



BEFORE THE PUBLIC UTILITIES COMMISSION OF THE  
STATE OF CALIFORNIA

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Order Instituting Rulemaking to Consider  
Proposed Changes to General Order 95 to  
Modernize the Rules and Regulations Governing  
the Design and Construction of Overhead Electric  
and Communications Facilities in California.

R.24-10-005

**SOUTHERN CALIFORNIA EDISON COMPANY'S (U 338-E), PACIFIC GAS AND  
ELECTRIC COMPANY'S (U 39-E), AND SAN DIEGO GAS & ELECTRIC COMPANY'S  
(U 902-E) JOINT WORKSHOP REPORT**

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Dated: **January 17, 2025**

**SOUTHERN CALIFORNIA EDISON COMPANY’S (U 338-E), PACIFIC GAS AND  
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**I.**

**INTRODUCTION**

Pursuant to Rule 1.8(d) of the Rules of Practice and Procedure of the California Public Utilities Commission (“Commission”) and Section 4.2 and Ordering Paragraph 6 of the Order Instituting Rulemaking (the “OIR”), Southern California Edison Company (“SCE”) respectfully files this Workshop Report for the ordered workshop held January 8, 2025 (the “Workshop”) on behalf of itself, Pacific Gas and Electric Company (“PG&E”), and San Diego Gas & Electric Company (“SDG&E”) (collectively, the “IOUs”). Pursuant to Rule 1.8(d) of the Rules of Practice and Procedure, PG&E and SDG&E have authorized SCE to submit this filing on their behalf.

Prior to the Workshop, SCE, PG&E and SDG&E met with representatives of the Commission’s Safety Policy Division to determine a workshop date, and to discuss content and agenda items. It was determined that the IOUs would develop the workshop agenda and Safety Policy Division would produce and distribute the workshop announcement and also make the necessary technical arrangements for hosting a virtual (electronic) workshop. Safety Policy Division transmitted the workshop meeting

notice to parties on December 26, 2024.<sup>1</sup> This workshop meeting notice included a copy of the workshop agenda.<sup>2</sup>

The Workshop focused on five main topics related to the development of a work plan to be followed by parties to allow thorough vetting of the proposed General Order (GO) 95 rule changes (PRCs) developed by the GO 95-128 Rules Committee (Rules Committee), which were submitted by SCE on behalf of the Rules Committee in Petition 24-03-024 and also in SCE's Reply Comments.<sup>3</sup> The Workshop was well attended, and all of the agenda topics were addressed. The Workshop was recorded and will be posted on the Commission's website. A list of the Workshop attendees is included as Attachment 6 to this Workshop Report.

## II.

### **PROCEEDING BACKGROUND**

On March 18, 2024, SCE filed a Petition on behalf of the Rules Committee to amend GO 95 pursuant to Public Utilities (Pub. Util.) Code Section 1708.5. The Petition requested that the Commission consider modernizing GO 95 to update the rules and regulations governing the design and construction of overhead electric and communications facilities in California through the incorporation of Load and Resistance Factor Design (LRFD). In its Petition, SCE stated that LRFD is an engineering methodology taught in engineering schools and adopted and applied through the United States and North America. Also in its Petition, SCE proposed a package of 21 proposed rule changes designed to incorporate LRFD into GO 95. SCE also stated that the proposed rule changes aim to improve GO 95's fire-safety, improving public and worker safety, as well as electric and communications system's reliability.

On October 23, 2024, the Commission issued the OIR, which granted SCE's petition and established an initial set of proceeding events. The OIR authorized comments and reply comments to be

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<sup>1</sup> See Attachment 1.

<sup>2</sup> See Attachment 2.

<sup>3</sup> See Attachments 3 and 4.

filed on the OIR, and required the IOU-led Workshop. Several parties filed comments and reply comments on the OIR.

### III.

#### **WORKSHOP DISCUSSION**

The Workshop was called to order at approximately 9 am and after some brief introductory comments by the facilitator,<sup>4</sup> assigned Commissioner Matthew Baker was introduced. Commissioner Baker thanked and addressed the attendees and spoke to the importance and value of the rulemaking proceeding.

The facilitator asked if there were suggested amendments to the agenda and none were offered by the attendees.

The facilitator addressed the purpose and intended outcome of the workshop as well as the possibility or necessity of considering other changes to GO 95 rules in this proceeding. After a short discussion, Commissioner Baker spoke briefly, noting the Commission did not necessarily oppose a new rulemaking for GO 95 on a set of other issues and that it was important to keep the scope of this rulemaking as tightly focused as possible and indicated that he (Commissioner Baker) voted for this rulemaking knowing that the proposals have already gone through a vetting process. With this input, the facilitator suggested discussions should continue with the understanding that this rulemaking would focus on the LRFD proposals developed by the Rules Committee but might include any necessary ministerial changes to indices or tables of content in GO 95 resulting from new or revised rules adopted by the Commission.

Following, the facilitator noted that he was not aware of any additional proposed rule changes related to LRFD being developed or submitted to the Commission but left open the possibility of such proposals being submitted in comments to the Workshop report. Safety Policy Division asked whether the intended future technical workshops would include discussions on changes to the PRC's developed

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<sup>4</sup> Samuel Stonerock, an SCE employee and member of the Rules Committee, served as Workshop facilitator.

by the Rules Committee and cited a Section 4 rule that included verbiage not aligned with the LRFD methodology. The facilitator offered that during the course of presumed technical workshops to be held later this year, rules in Section 4 and other Sections would be discussed and additional changes could and likely would be made.

A short break was taken at approximately 10:10 am.

After the break, the facilitator led a review of draft workshop protocols included with the agenda, noting that these protocols had been used successfully in previous rulemaking proceedings dating back to 2001 to assist parties in developing and considering revisions to the Commission's General Orders 95, 128, 165, and 166. Attendees were invited to provide comments on the draft workshop protocols.

The final topic of discussion was future technical workshops. The facilitator led a discussion on the value of in-person meetings to work through technical matters and noted that state, national, and international standards development organizations such as IEEE, NFPA, and ASTM among others have been holding in-person meetings since late 2022 and early 2023, albeit with a virtual option to accommodate committee members or experts that were expected or needed to contribute to the outcome but were unable to attend in-person. A number of attendees spoke to this topic and agreed that in-person workshops were preferred and useful, particularly for dense or technical subject matter. Attendees also discussed how many technical workshops might be needed. The facilitator opined that based on the subject matter and number of PRCs, it was foreseeable that at least five, 2-day or 3-day workshops convened every 2-3 weeks would be needed.

Attendees also discussed the need for progress checks and review of the technical working group's work product by attorney's, regulatory leads, and managers as part of the workshop process. The facilitator described how these process checks occurred in prior Commission proceedings that included workshops addressing numerous and/or potentially controversial changes to General Order rules and invited attendees to submit comments on this and other topics related to the organization, facilitation, and reporting of results of future technical workshops.

At approximately 11:15 am, the facilitator introduced Mr. Andy Stewart who presented a PowerPoint deck describing the differences between Allowable Strength Design the current standard in

GO 95, and LRFD and the development of the proposed new minimum load factors and maximum strength factors intended for inclusion of GO 95 Rule 44 as new Table 4-1 and new Table 4-2, respectively.<sup>5</sup> Following, Mr. Stewart answered several questions posed by Safety Policy Division, and the facilitator answered questions posed by PacifiCorp and Sonic Telecom. After the presentation by Mr. Stewart, AT&T offered comments supporting the technical workshop process outlined in the Workshop Agenda and as described above.

At approximately 12:15 pm, the Workshop was adjourned.

#### **IV.**

#### **CONCLUSION**

The IOUs appreciate the opportunity to host this workshop and wish to thank Commissioner Baker and his Staff for attending. The IOUs also thank the Safety Policy Division and the Commission's IT technical support Staff for their collaboration and invaluable assistance hosting this workshop.

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<sup>5</sup> See Attachment 5.

Respectfully submitted,

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RYAN JERMAN  
KRIS VYAS

*/s/ Kris G. Vyas*

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January 17, 2025

**Attachment 1**

**Workshop Notice**

## Attachment 1: Workshop Notice

Members of the R.24-10-005 Proceeding Service List,

The IOU Led Party Workshop is scheduled for 1/8/2025. Please see the attached agenda.

The official meeting info may be found on the daily calendar, but is copied and pasted below for reference with some modifications for formatting:

**R.24-10-005 (WS) - Order Instituting Rulemaking to Consider Proposed Changes to General Order 95 to Modernize the Rules and Regulations Governing the Design and Construction of Overhead Electric and Communications Facilities in California.**

**Webex:**

<https://cpuc.webex.com/cpuc/j.php?MTID=mf10d6dcb880042137b05637565bfbd0>

**Join by Phone:** 855-282-6330 (United States Toll Free) | 415-655-0002 (United States Toll) |  
Access Code: 2491 686 7410

**Contact:** Henry Sweat | [henry.sweat@cpuc.ca.gov](mailto:henry.sweat@cpuc.ca.gov) | 415-816-0970

**Note:** A quorum of commissioners, and their advisors, may be present but no decisions will be made

Thank you,

**Henry Sweat** (he)

Senior Utilities Engineer – Safety Policy Division

Safety Management System Branch, Wildfire and Safety Performance Section

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**Attachment 2**

**Workshop Agenda**

## CPUC Rulemaking 24-10-005 – Amending General Order 95

### Agenda/Information for IOU led Workshop (virtual)

**Date:** January 8, 2025

**Time:** 9 am – 12:30 pm, lunch break, 1 – 4 pm (if needed)

### Meeting information:

### Meeting day contact(s):

Sam Stonerock (SCE), [samuel.stonerock@sce.com](mailto:samuel.stonerock@sce.com) (951) 317-6149

Asst. Facilitator – Kevin Galloway / Note takers: SCE / SDG&E / PG&E

### Agenda

- A. 9:00 am – Welcome/call to order (Sam)
  - Reminder to mute devices and use ‘raised hand’ feature
  - Safety reminder
  - Self-introductions / if-needed (First/last name and entity represented, place in ‘chat’)
- B. 9:30 am - Review/Amend agenda (if necessary) and identify note takers (Sam)
- C. 9:45 am – Review purpose/intended outcome of this meeting (All)
- D. 10:00 am – Discuss/identify add’l LRFD proposed rule changes (All)
- E. 10:30 – 10:35 am - break
- F. 11:00 am – Review/discuss draft technical workshop protocols (attached) (All)
- G. 11:30 am – Review/discuss draft calendar of events
  - future technical workshops
    - i. format
      - 1. If in-person and/or hybrid: hosts and locations - TBD
      - 2. If virtual only, facilitator(s) will host
    - ii. facilitation and note taking
    - iii. number of workshops / future dates

iv. notices on CPUC calendar

v. workshop report

1. example: workshop report for GO 95 revisions

a. R.17-10-010 - GO 95 Rulemaking WR CPUC website - [Results](#)

2. drafting team members

3. Review by parties prior to submittal

a. Daisy chain (party to party hand off)

b. 1-2 week time

H. 12:30 pm – adjourn for lunch or for the day

I. Related procedural matters (2<sup>nd</sup> or 3<sup>rd</sup> phase of OIR)

- Review Appx. F comparison using WSD method and LRFD method
- Discuss development of proposed strength and loading factors for Rule 44

J. 1:00 pm – continue discussing agenda topics if/as – needed

Notes:

## **DRAFT (based on Workshop Protocols for R.08-11-005 and R.15-05-006)**

### **R.24-10-005 Workshop Protocols for GO 95 Proposed Rule Changes**

#### **1. PURPOSE**

These workshop protocols address the means and methods for vetting Proposed Rule Changes (PRCs) approved by the Commission for inclusion in publicly noticed all-party workshops and identifying consensus and non-consensus PRCs, Recommendations, and Alternative Proposals to be submitted to the Commission in a Workshop Report.

#### **2. PARTICIPANTS**

“Participant” is defined as any representative of a party to this proceeding who participates in one or more scheduled workshop. A party may bring as many representatives to participate in a workshop as necessary. A primary contact or spokesperson for each party should be designated for purposes of notices and document distribution.

#### **3. AGENDAS**

An agenda for each workshop will be developed by the Chair or Co-Chairs (with assistance from Participants as needed) starting with the first meeting, and may be updated at the meeting as agreed upon by the Participants. The agenda will specify the date, time, location and host /contact person for the meeting and will list the matters to be addressed.

3.1 To the extent possible, work items requiring the presence of Participants with special qualifications or expertise will be scheduled on the same or consecutive days.

3.2 To the extent possible, PRCs requiring the presence of Participants with special qualifications or expertise will be scheduled for discussion on the same or consecutive days.

3.3 The Participants may agree to defer a work item or PRC if, during discussions it becomes apparent that participants with special qualifications or expertise, not then present, are needed.

3.3 A party represented by a single Participant may request that a work item or PRC of particular interest to them not be addressed on a specific date if they cannot be present. Such a request should be made to the Chair or Co-Chairs as soon as the party's scheduling constraint becomes known to them, and reasonable efforts will be made to accommodate such requests.

#### **4. DISCUSSION PRINCIPLES**

4.1 The discussions will be governed by the following general principles:

4.1.1 Describe the specific proposal. (Specific circumstances at issue in another OII or OIR pending before the Commission will not be considered.)

4.1.2 Identify and understand the Participants' respective points of view, interests and desired outcomes relative to the subject matter.

4.1.3 Obtain (to the extent feasible) information that Participants believe necessary to understand the topic and make an informed decision.

4.1.4 Address all interests insofar as possible.

4.2 During workshops or meetings, opportunities will be allowed for a brief ongoing evaluation of progress and process ("process checks").

#### **5. DECISION MAKING PROCESS**

5.1 Consensus will be sought utilizing a "levels of agreement" process:

5.1.1 "Consensus" is defined as no "Level 2" votes.

5.1.2 Levels of agreement scale:

- Level 1 - I support/can live with this recommendation or PRC.
- Level 2 - I do not support/cannot live with this recommendation or PRC.
- Level 3 - I abstain/am neutral.

5.1.3 Each party will state a single Level of agreement, regardless of how many Participants it has brought to the workshop or meeting.

5.1.4 A "straw vote" to ascertain the level of support for, or opposition to a recommendation or PRC may be called for at any time and should be held prior to a final vote.

