ASME P30.1-2019

(Revision of ASME P30.1-2014)

Planning for Load Handling Activities

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Two Park Avenue • New York, NY • 10016 USA

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FOREWORD

As load handling activities grow in complexity, there is an increased need to develop a set of recognized planning guidelines. While some guidance for planning of load handling activities, also referred to as lift planning, has been available in publications, literature from equipment manufacturers, and in-house procedures of various organizations and companies, there has not been any published comprehensive, broadly authoritative guidance available. The absence of uniform considerations or comprehensive practices has created an uneven range of planning activities.

In 2008, the B30 Standard Committee created a Task Group to consider the feasibility of developing a standard for lift planning. Based upon the report of the Task Group, the B30 Standard Committee favored the creation of a standard but recognized that such a standard would not fit the equipment-based orientation of B30. The American Society of Mechanical Engineers (ASME) and the American National Standards Institute (ANSI) were petitioned to form a committee to develop a lift planning standard.

The formation of the ASME P30 Standards Committee, Planning for the Use of Cranes, Derricks, Hoists, Cableways, Aerial Devices, and Lifting Accessories, was approved by ASME on June 8, 2010, and a Project Initiation Notification System (PINS) was posted in ANSI Standards Action on July 2, 2010. The Committee held its inaugural meeting on September 20, 2010, with the intent to develop a standard that provides guidance on general planning considerations and practices for load handling operations occurring in all industries, so that users could apply the Standard as a template and adapt it to the needs of their specific industry or situation.

The first edition of ASME P30.1 was approved by ANSI on January 14, 2014. The 2019 edition contains changes to Nonmandatory Appendix A, additional guidance on rigging planning and how to establish a limiting wind speed for a load handling activity as part of the lift-planning process.

ASME P30.1-2019 was approved by the P30 Committee and by ASME, and was approved by ANSI and designated as an American National Standard on May 3, 2019.

ASME P30 COMMITTEE
Planning for the Use of Cranes, Derricks, Hoists, Cableways, Aerial Devices, and Lifting Accessories

(The following is the roster of the Committee at the time of approval of this Standard.)

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P30 STANDARD INTRODUCTION

SECTION I: CHARTER FOR P30 — PLANNING FOR THE USE OF CRANES, DERRICKS, HOISTS, CABLEWAYS, AERIAL DEVICES, AND LIFTING ACCESSORIES COMMITTEE

The development and maintenance of standards that support load handling activities where mechanical equipment including, but not limited to, cranes, derricks, hoists, cableways, aerial devices, material lifting accessories, and combinations thereof are used.

(19) **SECTION II: PURPOSE**

The P30 Standard is intended to

(a) prevent or minimize injury, and provide for the protection of life, limb, and property by offering guidance for planning efforts that enhance the safety of load handling activities

(b) provide guidance to work site personnel, equipment owners, employers, users, and others concerned with or responsible for the safety of load handling activities

(c) guide governments and other regulatory bodies in the development, promulgation, and enforcement of appropriate safety directives

SECTION III: USE BY REGULATORY AGENCIES

This Standard may be adopted in whole or in part for governmental or regulatory use. If adopted for governmental use, the references to other codes and standards in this Standard may be changed to refer to the corresponding regulations of the regulatory agency or governmental authorities.

SECTION IV: EFFECTIVE DATE

(a) Effective Date. The effective date of this Standard shall be 1 yr after its date of issuance.

(b) The need to meet the guidelines established in the current edition of this Standard shall be evaluated by a qualified person, and any recommended changes to the user's planning activities shall be made within 1 yr.

SECTION V: REQUIREMENTS AND RECOMMENDATIONS

Requirements of this Standard are characterized by use of the word *shall.* Recommendations of this Standard are characterized by the word *should.*

SECTION VI: REQUESTS FOR REVISION

The P30 Standards Committee will consider requests for revision. Such requests should be directed to

Secretary, P30 Standards Committee
ASME Standards and Certification
Two Park Avenue
New York, NY 10016-5990

SECTION VII: REQUESTS FOR INTERPRETATION (19)

Request for interpretation should preferably be submitted through the online Interpretation Submittal Form. The form is accessible at http://go.asme.org/InterpretationRequest. Upon submittal of the form, the Inquirer will receive an automatic e-mail confirming receipt.

If the Inquirer is unable to use the online form, he/she may mail the request to the

Secretary, P30 Standards Committee
ASME Standards and Certification
Two Park Avenue
New York, NY 10016-5990

SECTION VIII: ADDITIONAL GUIDANCE

Load handling activities addressed by the P30 Standard are subject to hazards that cannot be abated solely through planning. Only by the application of knowledge, care, common sense, and experience can safe load handling activities be anticipated. It is therefore essential that personnel responsible for the planning and implementation of load handling activities are competent, qualified, and trained with the skills to satisfactorily accomplish their assigned tasks.

The P30 Standards Committee recognizes the importance of proper design factors, minimum or maximum dimensions, and other limiting criteria of equipment used in load handling activities. The P30 Committee expects that the equipment used to execute load handling activities meets the requirements of applicable equipment safety standards. The P30 Committee also expects that any recommendations or requirements provided in those standards are interpreted and applied correctly.

ASME P30.1-2019
SUMMARY OF CHANGES

Following approval by the ASME P30 Committee and ASME, and after public review, ASME P30.1-2019 was approved by the American National Standards Institute on May 3, 2019.

ASME P30.1-2019 includes the following changes identified by a margin note, **(19)**.

Page	*Location*	*Change*
vii	Introduction	(1) Section II(a) revised
		(2) Section VII editorially revised
1	1-1	Last paragraph deleted
1	1-2	Definitions of *rigging* added
2	2-1	(1) First paragraph revised
		(2) Subparagraphs (d)(4), (e), (e)(1), (e)(2), and (e)(2)(-g) revised
		(3) Subparagraph (e)(3) redesignated as (e)(2)(-k)
		(4) Subparagraphs (f) through (h) redesignated as (g) through (i), correspondingly, and new (f) added
3	Figure 2-1-1	Revised
6	4-1	Second paragraph revised
7	5-1	Second paragraph revised
7	5-2.3	Title and subpara. (g) revised
8	5-2.6	Subparagraphs (a)(2) and (a)(5)(-c) revised
10	A-1	Revised
10	A-2	Title revised
10	A-2.2	Revised
10	A-2.3.2	Subparagraphs (a) through (c) revised
11	A-2.3.3	Third paragraph and Note deleted
11	A-2.3.4	Added
11	A-2.3.5	Renumbered from A-2.3.4 and revised
11	A-2.3.6	Renumbered from A-2.3.5 and subpara. (b) revised
11	A-2.3.7	Renumbered from A-2.3.6 and second paragraph revised
12	A-3	Added
12	A-4	Added
12	A-5	Added
14	Figure A-1-1	Revised
18	Nonmandatory Appendix B	Added
22	Nonmandatory Appendix C	Added
32	Nonmandatory Appendix D	Former Nonmandatory Appendix B redesignated and revised

Chapter 1
Scope and Definitions

(19) 1-1 SCOPE

This Standard establishes planning considerations and practices that apply to load handling equipment (LHE), other associated equipment, and activities when moving loads vertically or horizontally. The planning guidance contained in this Standard is divided into two categories dependent upon the nature of the load handling activity and the degree of exposure to the issues that impact safety. The categories are designated as standard lift plan and critical lift plan. This Standard does not preclude the user of this Standard from creating subcategories based on their specific load handling activity considerations.

The P30.1 Standard does not exclude any particular equipment or industry. This Standard may not address all of the hazards that could be encountered during a load handling activity. It is the responsibility of the user of this Standard to assess and address the hazards associated with a particular load handling activity.

(19) 1-2 DEFINITIONS

D/d ratio: the ratio between the diameter of curvature, *D*, taken by the sling when in contact with an object and the diameter of the wire rope, synthetic rope, or chain, *d*.

dynamic load: forces introduced into the LHE as a result of change in motion.

lift: to move a load vertically or horizontally with the LHE.

lift director (load handling director): the person designated to direct the load handling activity.

lift plan: information and/or instruction, written or verbal, used in support of a load handling activity.

load handling equipment (LHE): equipment used to move a load vertically or horizontally.

qualified person: a person who, by possession of a recognized degree or certificate of professional standing in an applicable field, or by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

rigging (noun): the components, hardware, and devices used to attach a load to the load handling equipment (LHE).

rigging (verb): the process of attaching a load to the load handling equipment (LHE) by means of components, hardware or devices.

shall: term used to indicate that a rule is mandatory and must be followed.

should: term used to indicate that a rule is a recommendation, the advisability of which depends on the facts in each situation.

Chapter 2
Load Handling Activity Considerations and Plan Categories

(19) 2-1 LOAD HANDLING ACTIVITY CONSIDERATIONS

An evaluation of a proposed load handling activity shall be performed (see Figure 2-1-1). Documentation of the evaluation is not required. It is recommended that the evaluation includes a risk analysis. Useful resources include ISO 31000:2009 and ISO 31010:2009. At a minimum, the load handling category should be determined based on review of the following considerations:

(a) Potential Hazards to Persons

(1) if the load handling activity will involve personnel lifting.

(2) if the load will be moved or suspended over areas accessible to the general public.

(3) if the load contains materials immediately dangerous to life and health.

(4) if load handling personnel will be in locations that may be hazardous during the load handling activity (e.g., pinch points, crush points).

(5) if site personnel other than load handling personnel will be in locations that are hazardous due to the load handling activity. This should include consideration of protection provided by existing structures.

(b) Hazards in Proximity to the Work Area

(1) if the load and/or the LHE can encroach the prohibited zone of power lines

(2) if there is potential for electromagnetic radiation/radio frequency hazard (e.g., loss of communication, electrical discharge, and shock)

(3) if the load handling activity can cause damage to pipes, lines, tanks, equipment, or products that could create an adverse environmental impact

(c) Complexity of Load Handling Activity

(1) if the load has potential for instability during the load handling activity due to the

(-a) design or configuration of the load (e.g., shape, load integrity, and sail area)

(-b) center-of-gravity of the load relative to the established connection points

(-c) load weight shift (e.g., liquid filled, swing arms, and moveable parts)

(2) if the load handling activity uses complex load handling methods

(3) if the load handling activity will be performed in proximity to obstructions or in limited clearance areas, including consideration of clearance between the LHE and the load

(4) if the load is to be manipulated (e.g., turned, rotated, and tilted)

(5) if the LHE travels during the lift

(6) if the load handling activity uses multiple LHE

(7) if the load handling activity is unique to or infrequently performed by the personnel involved

(8) if special means or access for attaching and removing rigging is required

(d) Adverse Impact From Environmental Conditions. If the load handling activity could be adversely impacted by conditions such as

(1) effects of wind on the load and/or LHE (e.g., speed, direction, sustained, and/or gusts)

(2) support for the load, the LHE, or both (e.g., ground, rail, girder, structure, foundation, vessel list, and trim)

(3) ambient temperature (e.g., high, low, and range)

(4) surfaces moving relative to one another (e.g., from land to water, or water to land, or water to water)

(5) visibility (e.g., fog, sun glare, lighting, and obstructions)

(6) precipitation

(7) lightning

(e) LHE Capacity and/or Performance

(1) if the load weight is significant compared to the LHE capacity as configured

(2) if factors, such as the following, have the potential to encroach upon maximum capacity of the LHE, as configured, and/or diminish its performance:

(-a) increased loading due to extraction or removal of a load (e.g., demolition, suction, and friction)

(-b) dynamic loading (e.g., abrupt starting, stopping, acceleration, deceleration, and abrupt load transfer)

