



12TH DESIGN & CONSTRUCT
INTERNATIONAL STUDENT STEEL BRIDGE
COMPETITION

RULES AND REGULATIONS

OUR MISSION;

-To contribute to education of university students of civil engineering/architecture departments by giving them an opportunity to practice their knowledge in a concept of competition; therefore, to contribute to the students' transition into practicable work life;

-To create value and make a difference by letting students inspire each other in a friendly, yet competitive atmosphere which emphasizes the importance of teamwork.

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1. INTRODUCTION

- In the organization of Boğaziçi University Design and Construct 2017 International Student Steel Bridge Competition, students compete in teams with bridges they design and produce. The participant teams earn experience in fields of designing, production process, and team organization.
- ❓ The topic of the competition is about the problems an engineer can face during a construction project. The competition is an application of this project, a steel bridge competition.
- ❓ The stability, usefulness and security standards defined in the topic of the competition are selected from daily life bridge construction knowledge. There are 5 different main categories in the evaluation of the competing bridges. The first is aesthetics and uniqueness, second is construction cost, third is deflection cost, fourth is weight cost and the last one is the compliance with organization/competition program.
- ❓ This document includes contents and the rules of the competition of 2017. All the information about the contest can be found at www.boundeco.org
- The first priority in the organization is security. As BUYAP (Boğaziçi University Construction Club), all we demand from the participants is to maintain all security measures to prevent any accidents.
- As a student organization, all projects and designs have to be processed by the students. However, the students may ask for the help of their instructors when it is needed. Boğaziçi University Construction Club has the right to change the rules within the 4 weeks after publishing the competition rules. No objections will be accepted about this specific issue.

2. THE TOPIC OF COMPETITION

- ❑ The local government decides to make a bridge crossing a natural river because of intended new roads in order to increase the choices of transportation.
- ❑ The local government demands the usage of steel as the main material because of its high strength and easy assemblage. They also require the bridge to have enough length not to prevent the flow of the river. Finally, they expect deflections of bridge to be in between the given limit.
- ❑ Because of the obstacles around the river, the legs of the bridge have to be built on soil. Extra support legs can be used during the construction to support the bridge. However, these extra supporting legs have to be removed at the end of the construction. The project finishes with the removal of the temporary platform.
- ❑ Similar field conditions and load tests are going to be applied to each bridge. The bridges are going to be tested in five categories determined by the local government. A contract will be signed with owners of the best project.

3. DESCRIPTIONS

3.1. Team:

- The competitor team consists of competitors who take place in the construction area at any moment of the set up time. In a team, there may be at least 4, at most 5 competitive members, who are registered to an undergraduate or graduate program of any engineering or architecture faculties of any university. At least one member of the competitor team should be an undergraduate civil engineering student. If the team consists of four members at least two competitors should be 3rd year or 4th year students; if the team consists of 5 members, then at least 3 competitors should be 3rd year or 4th year students. 1st year students cannot be a member of a team. In each team there can be at most 1 graduate student.

3.2. Barge:

- Barge is one single member who is chosen by the captain of the team before timing starts. This member works only as the barge in the river area (between river reference lines) from start to end of the competition.

3.3. Assembled Part:

- An assembled part consists of at least 2, at most 3 load carrying members that are fastened together by bolts (screws and nuts). An assembled part must be assembled in assembly area. Any part of the parts to be assembled cannot be carried out.

3.4. Load Carrying Member:

- It is a member of bridge, having a weight of at most 7 kilograms, which can be perpendicularly placed in a 120cm x 25cm x 25cm box. Legs of the bridge should be perpendicularly placed in a 120cm x 35cm x 35cm box. Before timing every member shall be checked and controlled. In case of a member weighing more than 7 kilograms, competitor team will be applied penalty#4. Load carrying member may consist of one single rigid piece, or multiple pieces, which have been welded at the time of production. Additionally, load-carrying piece should conserve its shape and dimensions during construction and after the bridge is assembled. Material properties of the steel should comply with ST 37 grade structural steel.

3.5. Binding Member:

- Is a steel bolt that possesses at least one nut. They are independent pieces. Binding member cannot be anchored /fastened/fixed or welded to a member of

the bridge before construction. Mounting can only take place in construction. Use of washers is permitted.

3.6. Temporary Support Member:

- Temporary support member is employed during construction for supporting purpose, placed on ground temporarily. Usage and number depends on preference. The first pair of temporary support member does not take part in cost calculations. (Two legs, not connected to each other, standing perpendicular to the longitudinal line of the bridge, is counted as one single temporary support member.) The temporary support member cannot be moved after use. Temporary support member cost is applied in case of moving. The others that are used additionally (may be placed wherever preferred) affect ratings through construction/manufacturing cost. Temporary support members' dimensions cannot exceed 20cm x 20cm. The material of these members' cross-sectional should be appropriate for ST37 standards. The members that do not fulfill these conditions will not be allowed for usage. Temporary support members cannot be fixed to the ground or supported by other members in any way.



Figure #1: Temporary Support Members (brown painted elements.)

