



DRAFT for Reaffirmation Public Review

E1.66 - 2020 (R202x)
Safety Standard for Followspot Positions Erected for
Short-term Use in Entertainment Venues

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Published by:

ESTA
630 Ninth Avenue, Suite 609
New York, NY 10036 USA
Phone: 1-212-244-1505
Fax: 1-212-244-1502
standards@ESTA.org
<http://www.ESTA.org/>

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The Followspot Position Working Group, which authored this Standard, consists of a cross section of entertainment industry professionals representing a diversity of interests related to equipment manufacturers, facility designers, event production, rigging and stage machinery for theatrical events. ESTA is committed to developing consensus-based standards and recommended practices in an open setting.

Contact Information

Technical Standards Manager

Karl G. Ruling
ESTA
630 Ninth Avenue, Suite 609
New York, NY 10036
Phone: 1-212-244-1505 x703
Fax: 1-212-244-1502
standards@ESTA.org

Assistant Technical Standards Manager

Richard J. Nix
630 Ninth Ave., Suite 609
New York, NY 10036
Phone: 1-212-244-1505 x649
Fax: 1-212-244-1502
standards@ESTA.org

Technical Standards Council Co-Chairs

Mike Garl
Mike Garl Consulting LLC
Phone: 1-432-694-7070
mike@mikegarlconsulting.com

Mike Wood
Mike Wood Consulting LLC
Phone: 1-512-288-4916
mike@mikewoodconsulting.com

Followspot Position Working Group Co-Chairs

Richard Logethetis
Lycian Stage Lighting
Phone: 1-845-469-2285
richard@lycian.com

Stephen Vanciel
IATSE Local 631
Phone: 1-321-278-0379
svanciel@bellsouth.net

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Acknowledgments

The Followspot Position Working Group members when this document was approved by the working group on 24 February 2020 are shown below.

Voting members:

- Jerry Gorrell; Theatre Safety Programs; U
- Robert Haycock; UC Berkeley; G
- Edwin S. Kramer; I.A.T.S.E. Local 1; U
- Jules Lauve ; Theatre Projects Consultants, Inc.; DE
- Richard Logothetis; Lycian Stage Lighting; MP
- Richard J. Nix; G
- Christopher B. Tilton; About the Stage, LLC; DE
- Stephen Vanciel; IATSE Local 631; U
- R. Duane Wilson; Amer. Society of Theatre Consultants; DE

Observer members:

- Justin Bennett; University of the Incarnate Word; U
- Curtis Kasefang; Theatre Consultants Collaborative, LLC; CP
- Kyle Kusmer; Steven Schaefer Associates, Inc; G
- Ford Sellers; Chauvet Lighting; MP
- Jeong Sik Yoo; Ghost LX; DE

Key to interest codes:

CP	Custom-market producer	DE	Designer
DR	Dealer or rental company	G	General interest
MP	Mass-market producer	U	User

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Foreword

Followspot positions are perhaps among the most challenging spaces to design in a performance facility. These areas are often addressed late in the design process, and thereby are compromised by space restrictions created by the needs of other equipment. In many other cases, they are afterthoughts, retrofitted into existing spaces that may not have been intended to accommodate them. In any case, the space where the followspots reside must accommodate many things: both equipment and operator, with adequate power and ventilation, accessible to the operators, and—perhaps as important—a clear sightline to the areas intended to be illuminated by the equipment.

When considering the possibilities, many questions arise. Where can they be located in order to provide the most effective functionality? Will the space provide sufficient clearance for the full range of pan, tilt, and operator movement? How does one access the “crow’s nest,” up there, in the building rafters? Is there a catwalk, or is ladder access necessary, with all of its associated additional personnel safety requirements?

The Followspot Positions Working Group was formed to address these various issues associated with the design and functionality of followspot positions. Its original mission limited scope to permanent installations. Its first publication, ANSI E1.28, *Guidance on planning followspot positions in places of public assembly*, was published in 2011 and reaffirmed in 2016. Today, ANSI E1.28 remains the only comprehensive standards document available, for followspot positions in permanent facilities.

In 2018, the working group decided to address temporary followspot positions, which present an even wider array of considerations, due to the temporary nature of these spaces. Temporary positions can be entirely self-contained, stand-alone structures, or might simply be located in an elevated area of an existing space. The intended space may already include some of the clearances and power necessary, while—more often than not—the space might begin as nothing more than a sketch on paper. Now what?

