendar/schedule for the 2031 edition. The 6-year cycle has been confirmed with AISC, with the next AISC 360 to be published dated 2033.
- Toby Anderson asked about a restructuring of task groups, which is a topic that will be addressed by the Spec Committee Chair and the RCSC Board in the near future

Specification for Structural Joints Using Stainless Steel Bolts

The RCSC Board has discussed this at length. Evaluating work that should be done and necessary research needs, it is probably too early to write the Spec.

Discussion:

- Writing a draft Spec will help to define missing pieces/needs
- Wait and see if there's a market or demand. We have the guide, is it being used and read?
- Building side stated a need for information
- ISO standard is in development for a test method to determine parameters of bolt tightening procedures, meant explicitly for pretensioned assemblies where no tightening parameters exist (e.g., SS bolting assemblies)
- Carmen Vertullo volunteered to lead an ad hoc group
- Will need support – email survey forthcoming from Bob to express interest
- Topics - Market need, What research is needed, Outlining spec, Starting the whole process, Contacting SS bolt suppliers to ask for participation

Open discussion:

- Ronnie Medlock: Should we consider partnership w/ Jason's task group? We should consider partnership with anyone.
- Carmen Vertullo: thanked the oversight committee members for AISC effort
 - If we decide the Guide/Spec was a waste of time, what did the committee on SS structures do? i.e. – the need for this has already been determined, as evidenced by multiple AISC SS publications
 - Neither publication looked closely at bolting
 - Convinced there is a great market, "if we build the Spec they will come"
 - These things are already being built/designed/used, so we should have design guidance in the form of a spec
- Larry Kruth: AISC SS spec not being published until Feb., we should review it
- Bob Shaw: No particular deadline for this
- Mark Holland:
 - Timing – deliberately followed AISC 360 to modify as needed for SS and implementation in AISC 370
 - If we do issue a spec, we should do the same thing w/ RCSC – follow the RCSC carbon steel spec and implement changes as needed for SS version
 - SS is being used already in various structures, including small modular nuclear reactors

Recommendations/Specification for Structural Bolting of Thermal Break Joints

- 30-second review of what thermal breaks are and where they're used
- Proposed to do something about it
- Larry Kruth:
 - concerns re: RCSC specification requiring only steel, but it's everywhere, and every time it's being used it violates RCSC
 - AISC funding (hopefully) 3 years of research
 - Interest can be communicated via incoming email, JotForm
 - If our experts can give some guidance, that would be appropriate

Recommendations/Specification for Anchor Rod Tensioning

- Only 4 states have devoted any concern to it
- Bob Shaw:
 - 2003 draft for "Specification for Steel-to-Concrete Connections", including Commentary and ballot comments
 - Included double-nut joint and others
 - Included vibrating machinery joints

Recommendations for Bolting Personnel Qualification

- Many comments from the committee members for the proposed additions to Spec Sections 1.7 and 1.8. Some didn't like what was written, others wanted more detail, so the topic was pared down to introducing topics.
- Work underway on ISO/DIS 19998:2025, going to DIS ballot soon. Scope involves
 - normative references,
 - terms and definitions,
 - tasks and responsibilities,
 - job descriptions,
 - technical knowledge and competence
 - Annex A – Essential bolting and related tasks to be considered when appropriate
- Bob Shaw, Tom Ringelstetter, and Ronnie Medlock are working on this

Additional Proposals for Future Consideration

Galvanized A490/Group 150 bolts

- Tom Schlafly: Not approached in A2/A4 committee, there has been no voice. Questions potential specification language and inclusion/exclusion of bolts, and the lack of market pressure to prove them adequate.
- Anyone interested, please reach out to A2/A4
- Doesn't want to guide industry, currently just watching what's happening
- Considered a "very" hot topic
- Bob Shaw: ASTM F3125 permitting galvanized A490s will probably pass in ASTM F16 later this year
- Bill Germuga: does not expect a large market for galvanized A490s, because we can galvanize Group 144's
- Bob Shaw:
 - concerns about the way we install bolts that can take these bolts to a tension that is very high, above tension capabilities/requirements, so some limitations may be needed
 - Some cautions needed, perhaps in an RCSC appendix, talking about good material/workmanship/etc.
- Will create an RCSC formal task group w/ chair/vice chair/etc. to report back to Research and Board

Other topics

- Bill Germuga: much conversation at last meeting re: bolts w/ special thread lengths
 - A lot of interest in ASTM tackling this, no preclusion for ROCAP testing these bolts
 - Extra threads w/n shear plane can cause problems
 - Being made a lot in A325 and A490
 - Don't always know what the end use is
- Installation of expanded list of fasteners, diameters, thread length
 - Per above thoughts from Bill
 - Creation of possible task group
- Vincent Sagan: Some previous topics require research, some assumption that RCSC volunteers will do, but there is a desire to follow up with the financials
 - Concerns re: amount of work by committee members with regards to the financial accounting and reporting
 - Should we hire a financial consultant, with oversight by RCSC Committee/Board in order to ensure full adherence to research project budgets and timelines
 - Response: research requests go to A2, consultant suggestions go to A2, other sources of funding for various things not necessarily out of the woodwork yet
- Need to determine whether we're going down certain paths or not. As such, it would be beneficial to respond to the interest survey/JotForm.

A2/A4 Report – Research Projects

Current research projects — Slip of metallic coatings — Status was presented this morning, excited to look forward into “what it all means”, White papers, articles, and magazines

New research project proposals — Nothing before them currently

New research project needs

- Been talking about some previously – all the power to AISC if they are funding things
- Can RCSC buy into that at all?
- AISC Research Committee meeting July 21st

Open discussion — Plate washers

- Washer thickness/grade/material
- Anything that will simplify spec is of value

A2/A4 Report – Education Projects

Current education projects

- Educational videos
 - Updating of 3rd edition Guide to Criteria - 12 chapters
- SS bolting design guide (RCSC paying only part of it)
- Bulletin updating

New education project proposals

- No proposals currently to spend on educational projects
- Bulletin updating (see above current projects)

Education needs and resources

- Bob Shaw: easier to update bulletins, but things never actually seem to finish
- Vincent Sagan: Desire to update website to increase usability and streamline wayfinding through available resources
 - Bob Shaw: Jim Swanson handles website
 - Jim Swanson: not a programmer, can post things, but we might look into hiring a professional
- Performance qualifications for bolters/erectors:
 - ASME has a certification qualification/credential, should we offer some type of credentialing program to them?
 - AISC doesn't certify individuals, only companies, because it's so incredibly difficult. The shops/contractors qualify their own workers.

Other Committee Activities

AISC – American Institute of Steel Construction — Chris Raebel, not in attendance

IFI – Industrial Fastener Institute — Salim Brahimi

- Technical committee has been revived and is currently getting much more active
- Currently no projects related to structural fasteners, but they are meeting more regularly

AGA – American Galvanizers Association — Alana Fossa

- AGA is working on proposed language in ASTM A143 (currently under revision) to update the practices for safeguarding against embrittlement of HDG steel products. However, to address concerns specific to movements with ASTM F3125 and outlining practices for avoiding hydrogen embrittlement of A490s, AGA will also recommend alignment & additional language in F2329 around: (1) Add reference to A143 in F2329, (2) Cleaning practices for A490s to discuss options, best practices, cleaning times, inhibitors (7.2.2), and (3) Bath temperature - review 7.2.1 and 7.2.3
- AGA (in consultation with U. Cincinnati, KTA-Tator, GPI Labs, and member galvanizers) is developing a guide to specifying, preparing, and galvanizing test plates for RCSC Appendix A testing. This is driven by increased interest in qualifying connections involving HDG with metallizing and AASHTO's introduction of Class D. This will be prepared ahead of the next annual meeting, where RCSC input and support of the document will be requested. A 1-2 page handout is available for those requesting samples.
- Anyone who wants to participate, please get in touch with Alana.

MBMA – Metal Building Manufacturers Association — Vincent Sagan

- JP Cardem to replace/transition due to the retirement of Lee Shoemaker
- MBMA is an ANSI-accredited standards organization, and will be maintaining a lot of the standards testing for AISI

ASTM International (F16 and A01.02) — Toby Anderson

- F16 met in May in Toronto and made progress on several projects, including a quality assurance documentation guide, and a new stainless steel washer standard. A plate washer standard is in preliminary stages; re-permitting galvanized A490's has moved forward to a concurrent ballot for this summer. Feedback on the effectiveness of the recently-adopted task group organization has been very positive.
- B08 also met last month in Toronto and continues its work adjusting its coating standards to raise its hardness limits for when baking products may be needed.

ISO – International Organization for Standardization — Toby Anderson (TC2) and Bob Shaw (TC 167)

- ISO/TC 2 – Fasteners
 - Redraft of ISO 10684 Fasteners — Hot dip galvanized coatings is in final stage, early committee review stages
 - ISO 898-1 is going to undergo a significant review
 - Some work going on regarding surface discontinuity standards
 - Stainless steel washer standard has been published recently
- ISO/TC 167 – Steel and Aluminium Structures
 - (4) documents underway
 - Structural bolting coordination tasks/responsibilities (mentioned earlier)
 - Test method for determining slip factors, led by German delegation, currently out for ballot
 - Test method to determine loss of pretension due to coatings, led by GA Rassati. currently out for ballot
 - Test method to determine parameters for bolt tightening procedures, led by German delegation, very complex, but could serve as a basis for RCSC with a more basic testing approach
 - Invitation extended for people to participate as desired — Would increase understanding of non-American policies/standards

A3 Report – Membership and Funding — Jason Chadee

Membership and Funding (see **Appendix F.**)

- Very recently active, (1) member – Jason Chadee
- 27% increase in membership from 2024 — Due to presence at AISC NASCC conference and direct membership outreach
- Desire for certain members:
 - Younger members
 - Expertise in SS fasteners
 - Expertise in Thermal breaks
 - Those who can support A2/A4 needs
- Currently looking for how to increase funding from outside of membership contributions
- Discussions:
 - Can we tap into the AISC membership pool somewhat?
 - Conversations with major corporations/suppliers/etc. within industries, Coating industry, for example
 - Invitation to forward any contacts/etc. regarding recruitment
 - Want to be sure we moderate increased membership to avoid creating a surplus/unnecessarily large council
 - Invitation made to accept A3 committee volunteers

Editorial Committee Report — Tom Schlafly

- Publishing people would like draft as soon as possible, Will be ready at end of year
 - Larry Kruth: Based on what happened today, date on 2025 spec will be today's date; Goal is to get draft all together and sent over to Editorial
- Open call for those looking to participate in the Editorial Committee
 - Lots of copy-editing
 - Excellent learning opportunity
 - Will be included in forthcoming JotForm

RCSC Annual Meeting 2026 — Bob Shaw / Dan Wroblewski

Peru, Illinois, hosted by Unytite

- Approximately 90 minutes from Chicago airports (O'Hare or Midway)
- State parks in the area
- Grand Bear Lodge or Starved Rock Lodge
 - Grand Bear Lodge is adjacent to Starved Rock State Park
 - Local transportation with/ tours through parks
- No taxis/Uber/Lyft service, will need a rental car

No other current offers for hosting, though Peru, IL, does follow the pattern of going across the country

Current date options:

- Tuesday, June 2 through Thursday, June 4
- AISC/ASCE steel bridge competition currently on Memorial Day Weekend (May 22nd)
- AASHTO bridge conference dates not currently decided
- AISC TC meetings during in the week of June 9th
- Straw poll:
 - Tuesday Wednesday Thursday: Large preference – (selected)
 - Wednesday Thursday Friday: 4 people
 - No preference: 5 people

Motion to set date and place — Unanimous, motion carried

Concluding Remarks — Bob Shaw

Many thanks to all for their active participation in setting the direction of the RCSC for the coming years.

