

ASCE Sustainable Solutions Competition

Tactical Urbanism Challenge

2020 Rules



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Section 1: Mission and Summary

The Sustainable Solutions Competition challenges student teams to design and fabricate structures based on real world issues facing the civil engineering community. Through this intercollegiate competition, students gain awareness of important issues in engineering practice which supplement their classroom education. In addition, they gain practical experience in structural and sustainable design, aesthetics, construction cost analysis, safety, teamwork, leadership, and project management.

Successful teams in this competition must emulate the following core values which are at the heart of the mission of the American Society of Civil Engineers (ASCE) to develop leaders in civil engineering and to serve the public good:

- **Sustainability.** ASCE and its members are dedicated to ensuring a sustainable future in which civil engineers maintain and improve the quality of life, without degrading the quantity, quality, or availability of natural, economic, and social resources. In this lens, ASCE has adopted the Envision program (administered by the Institute for Sustainable Infrastructure) intended to transform the profession and increase the societal, environmental, and economic value of engineering projects. The Envision guidelines can be found on the ASCE Website <https://www.asce.org/envision/>.
- **Leadership and Teamwork.** The Sustainable Solutions Competition provides opportunities for leadership, teamwork, and networking. It is intended to be an all-inclusive competition, involving all eligible members of the student chapter. Students gain maximum benefit by developing and managing the project as a team. Student teams should develop and fabricate all elements of the project.
- **Safety.** Safety is the priority for all competitions. Students must complete all work associated with the Sustainable Solutions Competition with safety in mind. This includes work at their school laboratories, or other locations where fabrication takes place, and competition sites. Risky procedures are prohibited. If the structure cannot compete safely in all aspects of the competition, it will be withdrawn from competition.
- **Ethics.** This competition is to be conducted in the highest ethical standard. Students are referred to ASCE's Code of Ethics, which sets the standards of professional practice by all members of the Society. The ASCE Code of Ethics can be found on the ASCE Website <https://www.asce.org/code-of-ethics/>.

The rules are intended to simulate a design-build request for proposal which responds to a real world challenge. The sustainability goals for the competition are an integral part of these rules. Each section in these rules is intended to guide the student teams in the development of their contest entry. Student teams should read these rules thoroughly and seek clarifications as necessary. The rules are intended to enable the student teams to be innovative in the development of their sustainable structure. They are intended to be prescriptive but may require interpretation.

This document, also available on the ASCE Student Competitions page of the ASCE Website https://www.asce.org/student_conferences/, defines the 2020 Sustainable Solutions Competition and the rules for both the conference and Society-wide Finals. Requests for information (RFI) should be sent to Student@ASCE.org. Clarifications will be posted at <https://collaborate.asce.org/communities/community-home?CommunityKey=a1ae0c20-35cc-483e-b22b-c2b51c4d3458> on every other Friday starting September 20, 2019 until February 7, 2020. Each post will address the questions received from the previous two weeks through the Wednesday before 11:59PM EST.

Section 2: Problem Statement

Tactical urbanism encompasses temporary, low-cost, innovative solutions to improve public spaces. This relatively new approach to solving transportation challenges provides short-term solutions in communities where there is a need for a transit improvement. Tactical urbanism methods can be put in place to educate the community about potential transit opportunities or to provide temporary solutions to problems that citizens face.

The basis for the competition is as follows:

Let the games begin! The 2020 International Athletic Games are fast approaching, and the Host City is dedicated to incorporating sustainable practices into every facet of the summer games. From medals created using recycled electronics, to utilizing existing venues, to implementing a carbon offset program, the Host City has a strategic plan to minimize the impacts of this exciting global gathering.

As part of this initiative, the Host City posted a request for proposal (RFP) for a student designed temporary, structure to be incorporated at the games this summer. Student design teams from around the world are tasked with designing a prototype bus stop structure and the surrounding site to be constructed in the Athlete Village. The site is meant to facilitate mobility, intentional use of resources, and fellowship within this bustling community of athletes, coaches, and officials. Designs should exemplify students' understanding of sustainable materials, site access, basic layout, and safe and efficient construction practices.

Structures should be designed to shelter occupants from the elements while they await transportation to their next event. The surrounding site should incorporate a thoughtful use of public space which serves the residents of the Athlete Village. In addition, accessibility and security should be considered in the site layout. Given the short construction window, the structure should be designed to be quickly assembled at the proposed location.

As part of the proposal, students are expected to deliver and professionally present a technical paper at an interview discussing the team's approach to the design, use of sustainable materials, and construction. Teams will be selected based on a best value calculation which considers scoring in all aspects of the competition. The bus stop and surrounding site will need to meet the specified guidelines in this document. Design teams will also display their assembled structure and a poster of their overall site plan as part of the selection process.

Teams should take this as an opportunity to not only display their knowledge of sustainable design but also to educate the community in which that design resides. As the world comes together briefly for the International Athletic Games, an experience of intentional and responsible solutions can send athletes and spectators back to their communities with an enlightened view of incorporating sustainable decisions into everyday life.

Section 3: Ethics

According to the ASCE Code of Ethics, Canon 5, "Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others".

In the context of this contest, "unfair competition" may include conduct such as the following:

- Failure to provide proper credit for past teams, plagiarism, or any other false statements concerning the source of material used in the contest.

- Taking other people’s designs, artwork, or other creative content without permission (for an overview of Intellectual Property Laws, including Trademark and Copyright, visit <https://fairuse.stanford.edu/overview/introduction/intellectual-property-laws/>).
- Any false or malicious statements about other teams, members, or others involved in the competition.

