



15<sup>TH</sup> 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 2022 International Student Steel Bridge Competition, students compete in teams with bridges they designed and produced. The participant teams earn experience in fields of practical designing, planning, production process, team work and collaboration.
- The topic of the competition is about the problems of an engineer can face during a construction project. The competition is a steel bridge modelling competition as an application of this project.
- 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.
- The first priority in the organization is security. As BUYAP (Boğaziçi University Construction Club), all we demand from the participants and jury is to take 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 and receive help from private corporations in the production process.
- 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 new roads are intended in order to increase the transportation opportunities of growing population.
- 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 limitations.
- Because of the obstacles around the river, the legs of the bridge have to be built on soil. Supporting legs can be used during the construction to support the bridge. However, these 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 evaluated in five categories determined by the local government. A contract will be signed with owners of the best project. The best project is the one with the lowest cost according to cost calculations stated in the rating section.

## 3. DESCRIPTIONS

### 3.1. Chief Referees:

- Chief referees are the coordinators of the Design and Construct.

### 3.2. 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. Prep and 1<sup>st</sup> year students cannot be member of a team. At most two 2<sup>nd</sup> year students can be found in a team. In the universities that undergraduate study lasting 3 years, 4<sup>th</sup> year students are evaluated as undergraduate and 5<sup>th</sup> year students are evaluated as graduate students.

### 3.3. Observers:

- Observers can participate from the universities at which their team passed preselection and takes part in the top 16. Prep, graduate, undergraduate students can attend as observers. Observers can take part in all the events at DE&CO schedule but they are not allowed to participate in assembling against time and aesthetics evaluation actively.

### 3.4. Barge:

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

### 3.5. 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 assembling area. All members will be assembled must stay in the assembling area before and during assembly.

### 3.6. 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 assembling against time 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.

### 3.7. 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 any member of the bridge before assembling against time. Installation can only take place during construction. Use of washers is permitted but washers cannot be welded to screws and nuts.

### 3.8. 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 more than 8 cm after using. Additional temporary support member cost is applied in case of moving. For the temporary support members used additionally, temporary support member definition above is valid. They can be placed wherever preferred. Despite one leg is used as temporary support member additionally, additional support member cost is added to construction 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
  - ✓ Organization and Competition Program Compliance

### 4.1. Aesthetics & Uniqueness

- Each member of the jury gives points to each competing bridges from 0 to 100. Scores will be delivered to BUYAP team in an envelope. Average of these points out of 100 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 category of aesthetics & uniqueness while scoring.
- 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\$***
  
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  - ***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.
- In the uniqueness branch creativeness and distinctness are taken into consideration.
- The bridge design which is different from other bridges in competition and bridges designed in previous years has 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 2022.
- **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.

- Teams should not make changes to their projects after submission. They must come to the competition with the bridge design they submitted. The jury and the chief referees consider any design change in the Aesthetic Evaluation category. Deduction of points of the team in question is their initiative.
- 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, 5 points of Aesthetics & Uniqueness General Category Point (AUGS) will be reduced.
- 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
  - ✓ 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 or not prepared in English, **organization and program non-compliance penalty** will be applied.

#### 4.2. Construction Cost

- Bridges' Construction Cost (CC) is calculated by the formula below:
  - **$CC = \text{Total time (minutes)} \times \text{Number of Team Member (person)} \times \text{Cost Coefficient (\$/min- person)}$**
- Time passed during setup (setup time, ST) plus all time penalties described in other sections is defined as total time.
- Restriction of the specification and numbers of the team members are indicated at the descriptions. Cost coefficients will be determined according to this description.

- Cost coefficient of the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade students is determined as 15000 \$/min.
- If there is one or two graduate students in the team, cost coefficient of the graduate students will be calculated as 30000\$/min. Remaining undergraduate students will have the cost coefficient indicated above.
- If there is three graduate students in the team, cost coefficient of the graduate students will be calculated as 40000\$/min. Remaining undergraduate students will have the cost coefficient indicated above.
- If there is four graduate students in the team, cost coefficient of the graduate students will be calculated as 50000\$/min. Remaining undergraduate students will have the cost coefficient indicated above.
- 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 additional temporary support member **200.000\$** will be added to construction cost of that team. Using of temporary support member is defined at 3.6.

