

BICSI G2.1-22

**ICT Outside Plant Construction
and Installation: Pole Setting,
Anchoring, and Guying**



BICSI G2.1-22

ICT Outside Plant Construction and Installation: Pole Setting, Anchoring, and Guying

Committee Approval: January 21, 2019

First Published: July 21, 2022



This page intentionally left blank

Currently in preview, click buy full versi

BICSI International Standards

BICSI international standards contain information deemed to be of technical value to the industry and are published at the request of the originating committee. The BICSI International Standards Program subjects all of its draft standards to a rigorous public review and comment resolution process, which is a part of the full development and approval process for any BICSI international standard.

The BICSI International Standards Program reviews its standards at regular intervals. By the end of the fifth year after a standard's publication, the standard will be reaffirmed, rescinded, or revised according to the submitted updates and comments from all interested parties.

Suggestions for revision should be directed to the BICSI International Standards Program, care of BICSI.

Copyright

This BICSI document is a standard and is copyright protected. Except as permitted under the applicable laws of the user's country, neither this BICSI standard nor any extract from it may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, photocopying, recording, or otherwise, without prior written permission from BICSI being secured.

Requests for permission to reproduce this document should be addressed to BICSI.

Reproduction may be subject to royalty payments or a licensing agreement.

Violators may be prosecuted.

Published by:



BICSI
8610 Hidden River Parkway
Tampa, FL 33637-1000 USA

Copyright © 2022 BICSI
All rights reserved
Printed in U.S.A.

Notice of Disclaimer and Limitation of Liability

BICSI standards and publications are designed to serve the public interest by offering information communication and technology systems design guidelines and best practices. Existence of such standards and publications shall not in any respect preclude any member or nonmember of BICSI from manufacturing or selling products not conforming to such standards and publications, nor shall the existence of such standards and publications preclude their voluntary use whether the standard is to be used either domestically or internationally.

By publication of this standard, BICSI takes no position respecting the validity of any patent rights or copyrights asserted in connection with any item mentioned in this standard. Additionally, BICSI does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the standard or publication. Users of this standard are expressly advised that determination of any such patent rights or copyrights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard does not purport to address all safety issues or applicable regulatory requirements associated with its use. It is the responsibility of the user of this standard to review any existing codes and other regulations recognized by the national, regional, local, and other recognized authorities having jurisdiction (AHJ) in conjunction with the use of this standard. Where differences occur, those items listed within the codes or regulations of the AHJ supersede any requirement or recommendation of this standard.

All warranties, express or implied, are disclaimed, including without limitation, any and all warranties concerning the accuracy of the contents, its fitness or appropriateness for a particular purpose or use, its merchantability and its non-infringement of any third party's intellectual property rights. BICSI expressly disclaims any and all responsibilities for the accuracy of the contents and makes no representations or warranties regarding the content's compliance with any applicable statute, rule, or regulation.

BICSI shall not be liable for any and all damages, direct or indirect, arising from or relating to any use of the contents contained herein, including without limitation, and all indirect, special, incidental, or consequential damages (including damages for loss of business, loss of profits, litigation, or the like), whether based upon breach of contract, breach of warranty, tort (including negligence), product liability or otherwise, even if advised of the possibility of such damages. The foregoing negation of damages is a fundamental element of the use of the contents hereof, and these contents would not be published by BICSI without such limitations.