Section 4: Eligibility

Only one entry per college or university may compete in the competition. A college or university may compete in only one ASCE student conference. The teams shall be led by undergraduate students and may be advised by graduate students. Students must be in good standing with their ASCE student chapter and be Society level ASCE student members during all or part of the fall through spring of the current competition academic year. ASCE student chapters hosting conferences can invite teams from colleges or universities that do not have ASCE student chapters or from ASCE student chapters assigned to different conferences. Conference assignments are listed in the ASCE Official Register at www.asce.org/official-register, and conference host chapters are listed at www.asce.org/studentconferences.

4.1 Levels of Competition

There are two levels of competition: ASCE annual student conferences and a Society-wide Finals level. The Society-wide Finals level will be conducted at a common location in conjunction with other Society-wide Finals student competitions.

Winning teams from the student conferences may be invited to a Society Wide Finals event.

To advance to Society-wide competition, teams must meet ASCE eligibility standards: https://www.asce.org/eligibility_for_national_competitions/

The student conference host student chapter shall promptly submit the completed official scoring spreadsheet for a conference competition to Student@ASCE.Org. Teams will not be invited to Society Wide Finals event until this spreadsheet is received and eligibility is confirmed.

4.2 Required Conduct

All participants shall act professionally and respectfully at all times. Failure to act appropriately can result in sanctions, disqualification, and loss of invitations to future competitions or Society-wide competitions. The inappropriate use of language, alcohol, materials, uncooperativeness, or general unprofessional or unethical behavior will not be tolerated.

4.3 Awards and Recognition

The winners of the Sustainable Solutions Competition shall be determined by compiling a team's total number of points. ASCE shall award \$3,000 in cash prizes to the Society-wide Finals winning teams' ASCE Student Chapter. To be eligible to receive a prize, the entrant school must be a recognized ASCE Student Chapter in good standing.

Total prizes shall be distributed as follows:

- 1st place overall winner: \$1,500 and trophy
- 2nd place overall winner: \$1,000 and trophy
- 3rd place overall winner: \$500 and trophy

Section 5: Safety

Safety is the highest priority and risk of personal injury will not be tolerated. Judges are empowered to stop and prohibit any activity which is deemed to be hazardous. Students should practice safe fabrication procedures and to seek appropriate instruction and supervision.

Section 6: Scoring

6.1 Recording Data and Submitting Scores

Scoring data shall be recorded for each team that competes. Official judging forms shall be used. The information from the judge's data sheets is entered into a spreadsheet which tabulates the official results of the competition. Judges data forms shall be retained by the student conference host for two weeks after the competition.

6.2 Categories of Competition

The competition will be judged with five (5) basic best value categories – Sustainability, Construction, Site Design, Technical Paper, and Presentation and Interview. These five categories will include individual elements as follows:

6.3 Sustainability (35%)

6.3.1 Envision

Envision is a rating system and best practice resource to provide engineers with the information necessary to successfully implement sustainability into infrastructure projects. Envision measures the sustainability of an infrastructure project from design through construction and maintenance. It can be used by infrastructure owners, design teams, community groups, environmental organizations, constructors, regulators, and policy makers to:

- Meet sustainability goals,
- Gain public recognition for high levels of achievement in sustainability,
- Provide guidance to communities and project teams to collaborate and discuss, “Are we doing the right project?” and “Are we doing the project right?”
- Make decisions about the investment of scarce resources, and
- Include community priorities in civil infrastructure projects.

Teams should refer to the Envision Checklist in Appendix A of this document.

6.3.2 Carbon Analysis

All construction projects leave a carbon footprint through the energy, materials, and methods utilized during the process. Teams should calculate the carbon impact of their structure. All materials used in the structure must be included in an embedded carbon analysis.

6.3.3 Use of sustainable materials

The use of sustainable materials shall be maximized in the design, fabrication, and construction of the structure. Sustainable materials are defined as those products which provide environmental, social, or economic benefits while protecting public health and the environment over the whole life cycle, from the extraction of raw materials until final disposal.

6.4 Construction (20%)

6.4.1 Construction Speed

The structure with the lowest construction time will win in this category. This is the complete tabulation of person-hours necessary for construction of the structure in addition to penalties.

6.4.2 Structural Integrity

The structure will be tested for structural integrity. This is a pass/fail test.

6.4.3 Lightness

The structure with the least total weight will win this category. This is the complete tabulation of structure weight as well as any penalties.

6.5 Site Design (15%)

6.5.1 Site Design

Teams will conceptually design the site which includes their structure. Overall function, accessibility, and community impact should be considered.

6.5.2 Poster

The poster should describe the overall structure and site design, and will accompany the assembled structure for judging.

6.5.3 Aesthetics

The complete structure will be judged for aesthetics and functionality. The structure shall be presented as constructed in competition.

6.6 Presentation and Interview (15%)

A presentation and interview on the approach and theory behind the development of the structure shall be delivered to a panel of professionals. This will be followed by questions from the panel. Teams are encouraged to use presentation technology as part of this presentation.

6.7 Technical Paper (15%)

The technical paper shall demonstrate the thought process used for the development of the structure and site including design, sustainable elements and construction methods, and accelerated modular construction. Teams are encouraged to use the technical paper to completely discuss any aspects of the design which address the problem statement and goals of the competition.

Section 7: Recommended Competition Schedule

The recommended order of competition is as follows:

- Technical papers must be submitted by teams and made available to the judges for grading in advance of the competition, at a date specified by the conference host. Allow adequate time for judges to read papers.
- A captains meeting is held to clarify construction logistics and rules.
- A judges meeting is held to clarify rules and procedures.
- Timed construction.
- Technical inspection. Structures are inspected in their as-built condition.
- Testing for structural integrity.