5.1.5 Tentative working agreements may be reached on parts of a recommendation or complex PRCs.

5.1.6 If no party gives a recommendation or PRC a “Level 2” vote, the item is agreed upon. Otherwise, the item may be:

5.1.6.1 Submitted to a smaller working group to refine outside of the workshop process and then brought back for later consideration; or

5.1.6.2 Assigned as an Alternative Recommendation (AR) or Alternative Proposal (AP) in which one or more parties, individually or in small working groups, return to a later workshop meeting with an alternative to an existing recommendation or PRC;

5.1.7 If an AR or AP does not lead to agreement, the proponent(s) may submit their AR or AP for a vote by Participants. Each AR or AP, together with the voting results and any statements of rationale Participants wish to provide, will be included in the Workshop Report.

5.1.7.1 An AR or AP not voted on by Participants or withdrawn by its proponent(s) will not be included in the Workshop Report.

5.2 Parties are responsible for having an informed Participant at each meeting who has authority to discuss the topics to be addressed, and who will seek management input prior to a final confirmation vote in order to expedite workshop efforts.

5.3 Any party that, without prior notice to the other parties, is absent from a meeting, is deemed to have abstained from the determination of Levels of agreement, and waived the opportunity to challenge or propose an alternative.

5.3.1 This protocol may be waived by agreement of the parties at a subsequent meeting in the event a party’s absence was due to circumstances beyond its control.

5.4 Agreed-upon items will be placed on a confirmation agenda, to be addressed at a subsequent meeting, in order to allow parties time to seek final approval by their respective management, if/when such approval has been stated by parties to be necessary.

5.4.1 Except for the final scheduled workshop(s), any party may remove an item from the confirmation agenda for further consideration, based on their management's direction.

5.5 Each Participant is responsible keeping their own organization or constituency group(s) informed of the progress of the workshops and to timely seek advice, comments and authorization as required.

#### 5.6 Participation by Proxy

Parties represented by a single Participant may designate another Participant to serve as their proxy for purposes of expressing Levels of agreement, if they are unable to attend a workshop.

To utilize a proxy, the party must satisfy the following:

5.6.1 The party shall notify the Chair or Co-Chairs and other parties by email at least one (1) business day prior to the meeting at which they expect to be absent; and

5.6.2 The party shall provide clear directions to the proxy holder regarding any limitations on the proxy's authority, in the event a work item is modified in the course of discussion; and

5.6.3 The proxy holder must inform the Facilitator (if different from the Chair or Co-Chairs) and Participants of their role at the beginning of the meeting.

## **6. COMMUNICATIONS**

6.1 Participants are allowed to meet or conference among themselves between noticed/scheduled workshops.

6.2 Audio and video recording devices are not to be used in meetings for any purpose. Participants are encouraged to explore ideas freely and the only official agreements are those explicitly reached via the voting process.

6.3 A Chair or Co-Chair shall be designated to keep the assigned ALJ informed of the dates, times, location and host contacts for upcoming workshops, in time for that information to be posted on the Commission's website and to be periodically issued in rulings as the ALJ deems appropriate.

## **7. INFORMATION MANAGEMENT**

7.1 A summary will be prepared following each workshop, noting:

7.1.1 Participants;

7.1.2 Key points of discussion;

7.1.3 Consensus, if reached, with supporting rationale and vote tallies (if taken);  
and

7.1.4 ARs or APs (if any).

7.2 The meeting summary will be prepared by the Chair, Co-Chair, or designated Participant(s). Meeting summaries will be available as soon as practicable and will be emailed to all Participants. The meeting summary will be reviewed by the Participants. Necessary corrections will be addressed at the next workshop.

7.3 Information will be posted to the SED website, if necessary.

7.3.1 Participants, and the parties they represent, reserve all rights to preserve the confidentiality of information in their possession, and participation in the workshop shall not be implied or understood to constitute a waiver of such rights.

## **8. ROLES**

8.1 Chairs and/or Co-Chairs are expected to:

8.1.1 Work on behalf of the Participants.

8.1.2 Encourage and facilitate participation.

8.1.3 Remind Participants of the protocols, as necessary.

8.1.4 Suggest strategies to move discussions along, as appropriate.

8.1.5 Perform other supportive activities as agreed upon by the Participants or as directed by the ALJ.

8.2 Participants are to:

8.2.1 Listen carefully, ask pertinent questions and educate themselves and others regarding the issues and interests that must be addressed, in a collaborative rather than confrontational manner.

8.2.2 Fully and thoughtfully explore the issues before forming conclusions.

8.2.3 Search for creative solutions that best serve the issues and interests that must be addressed.

## **9. REPORTING**

The final product will be a written Workshop Report that documents consensus recommendations and ARs; or consensus PRCs and APs. The Workshop Report will be filed with the Commission or otherwise made a part of the official record as directed by the assigned ALJ.

9.1 If specific instructions regarding the outline and content of the Workshop Report are not included in a Scoping Memo or Decision, previously submitted workshop reports may be used as guides.

9.2 It is recommended that the Participants select a Chair, Co-Chair(s), and a small number of Participants to serve as the Workshop Report committee.

## **10. ACCESS AND ACCOMMODATIONS**

Workshops shall be noticed on the Commission's Daily Calendar and scheduled in locations that comply with the Americans with Disabilities Act.

**Reviewed/Approved:**

**Attachment 3**

**LRFD Proposed Rule Changes for GO 95 submitted in P.24-03-014**

# **APPENDIX - A**

## **Proposed Revisions to General Order 95 to Incorporate Load and Resistance Factor Design Methodology**

## **Introduction**

The proposed rule changes (PRCs) in this document were initially developed by the GO 95/128 Rules Committee and certain PRCs were revised during meet and confer sessions with the CPUC's Safety Enforcement Division/Electric Safety Reliability Branch engineers.

## **Purpose**

The purpose of these PRCs is to modernize General Order 95 and align this vital General Order with an engineering methodology, Load and Resistance Factor Design, already adopted and applied throughout most of the United States and North America.

## **Rationale**

The following PRCs, if adopted, would make some significant changes to Section IV while also seeking to incorporate most of the current requirements of GO 95, albeit with the modifications necessary for incorporating a load and resistance factor design (LRFD) method. These changes include migrating from the "Working Stress Design (WSD) method now in Section IV to an LRFD method that is consistent with the current structural design methodology embedded in the National Electrical Safety Code. Although these PRCs reflect the LRFD methodology incorporated in the NESC, this work product is not an attempt to transplant the NESC's strength and loading rules into GO 95. The initial goal is to provide a framework of rules in GO 95 that improves control of structural reliability and at some point in the future supports a transition to Reliability-Based Design (RBD). It is also important to note that as a starting point, the load and strength (aka resistance) factors in new Table 4-2 of Rule 44 (associated with Light Loading and Heavy Loading criteria) were selected to yield the same results as applying the current 'safety factors' via a WSD method in Rule 44.

In the Rule's Committee's view, there are several shortcomings to applying the existing safety factors requirements. Presently, the result of WSD is inconsistent reliability for different materials and components. This shortcoming has not been fully addressed in these proposals due to the initial challenges of replacing a long held, albeit outdated WSD methodology with a more modern and industry tested methodology (LRFD). Such challenges include but are not limited to – ensuring technical accuracy and completeness, agreeing on the correct verbiage and terms of art to replace the term 'safety factor', validating the strength criteria and sources referenced for information on materials, correcting existing verbiage conflicts or errors, while remaining mindful of editorial and ministerial changes. For example, Appendix F may need to be revised to include examples of how to apply the LRFD methodology. These examples would illustrate that the LRFD format yields essentially the same results as previously allowed by applying the WSD methodology.

A transition to an LRFD methodology would modernize GO 95. The WSD methodology (currently in GO 95) is basic, simple, and attempts to ensure that overhead line designs will provide adequate safety and reliability at reasonable costs through the selection of components so that the effects of the loads (e.g., bending stresses) to which the selected line elements (poles, crossarms, insulators, hardware, etc...) are subjected to will not exceed designated

material/component/structure strength characteristics when divided by a prescribed factor of safety. While simple to use, this methodology has several limitations including (but not limited to): 1) WSD does not directly or adequately account for variability in loads and strengths, which is evidenced by the current debate and misunderstanding regarding the safety and reliability provided by application of the minimum requirements set forth in Section IV of GO 95, and 2) the safety factors used in WSD are subjective and can be misleading as is evidenced by the disparity in structural reliability provided by wood and steel structures designed using the safety factors currently in Table 4 of Section IV.

Like WSD, LRFD is intended to ensure that selected materials and line elements will provide adequate safety and reliability at reasonable costs. However, LRFD accomplishes this in a different way than WSD. Rather than dividing material/component/structure strength by a safety factor, LRFD uses an approach in which load effects and strengths are segregated such that they can be treated separately. The desired level of safety and reliability is established by: 1) multiplying the loads by load factors (load factors are typically greater than 1.0) determined with consideration given to the characteristics of the load (e.g., the statistical variability of the loads as well as the quality and quantity of available loading data), and 2) multiplying the material/component/structure strengths by resistance factors (aka strength factors) (resistance/strength factors are typically less than 1.0) that are established based on consideration of the characteristics of the materials, components, and structures (e.g., the statistical variability of the strength properties as well as the quality and quantity of data available on the properties).

In day-to-day practice the application of LRFD requires little to no more effort than applying the WSD method. However, it is the underlying framework and principles upon which LRFD relies that provide a clear and traceable approach to account for variability, to base criteria selection on reliability theory, and to guide the designs of different grades of construction to rational and consistent reliability levels. LRFD also promotes awareness of the inescapable fact that there is a finite, but mostly controllable, probability of failure for every engineered facility and fosters an understanding that a structural failure, that is not attributable to errors in the design process, should be viewed as occasionally-expected events albeit with controllably low probabilities of occurrence rather than as events that can only be attributed to the consequences of poor designs, construction errors, or completely unexpected/unanticipated loadings.

Further, LRFD is information centric and provides a framework for adopting new and/or improved information on loads, load effects, strengths and structural behavior, and identifying the limitations and deficiencies of current data. LRFD also fosters a more complete understanding of material properties, actual loads, and the ways structures respond to loads, which should ultimately help California's electric and communication companies produce improved designs that are safe and secondarily, cost effective.

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## PRC 1 Rule 44 – Safety Factors

### Original

#### **44 Safety Factors**

The safety factors specified in these rules are the minimum allowable ratios of material and/or line element strengths to the effect of design loads as specified in Rule 43.

Note: Revised March 30, 1968 by Decision No. 73813, February 13, 1974 by Decision No. 82466 and February 5, 2014 by Decision No. 14-02-015.

### Strikeout/underline

#### **44 Safety Factors**

~~The safety factors specified in these rules are the minimum allowable ratios of material and/or line element strengths to the effect of design loads as specified in Rule 43.~~

The ratios of the load factors in Table 4-1 to the strength factors in Table 4-2 are analogous to factors of safety (i.e., safety factors). These factors are applied to account for variabilities (e.g., deterioration, material properties, environmental loads, additional attachments, construction details and workmanship).

The effects of the loads in Rule 43, multiplied by the load factors in Table 4-1, shall be less than or equal to the strengths of materials and/or line elements multiplied by the applicable strength factors in Table 4-2.

Note 1: Deformation, deflection, or displacement of the structure or parts of the structure may change the effects of the assumed loads. When calculating stresses and loads that account for deformation, deflection, or displacement of supporting structures and other line elements, calculations should be made using Rule 43 loads prior to application of the load factors.

Note 2: See Table "x" in Appendix F for a summary of comparable factors of safety for various line components.

Note: Revised March 30, 1968 by Decision No. 73813, February 13, 1974 by Decision No. 82466 and February 5, 2014 by Decision No. 14-02-015.

***Proposed Final***

**44 Safety Factors**

The ratios of the load factors in Table 4-1 to the strength factors in Table 4-2 are analogous to factors of safety (i.e., safety factors). These factors are applied to account for variabilities (e.g., deterioration, material properties, environmental loads, additional attachments, construction details and workmanship).

The effects of the loads in Rule 43, multiplied by the load factors in Table 4-1, shall be less than or equal to the strengths of materials and/or line elements multiplied by the applicable strength factors in Table 4-2.

Note 1: Deformation, deflection, or displacement of the structure or parts of the structure may change the effects of the assumed loads. When calculating stresses and loads that account for deformation, deflection, or displacement of supporting structures and other line elements, calculations should be made using Rule 43 loads prior to application of the load factors.

Note 2: See Table "x" in Appendix F for a summary of comparable factors of safety for various line components.

Note: Revised March 30, 1968 by Decision No. 73813, February 13, 1974 by Decision No. 82466 and February 5, 2014 by Decision No. 14-02-015.

## PRC 2      Rule 44.1 – Installation and Reconstruction

### ***Original***

#### **44.1 Installation and Reconstruction**

Lines and elements of lines, upon installation or reconstruction, shall provide as a minimum the safety factors specified in Table 4. The design shall consider all supply and communication facilities planned to occupy the structure. For purposes of this rule, the term “planned” applies to the facilities intended to occupy the structure that are actually known to the constructing company at the time of design.

The entity responsible for performing the loading calculation(s) for an installation or reconstruction shall maintain records of these calculations for the service life of the pole or other structure for which a loading calculation was made and shall provide such information to authorized joint use occupants and the Commission upon request.

Note: Revised January 12, 2012 by Decision No. 1201032 and February 5, 2014 by Decision No. 14-02-015.

Table 4: Minimum Safety Factors

Line Element	Grades of Construction		
	Grade "A"	Grade "B"	Grade "C"
Conductors, splices and conductor fastenings (other than tie wires)	2	2	2
Pins	2	2	2
Pole line hardware	2	2	2
Line Insulators (mechanical)	3	2	2
Guy insulators (mechanical)			
Interlocking	2	2	2
Noninterlocking glass fiber	3	2 (a)	2 (b)
Guys	2	2	2
Messengers and span wires	2	2	2
Foundations against uplift	1.5	1.5	1.5
Foundations against depression	3	2	2
Poles Towers and Structures			
Wood	4	3	2
Metal (including elements of foundations)	1.5 (c)	1.25 (c)	1.25 (c)
Reinforced concrete	4	3	3
Prestressed or post-tensioned concrete	1.8	1.5	1.5
Other engineered materials	1.5	1.25	1.25
Crossarms			
Wood	2	2	2
Metal	1.5(c)	1.25(c)	1.25(c)
Prestressed Concrete	1.8	1.5	1.5
Other engineered materials	1.5	1.25	1.25

- a) Insulators are to be replaced before safety factors have been reduced (due to deterioration or changes in construction, arrangement, or other conditions subsequent to installation) to less than 95 percent of the safety factor specified in Rule 44.1.
- b) Insulators are to be replaced before safety factors have been reduced (due to deterioration or changes in construction, arrangement, or other conditions subsequent to installation) to less than 75 percent of the safety factor specified in Rule 44.1.
- c) For aluminum members subject to tension caused by one or more estimated loads and where the critical load combination for the tension member would not endanger adjacent compression members, the factor of safety on ultimate tension shall be 2 for Grade "A" construction and 1.67 for Grades "B" and "C" construction.