(-c) line pull

(-d) brake/clutch/pump settings and/or conditions

(-e) accuracy of load weight information/determination

(-f) site conditions as outlined in para. 5-2.6

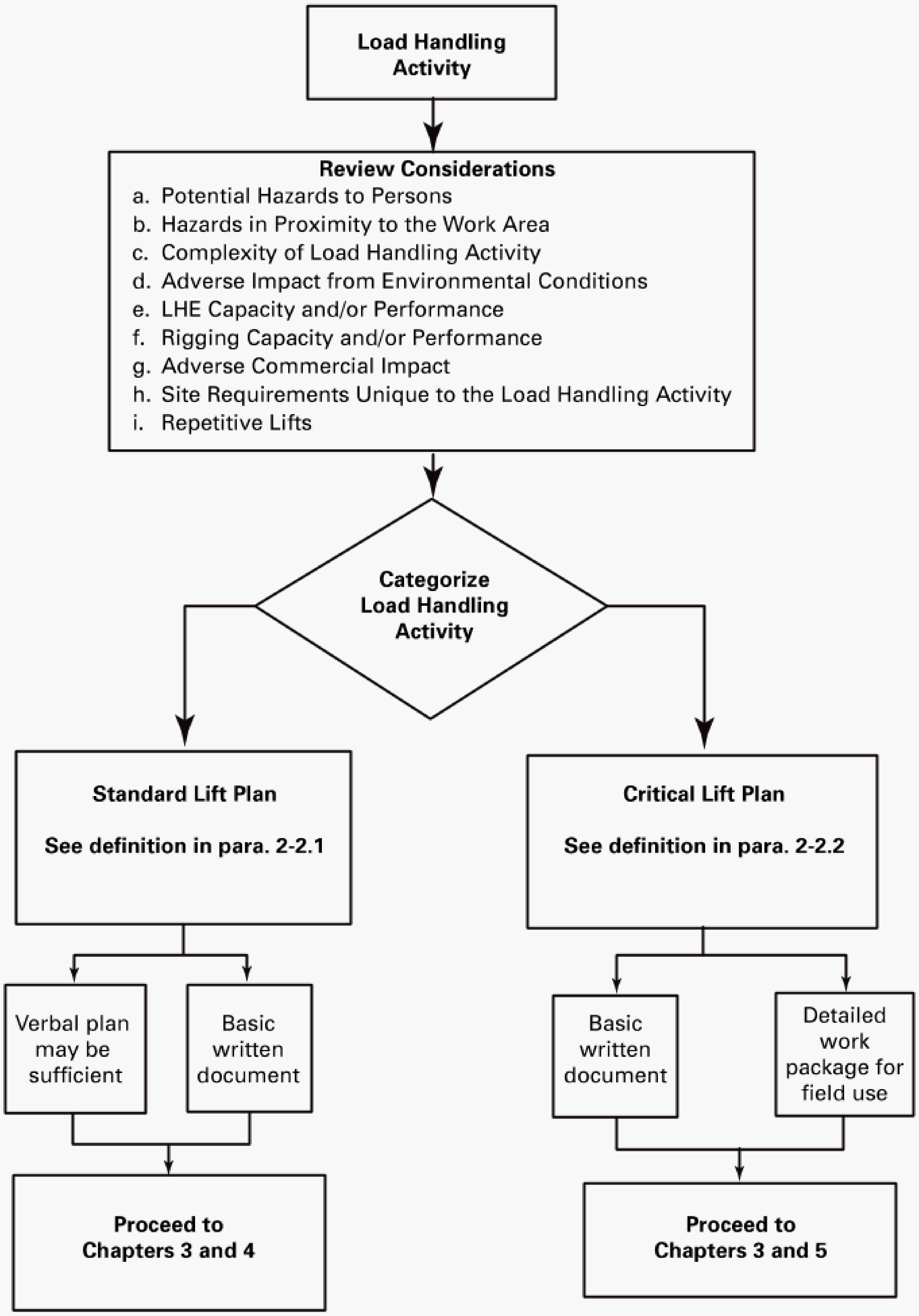
(-g) potential load shift during load handling activity

(-h) weight distribution or transfer between multiple LHEs

(-i) effects of moving to/from liquids (current, buoyancy)

(-j) out-of-plane loading

(19) **Figure 2-1-1 Load Handling Activity Categorization**



(-k) equipment history or condition

(f) Rigging Capacity and/or Performance. If factors, such as those listed in (e)(2)(-c) and (e)(2)(-e) above, and/or the following, have the potential to encroach upon maximum capacity of the rigging, as configured, and/or affect its performance:

(1) rigging attachment points of the load (e.g., lifting lugs, precast inserts)

(2) side loading of the rigging hardware and attachments

(3) complexity of rigging

(4) weight distribution or transfer of load within the rigging arrangement

(5) environmental conditions (e.g., temperature or chemically active environment)

(g) Adverse Commercial Impact

(1) if the load has a significant replacement time

(2) if the cost of replacing the load is considered significant or the load is irreplaceable

(3) if failure to complete the load handling activity could create a project delay, work shutdown, or disruption to the general public

(4) if the load handling activity can cause damage to pipes, lines, tanks, equipment, or products that could create an adverse commercial impact

(h) Site Requirements Unique to the load handling Activity

(1) corporate considerations/policies

(2) regulatory considerations [e.g., local, state, federal, DOT, railroad (FRA), FAA, and military]

(3) potential impact to vital infrastructure (e.g., public utilities, roadways, seaports, pipelines, and railroads)

(i) Repetitive Lifts

(1) distractions, fatigue, inattention, or lack of concentration of the load handling personnel

(2) the LHE and rigging equipment manufacturer's recommendations for duty cycle or repetitive operations

2-2 PLAN CATEGORIES

2-2.1 Standard Lift Plan

A standard lift plan is a proposed load handling activity plan in which considerations in section 2-1 have been evaluated and it has been determined that the load handling activity can be accomplished through standard procedures, and that the load handling activity personnel can execute using common methods, materials, and equipment.

2-2.2 Critical Lift Plan

A critical lift plan is a proposed load handling activity plan in which considerations in section 2-1 have been evaluated and it has been determined that the load handling activity exceeds standard lift plan criteria and requires additional planning, procedures, or methods to mitigate the greater risk.

Chapter 3
Personnel and Responsibilities

3-1 PERSONNEL QUALIFICATION/COMPETENCE

Persons performing the lift planning and load handling activities shall be qualified and competent, as determined by the employer or employer's representative, to perform the assigned tasks.

All personnel involved in the load handling activities shall meet the qualifying criteria established in applicable consensus standard(s), site-specific requirements, or regulations.

3-2 ROLES AND RESPONSIBILITIES

It is essential that roles and responsibilities identified in the lift plan are defined and understood by all personnel involved. The roles and responsibilities may include, but are not limited to, those outlined below. Not all of the roles below may be identified in or required by the lift plan. In some cases an individual or entity may perform multiple, nonconflicting roles.

(a) Assembly/disassembly director — responsible for directing the assembly/disassembly (erect/dismantle) of the LHE

(b) Engineer — responsible for providing any required engineering support and documentation for the load handling activity

(c) General contractor/construction manager — responsible for contractual requirements including deliverables, and ensuring performance and safety requirements are established and implemented

(d) Lift director — responsible for verifying the category of the load handling activity and reviewing and implementing the lift plan

(e) LHE operator — responsible for directly controlling the LHE's functions

(f) LHE owner — responsible for custodial control of the LHE by virtue of a lease or ownership

(g) LHE user — responsible for arranging the LHE's presence on a work site and controlling its use

(h) Lift planner — responsible for developing the lift plan

(i) Rigger — responsible for performing rigging tasks associated with the load handling activity

(j) Signalperson — responsible for directing the movements of the LHE by providing signal commands to the LHE operator

(k) Site safety officer — responsible for enforcing work site safety policies

(l) Site supervisor — responsible for overseeing the work site on which the LHE is used and the work that is performed on the site

(m) Spotter — responsible for observing and reporting as directed on the movement of the LHE and load

(n) Transport operator — responsible for operation of transport equipment used in support of the load handling activity

Chapter 4
Standard Lift Plan

(19) 4-1 INTRODUCTION

The decision to use a standard lift plan should be based on the considerations outlined in Chapter 2. The lift director should determine that none of these considerations would cause the load handling activity to be recategorized.

Prior to the load handling activity, the lift director should verify that the standard lift plan has been developed. The standard lift plan can be written or verbal. See Nonmandatory Appendix A for an example of lift plan template, Nonmandatory Appendix B for an example of rigging data sheet, and Nonmandatory Appendix C for guidance on establishing a limiting wind speed.

4-2 STANDARD LIFT PLAN DEVELOPMENT

(a) The standard lift plan should identify, evaluate, and address the following for all phases of the load handling activity:

(1) the load, its weight, center of gravity, and attachment points

(2) the gross load is within the LHE's rated capacity as configured

(3) the rigging

(-a) is selected to have sufficient rated capacity for the intended configuration

(-b) is configured to secure and stabilize the load

(-c) and the loads are protected from damage

(4) movement of the LHE and load

(5) the personnel required to execute the load handling activity

(6) site conditions, weather, work area, LHE foundation and support, utilities, support services, and ancillary equipment

(7) communication method or system

(8) site control for vehicular and pedestrian access and potential interferences

(9) contingency considerations

(10) emergency action plan

(11) for repetitive lifts, additional LHE and rigging inspection and maintenance

(b) Standard lift plans do not require documentation unless required by site policies or as otherwise warranted.

4-3 PRE-LIFT REVIEW

(a) Prior to executing the load handling activity, the participants should communicate and agree upon the details of the plan and their assignments.

(b) For repetitive lifts, the lift director should decide the frequency of pre-lift reviews. Pre-lift reviews may not be required prior to each repetition of the lift.

(c) Concerns raised during the pre-lift review should be addressed prior to proceeding with the load handling activity.

4-4 EXECUTING THE STANDARD LIFT PLAN

(a) The load handling activity should only commence after

(1) all setup and preparation requirements of the plan are in place

(2) all required inspections and tests of the LHE and rigging equipment have been completed

(3) all requirements of the plan continue to be met and no conditions exist that would preclude implementation of the plan

(b) If the operation deviates from the plan, the load handling activity should be stopped and evaluated. The deviation should be resolved before resuming the load handling activity. Changes or modifications to the plan should be communicated to all affected load handling personnel.

4-5 POST-LIFT REVIEW

(a) After completion of the load handling activity, any measures identified by the participants to improve future load handling activities should be communicated to the appropriate personnel.

(b) For repetitive lifts, the lift director should decide the frequency of post-lift reviews and evaluation of the lift plan. Post-lift reviews may not be required after each repetition of the load handling activity.

Chapter 5
Critical Lift Plan

(19) 5-1 INTRODUCTION

The decision to use a critical lift plan should be based on the considerations outlined in Chapter 2.

The critical lift plan shall be written prior to executing the load handling activity. See Nonmandatory Appendix A for an example lift plan template, Nonmandatory Appendix B for an example of rigging data sheet, and Nonmandatory Appendix C for guidance on establishing a limiting wind speed.

5-2 CRITICAL LIFT PLAN DEVELOPMENT

The critical lift plan should address the applicable items identified in paras. 5-2.1 through 5-2.10 and any additional considerations identified during the planning process.

5-2.1 The Load

(a) Identify the load's weight, center of gravity, and dimensions, and the sources of that information.

(b) Identify components that could shift during the load handling activity and develop a method for securing, if required.

(c) Identify the load attachment or contact points and ensure that they are suitable for the load to be handled, while maintaining load integrity.

(d) Identify the requirements to be met for the load's orientation and securement prior to the release of the LHE and rigging.

5-2.2 Load Handling Equipment

(a) Identify the LHE and the anticipated configuration (s).

(b) Ensure that the LHE is capable of handling the total anticipated load, including the rigging, accessories, and attachments in the intended configuration(s), giving consideration to the factors listed in (e).

(c) Ensure that the LHE is in compliance with the requirements of the site, the manufacturer or qualified person, industry-recognized standards (e.g., applicable ASME B30 volume), and federal, state, or local regulations.

(d) Establish the process to set up, erect, or install, and dismantle the LHE using the information provided by

(1) the manufacturer

(2) a qualified person

(3) site-specific recommendations

(4) applicable regulatory requirements

(e) Identify all required inspections and tests on the LHE that need to be performed using the information provided by the manufacturer, a qualified person, site-specific recommendations, or applicable regulatory requirements. For repetitive lifts, additional LHE inspection and maintenance should be considered.

5-2.3 Rigging Plan (19)

(a) Establish the rigging method that will support and secure the load and is suitable for the load handling activity.

(b) Ensure that the rigging method and the equipment have the capacity to support the load, in the configuration or geometry required, giving consideration to the factors addressed in para. 5-2.1 and the following:

(1) dynamic effects (beyond that considered in the design of the equipment)

(2) adverse environmental conditions (temperature, wind, and water/ice)

(3) position of the center of gravity relative to rigging support points

(4) D/d ratio

(c) Identify the weight of the rigging, accessories, and attachments, and the sources of that information.

(d) Establish the process to ensure that the rigging equipment meets the manufacturer's specifications, regulations, industry-recognized standards (e.g., ASME B30.9, ASME B30.20, and ASME B30.26), and site-specific requirements for the methods and equipment selected.

(e) Identify all necessary inspections and tests for the rigging equipment.

(f) For repetitive lifts, establish any additional rigging inspection and maintenance requirements that may be necessary.

(g) Establish the process to assemble, install, remove and disassemble the rigging equipment using the information provided by

(1) the manufacturer

(2) a qualified person

(3) site-specific recommendations

(4) applicable regulatory requirements

(h) Ensure that the rigging will be protected from damage during the load handling activity from conditions such as the following:

(1) temperature (e.g., shielding from heat, cold)
(2) degradation (e.g., chemically active environment)
(3) cutting, abrasion, and friction damage (e.g., turning, shifting, and contact with edges)

5-2.4 LHE and Load Travel Path

(a) Identify travel path(s) of the load and LHE.
(b) Ensure that the load and LHE have adequate clearance to prevent contact with site-specific hazards or obstructions during the load handling activity (e.g., LHE to LHE, load to LHE, tail swing, boom/attachment clearance, and headroom).
(c) Consider the factors addressed in paras. 5-2.6 and 5-2.8 and the following:
(1) dynamic movement
(2) environmental (e.g., temperature, wind, and water/ice)
(3) load eccentricities during operation
(d) Identify the need for load control [e.g., tag line(s), push/pull poles].
(e) Identify positioning and movement of personnel required to support the load handling activity.
(f) Identify effects of slope or grade on the LHE.

