DSA IR 16-5.16

DESIGN, FABRICATION AND INSPECTION OF BLEACHERS, FOLDING AND TELESCOPIC SEATING, AND GRANDSTANDS: 2016 CBC

Disciplines: Structural **History:** Issued 03/21/17
Revised from IR 16-5.07

Division of the State Architect (DSA) documents referenced within this publication are available on the DSA Forms or DSA Publications webpages**.**

Purpose: This IR clarifies the structural design requirements for bleachers. Do not use this IR for any other structures.

Scope: This IR is applicable only to bleachers, folding and telescopic seating, and grandstands submitted to DSA for review under the 2016 CBC.

1. Definitions: In addition to those in ICC/ANSI 300, Section 202, the following terms are defined for this IR.

1.1 School Buildings: DSA reviews and approves the construction of school buildings. Section 4-314, Part 1, Title 24, California Code of Regulation defines grandstands and bleachers more than five rows of seats above grade as school buildings.

1.2 Bleacher/Grandstand: ICC 300 defines bleachers and grandstands identically. The terms “bleacher” and “grandstand” will be used interchangeably in this IR. All provisions pertaining to bleachers will also be applicable to grandstands and vice versa.

1.3 Portable Bleachers: Seating facilities located outside of a building and not attached to permanent foundations. The maximum height of any portable bleachers may not exceed eleven rows, or nine feet above grade to the top seating board.

1.4 Temporary Portable Bleachers: Portable bleachers that remain at a location for less than 90 days. They are exempted from DSA review, but must be in compliance with the requirements of ICC/ANSI 300.

1.5 Folding and Telescopic Seating: Indoor tiered seating whose overall size and shape may be reduced without being dismantled for purposes of moving or storing. Unless otherwise noted, all provisions in this IR pertaining to bleachers and grandstands will also be applicable to this type of seating.

1.6 Acceptance of Folding and Telescopic Seating Fabrication Plants: Plants fabricating folding and telescopic seating for projects under DSA jurisdiction will require DSA acceptance. To qualify for DSA acceptance, the fabricator shall comply with the following:

- Obtain and maintain accreditation from any of the following organizations:
  - The International Accreditation Service (IAS).
  - The American Welding Society (AWS) per AWS QC17.
  - The Canadian Welding Bureau (CWB) per CSA Standard W47.1, Division 1.

Other nationally recognized evaluation services or accreditation bodies, equivalent to those indicated above, may be accepted by DSA with prior approval. Have a minimum of five years of documented continuous experience in the fabrication of folding and telescopic seating.

Documentation showing evidence of valid accreditation and experience shall be submitted to DSA upon initial acceptance and upon subsequent renewals of the accreditation noted above. Send the required documentation to DSA Headquarters at the following address:

ATTN: LEA Program
DSA Headquarters
1102 Q Street, Suite 5100
Sacramento, CA 95811

1.7 Bleacher Height: The overall height of a bleacher is measured from the top of foundation at the front to the upper most seatboard.

2. Relocation: DSA approval is only for the specific location originally shown. Any subsequent move to another location voids the approval and will require submittal of an application for approval at the new site. To be relocated, the bleacher must be DSA certified or be rehabilitated to meet the provisions of ICC 300 and this IR. Relocation shall comply with ICC/ANSI 300-2012, Section 505, and with fire and life safety and accessibility requirements per the current CBC.

3. Structural Design: The structural design shall be in accordance with ICC/ANSI 300, Section 303, CBC Table 1607A.1, and Section 3.1 through 3.8 of this IR.

3.1 Sway Loads: The design of bleachers and all supporting elements (e.g., connection to foundation or wall, wall element, etc.) shall include sway loads per ICC/ANSI 300, Section 303.4.

3.2 Seismic Loads:

3.2.1 Outdoor Bleachers: Freestanding outdoor bleachers shall be designed for seismic forces in accordance with ASCE 7 as follows:

- Transverse direction (perpendicular to seating): The seismic force shall be determined in accordance with Chapter 15 (“Nonbuilding Structures not Similar to Buildings”) using a seismic response factor R=1.25 per Table 15.4-2, (“All other self-supporting structures”) including all applicable requirements and limitations, such as height limit. I_e shall be per Table 1.5-2.

  Exception: When the seismic force-resisting system can be classified according to Chapter 15 (“Nonbuilding Structures Not Similar to Buildings”), the seismic force is permitted to be determined using the corresponding seismic coefficients taken from Table 15.4-1. All applicable requirements and limitations specified in the Table shall be considered.