#### 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 Displacement Cost (HDC)**  
= **Horizontal Displacement (cm) x 1.200.000(\$/cm)**
  - **DC= Vertical Displacement Cost (VDC) + Horizontal Displacement Cost**
- The teams with vertical displacement that does not exceed 0.30 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 0.1 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.
- Loading tables 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

- BUYAP pay importance to organization and program compliance substantially.
- This is the category that includes pre-organization program compliance, attending to presentations and meetings during the contest, delivery of the progress reports, registration agreements, documents that check the conformity of bridge to the related standards on time, obeying the rules indicated in this document.
- If one of the events will be missed, team guides assigned by BUYAP need to be informed.
- Format of the team presentations and objections need to be considered in this content.
- 1.000.000\$ as **organization and competition program incompliance penalty** (OPC) will be added to total cost of team that do not act properly in the context of these conditions.
- Details of this category will be explained in the meeting team leaders will attend.
  
- If there is more than one situation that requires application of organization and program incompliance penalty, this penalty is multiplied with the number of

intrusion.

#### 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).
- **$Total\ Cost = CC + DC + WC + OPC - A$**
- **The bridge with the lowest total cost wins the contest Design and Construct 2022.**

#### 4.7. Evaluation

- Referees appointed by BUYAP reserve all rights to stop every progressing operation found to be dangerous, carry out the competition and apply the rules according to rules & regulations file. All decisions, evaluations, and prohibitions are in their commitment.
- Boğazici University Construction Club guarantees to fully inform all referees about rules and methods and declares to provide all knowledge for their mission
- For intrusions appeared by the observations of referees and not pointed in the penalties section and for disqualifications, last decision belongs to BUYAP board.

#### 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 in a manner that they will not touch the 6.0 meter river and standing parallel to the reference line. 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.

- Vehicle way on the bridge must be parallel to the ground.
- To be able to load steel plates to loading table (steel tray to carry loading plates) during the vertical load test, there should be enough space on the sides of the bridge.
- A 5 cm deep,80 cm wide and 50 cm long deck must be able to be placed on the bridge. To be able to carry the deck 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.
- 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.

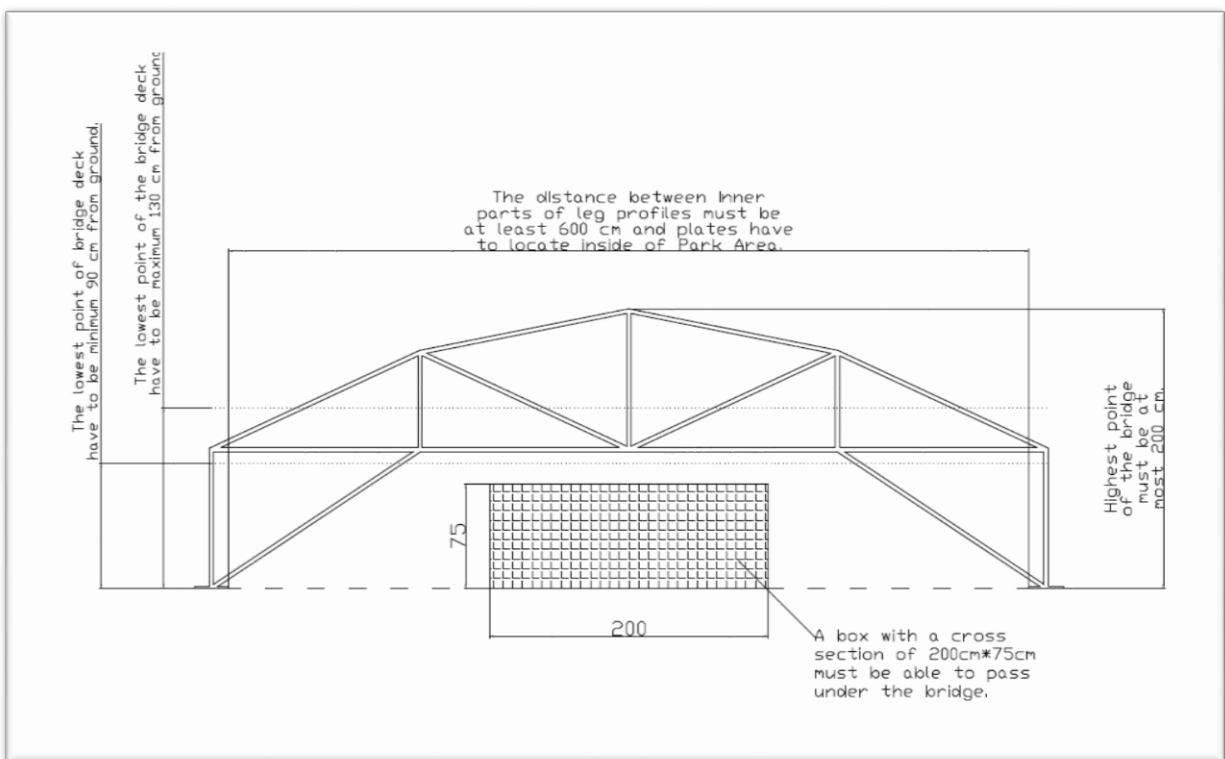
Standards of constructional steel are determined as ST37. The company who provides the steel should send details to BUYAP. Competitor team should also send a document which includes the details of the material used obtained from the company they provided their materials, to BUYAP. Jury will choose a 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 2022. Besides, teams which don't give permission for the test will be eliminated as well.