4. RATING

Bridges are evaluated in the following categories;

- ✓ Aesthetics & Uniqueness
- ✓ Construction Cost
- ✓ Deflection Cost
- ✓ Weight Cost
- ✓ Compatibility to Organization/ Competition Program

4.1. Aesthetics & Uniqueness

- Each member of the jury gives points to each competing bridges from 0 to 100. This score will be multiplied by 60% for the aesthetics and by 40% for the uniqueness categories, then these values will be added to total score. Multiplication of total score by 40 000\$ gives the Aesthetics & Uniqueness Cost (A) which will be reduced from the total cost. The jury does not have to explain the basis of his/her point in the aesthetics & uniqueness branch.
- Aesthetics & Uniqueness Cost (A) is calculated by the formula below:
 - ***Aesthetics Subcategory Score (ASS) = (Over 100 points rating) * (%60)***
 - ***Uniqueness Subcategory Score (USS) = (Over 100 points rating) * (%40)***
 - ***Aesthetics & Uniqueness General Category Score (AUGS) = ASS+USS***
 - ***Aesthetics & Uniqueness Cost (A) = AUGS*40 000\$***
- In the Aesthetics branch, four criteria are taken into consideration; originality, balance, proportion and elegance. Furthermore, the quality of production and fabrication is judged. Structural stability of the bridge doesn't affect this category.
- In the Uniqueness branch creativeness and distinctness are taken into consideration.
- The bridge which has a different design from other bridges in competition a significant advantage in uniqueness branch
- Furthermore, The best team in Aesthetics & Uniqueness branch will have a considerable monetary award at the end of Design & Construct 2017.
- Important warning: Under vertical loading, If the displacement of a bridge exceeds 1,5 cm in 400 kg, it will be disqualified from the aesthetics competition.
- The bridges have to be designed by competitor students. If the members of the jury have doubts on originality, they will consider their doubt while giving points.

- Full name of the college or university must appear on the bridge or on a banner or a placard attached to the bridge, in letters having the height at least 5 cm. It should be placed on the bridge during aesthetics judging and at other times when the bridge is on display. If the bridge does not fulfill this condition, jury will reduce 5 points of Aesthetics & Uniqueness General Category Point (AUGS).
- Each team has to have a poster or a plate having a size at most 100cmx100cm near the bridge which includes the university name of the team, explanations about the design process, a scaled-dimensioned side view of the bridge, a brief explanation of why such an overall configuration of the bridge was selected and information of technical additional. If this stated poster or plate is missing, 10 of total Aesthetics & Uniqueness General Category Point (AUGS) will be reduced. If the poster does not contain any part of the stated conditions, 2 points will be reduced for each missing part.
- Teams should prepare a 5 minutes long presentation, which includes design, manufacturing process and additional technical information about the bridge. If this presentation is not prepared, then 10 of Aesthetics & Uniqueness General Category Point (AUGS) will be reduced.

4.2. Construction Cost

- Bridges' Construction Cost (CC) is calculated by the formula below:
 - **$CC = Total\ time\ (minutes) \times Number\ of\ Male\ Team\ Member\ (person) \times 15.000\ (\$/minute \times person) + Total\ time\ (minutes) \times Number\ of\ Female\ Team\ Member\ (person) \times 12.500\ (\$/minute \times person)$**
- Time passed during setup (setup time, ST) plus all time penalties described in other sections is defined as total time.
- Setup time will be evaluated linearly the maximum time being 120 min. In total time (setup+penalties) the teams who exceed 120 min will be applied penalty #9. For each support member after the first one 200.000\$ will be added to construction cost of that team.

4.3. Deflection Cost

- Deflection cost is obtained by the multiplication and the addition of the vertical and horizontal displacements in determined cost.
- Deflection Cost (DC) is calculated by following way
 - **Vertical Displacement Cost (VDC)**
= Vertical Displacement (cm) x 3.000.000(\$/cm) Horizontal
 - **Horizontal Displacement Cost (HDC)**
= Horizontal Displacement (cm) x 1.200.000(\$/cm)
(HDC)

- ***DC= Vertical Displacement Cost (VDC) + Horizontal Displacement Cost***

(HDC)

- The teams with vertical displacement that does not exceed 0.35 cm will get zero cost from vertical displacement cost. The teams with vertical displacement that exceeds 2.5 cm will be applied **penalty#9**.
- The teams with horizontal displacement that does not exceed 0.137 cm will get zero cost from horizontal displacement cost. The teams with horizontal displacement that exceeds 1.5 cm will be applied **penalty#9**.

4.4. Weight Cost

- Total weight is the sum of the self-weight of the bridge and added weight penalties, which are clarified in other sections.
- Apron, tools and temporary supports are not included in total weight. The weight of the bridges is limited to 300 kg. If the weight of the bridge exceeds 300 kg, the competitor team will be applied **penalty#9**.
- The Weight Cost (WC) is calculated as below:
 - **$WC = \text{Total weight (kg)} * 30\,000 (\$/\text{kg})$**

4.5. Organization and Competition Program Compliance

- This is the category that includes pre-organization program compliance, attending to presentations and meetings during the contest, returning progress reports in on time, obeying the rules indicated in this document. 1.000.000\$ will be added to total cost of team that do not act properly to these conditions. Details of this category will be explained in the meeting team leaders will attend.

4.6. Total Cost

- The overall performance rating of a bridge is the sum of Aesthetics & Uniqueness (A), Construction Cost (CC), Deflection Cost (DC), Weight Cost (WC) and Compliance with Organization/ Competition Program (OPC).
- **$\text{Total Cost} = CC + DC + WC + OPC - A$**
- **The bridge whose total cost is the lowest wins the contest Design and Construct 2017.**

4.7. Evaluation

- Referees appointed by Boğaziçi University Construction Club reserve all rights to pause every act found to be dangerous, resume the competition, or proceeding according to the rules. All decisions, evaluations, and prohibitions are in their commitment. Boğaziçi University guarantees to fully inform all referees about rules and methods and declares to provide all knowledge for their mission.

4.8. Conditions Causing Disqualification in Certain Categories

Violating the rules below causes not to be evaluated in categories of Construction Cost, Deflection Cost, and Weight Cost, and the cost associated with those categories will be calculated as 12 000 000 \$ and added to total cost:

- Bridge should only include load carrying and binding members.
- Bridge should not touch the ground except at its four legs.
- Bridge legs should be established, so that they will not touch the 6.0 meter river and standing parallel to the reference line. Maximum length of the bridge is up to competitor teams. The legs should not be on the river and must not touch the river border line. Bridge legs can be placed anywhere on the park area.