- Structure moved to designated display location*.
- Data entry.
- Rankings are determined.
- Student conference host submits results to ASCE Student Programs.
- Student conference host keeps records for two weeks after the competition.

The order of competition for each stage, presentation and interview, and construction to be determined by the student conference host.

* The student conference host may decide to have display judging at a time and location separate from the construction judging for convenience.

Section 8: Definitions

8.1 Accident – occurs when a builder drops an item or steps on or over a boundary. Accidents add penalty time to the construction of the structure.

8.2 Assembly Zone – the area which includes staging yards and footings which constitutes the location where the team construct the structure during timed construction at the competition.

8.3 Builder – eligible student who is part of the team constructing the structure.

8.4 Captain – eligible student who is the responsible party throughout the competition.

8.5 Constructed segment – the segment of the structure placed within the footing, in essentially its final position, which consists of panels, members, and nuts and bolts.

8.6 Footing – the location where the structure is to be placed and constructed.

8.7 Ground – the floor inside the Assembly Zone, including footings and staging yards.

8.8 Personal Protective Equipment (PPE) – equipment worn by the builders includes safety-toe shoes meeting ANSI standard Z41.1, a hard hat meeting ANSI standard Z89.1 and protective eyewear or safety goggles meeting ANSI standard Z87.1. PPE is considered an article of clothing and is provided by the team. PPE is worn at all times during timed construction and load testing of the structure.

8.9 Pouch – an optional article of clothing used to carry nuts, bolts, and tools. This definition encompasses tool belts, magnets, lanyards, and other accessories worn by the builders and having the same function.

8.10 Platform - an optional item which is utilized by the construction team to facilitate construction of the structure. A team provides its own platform(s).

8.11 Staging Yard – marked areas which are part of the site where panels, members, loose nuts, loose bolts, platforms, and tools are located prior to the start of timed competition. This is also where builders begin and end timed competition.

8.12 Tool – a device used to construct the structure but is not part of the completed structure. A team provides its own tools.

Section 9: Sustainability

9.1 Envision Checklist

A selection of Envision parameters applicable to this project is provided in Appendix A. Teams are required to reach exactly fifteen (15) credits. At least one (1) credit must come from each of

the three categories (Quality of Life, Leadership, and Resource Allocation). The Envision Checklist in Appendix A shall be included as an Appendix to the Technical Paper and be filled out to the extent that the project addresses those parameters. The body of the Technical Paper should include a description of how the project addresses each of the parameters the team indicated in the table.

9.2 Carbon Analysis

Teams should provide an analysis of how much carbon is embedded in the materials selected for their structure. A brief description of the chosen methodology used in the analysis and a summary of the results should be included in the body of the Technical Paper. Representative calculations and inputs for all materials used should be included as an Appendix to the Technical Paper.

9.3 Materials

Teams should make an effort to use materials for their structure which are sustainable. Methodology for material selection and procurement should be described in the Technical Paper.

Section 10: Structure Component Specifications

10.1 Structure

The structure may consist of panels, members, loose nuts and loose bolts. Screws are allowed in the construction of a panel but not allowed to be used during timed construction. Violations of this sub-section shall result in penalties added to the weight of the structure. These components will be checked by judges prior to the start of timed construction.

The penalty shall be 20 pounds for any non-compliant component.

10.2 Panels

A panel is a rigid component of the finished structure. Panels are fabricated using screws, nuts, bolts, timber fasteners, or other sustainable products. A panel is fabricated prior to competition. A panel shall retain its shape, dimensions, and rigidity during timed construction and testing. The maximum dimension of panels shall be 3' x 2' x 6".

10.3 Members

A member is a rigid component of the finished structure. Members are fabricated using screws, nuts, bolts, timber fasteners, or other sustainable products. A member shall retain its shape, dimensions, and rigidity during timed construction and testing.

A member shall fit into a right rectangular prism of dimensions of 3'-6" x 6" x 4".

10.4 Loose Bolts

Loose bolts, if used, shall not have parts which flex or move. They shall be commercially available and not mechanically altered or modified in any way. Loose bolts may be painted.

The nominal length of loose bolts shall not exceed 4-1/2" measured from the bottom of the head to the end. Loose bolts shall have threads that extend around the full circumference.

10.5 Loose Nuts

Nuts, if used, shall have a hexagonal shape and not have parts which flex or move. Nuts shall

be commercially available and not be mechanically altered or modified in any way. Nuts may be painted. Nuts shall have internal threads which extend for the full circumference and thickness.

10.6 Tools

Individual pieces making up a tool shall not weigh more than fifteen (15) pounds and shall fit into a box measuring 3'-6" x 6" x 4". Tools which do not meet these specifications will not be allowed to be used for construction. Power tools are not allowed.

10.7 Platform

A platform of dimensions 2' x 2' x 1' (L x W x H) may be used for builders to stand on during construction. Only one builder may stand on a single platform at a time. A maximum of two platforms may be used during construction. Platforms will be tested prior to the start of timed competition by demonstrating to the judges that each builder on the team is able to stand on the platform while it remains stable.

Section 11: Finished Structure Specifications

The structure shall meet the design problem and shall have the following characteristics and dimensions. Details are shown on the Structure Diagram (Appendix B) and Site Diagram (Appendix C). At the competition, the structure will be constructed within the Assembly Zone as shown in the Assembly Zone Diagram (Appendix D). The structure shall:

- Have a maximum footprint of 4' x 9' and fit within the specified footing during assembly.
- Have a maximum height of 7' and a minimum height of 6' as measured from the ground.
- Be designed to shelter occupants from rainfall from three directions.
- Be completely open on one side.
- Utilize a roof style which provides drainage. The structure shall have an eave no greater than six inches, as measured from the wall at the rear and sides of the structure. The structure eaves do not have to fit inside the designated footprint.