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)

## 5. DIMENSIONAL RULES

- The limits for the vehicle way are; minimum 0.9m from ground (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 bending.)
- Length of the vehicle way cannot be shorter than the span of the bridge.
- Welded members are counted as a single part so 0.9 m limitation of the vehicle way will be controlled from the bottom of that members.
- 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. Flanges are taken into account when making measurements.

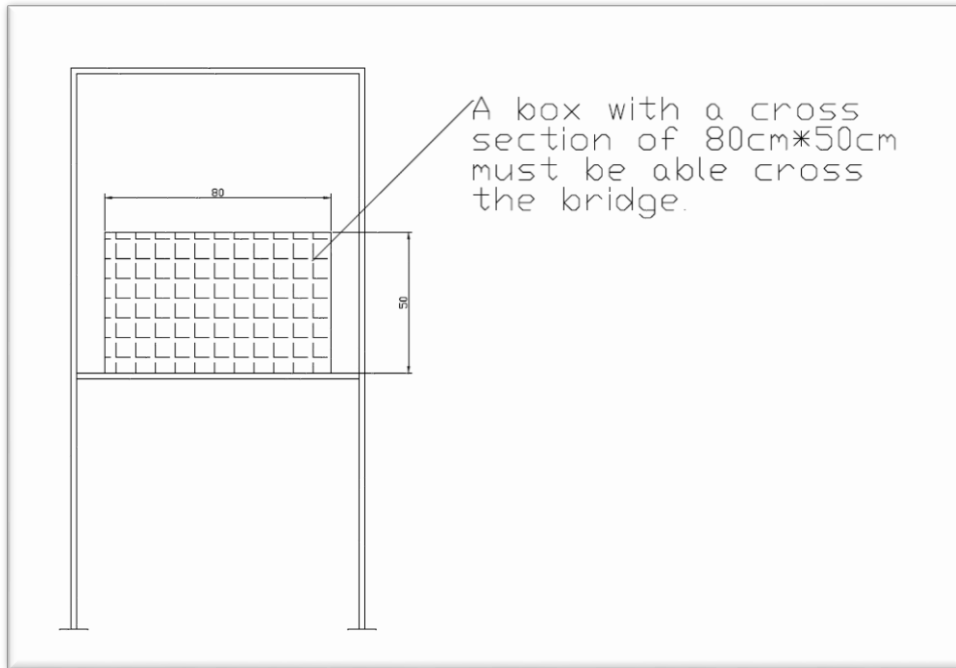
- Support legs should have the size of 20cm x 20cm at most. Supports will be checked before the contest begins. In case of a violation, support legs will not be used.
- A box having the size of 2m x 2m x 0.75 m (height: 0.75 m) should be able to pass under the bridge. This gap may be left anywhere under the bridge, including temporary platform. In case of a violation, **penalty #8** will be applied.