Chief referee and jury can decide a bridge not to be evaluated considering safety. (e.g. important plastic deformations, serious collapsing danger of a bridge)

- Vehicle way on the bridge should be parallel to the ground.
- To be able to make load tests, there should be enough space on the sides of the bridge.
- A 5 cm deep and 80 cm wide and 50 cm long apron (steel tray to carry loading plates) must be able to be placed on the bridge. To be able to carry the apron provided by Boğaziçi University is the priority of load tests for bridges.



Figure #2: Loading System

- Pre-stressed or post-tensioned load-carrying members are not allowed.

- Standards of constructional steel are determined as ST37. The company who provides the steel should send details to BUYAP. Competitor team should also send a document which includes the details of the material used obtained from the company they provided their materials, to BUYAP. Jury will choose a piece randomly from each bridge in order to make yield strength test. According to test results, teams which use stronger material than the standard of the competition, ST37, will be eliminated from the Design and Construct 2017. Besides, teams which don't give permission for the test will be eliminated as well.
- Horizontal displacement should not exceed 1.5 cm, vertical displacement should not exceed 2.5 cm.
- After measuring starts, the competitor teams are not allowed to touch the test devices.
- After assembly, bridges should not suffer any break-apart or collapse.
- Load-Carrying members should preserve their shapes, size and rigidity during configuration stage and load tests.
- For the load tests, bridge should confirm the other conditions of Deflection Cost, Weight Cost.

5. DIMENSIONAL RULES

- ❑ The limits for the plate of vehicles are; from ground minimum 0.9m (lowest point of the bridge deck) and maximum 1.3m from the ground (highest point of the bridge deck). In case of a violation, **penalty#7** will be applied. (Penalties will also be imposed for violations resulting from steel bending.)
- ❑ The span of the bridge will be measured from one leg to the other as shown in **Figure #3**. Bridge legs have to be located in the park area which is shown **Figure #5**. In case of violation **penalty#10** will be applied.
- ❑ The highest point of the bridge should be at most 2.0 m from the ground. In case of violation, **penalty #7** will be applied.
- ❑ Support legs should have the size of 20cm x 20cm at most. Supports will be checked before the contest begins. In case of a violation, support legs will not be used.
- ❑ A box having the size of 2m x 2m x 0.75 m (height: 0.75 m) should be able to pass under the bridge. This gap may be left anywhere under the bridge, including temporary platform. In case of a violation, **penalty #8** will be applied.

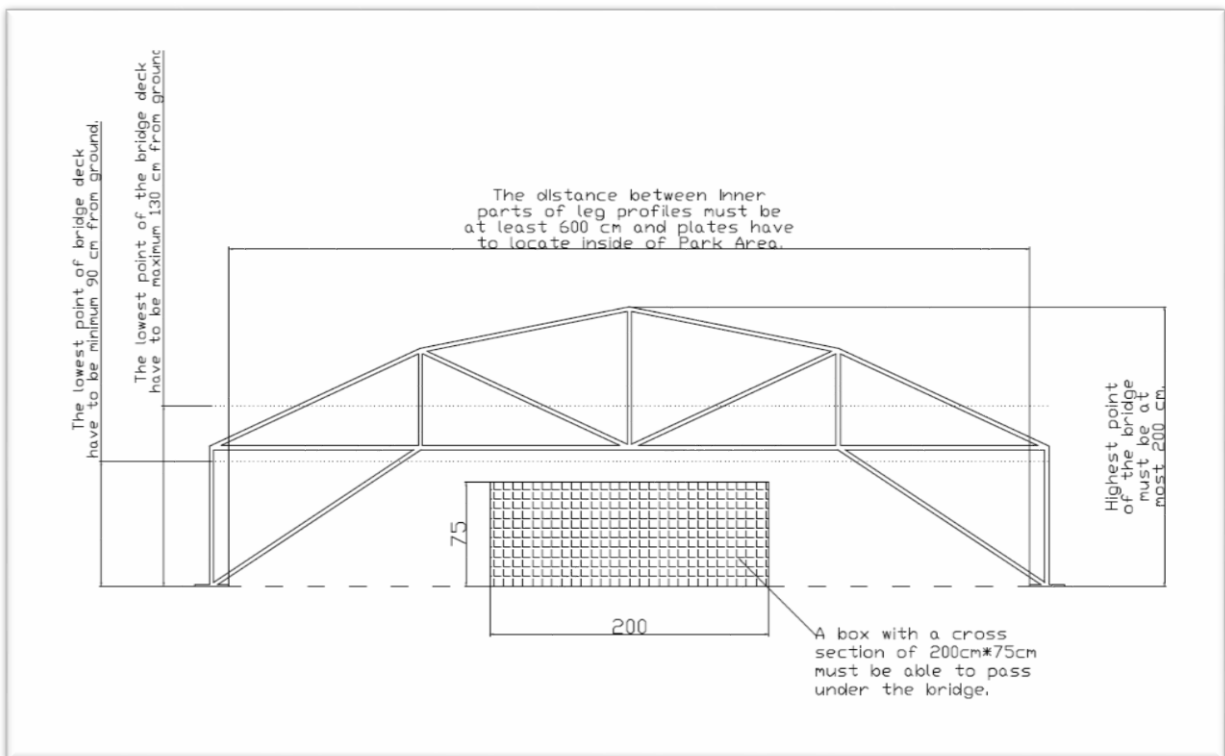


Figure #3: Dimensional Rules I

- ❑ Every load carrying member except legs of the bridge should fit into a box having the size of 120cm x 25cm x 25cm. In case of a violation, **penalty #3** will be applied. (The length of the members cannot exceed 120 cm. For curving members, important thing



is being able to fit in the box.)