Adjournment

Motion made and seconded to adjourn. Passed unanimously at 2:03 pm.

Minutes prepared by:

Sahil Prabhudesai, RCSC Secretary

Bob Shaw, RCSC President

With meeting notes taken by: Margaret (Maggie) Sullivan-Miller, UC

RCSC Membership Roster

as of June 3rd 2025

<u>First</u>	<u>Last</u>	<u>Company</u>	<u>Group</u>	<u>Voting Member</u>
Toby	Anderson	Bay Bolt	Producer	Yes
Jones	Barton	GPI Laboratories, Inc.	User	Yes
Peter C.	Birkemoe	University of Toronto	Life Member	Yes
David	Bogaty	Ingenium Professional Services, Inc	General Interest	Yes
David	Bornstein	Skidmore Wilhelm	Producer	Yes
Salim	Brahimi	Industrial Fasteners, Institute (IFI)	Association	Yes
Rich	Brown	Consultant	General Interest	Yes
Carolyn	Carbonneau	Cimolai-HY	User	Yes
Chad T.	Case	Skanska USA Civil Northeast	General Interest	Yes
Derrick	Castle	The Sherwin Williams Company	Producer	Yes
Jason	Chadee	Red Iron Works	User	Yes
David	Cohen	Baco Enterprises Inc	Distributor	Yes
Robert J.	Connor	Purdue University	General Interest	Yes
Bastiaan	Cornelissen	Spectrum Forensics LLC	General Interest	Yes
Chris	Curven	Applied Bolting Technology	Producer	Yes
James	DiPasquale	HNTB	General Interest	Yes
Kenneth	Damiao	LRKD Industries	Distributor	Yes
Lucky	Damiao	Elite Steel Fabricators and Erectors	User	Yes
John	Davis	The Reaction Washer Company	Producer	Yes
Brady	Dobbin	JC Steel Erectors Corporation	User	Yes
Noah	Dorsey	Infasco	Producer	Yes
John W.	Fisher	Lehigh University - ATLSS Center	Life Member	Yes
James	Foreman	Martin/Martin Consulting Engineers	General Interest	Yes
Alana	Fossa	American Galvanizers Association	Association	Yes
Karl H.	Frank	NSBA	Life Member	Yes
Michael C.	Friel	Haydon Bolts, Inc.	Producer	Yes
Mike	Gase	Midwest Steel, Inc.	User	Yes
Albert	Gelles	Doerken Corporation	Producer	Yes
Bill	Germuga	St. Louis Screw & Bolt	Producer	Yes
Rodney D.	Gibble	Rodney D. Gibble Consulting Engineers	General Interest	Yes
Ted	Goldstein	Atlas Tube	Producer	Yes
Jeff	Greene	LeJeune Bolt Company	General Interest	No
Quentin	Greiner	ruby+associates	General Interest	Yes
Matthew	Haaksma	Orange County Ironworks, LLC	User	Yes
Jerome F.	Hajjar	Northeastern University, Department of C&E Eng.	General Interest	Yes
Robert A.	Hay III	Construction Services of Illinois	General Interest	Yes
Mark V.	Holland, PE	Paxton & Vierling Steel Co	User	Yes
Lawrence A.	Kloiber	LeJeune Steel	Life Member	Yes
Lawrence	Kruth	Kruth Engineering	General Interest	Yes
Alyssa	Kumfer	Nucor Fastener	Producer	Yes
Debra	Laefer	New York University	General Interest	Yes
Chad M.	Larson	LeJeune Bolt Company	Distributor	Yes
Bill R.	Lindley II	W W Steel, LLC	User	Yes
John	Martinez	Derr & Gruenewald	User	Yes
John "Chris"	Marvin	Cives Steel Company	User	Yes

Appendix A

<u>First</u>	<u>Last</u>	<u>Company</u>	<u>Group</u>	<u>Voting Member</u>
Carly	McGee	KTA-Tator, Inc.	User	Yes
Jonathan C.	McGormley	Wiss, Janney, Elstner Assoc.	General Interest	Yes
Helen	McKay	LeJeune Steel Company	User	Yes
Ronnie	Medlock	High Steel Structures, LLC	User	Yes
Jinesh K.	Mehta	Alta Vista Solutions	General Interest	Yes
Timothy Robert	Melander	LPR Construction	User	Yes
Heath E.	Mitchell	G.W.Y., LLC	Distributor	Yes
Thomas M.	Murray	Virginia Tech.	Life Member	Yes
Michael	Musselwhite	Hercules Bolt Company	Producer	Yes
James	Neeley	Walsh Group	User	Yes
Justin	Ocel	Federal Highway Administration	General Interest	Yes
Travis	Pechacek	Orlo Forensics	General Interest	Yes
Anna	Petroski	DOTQS	General Interest	Yes
Lee	Pielaet	Pioneer Steel Services	General Interest	Yes
Brad	Porter	Birmingham Fastener	Producer	Yes
Joseph	Poulin	Alpine Consulting & Metal Works LLC	General Interest	Yes
Sahil	Prabhudesai	Nucor Steel Berkeley	General Interest	Yes
Steven	Putnam	Hercules Bolt Company	General Interest	No
David	Rank	Wrought Washer	Producer	Yes
Gian A.	Rassati	University of Cincinnati	General Interest	Yes
Mathew	Reynolds	COWI North America	General Interest	No
Clinton	Rex	Stanley D. Lindsey & Assoc.	General Interest	Yes
Joseph T.	Ridgway	Pennoni	General Interest	Yes
Thomas E.	Ringelstetter	Kraemer North America, LLC	User	Yes
Andy	Rios	Schuff Steel Company	User	Yes
Sougata	Roy	FHWA	General Interest	Yes
Vincent	Sagan	MBMA	Association	Yes
Thomas J.	Schlaflly	AISC	Association	Yes
Rachel	Shanley	Simpson Gumpertz & Heger	General Interest	Yes
David	Sharp	HYTORC	Producer	Yes
Robert E.	Shaw Jr.	Steel Structures Technology Center	General Interest	Yes
Daniel Ethan	Smith	Hazen and Sawyer	General Interest	Yes
Eric	Smith	Birmingham Fastener	General Interest	No
Nicholas	Sovell	HDR Engineering, Inc.	General Interest	Yes
Mritunjaya	Srivastava	Bechtel India Private Limited	User	Yes
Winston	Sturge	NYC Constructors LLC	User	Yes
Carlos	Suarez Gallardo	Pernostock Ltda.	Distributor	Yes
James A.	Swanson	University of Cincinnati	General Interest	Yes
Donny Dean	Thompson	Bracken Construction	User	Yes
William A.	Thornton	Cives Steel Company	Life Member	Yes
Christopher	Tribble	Würth Construction Services	Producer	Yes
Todd C.	Ude	PARSONS	General Interest	Yes
Carmen	Vertullo	Carver Engineering	General Interest	Yes
Nathan	Wilkinson	Structural Bolt & Manufacturing, Inc.	Distributor	Yes
Ryan	Wilson	KTA-Tator, Inc.	General Interest	No
Dan	Wroblewski	Unytite, Inc.	Producer	Yes
Doug	Yates	Pennoni	General Interest	Yes
Joseph A.	Yura	U of T Austin/Phil M. Ferguson Str. Eng. Lab.	Life Member	Yes



**2025 Annual Meeting
University of Cincinnati
Thursday, June 5, 2025**

10:10	Call to order	Bob Shaw
10:15	Recognition of Meeting Hosts, Announcements	Bob Shaw / UC Team
10:20	Recognition of Sponsors for Annual Meeting	Bob Shaw
10:25		

Thank you to our Organizers



James A. Swanson
Associate Professor



Gian Andrea A. Rassati
Associate Professor

Thank you to our Organizers



Christine Cheevers
Executive Staff Assistant
CEAS-Civil & Architectural Engineering, Construction Management

Margaret (Maggie) Sullivan-Miller

Kara Stall

Thank you to our RCSC 2025 Annual Meeting Sponsors



Pretensioned



STEEL STRUCTURES TECHNOLOGY CENTER, INC.



Snug Tightened



RCSC Mission

To provide a non-profit forum of individuals with expertise and interest in the technology of **civil engineering** and **structural connections** using **threaded fasteners**, and to advance the state of the art in those fields.

The Council supports **scientific research**, the results of which are used by the Council to develop design, application, and inspection **standards**, and to promote **education**.



The RCSC is a forum of leading experts in the fields of structural steel connection design, engineering, fabrication, erection, and bolting, with special expertise and interest in bolted connections in civil engineering applications.

The Council is organized exclusively for

- guiding scientific research and its dissemination,
- development of design, application, and inspection standards, including the Specification for Structural Joints Using High-Strength Bolts, and
- providing related educational and training material.

Membership in RCSC is available to individuals, businesses, and organizations. ...

10:25	Introduction of Members and Guests	all
10:35		

600 seconds / 55 attendees → 10 seconds each!