- Longitudinal direction (parallel to seating): The seismic force shall be determined in accordance with Chapter 15 (“Nonbuilding Structures Not Similar to Buildings”) using a seismic response factor R=1.25 per Table 15.4-2, (“All other self-supporting structures”) including all applicable requirements and limitations, such as height limit. I_e shall be per Table 1.5-2.

Exception: When the seismic force-resisting system for independent lines of resistance can be classified according to Chapter 15 ("Nonbuilding Structures Similar to Buildings"), it is permitted to use the corresponding seismic response factor (R) taken from Table 15.4-1, including all applicable requirements and limitations, for that line of resistance.

Note: Braced frames with tension-only braces (rods, angles, etc.) are permitted to be considered "steel ordinary concentric braced frames" (R=3.25) in accordance with Table 15.4-1. All applicable requirements and limitations specified in the Table shall be considered.

3.2.2 Indoor Folding and Telescopic Seating: Indoor folding and telescoping seating structural framing, supports, and attachments, shall be designed in accordance with this section.

The provisions of this section apply only when the weight of the seating is less than 25% of the combined effective seismic weight of the seating and the structure. Where the weight of the seating is greater than or equal to 25% of the combined effective seismic weight of the seating and structure, refer to ASCE 7 Section 15.3.2.

3.2.2.1 Folding and Telescopic Seating Attached to the Building Wall: Where the lateral support of indoor folding and telescopic seating is provided entirely, or in part, by attachment to the building wall, the provisions of this section shall apply.

Seating Design: The seating structural framing shall be designed to resist seismic forces determined as follows:

- Transverse direction (perpendicular to seating): Seismic forces perpendicular to the seating shall be determined in accordance with ASCE 7 equation 13.3-1 using the following coefficients:

  $a_p = 1.0$ $R_p = 2.5$ $(z/h) = z_{cg\ seating}/h_{bldg\ ht.}$

  Height ($z_{cg\ seating}$) is the elevation of the center of gravity of the seating with respect to the base of the building. Height ($h_{bldg\ ht.}$) is the average roof height with respect to the base of the building. For pre-checked (PC) plans, it is recommended that a (z/h) equal to or greater than 0.80 be used.

- Longitudinal direction (parallel to seating): Seismic forces parallel to the seating shall be determined in accordance with ASCE 7 Chapter 15 using a seismic response factor R=1.25 per Table 15.4-2, ("All other self-supporting structures") including all applicable requirements and limitations, such as height limit. I_e shall be per ASCE 7 Table 1.5-2.

  Exception: When the seismic force-resisting system can be classified according to Chapter 15 ("Nonbuilding Structures Similar to Buildings"), the seismic force is permitted to be determined using the corresponding seismic coefficients taken from Table 15.4-1. All applicable requirements and limitations specified in the Table shall be considered.

Supports and Attachments Design: The supports and attachments for indoor folding and telescopic seating shall be designed to resist seismic forces determined in accordance with ASCE 7 equation 13.3-1 using the following coefficients:

- Transverse direction (perpendicular to seating):

  $a_p = 1.0$ $R_p = 2.5$ $\Omega_0 = 2.0$ $(z/h)_{building\ base} = 0$

  $(z/h)_{floor} = z_{floor}/h_{bldg\ ht.}$

  $(z/h)_{wall} = z_{pt\ on\ wall}/h_{bldg.\ ht}$

- Longitudinal direction (parallel to seating):

  $a_p = 2.5$ $R_p = 2.5$ $\Omega_0 = 2.0$ $(z/h)_{building\ base} = 0$

  $(z/h)_{floor} = z_{floor}/h_{bldg\ ht.}$

  $(z/h)_{wall} = z_{pt\ on\ wall}/h_{bldg.\ ht}$

Height (z) is the elevation of the point of attachment whether it is the building base, floor, or wall, with respect to the base of the building. Height ($h_{bldg\ ht.}$) is the average roof height with respect to the base of the building. For pre-checked (PC) plans, it is recommended that a (z/h) equal to or greater than 0.80 be used for the upper anchorage and a (z/h) equal to or greater than 0.15 be used for the lower anchorage.

3.2.2.2 Folding and Telescopic Seating Attached Only to the Building Floor: Seismic force applied in both the perpendicular and parallel to the seating direction; for the purpose of designing indoor folding and telescopic seating structural elements, supports, and attachments, shall be determined in accordance with ASCE 7 as follows:

The seismic force shall be determined in accordance with Chapter 15 (“Nonbuilding Structures Not Similar to Buildings”) using a seismic response factor R=1.25 per Table 15.4-2, (“All other self-supporting structures”) including all applicable requirements and limitations, such as height limit. I_e shall be per Table 1.5-2.