- ❑ Legs of the bridge should fit into a box having the size of 120cm x 35cm x 35cm. In case of a violation, **penalty #3** will be applied. (The length of the members cannot exceed 120 cm. For curving members, the curved length of the member is taken into account.)
- ❑ The place of barge in the river, the temporary platform on the river and other parts are displayed with drawings in **Figure #5**.
- ❑ A vehicle, which is 80cm wide and 50cm high, should be able to cross the bridge. (A 80cm x 50cm x 50cm box will be used for control). In case of a violation, **penalty#7** will be applied.

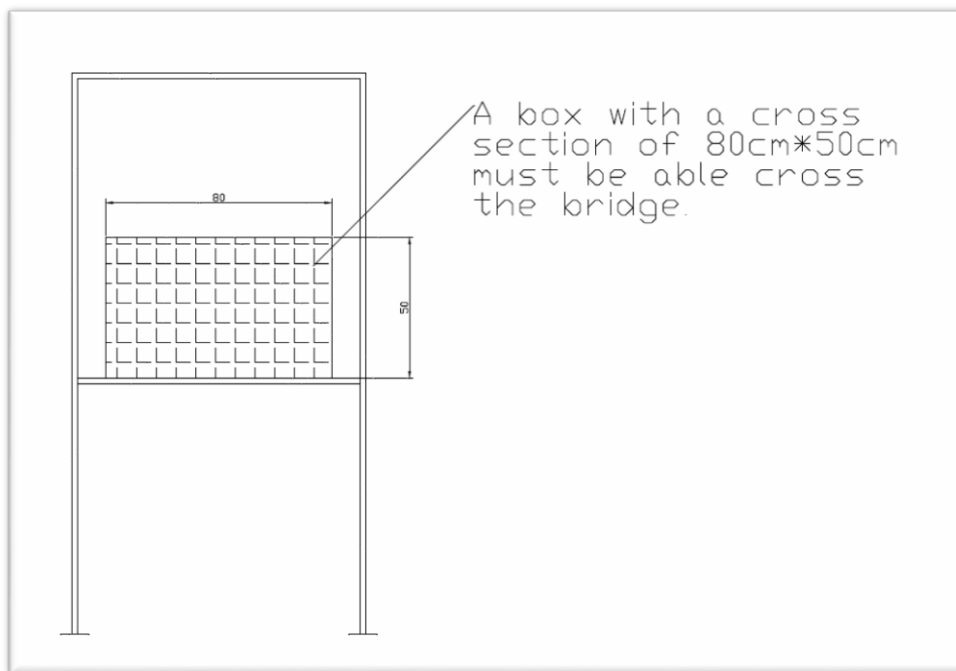


Figure #4: Dimensional Rules II

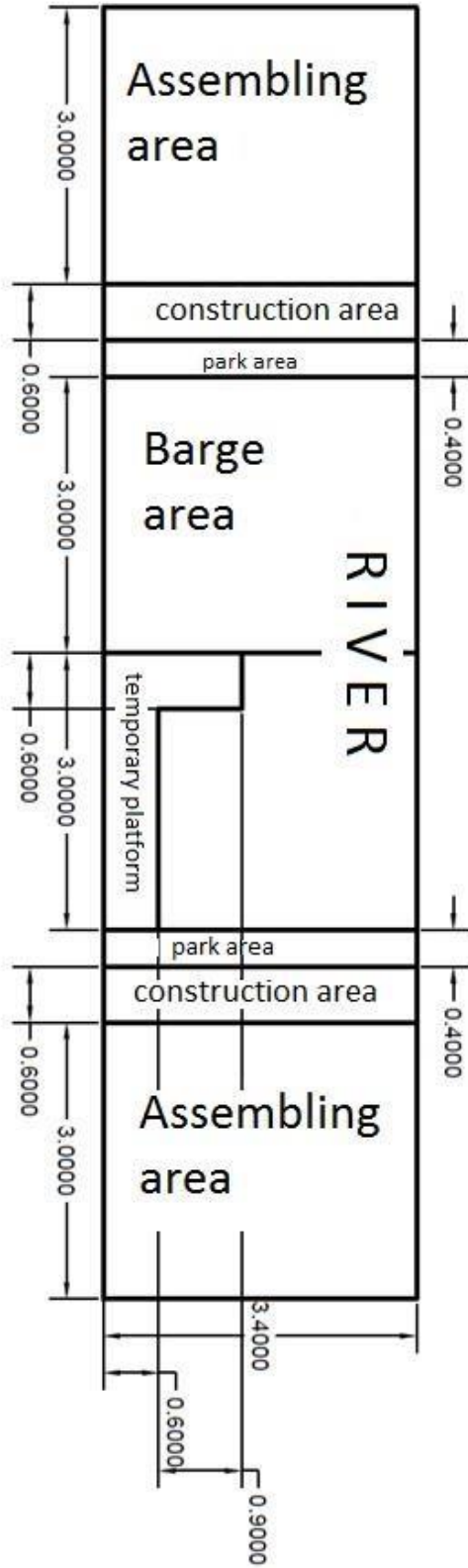


Figure #5: Construction Site Plan

6. CONSTRUCTION INFORMATION

6.1. Construction Rules

- Competitor teams should bring their own tools, white hard hats, gloves and goggles to the construction area. Team members should use these while setting up their bridges. If they don't bring any of these, because of the safety reasons, the team will not be allowed to start.
 - Competitors have to put on steel toe shoes during the installation.
 - Before starting the installation, bolts shall be kept in the tool belt. Components should stay away from the line and should not touch each other.
 - Bridge legs are going to be fixed on the ground at the second day of the competition by the tools which are going to be provided by BUYAP.
 - Before the teams start assembling against time two legs of the same side will be fixed on the ground. This side is up to teams. After assembling against time other two legs of the other side will be fixed on the ground.
 - Load tests are going to be applied after the bridge legs are fixed on the ground. However, bridges are required to be able to stand still without being fixed on the ground in Boğaziçi University South Campus during construction process and aesthetics evaluation.
 - Any part of the bridges, any tools, nuts, bolts, hard hats, gloves and goggles should not touch the river or outside of the construction area. In case of a violation, **penalty #5** will be applied. (Temporary support member is also a part of construction area.) Permission must be obtained from the referee in order to receive the falling tool. (The time is stopped, the old position is taken and after tool is received the team can continue.)
 - None of the competitors should step out of the construction area. In case of a violation, **penalty #6** will be applied. (Exception: A competitor may step in the river to take dropped a tool, hard hat, nut or bolt.)
 - Temporary support members should not collapse while supporting the bridge. In case of a violation, **penalty #1** will be applied.
 - Only one competitor from each team except for the barge may cross the river and come back for only one single time. (Competitors are not allowed to cross the river by jumping, using bridge body or any other technique.) In case of violation **penalty#2** will be applied.
- #1** will be applied.

- A competitor, while supporting a part of the bridge, cannot support any other part of the bridge or help any teammate to do so. In case of a violation, **penalty**

#1 will be applied.

- No more than 3 parts can be assembled in the assembling area. Competitor teams can only insert nuts or tighten bolts to these assembled parts out of the assembling area. In case of violation **penalty #2** will be applied.
- Assembled parts can only be attached to the constructed part of the bridge. In case of violation **penalty #2** will be applied.
- Constructed parts of the bridge should not be moved, manhandled or transported in any way. (Exception: Any movement in any direction to link the parts of bridge or moving the supporting parts can be accepted under the condition of being moved for 8 cm at most.) In case of violation **penalty #2** will be applied.
- At least two competitors must carry the assembled parts. One single person can carry the parts, which were not assembled at the construction area.
- Bolts should have maximum diameters of 20 mm and maximum lengths of 240 mm and hexagonal heads.
- Other kinds of bolts are not allowed.
- Nuts and bolts should be inserted with their original form without any mechanical differences. Otherwise, competitor teams will not be allowed to use them. Teams can use washers.
- Every load-carrying member should be assembled to one another through at least one binding member.
- The bridge should stand parallel to the reference lines of the construction area.