5-2.5 Personnel

(a) Identify tasks to be completed prior to, during, and after the load handling activity, and the personnel required to complete each task (see Chapter 3).
(b) Identify specialized training of personnel necessary to accomplish the load handling activity, if required.

(19) 5-2.6 Site, Services, and Ancillary Equipment

(a) The following site parameters/conditions/services required to perform the load handling activity should be identified:
(1) the work area(s) required (e.g., equipment setup, laydown, load, and LHE path).
(2) support services/utilities (e.g., fuel, air, electrical, and water).
(3) ancillary equipment required (e.g., high reach equipment, assist LHE).
(4) unobstructed access, travel path, and egress for the LHE and the load.
(5) suitable LHE foundation and support requirements during all phases of the load handling activity. Considerations should include, but not be limited to
(-a) soils analysis (e.g., allowable ground pressure)
(-b) potential for change to support due to environmental conditions (e.g., erosion, frost heave, water saturation, and flooding)
(-c) supporting structure integrity (e.g., barges, piers, slabs, bridge decks, foundations, pavements, buildings, crane mats, and cribbing)
(-d) site-specific hazards such as vaults, pipelines, tunnels, previous excavations, or voids
(-e) presence of additional loads imposed by surrounding structures on the LHE foundation
(-f) presence of additional loads imposed by LHE on surrounding structures, excavations, or backfill
(6) requirements that ensure sufficient capacity, stability, and orientation to support the load at the point of origin and landing point.
(b) Ensure that all adjustments, soil mitigation, and reinforcements are completed prior to performing the load handling activity.

5-2.7 Communication System

(a) Identify suitable communication systems for use during the load handling activity, such as the following:
(1) hand signals
(2) voice signals (e.g., direct, radio, and hardwired audio)
(3) video
(4) horns or other audible signals
(5) signal or warning lights
(b) Identify a backup communication system and plan in case the primary communication system becomes ineffective.

5-2.8 Site Control

(a) Identify the vehicular and pedestrian access and the traffic controls to be used.
(b) Ensure that the plan addresses the following:
(1) vehicular and pedestrian traffic in and around the site that could be affected by or will affect the load handling activity
(2) potential interference from other site activities and the controls to be in place
(c) Identify location of barricades or other measures to be put in place to restrict traffic or prohibit interference during the load handling activity.

5-2.9 Contingency Considerations

The plan should address, at a minimum, the following potential events that could cause a deviation from the lift plan:
(a) equipment malfunction (e.g., LHE power failure, fouled rigging, and radio communication failure)
(b) adverse changes to environmental conditions (e.g., weather, visibility)
(c) deviation from the planned load characteristics as identified in para. 5-2.1
(d) adverse changes to site conditions (e.g., surrounding activities, change in ground conditions, and unauthorized entry into the work site as identified in para. 5-2.8)

5-2.10 Emergency Action Plan

(a) Review any existing site-specific emergency action plans and coordinate any required modifications.
(b) Identify the need for an emergency action plan directly related to the load handling activity.

5-3 PRE-LIFT MEETING

The lift director should hold a pre-lift meeting to discuss the plan and the roles of the personnel involved.
(a) At a minimum, the following elements should be reviewed with all load handling activity personnel:
(1) overview of the load handling activity
(2) LHE, rigging, and other equipment involved in the load handling activity
(3) the sequence of events and step-by-step procedures for the entire load handling activity
(4) safety measures, as required (e.g., Job Safety Analysis action items)
(5) load handling activity personnel assignments, addressing
(-a) individual responsibilities (e.g., location, time, and task)
(-b) work location hazards (e.g., pinch points)
(-c) communication methods
(-d) personal protective equipment requirements
(-e) qualification(s) of assigned personnel
(6) any contingency measures as determined in para. 5-2.9
(7) any emergency action plan as determined in para. 5-2.10
(b) Concerns raised during this meeting shall be addressed prior to proceeding with the load handling activity.
(c) At the completion of the pre-lift meeting, the lift director should confirm that the attendees understand the plan and their roles and responsibilities during the load handling activity.
(d) For repetitive lifts, the lift director should decide the frequency of pre-lift meetings. Pre-lift meetings may not be required prior to each repetition of the load handling activity.

5-4 EXECUTING THE CRITICAL LIFT PLAN

5-4.1 Preparation for the Load Handling Activity

The lift director should confirm that all setup and preparation requirements of the plan (see sections 5-2 through 5-3) are in place and all required inspections and tests on the LHE(s) and rigging equipment have been completed.

5-4.2 Initiating the Load Handling Activity

Immediately prior to performing the load handling activity, the lift director should ensure that either
(a) all requirements of the plan continue to be met and no conditions exist that would preclude implementation of the plan; or
(b) a deviation exists, in which case the load handling activity is not initiated until the deviation is addressed by a qualified person or the lift director determines that conditions are acceptable to allow the activity to begin.

5-4.3 During the Load Handling Activity

The lift director should ensure that the load handling activity continues to comply with the plan.
(a) If the operation deviates from the plan, the load handling activity should be stopped and evaluated to determine if
(1) the load handling activity can resume according to plan.
(2) the contingency measures can be implemented per para. 5-2.9.
(3) the plan can be readily modified at the site to accommodate an unexpected condition or event.
(4) the load handling activity can no longer be implemented as planned, requiring a modified plan to be prepared. In such cases, the load and the LHE shall be secured, if possible, until a new plan can be developed.
(b) Changes or modifications to the plan should be communicated to all affected load handling personnel prior to initiating the change.
(c) If the load handling activity is stopped for any reason, only the lift director may initiate a restart.

5-5 POST-LIFT REVIEW

After the completion of the load handling activity, the lift director should
(a) review the development, planning, and execution of the load handling activity with the load handling personnel. Items for review should include, but not be limited to, the requirements of sections 5-2 through 5-4.
(b) identify potential measures to improve future load handling activity.
(c) communicate any recommendations identified in (b) to the appropriate personnel for future consideration.
(d) for repetitive lifts, decide the frequency of post-lift reviews and evaluation of the lift plan. Post-lift reviews may not be required after each repetition of the load handling activity.

NONMANDATORY APPENDIX A
LIFT DATA SHEET (LDS)

(19) A-1 INTRODUCTION

A documented lift plan may be one or more pages comprised of applicable data files, charts, schematics, and procedural instructions. Figure A-1-1 is offered as an example of a blank planning document for a single mobile crane load handling activity and may be modified by the user as required.

Similar documents can be developed for LHE performing a variety of vertical and horizontal load handling.

(19) A-2 LIFT DATA SHEET INSTRUCTIONS AND COMMENTARY (FIGURE A-1-1)

A-2.1 General

A lift data sheet (LDS) summarizes the essential details of a lifting operation in a standardized, easy to read form. It should include

(a) a brief description of the operation to be undertaken

(b) load characteristics including weight and center of gravity

(c) details of the crane or other LHE to be used including specific configuration

(d) a summation of the total load to the LHE

(e) LHE rated capacities during the relevant phases of the operation

(f) a comparison of total load to the LHE versus LHE capacity throughout the operation (as a percentage)

(g) a comparison of total load supported by the LHE's reeved load line versus the rated capacity of the reeved load line (as a percentage)

(h) notes outlining key operational requirements on which the validity of the data sheet is based

(i) a list of relevant attachments included (e.g., LHE chart extract, layout, and rigging sketches)

(j) any required review and approval signatures and applicable statutory requirements such as a Professional Engineer's stamp

The LDS should be designed to suit the type of operation to be undertaken (e.g., mobile crane — single lift, mobile crane — tandem/multiple crane lift, tower crane lift, overhead traveling crane lift, jacking and rolling activity, lift system, or gantry lift). It is unlikely that a single format sheet will suffice for every eventuality.

A-2.2 Example Data Sheet (19)

For guidance, an example of a blank lift data sheet for a lifting operation using a single mobile crane is included (see Figure A-1-1).

Crane chart capacities for mobile cranes are the load the crane is rated to support at the boom or jib head as applicable. To evaluate what percentage of that capacity it is planned to use, it is first necessary to sum the total load applied to the crane at the boom or jib head.

Note that in the case of LHE such as tower cranes or overhead traveling cranes, the situation is slightly different, as the capacity is likely to be quoted at the hook block. In all cases follow the instructions and warnings of the manufacturer concerning the LHE's capacity and limitations and adjust your data sheet accordingly.

A-2.3 Completing the Example LDS

A-2.3.1 Payload and Crane Details Sections. The first two sections, "Payload" and "Crane Details," are self-explanatory. Mark nonapplicable fields as "N/A" rather than leaving them blank (which could be construed as an omission).

The "single hoist line pull" is the rated winch line pull. "Parts line used" are the actual parts of line with which the crane is reeved for the lift (not necessarily the maximum for which it is equipped). "Reeved capacity" is the hoisting capacity as reeved, typically the parts of line times the rated single line pull. This figure is carried below.

A-2.3.2 Load Details. The next three subsections relate (19) to load applied to the crane.

(a) Load details — the weight of the payload, any attachments to it (such as ladders and platforms, insulation), or contents (such as oil, catalyst) can be summed here to yield a total weight of the item to be lifted.

(b) Rigging data — the weight of rigging materials to attach the load to the crane hook is weight on the crane and has to be considered. This section allows the rigging items to be described, quantified, and summed to give a total rigging weight. If the rigging is simple, it can be placed on the Lift Data Sheet. For more complex rigging arrangements Nonmandatory Appendix B can be used.

(c) Additional weight items — as applicable, allowance should be made for

(1) the weight of the main hook (block) being used to suspend the payload.

(2) the weight of the parts of hoist line below the boom or jib head (whichever is being used), i.e., the number of parts of line being used times the longest anticipated drop from boom or jib tip to the hook block (ft) times the weight per foot of the hoist line. Check the manufacturer's manual to determine if the weight of the wire rope necessary to lift the suspended load has been accounted for in the load chart and the weight of any extra reeved parts of line need to be added as additional weight, or if all parts of line need to be accounted for as additional weight.

(3) jibs where fitted when using the main boom; the weight allowances to be considered vary according to whether the jib is erected, stowed, extended, or retracted — consult the manufacturer's manual.

(4) the weight of other suspended hooks/overhaul balls fitted and the weight of the associated suspended hoist lines.

(5) boom extensions/runners/auxiliary boom sheaves and other similar attachments fitted to the boom or jib (when the chart being used does not relate to their use).

Totaling the above three subtotals (payload plus rigging plus additional weight items) gives the total weight to the crane for comparison with the rated capacity.

(19) **A-2.3.3 Crane Capacities.** The next section relates to the crane capacities. Capacity varies according not only to configuration but also to operating radius. Three columns are provided on this particular sheet allowing the user to calculate the loads at up to three different radii as applicable (e.g., hoist, swing, and place). It may however be sufficient to consider only the worst radius. For each column to be used, enter first the actual radius of operation then, unless capacity interpolation for that specific radius is allowed, the next greatest radius for which a chart capacity is quoted. The next line, "Chart Capacity," is for entering the rated capacity of the crane at the aforementioned chart radius. Ensure use of the correct chart specific to that particular crane in the particular configuration in which it is being used.

The "Total Load to Crane" divided by "Crane Capacity" yields the percentage of chart capacity being used for each radius for which the calculation is performed. Knowing this figure at up to three operating radii, the "Maximum Percentage of Chart Capacity Used" can be noted.

The total suspended load is the load supported by the main hoist lines equal to the total of "Total Weight of Item to be Lifted" plus "Total Rigging Weight" plus the weight of the hook block being used plus the self weight of the reeved hoist lines being used.

(19) **A-2.3.4 Reeved Capacities.** The ability of the crane to hoist the load within capacity is a function of the rated line pull and the number of reeved parts of line. The load suspended on the parts of the line is the total weight of item to be lifted plus the rigging weight plus the weight of the load block, if applicable. The manufacturer's recommendations for reeved capacity should always be followed.

NOTES:
(1) The weight of a jib or boom attachments is not part of the load suspended on the reeved hoist line.
(2) In the case of cranes such as tower cranes or overhead cranes the manufacturer may have already considered the weight of the load block when specifying a part of line capacity.
(3) Weight of the hoist line below the boom tip should be considered, where applicable.

The "Maximum Percentage of Reeved Capacity Planned to Be Used" is "Total Suspended Load (main)" divided by the reeved capacity (from above) — see the "Crane Details" section.

A-2.3.5 Document Attachments. This section lists (19)
documents commonly attached to an LDS (e.g., a crane layout, rigging arrangement, and crane chart extract). Not all will be relevant or required. The user should mark (check) those he/she has appended, adding to the list as required. Note the acronyms: GBP (ground bearing pressure), JHA (job hazard analysis), JSA (job safety analysis), AHA (activity hazard analysis). It is recommended that a risk analysis be undertaken. Resources such as ISO 31000 and other industry guides may be useful.

A-2.3.6 Notes. In this section, the user should include (19)
any further information (e.g., warnings, references, and instructions) essential to the safety of the operation. This section may also detail the crane operating mode if not adequately described elsewhere.