10:35	Roll Call of Voting Members, Establish Quorum	Bob Shaw / Sahil Prabhudesai
10:40	Approval of Agenda	Bob Shaw / Members
10:40	Approval of Minutes, Annual Meeting of June 7, 2024 (Pittsburgh)	Sahil Prabhudesai / Members
10:45		

Agenda

Minutes

10:35	Roll Call of Voting Members, Establish Quorum	Bob Shaw / Sahil Prabhudesai
10:40	Approval of Agenda	Bob Shaw / Members
10:40	Approval of Minutes, Annual Meeting of June 7, 2024 (Pittsburgh)	Sahil Prabhudesai / Members
10:45		

10:45	Review of Membership and Classifications	Sahil Prabhudesai
10:50	Financial Reports a) 2024 year-end b) Current financial condition c) Approval of financial report(s)	Sahil Prabhudesai / Members
11:00		

RCSC Annual Meeting Secretary-Treasurer Report 6/5/25 Cincinnati OH		
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See Financial Report in Meeting Minutes

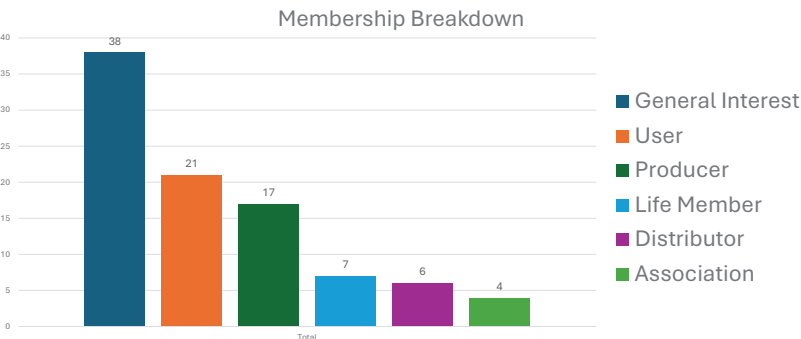
Membership

Drop due to retirements,
members for non-payment
consecutive years

93 members vs 73 members vs 82 members
2025 vs 2024 vs 2023

Roster with voting status uploaded on website

Current Classifications



New Members

New Members				
First	Last	Company	Classification	Voting
Carolyn	Carbonneau	Cimolai-HY	User	Yes
David	Cohen	Baco Enterprises Inc	Distributor	Yes
Kenneth	Damiao	LRKD Industries	Distributor	Yes
Lucky	Damiao	Elite Steel Fabricators and Erectors	User	Yes
John	Davis	The Reaction Washer Company	Producer	Yes
Brady	Dobbin	JC Steel Erectors Corporation	User	Yes
Ted	Goldstein	Atlas Tube	Producer	Yes
Quentin	Greiner	ruby+associates	General Interest	Yes
Mark V.	Holland, PE	Paxton & Vierling Steel Co	User	Yes
Alyssa	Kumfer	Nucor Fastener	Producer	Yes
Debra	Laefer	New York University	General Interest	Yes
John	Martinez	Derr & Gruenewald	User	Yes
Timothy Robert	Melander	LPR Construction	User	Yes
Michael	Musselwhite	Hercules Bolt Company	Producer	Yes
Lee	Pielat	Pioneer Steel Services	General Interest	Yes
Joseph	Poulin	Alpine Consulting & Metal Works LLC	General Interest	Yes
Steven	Putnam	Hercules Bolt Company	General Interest	No
David	Rank	Wrought Washer	Producer	Yes
Thomas E.	Ringelstetter	Kraemer North America, LLC	User	Yes
Vincent	Sagan	MBMA	Association	Yes
Daniel Ethan	Smith	Hazen and Sawyer	General Interest	Yes
Donny Dean	Thompson	Bracken Construction	User	Yes
Doug	Yates	Pennoni	General Interest	Yes
Re-classification				
First	Last	Company	Classification	Voting
Jason	Chadee	Red Iron Works	User	Yes

Re-classifications

Appendix B

Membership Changes, Members Departed

Members Removed			
Curtis	Mayes	Stanley D. Lindsey & Assoc.	succeeded by Clinton Rex
Lee	Shoemaker	MBMA	succeeded by Vincent Sagan
Tate	Nickerson	Nucor Fastener	succeeded by Alyssa Kumfer
Members Departed			
Douglas B.	Ferrell	Ferrell Engineering	

Members – non-payment

Members will be removed on 6/6/2025 and will need to re-approved by the BoD

First	Last	E-mail	Group	Voting Member
Rich	Brown	rcjbrown@gmail.com	General Interest	Yes
Robert J.	Connor	connor@purdue.edu	General Interest	Yes
Kenneth	Damiao	kennethdamiao@lrkdindustries.com	Distributor	Yes
Lucky	Damiao	ldamiao@elite-steel.com	User	Yes
Noah	Dorsey	ndorsey@infasco.com	Producer	Yes
Michael	Musselwhite	mmusselwhite@herculesbolt.com	Producer	Yes
Steven	Putnam	sputnam@herculesbolt.com	General Interest	No
Winston	Sturge	westurge@nyconconstructors.com	User	Yes

New Members have 30 days after notification of Membership Application being approved before being considered delinquent

11:00	RCSC Annual Report	Bob Shaw
11:10		
Board of Directors Meetings September 30, 2024 October 29, 2024 November 26, 2024 January 21, 2025 April 22, 2025 June 3, 2025 Annual Meeting June 5, 2025		

11:00	RCSC Annual Report	Bob Shaw
11:10		

Membership Activities

AISC NASCC 2025, Louisville, KY; March 2025
Jason Chadee – Membership and Funding

General Interest	7
Users	8
Distributors	2
Producers	4

11:00	RCSC Annual Report	Bob Shaw
11:10		
Committees of the Board of Directors Formation of Three Committees • Executive Committee: Bob, GA, Sahil • Finance Committee: Sahil, Dan, Ronnie • Governance Committee: GA, Toby, Carly By-laws Article 6		

11:00	RCSC Annual Report	Bob Shaw
11:10		

New Work Items

Structural Joints Using Stainless Steel Bolts	ad-hoc group
Structural Bolting of Thermal Break Joints	Task Group
Bolting Personnel Qualification	Task Group
Anchor Rod Tensioning	Task Group

11:00	RCSC Annual Report	Bob Shaw
11:10		

New, functioning LinkedIn page

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS



RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS

Civil Engineering · CHICAGO, Illinois · 6 followers · 0-1 employees

 Corbin follows this page

✓ Following

...

Home

About

Posts

Jobs

People

Overview

The RCSC is a not-for-profit corporation, comprised of leading experts in the fields of structural steel connection design, engineering, fabrication, erection, and bolting. Previous, current, and future research projects funded by the RCSC serve to provide safety, reliability, and standard practice for the st ... see more

11:10	Nominating Committee Report / Election of Directors	Larry Kruth / Members
11:15		

AS OF ANNUAL MEETING 2025						
Position	Officer	2-yr Terms completed	First Year Elected	Last Year of Service Permitted	Year of Next Nomination / Re-election	Current Year
	years per term - 2 3 consecutive term limit					
Chair	Bob Shaw	0.50	2024	2030	2026	General Interest
Vice-Chair	GA Rassati	0.50	2024	2030	2026	General Interest
Secretary-Treasurer	Sahil Prabhudesai	1.00	2023	2029	2026	General Interest (Not Producer)
Position	Director	3-yr Terms completed	First Year Elected	Last Year of Service Permitted	Year of Next Nomination / Re-election	Current Year
	years per term - 3 3 consecutive term limit					
Director 1	Salim Brahimi **	2.00	2024	2028	2025	Association
Director 2	Jason Chadde ***	0.67	2023	2031	2025	User
Director 3	Ronnie Medlock	0.67	2023	2032	2026	User
Director 4	Dan Wroblewski	0.67	2023	2032	2026	Producer
Director 5	Toby Anderson *	2.67	2017	2027	2027	Distributor
Director 6	Carly McGee	2.33	2018	2027	2027	General Interest
* Appointed to complete previous term						
** 2024 Elected for one year to complete previous term of GA Rassati (limited to 2028)						
*** 2023 Special Election prior to Incorporation, JC set for two-year term to re-establish balance of two Directors per year						

11:15	2025 RCSC Specification approval	Larry Kruth
11:20		

Motion to approve the 2025 edition of the RCSC Specification for Structural Joints Using High-Strength Bolts, as approved by the Specification Committee this morning, to be subject to editorial review and editorial corrections by the Editorial Committee, and subject to preparation by the Editorial Committee of front matter and indexing for publication by AISC.

11:20	Technical Presentation – Stainless Steel Bolting	Jason Provines, Virginia Transportation Research Council
11:40	Discussion	all
11:45		

11:45	Technical Presentation – Anchor Rod Tensioning	Justin Ocel, Federal Highway Administration
12:05	Discussion	all
12:10		

12:10	Lunch Break	all
12:25		

12:25	New work item proposals –	Bob Shaw
12:30		

POINTS

Total Points for Ranking

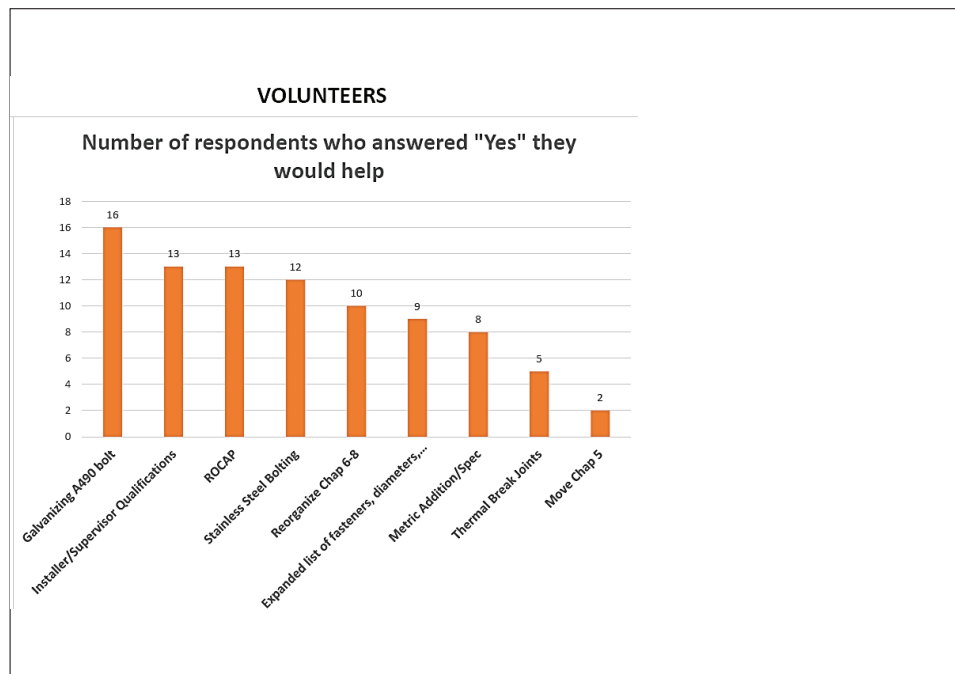
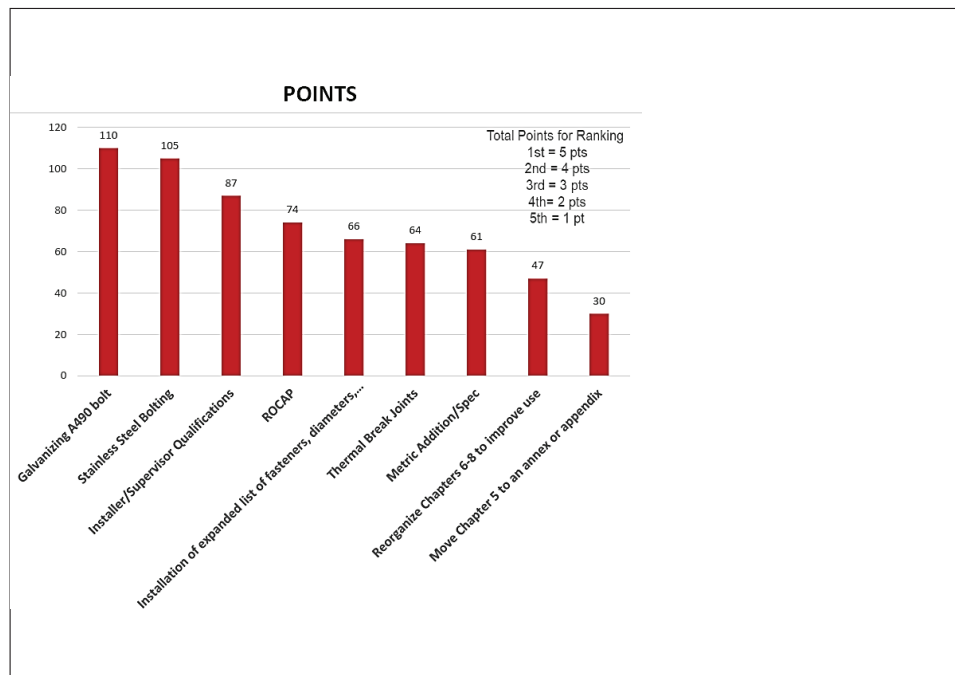
1st = 5 pts
2nd = 4 pts
3rd = 3 pts
4th = 2 pts
5th = 1 pt