11.1 Competition Site

The structure shall not be anchored or tied to the floor. Teams shall accept, and structures shall accommodate, conditions at the competition site. Dimensions for the construction site are shown in the Assembly Zone Diagram (Appendix D).

11.2 Violations

A weight penalty will be assessed for violation of each specification in this section. If there are multiple violations of the same specification, the structure will be penalized with the largest violation.

- 25 pounds for a dimensional violation not exceeding 1/4"
- 50 pounds for a violation greater than 1/4", but not exceeding 1"
- 100 pounds for a violation greater than 1", but not exceeding 2"
- If a violation exceeds 2", the structure will not be ranked for awards in any category.

Conformance with these specifications will be checked with the structure in its as-built condition after termination of timed construction and before the structure is moved. The structure shall not be modified or distorted from its as-built condition to conform to these specifications. Judges may touch the structure but shall not alter it in any way.

Section 12: Construction Regulations

12.1 Construction Speed

The speed of construction is a factor in the overall scoring of the structure. However, there is a twenty-five-minute limit on construction time. A structure exceeding this time will be withdrawn from competition. Judges will notify the teams at the twenty-minute mark and again at the twenty-four-minute mark.

12.2 Pre-Construction Procedures

Only builders and judges are allowed within the Assembly Zone. Other team members, including; coaches, faculty, advisors, and spectators shall be in designated areas away from the construction site which ensures they are not at risk and cannot interfere with the competition.

The construction team shall have no more than four builders. Timed construction will not commence if any provision of this sub-section is violated.

12.3 Safe Construction Practices

If any rule in this sub-section is violated during timed construction, the judge will stop the clock and explain the violation. Students will be given the opportunity to correct the problem. Before the clock is restarted, builders, tools, panels, members, and loose nuts and bolts are returned to the location they occupied prior to the violation. If the structure cannot be constructed safely then it will be removed from competition.

Builders, judges, host personnel, and spectators shall not be exposed to risk of personal injury at any time during construction. Only builders and judges are allowed in the construction site. PPE shall be worn in a proper manner, at all times within the construction site.

12.3.1 Pouches, or other articles of clothing, shall not be removed from a builder's person or held in the builder's hand(s).

12.3.2 Nuts, bolts, or tools shall not be held in the mouths of builders.

12.3.3 Throwing anything is prohibited.

12.3.4 A builder, outside the staging yard, shall not simultaneously support or touch, directly or with tools, more than one panel or member, or the constructed segment.

12.3.5 A builder must not use the structure, or a constructed segment, to support their weight.

12.3.6 A builder shall not depend on another builder for support or balance.

12.3.7 Construction of the structure begins by creating a constructed segment within the defined footing.

12.3.8 The structure must be constructed entirely within the footing boundary. No components of the structure may touch the ground outside of the footing at any time.

12.3.8 At no time shall a builder or builders support the entire weight of a constructed segment.

12.3.9 No part of the constructed segment shall extend beyond the Assembly Zone boundary at any time.

12.3.10 Teams may use up to two platforms during construction, but only one builder may use a single platform at a time. Platforms may not be used within the footing boundary.

12.3.11 If a structural component is lifted above a builder's head, at least two builders must be touching the component.

12.4 Accidents

The clock is not stopped during an accident. A penalty is assessed for each separate accident. If an accident is continuous then it will result in multiple occurrences. Construction cannot depend on deliberately committing an accident. If work cannot continue without creating an accident, then the structure will be removed from competition. Builders do not create an accident by retrieving a dropped item. **The penalty is 15 seconds for each item during each occurrence.**

12.4.1 A panel, member, constructed portion, tool, loose nut, loose bolt, or PPE touches the ground outside the staging yard or footing, or the floor or ground outside the Assembly Zone.

12.5 Assembly Zone

The construction site for the competition is shown in the Assembly Zone Diagram (Appendix D). All materials and tools used to assemble the structure must start in the staging yard and the structure will be assembled within the footing boundary. Only tools, platforms, and structural components are permitted within the staging yard.

12.6 Inspection

Before construction begins, only builders, panels, members, loose nuts, loose bolts, platforms, and tools are allowed in the staging yard. Each panel, member, loose nut, loose bolt, platform, and tool must be touching the ground and cannot be in contact with each other. The exception is loose nuts and bolts can be touching prior to timed construction. Builders are wearing tool belts and PPE.

Judges inspect panels, members, loose nuts, loose bolts, and tools as they are placed within the staging yard. Tools and platforms which do not conform to the rules will be removed from the staging yard. Additional tools, panels, members, loose nuts, or loose bolts shall not be added to the staging yard after inspection begins.

Section 13: Post Construction

13.1 Load Test

Structures shall be required to have one (1) 2" diameter eye hook mounted at each corner of the structure in accordance with the Structure Diagram. The structure will be load tested to verify stability by means of a fish scale located at two (2) different locations. The location and order of the two tests will be randomly determined prior to the competition and shall be the same for all structures in the competition.