Included in this section are

(a) a line allowing the user to compare the planned imposed ground loading (typically derived from a ground bearing pressure estimator further distributed through any load-spreading mats or blocking/cribbing provided) with the permissible ground bearing pressure (as derived from geotechnical data, calculation, or other informed guidance).

(b) a line in which the limiting wind speed for the operation should be entered. For guidance see Nonmandatory Appendix C.

A-2.3.7 Signatures and Approvals. This section is to be (19)
completed by the preparer, checked, and approved by qualified and competent persons as required by governing policies (modify the sheet as required).

Where this document forms the official record of the operation, applicable legislation or contractual stipulations may require it to be stamped by a knowledgeable P.E., in which case it shall appear prominently in a relatively clear area of the sheet.

(19) A-3 CRANE LAYOUT (SCHEMATIC) (FIGURE A-3-1)

The purpose of the crane layout schematic is to dimensionally locate the crane in the work area, indicate related crane information and site features so that the end user can understand how the crane is to be set up.

A-3.1 Plan View

A Plan view could include the following, as applicable:

(a) geographic orientation (e.g., north)
(b) drawing scale/scale bar
(c) key site features (e.g., buildings and property lines)
(d) layout sections and detail references
(e) crane center and orientation including field verifiable dimensions
(f) front, rear and side quadrants, where relevant to capacity
(g) crane swing radius (tail and cab)
(h) label the load delivery and disposal locations
(i) label weight/radii of loads
(j) support under the crane and load (e.g., matting, cribbing, and dunnage)
(k) crane description
(l) overhead/underground obstructions
(m) pedestrian and traffic control
(n) delivery and disposal call out
(o) column line, station, bent, pier, and call outs

A-3.2 Elevation View

An elevation view could include the following, as applicable:

(a) drawing scale/scale bar
(b) locate centerline of crane with field measurable dimension
(c) indicate elevations
(d) dimension crane radius/radii
(e) boom length(s) showing adequate lift height
(f) specify hook block weight and minimum parts of line
(g) tail swing radius
(h) clearances from existing structures and load set points
(i) cross sections showing vault, foundation wall, and influence line of load and underground structure affected by crane
(j) column line, station, bent, pier, and call outs
(k) two blocking distance
(l) boom and jib angles

(19) A-4 RIGGING DIAGRAM (FIGURE A-4-1)

The rigging diagram is used to describe the load or items to be lifted and show the configuration of the rigging equipment. The diagram should include enough detail to allow field personnel to install appropriately rated gear and reviewers to follow calculations.

A-4.1 Diagram

The diagram could include the following:

(a) scale/scale bar
(b) dimensions of item to be lifted, lifting points and center of gravity
(c) sling size and hitch configuration
(d) rigging components/hardware used and key dimensions (i.e., pin diameter/hole diameter for lifting lugs)
(e) sling/hoist angles at critical stages of the lift
(f) rated capacity of rigging components and adjusted capacity as used (e.g., *D/d* ratio, temperature)
(g) loads within the rigging system and support reactions
(h) tension on slings/hoist, rigging hardware and BTH lifting devices
(i) dimension the overall height and length of the rigging arrangement
(j) accessories used (softeners, grillage, etc.)
(k) elevation section and detail references
(l) effects of friction, as applicable

A-4.1.1 The diagram should also confirm that the centerline of LHE lift point (i.e., boom tip or hook block) is located above the center of gravity of the load.

A-4.1.2 The rigging planner should ensure the rigging components, geometry and lifting points are compatible.

A-4.1.3 The rigging diagram should identify loads at the interface of the rigging system such as at load attachment points and at temporary or permanent suspension points. See para. 5-2.6(a)(5).

A-4.1.4 The overall height and length of the rigging arrangement should also be shown on the elevation view of the LHE.

A-5 PRE-LIFT SAFETY CHECKLIST (19)

A pre-lift safety checklist summarizes the essential safety considerations of a load handling operation in a standardized, easy to read form. The checklist should include notes for outlining key safety requirements on which the validity of the checklist is based. The pre-lift safety checklist should be designed to suit the type of operation to be undertaken (e.g., mobile crane (LHE) — single lift, mobile crane (LHE) — tandem/multiple crane (LHE) lift, jacking and rolling activity, lift system, or gantry lift). It is unlikely that a single format sheet will suffice for every situation.

A-5.1 Example Pre-Lift Safety Checklist

For guidance, an example of a blank pre-lift safety checklist for a lifting operation using a single mobile crane (LHE) is included (see second page of Figure A-1-1). This example has been broken down into four main categories and key points per category as it applies to a single mobile crane (LHE) lift.

A-5.2 Notes

This section allows the user to input notes that are important to the load handling activity that are not covered elsewhere.

(19)

Figure A-1-1 Lift Data Sheet

Single Mobile Crane Lift

Payload Name:		**Lift Description:**	
Project:		**Units:**	U.S. (ft-lb)

Crane Details **Manufacturer:** **Model No.**

Configuration:		Base mount type:		Track/outrigger c/s:	ft
Boom type:		Boom length used:	ft	Boom/jib angle:	deg
Jib type:		Jib length used:	ft	Tail swing:	ft
Machine ballast:	lb	Aux. counterweight:	lb		
Block capacity:	ton	Line size:	in.		
Single hoist line pull:	lb	Parts line used:		Reeved capacity:	lb
Heavy lift attachments:		SL radius	ft	Superlift wt:	ton

Load Details

	Quantity	Wt./each	Weight	Totals
Basic weight of item			lb	
			lb	
			lb	
			lb	
			lb	
Total weight of item to be lifted				**lb**

Rigging Data (size, type, and capacity)

			Weight	Totals
			lb	
			lb	
			lb	
			lb	
			lb	
			lb	
			lb	
Total rigging weight				**lb**

Additional Weight Items

			Weight	Totals
Main hook			lb	
Wire rope			lb	
Other suspended hooks			lb	
Aux. boom sheaves			lb	
Jib			lb	
Other:			lb	
Other:			lb	
Total additional weight				**lb**
GROSS LOAD (sum of all items above)				**lb**

Crane capacities

	(Desc.)	(Desc.)	(Desc.)
Total load to crane:	lb	lb	lb
Planned Radius:	ft	ft	ft
Chart Radius Used:	ft	ft	ft
Chart Capacity:	lb	lb	lb
% of chart capacity:			

THE MAXIMUM PERCENTAGE OF CHART CAPACITY PLANNED TO BE USED IS %

Reeved Capacities:

Total suspended load (main): lb **Reeved capacity:** lb

THE MAXIMUM PERCENTAGE OF REEVED CAPACITY PLANNED TO BE USED IS %

Document Attachments

☐ Crane layout	☐ Plan categorization	☐ GBP source/calculations
☐ Rigging hookup arrangement	☐ JHA/JSA/AHA	☐ Project scope
☐ Crane chart extract	☐ Risk evaluation	☐ Load weight/CG source info
☐ Foundation details/calculations	☐ Wind/weather Forecast	☐ Load/crane clearances
☐ Crane cribbing arrangement	☐ Drawing of load	☐

Notes

Ground Bearing Pressure:	Allowable:	**Actual:**	
Max. allowable wind speed:	Allowable:		

	Name (Print)	Signature	Title	Date
Prepared by:				
Checked by:				
Approved by:				

Figure A-1-1 Lift Data Sheet (Cont'd)

Pre-Lift Check	Yes	N/A
Payload weight / CG verified?		
Lift correctly categorized?		
Plan in place?		
Field conditions match plan?		
Required approvals / permits?		
Weather / wind acceptable?		
Power lines/undergrounds?		
Site control / area barricaded?		
Contingency plan needed?		
Emergency plan needed?		

Personnel Check	Yes	N/A
Lift director in place?		
Qualified rigger in place?		
Qualified signalperson(s)?		
Communication (hand/radio)?		
Operator certified/qualified?		
Nonessential persons out?		
Rigger roles identified?		
Other roles identified?		
Qualified person present?		
Pre-lift meeting held?		

LHE Setup Check	Yes	N/A
Annual inspection?		
Pre-use inspection?		
Adequately supported?		
Mats where required?		
Setup checked/level?		
Adequate parts of line?		
Obstructions/clearance?		
Configuration correct?		
Controls / functions OK?		
Services / ancillary eqpt.?		

Rigging Check	Yes	N/A
Correct rigging?		
Rigging inspections current?		
Inspected before use?		
Rigging correctly assembled?		
Softeners used as needed?		
Rigging properly tagged?		
Sling angles acceptable?		
Sling tension acceptable?		
Length of rigging acceptable?		
Obstruction/clearance?		
D/d ratio adequate?		
Lift points identified?		
Lift points visually inspected?		
Tag lines?		
Height of rigging acceptable?		

NOTES:

PRE-LIFT BRIEFING

I confirm that the rigging design has been explained to me, that we have discussed it, and that I understand the operation and my role and responsibilities.

NAME (PRINT)	SIGNATURE	CRAFT/TRADE

NAME (PRINT)	SIGNATURE	LIFT DIRECTOR

Figure A-3-1 Crane Layout (Schematic)

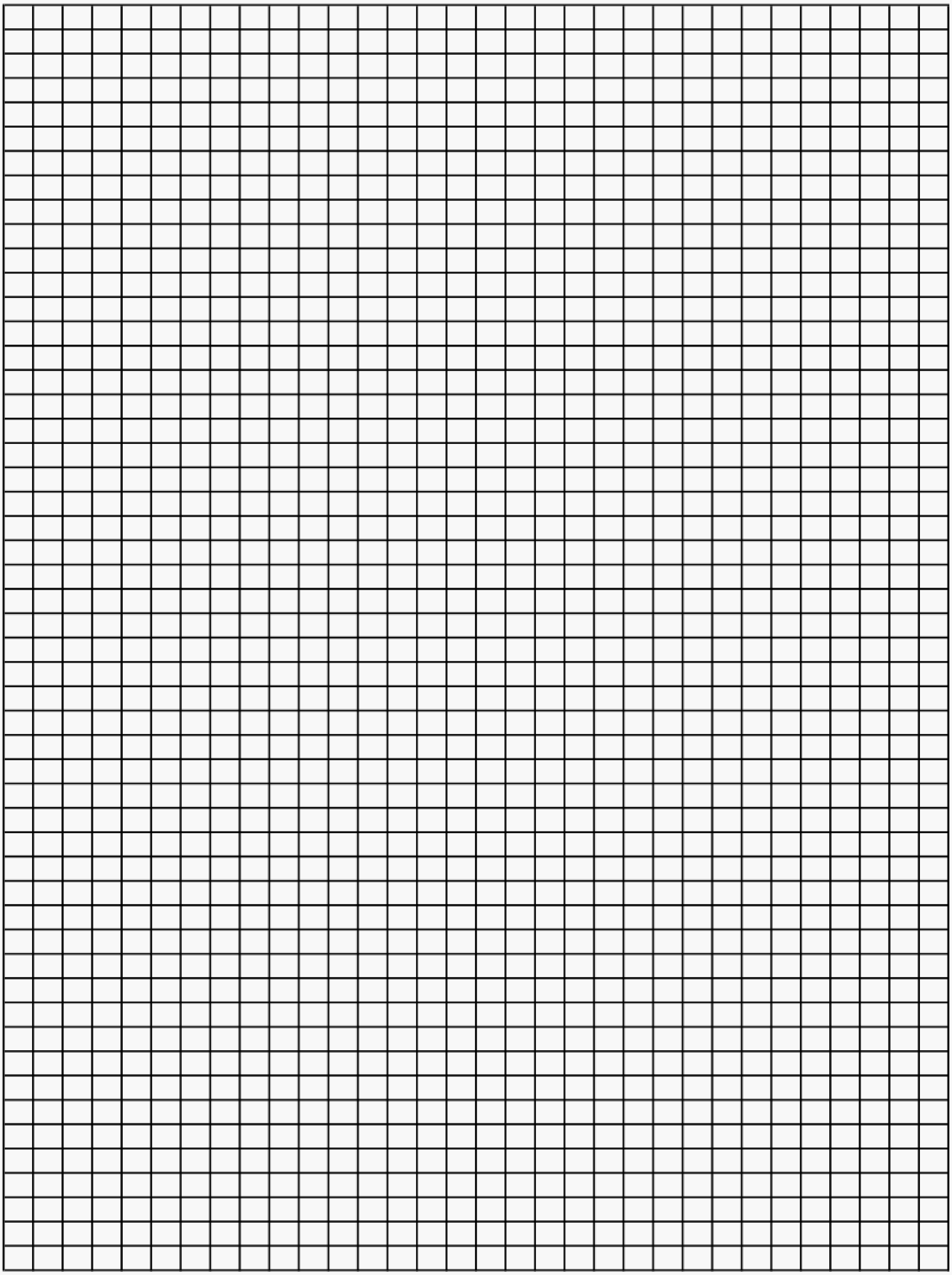


Figure A-4-1 Rigging Arrangement (Schematic)

LIFT SEQUENCE

NONMANDATORY APPENDIX B RIGGING DATA SHEET (RDS)

(19)

B-1 RIGGING DIAGRAM

The rigging diagram is used to describe the load or items to be lifted and configure the rigging equipment. The diagram should include enough detail to allow field personnel to install appropriately rated gear and reviewers to follow calculations.