Proposal	Points
Galvanizing A490 bolt	110
Stainless Steel Bolting	105
Installer/Supervisor Qualifications	87
ROCap	74
Installation of expanded list of fasteners, diameters...	66
Thermal Break Joints	64
Metric Addition Spec	61
Reorganize Chapters 6 & 9 to improve use	47
Move Chapter 5 to an annex or appendix	30

VOLUNTEERS

Number of respondents who answered "Yes" they would help

Proposal	Number of respondents
Galvanizing A490 bolt	16
Installer/Supervisor Qualifications	13
ROCap	13
Stainless Steel Bolting	12
Reorganize Chap 6 & 9	10
Expanded list of fasteners, diameters...	9
Metric Addition Spec	8
Thermal Break Joints	5
Move Chap 5	2



12:25	New work item proposals –	Bob Shaw
12:30	Specification for Structural Joints Using High-Strength Bolts 2031	all
12:35		

	New work item proposals –	Bob Shaw
12:35	Specification for Structural Joints Using Stainless Steel Bolts	all
12:40		
   <i>Structural Joints using Stainless Steel Bolts</i> FRANCISCO MEZA AND NANCY BADDOO The Steel Construction Institute Unit 2, The E Centre, Bracknell, Berkshire UK JASON PROVINES Virginia Transportation Research Council Virginia Department of Transportation, Richmond, VA, USA		

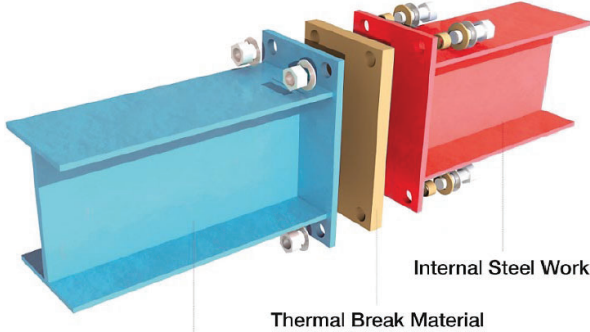
	New work item proposals –	Bob Shaw
12:35	Specification for Structural Joints Using Stainless Steel Bolts	all
12:40		
GLOSSARY SYMBOLS    1 Introduction and General Requirements 2 Bolting Components, Assemblies and Alloy Selection 3 Bolted Parts 4 Joint Type 5 Joints Between Dissimilar Metals 6 Limit States in Bolted Joints 7 Use of Washers 8 Pre-Installation Verification 9 Installation 10 Inspection 11 Arbitration A Examples of how to specify stainless steel bolted assemblies B Procedure for a Rotational-Capacity Test for Stainless Steel Bolting Assemblies C Testing Method to Determine the Slip Coefficient 2026 in Stainless Steel Bolted Joints D Design Examples <i>Structural Joints using Stainless Steel Bolts</i>		

ISO/DIS 18954

Steel structures — Structural bolting — Test method to determine parameters of bolt tightening procedures

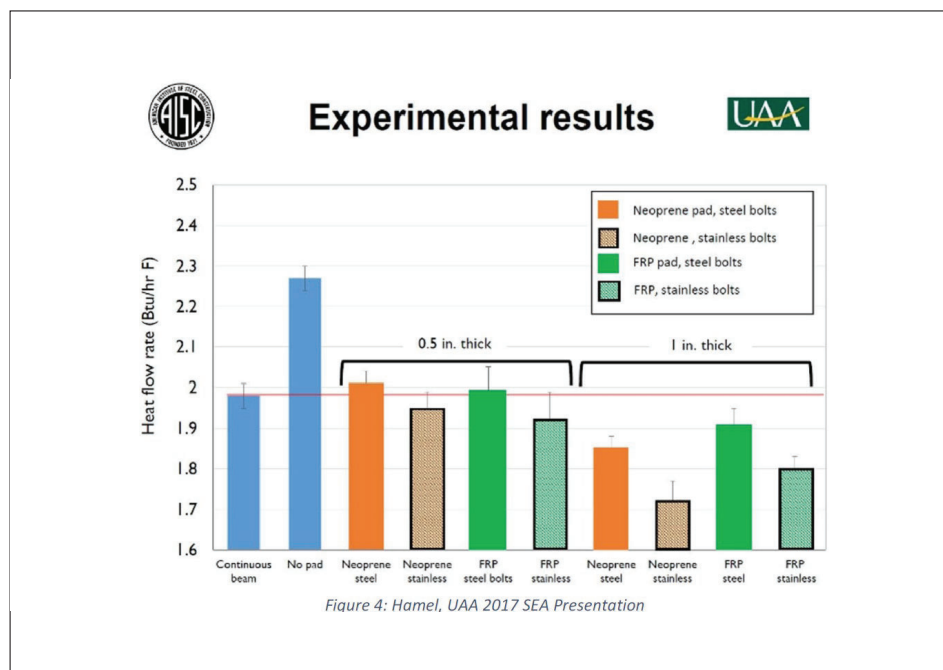
This document has been prepared to provide provisions and guidance in the testing of bolting assemblies for pretensioning for which no tightening parameters exist, **e.g. stainless steel bolting assemblies**. This document gives provisions and guidance on how to determine secure tightening parameters.

	New work item proposals –	Bob Shaw
12:40	Recommendations/Specification for Structural Bolting of Thermal Break Joints	all
12:45		



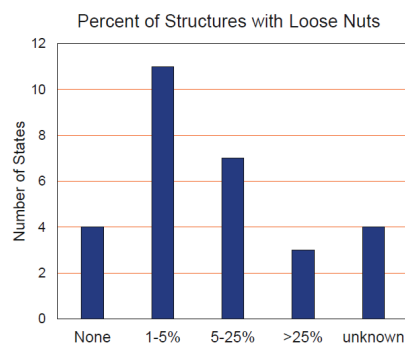
External Steel Work Thermal Break Material Internal Steel Work

Armatherm Thermal Bridging Solutions



	New work item proposals –	Bob Shaw
12:45	Recommendations/Specification for Anchor Rod Tensioning	all
12:50		

History of Anchor Rod Problems

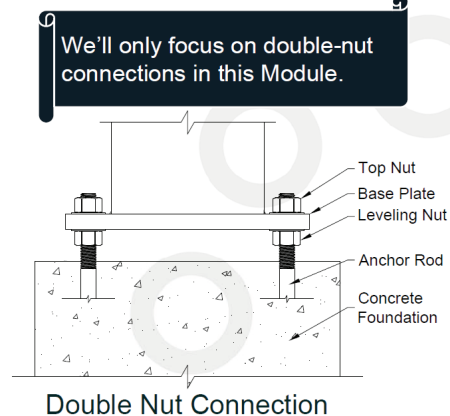
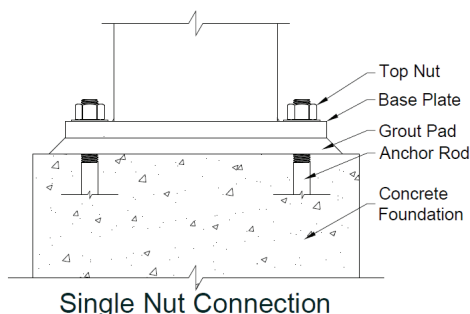


Chen et. al. (2018). *Re-tightening the Large Anchor Bolts of Support Structures for Signs and Luminaires*. Minnesota Department of Transportation. St. Paul, MN.

298



Anchorage Types

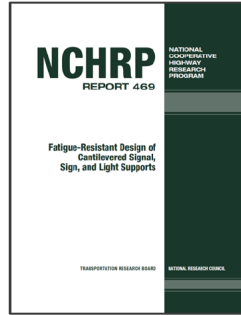


299



Anchor Rod Minimum Installed Tension

- We'll focus on method in NCHRP Report 469 Appendix A.
- Method was adopted by AASHTO, but critical steps were left out.



Dexter, R. J., and M. J. Ricker. "Fatigue-Resistant Design of Cantilevered Sign, Sign, and Light Supports." Washington, D.C.: Transportation Research Board, 2002.



DRAFT FOR RCSC COMMITTEE USE ONLY

17 June 2003

SPECIFICATION FOR

STEEL-TO-CONCRETE JOINTS USING

ASTM F1554 GRADES 36, 55, AND 105 SMOOTH ANCHOR RODS,

ASTM A615 AND A706 GRADE 60 DEFORMED BARS

Approved by the Research Council on Structural Connections, <date>

3.1 Threaded-Shear-and-Uplift Joints

Anchor rods in threaded-shear-and-uplift joints shall be designed in accordance with the applicable provisions of Sections 4.1 and 4.3 through 4.6, installed in accordance with Section 5.1 and inspected in accordance with Section 7.