Exception: When the seismic force-resisting system can be classified according to Chapter 15 (“Nonbuilding Structures Similar to Buildings”), the seismic force is permitted to be determined using the corresponding seismic coefficients taken from Table 15.4-1. All applicable requirements and limitations specified in the Table shall be considered.

The seismic force shall not be less than the seismic force determined in accordance with Chapter 13, equation 13.3-1, using coefficients as follows:

$a_p = 2.5$ $R_p = 2.5$ $\Omega_0 = 2.0$ $(z/h)_{floor} = z_{floor}/h_{bldg\ ht.}$

Height (z_{floor}) shall be the elevation of the point of attachment with respect to the base of the building. Height ($h_{bldg\ ht.}$) is the average roof height with respect to the base of the building.

3.3 Wind Loads: Outdoor bleachers shall be designed for wind loads in accordance with CBC Section 1609A. Freestanding sloped outdoor metal bleachers are not permitted to be designed using the All-Heights procedure of CBC Section 1609A.6. The following wind provisions shall apply:

- Seatboards and Footboards shall be designed to resist cladding pressures per ASCE 7.
- Stringers with wind tributary area less than 700 square feet shall be designed for Components and Cladding (C&C) pressures in accordance with ASCE 7.
- Girders, regardless of wind tributary area, may be considered part of the Main Wind-Force Resisting System (MWFRS) and need not be designed for Components and Cladding (C&C) pressures.

3.4 Load Combinations: Load combinations shall be per ICC/ANSI 300, Section 303.5, except as modified by this section.

Where strength design or load and resistance factor design is used, the bleacher shall be designed to resist the effects resulting from the following combination of factored loads in addition to the load combinations specified in ICC/ANSI 300, Section 303.5.1:

$0.9D + 0.4L + 1.6Z$ (Equation 3-1a)

Where allowable stress design is used, the bleacher shall be designed to resist the effects resulting from the following combination of loads in addition to the load combinations specified in ICC/ANSI 300, Section 303.5.2:

$D + 0.4L + Z$ (Equation 3-3a)

$0.6D + 0.3L + Z$ (Equation 3-3b)

The supplemental load combinations in ICC/ANSI 300 which include handrail and guard loading shall be replaced with the following:

$1.2D + 1.6L + 1.6R_r$ (Equation 3-2)

$D + L + R_r$ (Equation 3-4)

The L used in Equation 3-2 and 3-4 is the uniform live load defined in ICC/ANSI 300, Section 303.2. Where the element supporting the handrail or guard does not support this uniform live load, L may be taken as zero.

Note: Contrary to past IR interpretations, the sway loads (Z) and guard or handrail loads (R_r) stipulated in ICC/ANSI 300 shall not be considered live loads (L) in the CBC Load Combinations in Section 1605A.

3.5 Seatboards and Footboards as Structural Elements: On the basis of full-scale tests, product tests, previously approved designs, and engineering data that were submitted, DSA has determined that seatboards and footboards are acceptable alternate structural elements, per Title 24, Part 1, Sections 4-304 and 4-305, for the following applications:

- Lateral bracing of the top flange of stringers.

  Note: Stringers that are continuous over supports and/or act in compression shall be designed assuming the bottom flange is laterally unbraced except at supports and locations specifically designed and detailed to provide bottom flange lateral bracing.

- Torsional restraint of the stringers. As a result of this torsional restraint, the stringers need not be designed for torsion induced by sway, seismic and wind forces. However, where stringers are continuous over supports, the stringer connection to each support (girder, column, etc.) shall be designed and detailed to resist torsion (rollover). In addition, stringers directly supporting guardrails or handrails shall be designed and detailed to resist torsion induced from guardrail or handrail loads in combination with applicable dead and live loads.

- Diaphragm action for distribution of sway, seismic and wind forces.

3.6 Footings: Footings for all bleachers are required to comply with CBC, Section 1808A, except temporary portable bleachers as defined in Section 1.2 above may be supported by wood sills or steel plates directly bearing on the ground surface, provided the soil pressure does not exceed 1,200 pounds per square foot (psf).

3.7 Professional Stamps and Signatures: A California licensed architect or registered structural engineer shall prepare and submit construction documents, which include plans and specifications, along with any supporting documents such as calculations to DSA for review and approval. All construction documents shall bear the stamp and signature of the architect or structural engineer per DSA *IR A-19: Design Professional's Signature and Seal (Stamp) on Construction Documents*.

The architect or structural engineer who is in general responsible charge of a project as defined by Title 24, Part 1, may exercise the option to use plans and specifications prepared by the fabricator's (California registered) civil or structural engineer, and submit a Statement of General Conformance. The requirements for using this option are provided in DSA *IR A-18: Use of Construction Documents Prepared by Other Professionals*.