Table Of Contents

Preface	xv
1 Introduction	1
1.1 Purpose.....	1
1.1 Categories of Criteria.....	1
2 Scope	1
3 Required Standards and Documents	3
4 Definitions, Acronyms, Abbreviations, and Units of Measurement	5
4.1 Definitions	5
4.2 Acronyms and Abbreviations.....	8
4.3 Units of Measurement.....	8
5 Pole Setting	9
5.1 Overview	9
5.2 Grades of Pole for Pole Line Construction	9
5.2.1 Overview	9
5.2.2 Requirements.....	9
5.3 Location of Poles.....	9
5.4 Diameter and Depth of Holes	9
5.4.1 Diameter of Holes.....	9
5.4.2 Depth of Pole Holes.....	9
5.4.3 Frozen Soil.....	11
5.5 Digging Holes.....	13
5.5.1 Digging Holes with Hand Tools.....	13
5.5.2 Boring Holes with an Earth Boring Machine	13
5.5.3 Water Jet.....	13
5.5.4 Explosives.....	13
5.6 Methods of Raising and Setting Poles.....	14
5.6.1 Overview	14
5.6.2 Pole Derrick Method	14
5.6.3 Pike Pole Method	14
5.6.4 Gin Pole Method	17
5.6.5 A-Frame Method of Raising and Setting Poles	19
5.7 Backfilling and Tamping	21
5.7.1 Requirements.....	21
5.7.2 Expanding Polymer Backfill Material for Utility Poles.....	21
5.8 Pole Footings.....	23
5.8.1 Plank Footings for Line Poles.....	23
5.8.2 Footings for Catenary Span Poles.....	23
5.8.3 Platform Supports and Plank Bracing.....	23
5.8.4 Platform Supports with Side Guys	25

5.9	Ground Braces	25
5.9.1	Log Brace.....	25
5.9.2	Plank Ground Brace.....	26
5.9.3	Concrete Ground Brace.....	27
5.9.4	Pole Key Anchor.....	28
5.10	Installing Pole Markers, Tags, and Birthmarks	29
5.10.1	Pole Markers and Tags.....	29
5.10.2	Pole Birthmarks.....	30
5.10.3	Making a Marker.....	30
5.11	Pole Rake	31
5.11.1	Dead-end Corner Poles and Stubs.....	31
5.11.2	Ground-braced Guy Stubs.....	31
5.11.3	Push-braced Poles.....	31
6	Attachments	33
6.1	Introduction	33
6.2	Attachments and Applications	33
6.2.1	Pole Attachments.....	33
7	Anchors	35
7.1	Types of Anchors	35
7.1.1	Introduction.....	35
7.2	Selecting Anchors and Anchor Rods	36
7.2.1	Introduction.....	36
7.2.2	Soil Classes.....	36
7.2.3	Anchor Types for Soil Classes.....	36
7.2.4	Anchor Size.....	37
7.2.5	Anchor Rods.....	38
7.3	Installation of Guy Anchors	41
7.3.1	Installation of Cone Anchors.....	41
7.3.2	Installation of Expanding Earth Anchors.....	41
7.3.3	Installation of Expanding Rock Anchors.....	43
7.3.4	Installation of Plate Anchors.....	44
7.3.5	Installation of Small Screw Anchors.....	45
7.3.6	Installation of Swamp Screw Anchors.....	45
7.3.7	Installation of Crossplate Anchors.....	45
7.3.8	Installation of Log Anchors.....	47
7.3.9	Installation of Precast Concrete Anchors.....	49
7.3.10	Installation of Cast-In-Place Concrete Anchors.....	49
7.3.11	Installation of Formast Anchors.....	50
8	Guys	51
8.1	Introduction	51
8.1.1	Anchor Guys.....	51
8.1.2	Pole-to-Stub (Stub) Guys.....	51
8.1.3	Pole-to-Pole Guys.....	52
8.1.4	Side-walk Guys.....	52
8.1.5	Long-span Suspension Guys.....	52
8.2	Guy Sizing	53
8.2.1	Lead-to-Height Ratio.....	53
8.2.2	Guy Rule.....	53
8.2.3	Determining Guy Size.....	54