3.2 Double-Nut-Moment Joints

Anchor rods in double-nut-moment joints shall be designed in accordance with the applicable provisions of Sections 4.1 through 4.6. Double-nut moment joints designed for Seismic Design Category D or greater according to ASCE 7 or designed for fatigue according to Section 4.6 shall be installed in accordance with Section 5.2 and inspected in accordance with Section 7, otherwise they may be installed in accordance with Section 5.1 and need not be inspected in accordance with Section 7. Grout need not be placed under the base plate in double-nut moment joints. In outdoor applications, electrical wires exposed between the base plate and the concrete shall be protected from damage by animals with a wire mesh or other suitable protection.

3.3 Vibrating-machinery Joints

Anchor rods in vibrating-machinery joints shall be designed in accordance with the applicable provisions of Sections 4.1 and Sections 4.3 through 4.6, installed in accordance with Section 5.3, and inspected in accordance with Section 7.

	New work item proposals –	Bob Shaw
12:50	Recommendations for Bolting Personnel Qualification	all
12:55		
ISO/DIS 19998:2024(E) ISO TC 167/WG 4 Structural bolting coordination – Tasks and responsibilities		

	New work item proposals –	Bob Shaw
12:50	Recommendations for Bolting Personnel Qualification	all
12:55		
1 Scope		
2 Normative references		
3 Terms and definitions		
4 Tasks and responsibilities		
5 Job description		
5.1 General		
5.2 Tasks		
5.3 Responsibilities and extent of authorization		
6 Technical knowledge and competence		
6.1 General		
6.2 Competency levels for bolting coordination personnel		
6.2.1 Comprehensive level		
6.2.2 Specific level		
6.2.3 Basic level		

	New work item proposals –	Bob Shaw
12:50	Recommendations for Bolting Personnel Qualification	all
12:55		
Annex A (normative) Essential bolting and related tasks to be considered when appropriate		
A.1	Review of requirements	A.12 Inspection before bolting
A.2	Technical review	A.13 Inspection during bolting
A.3	Sub-contracting	A.14 Inspection and testing after bolting
A.4	Bolting Personnel	A.15 Non-conformance and corrective actions
A.5	Bolting and associated equipment	A.16 Calibration and validation of measuring, inspection, and testing equipment
A.6	Production planning	A.17 Identification and traceability
A.7	Qualification of bolting procedures	A.18 Quality records
A.8	Bolting procedure specifications (BPSs)	A.19 Health, safety, and environment
A.9	Work instructions	
A.10	Bolting components and assemblies	
A.11	Connections	

	New work item proposals –	Bob Shaw
12:55	Additional Proposals for Future Consideration	all
1:00		

☐ Galvanized A490 / Group 150 Bolts

1:00	A2/A4 Report – Research Projects a) Current research projects b) New research project proposals c) New research project needs	Todd Ude
1:20		

1:20	A2/A4 Report – Education Projects a) Current education projects b) New education project proposals c) Education needs and resources	Todd Ude
1:30		

1:30	A5 - Organizational Liaison Reports	Bob Shaw (for Salim Brahimi)
1:30	AISC – American Institute of Steel Construction	Chris Raebel
1:33	IFI – Industrial Fastener Institute	Salim Brahimi
1:35	AGA – American Galvanizers Association	Alana Fossa
1:37	MBMA – Metal Building Manufacturers Association	Vincent Sagan
1:39	ASTM – ASTM International (F16 and A01.02)	Toby Anderson
1:42	ISO – International Organization for Standardization ISO/TC 2 – Fasteners ISO/TC 167 – Steel and Aluminium Structures	Salim Brahimi Bob Shaw
1:45		

ISO/DIS 18963

Steel structures — Structural bolting — Test method to determine loss of pretension from faying surface coatings

This document has been prepared to provide provisions and guidance in the determination of the loss of pretension of bolts in the presence of coatings on the faying surface of a joint. For pretensioned bolted joints, the potential loss of pretension should be checked when the coatings applied to any of the individual coated faying surfaces are thick or consist of a creep-prone material. In this context, coatings exclude adherent mill scale, and include liquid applied coatings as well as coatings that are the result of a galvanizing or metallizing process. Loss of pretension due to other material, such as insulation, in the grip of a bolt is not considered in this document. This document provides provisions and guidance on the measurement of pretension loss, considering that the suitability of the protective coatings or coating systems for use in pretensioned bolted joints depends on the extent of the possible system reserves due to the tightening procedure, the target of pretensioning, and the losses over the service life of a structure. The test methods in this document can be also applied to uncoated faying surfaces.

ISO/DIS 18954

Steel structures — Structural bolting — Test method to determine parameters of bolt tightening procedures

This document has been prepared to provide provisions and guidance in the testing of bolting assemblies for pretensioning for which no tightening parameters exist, e.g. stainless steel bolting assemblies. This document gives provisions and guidance on how to determine secure tightening parameters.

ISO/DIS 18900

Steel structures — Structural bolting — Test method for determining the slip factor for faying surfaces of slip-resistant connections

This document has been prepared to provide provisions and guidance in the testing of slip-resistant connections made of steel for providing slip factors to be used in structural steelwork.

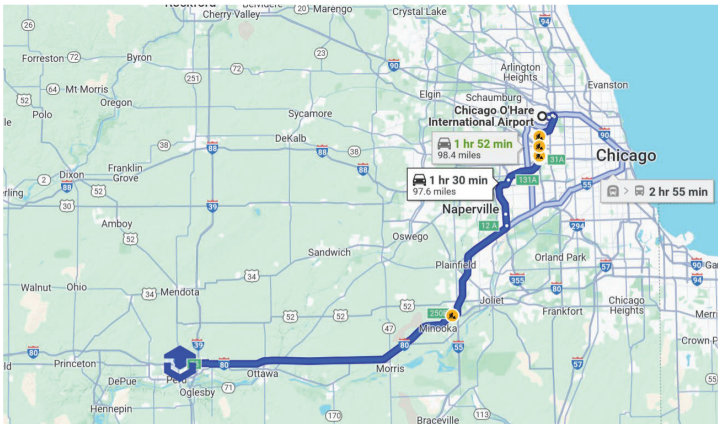
- This document specifies a procedure to determine the slip factor of faying surfaces in slip-resistant connections to be used in structural steelwork.
- The method is mainly applicable to uncoated and coated components made of steel with different surface treatments.
- This document applies mainly to ferritic steels but can be used for other types of steels as appropriate.

1:45	A3 Report – Membership and Funding	Jason Chadee
1:47	B Report - Editorial	Tom Schlafly
1:50		

1:50 pm	RCSC Annual Meeting 2026	Bob Shaw / Dan Wroblewski
1:55 pm		



Location



Community



Peru-Pop 9,896



LaSalle-Pop 9,344



Spring Valley-Pop 5,362



Oglesby-Pop 3,599



Utica-Pop 1,833

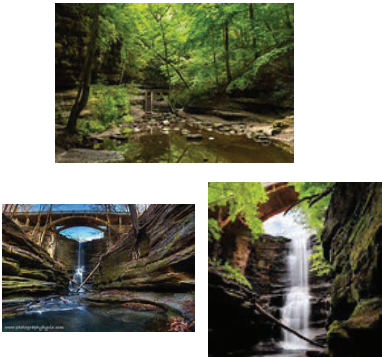


State Parks

Starved Rock



Matthiessen



Buffalo Rock



Potential meeting locations



Potential meeting locations-Starved Rock Lodge





Meeting Space

6 Meeting Rooms available June 1-5, 2026:

- Starved Rock Room (33 x 68) 70-200 occupants \$300/day
- LaSalle Room (19 x 36) 25-60 occupants \$225/day
- Utica Room (19 x 35) 28-60 occupants \$225/day
- Hennepin Room (26 x 22) 12-16 occupants \$100/day
- Peru Room (13 x 29) 14 occupants \$100/day
- Canyonside Cabin (24 x 16) 12-25 occupants \$200/day
- WiFi/AV equipment available



Lodging

- Can accommodate 50 people June 1-5, 2026
- Room rates range from \$180-\$200
- No group rate available

Food/Catering

- Meeting refreshments/snacks
- Breakfast, lunch, and dinner available
- Buffet available



Local Transportation

- 3 trolleys busses available for up to 30 people each
- \$600/hour each
- Will service within 50 mile radius
- Trolley group tours available





Meeting Space

7 Meeting Rooms available June 1-5, 2026:

- Grand Ballroom: (6000 ft²) can be broken up into 3 equal rooms 100 occupants max \$900/day
 - Joliet Room: \$300/day
 - Marquette Room: \$300/day
 - LaSalle Room: \$300/day
- Mezzanine Space: 100 occupants max \$300/day
- Cascade Falls 30-35 occupants \$250/day
- Canyon Cliff: 24 occupants max \$150/day
- Sandstone Bluff: 10-15 occupants \$150/day
- Wifi/AV equipment available



Lodging

- 50 rooms available June 1-5, 2026
- Room rates range from \$145/night

Food/Catering

- Meeting refreshments/snacks
- Breakfast, lunch, and dinner available
- Buffet available
- Alcohol and beverages available

Local Transportation

- No transportation available

May 2026

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	AISC/ASCE Student Steel Bridge Competition
24	25 Memorial Day	26	27	28	29	30
31						

May 25 Memorial Day

June 2026

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

1:55 pm Concluding Remarks

Bob Shaw

2:00 pm Adjourn

Members



Thank you for all you do for RCSC !!!

