[DRAFT]

Asia Steel Bridge Competition

2023

Kasetsart University, KPS

Rules

1. Changes of rules from 2019 Draft

The following items identify some of changes from the 2019 Draft rules.

(1) The bridge span is changed to 4000 mm.

(2) Construction is changed due to bridge span.

(3) Loading condition is changed: Total load is 350 kg (not including spreader plates).

(4) Displacement meters are set to zero after placing spreader plates and locations of displacement meters are changed.

(5) Bridge is directly put on the pier without pin/roller supports

(6) No minimum number of constructors and construction time

(7) Woman constructor is regarded as 0.9 constructor

(8) Calculation report is not required for Prediction of deflection

(9) Calculation of Overall performance is changed

(10) Carriage: Maximum of bridge member which can be carried at one time is changed to 4.

(11) Assembly: Sliding and rotating condition the bridge is specified.

(12) Loading sequence is adjusted.

2. Design conditions

2.1 Dimensions and design conditions

- The bridge length is between 4000mm and 4100mm and the span is 4000. (**Fig.2.1**a, b).
- The bridge is settled on the four abutments (**Fig.2.1**a, b).
- When load tests, 15 loading blocks (LB) + spreader plate (SP) placed at mid of the span and 10 loading blocks + spreader plate at each ¼ span. Each block have 10Kg of weight. Bridges must have the space for the spreader plate of 600x600 mm width. (**Fig.2.1**a, b).
- The bridge must be able to safely carry the loadings that are in total 350kg (100Kg at each 1/4span +150Kg at Mid Span).
- Deflection measured at mid span **Fig. 2.1.c** and **2.1.d.**

- The span center deflection in the full loading condition is targeted at 6mm ($\pm 1\text{mm}$). If the average deflection value reaches 15mm, the bridge is regarded as collapse.

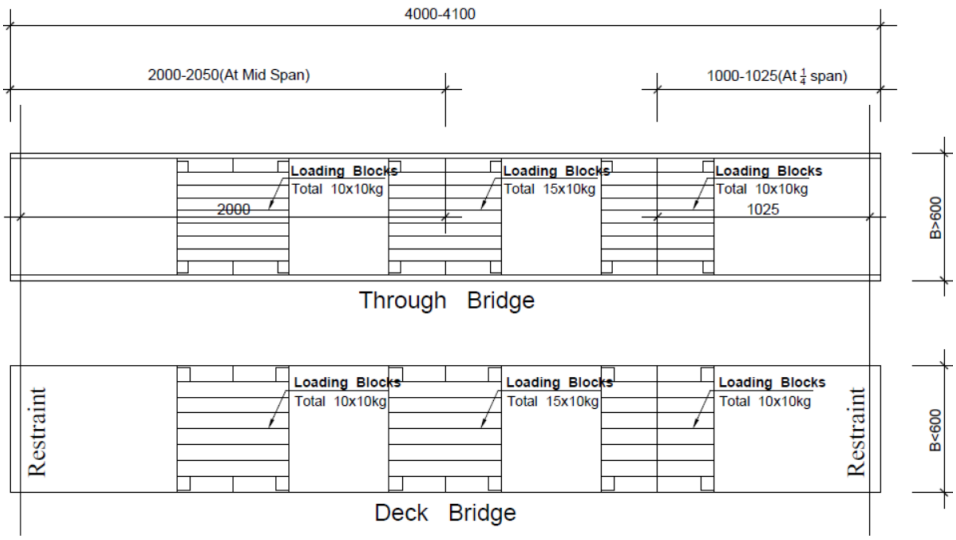

Fig.2.1a Bridge dimension (Plane view)