Note: Revised July 26, 1966 by Decision No. 71009; January 6, 1968 by Decision No. 73455; March 30, 1968 by Decision No. 73813; February 13, 1974 by Decision No. 82466; January 21, 1992 by Resolution SU-10, January 13, 2005 by Decision No. 0501030 and February 5, 2014 by Decision No. 14-02-015.

**Strikeout/Underline**

**44.1 Installation and Reconstruction**

~~Lines and elements of lines, upon installation or reconstruction, shall provide as a minimum the safety factors specified in Table 4. The load and strength factors in Table 4-1 and Table 4-2 shall be used when designing lines and elements of lines for installation or reconstruction.~~

The design shall consider the structural loading and mechanical strength requirements of all supply and communication facilities planned to occupy the structure. For purposes of this rule, the term "planned" applies to the facilities intended to occupy the structure that are actually known to the constructing company at the time of design.

The entity responsible for performing the loading calculation(s) for an installation or reconstruction shall maintain records of these calculations for the service life of the pole or other structure for which a loading calculation was made and shall provide such information to authorized joint use occupants and the Commission upon request.

Note: Revised January 12, 2012 by Decision No. 1201032 and February 5, 2014 by Decision No. 14-02-015.

~~**Table 4: Minimum Safety Factors**~~ *(Strike existing Table 4 and replace with new Table 4-1 and new Table 4-2)*

**Table 4-1: Minimum Load Factors**

<u>Load Condition</u>	<u>Load Factors</u>		
	<u>"Grade A"</u>	<u>"Grade B"</u>	<u>"Grade C"</u>
<u>Vertical Loads</u>	<u>1.5</u>	<u>1.25</u>	<u>1.25</u>
<u>Wind Loads</u>	<u>1.5</u>	<u>1.25</u>	<u>1.25</u>
<u>Wire Tension Loads</u>	<u>1.5</u>	<u>1.25</u>	<u>1.25</u>

**Table 4-2: Maximum Strength Factors**

<u>Line Element</u>	<u>Strength Factors</u>		
	<u>"Grade A"</u>	<u>"Grade B"</u>	<u>"Grade C"</u>
<u>Conductors, splices and conductor fastenings (other than tie wires)</u>	<u>.75</u>	<u>.62</u>	<u>.62</u>
<u>Pins</u>	<u>.75</u>	<u>.62</u>	<u>.62</u>
<u>Pole line hardware</u>	<u>.75</u>	<u>.62</u>	<u>.62</u>
<u>Line Insulators (mechanical)</u>	<u>.5</u>	<u>.62</u>	<u>.62</u>
<b><u>Guy insulators (mechanical)</u></b>			
<u>Interlocking</u>	<u>.75</u>	<u>.62</u>	<u>.62</u>
<u>Noninterlocking glass fiber</u>	<u>.5</u>	<u>.62 (a)</u>	<u>.62(b)</u>
<u>Guys</u>	<u>.75</u>	<u>.62</u>	<u>.62</u>
<u>Messengers and span wires</u>	<u>.75</u>	<u>.62</u>	<u>.62</u>
<u>Foundations against uplift</u>	<u>1.0</u>	<u>.83</u>	<u>.83</u>
<u>Foundations against depression</u>	<u>.5</u>	<u>.62</u>	<u>.62</u>
<b><u>Poles, Towers and Structures</u></b>			
<u>Wood</u>	<u>.375</u>	<u>.415</u>	<u>.625</u>
<u>Metal (including elements of foundations)</u>	<u>1.0(c)</u>	<u>1.0(c)</u>	<u>1.0(c)</u>
<u>Reinforced concrete</u>	<u>.37</u>	<u>.41</u>	<u>.41</u>
<u>Prestressed or post-tensioned concrete</u>	<u>.83</u>	<u>.83</u>	<u>.83</u>
<u>Other engineered materials</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>
<b><u>Crossarms</u></b>			
<u>Wood</u>	<u>.75</u>	<u>.62</u>	<u>.62</u>
<u>Metal</u>	<u>1.0(c)</u>	<u>1.0(c)</u>	<u>1.0(c)</u>
<u>Prestressed Concrete</u>	<u>.83</u>	<u>.83</u>	<u>.83</u>
<u>Other engineered materials</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>

- (a) Insulators are to be replaced before their mechanical strengths safety factors have been reduced (due to deterioration or changes in construction, arrangement, or other conditions subsequent to installation) to less than 95 percent of the strength required at installation. safety factor specified in Rule 44.1.
- (b) Insulators are to be replaced before their mechanical strengths safety factors have been reduced (due to deterioration or changes in construction, arrangement, or other conditions subsequent to installation) to less than 75 percent of the strength required at installation. safety factor specified in Rule 44.1.
- (c) For aluminum members subject to tension caused by one or more estimated loads and where the critical load combination for the tension member would not endanger adjacent compression members, the strength factor of safety on ultimate tension shall be .75-2 for Grades "A", "B" and "C" construction, and 1.67 for Grades "B" and "C" construction.

Proposed Final

**44.1 Installation and Reconstruction**

The load and strength factors in Table 4-1 and Table 4-2 shall be used when designing lines and elements of lines for installation or reconstruction.

The design shall consider the structural loading and mechanical strength requirements of all supply and communication facilities planned to occupy the structure. For purposes of this rule, the term "planned" applies to the facilities intended to occupy the structure that are actually known to the constructing company at the time of design.

The entity responsible for performing the loading calculation(s) for an installation or reconstruction shall maintain records of these calculations for the service life of the pole or other structure for which the loading calculation was made and shall provide such information to authorized joint use occupants and the Commission upon request.

Note: Revised January 12, 2012 by Decision No. 1201032 and February 5, 2014 by Decision No. 14-02-015.

**Table 4-1: Minimum Load Factors**

Load Condition	Load Factors		
	"Grade A"	"Grade B"	"Grade C"
Vertical Loads	1.5	1.25	1.25
Wind Loads	1.5	1.25	1.25
Wire Tension Loads	1.5	1.25	1.25

**Table 4-2: Maximum Strength Factors**

Line Element	Strength Factors		
	"Grade A"	"Grade B"	"Grade C"
Conductors, splices and conductor fastenings (other than tie wires)	.75	.62	.62
Pins	.75	.62	.62
Pole line hardware	.75	.62	.62
Line Insulators (mechanical)	.5	.62	.62
<b>Guy insulators (mechanical)</b>			
Interlocking	.75	.62	.62
Noninterlocking glass fiber	.5	.62 (a)	.62(b)
Guys	.75	.62	.62
Messengers and span wires	.75	.62	.62
Foundations against uplift	1.0	.83	.83
Foundations against depression	.5	.62	.62
<b>Poles, Towers and Structures</b>			
Wood	.375	.415	.625
Metal (including elements of foundations)	1.0(c)	1.0(c)	1.0(c)
Reinforced concrete	.37	.41	.41
Prestressed or post-tensioned concrete	.83	.83	.83
Other engineered materials	1.0	1.0	1.0
<b>Crossarms</b>			
Wood	.75	.62	.62
Metal	1.0(c)	1.0(c)	1.0(c)
Prestressed Concrete	.83	.83	.83
Other engineered materials	1.0	1.0	1.0

- (a) Insulators are to be replaced before their mechanical strengths have been reduced (due to deterioration or changes in construction, arrangement, or other conditions subsequent to installation) to less than 95 percent of the strength required at installation.
- (b) Insulators are to be replaced before their mechanical strengths have been reduced (due to deterioration or changes in construction, arrangement, or other conditions subsequent to installation) to less than 75 percent of the strength required at installation.
- (c) For aluminum members subject to tension caused by one or more estimated loads and where the critical load combination for the tension member would not endanger adjacent compression members, the strength factor on ultimate tension shall be .75 for Grades "A", "B" and "C" construction.

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## PRC 3 Rule 44.2 – Additional Construction

### Original

#### **44.2 Additional Construction**

Any entity planning the addition of facilities shall ensure that the addition of the facilities will not reduce the safety factors below the values specified by Rule 44.3.

If performed, the entity responsible for performing loading calculations for additional construction shall maintain these loading calculations for the service life of the pole or other structure for which a loading calculation was made and shall provide such information to authorized joint use occupants and the Commission upon request.

Any loading calculations performed for wood structures more than 15 years old shall incorporate the results of intrusive inspections performed within the previous five years.

Note: Added August 20, 2009 by Decision No. 09-08-029. Revised January 12, 2012 by Decision No. 1201032, and February 5, 2014 by Decision No. 14-02-015.

### Strikeout/underline

#### **44.2 Additional Construction**

Any entity planning the addition of facilities shall ensure that, following the addition, of the facilities supporting structures, including their members and connections, will not reduce the safety factors below the values meet the strength requirements specified by Rule 44.3.

If performed, the entity responsible for performing loading calculations for additional construction shall maintain these loading calculations for the service life of the pole or other structure for which a loading calculation was made and shall provide such information to authorized joint use occupants and the Commission upon request.

Any loading calculations performed for wood structures more than 15 years old shall incorporate the results of intrusive inspections performed within the previous five years.

Note: Added August 20, 2009 by Decision No. 09-08-029. Revised January 12, 2012 by Decision No. 1201032, and February 5, 2014 by Decision No. 14-02-015.

**Proposed Final**

**44.2 Additional Construction**

Any entity planning the addition of facilities shall ensure that, following the addition, supporting structures, including their members and connections, will meet the strength requirements specified by Rule 44.3.

If performed, the entity responsible for performing loading calculations for additional construction shall maintain these loading calculations for the service life of the pole or other structure for which a loading calculation was made and shall provide such information to authorized joint use occupants and the Commission upon request.

Any loading calculations performed for wood structures more than 15 years old shall incorporate the results of intrusive inspections performed within the previous five years.

Note: Added August 20, 2009 by Decision No. 09-08-029. Revised January 12, 2012 by Decision No. 1201032, and February 5, 014 by Decision No. 14-02-015.

## PRC 4 Rule 44.3 – Replacement

### Original

#### **44.3 Replacement**

Lines or parts thereof shall be replaced or reinforced before safety factors have been reduced (due to factors such as deterioration and/or installation of additional facilities) in Grades "A" and "B" construction to less than two-thirds of the safety factors specified in Rule 44.1 and in Grade "C" construction to less than one-half of the safety factors specified in Rule 44.1. Poles in Grade "C" construction that only support communication lines shall also conform to the requirements of Rule 81.3-A. In no case shall the application of this rule be held to permit the use of structures or any member of any structure with a safety factor less than one.

Note: Allowed reductions specified in this rule are modified by Table 4, Footnotes.

Note: Revised January 13, 2005 by Decision No. 0501030, January 12, 2012 by Decision No. 1201032 and February 5, 2014 by Decision No. 14-02-015

### Strikeout/underline

#### **44.3 Replacement**

~~Lines or parts thereof shall be replaced or reinforced before safety factors have been reduced (due to factors such as deterioration and/or installation of additional facilities) in Grades "A" and "B" construction to less than two-thirds of the safety factors specified in Rule 44.1 and in Grade "C" construction to less than one-half of the safety factors specified in Rule 44.1.~~

Lines or parts thereof shall be replaced or reinforced before their ability to withstand the loads specified in Rule 43 is reduced (due to changes such as the addition of facilities and/or deterioration) to less than two-thirds of that required at installation by Rule 44 for Grades "A" and "B" construction, and to less than one-half of that required for Grade "C" construction.

Poles in Grade "C" construction that only support communication lines shall also conform to the requirements of Rule 81.3-A.

In no case shall the application of this rule be held to permit the ~~use of structures or any member of any structure with a safety factor less than one.~~ design of lines or parts thereof with strengths less than the effects of the loads.

Note: Allowed reductions specified in this rule are modified by Table 4-2 Footnotes.

Note: Revised January 13, 2005 by Decision No. 0501030, January 12, 2012 by Decision No. 1201032, and February 5, 2014 by Decision No. 14-02-015.

**Proposed Final**

**44.3 Replacement**

Lines or parts thereof shall be replaced or reinforced before their ability to withstand the loads specified in Rule 43 is reduced (due to changes such as the addition of facilities and/or deterioration) to less than two-thirds of that required at installation by Rule 44 for Grades "A" and "B" construction, and to less than one-half of that required for Grade "C" construction.

Poles in Grade "C" construction that only support communication lines shall also conform to the requirements of Rule 81.3-A.

In no case shall the application of this rule be held to permit the design of lines or parts thereof with strengths less than the effects of the loads.

Note: Allowed reductions specified in this rule are modified by Table 4-2 Footnotes.

Note: Revised January 13, 2005 by Decision No. 0501030, January 12, 2012 by Decision No. 1201032, and February 5, 2014 by Decision No. 14-02-015.

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## PRC 5 Rule 45 – Transverse Strength Requirements

### Original

#### **45 Transverse Strength Requirements**

In computing the transverse strength requirements of Lines (See Rule 22.1) under the conditions specified in Rule 43, safety factors at least equal to those of Rule 44 shall be used. In heavy loading areas, for supporting structures carrying more than 10 wires (not including cables and supporting messengers) where the pin spacing does not exceed 15 inches, the transverse wind load shall be calculated on two-thirds of the total number of such wires with a minimum of ten. Where there is a change in direction of conductors and messengers, an additional transverse load shall be the resultant of all tensions under the assumed loading conditions.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

#### **45.1 Special Provisions**

Where it is impossible to obtain the required transverse strength except by the use of side guys or special structures and it is physically impossible to install them at the location of the transversely weak support, the strength may be supplied by side guying the support at each side of, and as near as practicable to, such weak support with a distance not in excess of 800 feet between the supports so guyed; provided that the section of line between the transversely strong structures is weak in regard to transverse loads only, that is in a straight line and that the strength of the side guyed supports is calculated on the transverse loading of the entire section of line between them.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

### Strikeout/Underline

#### **45 Transverse Strength Requirements**

In computing the transverse strength requirements of Lines (See Rule 22.1) under the conditions specified in Rule 43, ~~safety load and strength~~ factors ~~at least equal to those meeting the requirements~~ of Rule 44 shall be used. In heavy loading areas, for supporting structures carrying more than 10 wires (not including cables and supporting messengers) where the pin spacing does not exceed 15 inches, the transverse wind load shall be calculated on two-thirds of the total number of such wires with a minimum of ten. Where there is a change in direction of conductors and messengers, an additional transverse load shall be the resultant of all tensions under the assumed loading conditions.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

## **45.1 Special Provisions**

Where it is impossible to obtain the required transverse strength except by the use of side guys or special structures and it is physically impossible to install them at the location of the transversely weak support, the strength may be supplied by side guying the support at each side of, and as near as practicable to, such weak support with a distance not in excess of 800 feet between the supports so guyed; provided that the section of line between the transversely strong structures is weak in regard to transverse loads only, that is in a straight line and that the strength of the side guyed supports is calculated on the transverse loading of the entire section of line between them.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

### **Proposed Final**

## **45 Transverse Strength Requirements**

In computing the transverse strength requirements of Lines (See Rule 22.1) under the conditions specified in Rule 43, load and strength factors meeting the requirements of Rule 44 shall be used. In heavy loading areas, for supporting structures carrying more than 10 wires (not including cables and supporting messengers) where the pin spacing does not exceed 15 inches, the transverse wind load shall be calculated on two-thirds of the total number of such wires with a minimum of ten. Where there is a change in direction of conductors and messengers, an additional transverse load shall be the resultant of all tensions under the assumed loading conditions.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

## **45.1 Special Provisions**

Where it is impossible to obtain the required transverse strength except by the use of side guys or special structures and it is physically impossible to install them at the location of the transversely weak support, the strength may be supplied by side guying the support at each side of, and as near as practicable to, such weak support with a distance not in excess of 800 feet between the supports so guyed; provided that the section of line between the transversely strong structures is weak in regard to transverse loads only, that is in a straight line and that the strength of the side guyed supports is calculated on the transverse loading of the entire section of line between them.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

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## PRC 6 Rule 46 – Vertical Strength Requirements

### Original

#### **46 Vertical Strength Requirements**

In computing vertical strength requirements, the loads upon Lines (See Rule 22.1) shall be their own weight plus the vertical loads which they support under the conditions of Rule 43, together with the effect of any difference in elevation of supports.