**Figure #3:** Dimensional Rules I

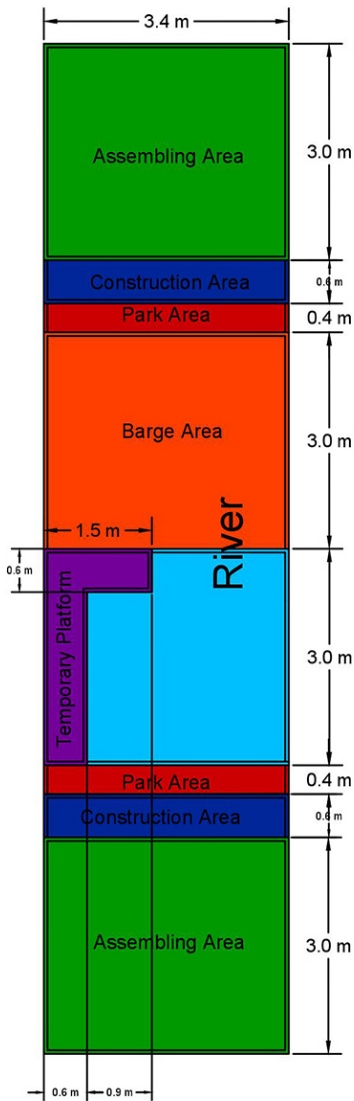
- Every load carrying member except legs of the bridge should fit into a box having the size of 120cm x 25cm x 25cm. In case of a violation, **penalty #3** will be applied. (The length of the members cannot exceed 120 cm. For curving members, important thing is being able to fit in the box.)

- 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



- Areas that the contact of members does not cause violation except barge.
- Areas that the contact of members causes violation including barge
- Areas that the dropping of the load carrying members, binding members and personal protective equipments cause violation
- River Area

\*Thickness of the lines that indicates the areas in the construction site is 5 cm .

## 6. INFORMATION ABOUT CONSTRUCTION

### 6.1. Construction Rules

- Competitor teams should bring their own tools, white hard hats, steel toe shoes, 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.
- 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 during construction process and aesthetics evaluation.
- For the safety of the observers, a safety line will be set up to competition area. Only chief referees , referees and team members that load tests are being applied to their bridges are allowed to enter the competition area. Other teams and observers can follow the process out of the safety line. If members of a team tries to enter the competition area while load tests are applying to the bridge of another team, **organization and program noncompliance penalty** will be applied.
- Any member of the bridge, equipment, strip, bolt, hard helmet or goggle must not fall into any area except construction area, assembling area and temporary platform. It is considered as violation to fall a member outside of the barge, river, park and construction area. In case of violation **penalty #5** will be applied. It's required to get permission from referee to take back the member which is fallen.
- 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.)
- 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.
- Temporary support members should not collapse while supporting the bridge. In case of a violation, **penalty #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. In case of violation **penalty#5** will be applied.
- 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.
- In case of any accidents occur, the referee stops the timing and checks the issue. After the referees get a grip on the situation, assembling continues.
- The barge cannot touch anywhere except for its own given space. In case of violation, **penalty#6** will be applied.
- 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, **organization and program non-compliance penalty** will be applied.
- Competitor teams should avoid insecure actions. In case of a violation, **penalty#2** will be applied.
- BUYAP will not supply any missing materials.
- During the assembling against time, it is not allowed to go out of competition area. In case of violation, **organization and program non-compliance penalty** will be applied.
- Any intervention from the outside is not acceptable. If a team is associated with the intervention, **program and organization non-compliance penalty** will be applied.

## 6.2. Construction Site

Construction site and competition area plans are displayed in our website. Only the referees and team members are allowed in the construction site. Observers and BUYAP team except referees cannot stand in the competition area.

## 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.

- Competitors can wear their team t-shirts during the two-day competition period. However, the t-shirt they use must have the De&Co logo on it, and the t-shirt must be designed in the same model and color for all the team. Teams can have their sponsor's logo on the t-shirt. Teams that do not design T-shirts are obliged to wear the T-shirt distributed by BÜYAP throughout the competition. It is the teams' responsibility to receive the t-shirts from the organization. In case of violation, **program and organization non-compliance penalty** will be applied.
- Team members must wear hard hat, glove and goggles during the construction. In case of violation **program and organization non-compliance penalty** will be applied.
- Time begins with the signal of the chief 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 not allowed. In case of violation **penalty#6** will be applied. 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 valid.

#### 6.5. Restrictions

Forbidden materials and devices stated below causes the disqualification of the team:

- 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 posttensioning 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)

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

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.

## 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, **organization and program incompliance penalty** will be applied.