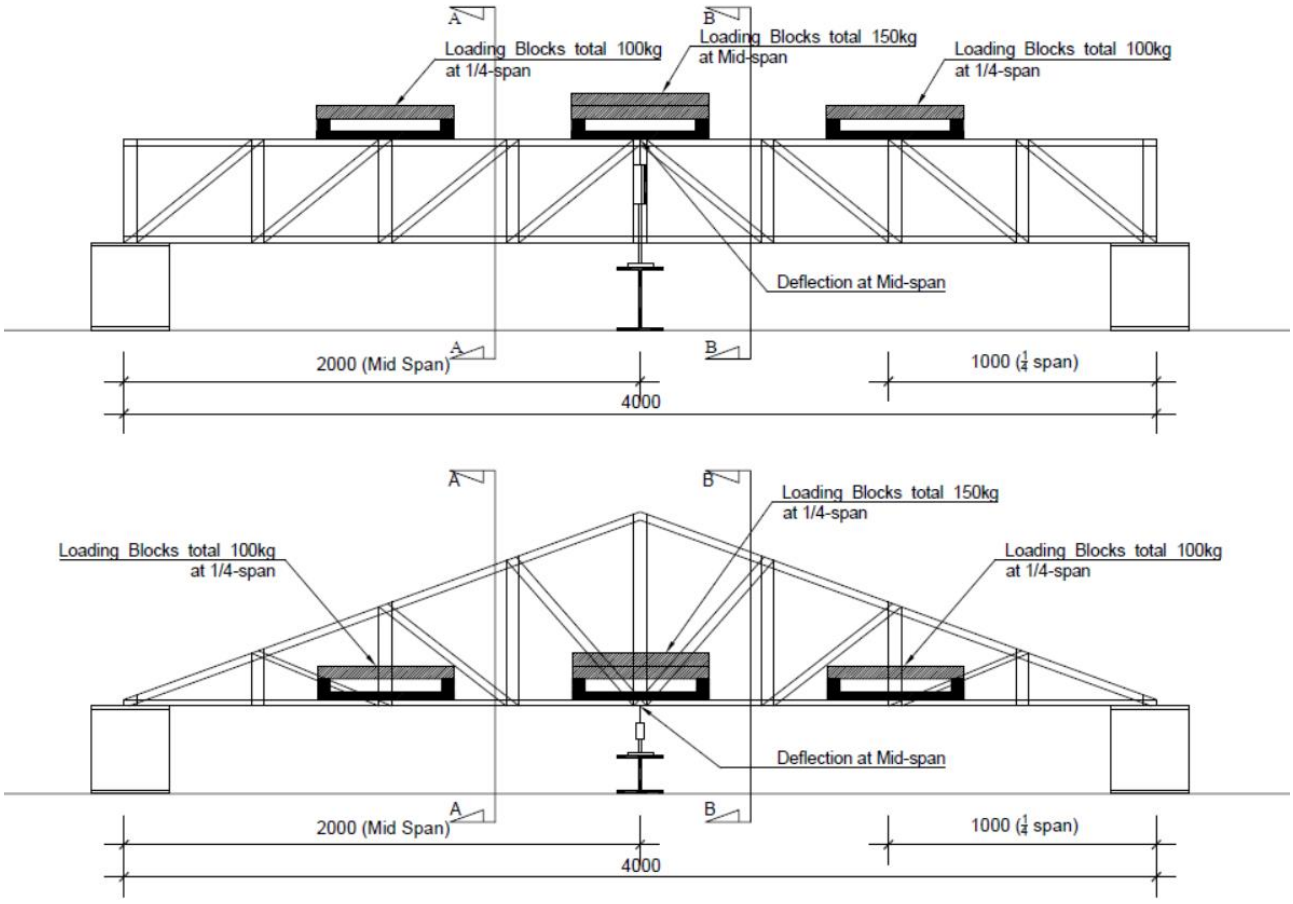

Fig 2.1b Bridge dimension (Side view) (unit=mm)

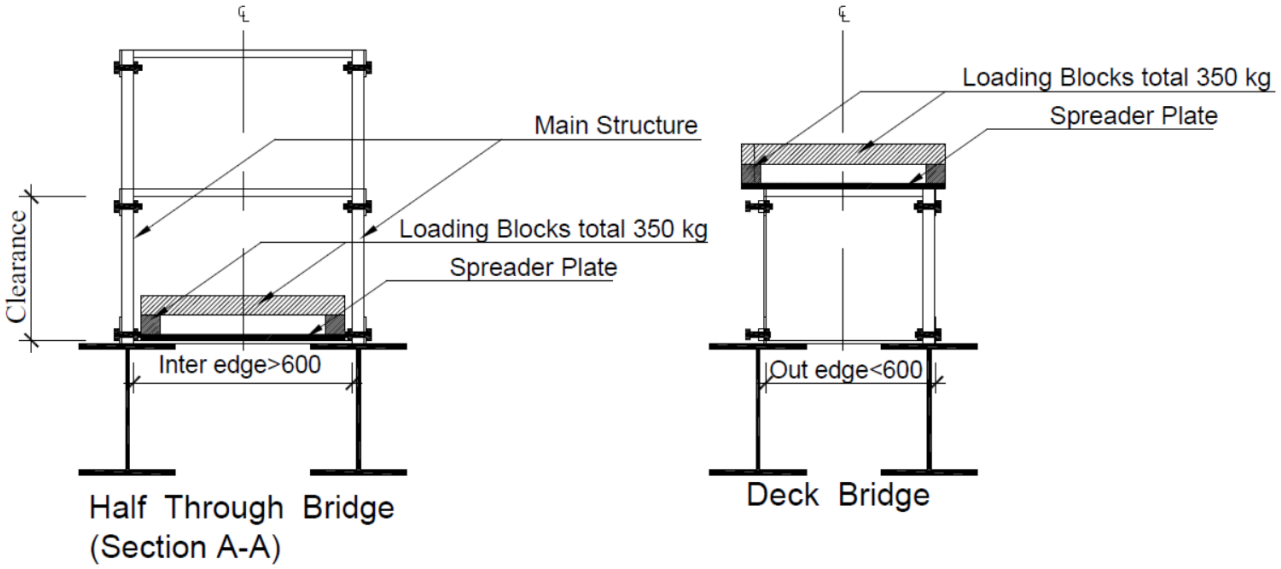

Fig 2.1c Section View (unit=mm)

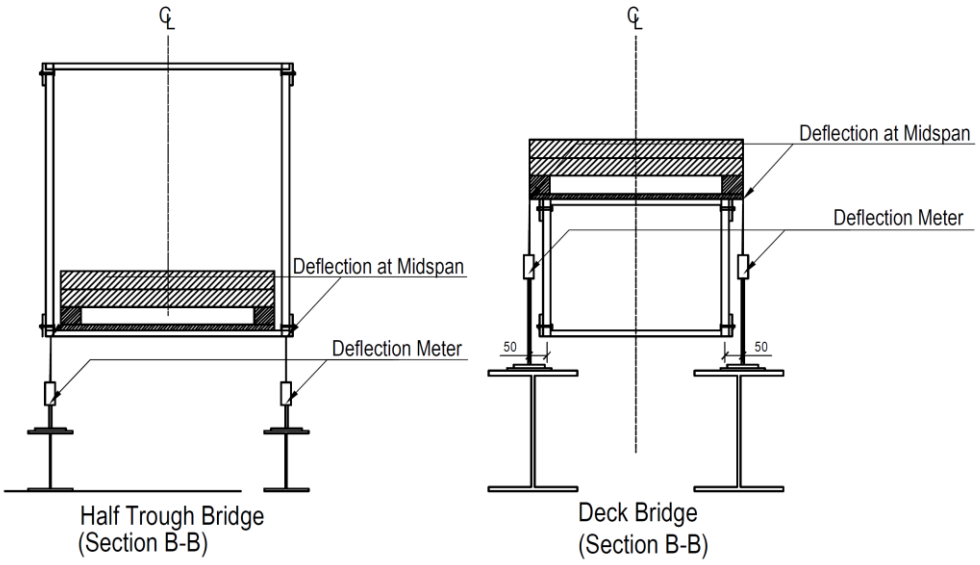

Fig 2.1d (unit=mm)

2.2 Bridge type

Any bridge type is OK, as long as it is a **simply-supported** bridge.