8.3	Guy Placement	55
8.3.1	General Rules for Guying Pole Lines.....	55
8.3.2	Guying Corners.....	56
8.3.3	Guying a Dead-end Pole.....	59
8.3.4	Storm Side and Storm Head Guys.....	59
8.4	Positions of Guys on Poles and Stubs	60
8.4.1	Guy Positions at Deadends.....	60
8.4.2	Guy Positions at Corners.....	62
8.5	Securing Guys	65
8.5.1	Introduction.....	65
8.5.2	Strand Vises.....	65
8.5.3	Strand Grips.....	66
8.5.4	Bolt-Type Strand Clamps.....	70
8.6	Attaching Guys	70
8.6.1	Eyebolt Method.....	70
8.6.2	Guy Hook Method.....	74
8.7	Tensioning Guys to Anchors and Stubs	76
8.7.1	Introduction.....	76
8.7.2	Strand Grip.....	76
8.7.3	Strand Vise.....	79
8.7.4	Retensioning.....	80
8.8	Guy Shields	81
8.8.1	Introduction.....	81
8.8.2	Installation of Guy Shields.....	81
8.9	Special Circumstances	81
9	Grounding and Isolating Exposed Guys	83
9.1	Overview	83
9.2	Grounding Guys	83
9.2.1	Types of Grounds for Exposed Guys.....	83
9.2.2	Methods of Grounding Exposed Guy.....	83
9.3	Isolating Guys	84
9.3.1	Selection of Strain Insulators.....	84
9.3.2	Location of Strain Insulators on Exposed Guys.....	84
9.3.3	Installing a Strain Insulator.....	87
9.4	Protecting Poles Against Lightning	87
9.4.1	Overview.....	87
9.4.2	Installation of Lightning Protection on Poles.....	87
10	Pole Braces	89
10.1	Introduction	89
10.2	Requirements	89
10.3	Length of Braces	89
10.4	Calculating Individual Brace Length	89
10.5	Position of Pole Braces	90
10.6	Installation of Pole Braces	91
10.6.1	Single Push Brace.....	91
10.6.2	Double Pole Braces.....	91
10.6.3	Push-and-Pull Braces.....	91
Appendix A	Related Documents	93

This page intentionally left blank

Currently in preview, click buy full version

Index Of Figures

Section 5	Pole Setting	
Figure 5-1	Typical Settings of Poles in Permafrost	12
Figure 5-2	Raising Medium Weight Pole with Pike Poles.....	15
Figure 5-3	Raising Heavy Poles – Initial Stage	16
Figure 5-4	Raising Heavy Poles – Final Stages.....	17
Figure 5-5	Raising a Pole – Gin Pull Method.....	18
Figure 5-6	A-Frame Pole Raising Preparation.....	19
Figure 5-7	Setting an A-Frame	20
Figure 5-8	Raising the Pole After A-Frame Removed.....	20
Figure 5-9	Expanding Polymer Backfill 1	22
Figure 5-10	Expanding Polymer Backfill 2	22
Figure 5-11	Expanding Polymer Backfill 3	22
Figure 5-12	Expanding Polymer Backfill 4	22
Figure 5-13	Expanding Polymer Backfill 5	22
Figure 5-14	Platform Pole Support.....	24
Figure 5-15	Platform Joist and Cross Plank Detail.....	25
Figure 5-16	Log Brace.....	25
Figure 5-17	Plank Ground Brace	26
Figure 5-18	Poured-in-place Concrete Ground Brace	27
Figure 5-19	Installing Pole Key Anchor.....	28
Figure 5-20	Example of Pole Identification.....	29
Figure 5-21	Examples of Aluminum Pole Rake Shapes.....	30
Figure 5-22	Example of Pole Rake on Corner Pole.....	31
Section 7	Anchors	
Figure 7-1	Expanding Earth Anchors	42
Figure 7-2	Expanding Earth Anchor in a Vertical Hole.....	42
Figure 7-3	Installation of an Expanding Rock Anchor	43
Figure 7-4	Locating the Plate Anchor Hole	44
Figure 7-5	Crosspiece Plank Anchor Installation	46
Figure 7-6	Anchor Log in Line with the Guy	48
Figure 7-7	Anchor Logs Reinforce by Crosspiece Logs.....	49
Figure 7-8	Installation of Cast-in Place Concrete Anchor	50
Section 8	Guys	
Figure 8-1	Pole-to-Stub Guy.....	51
Figure 8-2	Pole-to-Pole Guy.....	52
Figure 8-3	Example of a Sidewalk Guy.....	52
Figure 8-4	Examples of Leads and Heights	53
Figure 8-5	Example of a Guy Rule	54
Figure 8-6	Example of a Pull Finder.....	56
Figure 8-7	Measuring Pull and Locating Guys for a Corner Pull	57