RCSC Specifications Schedule for Standards Development		
rev. 6/2/2025		RCSC Specification 2031
2026	Jan	
	Feb	
	March	
	April	
	May	
	June	Annual Meeting TGs develop Ballot items
	July	
	August	
	Sept	
	Oct	
	Nov	
	Dec	
2027	Jan	
	Feb	
	March	
	April	
	May	
	June	Annual Meeting TGs develop Ballot items
	July	
	August	
	Sept	
	Oct	
	Nov	
	Dec	
2028	Jan	
	Feb	
	March	
	April	
	May	
	June	Annual Meeting TGs develop Ballot items
	July	
	August	
	Sept	
	Oct	
	Nov	
	Dec	
2029	Jan	
	Feb	Draft of Ballot 1 items due to Chair
	March	Ballot 1 voting (entire Specification is open for comments)
	April	
	May	
	June	Annual Meeting Review ballot 1 results
	July	
	August	
	Sept	
	Oct	
	Nov	
	Dec	
2030	Jan	
	Feb	Draft of Ballot 2 items due to Chair
	March	Ballot 2 voting (only changed items are open for voting) and 1st Draft Public Review
	April	
	May	
	June	Annual Meeting Review ballot 2 results
	July	
	August	
	Sept	
	Oct	
	Nov	
	Dec	
2031	Jan	
	Feb	Draft of Ballot 3 items due to Chair
	March	Ballot 3 voting (only negative resolutions are open for voting) and 2nd Draft Public Review
	April	
	May	
	June	Annual Meeting Review ballot 3 results - resolve all negatives
	July	Final Draft to Editorial
	August	
	Sept	
	Oct	
	Nov	
	Dec	Publication RCSC 2031 Specification



STAINLESS STEEL BOLTING

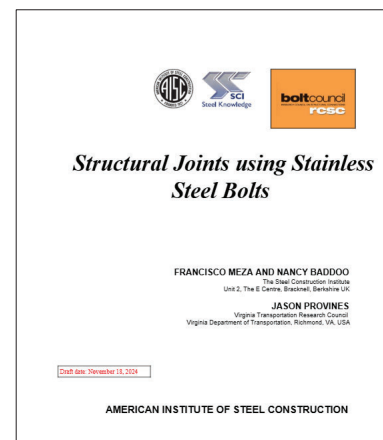
RCSC Annual Meeting

Jason Provines, Francisco Meza, and
Nancy Baddoo

June 5, 2025

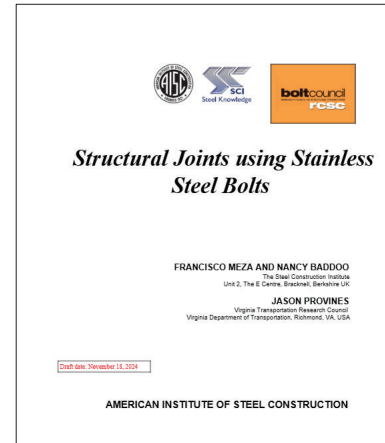
Stainless Steel Bolting Design Guide

- AISC/RCSC jointly funded project
- SCI is lead contractor
 - Francisco Meza and Nancy Baddoo
- VTRC (VDOT) is subcontractor
 - Jason Provines



Stainless Steel Bolting Design Guide

- Objectives:
 - Develop a stainless steel bolting design guide, covering same main topics as the RCSC Spec
 - Cover commonly available austenitic, duplex, and PH alloys
 - Include dissimilar metal connections



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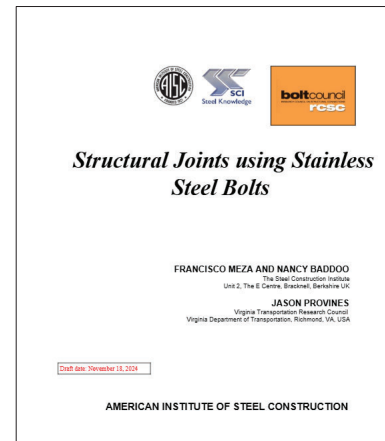
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3

Stainless Steel Bolting Design Guide

- Based on:
 - Existing AISC 370 and AISC DG 27 2nd Ed
 - Discussions with bolt manufacturers, bolting engineers, designers, researchers, metallurgists, etc.



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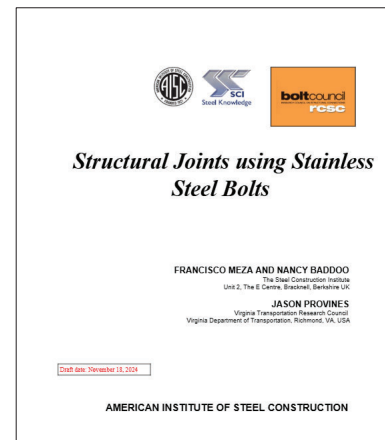


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Stainless Steel Bolting Design Guide

- Timeline

Date	Task
October 30, 2023	Commencement of Work
December 4, 2023	Proposed Outline to AISC
January 17, 2023	Outline Review Comments to Consultant from AISC
March 4, 2023	Final Outline to AISC
July 1, 2024	65% Review Draft to AISC
August 2, 2024	65% Review Draft Comments to Consultant from AISC
November 18, 2024	Final Review Draft to AISC
February 19, 2025	Final Review Draft Comments to Consultant from AISC
May 19, 2025	Final Deliverables to AISC
July 19, 2025	



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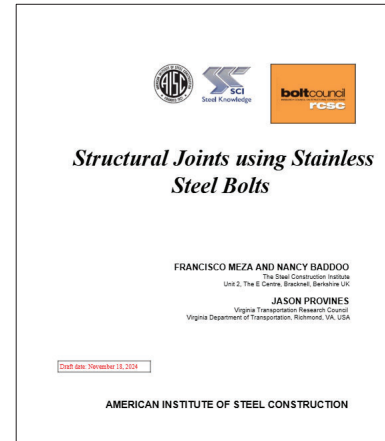
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Stainless Steel Bolting Design Guide

- Currently finishing comment resolution
 - Received 291 comments on 100% draft from AISC/RCSC
- Plan to provide responses to all comments



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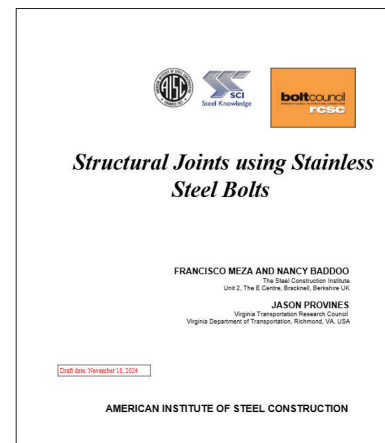
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6

Stainless Steel Bolting Design Guide

- Notable differences to RCSC Spec:
 - “Should” instead of “shall”
 - Intro to stainless steel
 - No single ASTM for all stainless bolts
 - Many different alloys & strengths
 - High-strength & non-high strength bolts
 - Structural & non-structural bolting assemblies
 - No ASTM for stainless washers
 - Galling & lubrication



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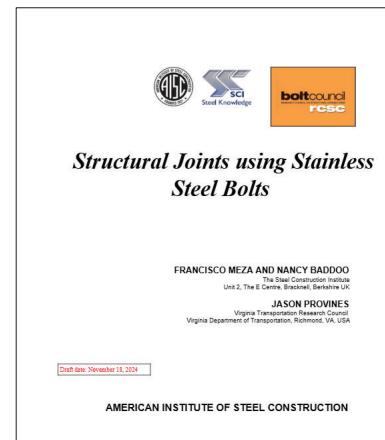
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7

Stainless Steel Bolting Design Guide

- Notable differences to RCSC Spec (cont.):
 - Corrosion and alloy selection guidance
 - Faying surfaces for slip-critical
 - Grit blasted only
 - Different slip coefficients
 - Dissimilar metal connections
 - Design equations
 - No tabulated pretension parameters
 - Rotational capacity testing requirements



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8

Things to consider when developing an *RCSC Specification for Structural Joints Using Stainless Steel Bolts*

High Strength vs. Non-High Strength Bolts

Family	ASTM	Alloy	Condition ^a	Diameter (in.)	$F_{u,b}$ (ksi)	$F_{y,b}$ (ksi)
ASTM F593		Alloy Group 1 ^a or Group 2 ^b	SH1	1/4 to 5/8, incl	95	120
			SH2	3/4 to 1, incl	75	110
			SH3	1 1/8 to 1 1/2, incl	60	100
			SH4	1 3/8 to 1 1/2, incl	45	95
Austenitic	ASTMs A193/A193M and A320/A320M	B8 (S30400) ^c	Class 2	3/4 to 1, incl	80	115
				over 1 to 1 1/4, incl	65	105
				over 1 1/4 to 1 1/2, incl	50	100
				3/4 and under	95	110
		B8M (S31600) ^c	Class 2	3/4 to 1, incl	80	100
				over 1 to 1 1/4, incl	65	95
				over 1 1/4 to 1 1/2, incl	50	90
				3/4 and under	95	110
Duplex	ASTM A1082/A1082M	2205 (S32205) ^c	-	all diameters	65	95
Precipitation Hardening	ASTM A1082/A1082M	Type 630 (S17400) ^c	H1150	all diameters	105	135
	ASTM F593	Group 7 (S17400) ^c	AH	1/4 - to 1 1/2, incl	105	135

^a Alloy Group 1 includes alloys 303, 304, 304L, 305, 384, XM1, 18-9LW, 302HQ, 304J3, and 303SE. The specific alloy must be specified on the purchase order.
^b Alloy Group 2 includes alloys 316 and 316L. The specific alloy must be specified on the purchase order.
^c The alloy designation used in the ASTM standard is given first, followed by the UNS designation in parentheses.
^d Condition:
 SH: machined from strain-hardened stock or cold-worked to develop the specific properties.
 AH: age hardened
 Class 2: solution treated and strain hardened. Austenitic stainless steels in the strain-hardened condition may not show uniform properties throughout the section particularly in sizes over 3/4 in. in diameter.
^e Some ASTM standards provide minimum and maximum $F_{u,b}$ values. Only minimum values are shown here.
 $F_{u,b}$ = specified minimum tensile strength of the bolt, $F_{y,b}$ = specified minimum yield strength of the bolt

Family	ASTM	Alloy	Condition ^a	Diameter (in.)	$F_{u,b}$ (ksi)	$F_{y,b}$ (ksi)
Austenitic	ASTM F593	Alloy Group 1 ^a or Group 2 ^b	CW1	1/4 to 5/8, incl	65	100
			CW2	3/4 to 1 1/2, incl	45	85
	ASTMs A193/A193M and A320/A320M	B8 ^c (S30400)	Class 1	all diameters	30	75
		B8M ^c (S31600)	Class 1	all diameters	30	75

^a Alloy Group 1 includes alloys 303, 304, 304L, 305, 384, XM1, 18-9LW, 302HQ, 304J3, and 303SE. The specific alloy must be specified on the purchase order.
^b Alloy Group 2 includes alloys 316 and 316L. The specific alloy must be specified on the purchase order.
^c The alloy designation used in the ASTM standard is given first, followed by the UNS designation in parentheses.
^d Condition:
 CW: headed and rolled from annealed stock thus acquiring a degree of cold work. Sizes 3/4 in. and larger may be hot-worked and solution annealed.
 Class 1: solution treated.
^e Some ASTM standards provide minimum and maximum $F_{u,b}$ values. Only minimum values are shown here.
 $F_{u,b}$ = specified minimum tensile strength of the bolt, $F_{y,b}$ = specified minimum yield strength of the bolt

High-Strength vs. Non-High Strength Stainless Bolts (cont.)

- Recommendation:
 - Decide which “high-strength” stainless bolts to include
 - Consider ISO bolts
 - Move non-high strength bolts to appendix or separate document
- Benefits:
 - Eliminates terminology for high-strength vs. non-high strength bolts & structural vs. non-structural bolting assemblies
 - Simplifies many tables

Tabulated Installation Parameters

- The existing dataset is limited on torqued tension testing of stainless steel bolts (Stranghoner & Provines)
- Adds complications throughout
 - PIV: “Round nut rotation up to nearest multiple of 60°. Max rounded nut rotation from 3 tests is required rotation in the work.”
 - Installation: relies on PIV results
 - Rocap: “Tighten to tension value and record nut rotation up to nearest multiple of 30°. Tighten to twice that rotation and check tension.”