On structures with crossarms or guard arms, the vertical loads on the structure shall include a load of 300 lbs. at one end of one of the arms.

Safety factors shall apply as specified in Rule 44.

### Strikeout/underline

#### **46 Vertical Strength Requirements**

In computing vertical strength requirements, the loads upon Lines (See Rule 22.1) shall be their own weight plus the vertical loads which they support under the conditions of Rule 43, together with the effect of any difference in elevation of supports.

On structures with crossarms or guard arms, the vertical loads on the structure shall include a load of 300 lbs. at one end of one of the arms.

Safety Load and strength factors shall apply as specified in Rule 44.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

### Proposed Final

#### **46 Vertical Strength Requirements**

In computing vertical strength requirements, the loads upon Lines (See Rule 22.1) shall be their own weight plus the vertical loads which they support under the conditions of Rule 43, together with the effect of any difference in elevation of supports.

On structures with crossarms or guard arms, the vertical loads on the structure shall include a load of 300 lbs. at one end of one of the arms.

Load and strength factors shall apply as specified in Rule 44.

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Original

**47      Longitudinal Strength Requirements**

In computing the longitudinal strength requirements of Lines (See Rule 22.1), the longitudinal load shall be considered as that due to the maximum working tension under the conditions specified in Rule 43.

Safety factors shall apply as specified in Rule 44.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**47.1      Use of Guys and Braces**

The longitudinal strength requirements for poles, towers and other supporting structures shall be met either by the structure alone or with the aid of guys and/or braces. Deflection shall be limited by guys and/or braces where such structures alone, although providing the strength and safety factors required, would deflect sufficiently under the prescribed loadings to reduce clearances below the required values.

**47.2      Change in Grade of Construction**

Where sections of higher grade construction are located in lines of lower grade construction the longitudinal load on each end support of such sections at the level involved shall be taken as an unbalanced load in the direction of the higher grade section equal to the total pull of all conductors in that direction. For spans not exceeding 500 feet in length, where the pull in the direction of the higher grade section exceeds 30,000 lbs., the loading requirements may be modified to consider 30,000 lbs. plus one-fourth the excess above 30,000 lbs., to a maximum of 50,000 lbs. The construction of the end supports (including poles, structures, towers, crossarms, pins, insulators, conductor fastenings and guys) of such sections shall be such as to withstand at all times the load specified with a safety factor at least equal to unity.

In lieu of meeting the requirements of this rule on single poles or structures at ends of higher grade sections, the longitudinal load may be distributed over two poles or structures provided that the two poles or structures are suitably side guyed or are in a straight line with the direction of the longitudinal load of the higher grade section and that the two poles or structures comply with the requirements for the higher grade as to transverse strength and conductors between the two poles comply with the requirements for the higher grade.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

### **47.3 End Supports in Grades "A" or "B" Construction**

In Grades "A" or "B" construction the longitudinal load on each end support of crossings, conflicts or joint use, where located in lines of the same grade of construction, shall be taken as the unbalanced load equal to the tension of one-third of the total number of conductors (not including overhead ground wires), such one-third of the conductors being so selected as to produce the maximum stress in the supports. If the application of the above results in the fractional part of a conductor, the nearest whole number of conductors shall be used. The construction of the supports (including poles, structures, towers, crossarms, pins, insulators, conductor fastenings and guys) shall be such as to withstand at all times the load specified with a safety factor at least equal to unity. Excluded from the requirements of this rule, where Grade "B" construction is required, are Class L lines crossing minor railways and conductor fastenings of Class C circuits crossing major railways.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

#### **Strikeout/underline**

### **47 Longitudinal Strength Requirements**

In computing the longitudinal strength requirements of Lines (See Rule 22.1), the longitudinal load shall be considered as that due to the maximum working tension under the conditions specified in Rule 43.

~~Safety Load and strength~~ factors shall apply as specified in Rule 44.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

#### **47.1 Use of Guys and Braces**

The longitudinal strength requirements for poles, towers and other supporting structures shall be met either by the structure alone or with the aid of guys and/or braces. Deflection shall be limited by guys and/or braces where such structures alone, although providing the ~~and safety load and strength~~ factors required would deflect sufficiently under the prescribed loadings to reduce clearances below the required values.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

#### **47.2 Change in Grade of Construction**

Where sections of higher grade construction are located in lines of lower grade construction the longitudinal load on each end support of such sections at the level involved shall be taken as an unbalanced load in the direction of the higher grade section equal to the total pull of all conductors in that direction. For spans

not exceeding 500 feet in length, where the pull in the direction of the higher grade section exceeds 30,000 lbs., the loading requirements may be modified to consider 30,000 lbs. plus one-fourth the excess above 30,000 lbs., to a maximum of 50,000 lbs. ~~The construction of the end supports (including poles, structures, towers, crossarms, pins, insulators, conductor fastenings and guys) of such sections shall be such as to withstand at all times the load specified with a safety factor at least equal to unity. In no case shall the application of this rule be held to permit the design of the end supports (including poles, structures, towers, crossarms, pins, insulators, conductor fastenings and guys) with strengths less than the effects of the loads.~~

In lieu of meeting the requirements of this rule on single poles or structures at ends of higher grade sections, the longitudinal load may be distributed over two poles or structures provided that the two poles or structures are suitably side guyed or are in a straight line with the direction of the longitudinal load of the higher grade section and that the two poles or structures comply with the requirements for the higher grade as to transverse strength and conductors between the two poles comply with the requirements for the higher grade.

### **47.3 End Supports in Grades "A" or "B" Construction**

In Grades "A" or "B" construction the longitudinal load on each end support of crossings, conflicts or joint use, where located in lines of the same grade of construction, shall be taken as the unbalanced load equal to the tension of one-third of the total number of conductors (not including overhead ground wires), such one-third of the conductors being so selected as to produce the maximum stress in the supports. If the application of the above results in the fractional part of a conductor, the nearest whole number of conductors shall be used.

~~The construction of the supports (including poles, structures, towers, crossarms, pins, insulators, conductor fastenings and guys) shall be such as to withstand at all times the load specified with a safety factor at least equal to unity. In no case shall the application of this rule be held to permit the design of the end supports (including poles, structures, towers, crossarms, pins, insulators, conductor fastenings and guys) with strengths less than the effects of the loads.~~

Excluded from the requirements of this rule, where Grade "B" construction is required, are Class L lines crossing minor railways and conductor fastenings of Class C circuits crossing major railways.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

Proposed Final

**47 Longitudinal Strength Requirements**

In computing the longitudinal strength requirements of Lines (See Rule 22.1), the longitudinal load shall be considered as that due to the maximum working tension under the conditions specified in Rule 43.

Load and strength factors shall apply as specified in Rule 44.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**47.1 Use of Guys and Braces**

The longitudinal strength requirements for poles, towers and other supporting structures shall be met either by the structure alone or with the aid of guys and/or braces. Deflection shall be limited by guys and/or braces where such structures alone, although providing the load and strength factors required would deflect sufficiently under the prescribed loadings to reduce clearances below the required values.

**47.2 Change in Grade of Construction**

Where sections of higher grade construction are located in lines of lower grade construction the longitudinal load on each end support of such sections at the level involved shall be taken as an unbalanced load in the direction of the higher grade section equal to the total pull of all conductors in that direction. For spans not exceeding 500 feet in length, where the pull in the direction of the higher grade section exceeds 30,000 lbs., the loading requirements may be modified to consider 30,000 lbs. plus one-fourth the excess above 30,000 lbs., to a maximum of 50,000 lbs. In no case shall the application of this rule be held to permit the design of the end supports (including poles, structures, towers, crossarms, pins, insulators, conductor fastenings and guys) with strengths less than the effects of the loads.

In lieu of meeting the requirements of this rule on single poles or structures at ends of higher grade sections, the longitudinal load may be distributed over two poles or structures provided that the two poles or structures are suitably side guyed or are in a straight line with the direction of the longitudinal load of the higher grade section and that the two poles or structures comply with the requirements for the higher grade as to transverse strength and conductors between the two poles comply with the requirements for the higher grade.

### **47.3 End Supports in Grades "A" or "B" Construction**

In Grades "A" or "B" construction the longitudinal load on each end support of crossings, conflicts or joint use, where located in lines of the same grade of construction, shall be taken as the unbalanced load equal to the tension of one-third of the total number of conductors (not including overhead ground wires), such one-third of the conductors being so selected as to produce the maximum stress in the supports. If the application of the above results in the fractional part of a conductor, the nearest whole number of conductors shall be used. In no case shall the application of this rule be held to permit the design of the end supports (including poles, structures, towers, crossarms, pins, insulators, conductor fastenings and guys) with strengths less than the effects of the loads.

Excluded from the requirements of this rule, where Grade "B" construction is required, are Class L lines crossing minor railways and conductor fastenings of Class C circuits crossing major railways.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

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***Original***

**48 Strength of Materials**

Structural members and their connection shall be designed and constructed so that the structures and parts thereof will not fail or be seriously distorted at any load less than their maximum working loads (developed under the current construction arrangements with loadings as specified in Rule 43) multiplied by the safety factors in Rule 44.

Values used for the strength of material shall comply with the safety factors specified in Rule 44.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

***Strikeout/underline***

**48 Strength of Materials**

~~Structural members and their connection shall be designed and constructed so that the structures and parts thereof will not fail or be seriously distorted at any load less than their maximum working loads (developed under the current construction arrangements with loadings as specified in Rule 43) multiplied by the safety factors in Rule 44.~~

~~Values used for the strength of material shall comply with the safety factors specified in Rule 44.~~

Structures, including their members and connections, shall be designed and constructed to withstand the loads in Rule 43 multiplied by the appropriate load factors in Table 4-1. The effects of these loads shall not exceed the strengths of the structures, including their members and connections, multiplied by the strength factors in Table 4-2.

Structures, structure members, and their connections shall be replaced or reinforced before the effects of the loads multiplied by the load factors exceeds their strengths multiplied by the strength factors, as specified in Rule 44.3.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

## *Proposed Final*

### **48 Strength of Materials**

Structures, including their members and connections, shall be designed and constructed to withstand the loads in Rule 43 multiplied by the appropriate load factors in Table 4-1. The effects of these loads shall not exceed the strengths of the structures, including their members and connections, multiplied by the strength factors in Table 4-2.

Structures, structure members, and their connections shall be replaced or reinforced before the effects of the loads multiplied by the load factors exceeds their strengths multiplied by the strength factors, as specified in Rule 44.3.

***Original***

**48.1 Wood**

**A. Natural Wood (Non Laminate)**

**(1) Poles**

The required strength for natural wood poles of various species meeting the requirements of ANSI O5.1 2008 shall be derived in conjunction with the safety factors in Rule 44 and the designated fiber strength specified in ANSI O5.1 2008. Table 5 lists some of the values of fiber strength specified in ANSI O5.1 2008.

**(2) Sawn Wood Structural Members**

The required strength for sawn wood structural members, such as crossarms and braces, meeting the requirements of ANSI O5.3 2008 shall be derived in conjunction with the safety factors in Rule 44 and the designated fiber strength specified in ANSI O5.3 2008.

Multiply the given allowable stress values by 0.55 for sawn wood where the loading being considered is a long-time loading (i.e., continuous load for one year or more).

**B. Laminated Wood**

The required strength for laminated wood poles and other structural members, such as crossarms, meeting the requirements of ANSI O5.2 2006 shall be derived in conjunction with the safety factors in Rule 44 and the designated strength specified in ANSI O5.2 2006.

Table 5: Sample Wood Strengths Specified in ANSI O5.1-2008

Species	Designated Fiber Strength
Cedar, western red	6,000 lbs per square inch
Douglas fir	8,000 lbs per square inch
Fir, white or red, local	6,600 lbs per square inch
Pine, southern	8,000 lbs per square inch

Note: Revised April 26, 1965 by Decision No. 68835; March 9, 1988 by Resolution E-3076, October 9, 1996 by Resolution SU-40 and February 5, 2014 by Decision No. 14-02-015.

Strikeout/underline

**48.1 Wood**

**A. Natural Wood (Non Laminate)**

**(1) Poles**

The ~~required~~ strength for natural wood poles of various species meeting the requirements of ANSI O5.1 2008 shall be ~~derived in conjunction with the safety factors in Rule 44 and~~ the designated fiber strength specified in ANSI ~~O~~5.1 2008. Table 5 lists some of the values of fiber strength specified in ANSI ~~O~~5.1 2008.

**(2) Sawn Wood Structural Members**

The ~~required~~ strength for sawn wood structural members, such as crossarms and braces, meeting the requirements of ANSI O5.3 2008 shall be ~~derived in conjunction with the safety factors in Rule 44 and~~ the designated fiber strength specified in ANSI O5.3 2008.

Multiply the given allowable stress values by 0.55 for sawn wood where the loading being considered is a long-time loading (i.e., continuous load for one year or more).