- Construction areas will be given to the teams by lottery. Teams should accept the slab conditions of the provided construction area.
- In case of any accidents occur, the judge stops the clock and checks the issue.
- Unless the situation is unsuitable to continue, the judge keeps the right of that team to continue.
- The barge cannot step out of the river reference lines (In case of a violation, penalty #6 will be applied). The barge can cross to the other side without using the bridge only for one single time. The barge is not allowed to jump over or pass under the bridge in order to cross to the other side. In case of violation **penalty #2** will be applied. The barge cannot stay inside after the plates are closed.
- Before the assembly period begins, every part of the bridge and every tool that is going to be used should be arranged in the assembling area without contacting each other. The temporary support member must be within the assembly area and the binding members should be inside the bag. Parts of the bridge and tools will be checked 5 minutes before the timing begins. In case of violation, extra cost will be added to total cost in accordance with compliance with



Design & Construct 2017 Rules and Regulations Handbook
Organization/Competition Program.



- Competitor teams should avoid insecure actions. In case of a violation, **penalty#2** will be applied.
- For safety reasons; during the loading test, a security line will be drawn and people will not be allowed to cross the security line, except the team members and the referee.

6.2. Construction Site

Site and bridge plans are displayed in our website. Only the referees and team members are allowed in the construction site. Construction site plan is updated.

6.3. Start

Before the construction starts, only these materials may exist in the construction area:

- Load- Carrying members (TE)
- Binding members (BE)
- Tools
- Temporary support members (if it will be used.)
- Every load carrying member has to contact the ground. Carrying members should not be attached or in contact with each other. Tools and binding members have to be separate from load carrying members. During the construction, it is not allowed to bring any other load carrying members, binding members or tools to the construction area or to take them away. It is the team's own responsibility to check these before the construction. Team members should wear hard hat, glove, goggles and their T-shirts (T-shirts are distributed by BUYAP) during the construction. Time begins with the signal of the referee after all teams are ready.

6.4. Time

Time is defined as the interval between the beginning and the end of the construction. The time of setting up the temporary support leg is included.

- 2 members of each team are allowed to survey their bridges after the stop of setup time and before the load tests, at most for 3 minutes. During this survey, any revision in the bridge and any contact with the bridge are allowed. If any fault is inspected, time for repair may be granted. Time consumed here is added to the total time after being multiplied by 2. Repair time is limited to 5 minutes. During the repair, the barge and another person except for the barge are allowed to take place in the construction site. During the repair, all competition rules are applied.

6.5. Restrictions

Forbidden materials and devices stated below causes not to be allowed to use them.

- Throwing load-carrying members or devices are forbidden. In case of a violation, Penalty #1 is applied.

- Devices like welding machine, engine etc., any type of electronically systems and energy transmitting, converting devices (Cables, batteries, engines, pistons, tribune springs etc.), which require an external power input are forbidden.
- Energy transmission to the bridge or from the bridge (magnetic / mechanical forces/ sound / light / radio waves / heat / electric current / etc.) is forbidden.
- Any load carrying members of the bridge which contains moving pieces, hinges, joints, latches, locking devices, springs or hooks are forbidden.
- Threaded or prefabricated truss connections are not permitted.
- Pre-stressed or post-tensioned load-carrying members are not allowed.
- Flexible tension members such as cables and chains, and post-tensioning members are not allowed.
- Greasing is not allowed during the setup or in the setup area, at any time.
- All binding members must be bolted.(bolt + nut)
- Crossing the river for the second time is forbidden. In case of a violation, Penalty#1 is applied.
- Any risky behavior, which can cause an accident, is not allowed. In case of a violation, Penalty #2 is applied.