Piers are prepared by the host university; while participants fabricate and assemble their upper structures. Dimensions of the pier are shown in **Fig.2.2**. Participants must consider their bridges being placed on the prepared piers.

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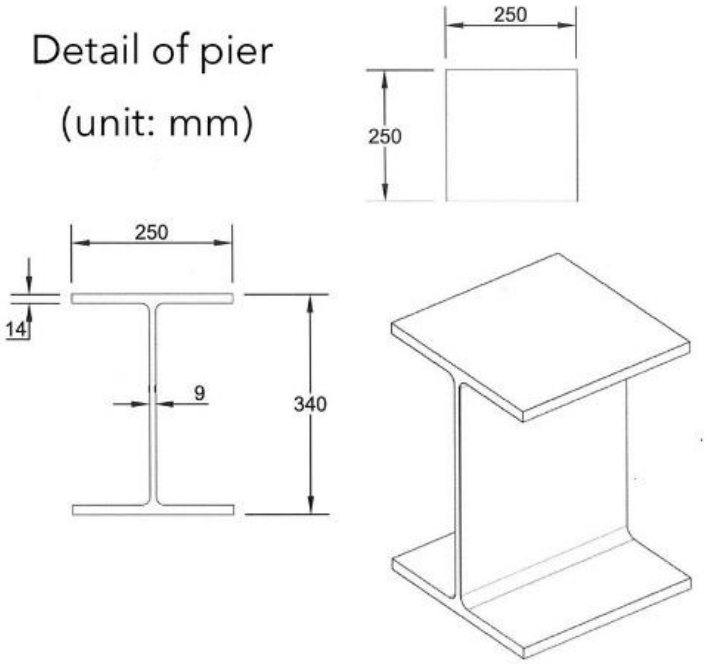

Fig 2.2 Pier

2.3 Restraint type

The bridge is directly put on the pier without pin/roller support.

2.4 Size and Weight of one bridge member

Straight steel or curved steel may be used for bridge members.

The size of one bridge member must be less than 150mm x 150mm x 800mm. The size is checked by a 150mm x 150mm x 800mm-volumn box (**Fig.2.4**). One steel assembly connected by welds is regarded as one bridge member, if it can be put into the box. The size will be checked before the construction work on the competition day. A bridge member must be equal to or less than 10kg.

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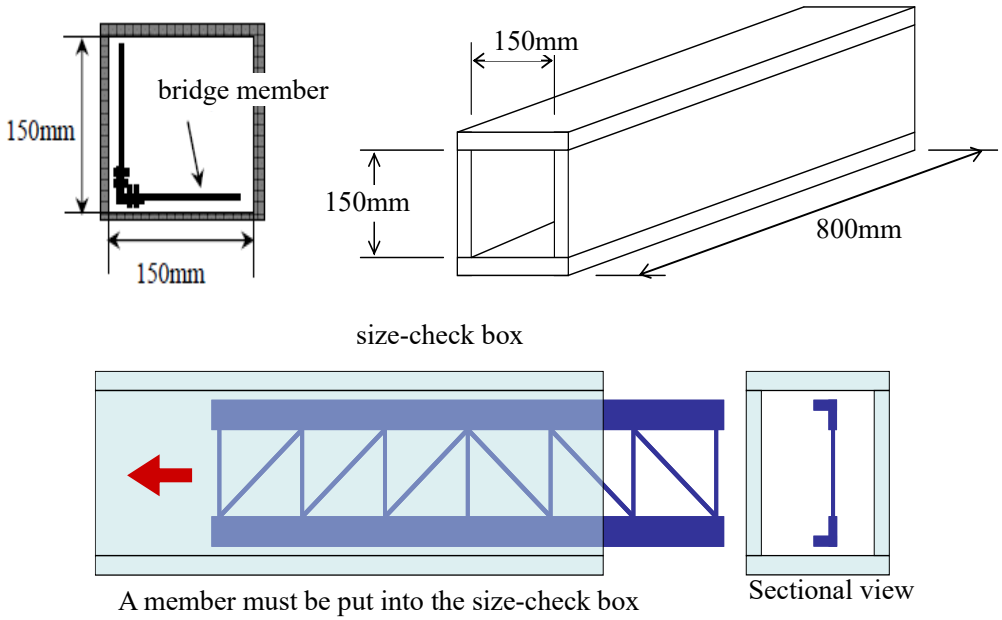

Fig.2.4 Regulation of a member size

2.5 Bridge member

1. Participants must use rigid steels; hence, a cable or a wire is not allowed.
2. Bridges must consist of structural steel. The steel is defined as an iron alloy that is strongly attracted to the **magnet.**
3. The size of a bridge member must be less than 150mm x 150mm x 800mm. Each member of the bridge must be able to pass the check box. (see also 2.4)
4. A bridge member must be a rigid component during the construction and the loading tests. **Hinged, telescoping members are prohibited.** This prohibition includes members with parts that are intended to slide, rotate, deflect or bend relative to the member such as cams, sliding pins, springs, and snap-lock devices.
5. A member may consist of multiple parts rigidly joined together before timed construction begins. Those parts must remain rigidly joined throughout timed construction and in the completed bridge. If the bridge has ready-component bolts and nuts, it cannot be loosened throughout the timed construction, and those bolts and nuts must be colored to show that they are not fasteners.