**B. Laminated Wood**

The ~~required~~ strength for laminated wood poles and other structural members, such as crossarms, meeting the requirements of ANSI O5.2 2006 shall be ~~derived in conjunction with the safety factors in Rule 44 and~~ the designated strength specified in ANSI O5.2 2006.

Table 5: Sample Wood Strengths  
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Fir, white or red, local	6,600 lbs per square inch
Pine, southern	8,000 lbs per square inch

Note: Revised April 26, 1965 by Decision No. 68835; March 9, 1988 by Resolution E-3076, October 9, 1996 by Resolution SU-40 and February 5, 2014 by Decision No. 14-02-015.

***Proposed Final***

**48.1 Wood**

**A. Natural Wood (Non Laminate)**

**(1) Poles**

The strength for natural wood poles of various species meeting the requirements of ANSI O5.1 2008 shall be the designated fiber strength specified in ANSI O5.1 2008. Table 5 lists some of the values of fiber strength specified in ANSI O5.1 2008.

**(2) Sawn Wood Structural Members**

The strength for sawn wood structural members, such as crossarms and braces, meeting the requirements of ANSI O5.3 2008 shall be the designated fiber strength specified in ANSI O5.3 2008.

Multiply the given allowable stress values by 0.55 for sawn wood where the loading being considered is a long-time loading (i.e., continuous load for one year or more).

**B. Laminated Wood**

The strength for laminated wood poles and other structural members, such as crossarms, meeting the requirements of ANSI O5.2 2006 shall be the designated strength specified in ANSI O5.2 2006.

Table 5: Sample Wood Strengths Specified in ANSI O5.1-2008

<b>Species</b>	<b>Designated Fiber Strength</b>
Cedar, western red	6,000 lbs per square inch
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Fir, white or red, local	6,600 lbs per square inch
Pine, southern	8,000 lbs per square inch

Note: Revised April 26, 1965 by Decision No. 68835; March 9, 1988 by Resolution E-3076, October 9, 1996 by Resolution SU-40 and February 5, 2014 by Decision No. 14-02-015.

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Original

**48.2 Steel**

The required strength of steel structures and components shall be designed using ASCE 10 97 for latticed steel structures and ASCE 48 11 for tubular steel pole structures, as applicable.

Allowable stresses for steel members and their connections shall be derived in conjunction with the safety factors in Rule 44 and the permitted stresses specified in the applicable standard.

Steel members not covered by either of these standards shall be designed using allowable stresses as defined below:

Tension: The maximum allowable tensile stress shall be calculated using the following formula:

$$F_t = \frac{1}{SF} (F_y)$$

Compression: The maximum allowable compressive stress shall be calculated using the following formula:

$$F_a = \frac{1}{SF} \left[ F_y - \left( \frac{F_y - 12,000}{200} \right) \frac{l}{r} \right]$$

Shear: The maximum allowable shear stress shall be calculated using the following formula:

$$F_v = \frac{1}{SF} 0.66(F_t)$$

Bending: The maximum allowable bending stress for a compact section shall be calculated using the following equation:

$$F_b = \frac{1}{SF} (F_y)$$

The maximum allowable bending stress for a non-compact section shall be determined according to the provisions of Chapter E of the AISC Manual of Steel Construction, Allowable Stress Design, 9th Edition.

Combined Stresses: The strength of members subjected to combined stresses shall be determined according to the provisions of Chapter H of the AISC Manual of Steel Construction, Allowable Stress Design, 9th Edition.

Where,

Fa = maximum allowable axial stress, psi

Fb = maximum allowable bending stress, psi

Ft = maximum allowable tensile stress, psi

Fv = maximum allowable shear stress, psi

Fy = specified minimum yield stress, psi

Fu = specified minimum tensile stress, psi

SF = safety factor specified in Rule 44

l = unsupported length of member, inches

r = radius of gyration of member, inches

The values used for yield stress, Fy, and tensile stress, Fu, shall be the specified minimum values as listed in the appropriate ASTM specification. If the material specification for the steel is unknown and cannot be determined, the values for its yield stress and tensile stress shall be assumed to be 33,000 psi and 60,000 psi, respectively. The modulus of elasticity, E, is defined to be 29,000 ksi.

Note: Revised March 30, 1968 by Decision No. 73813, January 13, 2005 by Decision No. 0501030, and February 5, 2014 by Decision No. 14-02-015.

### **Strikeout/underline**

#### **48.2 Steel**

~~The required strength of steel structures and components shall be designed using ASCE 10-97 for latticed steel structures and ASCE 48-11 for tubular steel pole structures, as applicable.~~

As applicable, steel members and their connections shall be designed in accordance with the following standards:

Latticed Steel Structures: ASCE 10-97, and

Tubular Steel Pole Structures: ASCE 48-11

Allowable stresses for steel members and their connections shall be derived ~~in~~ conjunction with the safety factors in Rule 44 and the permitted stresses specified in the applicable standard. by multiplying the values specified in the applicable standard by the appropriate strength factors specified in Table 4-2.

Steel members not covered by either of these standards shall be designed using allowable stresses as defined below, consistent with Rule 48:

Tension: The maximum allowable tensile stress shall be calculated using the following formula:

$$F_t = \frac{1}{SF} SF (F_y)$$

Compression: The maximum allowable compressive stress shall be calculated using the following formula:

$$F_a = \frac{1}{SF} SF \left[ F_y - \left( \frac{F_y - 12,000}{200} \right) \frac{l}{r} \right]$$

Shear: The maximum allowable shear stress shall be calculated using the following formula:

$$F_v = \frac{1}{SF} SF 0.66(F_{u\#})$$

Bending: The maximum allowable bending stress for a compact section shall be calculated using the following equation:

$$F_b = \frac{1}{SF} SF (F_y)$$

The maximum allowable bending stress for a non-compact section shall be determined according to the provisions of Chapter E of the AISC Manual of Steel Construction, Allowable Stress Design, 9th Edition.

Combined Stresses: The strength of members subjected to combined stresses shall be determined according to the provisions of Chapter H of the AISC Manual of Steel Construction, Allowable Stress Design, 9th Edition.

Where,

F<sub>a</sub> = maximum allowable axial stress, psi

F<sub>b</sub> = maximum allowable bending stress, psi

F<sub>t</sub> = maximum allowable tensile stress, psi

F<sub>v</sub> = maximum allowable shear stress, psi

F<sub>y</sub> = specified minimum yield stress, psi

Fu = specified minimum tensile stress, psi

SF = **safety strength** factor specified in Rule 44

l = unsupported length of member, inches

r = radius of gyration of member, inches

The values used for yield stress, Fy, and tensile stress, Fu, shall be the specified minimum values as listed in the appropriate ASTM specification. If the material specification for the steel is unknown and cannot be determined, the values for its yield stress and tensile stress shall be assumed to be 33,000 psi and 60,000 psi, respectively. The modulus of elasticity, E, is defined to be 29,000 ksi.

Note: Revised March 30, 1968 by Decision No. 73813, January 13, 2005 by Decision No. 0501030, and February 5, 2014 by Decision No. 14-02-015.

### **Proposed Final**

#### **48.2 Steel**

As applicable, steel members and their connections shall be designed in accordance with the following standards:

Latticed Steel Structures: ASCE 10-97, and

Tubular Steel Pole Structures: ASCE 48-11

Allowable stresses for steel members and their connections shall be derived by multiplying the values specified in the applicable standard by the appropriate strength factors specified in Table 4-2.

Steel members not covered by either of these standards shall be designed using allowable stresses as defined below, consistent with Rule 48:

Tension: The maximum allowable tensile stress shall be calculated using the following formula:

$$F_t = SF (F_y)$$

Compression: The maximum allowable compressive stress shall be calculated using the following formula:

$$F_a = SF \left[ F_y - \left( \frac{F_y - 12,000}{200} \right) \frac{l}{r} \right]$$

Shear: The maximum allowable shear stress shall be calculated using the following formula:

$$F_v = SF 0.66 (F_u)$$

Bending: The maximum allowable bending stress for a compact section shall be calculated using the following equation:

$$F_b = SF (F_y)$$

The maximum allowable bending stress for a non-compact section shall be determined according to the provisions of Chapter E of the AISC Manual of Steel Construction, Allowable Stress Design, 9th Edition.

Combined Stresses: The strength of members subjected to combined stresses shall be determined according to the provisions of Chapter H of the AISC Manual of Steel Construction, Allowable Stress Design, 9th Edition.

Where,

Fa = maximum allowable axial stress, psi

Fb = maximum allowable bending stress, psi

Ft = maximum allowable tensile stress, psi

Fu = specified minimum tensile stress, psi

Fv = maximum allowable shear stress, psi

Fy = specified minimum yield stress, psi

SF = strength factor specified in Rule 44

l = unsupported length of member, inches

r = radius of gyration of member, inches

The values used for yield stress, Fy, and tensile stress, Fu, shall be the specified minimum values as listed in the appropriate ASTM specification. If the material specification for the steel is unknown and cannot be determined, the values for its yield stress and tensile stress shall be assumed to be 33,000 psi and 60,000 psi, respectively. The modulus of elasticity, E, is defined to be 29,000 ksi.

Note: Revised March 30, 1968 by Decision No. 73813, January 13, 2005 by Decision No. 0501030, and February 5, 2014 by Decision No. 14-02-015.

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PRC 11 Rule 48.3 – Concrete

Original

**48.3 Concrete**

**A. Reinforced Concrete**

Values used for ultimate strengths of reinforced concrete, in conjunction with safety factors given in Rule 44, shall not exceed the following:

Reinforcing steel, tensile or compressive strength, pounds per square inch: 55,000

Concrete, 1:2:4 mixture	Age	Compressive Strength
	7 days	900 lbs per sq. in.
	30 days	2,400 lbs per sq. in.
	90 days	3,100 lbs per sq. in.
	6 months	4,400 lbs per sq. in.

If reinforced concrete is designed for higher strength values which are proven by test, such values may be used in lieu of the figures given.

**B. Prestressed Concrete**

The minimum strength of the materials used in prestressed concrete structures used in conjunction with the safety factors given in Table 4 shall be as follows:

Reinforcing Steel - yield strength ( $F_y$ ) 40,000 psi

Prestressing Steel - yield strength ( $F_y$ ) 188,000 psi

Concrete - compressive strength ( $F'_c$ ) at 28 days 4,000 psi

Other strength values may be used provided the strength values used for design are proven by tests.

Note: Rule 48.3-B added on February 13, 1974 by Decision No. 82466.

Strikeout/underline

**48.3 Concrete**

**A. Reinforced Concrete**

Values used for ultimate strengths of reinforced concrete, ~~in conjunction with safety strength factors given in Rule 44,~~ shall not exceed the following:

Reinforcing steel, tensile or compressive strength, pounds per square inch: 55,000

Concrete, 1:2:4 mixture	Age	Compressive Strength
	7 days	900 lbs per sq. in.
	30 days	2,400 lbs per sq. in.
	90 days	3,100 lbs per sq. in.
	6 months	4,400 lbs per sq. in.

If reinforced concrete is designed for higher strength values which are proven by test, such values may be used in lieu of the figures given.

**B. Prestressed Concrete**

The minimum strength of the materials used in prestressed concrete structures ~~used in conjunction with the safety strength factors given in Table 4-2~~ shall be as follows:

Reinforcing Steel - yield strength ( $F_y$ ) 40,000 psi

Prestressing Steel - yield strength ( $F_y$ ) 188,000 psi

Concrete - compressive strength ( $F'_c$ ) at 28 days 4,000 psi

Other strength values may be used provided the strength values used for design are proven by tests.

Note: Rule 48.3-B added on February 13, 1974 by Decision No. 82466.

Proposed Final

**48.3 Concrete**

**A. Reinforced Concrete**

Values used for ultimate strengths of reinforced concrete shall not exceed the following:

Reinforcing steel, tensile or compressive strength, pounds per square inch: 55,000

Concrete, 1:2:4 mixture	Age	Compressive Strength
	7 days	900 lbs per sq. in.
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	90 days	3,100 lbs per sq. in.
	6 months	4,400 lbs per sq. in.

If reinforced concrete is designed for higher strength values which are proven by test, such values may be used in lieu of the figures given.

**B. Prestressed Concrete**

The minimum strength of the materials used in prestressed concrete structures shall be as follows:

Reinforcing Steel - yield strength ( $F_y$ ) 40,000 psi

Prestressing Steel - yield strength ( $F_y$ ) 188,000 psi

Concrete - compressive strength ( $F'_c$ ) at 28 days 4,000 psi

Other strength values may be used provided the strength values used for design are proven by tests.

Note: Rule 48.3-B added on February 13, 1974 by Decision No. 82466.

Original

**48.4 Fiber-Reinforced Polymer**

The required strength of overhead line structures and subcomponents made with fiber-reinforced polymer shall be derived in conjunction with the safety factors in Rule 44 and other permitted stresses specified in the applicable standard. This requirement applies to tension and bending, compression and bending, and shear.

The compressive strength of the material shall be determined by suitable formula for the material or structure, considering the strength of the material, modulus of elasticity, geometry, slenderness ratio and eccentricity of connection.

Note: The strength may be determined per Section 2.6.2 of ASCE 111-2006.

Note: Added February 5, 2014 by Decision No. 14-02-015.

Strikeout/underline

**48.4 Fiber-Reinforced Polymer**

The ~~required~~ strength of overhead line structures and subcomponents made with fiber-reinforced polymer shall be ~~derived in conjunction with the safety factors in Rule 44 and other permitted stresses specified in the applicable standard. by multiplying the lower 5th percentile strengths determined in accordance with ASCE 111-2006 by the strength factors in Table 4-2.~~ This requirement applies to tension and bending, compression and bending, and shear.

The compressive strength shall be determined by a suitable formula for the material or structure, considering the strength of the material, modulus of elasticity, geometry, slenderness ratio and eccentricity of connection.

~~Note: The strength may be determined per Section 2.6.2 of ASCE 111-2006.~~

Note: Added February 5, 2014 by Decision No. 14-02-015.

*Proposed Final*

**48.4 Fiber-Reinforced Polymer**

The strength of overhead line structures and subcomponents made with fiber-reinforced polymer shall be the lower 5th percentile strength determined in accordance with ASCE 111-2006. This requirement applies to tension and bending, compression and bending, and shear.

The compressive strength shall be determined by a suitable formula for the material or structure, considering the strength of the material, modulus of elasticity, geometry, slenderness ratio and eccentricity of connection.

Note: Added February 5, 2014 by Decision No. 14-02-015.

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**48.5 Other Engineered Materials**

The required strength of overhead line structures and subcomponents made with other engineered materials shall be derived in conjunction with the safety factors in Rule 44 and other permitted stresses specified in the applicable standard. This requirement applies to tension, compression and shear.