The teams will be disqualified if the specified rules are violated!

6.6. Finish

When all conditions stated below are satisfied, the constructions and the time is stopped.

- All members of the bridges should to be connected.
- Tools and temporary support members have to be carried back to the construction site.
- Competitors should be out of construction site.
- Team captain should give a signal when they are finished.

Important Warning: Competitors cannot enter the construction site in the time period between the finish time and the beginning of the loading test. In case of violation, Penalty #1 will be applied.

***The teams wishing to take their bridges back are responsible for the arrangements of**



shipping after the award ceremony. Forklift will be provided by BUYAP. At the end of the day BUYAP is not responsible for shipping of the left bridges.

7. FIXING THE BRIDGE LEGS TO THE GROUND

At Design & Construct 2017 before the loading tests (vertical and lateral), the legs of each competing bridge are going to be fixed to the ground. Below is the subject explanation with details:

- On the second day of Design & Construct, after the time competition and before the load tests, bridges will be fixed to the ground of the parking area of Boğaziçi University in South Campus.
- ❓ All the equipment to be used while fixing the bridge to the ground will be provided by HILTI.
- ❓ All the bridge legs are supposed to have their own steel anchorage plate which has the dimensions of 250x100x10 mm and contains two holes. Each of these holes must have 18mm of diameter and centers are located 50 mm away from the shorter sides of the subject plate.

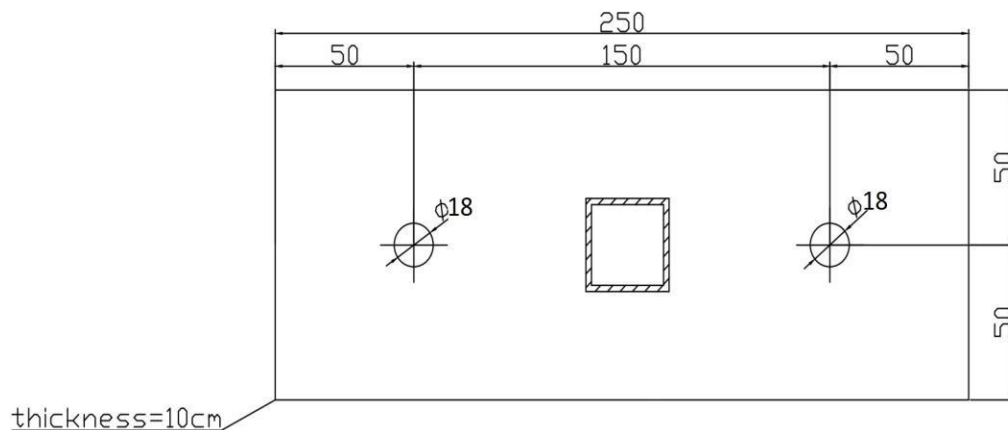
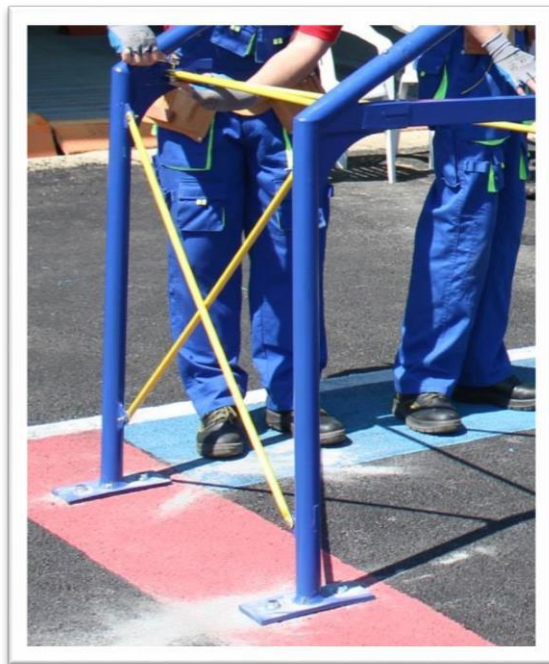


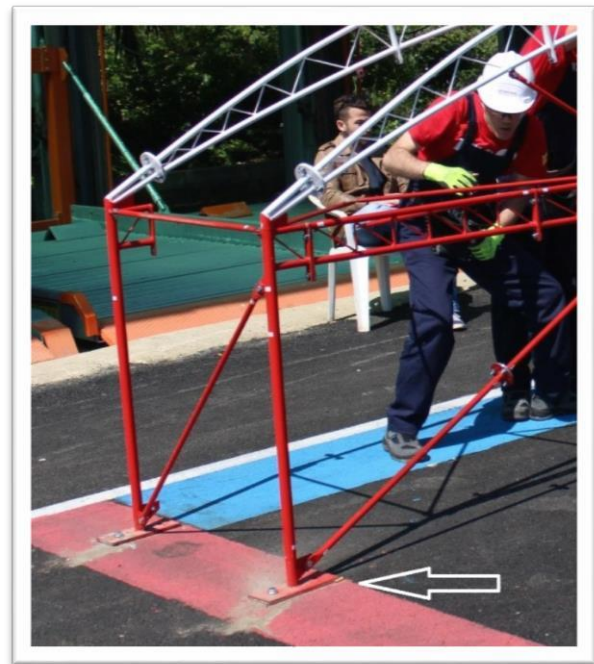
Figure #6: Steel anchorage plate

- ❓ All competing bridges should have their plate welded beneath their legs ready before the competition begins. During the competition, any kind of interference to the bridge legs or plates such as welding is not allowed. Competing teams are responsible of calculations and proper application of welding between bridge legs and steel plates.
- On the first day of the organization, in the period of aesthetics evaluation in the South Square of Boğaziçi University, bridges are not going to be fixed to the ground. Therefore, competing bridges must stand still under their own weight without the legs fixed to the ground.