2.6 Fastener

1. A fastener is a steel bolt that is not a part of a member, with at least one steel nut that is not part of a member. Diameter is not restricted.
2. The nuts in a fastener must match the bolt.
3. Nuts and bolts that connect the parts of a member but do not connect a member to other members are not considered to be fasteners.
4. Fasteners must NOT be colored. The original metallic surface condition must be kept in order to distinguish fasteners from a part of the member.
5. Washer is allowed to use as a part of fasteners; also, as a use of a spacer.
6. If participants use washers, the washers must not be welded or glued to the bolt head or the nut.
7. Tools for fasteners must be hand worked, not be electric assists including battery devices. Those tools, which are spanner, ratchet, and monkey wrench for example, must be prepared by participants themselves.

2.7 Member-to-member connection

1. During the construction works, each member must be connected by at least one fastener.
2. A couple of a bolt and a nut must match each other on its size.
3. A member shall be connected to other ones by combinations of bolts and nuts during timed construction. No bolts and nuts can be welded to members; also screwed connections are not allowed (**Fig.2.7**)

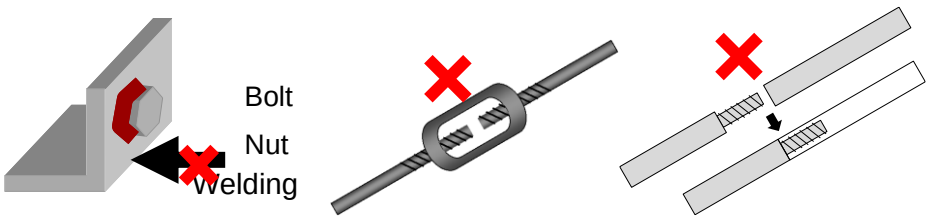

Fig.2.7 Prohibited Connections

2.8 Construction site

1. Bridges cross over a 1600mm-width river. The river is located right below the span center (**Fig.2.8**).
2. The river in the construction site is represented by tape.
3. Both sides of the river are river bed. Ground builders can work in the river bed (**Fig.2.8**).
4. If a constructor or drops a bridge member, fastener or tools to the river or ground, penalties will be given.
5. If a ground builder touches the river or a barge touches the river bed, penalties will be given.

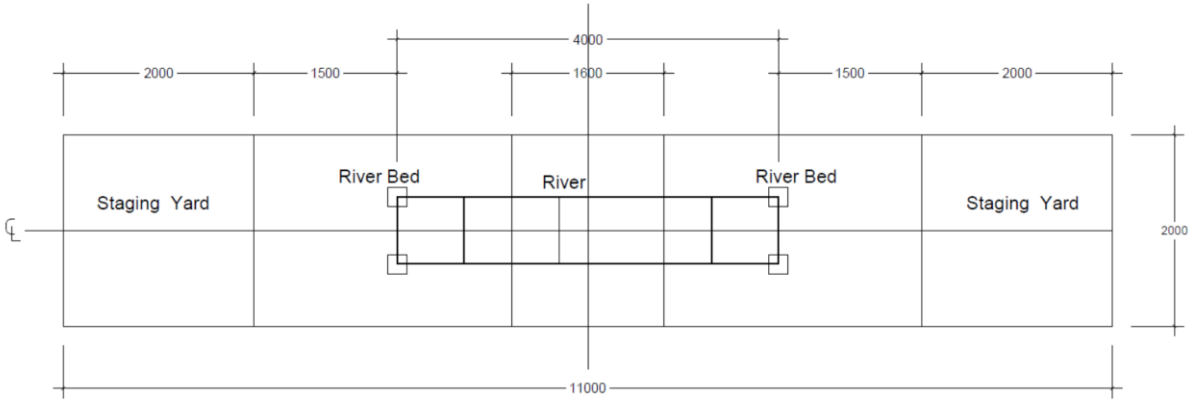

Fig.2.8 Construction site (unit=mm)

2.9 Vehicle running space (Half Trough Bridge type)

B*H*L=500*300*4000~4100

Bridges provide vehicle running space of 500mm width, 300mm height through the bridge. For through bridges, the portal bracings H_{PB} must be located over 300mm to allow the vehicle passage (**Fig. 2.9**). For the open deck bridges, it is assumed that vehicles run on the top surface; hence, it is no necessary to consider H_{PB} (**Fig.2.7**). The space does not include loading plates.

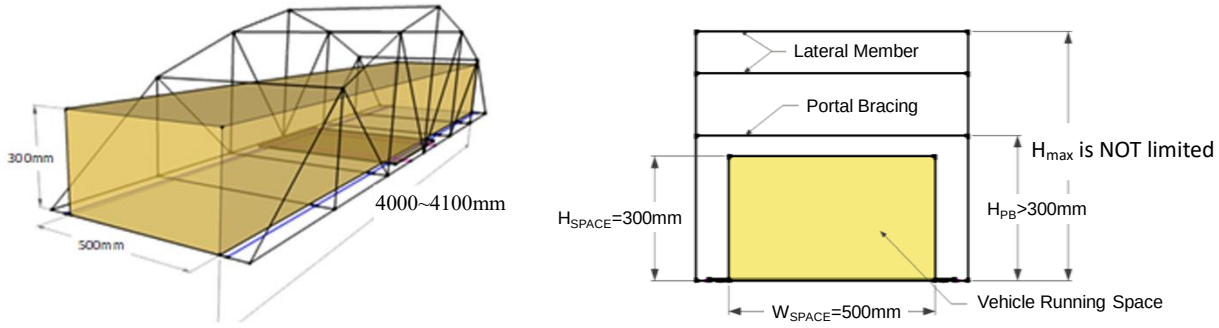

Fig.2.9 Dimensions of vehicle running space.

2.10 Loading block

Participants are not required to prepare loading block. The block are prepared by the host university. The block made of steel.