Tension: If the material has a published yield strength value, that value shall be used in lieu of the tensile strength value.

Compression: The compressive strength shall be determined by suitable formula for the material used and member geometry, considering yield and /or tensile strength of the material, modulus of elasticity, slenderness ratio and eccentricity of connection. In no case shall the compressive stress be greater than the yield strength of the material.

Note: The strength may be determined per Section 2.6.2 of ASCE 111-2006.

Note: Added February 5, 2014 by Decision No. 14-02-015.

***Strikeout/underline***

**48.5 Other Engineered Materials**

The ~~required~~ strength of overhead line structures and subcomponents made with other engineered materials shall be ~~derived in conjunction with the safety factors in Rule 44 and other permitted stresses specified in the applicable standard. by multiplying the lower 5th percentile strengths determined in accordance with ASCE 111-2006 by the strength factors in Table 4-2.~~ This requirement applies to tension, compression and shear.

Tension: If the material has a published yield strength value, that value shall be used in lieu of the tensile strength value.

Compression: The compressive strength shall be determined by suitable formula for the material used and member geometry, considering yield and /or tensile strength of the material, modulus of elasticity, slenderness ratio and eccentricity of connection. In no case shall the compressive stress be greater than the yield strength of the material.

~~Note: The strength may be determined per Section 2.6.2 of ASCE 111-2006.~~

Note: Added February 5, 2014 by Decision No. 14-02-015.

*Proposed Final*

**48.5 Other Engineered Materials**

The strength of overhead line structures and subcomponents made with other engineered materials shall be the lower 5th percentile strength determined in accordance with ASCE 111-2006. This requirement applies to tension, compression and shear.

Tension: If the material has a published yield strength value, that value shall be used in lieu of the tensile strength value.

Compression: The compressive strength shall be determined by suitable formula for the material used and member geometry, considering yield and /or tensile strength of the material, modulus of elasticity, slenderness ratio and eccentricity of connection. In no case shall the compressive stress be greater than the yield strength of the material.

Note: Added February 5, 2014 by Decision No. 14-02-015.

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**48.7 Tower or Pole Foundations and Footings**

The resistance of soil to foundation or footing bearing and uplift shall be calculated from the best available data or determined by test(s).

Foundation or footing resistance shall be designed with safety factors applied as specified in Rule 44.

***Strikeout/underline***

**48.7 Tower or Pole Foundations and Footings**

The resistance of soil to foundation or footing bearing and uplift shall be calculated from the best available data or determined by test(s).

Foundations ~~or and~~ footings ~~resistance~~ shall be designed consistent with Rule 48 ~~with safety factors applied as specified in Rule 44.~~

***Proposed Final***

**48.7 Tower or Pole Foundations and Footings**

The resistance of soil to foundation or footing bearing and uplift shall be calculated from the best available data or determined by test(s).

Foundations and footings shall be designed consistent with Rule 48.

Original

**C. Strength**

Crossarms shall be securely supported by bracing, where necessary, to withstand unbalanced vertical loads and to prevent tipping of any arm sufficiently to decrease clearances below the values specified in Section III. Such bracing shall be securely attached to poles and crossarms. Supports in lieu of crossarms shall have means of resisting rotation in a vertical plane about their attachment to poles or shall be supported by braces as required for crossarms. Metal braces or attachments shall meet the requirements of Rules 48.2 and 49.8.

In addition to the above, a vertical load of 300 lbs. at the outer pin position shall be included in computing the vertical loads on all crossarms.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**(1) Longitudinal Loads Normally Balanced:**

- (a) Supply Lines:** Where longitudinal loads are normally balanced, crossarms supporting supply conductors shall have sufficient strength to withstand a load, applied in the direction of the conductors at the outer pin position, of 700 pounds with a safety factor of not less than unity.
- (b) Communication Lines, Class C:** Where longitudinal loads are normally balanced, crossarms supporting Class C conductors shall have sufficient strength to withstand a load, applied in the direction of the conductors at the outer pin position, of 400 pounds with a safety factor of not less than unity.

**(2) Longitudinal Loads Normally Unbalanced:** Crossarms subjected to unbalanced longitudinal loads shall have sufficient strength to meet the strength requirements with safety factors at least equal to those in Rule 44.

At unbalanced corners and dead ends in Grades "A", "B" or "C" construction, where conductor tension is held by cantilever strength of pin-type insulators and pins, double crossarms shall be used to permit conductor fastenings at two insulators to prevent slipping. In lieu of double crossarms and double insulators, single crossarms may be used with single insulators and steel pins and prefabricated conductor ties.

For conductor tensions up to 2,000 pounds per conductor, double wood crossarms fitted with spacing devices at each end will be considered as meeting the strength requirements of Rules 47.2 and 47.3.

Note: Revised March 9, 1988 by Resolution E-3076, and February 5, 2014 by Decision No. 14-02-015.

### **Strikeout/underline**

#### **C. Strength**

Crossarms shall be securely supported by bracing, where necessary, to withstand unbalanced vertical loads and to prevent tipping of any arm sufficiently to decrease clearances below the values specified in Section III. Such bracing shall be securely attached to poles and crossarms. Supports in lieu of crossarms shall have means of resisting rotation in a vertical plane about their attachment to poles or shall be supported by braces as required for crossarms. Metal braces or attachments shall meet the requirements of Rules 48.2 and 49.8.

In addition to the above, a vertical load of 300 lbs. at the outer pin position shall be included in computing the vertical loads on all crossarms.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

##### **(1) Longitudinal Loads Normally Balanced:**

**(a) Supply Lines:** Where longitudinal loads are normally balanced, crossarms supporting supply conductors shall be designed to withstand a load, applied in the direction of the conductors at the outer pin position, of 700 pounds. ~~with a safety factor of not less than unity. In no case shall the application of this rule be held to permit the design of crossarms with strengths less than the effects of the loads.~~

**(b) Communication Lines, Class C:** Where longitudinal loads are normally balanced, crossarms supporting Class C conductors shall have sufficient strength to withstand a load, applied in the direction of the conductors at the outer pin position, of 400 pounds. ~~with a safety factor of not less than unity. In no case shall the application of this rule be held to permit the design of crossarms with strengths less than the effects of the loads.~~

**(2) Longitudinal Loads Normally Unbalanced:** Crossarms subjected to unbalanced longitudinal loads shall have sufficient strength to meet the strength requirements with ~~safety factors at least equal to those~~ the load and strength factors specified in Rule 44 applied.

At unbalanced corners and dead ends in Grades "A", "B" or "C" construction, where conductor tension is held by cantilever strength of pin-type insulators and pins, double crossarms shall be used to permit conductor fastenings at two insulators to prevent slipping. In lieu of double crossarms and double insulators, single crossarms may be used with single insulators and steel pins and prefabricated conductor ties.

For conductor tensions up to 2,000 pounds per conductor, double wood crossarms fitted with spacing devices at each end will be considered as meeting the strength requirements of Rules 47.2 and 47.3.

Note: Revised March 9, 1988 by Resolution E-3076, and February 5, 2014 by Decision No. 14-02-015.

### **Proposed Final**

#### **C. Strength**

Crossarms shall be securely supported by bracing, where necessary, to withstand unbalanced vertical loads and to prevent tipping of any arm sufficiently to decrease clearances below the values specified in Section III. Such bracing shall be securely attached to poles and crossarms. Supports in lieu of crossarms shall have means of resisting rotation in a vertical plane about their attachment to poles or shall be supported by braces as required for crossarms. Metal braces or attachments shall meet the requirements of Rules 48.2 and 49.8.

In addition to the above, a vertical load of 300 lbs. at the outer pin position shall be included in computing the vertical loads on all crossarms.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

#### **(1) Longitudinal Loads Normally Balanced:**

**(a) Supply Lines:** Where longitudinal loads are normally balanced, crossarms supporting supply conductors shall be designed to withstand a load, applied in the direction of the conductors at the outer pin position, of 700 pounds. In no case shall the application of this rule be held to permit the design crossarms with strengths less than the effects of the loads.

**(b) Communication Lines, Class C:** Where longitudinal loads are normally balanced, crossarms supporting Class C conductors shall have sufficient strength to withstand a load, applied in the direction of the conductors at the outer pin position, of 400 pounds. In no case shall the application of this rule be held to permit the design of crossarms with strengths less than the effects of the loads.

- (2) **Longitudinal Loads Normally Unbalanced:** Crossarms subjected to unbalanced longitudinal loads shall have sufficient strength to meet the strength requirements with the load and strength factors specified in Rule 44 applied.

At unbalanced corners and dead ends in Grades "A", "B" or "C" construction, where conductor tension is held by cantilever strength of pin-type insulators and pins, double crossarms shall be used to permit conductor fastenings at two insulators to prevent slipping. In lieu of double crossarms and double insulators, single crossarms may be used with single insulators and steel pins and prefabricated conductor ties.

For conductor tensions up to 2,000 pounds per conductor, double wood crossarms fitted with spacing devices at each end will be considered as meeting the strength requirements of Rules 47.2 and 47.3.

Note: Revised March 9, 1988 by Resolution E-3076, and February 5, 2014 by Decision No. 14-02-015

## PRC 16 Rule 49.3-C – Strength (Pins and Conductor Fastenings)

### Original

#### C. Strength

Insulator pins and conductor fastenings shall be able to withstand the loads to which they may be subjected with safety factors at least equal to those in Rule 44.

Note: A 1–1/2 inch by 9 inch locust pin will usually provide cantilever strength up to 1,000 pounds tension in the conductor with the conductor 3–1/2 inches above the crossarm and a load factor of unity.

#### (1) Longitudinal Loads Normally Balanced:

- (a) **Insulator Pins:** Where longitudinal loads are normally balanced, insulator pins which support conductors shall have sufficient strength to withstand, with a load factor of not less than unity, a load at the conductor position as follows:

Pins supporting supply conductors 700 pounds

Pins supporting Class C conductors 400 pounds

- (b) **Conductor Fastenings:** Where longitudinal loads are normally balanced, tie wires or other conductor fastenings shall be installed in such a manner that they will securely hold the line conductor to the supporting insulators and will withstand without slipping of the conductor unbalanced pulls as follows:

Supply conductor fastening	40% of the maximum working tensions but not more than 500 pounds.
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Class C conductor fastenings	15% of the maximum working tensions but not more than 300 pounds.
------------------------------	---

Tie wires are not required on Class C conductors at point– type transpositions in Grade F construction.

- (2) **Longitudinal Loads Normally Unbalanced:** At unbalanced corners and dead ends in Grades “A”, “B” or “C” construction, where conductor tension is held by cantilever strength of pin–type insulators and pins, double insulators and wood pins or single insulators and steel pins shall be used. Each line conductor shall be tied or fastened to both insulators, or the single insulator, to prevent slipping of the conductor under maximum working tension with a safety factor of 2 for the

temperature and loading conditions specified in Rule 43.

At changes in grade of construction and at end supports in Grades "A" or "B" construction where the conductors are not dead-ended and are supported on pin-type insulators, double insulators and pins with tie wires, or equivalent fastenings, will be considered as meeting the strength requirements of Rules 47.2 and 47.3 for conductor tensions up to 2,000 pounds per conductor.

Note: Revised March 9, 1988 by Resolution E-3076, and February 5, 2014 by Decision No. 14-02-015.

### Strikeout/Underline

#### **C. Strength**

Insulator pins and conductor fastenings shall be able to withstand the loads to which they may be subjected with ~~safety factors at least equal to those~~ the load and strength factors specified in Rule 44 applied.

Note: A 1-1/2 inch by 9 inch locust pin will usually provide cantilever strength up to 1,000 pounds tension in the conductor with the conductor 3-1/2 inches above the crossarm and a load factor of unity.

#### **(1) Longitudinal Loads Normally Balanced:**

- (a) **Insulator Pins:** Where longitudinal loads are normally balanced, insulator pins which support conductors shall have sufficient strength to withstand; ~~with a safety factor of not less than unity,~~ a load at the conductor position as follows:

Pins supporting supply conductors 700 pounds

Pins supporting Class C conductors 400 pounds

In no case shall the application of this rule be held to permit the design of insulator pins and conductor fastenings with strengths less than the effects of the loads.

- (b) **Conductor Fastenings:** Where longitudinal loads are normally balanced, tie wires or other conductor fastenings shall be installed in such a manner that they will securely hold the line conductor to the supporting insulators and will withstand without slipping of the conductor unbalanced pulls as follows:

Supply conductor fastening

40% of the maximum working tensions but not more than 500 pounds.

Class C conductor fastenings 15% of the maximum working tensions but not more than 300 pounds.

~~Tie wires are not required on Class C conductors at point-type transpositions in Grade F construction.~~

- (2) Longitudinal Loads Normally Unbalanced:** At unbalanced corners and dead ends in Grades "A", "B" or "C" construction, where conductor tension is held by cantilever strength of pin-type insulators and pins, double insulators and wood pins or single insulators and steel pins shall be used. Each line conductor shall be tied or fastened to both insulators, or the single insulator, to prevent slipping of the conductor under maximum working tension with a **safety load** factor of 2 for the temperature and loading conditions specified in Rule 43.

At changes in grade of construction and at end supports in Grades "A" or "B" construction where the conductors are not dead-ended and are supported on pin-type insulators, double insulators and pins with tie wires, or equivalent fastenings, will be considered as meeting the strength requirements of Rules 47.2 and 47.3 for conductor tensions up to 2,000 pounds per conductor.

Note: Revised March 9, 1988 by Resolution E-3076, and February 5, 2014 by Decision No. 14-02-015.

### ***Proposed Final***

#### **C. Strength**

Insulator pins and conductor fastenings shall be able to withstand the loads to which they may be subjected with the load and strength factors specified in Rule 44 applied.

Note: A 1-1/2 inch by 9 inch locust pin will usually provide cantilever strength up to 1,000 pounds tension in the conductor with the conductor 3-1/2 inches above the crossarm and a load factor of unity.

#### **(1) Longitudinal Loads Normally Balanced:**

- (a) Insulator Pins:** Where longitudinal loads are normally balanced, insulator pins which support conductors shall have sufficient strength to withstand a load at the conductor position as follows:

Pins supporting supply conductors 700 pounds

Pins supporting Class C conductors 400 pounds

In no case shall the application of this rule be held to permit the design of insulator pins and conductor fastenings with strengths less than the effects of the loads.

**(b) Conductor Fastenings:** Where longitudinal loads are normally balanced, tie wires or other conductor fastenings shall be installed in such a manner that they will securely hold the line conductor to the supporting insulators and will withstand without slipping of the conductor unbalanced pulls as follows:

Supply conductor fastening	40% of the maximum working tensions but not more than 500 pounds.
Class C conductor fastenings	15% of the maximum working tensions but not more than 300 pounds.