- ❑ On the second day of organization, before assembly, two legs on the same side of the river are going to be fixed first. After the construction is over, the other two legs are going to be fixed to the ground.
- ❑ Teams are responsible for bringing their own socket sets.
- ❑ For fixing process, If the team wants to assembly by using two holes, there should be a 25 cm vertical gap between the other members of bridge and the holes of plates (fixing points). This gap is a necessity since a machine will be used for fixing process.(If the team prefer one hole for assembly, the gap is up to team choice.)
- ❑ The accuracy of the places of the holes on the plate is the responsibility of the subject team. Teams are obliged to measure the distance between the plates welded to bridge legs and the distance between two holes on each in millimetric scale. Furthermore, each team has to inform the organization crew about these measures. Following the approval of team captains, holes will be made in the ground. BUYAP is not responsible of any problem resulting from measurement mistakes.



True



False

Figure #7: True and False Gap Design

- In the attachment related to this topic, there is all the necessary information about fixing methods and equipment to be used in the process of fixing the legs to the



ground. You can contact Yetkin Cetin for any question or comment about the technical details via the following email address: yetkin.cetin@hilti.com

8. DEFLECTION MEASUREMENT

8.1. Horizontal Load Test

25 Kg of load is applied to the mid-span of the bridge at the deck level and the horizontal deflection measured. For the vertical load test to be applied, horizontal deflection should not exceed 1.5cm.

A 35 Kg of vertical load is placed on the bridge (at the mid-span) during the horizontal loading test.

8.2. Vertical Loading Test

Vertical loading test contains two different vertical loading applications.

In the first vertical loading application, 1000 kg weight (steel plates) is loaded onto two piece of loading aprons (weighing approximately 25 kg each and totally having a length of 1.0 m) will be safely placed on the bridge, symmetrically, in such a way that weight is distributed symmetrically with respect to the mid-span. The teams are responsible of designing a bridge that lets the loading to be symmetrical. **If not, the loading will be done the way which the referees decide. No objections will be taken into account.**

For a more reliable measurement, after 50 kg weight is loaded, measuring device is reset, then loading continues. Measuring devices are placed on the mid-span of the bridge and 15 seconds after the loading is finished, the value is read under the supervision of the referee committee. As soon as the loading is finished, the competitors have to move off from the bridge. Otherwise, until the surrounding area of the bridge is emptied, waiting for the measurement is mandatory.

The second vertical loading application is done immediately after first loading application with an extra loading apron of 250 kg weight is applied on the middle point between the mid-span of the bridge and one end. The end is decided by a draw of a dice which is drawn by the team captain under the supervision of the referee committee. If it is an even number, the weight will be applied on the right side of the referee committee's standing position. If it is an odd number, the weight will be applied on the left side of the referee committee's standing position.

- Loading of both of the weights is done by the four selected members of the group and can be done at the same time or one by one. This is the choice of the group. The competitors who are loading the weight have to wear white helmets, gloves, protective goggles, and steel nosed boots.
- Total vertical shift is the absolute value of the vertical displacement of the measurement devices measures.
- Temporary support members are removed before the measurement is done.

- **Warning:** Under loading, horizontal displacement of the bridge should not exceed 1.5cm, vertical displacement should not exceed 2.5 cm. If these values exceed, penalty #9 will be applied.
- **Important warning:** Under vertical loading, If the displacement of a bridge exceeds 1,5 cm in 400 kg, it will be disqualified from the aesthetics competition.

9. SAFETY CONDITIONS

Safety is the most important subject for our student organization. During the contest, it's our main responsibility to provide safety for our organizer team and contestants. Therefore, this section is a complementary one for other sections and has prior importance. Please read this section carefully in order to learn about the application of the contest and help us providing your safety.

BÜYAP is not responsible for any inappropriate situation originated from noncompliance to the safety precautions which are emphasized in this section clearly.

9.1. Construction Safety Precautions

- The build team, judges, host personnel, and spectators must not be exposed to risk of personal injury.
- Only builders and judges are permitted within the construction site boundary during timed construction and repair. The supervisor observes and directs construction from outside the construction site and shall not interfere with judges. Spectators, including coaches, faculty, advisers, and other associates of the team, must remain in designated areas at a distance from the construction site that assures they are not at risk and cannot interfere with the competition.
- The build team shall include no more than five persons.
- At all times during timed construction and repair every member of the build team shall wear personal protective equipment in the proper manner (e.g. hardhat with peak in front).
- Each team has to bring their bridge members and equipment inside a proper box and palette to the construction site in Boğaziçi University. If not, extra cost will be added to total cost in accordance with the category of Compatibility to Organization/ Competition Program.

9.2. Load Test Safety Precautions

- Any activity shall be halted if the judge considers it to be hazardous. If competitors cannot load their bridge safely (section 7.2), loading will cease and the bridge will not be eligible for awards in any category.
- Competitors who are not participating in loading, faculty, advisers, and other spectators shall observe from a safe area designated by the judges and host student organization.
- While participating in load testing, competitors shall wear hardhats, protective eyewear or safety goggles meeting, work gloves, and leather construction boots. This safety equipment is provided by the competitors. Judges will not permit load

testing by competitors who are not wearing the specified safety equipment or are wearing it improperly.