The Followspot Positions Working Group hopes to answer such questions with this standard. More importantly, it aspires to enlighten readers of the possibilities and potential risks associated with temporary followspot positions.

1 Scope, purpose and application

This standard covers safety requirements for followspot positions in, or on, structures erected for short-term use, and positions not covered by ANSI E1.28. It is applicable to positions located indoors or outdoors. It addresses structural, electrical, and personnel safety requirements associated with them.

1.1 Purpose

The purpose of this document is to define design, fabrication, operation and use, inspection and maintenance requirements for the structures included in its scope. This document provides general guidelines for structures. It is not meant to replace the advice of a professional engineer or the requirements dictated by the authorities having jurisdiction for the event site.

1.2 Intent

This document is intended for use by both users and enforcement officials in order to help establish and maintain minimum standards for care and public safety. It is not intended for use as a design manual.

1.3 Application

This document provides guidance and general design requirements, but should not be construed as a design manual for the complete requirements for any given structure. The application of this standard is relevant to three phases of event production: design, installation/dismantle, and operational use. Applicability of this standard may vary based upon the risks associated with each phase.

1.4 Normative references

The following documents contain requirements relating to the scope of this standard. They are provided for guidance only, unless otherwise referenced specifically elsewhere within this standard. Where a specific version is not given, the version applicable to the event jurisdiction shall be used. European standards are also recommended for review, as they are considered useful references where recognized national standards do not already exist.

- ANSI ES1.19 –2018, *Safety requirements for special event structures*
- ANSI E1.28 – 2016, *Guidance on planning followspot positions in places of public assembly*
- ANSI E1.58 - 2017, *Electrical Safety Standard for Portable Stage and Studio Equipment Used Outdoors*.
- International Fire Code as applicable to the state, local or municipal jurisdiction
- International Building Code as applicable to the state, local or municipal jurisdiction
- *IstructE Temporary Demountable Structures, 4th Edition*
- *NFPA 70 - 2020, National Electrical Code*

2 Definitions

2.1 anchorage: Something that provides a secure hold to resist a vertical uplift force, a horizontal or lateral force, or combination of forces. The term anchorage shall be construed to include any type of earth-embedded anchor, ballast in the form of dead-weight placed on the erection surface or any fixed point, such as a building or other structure.

2.2 Authority Having Jurisdiction (AHJ): The regulatory agency responsible for enforcement, administration and compliance with any law, rule, code, standard or regulation applicable to the site, structure or event.

2.3 competent person: A person who is capable of identifying existing and predictable hazards in the workplace, and who is authorized to take prompt corrective measures to eliminate hazards.

2.4 lateral force resisting system (LFRS): That part of a structural system designed to prevent collapse by resisting sideways or horizontal forces applied to the structure.

2.5 platform (stage): Any structurally framed surface used to support equipment, scenery or performers, whether for storage or for live performance.

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

2.7 registered design professional: An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws or jurisdiction in which the project is to be constructed.

2.8 shall: denotes a mandatory requirement.

2.9 should: denotes a recommendation.

2.10 stage: see **platform**

3 Essential design requirements

3.1 General

Temporary followspot positions shall be designed by qualified persons, and shall be evaluated by a registered design professional, to ensure structural capacity and suitability of use in the designated special event environment.

3.1.2 Documentation - Structural description

Temporary structures shall be described by a qualified person. The description shall define the structural support systems used for the design.

3.1.3 Documentation – Structural detailing

Temporary structures shall be documented in a manner that details the components and connections for the structural support system.

3.1.4 Documentation – Limits of use

The description for temporary structures shall include the intended use, and limits of use for the structure.

3.1.5 Documentation – Occupancy and egress

The description for temporary structures shall include occupancy type and classification, maximum number of occupants permitted on or within the structure. Documentation shall show the egress requirements necessary for conforming with the structure's limits of use, and for conformance with any AHJ egress, exit and evacuation requirements.

3.1.5.1 Occupancy load factors, general. Occupancy load factors shall be determined using methods approved by the AHJ. Use of the specific methods described in 3.1.5.2 and 3.1.5.3 shall be permitted where no specific requirement is provided by the AHJ, and provided that the lowest result shall be used.

3.1.5.2 Occupancy load factors, IFC method. Where the IFC applies to the jurisdiction of use, occupancy load factors shall be determined in accordance with the International Fire Code - 2018 edition, Chapter 10 Means of Egress, Table 1004.2 Maximum Floor Area Allowances Per Occupant.