**(2) Longitudinal Loads Normally Unbalanced:** At unbalanced corners and dead ends in Grades "A", "B" or "C" construction, where conductor tension is held by cantilever strength of pin-type insulators and pins, double insulators and wood pins or single insulators and steel pins shall be used. Each line conductor shall be tied or fastened to both insulators, or the single insulator, to prevent slipping of the conductor under maximum working tension with a load factor of 2 for the temperature and loading conditions specified in Rule 43.

At changes in grade of construction and at end supports in Grades "A" or "B" construction where the conductors are not dead-ended and are supported on pin-type insulators, double insulators and pins with tie wires, or equivalent fastenings, will be considered as meeting the strength requirements of Rules 47.2 and 47.3 for conductor tensions up to 2,000 pounds per conductor.

Note: Revised March 9, 1988 by Resolution E-3076, and February 5, 2014 by Decision No. 14-02-015.

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## PRC 17 Rule 49.4-B – Size (Conductors)

### Original

#### **B. Size**

The minimum sizes of conductors which shall be used in spans of 150 feet or less under the several classes of construction and loadings in both urban and rural districts are specified in Table 8. Larger conductors than those specified in the table will often be necessary to maintain reasonable sag and at the same time provide the required safety factors of Rule 44, ground clearances of Table 1, and wire clearances of Table 2.

Conductors of the sizes specified in Table 8 may be used in spans longer than 150 feet, except when specifically prevented by Rule 49.4–C, provided the sags and conductor positions are so adjusted that the allowable working tensions and clearances of this Order are not violated.

The common neutral conductor in common neutral systems shall conform to the requirements of Rule 59.3–B in addition to the above requirements.

Note: Revised February 5, 2014 by Decision No. 1402015.

### Strikeout/Underline

#### **B. Size**

The minimum sizes of conductors which shall be used in spans of 150 feet or less under the several classes of construction and loadings in both urban and rural districts are specified in Table 8. Larger conductors than those specified in the table will often be necessary to maintain reasonable sag and at the same time ~~provide the required safety~~ be consistent with the load and strength factors ~~requirements~~ of Rule 44, ground clearances of Table 1, and wire clearances of Table 2.

Conductors of the sizes specified in Table 8 may be used in spans longer than 150 feet, except when specifically prevented by Rule 49.4–C, provided the sags and conductor positions are so adjusted that the allowable working tensions and clearances of this Order are not violated.

The common neutral conductor in common neutral systems shall conform to the requirements of Rule 59.3–B in addition to the above requirements.

Note: Revised February 5, 2014 by Decision No. 1402015.

***Proposed Final***

**B. Size**

The minimum sizes of conductors which shall be used in spans of 150 feet or less under the several classes of construction and loadings in both urban and rural districts are specified in Table 8. Larger conductors than those specified in the table will often be necessary to maintain reasonable sag and at the same time be consistent with the load and strength factor requirements of Rule 44, ground clearances of Table 1, and wire clearances of Table 2.

Conductors of the sizes specified in Table 8 may be used in spans longer than 150 feet, except when specifically prevented by Rule 49.4–C, provided the sags and conductor positions are so adjusted that the allowable working tensions and clearances of this Order are not violated.

The common neutral conductor in common neutral systems shall conform to the requirements of Rule 59.3–B in addition to the above requirements.

Note: Revised February 5, 2014 by Decision No. 1402015.

***Original***

**49.5 Insulators**

**A. Line**

Insulators, supports, clamps and other miscellaneous attachments shall be designed to withstand, with at least the safety factors specified in Rule 44, the mechanical stress to which they are subjected by conductors, wires or structures, under the loading conditions as specified in Rule 43. Pin insulators shall effectively engage the thread of the pin for at least two and one-half turns.

**B. Guy**

Guy insulators, including insulators in messengers, shall have mechanical strength at least equal to that required of the guys in which they are installed.

**C. Replacements** (See Rule 44.3)

**D. Post**

Post insulator units including insulator supports, clamps, and other miscellaneous attachments shall have a cantilever strength determined in accordance with paragraph 5.1.3 of the American Standard Insulator Tests, Publication No. C29.1–1961, or the latest revision thereof, equal to or greater than the product of the safety factors specified in Rule 44 and the mechanical load to which they are subjected by conductors, wires, or structures under the loading conditions as specified in Rule 43.

Note: Added January 6, 1968 by Decision No. 73455.

## Strikeout/underline

### **49.5 Insulators**

#### **A. Line**

Insulators, supports, clamps and other miscellaneous attachments shall be designed to withstand, ~~with at least the safety factors specified in Rule 44,~~ the mechanical stress-load to which they are subjected by conductors, wires or structures, under the loading conditions as specified in Rule 43, with the load and strength factors of Rule 44 applied.

Pin insulators shall effectively engage the thread of the pin for at least two and one-half turns.

#### **B. Guy**

Guy insulators, including insulators in messengers, shall have mechanical strength at least equal to that required of the guys or messengers in which they are installed.

#### **C. Replacements** (See Rule 44.3)

#### **D. Post**

Post insulator units including insulator supports, clamps, and other miscellaneous attachments shall have a cantilever strength determined in accordance with paragraph 5.1.3 of the American Standard Insulator Tests, Publication No. C29.1-1961, or the latest revision thereof, equal to or greater than ~~the product of the safety factors specified in Rule 44 and~~ the mechanical load to which they are subjected by conductors, wires, or structures under the loading conditions as specified in Rule 43 with the load and strength factors of Rule 44 applied.

Note: Added January 6, 1968 by Decision No. 73455.

***Proposed Final***

**49.5 Insulators**

**A. Line**

Insulators, supports, clamps and other miscellaneous attachments shall be designed to withstand the mechanical load to which they are subjected by conductors, wires or structures, under the loading conditions as specified in Rule 43, with the load and strength factors of Rule 44 applied.

Pin insulators shall effectively engage the thread of the pin for at least two and one-half turns.

**B. Guy**

Guy insulators, including insulators in messengers, shall have mechanical strength at least equal to that required of the guys or messengers in which they are installed.

**C. Replacements** (See Rule 44.3)

**D. Post**

Post insulator units including insulator supports, clamps, and other miscellaneous attachments shall have a cantilever strength determined in accordance with paragraph 5.1.3 of the American Standard Insulator Tests, Publication No. C29.1-1961, or the latest revision thereof, equal to or greater than the mechanical load to which they are subjected by conductors, wires, or structures under the loading conditions as specified in Rule 43 with the load and strength factors of Rule 44 applied.

Note: Added January 6, 1968 by Decision No. 73455

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***Original***

**B. Size**

The size and ultimate strength of guys crossing in spans over Class H, L, T or C circuits shall be not less than as specified in Table 9 and shall also be such as to provide safety factors not less than those specified in Rule 44 for the loads imposed by the construction involved under the loading conditions specified in Rule 43.

***Strikeout/underline***

**B. Size**

The size and ultimate strength of guys crossing in spans over Class H, L, T or C circuits shall be not less than as specified in Table 9 and shall also be ~~such as to provide consistent with the load and strength safety~~ factor ~~requirements not less than those~~ specified in Rule 44 for the loads imposed by the construction involved under the loading conditions specified in Rule 43.

***Proposed Final***

**B. Size**

The size and ultimate strength of guys crossing in spans over Class H, L, T or C circuits shall be not less than as specified in Table 9 and shall also be consistent with the load and strength factor requirements specified in Rule 44 for the loads imposed by the construction involved under the loading conditions specified in Rule 43.

***Original***

**49.7 Messengers and Span Wires**

**A. Material**

Messengers and span wires shall be stranded and of galvanized steel, copper-covered steel or other corrosion-resisting material not subject to rapid deterioration.

**B. Strength**

Messengers and span wires shall be capable of withstanding, with safety as specified in Rule 44, the tension developed because of the load they support combined with the loading conditions specified in Rule 43. An allowance of 300 lbs. of vertical load for a worker and cable chair shall be made in computing tensions in messengers and span wires which support cables except in the case of short spans which are not required to support workers or where the ice loading specified in Rule 43.1-B would exceed the allowance for the worker and cable chair.

Guys supporting messenger loads shall comply with the safety factors specified in Rule 44.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**C. Supports**

Messengers supporting cables shall be attached to poles or crossarms with hardware that complies with the safety factors specified in Rule 44, based on the weight of the messenger wire, cable, line-mounted equipment plus an allowance of 300 lbs. for a worker and cable chair. If in heavy loading areas the specified ice load exceeds in weight the 300 lbs. allowance, such ice load shall be used in making the calculations in preference to the weight of the worker and cable chair.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**D. Replacements (See Rule 44.3)**

Strikeout/underline

**49.7 Messengers and Span Wires**

**A. Material**

Messengers and span wires shall be stranded and of galvanized steel, copper-covered steel or other corrosion-resisting material not subject to rapid deterioration.

**B. Strength**

Messengers and span wires with the load and strength factor requirements as specified in Rule 44 applied shall be capable of withstanding ~~with safety factors as specified in Rule 44,~~ the tension developed because of the load they support combined with the loading conditions specified in Rule 43. An allowance of 300 lbs. of vertical load for a worker and cable chair shall be made in computing tensions in messengers and span wires which support cables except in the case of short spans which are not required to support workers or where the ice loading specified in Rule 43.1-B would exceed the allowance for the worker and cable chair.

Guys supporting messenger loads shall comply with the load and strength safety factors requirements specified in Rule 44.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**C. Supports**

Messengers supporting cables shall be attached to poles or crossarms with hardware that complies with the safety load and strength factors requirements specified in Rule 44, based on the weight of the messenger wire, cable, line-mounted equipment plus an allowance of 300 lbs. for a worker and cable chair. If in heavy loading areas the specified ice load exceeds in weight the 300 lbs. allowance, such ice load shall be used in making the calculations in preference to the weight of the worker and cable chair.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**D. Replacements (See Rule 44.3)**

*Proposed Final*

**49.7 Messengers and Span Wires**

**A. Material**

Messengers and span wires shall be stranded and of galvanized steel, copper-covered steel or other corrosion-resisting material not subject to rapid deterioration.

**B. Strength**

Messengers and span wires with the load and strength factor requirements specified in Rule 44 applied shall be capable of withstanding the tension developed because of the load they support combined with the loading conditions specified in Rule 43. An allowance of 300 lbs. of vertical load for a worker and cable chair shall be made in computing tensions in messengers and span wires which support cables except in the case of short spans which are not required to support workers or where the ice loading specified in Rule 43.1-B would exceed the allowance for the worker and cable chair.

Guys supporting messenger loads shall comply with the load and strength factor requirements specified in Rule 44.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**C. Supports**

Messengers supporting cables shall be attached to poles or crossarms with hardware that complies with the load and strength factor requirements specified in Rule 44, based on the weight of the messenger wire, cable, line-mounted equipment plus an allowance of 300 lbs. for a worker and cable chair. If in heavy loading areas the specified ice load exceeds in weight the 300 lbs. allowance, such ice load shall be used in making the calculations in preference to the weight of the worker and cable chair.

Note: Revised February 5, 2014 by Decision No. 14-02-015.

**D. Replacements (See Rule 44.3)**

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**Attachment 4**

**Supplemental LRFD Proposed Rule Changes submitted in SCE Reply**

**ATTACHMENT A**

**Associated Rule Changes related to Rule 44 (Safety Factors) and LRFD Proposed Rule Changes**

<b>Associated Rule Change</b>	<b>GO 95 Rule</b>	<b>Title</b>	<b>Page</b>
1	12.1-C	Construction and Reconstruction of Lines	2
2	12.2	Maintenance of Lines	3
3	12.3	Lines Constructed Prior to This Order	4
4	34	Foreign Attachments	5
5	54.5	Sags	6
6	56.5	Overhead Guys, Anchor Guys and Span Wires	7
7	57.2	Use of Messenger	8
8	66	Guys	9
9	77.3	Material and Strength	10
10	84.5	Sags	11
11	86.2	Use	12
12	87.2	Use of Messenger	13
13	87.5	Fastenings	14
14	94.3	General Requirements	15
15	Appx. C	Conductor Sags	16

## Associated Rule Change 1

### 12.1 Construction and Reconstruction of Lines

#### C Subordinate Element

##### Original Rule

An element (such as a crossarm or a conductor) added to a pole, tower or structure shall meet all requirements of these rules but does not require any change in like elements already existing except where the added element is related in buck arm construction to an existing arm in which case all construction on the related arms shall meet the requirements of these rules. A crossarm, pole, tower or other structure to which any subordinate element is added shall meet the strength safety factor requirements specified in Rule 44.3.

##### Strikeout/Underline

#### C Subordinate Element

An element (such as a crossarm or a conductor) added to a pole, tower or structure shall meet all requirements of these rules but does not require any change in like elements already existing except where the added element is related in buck arm construction to an existing arm in which case all construction on the related arms shall meet the requirements of these rules. A crossarm, pole, tower or other structure to which any subordinate element is added shall meet the ~~strength safety factor~~ requirements specified in Rule 44.3.

##### Proposed Final Rule

#### C Subordinate Element

An element (such as a crossarm or a conductor) added to a pole, tower or structure shall meet all requirements of these rules but does not require any change in like elements already existing except where the added element is related in buck arm construction to an existing arm in which case all construction on the related arms shall meet the requirements of these rules. A crossarm, pole, tower or other structure to which any subordinate element is added shall meet the requirements specified in Rule 44.3.

## Associated Rule Change 2

### Original Rule

#### 12.2 Maintenance of Lines

All lines and portions of lines shall be maintained in such condition as to provide safety factors not less than those specified in Rule 44.3. Lines and portions of lines constructed or reconstructed on or after the effective date of this Order shall be kept in conformity with the requirements of this Order. The restoration of clearance originally established prior to the effective date of this Order, where the original clearance has been reduced by additional sagging or other causes, is not considered to be reconstruction and the reestablished clearance shall conform to the requirements of the rules in effect at the time the original clearance was established. The changing of clearance for any other purpose is reconstruction and clearances so changed shall comply with the rules of this Order applicable to reconstruction.

### Strikeout/Underline

#### 12.2 Maintenance of Lines

All lines and portions of lines shall be maintained in such condition as to ~~provide safety factors not less than those~~ meet the requirements specified in Rule 44.3. Lines and portions of lines constructed or reconstructed on or after the effective date of this Order shall be kept in conformity with the requirements of this Order. The restoration of clearance originally established prior to the effective date of this Order, where the original clearance has been reduced by additional sagging or other causes, is not considered to be reconstruction and the reestablished clearance shall conform to the requirements of the rules in effect at the time the original clearance was established. The changing of clearance for any other purpose is reconstruction and clearances so changed shall comply with the rules of this Order applicable to reconstruction.