To select the load points a die will be rolled by the head judge to determine loading locations. The locations will be based on the following table:

Die Role	1	2	3	4	5	6
Corner Locations	1 and 2		2 and 4		3 and 4	

The two load tests will be conducted in the order specified on the table. A judge will attach the fish scale to the hook at each location and the build team will then pull horizontally, perpendicular to the structure, in the direction specified in the Structure Diagram, until a force of 50 pounds has registered on the scale. **This is a pass/fail test.**

13.2 Weighing

After completion of construction and load testing, structures will be weighed. Teams should be prepared to safely move assembled structures to a different location for weighing. Teams should expect the scales to be placed, at a minimum, of each corner of the structure for weighing.

Section 14: Site Design

14.1 Site Layout

The bus stop will be placed on a paved 20' x 10' site within the Athlete Village (as shown in the team's proposed Site Drawing). Teams shall propose a layout and design for this site. Design should include placement of the structure and utilization plan for remaining space on the site, including access. Teams should seek to maximize the impact of the project site in relation to the problem statement. The site constraints are illustrated in the Site Diagram, Appendix C.

14.2 Poster

The display shall consist of a poster showcasing the team's approach to the problem. This poster shall present the following:

- Description of the inspiration and development of the design.
- Description of sustainable methods used in the development and construction of the structure.
- Scaled site drawing.
- Scaled diagram of the structure.
- Identification of the college or university, which shall be the same as the identification on the structure.
- The poster shall be:
 - Flat with dimensions of 24" x 36"
 - Single-sided without attached pages which must be lifted or turned
 - Written in English

Additional information which provides insight into the development and design may be included. Sponsors may be recognized on a separate poster. If English is not the dominant language where the competition is conducted an optional translation poster may be provided.

14.3 Aesthetics

The structure and site design will be judged on its overall appearance and functionality as a bus stop. Permanent identification of the structure consisting of the college or university name as listed on the ASCE student Website, www.asce.org/find-a-chapter. The name shall be applied with a placard, decals, or paint. The letters shall be a minimum of 3" high (note: decals with a field of 3" high with letters within this field is a violation of this requirement). **A penalty of 50 pounds will be added to the overall weight of the structure with a violation of this requirement.**

Section 15: Presentation and Interview

15.1 Oral Presentation

A presentation of up to seven (7) minutes shall be required for each participating school. All presentations shall be conducted in a professional manner (defined as a presentation that a professional engineer would give to a prospective client or community group). Oral presentations shall be presented in English. Teams should use PowerPoint or other presentation software in the development of their presentation. The presentation order of the teams shall be randomly selected before the competition begins and shall be provided no later than at the time of the business meeting. An additional five (5) minute period shall be permitted for judges' questions immediately following the presentation. Questions are not to be permitted by members of the audience. The oral presentations, including the question and answer period, shall be open to the public for viewing. The time required to set up equipment shall not exceed four (4) additional minutes for each school and the time required to take down shall not exceed four (4) minutes for each school.

15.2 Visual Component

As part of the presentation, teams are required to provide a sixty (60) second video which provides additional insight into the development and function of the project. Students are encouraged to use video from the fabrication of the structure elements as part of this video. Students should consider a smooth transition between any PowerPoint (or other presentation software) and the video to maximize their use of the allotted time. All presentations will be stopped at the seven (7) minute mark, regardless of where the team stands in the presentation. Presentations which are cut off will be judged as incomplete.

Section 16: Technical Paper

The technical paper shall include, at a minimum, a discussion of the following; design (including calculations), design drawings, sustainable material selection, embedded carbon analysis for structure components, technical considerations, project management (including organization chart and schedule), quality control, budget, and team considerations. The technical paper will be used to determine the overall responsiveness to the design problem and must elaborate especially on how the final project has been delivered in accordance with Envision. The paper will be evaluated on the following items:

- Application of sustainable fabrication and construction practices
- Design approach
- Inclusion of embedded carbon analysis
- Inclusion of approach to Envision criteria
- Project management
- Responsiveness to the design problem
- Organization and written product
- Includes all required information

Teams are encouraged to use the technical paper to demonstrate their approach to the problem statement and how each facet of the competition was addressed. Teams are encouraged to use figures, tables, photographs, graphs, project schedule, and other graphical elements to demonstrate the approach to the problem. The appendices of the technical paper shall include,

at a minimum, a project schedule, carbon analysis calculations, Envision Checklist (from Appendix A) CAD drawing(s) of the structure with dimensions, and CAD drawing(s) of the site layout.

The body and appendices of the technical paper shall be presented on white 8-1/2" x 11" pages in portrait orientation. CAD drawings and schedules can be shown in 11" x 17" if necessary. No background images or watermarks are permitted behind the text in the body or appendices of the paper. No blank pages shall be inserted into the report. All pages of the report, including the organization chart, project schedule, design calculations, design drawing(s), and appendices shall maintain a minimum of 1/2" margins on all sides.

Body text shall be in English and use 12-point, normal width character spacing, Times New Roman or Arial font, and be at least single spaced. Section headings and subheadings may be of any legible font type or size. The hard copy of the report shall consist of a single-sided report cover, double-sided pages for the body, single-sided pages for the appendices, and a back cover.

Body pages, except for the table of contents and executive summary, shall be numbered beginning with the number one (1). The table of contents and executive summary shall be numbered with lowercase Roman numerals i and ii, respectively. Pages located in the appendices shall be numbered in such a way that the appendix and page number are clearly listed (e.g., A-1, A-2, B-1, B-2; A1, A2, B1, B2; etc.) as appropriate. There shall be a maximum of 20 pages total in the technical paper.

Captions for figures and tables shall be used and shall be no less than 10-point, normal width, and any legible font type. Items such as page numbers, logos, images/designs, section headings, etc. may be incorporated into the header and footer of the pages and are not subject to the font requirements of the body text. The header and footer may be located within the margin itself (i.e., outside of the body text limits). Headers and footers are not required on the project schedule or design drawings. Material on the report cover, appendix cover pages, and table of contents may not be directly referred to in the body pages.