3. Measurement items

3.1 Size of a bridge member

Large bridge members must be checked by the check box, the volume of which is $\mathbf{150mm \times 150mm \times 800mm}$. If a bridge member cannot put in the box, a penalty will be given.

3.2 Construction time

Judges measure the construction time and repairing time with a stop watch. The construction time in scoring is a summation of construction time and **150% of repairing time** (See also 5.7). The number of repairing constructors must be the same as the construction stage.

3.3 Number of constructors

The maximum number of constructors is not limited.

Constructor: A worker who is engaged in the constructions works. Constructor is genetic term of ground builder and barge.

Ground builder: A ground builder is a worker to assemble the bridge in the staging yard and ground area. He or she cannot step/enter the river, but kneeing is not prohibited.

Barge: A barge is a worker to assemble the bridge in the river. He or she cannot step out from the river.

All the constructors must not get out from the construction site.

3.4 Bridge weight

Bridge weight is recorded by using two weight scale (**Fig.3.4**). A summation of the two scales is recorded for scoring. Weight penalty is added to the weight if the size regulation of a bridge member is violated.

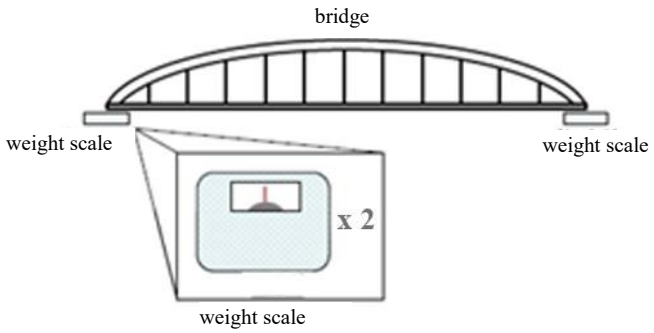

Fig.3.4 Weight measurement

Loading plates, construction tools, piers and posters are not included in the bridge weight.

3.5 Deflection

Deflection is measured at the span center and will be set to zero after placing spreader plates on the bridge. The deflection is recorded at **30 seconds** after all the weight loads are applied. Deflection value is recorded by the average of two records in the transverse direction.

3.6 Clearance

Clearance is checked by measuring the distance from the ground to the lowest part of the bridge. (**Fig.3.6**)

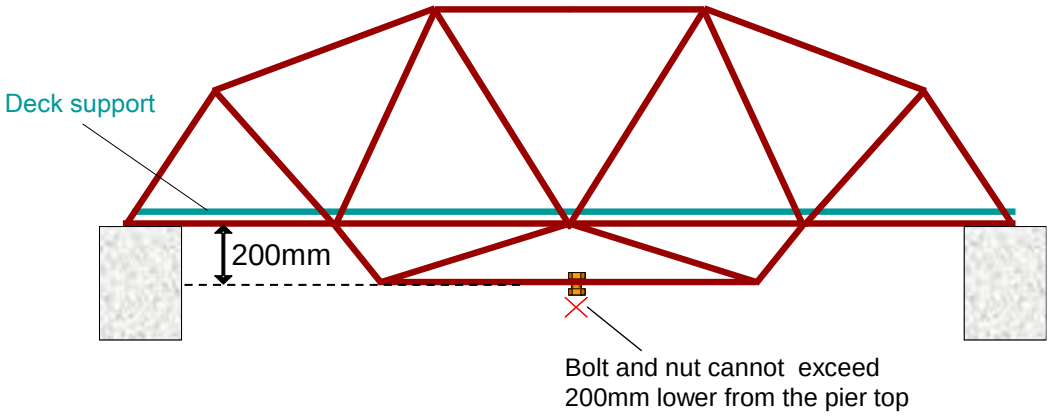

Fig. 3.6 Clearance check

3.7 Vehicle running space

Judges check whether the bridge provides vehicle running space. A plate of **300mm*500mm** passes the whole bridge for the check.

4. Scoring categories and Awards

Scoring is done in the following 6 categories and one overall performance.

1) Construction cost(C_C)
2) Structural cost(C_S)
3) Total cost($C_C + C_S$)
4) Aesthetics(D)
5) Presentation(P)
6) Prediction of deflection(Pr)
7) Overall performance

The award of each category is given to the top two teams.

4.1 Construction Costs(C_C)

The winner is the team which recorded the lowest cost. The construction costs C_C follow the next formula.

$$\boldsymbol{Cc}(\mathbf{THB})\mathbf{=[Number\ of\ constructors]*[Total\ construction\ time(min)]*5}(\times \mathbf{1000^3})$$

Total construction is a summation of construction time, repairing time multiplied by 1.5 (see also 3.2) and time penalties. The time penalties are from drops of tools, fasteners, bridge members, to step into the river (See also Chap.10).

* NOTE: One male ground builder is regarded as **1 constructors**,
One female ground builder is regarded as **0.9 constructors**,
One male barge is regarded as **1.5 constructors,**
One female barge is regarded as **1.35 constructors.**

4.2 Structural Costs(C_S)

The structural cost is calculated by the following formula. The team of lowest cost wins in this category.

$$\mathbf{C_S(THB)=[bridge\ weight]*5}(\times \mathbf{1000^3}) + \boldsymbol{\delta} \times \mathbf{100}(\times \mathbf{1000^3})$$

Where, δ is determined by deflection at the span center.

If 5mm < [deflection at the span center] < 7mm,

$$\delta = 0$$

Else if, ([deflection at the span center]≦ 5mm, or 7mm ≦[deflection at the span center])

$$\delta = |([\text{deflection at the span center}] - 7\text{mm}| \text{for deflection greater than } 7$$

$$\delta = |5\text{mm} - ([\text{deflection at the span center}]| \text{for deflection less than } 5$$

Else if bridge collapses before all load is applied (i.e. deflection > 15 mm),

$$\delta = 10$$

The bridge weight includes the bridge's own weight, and **weight penalties**. (Chap.10)

4.3 Aesthetics (D)

Aesthetics is scored by voting from committee members and team members. Each team will have 3 balls for give in the box of other teams (cannot vote own team). It is independently for voting.