Tabulated Installation Parameters (cont.)

- Recommendation:
 - Support research to conduct torqued tension testing on high-strength stainless steel bolts to develop tabulated installation parameters for turn-of-nut and combined methods
- Benefits:
 - Simplifies PIV, installation, rocap requirements
 - Can replace equations with tables for easier use



Stainless Washer ASTM

- No ASTM for stainless washers
- Currently specify stainless washers based on:
 - Alloy designation to match bolt alloy designation
 - Hardness of 2 HRC greater than bolt's specified maximum hardness
 - Dimensional requirement to ASTM F436
- Adds complication to specifying stainless washers



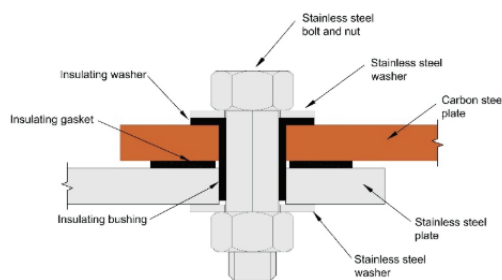
Stainless Washer ASTM (cont.)

- Recommendation:
 - Work with ASTM on development of stainless washer specification (currently underway)
 - Advocate for washer hardness limits
- Benefits:
 - Simplifies washer specification throughout

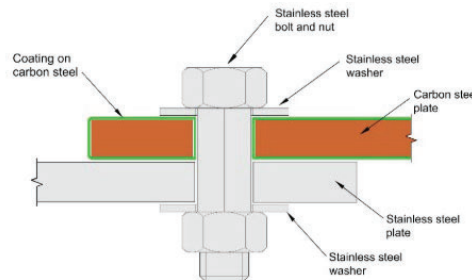
Dissimilar Metal Bolted Connections

- Two options based on experience, engineering judgement, and expert opinion

Insulating Gaskets



Coating



Dissimilar Metal Bolted Connections (cont.)

- Recommendation:
 - Support research on both corrosion and structural performance of isolation systems
 - Consider isolation materials (G10/G11 glass epoxy, Teflon, neoprene, etc.) and coatings
 - Consider insulating washers in slip-critical connections and slip-coefficient of coated faying surfaces in contact with stainless
- Benefits:
 - Obtain test data to validate different isolation systems

Faying Surfaces

- Limited research conducted only on grit-blasted faying surfaces, with roughness measured according to Method C of ASTM D4417 (Stranghoner)

Table 6-2. Slip Coefficients, μ , for Grit Blasted Faying Surfaces

Class ^a	Slip coefficient, μ ^b
SSB	0.20
SSC	0.40
SSD	0.50

^a Surface classes meeting the requirements in Table 6-3.
^b The potential loss of preloading force due to time dependent relaxation from its initial value is considered in these slip coefficient values.

Table 6-3. Definition of surface classes for Slip-Critical Grit Blasted faying surfaces

Surface Class	R_t ^(b)
	μ in.
SSB	≥ 2000
SSC	≥ 2400
SSD	≥ 2800

^(b) R_t is the surface roughness according to Method C of ASTM D4417 (ASTM, 2021b).

Faying Surfaces (cont.)

- Recommendation:
 - Support research to evaluate stainless faying surfaces
 - Blasted with stainless shot
 - Roughness evaluated using common methods (ASTM D4417 Methods B, C, and possibly D)
 - In combination with a coated faying surface
- Benefits:
 - Shot does not damage blasters
 - Make roughness evaluation methods more applicable

Galling

- Much of the guidance is based on lubrication, performance testing (PIV & rocap), and experience
- No existing guidance on:
 - How to know when it is occurring during tensioning
 - Other mitigation strategies, such as mixing alloys (e.g. 316 nut with 304 bolt)

Galling (cont.)

- Recommendation:
 - Support research- or experience-based investigation into galling
 - How to know when it is occurring?
 - Other mitigation strategies
 - Impact tools allowed?
- Benefits:
 - Gain better understanding of galling and mitigation strategies



Resistance Factor for PH Bolts

- Lack of experimental data on shear and tensile tests on PH bolts
 - Prevented a reliability analysis
 - 10% reduction in resistance factor compared to austenitic and duplex bolts

$$\phi = 0.75 \text{ (LRFD)} \quad \Omega = 2.00 \text{ (ASD)}$$

for austenitic (such as from ASTM F593 Alloy Group 1 or Group 2, ASTM A193/A193M, and ASTM A320/A320M) and duplex (such as from ASTM A1082/A1082M Alloy 2205) stainless steel bolts

$$\phi = 0.67 \text{ (LRFD)} \quad \Omega = 2.25 \text{ (ASD)}$$

for **precipitation hardening** (such as from ASTM A1082/A1082M Type 630 or ASTM F593 Group 7) stainless steel bolts



Resistance Factor for PH Bolts (cont.)

- Recommendation:
 - Support research for additional experimental testing of PH bolts in shear and tension
- Benefits:
 - Obtain test data to validate or determine resistance factors



Summary of Recommendations

- Decide which high-strength bolts to include
- Research to develop tabulated installation parameters
- Work with ASTM on stainless washer specification
- Research to evaluate isolation systems for dissimilar metal connections
- Research on faying surfaces
- Further investigation of galling
- Research on 10% reduction for PH bolts



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24

Questions?



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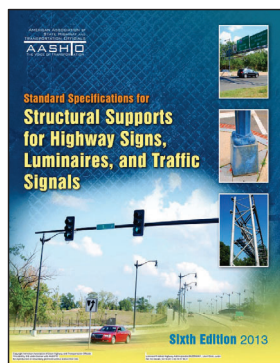


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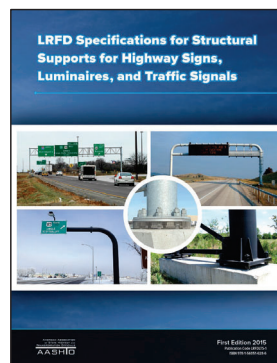
Anchor Rod Pitch

Justin Ocel, Ph.D., P.E.
May 5, 2025
RCSC Annual Meeting

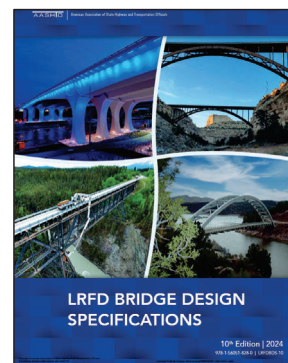
Transportation Sector Specifications



“AASHTO SLTS”



“AASHTO LRFD LTS”



“AASHTO LRFD BDS”



Source: VADOT



Source: Justin Ocel



Source: VADOT

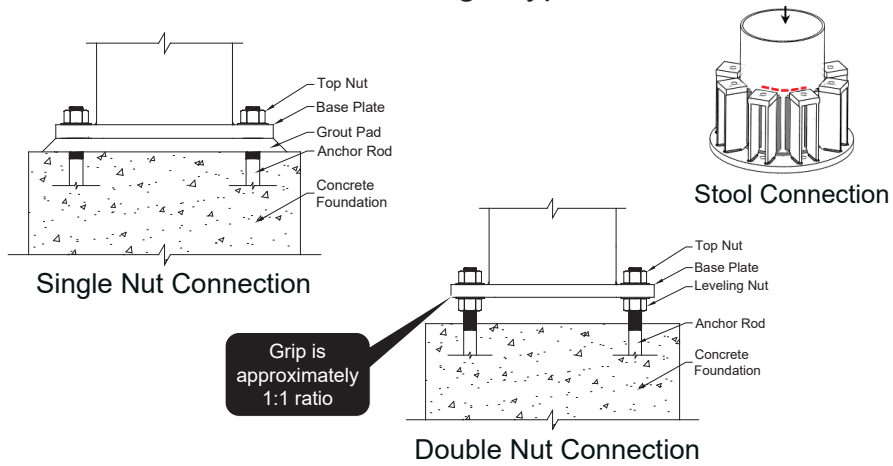


Source: WADOT



Source: WADOT

Anchorage Types



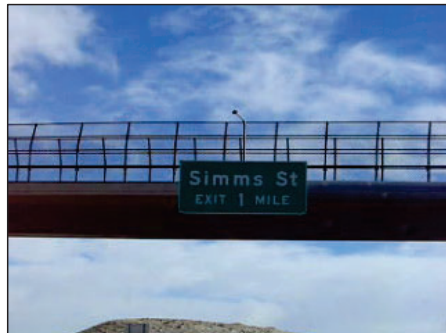
Anchor Rod Materials

Specification	AASHTO SLTS or LRFD LTS	AASHTO LRFD BDS
ASTM F1554 (Grades 36, 55, 105)	Yes	Yes
ASTM A615 (up to Grade 80)	Yes	No
ASTM A706 (up to Grade 80)	Yes	No

I have also seen state DOT's use:

- ASTM A193
- ASTM A307
- ASTM A354
- ASTM A449

History of Anchor Rod Problems



- Wind causes ancillary sign and lighting structures to vibrate.

History of Anchor Rod Problems

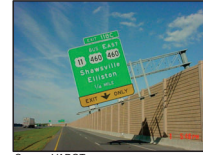
- Jan. 25, 1990. Cantilever fell onto I-75 (Exit 2 near OH border) and was hit by a pickup (only property damage).
- Feb. 16, 1990. Cantilever fell onto M-39 (Dearborn, MI) killing woman and injuring the male driver.



Source: VADOT



Source: IADOT



Source: VADOT



Source: VADOT



Source: VADOT

History of Anchor Rod Problems



Source: VADOT



Source: VADOT



Source: VADOT



Source: Robert Dexter



Source: Robert Dexter

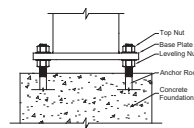
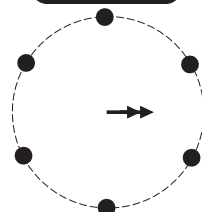
History of Anchor Rod Problems

EXAMPLE
Six - 2" (4UNC) rods
24" bolt circle

$$A = 15 \text{ in}^2$$

$$I = 962 \text{ in}^4$$

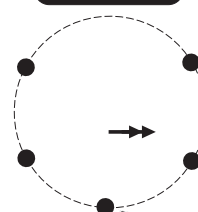
$$S_{\text{bot}} = 80.2 \text{ in}^3$$



$$A = 12.5 \text{ in}^2$$

$$I = 530 \text{ in}^4$$

$$S_{\text{bot}} = 55.2 \text{ in}^3$$



Lack of pretension
or loose nuts

45% increase
in stress

History of Tensioning Procedures

Till, R. D., and Lefke, N. A. (1994) *"The Relationship Between Torque, Tension, and Nut Rotation of Large Diameter Anchor Bolts."* Michigan Department of Transportation. Lansing, MI.