3.1.5.3 Occupancy load factors, NFPA method. Where NFPA 101 applies to the jurisdiction of use, occupancy load factors shall be determined in accordance with NFPA 101 Life Safety, 2015 edition, Chapter 7 Means of Egress, Table 7.3.1.2 Occupant Load Factor.

3.1.6 Definition of design loads

All anticipated structural loads shall be defined. Anticipated loads shall be construed as including any design loads intended to be accommodated, and any loads required by the applicable design codes adopted by the AHJ.

3.1.6.1 When a structure is designed to meet specific application requirements, those intended requirements shall be defined by the designer.

3.1.6.2 When a structure is evaluated by a registered design professional, all loads and load cases required to be considered by commonly acceptable engineering practice shall be defined.

3.1.6.3 The designer and the registered design professional shall collaborate to ensure that all intended design loads are accommodated by the engineering evaluation.

3.1.6.4 When application design requires the structure to accommodate variable, event-specific live-load cases, the initial structural design shall be templated so that the variations in live-load cases can be evaluated by the registered design professional.

3.1.6.5 When the structure cannot, or is not intended to, accommodate variable, event-specific load cases, such limitations shall be explicitly defined by the designer or by the registered design professional.

3.1.7 Permit submittal and Construction Documents *

Where permits are required for construction, use or occupancy of a temporary structure, all documentation required by this standard shall be submitted as part of the permit application. Documents shall be provided in printed or electronic format, scaled and dimensionally accurate at scale.

3.1.8 Pre-engineered modular platform systems

Pre-engineered modular platform systems shall be erected in accordance with the manufacturer's instructions.

3.1.9 Scaffold systems

Scaffold systems shall be erected and used in accordance with ANSI/ASSP A10.8 – 2019, *Scaffolding safety requirements*.

3.1.10 Mobile elevated work platforms

Mobile elevated work platforms shall be used in accordance with ANSI/SAIA A92.22, *Safe Use of Mobile Elevated Work Platforms*. Personnel shall be trained in accordance with A92.24, *Personnel training for use of Mobile Elevated Work Platforms*.

3.2 Foundations & footings

All temporary structures shall be placed on load-bearing surfaces capable of supporting the structural bearing pressures required by the jurisdiction's applicable building code requirements, and as determined by a registered design professional. Modifications to allowable bearing pressures for temporary structures shall be permitted where the jurisdiction's applicable building code specifically allows modifications relevant to temporary structures.

3.3 Design loads*

Vertical, lateral, environmental, event-specific and other anticipated loads, including structural self-weight, shall be defined and included in the design evaluation of temporary special event structures.

3.4 Lateral force resisting systems

Lateral loads shall be defined and assessed. Details of the lateral force resisting system requirements shall be included in the design evaluation of temporary special event structures.

3.5 Specific requirements

3.5.1 Platforms

Platforms used as followspot positions shall not be used for public access.

3.5.1.1 Special purpose required.

Platforms for use as followspot positions shall be restricted- or controlled-access only.

3.5.1.2 Allowable capacity*

Temporary followspot platforms shall be designed for an allowable capacity of not less than 100 pounds per square foot for the entire platform surface area.

3.6 Anchorage*

Anchorage systems shall be designed by a registered design professional, and implemented by a competent person.

3.6.1 Anchorage system capacity documentation

Anchorage system capacity shall be included in construction documents, and in all installation and use documents. Anchorage system documentation shall include all acceptable anchorage configurations, quantities, tension capacities, tension cable angles and connection methods.

3.6.2 Anchorage proof test required

Where anchorage systems rely on soil penetration, anchorages shall be proof-tested at each installation in accordance with the anchorage manufacturer's instructions. Where no manufacturer's instructions exist, the proof load test shall not be less than the anchorage design capacity shown on the construction documents.

3.6.3 Anchorage minimum proof load.

Where anchorages for a single structure require different design capacities, the proof load test shall not be less than the highest anchorage design capacity for the structure. All components used in the connection shall have a rated capacity of not less than the design evaluation loads shown on the construction documents.

3.7 Equipment restraint

Followspot equipment shall be anchored to the followspot position, or shall be restrained from falling from the platform.