- Damaged bridges (e.g., broken weld, missing or broken fastener, missing or broken member) shall not be tested.
- No more than three competitors shall be in the testing area during lateral load tests.
- The number of people near the bridge shall be minimized during vertical load tests. No more than three competitors shall be in the testing area during a vertical load test. Other members of the team can watch the test from the designated area which assures they are not at risk and cannot interfere with competition.
- Safety supports shall be provided by the host student organization, and shall be of adequate strength, height, and number to arrest falling load if a bridge collapses.
- Safety supports shall be in place under the decking units before load is placed on the bridge.
- The number and location of safety supports under a decking unit shall be sufficient to arrest the load even if only one side or one end of the bridge collapses. Therefore, safety supports are needed under the sides and ends of the decking units, not just in the middle. Safety supports should be directly under decking units rather than under bridge trusses or cross braces, if possible.
- Safety supports shall be adjusted individually for each bridge so that load cannot drop more than 15 cm. If the height of the safety supports is not adjustable in appropriate increments, they shall be augmented with pieces of wood or other suitable material provided by the host student organization.
- No one shall reach, crawl, or step under a bridge while any portion of vertical load is in place. Safety supports must be in place before any load is on the bridge. If safety supports must be adjusted during loading, the load shall first be removed without disturbing the bridge, adjustments made, and the load replaced as it was before being removed.

10. OBJECTIONS

- Referees will not take an objection from a team about another team's bridge into consideration.
- Objections can only be delivered by the team captain to the referees. Team captain objects to the chief referee with an objection card, which is provided by BUYAP. Otherwise objections will not be taken into consideration.
- Each team will have only one objection card. Referees can decide not to bring the card back to the team.
- Objections must be offered right after the non-compliance is made.
- Any changes on the bridges cannot be made in the process of evaluation.
- Participants must be treated with respect and ethics during appeals and competition. Referees may find it necessary to remind to the participants.
- After the referee explains his / her decision, the team captain may ask for 5 minutes in order to discuss the decisions with colleagues. After 5 minutes, if the team is not satisfied with the decisions, competitors may request referees to observe and analyze again.

11. PENALTIES

- **Penalty 1:** Referee stops the time. The state before the violation is set, and the time is restarted. 10-minute penalty is applied.
- **Penalty 2:** Referee stops the time. 3 minutes penalty is applied. The state before the violation is set, and the time is restarted.
- **Penalty 3:** If the longest size which overflows the box is X, the weight that will be added as penalty C3 (kg) is calculated as given below:

Penalty#3 =	X ≤ 5 cm;	→	(10*X) kg
	5 cm < X ≤ 10 cm	→	(15*X) kg
	10 cm < X	→	(20*X) kg

- **Penalty 4:** If the weight exceeded is X, the time that will be added as penalty C4 (min) is calculated as given below:

Penalty#4=	1 min/kg	→	X ≤ 0,5 kg
	5 min/kg	→	0,5 kg < X ≤ 1 kg
	10 min/kg	→	1 kg < X ≤ 5 kg
	30 min/kg	→	5 kg < X

- **Penalty 5:** Penalty time of 1min. is applied.
- **Penalty 6:** Penalty time of 3min. is applied.
- **Penalty 7:** If the length exceeded is X(cm), the weight that will be added as penalty. C7 (kg) is calculated as given below:

$$\text{Penalty 7} = 5X^{1,4} \text{ kg}$$

- **Penalty 8:** If the length exceeded is X(cm), the weight that will be added as penalty. C8 (kg) is calculated as given below:

$$\text{Penalty 8} = 6X^{1,4} \text{ kg}$$

- **Penalty 9:** In the case of exceeding the stated limits there will be no evaluation in the category, and the cost associated with that category will be calculated as 12 000 000 \$ and added to total cost.
- **Penalty 10:** Penalty time of 10min. is applied.

12. EQUIPMENTS PROVIDED BY ORGANISATION COMMITTEE

- Lateral Load Device which can apply a 25kg of load in the horizontal direction.
- Equipment for measuring horizontal displacement.
- Equipment for measuring deflection.
- Approximately 25kg heavy, aprons (loading trays) having a 50cm x 80cm x 5cm size. (50 cm wide in the longitudinal direction of the bridge, 80 cm wide in the transverse direction.)
- Ground: Load tests are done on the second day of the competition at Boğaziçi University South Campus Parking Lot (The surfaces which bridges will stand on should be as flat and levelled as possible, in both the construction site and loading area.)
- Equipment for fixing the legs of the bridges on the ground.
- Those teams who would like to take their bridges back are responsible for bringing the trucks of the cargo companies they agreed with, after the ceremony. A forklift will be provided by BUYAP. BUYAP is not responsible for the transportation of bridges which are not taken back by the end of the day.
- *Participants should keep small equipment and tools they would use in assembling the parts with themselves.*

13. MATERIAL SUPPORTERS OF TEAMS

Teams;

- Shall make their own material supporter arrangements and agreements. The teams are asked to deliver a document from their supporter company to BUYAP in order to make sure that only “steel according to ST37 standards” will be used.
- Shall provide BUYAP all contact information and who from which company they are keeping in touch with.
- Are allowed to use the names and logos of the supporter company, having the size of at most 20cm x 20 cm, on posters and plates which will be presenting their bridge during aesthetics evaluation.
- Are allowed to add the name of the supporter company to the name of their bridge.
- Are allowed to mention the company name during aesthetics evaluation presentation.

14. OTHER

- ❓ All questions regarding to rules and competition are to be consulted, asked and replied on infodeco2018@gmail.com
- ❓ Following the end of competition, all teams will be delivered their certificates.
- ❓ The teams are not allowed to make changes on their bridges in practicing. They will compete with the very same bridge they presented before. Any changes will be considered by judges and referees in the aesthetics evaluation category and will cause loss of points according to the opinion of judges.
- ❓ In the case of excess number of applications, a method of elimination over the projects will be followed. For this elimination, a board of civil engineers will be in charge. This board does not evaluate the bridge designs.
- Bridges have to reach Boğaziçi University and be taken afterwards on declared dates. Teams are responsible for the shipping of their bridges.
- ❓ Bridges have to be packed in 1x1x1 m sized box which is fixed to a pallet for the purpose of transportation convenience. Forklift will be provided by BUYAP.

Boğaziçi University Construction Club has the right to change the competition rules in any case of need.