### Proposed Final Rule

#### 12.2 Maintenance of Lines

All lines and portions of lines shall be maintained in such condition as to meet the requirements specified in Rule 44.3. Lines and portions of lines constructed or reconstructed on or after the effective date of this Order shall be kept in conformity with the requirements of this Order. The restoration of clearance originally established prior to the effective date of this Order, where the original clearance has been reduced by additional sagging or other causes, is not considered to be reconstruction and the reestablished clearance shall conform to the requirements of the rules in effect at the time the original clearance was established. The changing of clearance for any other purpose is reconstruction and clearances so changed shall comply with the rules of this Order applicable to reconstruction.

## Associated Rule Change 3

### Original Rule

#### 12.3 Lines Constructed Prior to This Order

The requirements of this Order, other than the safety factor requirements specified in Rule 12.2, do not apply to lines or portions of lines constructed or reconstructed prior to the effective date of this Order. In all other particulars, such lines or portions of lines shall conform to the requirements of the rules in effect at the time of their construction or reconstruction. Lines or portions of lines constructed or reconstructed before July 1, 1942, may conform to and be maintained in accordance with the requirements of this Order, instead of the requirements in effect at the time of such construction or reconstruction.

### Strikeout/Underline

#### 12.3 Lines Constructed Prior to This Order

The requirements of this Order, other than the ~~safety factor~~ requirements specified in Rule 12.2, do not apply to lines or portions of lines constructed or reconstructed prior to the effective date of this Order. In all other particulars, such lines or portions of lines shall conform to the requirements of the rules in effect at the time of their construction or reconstruction. Lines or portions of lines constructed or reconstructed before July 1, 1942, may conform to and be maintained in accordance with the requirements of this Order, instead of the requirements in effect at the time of such construction or reconstruction.

### Proposed Final Rule

#### 12.3 Lines Constructed Prior to This Order

The requirements of this Order, other than the requirements specified in Rule 12.2, do not apply to lines or portions of lines constructed or reconstructed prior to the effective date of this Order. In all other particulars, such lines or portions of lines shall conform to the requirements of the rules in effect at the time of their construction or reconstruction. Lines or portions of lines constructed or reconstructed before July 1, 1942, may conform to and be maintained in accordance with the requirements of this Order, instead of the requirements in effect at the time of such construction or reconstruction.

## Associated Rule Change 4

### Original Rule

#### 34 Foreign Attachments

##### G. Guying

Where mechanical loads imposed on poles or structures exceed safety factors as specified in Rule 44, or at the request of the granting authority, additional strength shall be provided by the use of guys or other suitable construction. When guying is required, refer to Rules 56 and 86 for applicable requirements.

54.5

### Strikeout/Underline

#### 34 Foreign Attachments

##### G. Guying

Where the effects of the mechanical loads imposed on poles or structures exceed ~~safety factors~~ the strength factors requirements as specified in Rule 44, or at the request of the granting authority, additional strength shall be provided by the use of guys or other suitable construction. When guying is required, refer to Rules 56 and 86 for applicable requirements.

### Proposed Final

#### 34 Foreign Attachments

##### G. Guying

Where the effects of the mechanical loads imposed on poles or structures exceed the strength requirements as specified in Rule 44, or at the request of the granting authority, additional strength shall be provided by the use of guys or other suitable construction. When guying is required, refer to Rules 56 and 86 for applicable requirements.

## Associated Rule Change 5

### Original Rule

#### 54.5 Sags

Minimum conductor sags shall be such that, under the loading conditions specified in Rule 43, the safety factor specified in Table 4, Rule 44 shall be met. See Charts in Appendix C for suggested sags at normal temperatures.

### Strikeout/Underline

#### 54.5 Sags

Minimum conductor sags shall be such that, under the loading conditions specified in Rule 43, the ~~safety factor requirements~~ specified in ~~Table 4~~, Rule 44 shall be met. See Charts in Appendix C for suggested sags at normal temperatures.

### Proposed Final Rule

#### 54.5 Sags

Minimum conductor sags shall be such that, under the loading conditions specified in Rule 43, the requirements specified in Rule 44 shall be met. See Charts in Appendix C for suggested sags at normal temperatures.

## Associated Rule Change 6

### Original Rule

#### 56 Overhead Guys, Anchor Guys and Span Wires

56.2 Use Where mechanical loads imposed on poles, towers, or structures are greater than can be supported with safety factors as specified in Rule 44, additional strength shall be provided by the use of guys or other suitable construction.

Where guys are used with poles or similar structures capable of considerable deflection before failure, the guys shall be able to support the entire load, the pole below the point of guy attachment acting merely as a strut.

Guys shall be attached to structures, as nearly as practicable, at the center of load. They shall be maintained taut and of such strength as to meet the safety factors of Rule 44.

### Strikeout/Underline

#### 56 Overhead Guys, Anchor Guys and Span Wires

56.2 Use Where mechanical loads imposed on poles, towers, or structures are greater than can be supported with ~~safety factors as~~ the requirements specified in Rule 44, additional strength shall be provided by the use of guys or other suitable construction.

Where guys are used with poles or similar structures capable of considerable deflection before failure, the guys shall be able to support the entire load, the pole below the point of guy attachment acting merely as a strut.

Guys shall be attached to structures, as nearly as practicable, at the center of load. They shall be maintained taut and of such strength as to meet the ~~safety factors~~ requirements of Rule 44.

### Proposed Final Rule

#### 56 Overhead Guys, Anchor Guys and Span Wires

56.2 Use Where mechanical loads imposed on poles, towers, or structures are greater than can be supported with the requirements specified in Rule 44, additional strength shall be provided by the use of guys or other suitable construction.

Where guys are used with poles or similar structures capable of considerable deflection before failure, the guys shall be able to support the entire load, the pole below the point of guy attachment acting merely as a strut.

Guys shall be attached to structures, as nearly as practicable, at the center of load. They shall be maintained taut and of such strength as to meet the requirements of Rule 44.

**Attachment 5**

**Presentation, Development of Proposed LRFD Load / Strength Factors**

**GO 95**

# **Overhead Electric Line Construction**

Current

**Allowable Strength Design (ASD)**

(aka Working Stress Design (WSD) and Allowable Stress Design)

Proposed

**Load & Resistance\* Factor Design (LRFD)**

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\*“Resistance” = “Strength”

# Summary of Current and Proposed Approaches

## **ASD:**

Strength\* / Load Effects  $\geq$  Minimum Safety Factor  
(Safety Factors  $\geq 1.0$ )

## **LRFD:**

Load Effects x Load Factor  $\leq$  Strength x Strength Factor  
(Load Factors  $\geq 1.0$ , Resistance Factors  $\leq 1.0$ )

*PREMISE FOR LRFD PROPOSAL: Implementation of LRFD and the proposed load and resistance (aka strength) factors will yield the same design results as the minimum safety factors currently included in GO 95.*

\*The terms “Strength” and “Resistance” can be used interchangeably in this context.

# Current Safety Factors

Table 4: Minimum Safety Factors

Line Element	Grades of Construction		
	Grade "A"	Grade "B"	Grade "C"
Conductors, splices and conductor fastenings (other than tie wires)	2	2	2
Pins	2	2	2
Pole line hardware	2	2	2
Line Insulators (mechanical)	3	2	2
Guy insulators (mechanical)			
Interlocking	2	2	2
Noninterlocking glass fiber	3	2 (a)	2 (b)
Guys	2	2	2
Messengers and span wires	2	2	2
Foundations against uplift	1.5	1.5	1.5
Foundations against depression	3	2	2
Poles Towers and Structures			
Wood	4	3	2
Metal (including elements of foundations)	1.5 (c)	1.25 (c)	1.25 (c)
Reinforced concrete	4	3	3
Prestressed or post-tensioned concrete	1.8	1.5	1.5
Other engineered materials	1.5	1.25	1.25
Crossarms			
Wood	2	2	2
Metal	1.5(c)	1.25(c)	1.25(c)
Prestressed Concrete	1.8	1.5	1.5
Other engineered materials	1.5	1.25	1.25

# Proposed Load and Strength Factors

**Table 4-1: Minimum Load Factors**

Load Condition	Load Factors		
	"Grade A"	"Grade B"	"Grade C"
Vertical Loads	1.5	1.25	1.25
Wind Loads	1.5	1.25	1.25
Wire Tension Loads	1.5	1.25	1.25

**Table 4-2: Maximum Strength Factors**

Line Element	Strength Factors		
	"Grade A"	"Grade B"	"Grade C"
Conductors, splices and conductor fastenings (other than tie wires)	.75	.62	.62
Pins	.75	.62	.62
Pole line hardware	.75	.62	.62
Line Insulators (mechanical)	.5	.62	.62
<b>Guy insulators (mechanical)</b>			
Interlocking	.75	.62	.62
Noninterlocking glass fiber	.5	.62 (a)	.62(b)
Guys	.75	.62	.62
Messengers and span wires	.75	.62	.62
Foundations against uplift	1.0	.83	.83
Foundations against depression	.5	.62	.62
<b>Poles, Towers and Structures</b>			
Wood	.375	.415	.625
Metal (including elements of foundations)	1.0(c)	1.0(c)	1.0(c)
Reinforced concrete	.37	.41	.41
Prestressed or post-tensioned concrete	.83	.83	.83
Other engineered materials	1.0	1.0	1.0
<b>Crossarms</b>			
Wood	.75	.62	.62
Metal	1.0(c)	1.0(c)	1.0(c)
Prestressed Concrete	.83	.83	.83
Other engineered materials	1.0	1.0	1.0

# GO 95 Allowable Strength Design (ASD)

$$\text{Strength} / \text{Load Effects} \geq \text{Minimum Safety Factor}$$

SAME TERMS

# Load & Resistance Factor Design (LRFD)

$$\text{Load Effects} \times \text{Load Factor} \leq \text{Strength} \times \text{Strength Factor}$$

or

$$\text{Strength} / \text{Load Effects} \geq \text{Load Factor} / \text{Strength Factor}$$

Thus, for the current proposal

effective “Minimum Safety Factor” = Load Factor / Strength Factor

# Selection of Load and Strength Factors

- 1) Load factors are the same for all loads within the same Grade of Construction.

**Table 4-1: Minimum Load Factors**

Load Condition	Load Factors		
	"Grade A"	"Grade B"	"Grade C"
Vertical Loads	1.5	1.25	1.25
Wind Loads	1.5	1.25	1.25
Wire Tension Loads	1.5	1.25	1.25

- 2) For each Minimum Safety Factor in Table 4 the Strength Factor for the LRFD proposal (Table 4-2) was determined as follows to provide for consistent design results:

$$\text{Strength Factor} = \text{Load Factor} / \text{Minimum Safety Factor}$$

# Examples to Demonstrate Equivalence

**Load Factor/Strength Factor = Minimum Safety Factor**

- 1) Guys (Grade A)  $1.5/.75 = 2$
- 2) Wood Poles (Grade A)  $1.5/.375 = 4$
- 3) Wood Poles (Grade B)  $1.25/.415 = 3$

Table 4: Minimum Safety Factors

Line Element	Grades of Construction		
	Grade "A"	Grade "B"	Grade "C"
Conductors, splices and conductor fastenings (other than tie wires)	2	2	2
Pins	2	2	2
Pole line hardware	2	2	2
Line Insulators (mechanical)	3	2	2
Guy insulators (mechanical)			
Interlocking	2	2	2
Noninterlocking glass fiber	3	2 (a)	2 (b)
<b>Guys</b>	<b>2</b>	2	2
Messengers and span wires	2	2	2
Foundations against uplift	1.5	1.5	1.5
Foundations against depression	3	2	2
Poles Towers and Structures			
<b>Wood</b>	<b>4</b>	<b>3</b>	2
Metal (including elements of foundations)	1.5 (c)	1.25 (c)	1.25 (c)
Reinforced concrete	4	3	3
Prestressed or post-tensioned concrete	1.8	1.5	1.5

Table 4-1: Minimum Load Factors

Load Condition	Load Factors	
	"Grade A"	"Grade B"
Vertical Loads	1.5	1.25
Wind Loads	1.5	1.25
Wire Tension Loads	1.5	1.25

Table 4-2: Maximum Strength Factors

Line Element	Strength Factors	
	"Grade A"	"Grade B"
Conductors, splices and conductor fastenings (other than tie wires)	.75	.62
Pins	.75	.62
Pole line hardware	.75	.62
Line Insulators (mechanical)	.5	.62
<b>Guy insulators (mechanical)</b>		
Interlocking	.75	.62
Noninterlocking glass fiber	.5	.62 (a)
Guys	.75	.62
Messengers and span wires	.75	.62
Foundations against uplift	1.0	.83
Foundations against depression	.5	.62
<b>Poles, Towers and Structures</b>		
Wood	.375	.415
Metal (including elements of foundations)	1.0(c)	1.0(c)
Reinforced concrete	.37	.41

**Attachment 6**

**List of Workshop Attendees**

## Attachment 6: Attendee List

Linda McLean, ExteNet Systems

Fadi Daye, CPUC/SED

Josh Alvarado, AT&T

Kevin Galloway, SDGE

Grant Guerra, PG&E

Tom Chou, BVES

Herman Eng, CPUC/Safety Analysis

Jerome Candelaria, CalBroadband

Ryan Lindsay, Charter

Kyle Bross, PG&E

Justin Wynne, CMUA

Gallardo, Enrique, CPUC, Legal

Randy Hopkins, PG&E

Bill Greenlaw, Sonic Telecom

Jed Gibson, for Bear Valley Electric Service, Liberty Utilities, and PacifiCorp

Darion Johnston, Coalition of California Utility Employees

Tyler Chamberlain, PacifiCorp

Brian Botteri, Sonic Telecom

Kris Bourbois, SDG&E

Mike Forchette, SDG&E

Josh Castillo, SDG&E

Kevin Galloway, SDG&E

Jason Aguas, Comcast

Marco Montoya, ExteNet Systems

Ana Gonzalez, PG&E

Zankel, Zeb C., for Charter Communications

Sweat, Henry, SPD/CPUC

Aaron George, for Charter Communications

Brian Thomas, Crown Castle

Steve Bowen, for Sonic Telecom

Jane Whang, Verizon

Nima Shirkhani, PG&E

Fisher, Arthur "Iain", Cal Advocates

Andy Stewart, EDM

Larry Slavin

Kris Vyas, SCE

Mel Stark, SCE

Sam Stonerock, SCE (facilitator)