Figure 8-8	Example of an In-Line Reverse Corner	58
Figure 8-9	Examples of Storm Guying	59
Figure 8-10	Supporting Two Suspension Strands with One Guy Wire.....	60
Figure 8-11	Supporting Two Suspension Strands with Three Guy Wires	61
Figure 8-12	Guying Attachment for a False Deadend.....	61
Figure 8-13	Examples of One Guy Corner Pole, less than 15 m (50 ft) pull	62
Figure 8-14	Corner Pull Guy, Cables in Opposition	63
Figure 8-15	Corner Pole Guy with Thimble Eyes.....	63
Figure 8-16	Corner Pole Guy for Suspension Strands on Same Side on the Pole.....	63
Figure 8-17	Examples of Two Guys for Two Strands	64
Figure 8-18	Corner Pole, Side and Head Guys	64
Figure 8-19	Guying a Deadend from Two Directions.....	65
Figure 8-20	Example of a Strand Vise Assembly	65
Figure 8-21	Completed Strand Vise on an Eyebolt.....	66
Figure 8-22	Example of a Strand Grip	67
Figure 8-23	Tensioned Strand for Strand Grip Installation.....	68
Figure 8-24	Placing the Strand Grip	68
Figure 8-25	Wrapping the First Leg.....	69
Figure 8-26	Wrapping the Second Leg	69
Figure 8-27	Both Legs Partially Wrapped	69
Figure 8-28	Splitting the Shorter Leg	70
Figure 8-29	Example of an Eyebolt Installation for 16M Strand or Smaller	72
Figure 8-30	Example of an Eyebolt Installation for 25M Strand	73
Figure 8-31	Example of a S Eyebolt Installation	73
Figure 8-32	Example of a Guy Hook	74
Figure 8-33	Example of a Completed Guy Hook Installation.....	74
Figure 8-34	Strand Vise Installation on a Guy Hook.....	75
Figure 8-35	Strand Grip Installation on a Guy Hook.....	75
Figure 8-36	Set Up for Guy Tensioning.....	76
Figure 8-37	Measuring the Terminating Point of the Guy Strand.....	77
Figure 8-38	Wrapping Legs Around the Strand.....	77
Figure 8-39	Legs Applied to Crossover Points	78
Figure 8-40	Pole-to-Stub Installation	78
Figure 8-41	Guy Assembled Hand-Tight.....	79
Figure 8-42	Tensioning Guy Using Pulling Eye or Pulling Hook	79
Figure 8-43	Tensioning Pole-to-Stub Using a Fabric Sling	80
Figure 8-44	Tensioning Pole-to-Stub Using a Pulling Hook	80
Figure 8-45	Example of a Guy Shield.....	81

Section 9	Grounding and Isolating Exposed Guys	
Figure 9-1	Example of Grounding a Guy to Strand.....	83
Figure 9-2	Grounding Suspension Strand to Ground Rod.	84
Figure 9-3	Example of a Single Fin Type Insulator.....	85
Figure 9-4	Insulating Guys in a Zone of Exposure (Voltages Less than 18,000)	85
Figure 9-5	Insulating Guys in a Zone of Exposure (Voltages Exceeding 18,000).....	86
Figure 9-6	Insulating Guys for Attachment Above Power Conductors	86
Figure 9-7	Lightning Protection Wire on an Unguyed Aerial Cable Pole	87
Figure 9-8	Lightning Protection Wire on an Anchored Guyed Cable Pole, Guy Above Cable Strand	88
Figure 9-9	Lightning Protection Wire on an Anchored Guyed Cable Pole, Guy Below Cable Strand.....	88
Section 10	Pole Braces	
Figure 10-1	Method of Measuring Pole Brace Length	90
Figure 10-2	Single Push Brace Installation.....	91