For the example, you can give 1 ball for 1 team and 1 ball for another team and 1 ball for another team or give 2 balls for 1 team and 1 ball for another team or give 3 ball for only 1 team. .

You must show idea of Bridge's aesthetic at presentation periods.

4.4 Presentation (P)

Evaluation details follow Chap.7

4.5 Prediction of deflection (Pr)

All the teams must predict their deflection (mm) before the loading. The deflection value is taken at the span center, and average of two deflection values of the both sides.

Difference is defined by the following equation.

$$\text{Diff} = |[Predicted\ deflection] - [Actual\ deflection]| \text{ (absolute value)}$$

The point is scored by the following table

Diff(mm)	$\boldsymbol{Pr(point)}$
$\text{Diff} \leqq 0.5$	10
$0.5 < Diff \leqq 1.0$	9
$1.0 < Diff \leqq 1.5$	8
$1.5 < Diff \leqq 2.0$	7
$2.0 < Diff \leqq 2.5$	6
$2.5 < Diff \leqq 3.0$	5
$3.0 < Diff \leqq 4.0$	3
$4.0 < Diff \leqq 5.0$	1
$5.0 < Diff$	0

In case the bridge collapses, Pr is equal to 0.

4.6 Overall performance

Overall performance is scored by the following formula. If a team wins all the categories, the overall performance score will be 100.

$$\text{Overall Performance} = 30\frac{C_s min}{C_s} + 30\frac{C_c min}{C_c} + 15\frac{D}{Dmax} + 15\frac{P}{Pmax} + Pr$$

Where,

$C_c min$: The minimum construction costs

$C_s min$: The minimum structural costs

$Dmax$: The maximum aesthetics point

$Pmax$: The maximum presentation point

If the bridge collapses, the award of the Overall performance cannot be given to the team even though the score of the overall performance was 1st or 2nd.

5. Construction

5.1 Definition

- River, River bed, Staging yard, Pier and construction boundaries are shown in **Fig.2.8**.
- Constructor means a student who assembles his or her team's bridge.
- A construction team consists of all the constructors selected from the team.
- Protection equipment is a helmet, a goggle, gloves. All the constructors in the team must wear them. Penalty will be given for not wearing each protection equipment. (See 10.11) If safety shoes are worn, it will be welcomed.
- Connection is to connect bridge members, the each size of which is fabricated to be capable of putting it into the $150\text{mm} \times 150\text{mm} \times 800\text{mm}$ box.
- A construction block is a group of bridge members connected by bolts by the staging yard. The connected bridge member in a construction block is up to three.
- A construction unit is connected to bridge members or construction blocks on the pier.
- If a member or a construction block is connected by one fastener to another member or construction block, the part is regarded as a construction unit.
- **If a bridge member or an installed construction unit is unstable, a constructor must hold it not to drop into the river or the ground.**

5.2. Tools

5-2-1. Fastener tools

Tools for fasteners must have no-electric assists, including wireless and battery devices. Fastening works must be governed by handwork wrenches, spanners and ratchets.

5-2-2. Pouch

A "pouch" is an article of clothing that may be used to carry fasteners and tools. This definition includes tool belts and other accessories worn by ground builders and having the same function.

5-2-3. A chain block, a temporary bridge member

A chain block or a temporary member cannot be used.

5.3. Preparation

1. All of the ground builder must be in the **staging yard**, and all of the barges are in the **river**.
2. Constructors wear gloves, goggles, helmets before start. If the team equips pouches to carry their tools, constructors can **tie them on their waists before start.**
3. Fasteners, such as bolts, nuts, spanners, ratchets, must be placed on the ground in the staging yard; also, bridge members **must be placed on the ground**. Constructors can use boxes to put bolts, nuts and washers with or without coupled condition.
4. Gloves must cover constructors' whole fingers. It is **NOT allowed to cut the tip** of gloves.
5. Before starting construction, all of the bridge members must be placed **separately**, and they cannot contact each other.
6. One of the constructors is a leader. The leader must declare to the judges when they get ready for start.
7. Construction starts with "starting call" of the chief judge; then, judges start to count construction time.

5.4. Carriage

1. One bridge member can be carried by one ground builder.
2. Multi bridge members can be assembled as a construction block in the staging yard, and they can be carried by multiple constructors. Four bridge members, at maximum, can be carried at one time.
   1) Two bridge members can be carried by two constructors or more
   2) Three bridge members can be carried by two constructors or more
   3) Four bridge members can be carried by three constructors or more
3. Constructors can run.
4. **Throwing anything is prohibited**.

5.5. Assembly

1. Bridge members put on the pier are regarded as a part of the bridge; hence, a constructor can hold bridge members more than one on the pier. The ground builder or barge holding the bridge member must hold the members until bridge members can stand by themselves. The temporarily held members by the constructor must be contiguous; that is, at least one bolt must be through the connected members but not required to be tightened.
2. **If carried members are separated on the pier, a constructor cannot hold more than one member.**
3. No electric tools can be used for the construction. Battery-type electric tools are also prohibited.
4. Only bolts and nuts can be used for member-to-member connection (See also2.6).
5. Colored bolts and nuts cannot be tightened during the construction (See also 2.5). They must be rigidly stuck to the bridge before and after the construction.
6. Constructors can force the bridge members to adjust bolt holes. **It is OK to use a hammer** to adjust members.
7. A constructor must not depend on another ground builder or buildings for support or balance.