Section 17: Host Supplied Equipment

The student conference host shall supply the following for the competition. All teams are required to accommodate local conditions and equipment.

17.1 Weighing

Six scales should be supplied to measure the total weight of the structure. Each scale should have a capacity of at least 100 pounds. These scales will be placed on the ground with the structure set upon them for weighing.

17.2 Load Test

The student conference host will provide a fish scale with a capacity of at least 50 pounds for the loading process. The host will also provide a 6-sided die to determine loading orientation.

17.3 Box

A box with inner dimensions of 3'-6" x 6" x 4" shall be supplied to ensure members and tools meet the dimensional requirements specified in Section 10. Wood or other non-deforming material is recommended.

17.4 Construction Site

The student conference host shall supply at least one construction site with dimensions shown in the Assembly Zone Diagram using the best available accommodations.

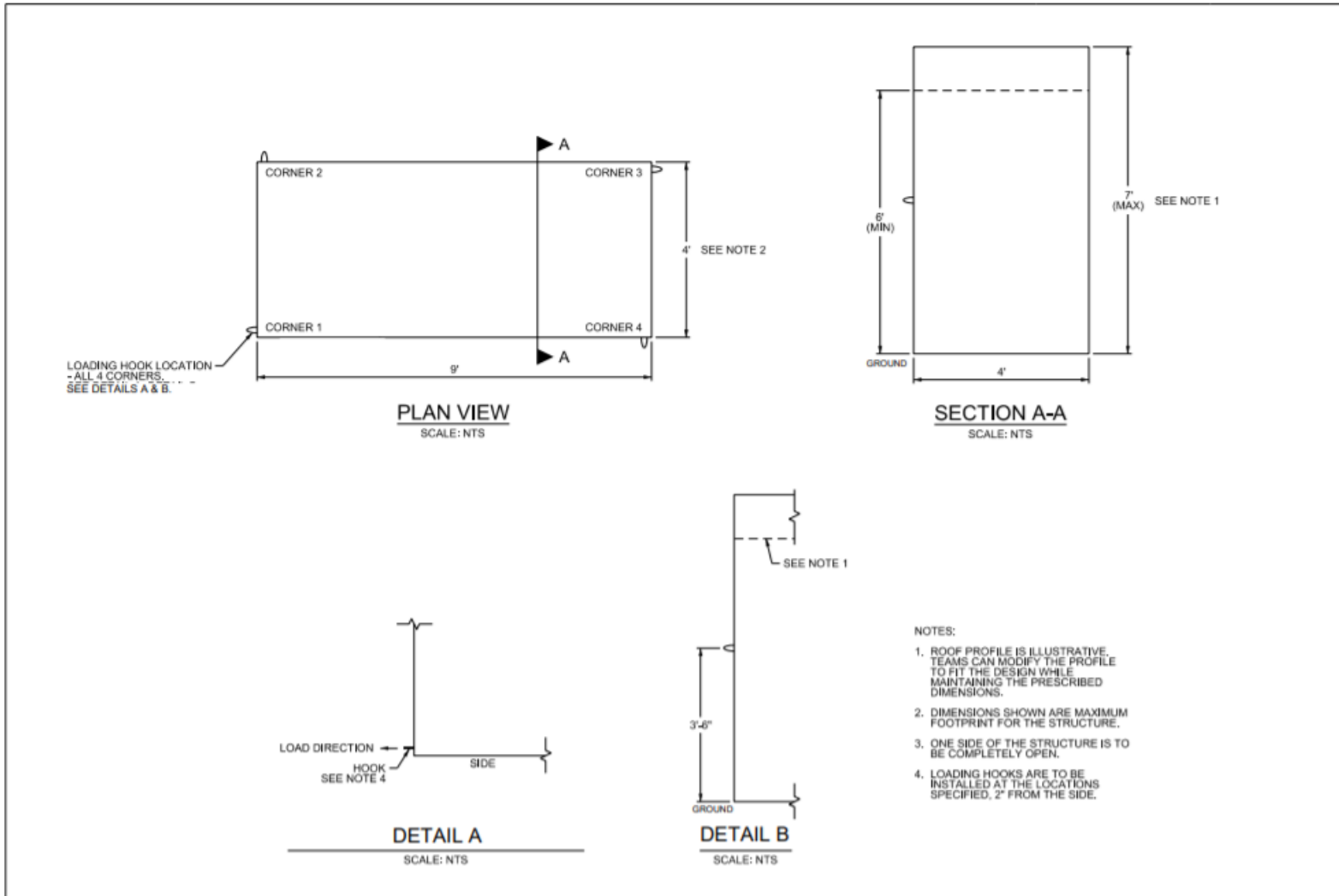
Section 18: Judging


The student conference host will a minimum of three (3) judges to review technical papers, presentations, and aesthetics. Additional judges may be needed to judge the construction of the structure. The judging panel should include educators and professionals and should have at least one (1) member well versed in sustainability. Judges have authority over the conduct of the competition. Judges have the authority to interpret the rules under the guidance of ASCE. The student conference host will ensure all judges are fully informed of the rules and procedures and are fully equipped to complete their tasks.