3.7.1 Shared anchorage. Where fall arrest anchorages are also used for equipment restraint, the anchorage shall be designed to accommodate the fall arrest load and the equipment restraining load, applied simultaneously.

3.8 Personnel access and safety

3.8.1 Platform access methods

Access to the followspot position's working platform shall be accomplished in any manner that protects personnel from tripping or falling hazards during access to, or egress from the platform.

3.8.1.1 Stair access. Stair access to followspot position platforms shall be permitted. Stair tread size, rise, run and railings shall conform to OSHA requirements.

3.8.1.2 Vertical access systems. Vertical access by wire rope ladder systems shall be permitted only when conforming with ANSI E1.1-2018, *Entertainment Technology -- Construction and Use of Wire Rope Ladders*.

3.8.1.2.1 Personal fall arrest systems required. Personal fall arrest systems shall be used with all vertical access systems.

3.8.2 Fall Protection

3.8.2.1 Fall arrest requirements

Personal fall arrest systems used for followspot position platform access shall conform with either 29 CFR 1926.501, *Duty to have fall protection* requirements for personal fall arrest systems, or ANSI E1.39-2015, *Entertainment Technology – Selection and Use of Personal Fall Arrest Systems on Portable Structures Used in the Entertainment Industry*, as applicable to the work platform.

3.8.2.2 Edge protection required

Edge protection, railings or guardrails shall be required on the followspot platform. Railing or other edge protection systems shall conform to OSHA requirements for height, strength, and rail spacing.

3.8.2.2.1 Railing exceptions

Other railing heights shall be permitted on the platform edge facing the performance platform, where necessary to facilitate unobstructed movement of the followspot equipment and its associated illumination path, provided that the equipment and personnel are protected from falling.

3.8.2.2.2 Fall restraint permitted

Fall restraint systems shall be permitted as an alternative to edge protection, if approved by a qualified person. Fall restraint systems shall conform to ANSI/ASSE Z359.3 - 2017 - *Safety Requirements for Positioning and Travel Restraint Systems*.

3.9 Electrical safety

3.9.1 Qualified personnel

Electrical supply for followspot positions shall be designed and installed by qualified personnel to comply with all applicable safety codes and standards.

3.9.2 Power and cabling requirements

Wiring for followspot positions shall comply with NFPA 70, National Electrical Code, Article 520, Theaters, Audience Areas of Motion Picture and Television Studios, Performance Areas, and Similar Locations.

3.9.3 Exempt from NEC Article 590

Wiring to followspot positions shall be exempt from the requirements of NFPA 70, National Electrical Code, Article 590, except during the actual construction of the followspot position.

3.9.4 Equipment rated for indoor use

Outdoor use of equipment rated for indoor use shall be permitted in accordance with ANSI E1.58 - 2017, Electrical Safety Standard for Portable Stage and Studio Equipment Used Outdoors. In addition, it is recommended that ground-fault protection with a nominal 30-milliampere, or lower, trip point be used on the circuits powering equipment.

3.9.5 Equipotential requirements

Electrically conductive structures used for followspot positions shall be bonded or constructed so that personnel cannot touch conductive elements that are at electrical potentials high enough to cause injury.

3.9.6 Electrical Emergency Plan

The required Operations Management Plans (OMP) shall include specifications for safely de-energizing the followspot position power supply and the conditions that will trigger this step.

4 Site selection and advance planning *

Site locations where structures will be placed shall be evaluated for suitability of soil allowable bearing pressure, hidden or buried utilities or obstructions, emergency vehicle access, egress doorways and pathways, and for required clearance between structures, if any, and if such clearance space includes perimeter lines for stakes, anchorage, or ballast.

5 Erection and dismantle

Structural erection and dismantle shall consider and implement reasonable work practices and procedures customary to the work, and in conformance with applicable OSHA workplace safety requirements.

6 Operation and use *

Structures shall be operated in conformance with their respective operations management plan, as correlated with or revised by the event-specific requirements.

6.1 OMP requirements: engineering limits

OMP shall define the engineering controls established by design and engineering evaluations.

6.2 OMP requirements: administrative controls

OMP shall define the administrative controls necessary for functional operation of the structure, and shall include all preparedness, alert, mitigation and stop-show/evacuation requirements as determined by the event risk assessment process.

6.3 Lightning protection

Outdoor followspot positions must be evacuated when the threat of lightning or thunderstorms exist.