## 7.FIXING THE LEGS

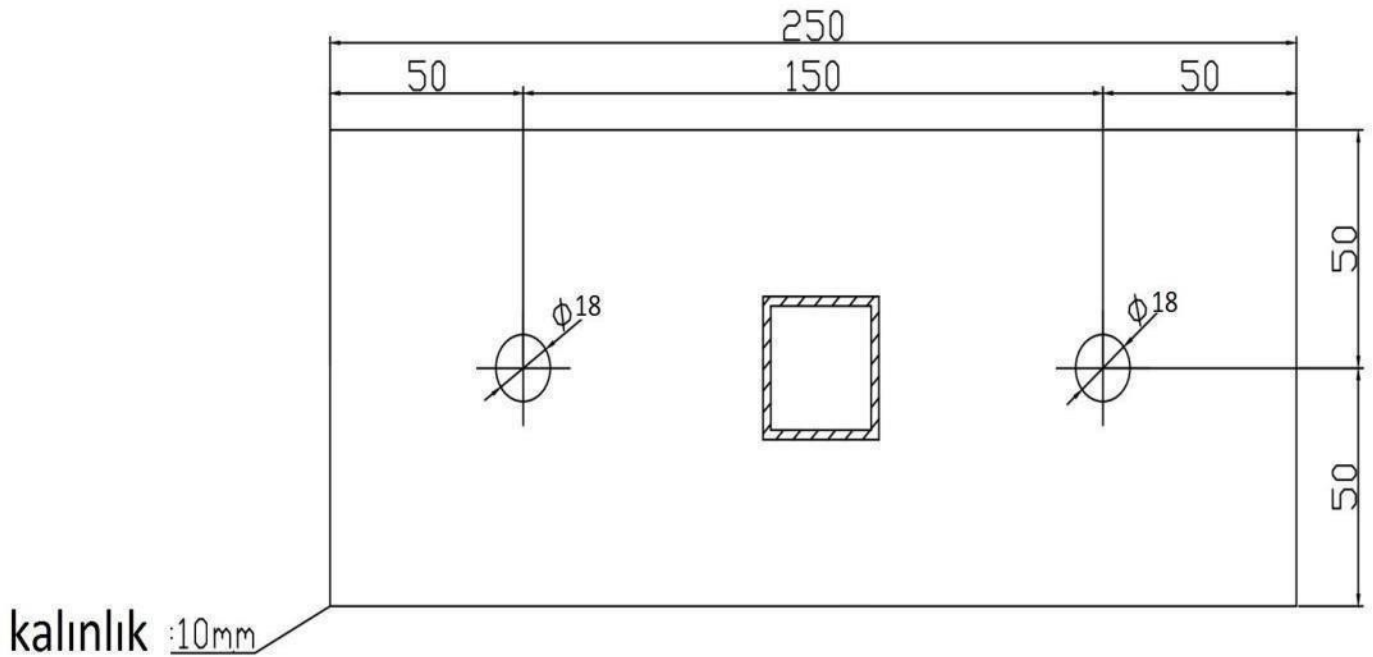
The bridges will be fixed during the construction phase and loading tests.

- 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.
- On the assembling against time day, teams are not allowed to practice before assembling against time starts. Teams can only build the deck to determine the location of the legs. If a team builds the bridge shell partially or completely, **organization and program incompliance penalty** will be applied.



**Figure #6:** Parts that teams may assemble before assembling against time.

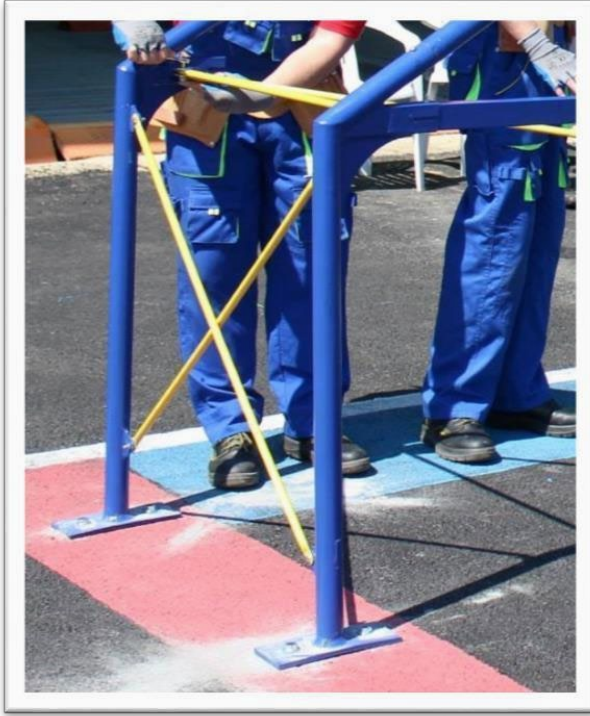
- All the materials will be provided by BUYAP.
- All the bridges must contain plates at their feet. (In sizes of 250x100mm and 10mm of thickness) There should be two holes with an 18mm diameter in every plate. Places of the holes are shown in Figure#6. In case of violation, **Penalty#11** will be applied.