- "Snug" was a person with a 34-inch adjustable wrench.
- $\frac{1}{3}$ turn for 1 to 2½ inch 8 UN.
- $\frac{1}{3}$ turn for 1 to 1¼ UNC.
- $\frac{1}{6}$ turn for 1½ to 2½ inch UNC.
- Beeswax has a K=0.12.

James, R. W. et. al. (1997). *"Tightening Procedures for Large Diameter Anchor Bolts."* Final Report. Texas Department of Transportation. Austin, TX.

- Lubricate with beeswax.
- "Snug" was full effort a person with a 12-inch wrench.
- $\frac{1}{6}$ turn applied in two $\frac{1}{12}$ turn increments.
- Use 16 lb hammer and sluggers or 10 ft. cheater bar w/3 people

History of Tensioning Procedures

AASHTO. (2001). *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.* 4th ed. Washington, D.C.

- *"All anchor bolts shall be adequately pretensioned to prevent loosening of nuts..."*
- Commentary referred user to James et. al. (1997).

Dexter, R. J., and M. J. Ricker. (2002). *"Fatigue-Resistant Design of Cantilevered Signal, Sign, and Light Supports."* Transportation Research Board. Washington, D.C.

- Lubricate with beeswax.
- "Snug" was 20-30% verification torque.
- Verification torque = $0.12d_b A_b (CF_u)$

Rod Specification	CF_u (ksi)
ASTM F1554 Grade 36	0.50 (58 ksi)
ASTM F1554 Grade 55	0.80 (75 ksi)
ASTM F1554 Grade 105	0.60 (125 ksi)
ASTM A615 or A706 Grade 60	0.60 (80 ksi)

This was a
"combined" method

- Apply rotation beyond snug.

Rod Diameter (in.)	ASTM F1554 Grade 36	All others
$\leq 1\frac{1}{2}$	$\frac{1}{6}$ turn	$\frac{1}{3}$ turn
$> 1\frac{1}{2}$	$\frac{1}{12}$ turn	$\frac{1}{6}$ turn

History of Tensioning Procedures

AASHTO. (2013). *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.* 6th ed. Washington, D.C.

- Adopted a simplified version of Dexter and Ricker (1998) procedure, except:
 - "Snug" was changed back to full effort of a person with a 12-inch wrench.
 - Verification torque calculation used F_y , not F_u .

Hoisington, D., Hoffman, J., and Hamel, S. (2014). *"Measured Anchor Rod Tightening of Highmast Light Poles in Alaska."* Journal of the Transportation Research Board, (2431), 67–72.

Chen, A. et. al. (2018). *"Re-tightening the Large Anchor Bolts of Support Structures for Signs and Luminaires."* Minnesota Department of Transportation. St. Paul, MN.

Singh, J., and Hebdon, M. (2021). *"Tightening Procedures for Proper Installation of Anchor Rods in Ancillary Structures."* Journal of Structural Engineering, 147(10).
[https://doi.org/10.1061/\(ASCE\)ST.1943-541X.0003110](https://doi.org/10.1061/(ASCE)ST.1943-541X.0003110)

Rod Diameter (in.)	ASTM F1554 Grades 36 and 55	ASTM F1554 Grade 105	Rod Specification	CF_u (ksi)
< 1	105°	120°	ASTM F1554 Grade 36	0.50 (58 ksi)
≤ 1 and $< 1\frac{1}{2}$	75°	90°	ASTM F1554 Grade 55	0.60 (75 ksi)
$\geq 1\frac{1}{2}$	60°	90°	ASTM F1554 Grade 105	0.70 (125 ksi)

On-Going FHWA Research

Rod Diameter (in.)	ASTM F1554 Grades	Finish
2	• 36 • 55 • 105	• Hot-dip • Plain
2½	• 55 • 105	
3	• 36 • 55 • 105	
3½	• 55 • 105	
4	• 36 • 55 • 105	

- Plate thickness = Rod diameter.
- Beeswax lubrication
- Triplicate specimens
- ASTM F3394 back-ups always used



Source: FHWA.

Test Types

- Stress relaxation.
- Torque/tension/rotation curve development.
- Reaction washer installation
 - 2" and 3",
 - Grades 55 and 105

What About Bridges?



Source: Enerpac.com



Source: Caltrans



Source: FHWA.



Source: FHWA.

- ASTM A354 Grade BD rods
- 388, 3-inch dia.
 - 36, 4-inch dia.

2003 Ballot

Robert Dexter was leading a ballot in 2003 for:

"Specification for Steel-to-Concrete Joints Using ASTM F1554 Smooth Anchor Rods and ASTM A615 and A706 Deformed Bars."

1. GENERAL REQUIREMENTS

- 1.1. Scope
- 1.2. Loads, Load Factors and Load Combinations
- 1.3. Referenced Standards and Specifications
- 1.4. Contract Document Information

2. JOINT COMPONENTS

- 2.1. Manufacturer Certification of Components
- 2.2. Shipping and Storage of Components
- 2.3. Anchor Rods
 - 2.3.1. Specifications
 - 2.3.2. Thread dimensions and tolerances
- 2.4. Nuts
- 2.5. Base Plates, Anchor Rod Holes, and Anchor Rod Group Assemblies
 - 2.5.1. Base Plates
 - 2.5.2. Anchor Rod Holes
 - 2.5.3. Anchor Rod Group Assemblies
- 2.6. Washers
 - 2.6.1. Standard Washers
 - 2.6.2. Plate Washers
 - 2.6.3. Use of Washers
- 2.7. Alternative-Design Anchors

3. JOINT TYPE

- 3.1. Threaded-Shear-and-Uplift Joints
- 3.2. Double-Nut-Moment Joints
- 3.3. Vibrating-Machinery Joints

4. LIMIT STATES IN ANCHOR ROD JOINTS

- 4.1. Design Tensile Strength
- 4.2. Design Compressive Strength
- 4.3. Design Shear Strength
- 4.4. Combined Shear and Tension
- 4.5. Design Bearing Strength at Bolt Holes
- 4.6. Tensile Fatigue

5. INSTALLATION AND CONSTRUCTION INSPECTION

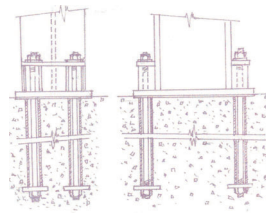
- 5.1. Threaded-Shear-and-Uplift Joints
- 5.2. Double-Nut-Moment Joints
- 5.3. Vibrating-machinery Joints

6. REPAIR OR MODIFICATION

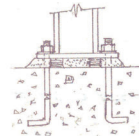
7. INSPECTION AND MAINTENANCE AFTER INSTALLATION

2003 Ballot Objections

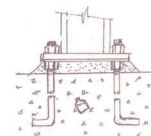
- Many comments thought the ballot was premature.
- Just LRFD format.
- Too sign structure centric.
- Didn't address seismic.



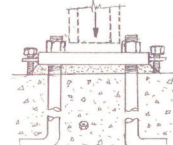
PRESTRESSED ANCHORAGE FOR LARGE STATIC TENSION OR MOMENT LOADING AND FOR CYCLIC TENSION OR MOMENT LOADING
Leveling plate with sleeves attached and with anchor rods through sleeves set to position and grade in wet concrete. Column positioned with rods protruding through base plate and refined detail, if used, to minimize rod bending due to base plate distortion.



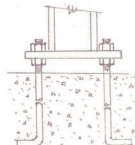
COMMON ANCHORAGE DETAIL
Anchor rods set to plan location in wet concrete. Columns set upon several stacks of steel plates positioned to specified grade. Nuts gradually tightened by hand wrenches to permit steel erection, plumbing and grouting to proceed. Maximum clear height 25 inches.



ANCHORAGE DETAIL USING LEVELING PLATE
Anchor rods set to plan location in wet concrete. Leveling plate positioned on lower rods and brought to specified grade. Columns set upon leveling plate and upper rods gradually tightened. Steel erection, plumbing and grouting proceeds. Maximum clear height 25 inches.

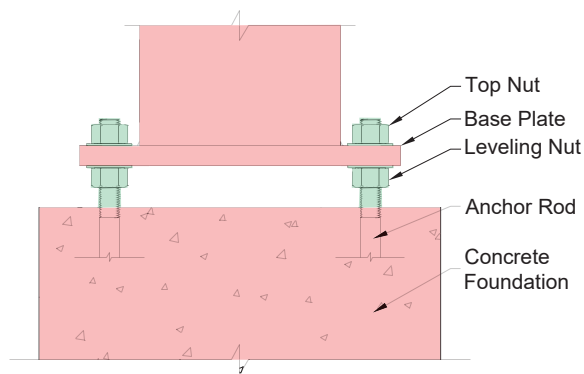


HEAVY BASE SLAB AND ANCHORAGE DETAIL
Anchor rods set to plan location in wet concrete. Base slab positioned on anchor rods and brought to specified grade using leveling sleeves in tapered holes in tabs vented to base plate. Upper rods gradually tightened. Column lowered and secured to base slab after erection.



ANCHORAGE DETAIL WITHOUT GROUTING
Anchor rods set to plan location in wet concrete. After concrete has set, column base brought to grade and secured by adjusting upper and lower rods. Maximum clear height 4 times bolt diameter.

Future Work Scope



?? Specification for Tensioning Anchor Rods ??

- Do not address:
 - Design of base plate
 - Design of concrete anchorage
- Need to address:
 - Applications requiring tensioning
 - Materials
 - Joint selection
 - Installation
 - Tensioning (Calibrated Wrench, Combined, DTI, and Direct Tensioning)

A3 Committee Report

Introduction: Jason Chadee, Chair of A3

A3 oversees membership and funding, collaborating with the secretary-treasurer and committees A2/A4 to report to the Board of Directors and members. A3 recently became active and currently has one member.

Membership Trends and Distribution

Membership Growth

Year | Membership Count

- 2024: -11% decline from 2023
- 2025 +27% increase from 2024

This increase is due to RCSC having a presence at the AISC Steel (NASCC) conference and direct membership outreach.

Membership Breakdown Chart

Membership Type	Number of Members
General Interest Members	38
User Members	21
Producers	17
Lifetime Members	7
Distributor Members	6
Association Members	4

We would like to invite younger members to join our organization, as well as individuals with expertise in stainless steel fasteners and thermal breaks, who can support the efforts of A2/A4.

Currently most of our funding comes from membership contributions