3.8 Approval by Comparison with Previously Approved Similar Designs: At the discretion of DSA, request for comparison review and approval may be granted for site-specific outdoor bleachers and indoor telescopic bleachers, which have already been approved at a DSA Regional Office or through the Pre-Check (PC) process, under the following conditions and limitations.

3.8.1 Structural Element Limitation: Structural elements and connections, such as welds, bolts, etc., must be the same or stronger than those used in the previously DSA approved drawings and specifications. The length of structural elements must be the same or shorter than previously approved.

3.8.2 Span Limitation: The spans of the structural system must be the same or less than shown on the previously DSA approved drawings and specifications.

3.8.3 Additional Limitations:

- There are no conceptual changes to the configuration of the structural system.
- There have been no subsequent changes in the CBC or DSA policy that would adversely affect the bleacher design.
- The design loads are no greater than those indicated in the previously DSA approved design.
- Material Specifications (sizes and grades) shall remain unchanged.

3.8.4 Soil Condition Limitation: The soil conditions must provide equal or greater capacity to support the structure than indicated in the previously DSA approved design. If the soil conditions provide less capacity, DSA will review the affected portions of the design. Once DSA determines that the site specific foundation system complies with the code requirements, the design will be approved.

3.8.5 Ancillary Attachments: Site adopted ancillary attachments such as ramps and walkways may require a full review.

3.8.6 Revisions and Corrections: DSA may require revisions and corrections to the new site-specific project in case of error, omission, changes in CBC or DSA policy, etc.

4. Testing and Inspection in Fabricator's Shop:

4.1 Special Inspection for Shop Fabrication of Bleachers, Folding and Telescopic Seating and Grandstands: Special inspection shall be required per CBC, Section 1704A.2 for shop fabrication of bleachers, folding and telescoping seating, and grandstands. The special inspector shall verify the fabricator's quality control procedures and inspect the fabrication to verify conformance to approved construction documents and referenced standards per CBC Section 1705A.2.1 and 1705A.2.5.

The special inspector shall be employed by the laboratory of record or school district (owner) per Title 24, Part 1, Section 4-335(f)1.A or 4-335(f)1.B, respectively. Special inspectors employed by the school district (owner) shall be approved by DSA in accordance with Title 24, Part 1, Section 4-333(c) and 4-335(f)1.B. Refer to DSA Procedure *PR 13-01: Construction Oversight Process* for additional requirements applicable to special inspection, including verified report submittal requirements.

4.1.1 Material Certification: The special inspector is responsible for ensuring all materials are identifiable or traceable to the certificates of compliance, such as mill certificates for steel and fasteners, lumber inspection certificates, etc. The DSA approved special inspector shall attach copies of these certificates to his or her daily inspection reports (DSA-250) per Title 24, Part 1, Section 4-335(f)4.A provided to the project inspector. When the special inspector is employed directly by the school, he/she shall submit a verified report (DSA 292) per Title 24, Part 1, Section 4-335(f)4.B. Refer to DSA Procedure PR 13-01 for additional requirements applicable to special inspection, including verified report submittal requirements.

4.1.2 Material Testing: If any material testing is required, such as for unidentifiable steel, testing must be performed by a test laboratory employed by the school district and acceptable to DSA. A list of acceptable test laboratories can be found on the DSA Accepted Laboratories page in the DSA Tracker website.

For remotely located fabricators, refer to *IR A-15: Testing and Inspection of Remotely Fabricated Structural Elements*.

Test reports shall be submitted by the laboratory per Title 24, Part 1, Section 4-335(d), and a final verified report *DSA 291: Laboratory of Record Verified Report* shall be submitted at the conclusion of the fabrication. Refer to DSA Procedure PR 13-01 for additional requirements applicable to the test laboratory, including verified report submittal requirements.

4.1.3 Special Inspection for Welding: If welding is required in the fabrication shop, an AWS-certified welding inspector (CWI) or AWS-senior certified welding inspector (SCWI) shall inspect welding in accordance with the CBC and DSA *IR 17-3: Structural Welding Inspection: 2016, 2013, 2010 and 2007*. Refer to Section 4.1 for special inspector employment and, when applicable, approval by DSA. The welding inspector shall provide daily inspection reports *DSA 250: Special Inspection Report* per Title 24, Part 1, Section 4-335(f)4.A. When the special inspector is employed directly by the school, he/she shall submit a final verified report *DSA 292: Special Inspectors Employed Directly by the District Verified Report* per Title 24, Part 1, Section 4-335(f)4.B. Refer to DSA Procedure PR 13-01 for additional requirements applicable to special inspection, including verified report submittal requirements.