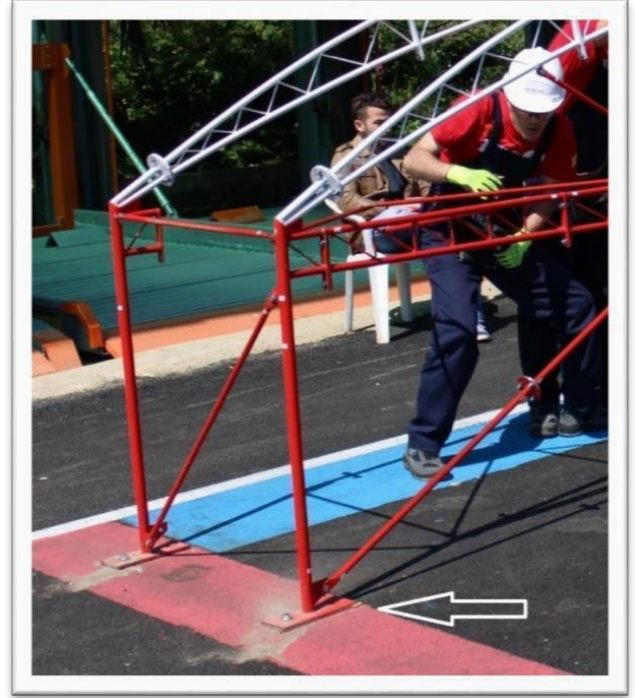
**Figure #6:** Steel Anchorage Plate

- 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.)

- 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.



True



False

Figure#7: True and false gap designs

- In the period of aesthetics evaluation, 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.
- 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 must 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.
- The construction and load tests will be in Boğaziçi University parking area, which has concrete and asphalt floor.
- Teams must accept the undesired conditions might have occurred by slightly oblique/rugged floor.

- Teams are responsible for bringing their own socket sets.
- Steel anchorage plates can be designed in a manner that they can make an angle with the reference lines but they must lie within the park area.
- Steel anchorage plates must fit in the dimensions and location given above. In case of violation **400.000 \$ penalty** will be applied.

## 8. DEFLECTION MEASUREMENTS

**It is not allowed for a team which is not called to enter the construction area.**

It is the participants' responsibility to observe the deflection measurements.

### 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 Load Test

In the vertical load test; two loading tables, having a length of 50 cm, are placed in the middle of the bridge. The place of the third loading table with the same size is decided with a coin flip.

1250 kg of weight is loaded during the vertical load test.

The displacement measurement device will be put in the bottom of the bridge. After the loading tables are placed, the device will be reset.

Without considering loading sequence:

- 1000 kilograms of weight will be loaded to the loading tables in the middle, and
- 250 kilograms to the side loading tables.

Displacement is measured in 15 seconds after the loading is completed. The participants

have to leave the surrounding area of the bridge in 15 seconds. Otherwise it is waited for participants to leave the area.

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 considered.

The tests are made with 4 members that team has chosen.

The participants shall wear hardhats, work gloves, and steel cap boots.

Temporary support members are removed before the measurement is done.

- **Reminder** : Under vertical loading, If the displacement of a bridge exceeds 1,5 cm in 400 kg, it will be disqualified from the aesthetics competition.
- **Reminder**: The teams with vertical displacement that exceeds 2.5 cm will be applied **penalty#9**. The teams with horizontal displacement that exceeds 1.5 cm will be applied **penalty#9**.

## 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.

BUYAP 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 referees are permitted within the construction site boundary during timed construction and repair. 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.
- 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,

still toe shoes). Each team has to bring their bridge members and equipment to the construction site in Boğaziçi University. If not, **program and organization noncompliance penalty** will be applied.