This page intentionally left blank

Index Of Tables

Section 5	Pole Setting	
Table 5-1	Typical Depth of Hold in Firm Ground or Solid Rock.....	10
Table 5-2	Minimum Hole Depths for Poles When Solid Rock is Below Ground Level (Up to 2m [6.5 ft])..	10
Table 5-3	Minimum Hole Depths for Poles When Solid Rock is Below Ground Level (Over 2m [6.5 ft])...	11
Table 5-4	Typical Lumber Requirements for Platform Supports and Plant Braces.....	24
Table 6-1	Pole Attachments and Applications	33
Section 7	Anchors	
Table 7-1	Recommended Anchor Types for Different Soil Classes.....	36
Table 7-2	Anchor Size Groups	37
Table 7-3	Anchor Rod Sizes Associated with Different Anchors	38
Table 7-4	Anchor and Anchor Rod Sizes for Guy Strands (Metric)	39
Table 7-5	Anchor and Anchor Rod Sizes for Guy Strands (Imperial).....	40
Table 7-6	Plate Anchor Rod Lengths (Metric and Imperial).....	44
Table 7-7	Anchor Log and Rod Sizing (Metric).....	47
Table 7-8	Anchor Log and Rod Sizing (Imperial).....	48
Section 8	Guys	
Table 8-1	Head Guy Sizing for Three or Less Spans	55
Table 8-2	Maximum Allowable Pull for Unguyed Corners	55
Table 8-3	Size of Head Guy Required on Head and Side Guyed Corner Poles.....	58
Table 8-4	Strand Vise Sizes.....	66
Table 8-5	Strand Grip Color Codes for Galvanized Steel Strand	67
Table 8-6	CR Strand Grip Color Codes for CR Strand	67
Table 8-7	Eyebolt Dimensions.....	71
Table 8-8	Materials for the Eyebolt Method	72
Table 8-9	Guy Hook Bolt Sizing	74
Table 8-10	Size of Chain Hoist Used for Tensioning Guys	76
Section 9	Grounding and Isolating Exposed Guys	
Table 9-1	Mechanical and Dielectrical Strength of Strain Insulators	85
Section 10	Pole Braces	
Table 10-1	Length of Pole Braces	89

This page intentionally left blank

Preface

Revision History

July 21, 2022 First publication of this standard, titled BICSI G2.1-22, *ICT Outside Plant Construction and Installation: Pole Setting, Anchoring, and Guying*

Translation Notice

This standard may have one or more translations available as a reference for the convenience of its readers. As that act of translation may contain inconsistencies with the original text, if differences between the translation and the published English version exist, the English text shall be used as the official and authoritative version.

This page intentionally left blank

1 Introduction

1.1 Purpose

This standard is written to provide a common methodology for the installation and implementation of telecommunication and data cabling, with aerial pathways used within the outside plant (OSP) environment, for varying applications, jurisdictions, and projects.

This standard is intended primarily for, but not limited to:

- OSP cable installers
- OSP project designers and managers
- Construction and installation entities performing aerial OSP cable and pathway activities
- Authorities having jurisdiction (AHJ)

1.1 Categories of Criteria

Two categories of criteria are specified – mandatory and advisory.

- Mandatory criteria generally apply to protection, performance, administration, and compatibility; they specify the absolute minimum acceptable requirements.
- Advisory or desirable criteria are presented when their attainment will enhance the general performance of the component, system, or other element as indicated within all its contemplated applications.

Mandatory requirements are designated by the word *shall*; advisory recommendations are designated by the words *should*, *may*, or *desirable*, which are used interchangeably in this standard. While requirements and recommendations are typically separated to assist in usability, paragraphs or sections may exist where both appear together for context or readability.

Where equivalent local codes and standards exist, requirements from these local specifications shall apply. Where reference is made to a requirement that exceeds minimum code requirements, the specification requirement shall take precedence over any apparent conflict with applicable codes.

2 Scope

This standard applies to the installation of telecommunication cable within aerial pathways. The methods within are written for balanced twisted-pair, optical fiber media, and coaxial cables, including installation methods for poles, supports, and arms within the aerial pathway.

The material found within this standard may not cover all requirements specific to the site or project requirements. Additionally, specific items not covered within this standard include:

- Electrical cabling installation
- Raising of concrete poles
- Maintenance, decommissioning or removal of aerial and underground cabling and its associated pathways
- Installation of electrical protection systems (e.g.: copper cable protection terminals and devices)

NOTICE: This standard does not purport to address all safety issues associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory or other limitations prior to use.