Appendix A: Envision Checklist

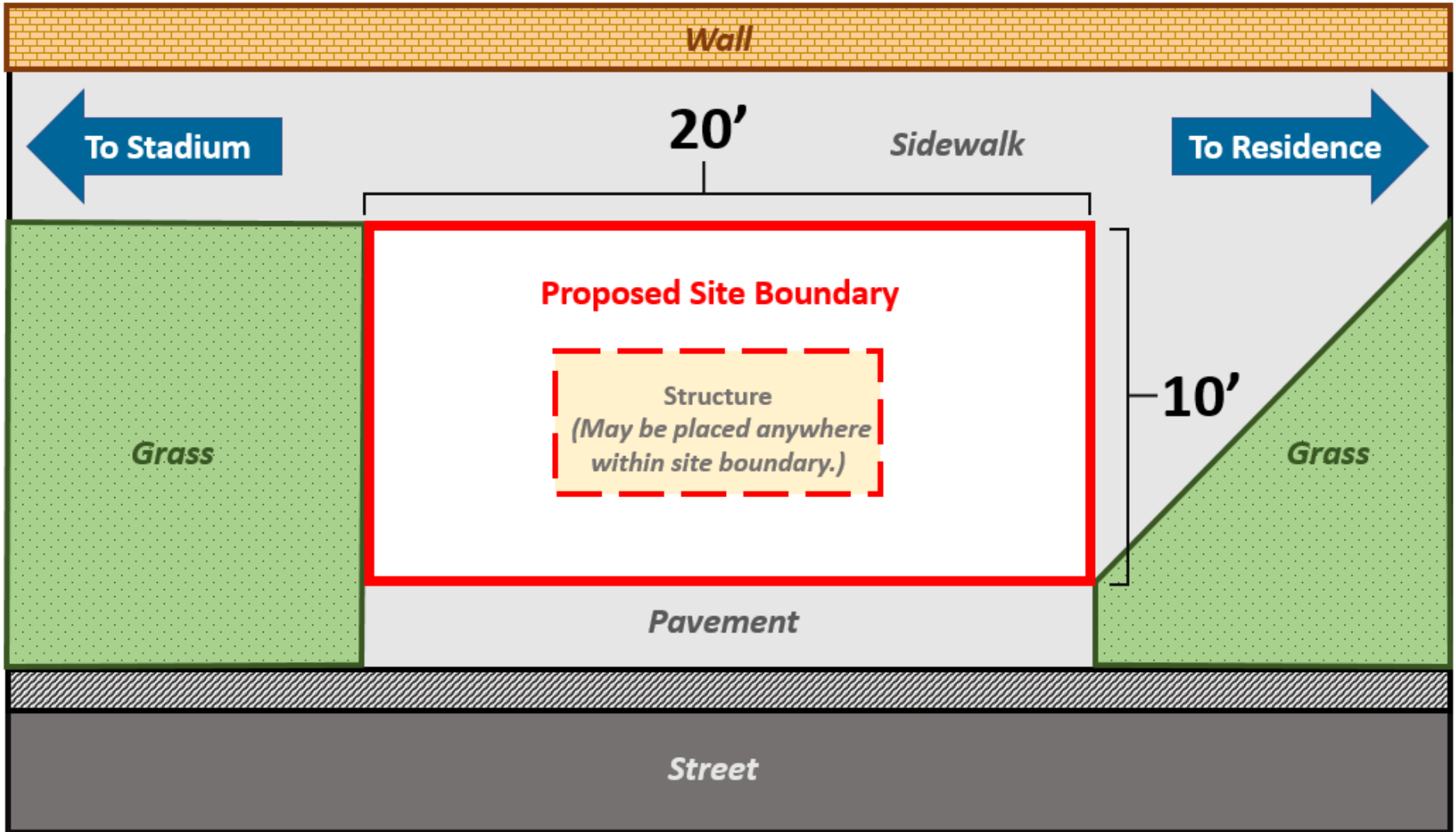
	Description	Metric	Credit	Project meets criteria (Students self-grade with ☑)	Project meets criteria (Judges grade with ☑)
Quality of Life	Enhance public health and safety	Efforts to exceed normal health and safety requirements, taking into account additional risks in the application of new technologies, materials and methodologies.	1		
	Improve community mobility and access	Extent to which the project improves access and walkability, reductions in commute times, traverse times to existing facilities and transportation. Improved user safety considering all modes, e.g., personal vehicle, commercial vehicle, transit and bike/pedestrian.	3		
	Encourage alternative modes of transportation	The degree to which the project has increased walkability, use of public transit, non-motorized transit.	2		
	Improve site accessibility, safety, and wayfinding	Clarity, simplicity, readability and broad-population reliability in wayfinding, user benefit and safety.	3		
	Enhance public space	Plans and commitments to preserve, conserve, enhance and/or restore the defining elements of the public space.	2		
Leadership	Foster collaboration and teamwork	The extent of collaboration within the project team and the degree to which project delivery processes incorporate whole systems design and delivery approaches.	3		
	Provide for stakeholder involvement	The extent to which project stakeholders are identified and engaged in project decision making. Satisfaction of stakeholders and decision makers in the involvement process.	3		
	Pursue by-product synergy opportunities	The extent to which the project team identified project materials needs, sought out nearby facilities with by-product resources that could meet those needs and capture synergy opportunities.	1		
	Improve infrastructure	The extent to which the design of the delivered works integrates with existing and planned community infrastructure, and results in a net improvement in efficiency and effectiveness.	3		
	Extend useful life	Extent to which renewable energy resources are incorporated into the design, construction and operation.	1		
Resource Allocation	Reduce Net Embodied Energy	Percentage reduction in net embodied energy from a life cycle energy assessment.	2		
	Use Recycled Materials	Percentage of project materials that are reused or recycled.	2		
	Divert Waste from Landfills	Percentage of total waste diverted from disposal.	3		
	Provide for deconstruction and recycling	Percentage of components that can be easily separated for disassembly or deconstruction.	3		
	Use renewable energy	Extent to which renewable energy resources are incorporated into the design, construction and operation.	2		