## 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 8.2), loading will cease, and the **Penalty#9** will be applied.
- Damaged bridges (e.g., broken weld, missing or broken fastener, missing or broken member) shall not be tested.
- 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. In case of violation, **organization and program noncompliance penalty** will be applied.
- While participating in load testing, competitors shall wear hardhats, 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.
- No more than three competitors shall be in the testing area during lateral load tests.
- 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

- The referees during the construction part will not accept any objections.
- Objections can only be delivered by the team captain to the referees. In case of violation, **organization and program non-compliance penalty** will be applied.
- Teams can make objections until midnight on the day of assembling against time. Objections made later are not taken into account by the referees.
- The coordinators can consult the board or the advising professor of BUYAP.
- Objections must be offered right after the non-compliance is made, except for the construction part of the competition.
- Any changes on the bridges cannot be made in the process of evaluation.
- Participants must treat with respect during appeals. Referees may find it necessary to remind to the participants. If teams behave oppositely, **organization and program non-compliance penalty** will be applied.
- After the chief referees explains his / her decision, the team captain may ask for some time in order to discuss the decisions with colleagues. After that, if the team is not satisfied with the decisions, competitors may request referees to observe and analyze again.
- In case of a team, taking too many objections that will effect the program; the coordinators have the right to overpass their objections.
- Participants can not object to the referee during construction. In case of a violation, **penalty#11** will be applied.



## 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 is calculated as given below:

<b>Penalty#3 =</b>	$X \leq 5 \text{ cm};$	→	$(10 * X) \text{ kg}$
	$5 \text{ cm} < X \leq 10 \text{ cm}$	→	$(15 * X) \text{ kg}$
	$10 \text{ cm} < X$	→	$(20 * X) \text{ kg}$

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

<b>Penalty#4=</b>	1 min/kg	→	$X \leq 0,5 \text{ kg}$
	5 min/kg	→	$0,5 \text{ kg} < X \leq 1 \text{ kg}$
	10 min/kg	→	$1 \text{ kg} < X \leq 5 \text{ kg}$
	30 min/kg	→	$5 \text{ kg} < X$

- **Penalty 5:** Penalty time of 1min. is applied. The timer doesn't stop.
- **Penalty 6:** Penalty time of 3min. is applied. The timer doesn't stop.
- **Penalty 7:** If the length exceeded is X(cm), the weight that will be added as penalty. C7 (kg) is calculated as given below:
  - Penalty 7 =  $5 * X^{1,4} \text{ kg}$
- **Penalty 8:** If the length exceeded is X(cm), the weight that will be added as penalty. C8 (kg) is calculated as given below:
  - Penalty 8 =  $6 * X^{1,4} \text{ kg}$
- **Penalty 9:** In the case of exceeding the stated limits there will be no evaluation in the category, and the cost in that category will be calculated as 12 000 000 \$.

- **Penalty 10:** Penalty time of 10min. is applied.
- **Penalty 11:** Penalty time of 5min. 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.
- 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.).
- Equipment for fixing the legs of the bridges on the ground.
- **Reminder: Participants should keep small equipment and tools they would use in assembling the parts with themselves.**

## 13. SPONSORS OF TEAMS

- Teams;
  - Shall make their own sponsor arrangements and agreements. The teams are asked to deliver a document from their material supporter company to BUYAP in order to make sure that only “steel according to ST37 standards” will be used.
  - Are allowed to use the names and logos of the sponsors, 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.
  - Shall provide BUYAP all contact information and who from which company they are keeping in touch with.

## 14. OTHER

- All questions regarding to rules and competition are to be consulted, asked and replied via mails of De&Co coordinators.
- Following the end of competition, all teams will have their certificates delivered.
- 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 the jury in the aesthetics evaluation category and will cause loss of points according to the opinion of the board.
- 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.
- Bridges must be transmitted to Boğaziçi University and be taken afterwards on declared dates. Teams are responsible for the shipping of their bridges.
- Bridges must be packed in 1x1x1 meter sized box which is fixed to a pallet for the purpose of transportation convenience. Forklift will be provided by BUYAP.
- BUYAP has the right to change the competition rules in any case of need, in 30 days after publishing current rules and regulations.
- Teams must arrange the transportation of their bridge, if they want to take their bridge back with them. BUYAP is not responsible for the shipping of the bridges that are not taken in time.