8. Team members who are not constructors must be outside of the construction site. They can give advices to constructors during the construction
9. Ground builders' knees can touch to the river if they are kneeling on their works, but they are prohibited to enter the river.
10. Barges' knees can touch to the ground if they are kneeling on their works, but they are prohibited to leave the river.
11. **Tools can be put on the piers during the construction**.
12. Constructors are not allowed to sit or lean on the bridge at the piers in order to prevent the bridge from moving. Though there is no penalty for such action.
13. Ground builders are not allowed step on members within the staging yard in order to help tighten the connectors. Though there is no penalty for such action.
14. Constructors can slide or rotate the bridge or a part of bridge. However, at least one point must be touched the pier during sliding and at least two points must be touched the pier during rotating.

5.6. Finish

1. Judges will stop counting time when the team leader **declares "construction finish".**
2. All of the ground builder must be in the staging yard, and all of the barges are in the river.
3. Fasteners, left bolts and nuts can remain in the pouch when the construction finishes.

5.7. Repairs

1. Inspection for repairing

   Before the judges measure the bridge, two constructors can have five minutes to inspect the bridge for construction mistakes and incompletion. They **must not touch the bridge** during the inspection. The checks are restricted to the bridge member.
2. Repairing works

   Constructors are permitted, but not required, to repair construction mistakes and incompletion found by their inspectors. Repairing workers must be the same as the construction stage.
3. Repairing cost

   The repairing cost is charged by the calculation of "Construction Cost (Cc)". The repairing cost will be 1.5 times of the construction cost for the repairing.

6. Exhibition and voting

After all the teams finish their constructions, all the teams will exhibit their bridges. An explanation panel is not required, but they can show the panel if they want to do so. Voting is done during the exhibition to evaluate esthetics. Each team has 3 balls for vote, but the voter cannot vote to his or her own team.

7. Presentation

Each team gives a presentation to show their originalities, ingenuities and effort points. Presentation time is for **5 minutes per a team**. The presentation time is strictly limited to the 5 min. After the presentation, **two minutes**

question and answer time are assigned. Evaluators consisting of bridge engineers who are not students give points with consideration of following items.

Presentation point is given by followings.

1. 4 items of ”(1)Idea”, ”(2)Structure”,”(3)Aesthetics” and ”(4)Ingenuity”. Maximum 4 points are given to each item.
2. 4:Excellent, 3:Very good, 2:Good, 1:Not special, 0:Nothing
3. Presentation points are summation of each item.

   Presentation point = $\sum(1) + \sum(2) + \sum(3) + \sum(4)$

   Full mark points are determined by the following.

   Full mark point = $(4 \text{ points}) \times (\text{Number of presentation judges}) \times (4 \text{ items})$

8. Loading test

Deflection of the span center is measured in the loading test after the construction works.

8.1 Loading weight

1. Loading block

   35 (@10kg) loading blocks are put on the bridge at mid and both ¼ of the span. The size of the block is show at **Fig.8.1**

2. Weight

   Loading weight sequence:

   1st 100kg at mid-span

   2nd 100kg at 1/4span and 100kg at 3/4span

   3rd 50kg at mid-span.

3. Spreader Plate or wider loading plate

   Spreader plate dimension of 600x600x50 (mm) is not considered as part of loading stages. Each spreader plate has **7** kg of weight.

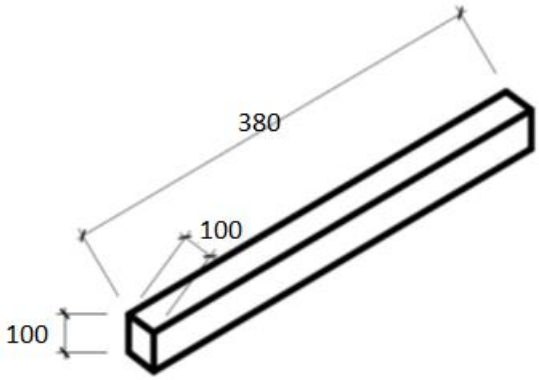

Fig. 8.1 Loading Block

8.2 Loading test and deflection

1. Installation of displacement meters

[For through bridges and half through bridges]

Two displacement meters acquire the deflection of the bridge under the main structures at mid span of the bridge. In other word two displacement meters placed at mid span of the bridge (**Fig.8.2a**). **The bridge must be provided surface/space to install displacement meters under both main structures at mid span of the bridge**.

[For upper deck bridges]

Two displacement meters acquire the deflection right under the center of the loading plate for the weight of 150kg. Installation points of them are 50mm from the outer edges of main structure. Note that the host university should provide wider center loading plate for deck bridges or provide two small metal plates to be rigidly clamped on both sides of the loading plate as measuring targets (**Fig.8.2b**).

If displacement meters cannot be installed at these points, the actual installation points are depended on Referees' decision.

2. Start and complete

The displacement meters will be set to zero after placing all spreader plates on the bridge. Loading weight is gradually and slowly added by the team constructors following loading weight sequence in 8.1. They must fully pay attention to their safety. In order to prevent sudden collapsing, the host university should prepare under stoppers to support the collapsed bridge. The stoppers are I-shaped steels, box-shaped steels, concrete solid masses and so on.

3. Loading

During the loading (**Fig.8.2c**), team workers to put loading weight must pay attention to the deflection values of both sides. If the condition is dangerous, the loading test may be stopped. Loading workers must care of their feet and hands not to be under the bridge. The deflection value for the evaluation is taken after 30 seconds of the time when all the weights are put. If the deflection exceeds 15mm, the bridge is regarded as collapse.