Figure B-1-1 is offered as an example of a blank planning document for a single rigging activity and may be modified by the user as required. This document can be used in conjunction with Nonmandatory Appendix A or as a standalone planning document for when a crane or similar LHE is not incorporated in a lift plan (e.g., operations using chain hoists, jacks, and industrial rollers).

B-1.1 Diagram

The diagram could include the following:

(a) scale/scale bar

(b) dimensions of item to be lifted, lifting points and center of gravity

(c) sling size and hitch configuration

(d) rigging components/hardware used and key dimensions (i.e., pin diameter/hole diameter for lifting lugs)

(e) sling/hoist angles at critical stages of the lift

(f) rated capacity of rigging components and adjusted capacity as used (e.g., *D*/*d* ratio, temperature)

(g) loads within the rigging system and support reactions

(h) tension on slings/hoist, rigging hardware and BTH lifting devices

(i) dimension the overall height and length of the rigging arrangement

(j) accessories used (softeners, grillage, etc.)

(k) elevation section and detail references

(l) effects of friction, as applicable

(m) revision date

B-1.1.2 The diagram should also confirm that the centerline of LHE lift point (i.e., boom tip or hook block) is located above the center of gravity of the load.

B-1.1.3 The rigging planner should ensure the rigging components, geometry, and lifting points are compatible.

B-1.1.4 The rigging diagram should identify loads at the interface of the rigging system such as at load attachment points and at temporary or permanent suspension points. See para. 5-2.6(a)(5).

B-2 RIGGING DATA SHEET INSTRUCTIONS AND COMMENTARY

B-2.1 General

A rigging data sheet (RDS) summarizes the essential details of a rigging operation in a standardized, easy to read form and should be designed to suit. It should include the following:

(a) a brief description of the operation to be performed

(b) lift type vertical, horizontal, or slope

(c) load characteristics including weight, center of gravity, and lift point location

(d) details of the rigging/hardware to be used including specific configuration

(e) a summation of the total load to the rigging/hardware

(f) a comparison of total load to the rigging/hardware versus rigging/hardware capacity

(g) below-the-hook (BTH) lifting device details

(h) a list of relevant attachments included (e.g., load weight, center of gravity source, and LHE specs)

(i) any required review and approval signatures and applicable statutory requirements such as a Professional Engineer's stamp

(j) detail diagram

B-2.2 Example RDS

For guidance, an example of a blank RDS for a lifting operation is included (see Figure B-2.2-1).

B-2.3 Completing the Example RDS

B-2.3.1 Type of Lift. Indicate whether the load will be lifted vertically or will be moved horizontally. If moved horizontally, indicate the % of slope in degrees and the anticipated coefficient friction (drag). Mark nonapplicable fields as "N/A" rather than leaving them blank (which could be construed as an omission).

B-2.3.2 Load. Enter the load dimensions. State weather the center of gravity is located in the center of the load (symmetrical) or is the center of gravity offset on the load. Report that center of gravity is above or below the lift points and that stability has been checked.

B-2.3.3 Rigging Data. The next four subsections relate to load applied to the external support(s).

(a) Load Details. Enter the weight data for the load. Indicate whether the weight is actual or estimated. Enter a detailed description of the load and its components with individual weights and total weight.

(b) Slings. Indicate if slings are used the type, size, rated capacity and actual load, quantity, weight of each; provide a total weight of slings.

(c) Hardware. Indicate the type of rigging hardware (eye bolts, shackles, etc.) to be used. Provide rated capacity and actual load, quantity, weight of each item and total weight of hardware.

(d) Below-the-Hook Lifting Devices. Indicate the below-the-hook (BTH) lifting devices (spreader bars, beam clamps, etc.) to be used. State the BTH category (A or B) of the devices as well as the rated capacity, actual load, quantity and weight. Provide a total weight of all BTH lifting devices and report if a load test was certified by a qualified person. Totaling the above four subtotals gives the total weight to the external support(s) for comparison with the rated capacity.

B-2.3.4 Document Attachments. This section lists documents commonly attached to an RDS (e.g., rigging diagram, load information). Not all will be relevant or required. The user should mark (check) those he/she has appended, adding to the list as required. It is recommended that a risk analysis be undertaken. Resources such as ISO 31000 and other industry guides may be useful.

B-2.3.5 Notes. In this section, the user should include any further information (e.g., warnings, references, and instructions) essential to the safety of the operation.

B-2.3.6 Signatures and Approvals. This section is to be completed by the preparer, checked, and approved by qualified and competent persons as required by governing policies (modify the sheet as required).

Where this document forms the official record of the operation, applicable legislation or contractual stipulations may require it to be stamped by a knowledgeable P.E., in which case it shall appear prominently in a relatively clear area of the sheet.

Figure B-1-1 Rigging Arrangement (Schematic)

LIFT SEQUENCE

Figure B-2.2-1 Rigging Data Sheet

Payload Name: ____________ **Lift Description:** ____________

Project: ____________

Date: ____________ **Date planned:** ____________

Load Handling Equipment

☐ Mobile crane ☐ Tower crane ☐ Overhead crane
☐ Derrick ☐ Fork lift ☐ Chain fall
☐ Hoist ☐ Jack ☐ Other

Type of Lift

☐ Vertical lift ☐ Horizontal lift
Slope (%, deg): ____________
Coefficient of friction: ____________

Load

Dimension: Length: ____ ft Width: ____ ft Height: ____ ft

Center of Gravity's Location: ☐ Symmetrical ☐ Offset ______

☐ Above the rigging lift point
☐ Below the rigging lift point
☐ If below, has stability been checked? ______

☐ Actual (source): ____________
☐ Estimated (source): ____________

Description	Quantity	Wt./each	Weight	Total

Total weight of item to be lifted ______

Rigging Data

Slings

Type	Size	Rated load	Applied load	Quantity	Wt./each	Weight

Total slings weight ______

Hardware

Type	Size	Rated load	Applied load	Quantity	Wt./each	Weight

Total hardware weight ______

Below-the-Hook Lifting Device (per ASME B30.20) if applicable

Type	Rated load	Applied load	Quantity	Wt./each	Weight

Total below-the-hook weight ______

Below-the-Hook Lifting Device: ☐ Load tested (if applicable) ☐ Certified by qualified person
☐ Lifter specifications and drawings

RIGGING WEIGHT

TOTAL WEIGHT: ______ **lb**

Document Attachments (As Needed)

☐ Rigging procedure ☐ Lift plan ☐ Rigging specifications
☐ Load weight/CG source info ☐ JHA/JSA/AHA ☐ Lifter specs and drawings
☐ Drawing of load/lift points ☐ Risk evaluation ☐ Rigging sketch

Notes ____________

	Name (Print)	**Signature**	**Title**	**Date**
Prepared by:				
Checked by:				
Approved by:				

NONMANDATORY APPENDIX C ESTABLISHING A LIMITING WIND SPEED

(19)

C-1 INTRODUCTION

The purpose of this Appendix is to provide guidance in establishing a limiting wind speed (LWS) for a load handling activity (LHA) as part of the lift-planning processes outlined in this Standard. The scope includes

(a) assessment of wind forces on loads being handled and the effects those forces have on the load-handling equipment (LHE)

(b) securing the load after landing

(c) contingency planning

(d) preparing for out-of-service winds and the control of loads subject to wind forces

C-2 RESPONSIBILITIES

(a) Planning for wind during an LHA requires knowledge of the LHE limitations, site conditions, load characteristics, and rigging method.

(b) Multiple parties may share planning responsibility, and one person may have more than one responsibility. Those involved in preplanning for wind may include the Engineer, Lift Planner, LHE User, and General Contractor/Construction Manager. Those involved in task planning may include the Lift Director, LHE Operator, Rigger, and Site Supervisor.

(c) Those involved in preplanning should remain available for future reference.

C-3 GUIDANCE FOR LIFT PLANNERS

(a) When developing a plan for an LHA in an area subject to wind, the lift planner should establish an LWS for the activity. The LWS should be sufficiently low to ensure the safe operation of the LHE and the safe execution of the LHA, and to ensure that control and stability of the load are maintained throughout the activity. The planned LWS should not exceed the maximum wind speed specified by the LHE manufacturer for the LHE as configured and should not result in wind forces being imparted into the LHE, the load, or the supporting environment in excess of their design parameters.

(b) Wind forces act on both the LHE and the load being handled. The LHE manufacturer normally provides a maximum operating wind speed; however, dependent on the design, this may not consider the effects of forces transferred into the LHE by wind acting on the load being handled. These effects may be reason to reduce the limiting wind speed for the activity.

(c) Further considerations include the effect of wind forces acting on the load regarding control, stability, and strength; these may be reason to further reduce the LWS.

(d) The guidance of a qualified person should be followed when

(1) custom LHE is involved

(2) the LHE manufacturer wind guidance is not available

(3) assessing the wind forces on an object is complex

(4) wind effects on the LHE are difficult to assess

(e) The flowchart and associated narrative contained in section C-9 provide a logical process map to guide the user in establishing an LWS and thereby mitigate wind hazards.

C-4 EFFECTS OF WIND FORCES ON THE LHE

(a) Regarding the LHE itself, in most cases the LHE manufacturers will provide maximum operating wind speeds for their equipment either in the operating manual or on the load charts. A general figure may be quoted or there may be a specific wind speed for each configuration. In the case of cranes with long booms, jibs, or both, the permissible wind speed will likely decrease with increasing length. The manufacturers may also recommend, or require, shutting down the LHE and making the LHE safe under specific conditions.

(b) The effect of the wind acting on the LHE varies with wind direction. Figure C-4-1 shows the different ways the wind affects a crane and a suspended load when it blows from the side, from behind, or from the front.

(c) Considerations for wind from the side of the boom. When the wind is from the side

(1) boom strength is a major factor.

(2) the wind creates lateral loading on the boom.

(3) the wind forces on the suspended load are transferred horizontally into the boom or jib head through the hoist ropes, independent of the elevation of the load.

(4) the wind acts to rotate the upper works of the crane. The LHE operator might need to compensate for this tendency to swing.

(5) wind forces on the load and LHE may increase LHE support loads.

(d) Considerations for wind from rear of the boom. When the wind is from behind a crane

(1) the wind applies a force to the boom, jib, and load that adds to the overturning moment of the LHE and may affect the forward stability

(2) the wind effect on the load increases the load radius in the plane of the boom/jib, effectively reducing rated capacity

(e) Considerations for wind from front of the boom. When the wind is from the front of the boom

(1) it reduces backwards stability. For a crane operating with the boom/jib approaching the maximum boom angle, the force could cause the boom/jib or the entire crane to tip backwards.

(2) wind acting on a suspended load decreases the load radius and can reduce clearances to the boom/jib, potentially creating the risk of contact.

(f) Considerations for wind on wheel or rail mounted LHEs. Wind acting on the load or structure of the LHE may cause unexpected movement along the travel paths.

C-5 EFFECTS OF WIND ON A LOAD

(a) When planning a LHA, it may be necessary to assess the wind forces acting on the load to determine whether they are of a magnitude that could affect the integrity of the load or make it difficult to control.

(b) The wind force acting on the load itself is a function of wind speed, surface area, and shape of the load. The weight of the load, the location of the center of gravity, and the location of the lift points are also very important to identify. The lighter the load and greater its surface area, the more difficult it may be to control.

(c) The wind pressure on a load may not be uniform (e.g., consider a modular electrical house; a closed recess in a flat wall may have an increased pressure while on an inclined roof the pressure may be reduced). This may alter with rotation of the load, LHE, or both. Section C-7 provides guidance on evaluating wind forces on a load.

(d) The center of wind pressure acting on a suspended load may not lie on the axis of suspension, e.g., if the center of area of panel is not coincident with its center of gravity as shown in Figure C-5-1.

The wind load acting to one side of the line of suspension will result in the load wanting to rotate until the center of area lies directly downwind of the suspension. This rotational effect can be considerable and the forces required to oppose it large. This possibility should be accounted for in planning for the LHA.

C-6 EFFECTS THAT WIND FORCES ON HANDLED LOADS HAVE ON LHE

(a) Wind acting on the load creates forces that are passed into the LHE, these act in conjunction with the forces acting on the LHE itself. In the case of a load suspended from a crane, the forces are transmitted through the suspension at the boom/jib tip sheaves; in the case of heavy transport, the forces are transmitted through friction at the supporting surface and lashing or restraints. These combined forces have effects on the LHE and its support that must be assessed. Typically, the user assesses the forces and determines whether the LHE can safely withstand the forces or the LWS should be reduced. When in doubt, consult the manufacturer or a qualified person.

(b) When a freely suspended (unrestrained) load hanging from an LHE is subject to a steady lateral wind force, the load moves downwind and the suspension takes up an out-of-plumb angle. The load comes to a new static equilibrium when the horizontal component of the tension in the suspension equals the wind force.