Appendix B: Structure Diagram

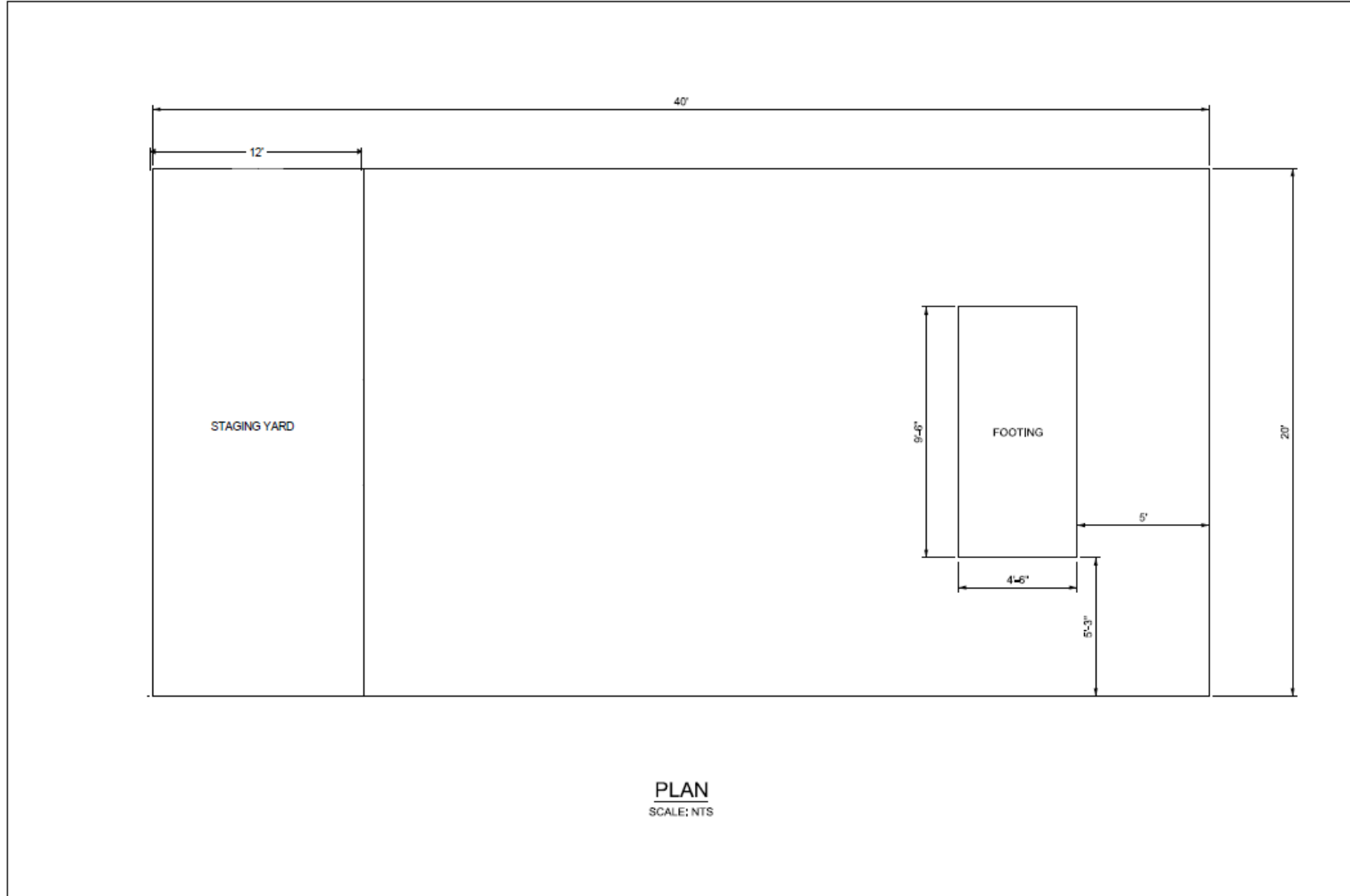


							DESIGNED BY D. SEPULVEDA	ASCE SUSTAINABLE SOLUTIONS COMPETITION  <small>AMERICAN SOCIETY OF CIVIL ENGINEERS</small>	STRUCTURE DIAGRAM	CONTRACT NUMBER
							DRAWN BY D. DELUCA			DRAWING NO. DWG 2
							CHECKED BY RULES COMM.			SCALE NTS
							CHANGE			SHEET NO. B
							DATE 09-06-2019			
REV	BY	DATE	APP	REC NO.	EXPIRES	SEAL HOLDER	DESCRIPTION			

Appendix C: Site Diagram



Appendix D: Assembly Zone Diagram



PLAN
SCALE: NTS

							DESIGNED BY D. SEPULVEDA	<p style="text-align: center;">ASCE SUSTAINABLE SOLUTIONS COMPETITION</p>  <p style="text-align: center;">AMERICAN SOCIETY OF CIVIL ENGINEERS</p>	<p style="text-align: center;">ASSEMBLY ZONE DIAGRAM</p>	CONTRACT NUMBER
						DRAWN BY D. DELUCA	DRAWING NO. DWG 1			
						CHECKED BY RULES COMM.	SCALE NTS			
						CHANGE	SHEET NO. D			
						DATE 09-05-2019				
REV	BY	DATE	APP	REC NO.	EXPIRES	SEAL HOLDER	DESCRIPTION			