4.2 Folding and Telescopic Seating Shop Fabrication Exempt from Special Inspection: Special inspections are not required for folding and telescopic seating fabrication performed on the premises of a folding and telescopic seating fabrication shop acceptable to DSA as defined in Section 1.6.

4.2.1 Fabrication Documentation: At the completion of the fabrication, the fabricator's engineer shall submit a Certificate of Compliance – Accepted Folding and Telescoping Seating Fabricator, form *DSA 130: Certificate of Compliance – Accepted Folding and Telescopic Seating Fabricator*, and supporting documentation indicated in said form to the owner, project inspector, the engineer or architect in general responsible charge, and DSA.

5. Inspection in the Field: When the bleacher is delivered to the job site, the project inspector (PI) shall be responsible for, but not limited to, the following:

- Ensure all the required documents per Sections 4.1 or 4.2 are submitted by the fabricator.
- Review the fabricator's submitted documents for compliance with DSA approved construction documents.
- Inspect the bleacher for defects and compliance with DSA approved construction documents.
- Inspect the field installation, including site work.

5.1 Special Inspection of Field Welding: If welding is required in the field, an AWS-certified welding inspector (CWI) or AWS-senior certified welding inspector (SCWI) shall inspect welding in accordance with the CBC and IR 17-3. Refer to Section 4.2 for employment requirements and, when applicable, DSA approval requirements. Refer to PR 13-01 for additional requirements applicable to special inspection.

Field welding inspectors shall provide daily inspection reports (DSA-250). When the special inspector is employed directly by the school district (owner), the inspector shall submit a verified report (DSA-292) at the completion of the work in addition to the daily inspection reports.

6. Yearly Inspection: After the installation, the owner shall conduct annual inspections as required by ICC/ANSI 300, Section 105.2. The owner will also maintain copies of all annual inspection reports and make them available on site for DSA review upon request.

7. Load Testing: When approved by DSA, load testing may be used to verify the structural capacity of a bleacher and/or bleacher element (e.g., guardrail) design as a basis for approval in lieu of engineering analysis.

New testing will be required if a bleacher and/or bleacher element is changed in such a way that the design of the revised bleacher and/or bleacher element cannot be verified by engineering analysis.

The test specimen must be an exact prototype of the design submitted for approval. The material used in the test specimen shall match the material specified for the design.

The load test procedure must be approved by DSA prior to testing. The test load shall be applied in not less than four approximately equal increments. The load test material shall be applied in such a manner as to avoid: 1) stiffening the structure, 2) arching of the load test material, and 3) impact loading the structure.

7.1 Test Load Factors: When load tests are made to check the design or as a basis for approval of bleachers and/or bleacher elements, the test load shall not be less than twice the design vertical load combined with twice the design lateral load.

7.2 Folding and Telescopic Seating: Load tests for the verification of primary structure of folding and telescopic seating may be permitted on a case by case basis.

7.3 Accessories: Load tests for accessories such as hand rails may be verified by tests on a case by case basis.

8. Existing Bleachers, Folding and Telescopic Seating, and Grandstands: Owners shall inspect, maintain and upgrade bleachers in accordance with Chapter 5 of ICC/ANSI 300. Upgrades will require DSA approval and certification of construction in accordance with Part 1, Title 24, California Code of Regulations.

9. Other Requirements: All bleachers shall comply with the CBC and ICC/ANSI 300 requirements for accessibility, fire-life safety, egress, lighting, etc.

9.1 Automatic Fire Sprinkler systems: Spaces Below or Under Bleachers: Unoccupiable spaces below bleachers (telescopic or fixed) shall not require fire sprinkler systems. Occupiable spaces (Concession Stands, Restrooms, Storage Rooms, etc.) shall require Automatic Fire Sprinkler systems in accordance with currently adopted codes.

REFERENCES:

California Code of Regulations (CCR) Title 24
Part 1, 2016 California Administrative Code
Part 2, 2016 California Building Code, Sections 1029.1.1, Table 1607A.1
Part 10, 2016 California Existing Building Code, Sections 301.1
ICC/ANSI 300-12

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This IR is intended for use by the DSA staff and by design professionals to promote statewide consistency for review and approval of plans and specifications as well as construction oversight of projects within the jurisdiction of DSA, which includes State of California public schools (K–12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is subject to revision at any time. Please check DSA's website for currently effective IRs. Only IRs listed on the webpage at https://www.dgs.ca.gov/dsa/publications at the time of project application submittal to DSA are considered applicable.