(c) The greater the wind force and lighter the load, the greater the resulting angle adopted. The distance the load moves to achieve this angle is determined by the suspension length (and the angle). Dependent on wind direction, this movement may increase or decrease the operating radius.

(d) The angle of the suspension transfers the wind load acting on the load up to the tip of the supporting structure where the horizontal force is resisted. The direction in which this force acts is determined by the wind direction relative to the LHE. Note that this force may be additive to inertial effects from swinging. As a result of the inclination, the suspension is less effective in supporting the vertical weight of the load and so the tension in the suspension is increased slightly. Note that an unrestrained load will tend to swing in the wind, particularly if it is gusting, creating dynamic forces.

(e) Possible adverse effects on an LHE of these forces include but are not limited to

(1) pendulation (swinging of the load).

(2) collision with the LHE structure (potentially causing damage or even failure).

(3) increase in load radius (which may take the LHE out of capacity).

(4) side loading on the LHE structure (which together with other operational forces may exceed permissible limits).

(5) increased loading in the plane of the LHE structure (which together with other operational forces may exceed permissible limits).

(6) load weather vaning in an uncontrolled fashion, i.e., turning at the load's attachment point to present its smallest area side to the wind; this can present a collision hazard. Please refer to Figure C-6-1.

C-7 CALCULATING WIND FORCES ON A LOAD TO BE HANDLED

If a suspended load presents a large area to the prevailing wind it may be necessary to calculate the wind force on the load when establishing a LWS for a LHA; this is particularly so when the area is large relative to the weight of the load. Typically, it is suggested to start by calculating the wind forces using the wind velocity that the LHE manufacturer specifies as the LWS for the LHE itself. Check whether those forces are satisfactory for stability and control of the LHE and, if not, reduce the LWS and repeat until the wind forces are sufficiently low.

(a) The wind pressure, q, created by wind velocity, V, acting on an object can be calculated for a specific maximum wind speed (the proposed LWS at the load). The equation to determine wind pressure, q, is the following, with V measured in mph:

$$q = 0.00256V^2\left[\mathrm{lb/ft}^2\right]$$

(b) The wind area (sail area) of a load (ft^2) is the surface area of the load presented to the wind. Wind forces are greatest when the wind acts normal (perpendicular) to that area.

(c) The drag area is a function of the wind area and the shape of the object. The drag area is usually expressed as a product of the wind area (A) and the drag coefficient (C), (also referred to as the shape factor or force coefficient) appropriate to the shape of the object. ASCE 7, chapter 29 offers coefficients for several different structure types and geometries. The wind force on an object is given by

$$F = qCA[\mathrm{lb}]$$

(d) If q is the pressure at the LWS, then F is the force on the object at that design maximum operational wind speed. If the force F proves to be too high, then the LWS should be lowered, reducing q until the wind force is at a level that can be safely sustained by the LHE and at a level at which the load can be safely controlled.

C-8 LOAD CONTROL

(a) Suspended Loads and Taglines. The lift planner should always consider how a freely suspended load, being acted on by the wind, is to be controlled to avoid uncontrolled movement and the associated hazards. Taglines shall be used where hazards exist to employees and should always be used where they would serve a useful purpose in controlling a suspended load.

(1) Taglines are used to

(-a) oppose uncontrolled rotation of a freely suspended load as it is lifted, maneuvered, or relocated under the influence of forces such as wind acting on it

(-b) alter the rotational attitude of a suspended load as it is guided along a path, or to position it in a particular attitude

(-c) avoid the need for persons to put their hands directly on a load to control it where that would pose a hazard, allowing distance between them and the load

(2) Taglines are not to be used to

(-a) pull a load out of its natural suspended line, thereby inducing in-haul or out-haul of the load lines

(-b) hold a load against wind forces trying to push it out of line

(-c) contribute to supporting the load

(3) Two opposing taglines may be required to adequately control a suspended load. They should be of adequate length to maintain an angle to the horizontal of approximately 45 deg or less and should be attached as far as possible from the C of G and as square as possible to the face for maximum effectiveness. Refer to Figure C-8-1 for an illustration of effective tagline use.

(4) The size and shape of the suspended load, the way its area is disposed relative to the line of suspension, and its weight together with the wind speed at the height of the load all determine the wind force on the suspended load and its tendency to rotate. A large flat-sided light object will, for instance, be more likely to swing and rotate, whereas a heavy cylindrical shape of a similar area will be much less likely to swing and weather vane. These factors should be taken into consideration when establishing a LWS for the activity.

(b) Supported Loads. The effect of wind loads on large structures on transport equipment should also be considered. Horizontal wind forces acting on the load will cause a rotational effect that can change the load distribution within the suspension arrangements of a trailer; inclination, overload, or instability may be induced as a result. Lashing and securing loads may be affected. Note also that potentially dangerous sway may be induced.

C-9 ESTABLISHING A LWS FOR A LHA

(a) Figure C-9-1 is a process flowchart providing guidance in establishing a LWS for a LHA. The required information includes the following:

(1) the shape and area of the load to be handled

(2) the LHE to be used and its configuration

(3) the environment in which the LHA is to be conducted

(4) historical wind data for the locale (where available)

(5) the intended travel path of the load and any obstructions

(b) If the LHE is a nonstandard engineered device or is a standard device used in a nonstandard configuration, it will be necessary to seek subject matter expertise from the manufacturer/designer of the LHE or from a qualified person to establish a LWS. The following paragraphs elaborate on the flowchart; the numbers below refer to the blocks in Figure C-9-1. If the LHE is configured within the manufacturer's specifications and guidelines for the required LHA, proceed as follows:

(1) Box 1. The LHE manufacturer should provide an LWS for the LHE as configured. This information is routinely found in machine manuals, posted operating data, or

planning software, and may vary by machine configuration.

(2) Box 2. Depending on the LHE design, the manufacturer-defined LWS might include some allowance for wind forces on the suspended load and there should be stipulations regarding the maximum wind area included in the chart capacities. The manual for the LHE should state whether this is the case or not. The manufacturer may also define limitations on lateral forces from the wind acting on the LHE.

(3) Box 3. If a specific chart capacity is subject to the wind area of the load being below a stated maximum value, determine if the wind area of the load exceeds that value. If it does, find out if the manufacturer provides a formula by which a load of that area can be lifted at a reduced LWS. If a formula is provided, a qualified person should use it to recalculate a lower LWS then proceed to Box 7. If no formula is provided, it will be necessary for a qualified person to assess the wind force on the load at the planned operational wind speed and its effect on the LHE. See Box 4. If the manufacturer does not provide a maximum wind area for the LWS, proceed directly to Box 7.

(4) Box 4. In some cases, the manufacturer might simply provide a general LWS for the LHE, which includes no specific provision for imposed forces resulting from the effects of wind on the load, leaving it to the user to assess the wind forces on the load at the planned operational wind speed and their effect on the LHE. In other cases, it might be necessary to determine an LWS for the operation that is less than the general LWS. If the manufacturer doesn't provide applicable general guidance, the user should seek specific technical advice from the LHE manufacturer or a qualified person.

(5) Box 5. Maximum wind speeds quoted by the LHE manufacturer are typically intended to be those indicated at the highest point of a lifting apparatus, e.g., a crane boom or jib head. The suspended load will be at a lesser elevation, and the wind speed acting on the suspended load may be different (usually lower) in which case applying the "crane" wind speed to the suspended load will be conservative. However, local effects such as wind funneling can raise the wind speed on the load, where such conditions exist; this must be considered.

(6) Box 6. If the steps followed so far do not allow the determination of an LWS, it may be necessary to calculate the wind force on the suspended load and make an engineering judgment as to whether the LHE can safely withstand its magnitude. Section C-7 provides guidance in calculating the wind forces on suspended loads.

(7) Box 7. Knowing the predicted wind speed acting on the load, the resulting wind forces on the load can be calculated and their effects when transferred into the LHE assessed to determine whether they are within LHE acceptable limits. If the site personnel cannot readily assess the effect of the wind speed on the LHE and determine that it is within acceptable limits, they should seek the advice of the manufacturer or qualified person. A determination should be made as to whether the LWS should be reduced. If it is necessary to reduce the LWS, go back to Box 4 and repeat. Once an acceptable LWS has been established for the LHE with suspended load, go to Box 8.

(8) Box 8. Once a safe LWS for the LHE is established, it is also necessary to ensure that the suspended load can be controlled at that wind speed. The following should be considered:

(-a) wind forces (including gusts) acting on the suspended load at the safe LWS

(-b) the size and shape of the load

(-c) maintaining control without causing harm to personnel

(-d) the environment

(-e) clearances to the load and its surroundings

These considerations might require that the LWS for the operation be lowered even further to ensure it is within acceptable levels. An established LWS that is satisfactory for the LHE and the load should be included in the plan for the LHA, together with necessary monitoring and other control measures.

(c) Following the steps in the process map should allow an LWS to be established for the operation at which the LHE can be operated within its design limits and the load can be safely controlled. That LWS is an essential element of the plan for the LHA.

(d) The LHA should only commence if the wind speed at the location of the activity (adjusted for height at the top of the LHE) is predicted not to exceed the established LWS for an adequately long window of time in which to complete the LHA safely.

The LWS is only one factor affecting the safety of an LHA. Calculation of a planned LWS, and confirmation that wind speed conditions at a work site are within the planned LWS, shall not supersede other concerns participants may have about the site conditions and the safety of the LHA.

C-10 WIND VELOCITY — PLANNED AND MEASURED

This section provides guidance on forecasting wind speeds, and measuring the wind speed, and the effects of gusting, and wind funneling. The following effects should be considered:

(a) Local weather information provides the forecast for sustained wind velocity and wind gust at a standard elevation of 10 m (33 ft) above the ground surface, assuming an open environment.

(b) National Oceanic and Atmospheric Administration (NOAA) defines WIND as the horizontal motion of the air past a given point. Wind describes the prevailing direction from which the wind is blowing with the speed given usually in miles per hour or knots. It may be a 2-min

average speed (reported as wind speed) or an instantaneous speed (reported as a peak wind speed, wind gust, or squall). Sustained wind velocity is the average wind speed steadily maintained over a period of 10 sec. Wind gusts are defined as rapid fluctuations in the wind speed with a variation of 10 knots (11.5 mph) or more between peaks and lulls. The speed of the gust is the maximum instantaneous wind speed maintained up to 3 sec.

(c) Wind speed is reduced by the force of interaction with the ground surface, and generally increases as distance above the ground increases. Wind speed varies with height, local terrain, and ground surface roughness conditions (e.g., buildings, vegetation).

(d) The wind velocity that the LHE manufacturer is typically referencing is that measured at the highest point on the LHE, whereas as noted above wind forecasts obtained from official sources are typically referenced at 10 m (33 ft) above grade in an open environment and may therefore need to be adjusted for height and location to be a useful predictor. Historical data from the jobsite, measured at height, is very useful (where available).

(e) Ideally, the wind velocity at the load is measured at the same height as the load is (or will be) above the ground. Supplemental anemometer devices can be used to measure wind velocities located at or about this height to verify that the wind is at, or below, the maximum velocity for which the LHA is planned. Anemometers are commonly used wind sensors that are mounted at the desired elevation of the load. They either wirelessly transmit the wind velocity to a device in the LHE or are monitored by the lift director, operator, or a designated person. The range, responsiveness, and accuracy of the wind sensor device should be capable of reporting the anticipated wind speed and wind gusts during the LHA in a timely manner.

(f) Wind speed is affected by localized conditions, which can affect the magnitude, direction, or both, depending on site conditions. Funneling effects, which increase the magnitude of wind velocity or change its direction, can result from the reflection or amplification of wind off adjacent buildings, vegetation, or other site conditions.

C-11 LHE OUT-OF-SERVICE DISPOSITION

Out-of-service disposition refers both to the ordinary preparation of an LHE before it is to be left unattended at the end of a shift and to exceptional preparations that are infrequently necessary in advance of a severe wind. Commonly an LHE manufacturer will specify both.

(a) Ordinary preparations might include measures to secure the LHE in an optimal configuration and orientation with its mechanisms in safe mode. A telescopic crane, for instance, would be scoped in, or a tower crane slew brake released, to allow for weather vaning. Operating personnel on duty in every shift should be familiar with these ordinary preparations and complete them daily.

(b) In anticipation of severe wind, some LHEs must be taken out of harms way or preparations made to weather the storm (e.g., a lattice mobile crane boom might be lowered to the ground or a gantry crane tied down in a designated parking location). In these instances, planners must specify the wind threshold for action and the response necessary to secure the LHE. The fundamental requirements for the plan usually comes from the LHE manufacturer, but might also be from a qualified person. Site Supervisors should have the following responsibilities:

(1) be aware of the wind limitations and the necessary response

(2) monitor forecasts

(3) maintain site conditions to be compatible with the execution of the response

(4) ensure designated personnel are qualified and available to carry out the response

(5) coordinate with public authorities or other appropriate entities if notifications, clearing of space, or access are needed

C-12 ASSESSING WIND FORCES ON LHE — SEMIPERMANENT INSTALLATIONS

(a) If a LHE is a semipermanent installation (e.g., strand jack tower system, tower cranes) and cannot be lowered in the event of high winds, the structure should be designed so that it can withstand

(1) out-of-service wind forces on the LHE

(2) in-service wind forces on the LHE and suspended load during the LHA at the defined LWS

(b) Determining the magnitude of design wind loads imposed on a structure should follow an established standard such as ASCE 7 or a similar standard.