6.4 Electrical Emergency Plan

The required Operations Management Plans (OMP) shall include specifications for the conditions that would trigger the need to safely de-energizing the followspot position power supply.

7 Inspections *

7.1 Inspections – general

Structures shall be inspected prior to first use. Site-specific inspection criteria shall be approved by the AHJ, but shall at minimum verify that the installed structural systems are as described in **3 – Essential design requirements**, including foundations, baseplates, cribbing (where required), bracing, anchorages, ballasting, guy wires and other components of the lateral force resisting system.

7.2 Types of inspections

The designer shall provide inspection types and criteria.

7.3 Frequency of inspections

The designer shall provide frequency of each type of inspection.

7.4 Results of inspection

The designer shall provide requirements for documentation of inspections.

8 Maintenance, repair, removal from use

The designer of the structure shall provide written criteria for maintenance, repair and removal from service for components and for the entire structure.

8.1 Repairs

The manufacturer and designer shall provide instructions for identifying components for repair, and whether or not such components may be repaired.

8.2 Removal from service

The manufacturer and designer shall provide criteria for identifying components that must be removed from service, and shall further provide instructions for all conditions by which any component removed from service may or may not be placed back into service, whether as a result of inspection, repair or replacement of the component. Unrepairable components shall be clearly marked and removed from service.

Annex A – Supplemental commentary, contains no requirements

A.3.1.7 Construction documents.

A basic set of documents should meet or exceed code requirements, regardless of what code requirements might indicate. Currently, most codes related to special events have submittal document requirements, but many of them are not explicit about the content of those requirements, nor are they consistent in explicit requirements. Recommended practice for due diligence suggests that there is no such thing as “too much information” with respects to special events. Every procedural aspect of event production can be anticipated, if not templated.

A.3.3 Environmental loads.

Environmental loads include wind, rain and snow. It is not always necessary to consider all environmental loads in the design of a temporary structure that is not intended to be erected and used in a specific type of environment. For example, snow loads need not be considered if the structure is erected in a warm environment, or is erected during a time of year when snow is not a consideration. Similar considerations apply for seismic design in non-seismic geographic locations. Consideration of wind loads is critically important, because geographic location, terrain type, presence of buildings contributing to wind funneling effects may all have a significant effect on the magnitude of loads to which a structure may be required to withstand.

A.3.5.1.2 Allowable capacity exceptions

When structural capacity is reduced, the event organizer is responsible for limiting the applied loads.

A.3.6 Anchorage

Anchorage systems include stakes, engineered earth anchors, and ballasting methods of many styles. Earth anchors are generally engineered soil penetration and embedment products, the manufacturers of which typically require a proof load test for validation of load bearing capacity. Such proof test loads are typically not less than 1.5 times the anchor’s rated capacity, which will vary depending upon soil geotechnical characteristics. Manufacturers of embedded anchorage systems usually provide a range of capacities, depending upon many site-specific factors. Anchorage capacity should always consider the worst-case geotechnical variables unless such variables can be reasonably limited or excluded altogether based on site-specific evaluation. Proof-load testing is always the best measure for determining the actual, in-situ anchorage capacity.

A.4 Site selection and advance planning

Site plans and onsite location of structures are assumed to have considered the location of underground utilities and other such obstructions or limitations in the event planning process prior to installation.

A.6 Operation and use

Refer to ANSI E1.21 for guidance on Operation Management Plans.

The engineering controls and physical limitations of the structure must be established in order to accurately develop administrative and operational controls for operation of the structure. For example, the structure’s wind speed capacity must be known in order to establish an appropriate high-wind action plan, in which wind speed triggering thresholds are established for alerts, mitigation actions, stop show and evacuation. All of these actions must be performed at wind speeds below the structure’s defined maximum wind speed capacity, unless other limiting safety criteria designates to the contrary. Evacuation(s) of the vicinity of the structure’s fall zone should occur when wind speeds exceed 56.3 kilometers per hour [35 miles per hour] 3-second gust.

A.7 Inspections

Inspections are important in the event production timeline. In general, they cannot be conducted without proper documentation – i.e construction documents – because inspections should be performed using construction documents, and should verify that the erected structure conforms to them. This illustrates the importance of respecting the event production timeline with respects to jurisdictional permitting processes. It also demonstrates the importance of collaborative safety and of the essential need for documentation prior to erection, so that

AHJ's and other planning participants can be duly apprised of expectations. Inspection criteria should always consider frequency and severity of the use environment.