(1) A design wind speed is determined on the basis of limiting the probability of it being exceeded during the design life of the structure.

(-a) The procedure requires that a basic wind speed be selected for the locale where the LHE is installed. ASCE 7 provides wind maps for this purpose. In some instances, the basic wind speed is dictated by the local authorities.

(-b) The wind speeds on the ASCE 7 wind maps are intended for permanent structures. When designing for a shorter duration construction periods, wind speeds associated with the same probability of exceedance would be less. ASCE 37 takes this into consideration. ASCE 37 allows a reduction factor to be applied to the basic wind speed based on the duration of construction.

(2) Once a design wind speed for exceptional winds is determined, the equations in ASCE 7 may be used to determine the design wind pressure. Factors to be accounted for include the exposure category, height

above ground, gust factor, wind directional factor, and the object geometry (force coefficient). The result is a design wind pressure to be applied in the analysis. This pressure can be used to assess whether the LHE installation has sufficient strength and stability for the local wind climate.

(c) Engineered lift systems may require analysis of the out-of-service condition and the establishment of a LWS on a case-by-case basis by a qualified engineer.

C-13 SECURING THE LOAD AFTER LANDING

The load should be secured as soon as practical after it has landed at the desired location. The method selected for securing the load should be capable of restraining the load during the full range of wind velocities that may occur or are anticipated to occur while the load remains at the location. The load should not be detached from the LHE until the designated person confirms that the load is in the correct location and is adequately supported and secured (e.g., guy wires, temporary bracing, and blocking).

C-14 CONTINGENCY PLANNING

Wind is highly variable by nature and thus could increase in velocity or change direction without notice. The lift planner should develop a contingency plan that includes measures to control the load, to land and secure the load in an alternate location, and to secure the LHE. The plan should be such that site personnel will be able to implement it immediately should the need arise. The plan should address the following scenarios:

(a) The forecast predicts a wind speed at which an out-of-service LHE must be secured (per manufacturer guidelines or legislative requirements).

(b) A revised forecast predicts that the wind speed will exceed the LWS during an ongoing LHA.

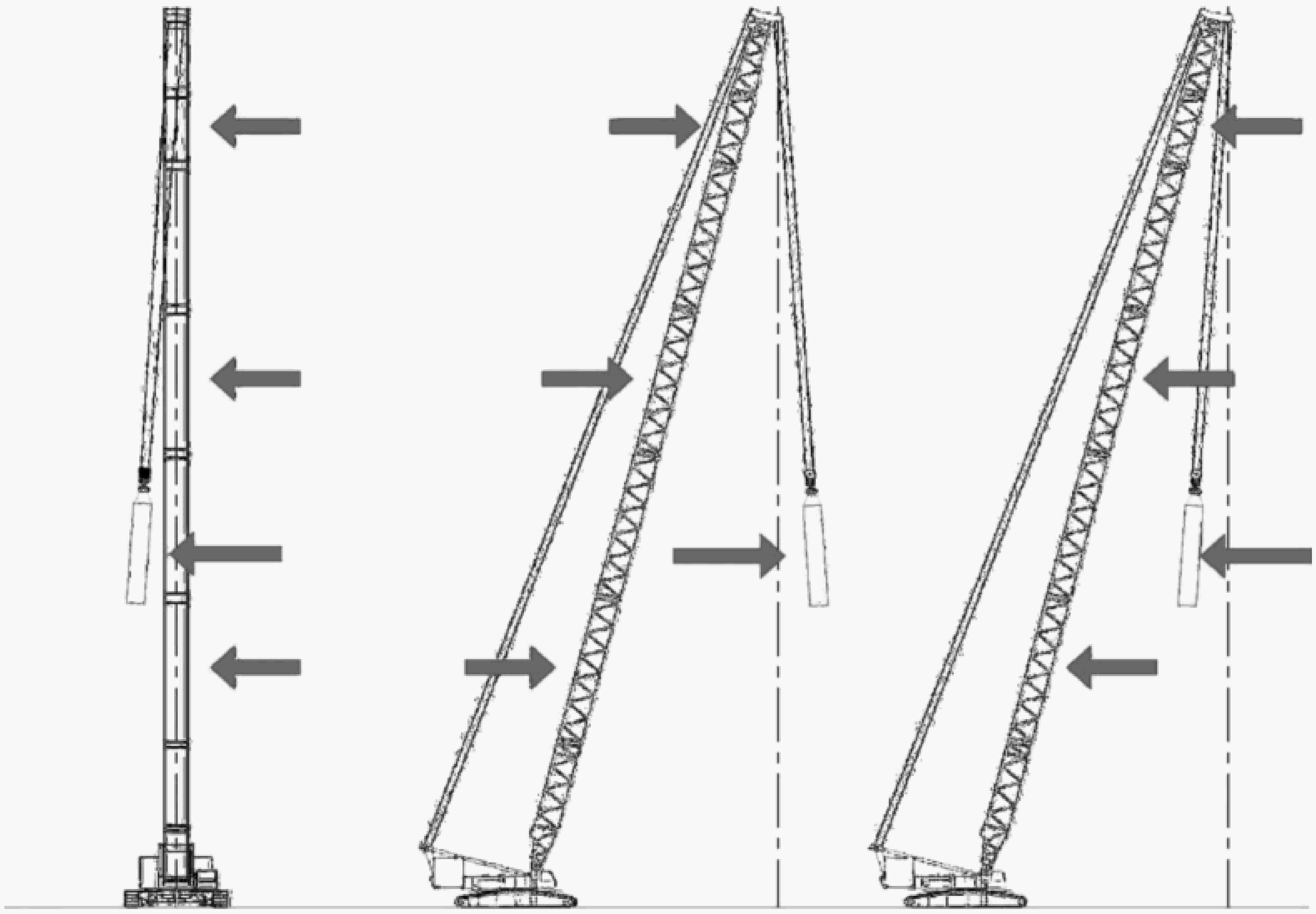
(c) The measured wind speed is close to or exceeds the LWS.

(d) An unattended LHE.

C-15 PERSONNEL LIFTING

For LHAs involving the lifting of personnel, regulatory agencies may require, and/or company- or site specific limitations may indicate the need for, a LWS lower than the one determined per section C-9. The lift planner shall consider these personnel-lifting requirements when developing the LHA plan. Guidance can be found in ASME B30.23.

Figure C-4-1 Wind Effect on LHE



(a) Wind From Side (b) Wind From Behind (c) Wind From Front

Figure C-5-1 Effects of Wind on Load

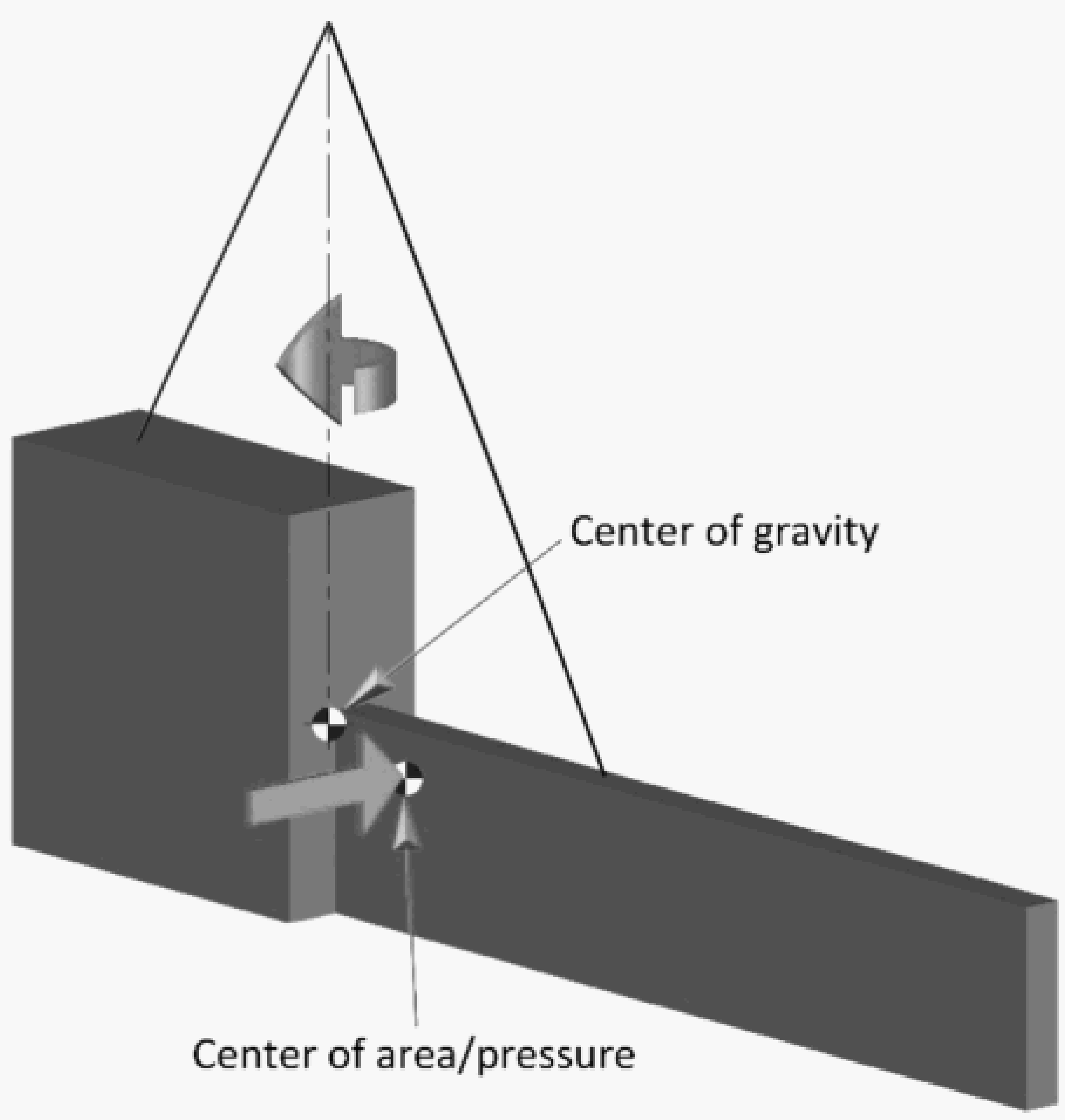


Figure C-6-1 Side Loading

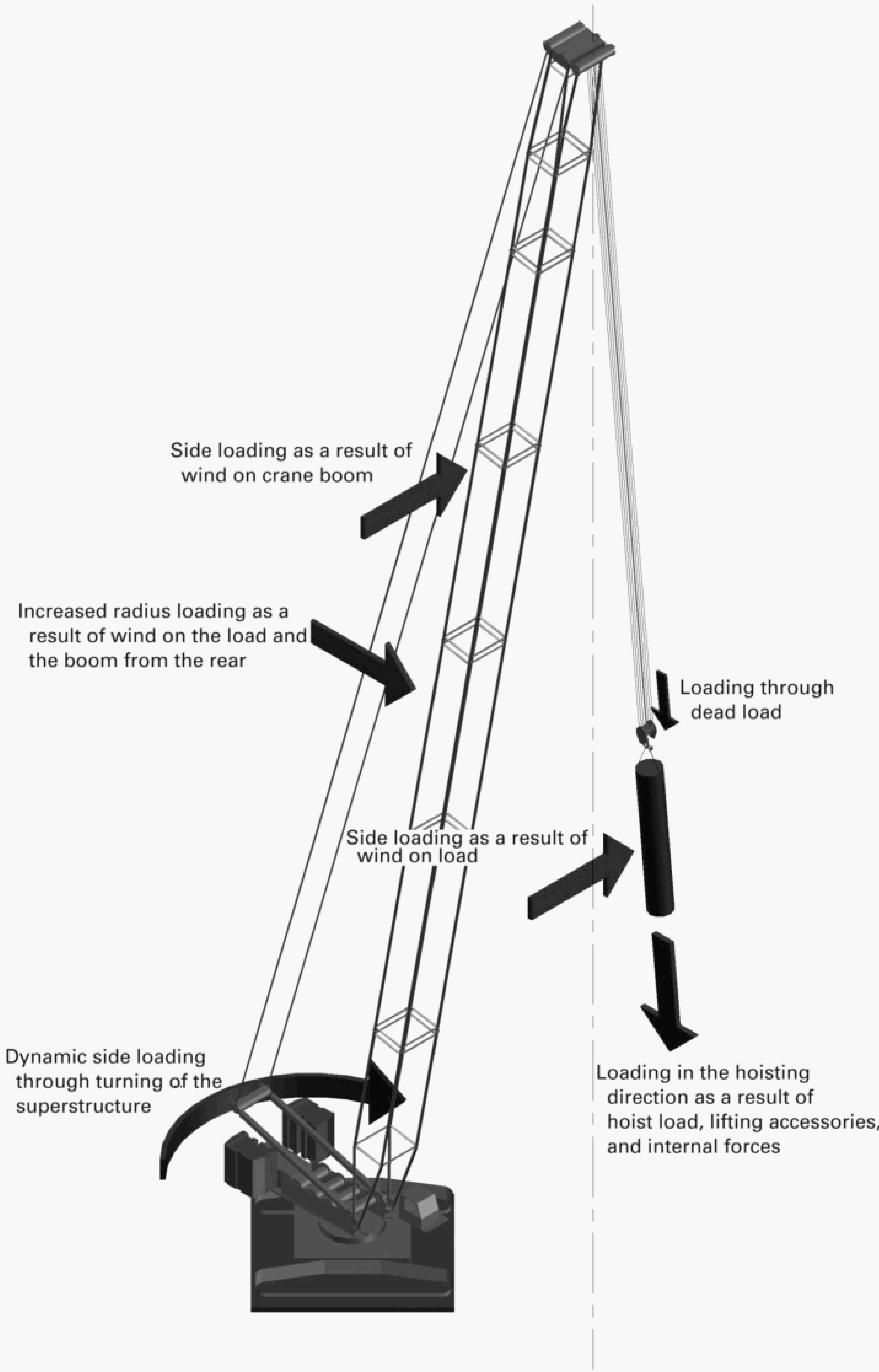


Figure C-8-1 Suspended Loads and Taglines

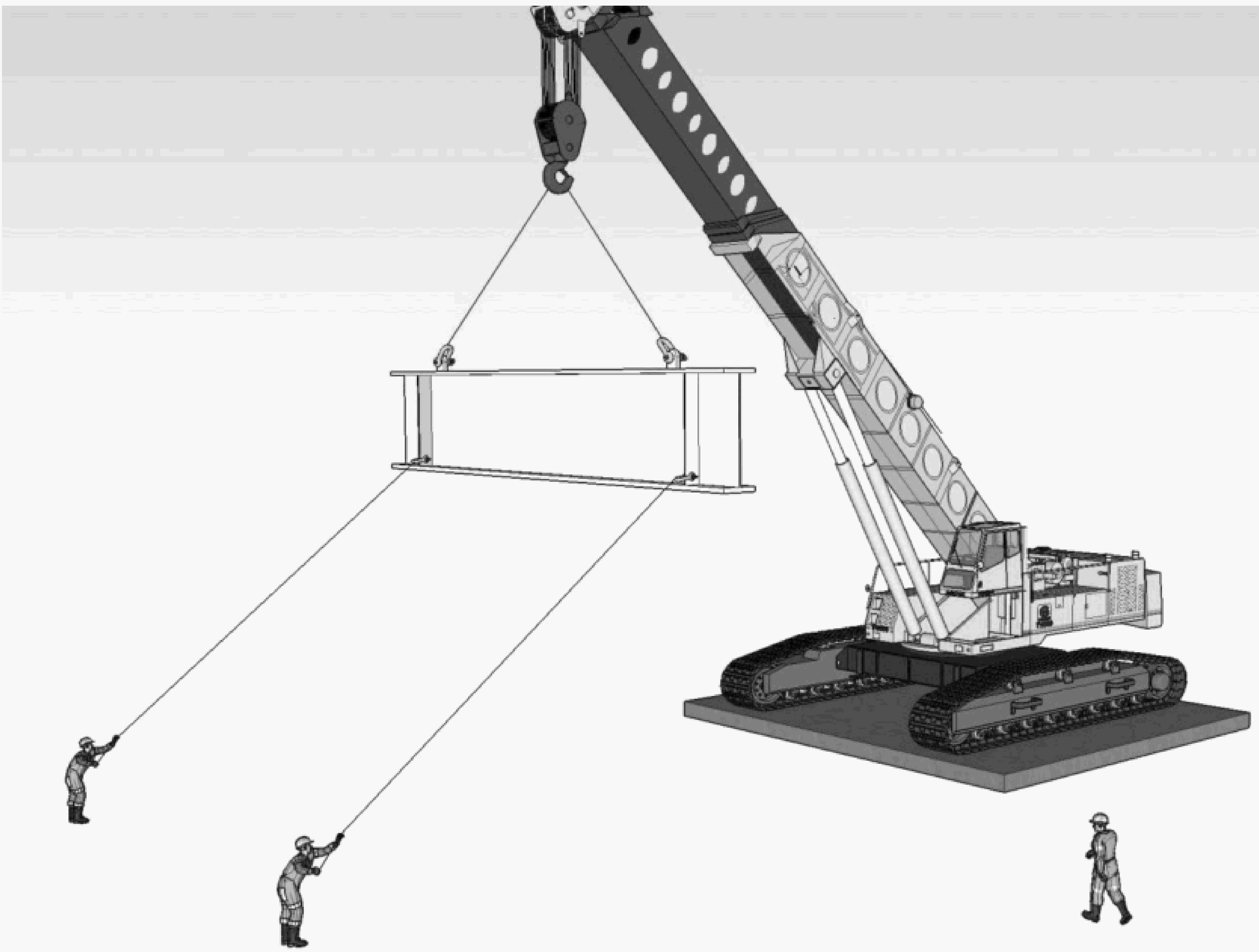
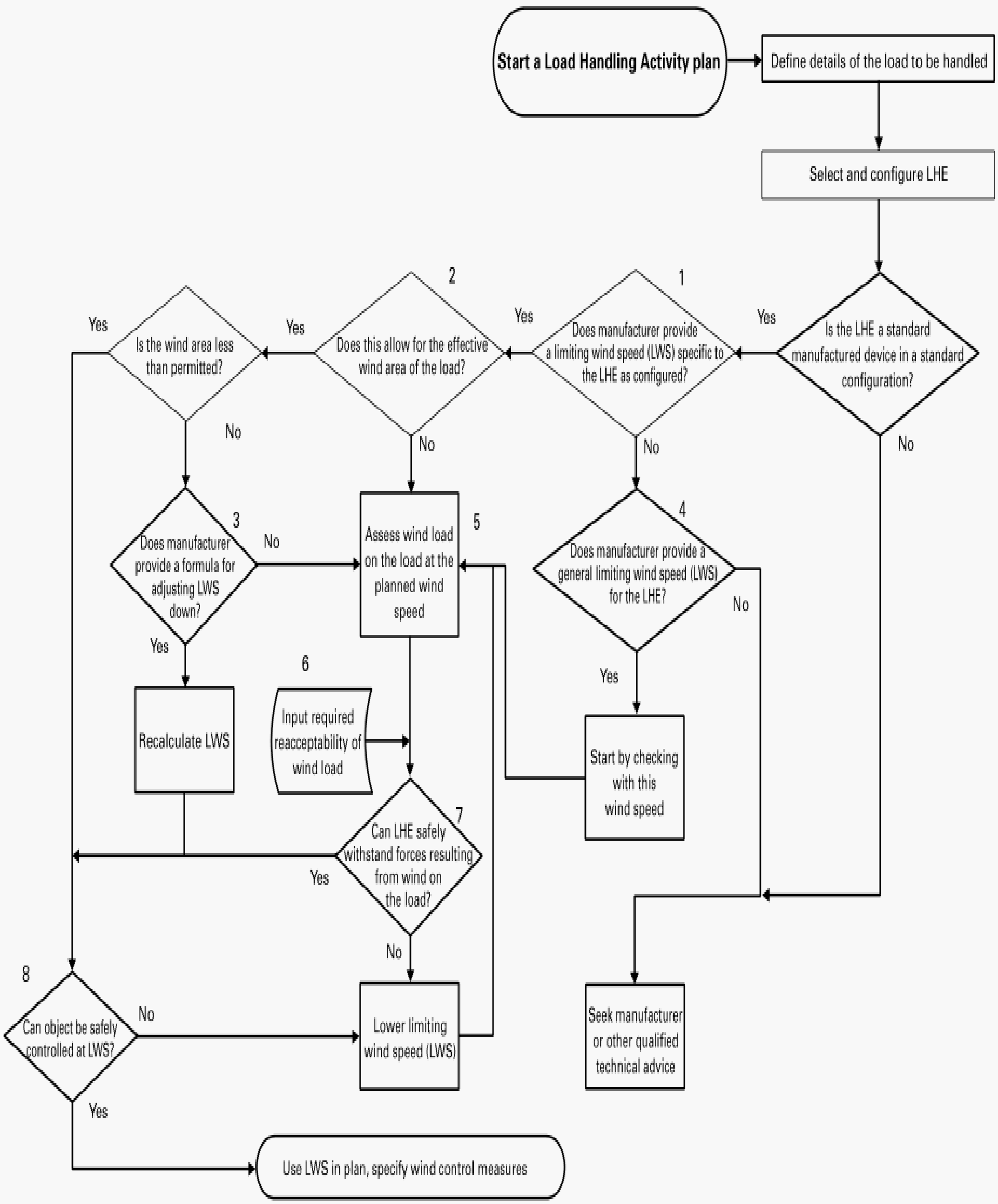


Figure C-9-1 Establishing a Limiting Wind Speed for a Load Handling Activity



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NONMANDATORY APPENDIX D INDUSTRY REFERENCES

The following list of industry documents may be helpful to LHE owners, users, lift directors, site supervisors, and others involved in the planning and execution of load handling activities. See latest edition.

API 2D, Operation and Maintenance of Offshore Cranes
Publisher: American Petroleum Institute (API), 200 Massachusetts Avenue NW, Suite 1100, Washington, DC 20001-5571 (www.api.org)

ASCE 7, Minimum Design Loads and Associated Criteria for Buildings and Other Structures
ASCE 37, Design Loads on Structures During Construction
Publisher: American Society of Civil Engineers (ASCE), 1801 Alexander Bell Drive, Reston, VA 20191-4400 (www.asce.org)

ASME B30.1, Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries
ASME B30.2, Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)
ASME B30.3, Tower Cranes
ASME B30.4, Portal and Pedestal Cranes
ASME B30.5, Mobile and Locomotive Cranes
ASME B30.6, Derricks
ASME B30.7, Winches
ASME B30.8, Floating Cranes and Floating Derricks
ASME B30.9, Slings
ASME B30.10, Hooks
ASME B30.11, Monorails and Underhung Cranes (withdrawn 2018 — requirements found in latest revision of B30.17)
ASME B30.12, Handling Loads Suspended From Rotorcraft
ASME B30.13, Storage/Retrieval (S/R) Machines and Associated Equipment
ASME B30.14, Side Boom Tractors
ASME B30.15, Mobile Hydraulic Cranes (withdrawn 1982 — requirements found in latest revision of B30.5)
ASME B30.16, Overhead Underhung and Stationary Hoists
ASME B30.17, Cranes and Monorails (With Underhung Trolley or Bridge)
ASME B30.18, Stacker Cranes (Top or Under Running Bridge, Multiple Girder With Top or Under Running Trolley Hoist)
ASME B30.19, Cableways
ASME B30.20, Below-the-Hook Lifting Devices
ASME B30.21, Lever Hoists
ASME B30.22, Articulating Boom Cranes
ASME B30.23, Personnel Lifting Systems
ASME B30.24, Container Cranes
ASME B30.25, Scrap and Material Handlers
ASME B30.26, Rigging Hardware
ASME B30.27, Material Placement Systems
ASME B30.28, Balance Lifting Units
ASME B30.29, Self-Erecting Tower Cranes
ASME B30.30, Ropes
ASME B30.31, Self-Propelled, Towed, or Remote-Controlled Hydraulic Platform Transporters (under development)
ASME B30.32, Unmanned Aircraft Systems (UAS) Used in Inspection, Testing, Maintenance, and Lifting Operations (under development)
ASME NOG-1, Rules for the Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)
ASME NUM-1, Rules for Construction of Cranes, Monorails, and Hoists (With Bridge or Trolley or Hoist of the Underhung Type)
Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

ASSE A10.6, Demolition Operations
ASSE A10.7, Transportation, Storage, Handling, and Use of Commercial Explosives and Blasting Agents
ASSE A10.12, Excavation
ASSE A10.13, Steel Erection
ASSE A10.15, Dredging
ASSE A10.19, Pile Installation and Extraction Operations
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ASSE A10.42, Rigging Qualifications and Responsibilities in the Construction Industry
ASSE A10.47, Highway Construction Safety
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CAN/CSA C225, Vehicle-Mounted Aerial Devices
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CAN/CSA Z150.3, Safety code on Articulating Boom Cranes
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CSA B167, Overhead Traveling Cranes Design, inspection, testing, maintenance, and safe operation
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Publisher: Industrial Truck Standards Developing Foundation (ITSDF), 1750 K Street NW, Suite 460, Washington, DC 20006 (www.itsdf.org)

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SIA A92.3, Manually Propelled Elevating Aerial Platforms
SIA A92.5, Boom-Supported Elevating Work Platforms
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Publisher: Scaffolding Industry Association (SIA), 20335 Ventura Blvd, # 310, Woodland Hills, CA 91364 (www.scaffold.org)

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