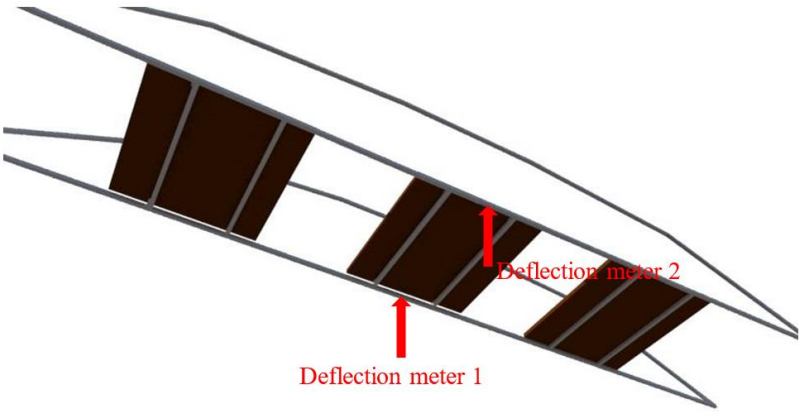

Fig 8.2a Data acquisition points for deflection (red arrows)

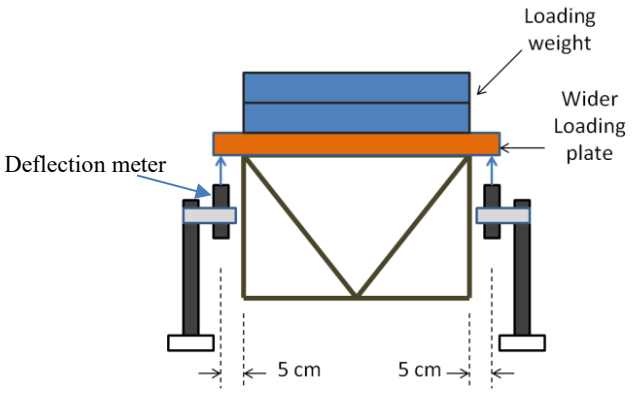

Fig. 8.2b Two deflection acquisition points for deck bridges

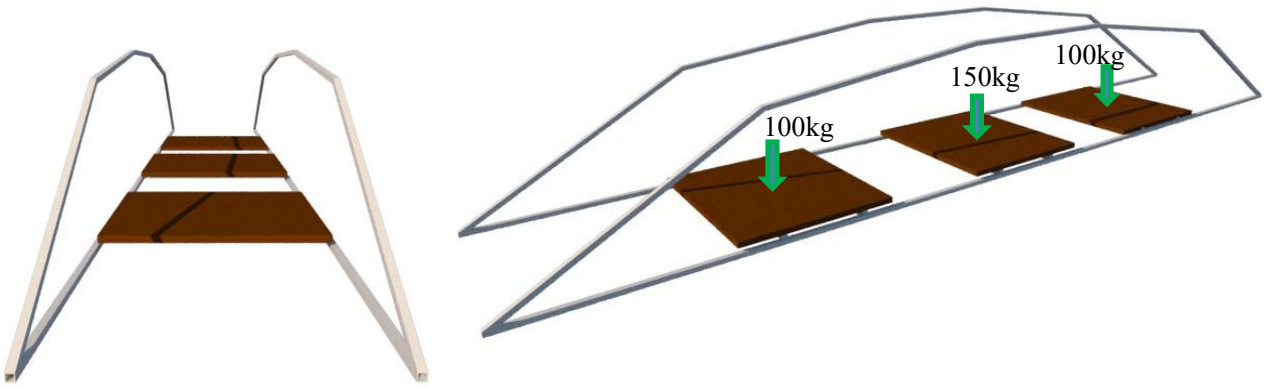

Fig 8.2c Loading and spreader plate condition.

9. Examination

Bridge Examination is done by your referees. The examination is listed as follows.

1. Before the construction
- Size of bridge members
- Number and sex of constructors
- Protective equipment (Helmet, gloves, goggle)

2. During the construction
- Construction time including repair works
- Drop of tools, fasteners, stepping into the river and so on
- Dangerous behavior

3. After the construction
- Bridge size
- Clearance
- Vehicle running space/Space for spreader plates (through bridges or half through bridges)
- Weight

4. Before loading

- Displacement meters installation
- Loading order

5. After loading

- Deflections are recorded after 30 seconds from the completion of loading

6. Others

- Exceptions of above are explained by the committee.

7. End of Referring

- When all the examination finishes, the main referee gathers score sheets and submit them to the committee.

Referees can stop if they find a dangerous action or behavior during the competition.

10. Penalties

In case of a violation on the regulations, a penalty will be given. The penalty is to add construction time or bridge weight.

10.1 Limitation of a bridge member

The size of each bridge member is limited to $150\text{mm} \times 150\text{mm} \times 800\text{mm}$. If the size exceeds the limitation, an addition weight is given as a penalty. Followings are additional weight:

[Additional weight] = [Weight of the violated bridge member]*3+5(kg)

NOTE: In case weight of the bridge member is less than 1kg, the original weight of the member will be 1(kg).

10.2 Limitation of construction time

Construction must be completed in **30 minutes**. If it exceeds 30 minutes, time measurement will be stopped; then, the construction will be continued outside of the construction field. In this case, construction time is regarded as 45 minutes.

10.3 Assembly works outside of the staging yard

Constructors must do assembling works in the staging yard or on the pier. A bridge member, a tool and a fastener must not touch the ground except the staging yard although a penalty is not given.

10.4 Construction works outside of the construction site

Construction works must be done in the construction area. If a constructor works outside of the area, judges will warn and penalty will be given. List of penalty that we can see at penalty table.

10.5 Clearance

The bridge clearance is regulated as “Clearance (mm) = pier height (mm) – 200mm”. It means that 200mm of the bridge lower parts can jut out from the pier top. The bridge part includes fasteners that are a bolt and a nut. If the clearance is violated, following weight penalty will be given.

Exceeding x (mm)	Additional weight (kg)
0<x≤10	2.5
10<x≤20	5
20<x≤30	7.5
30<x	15

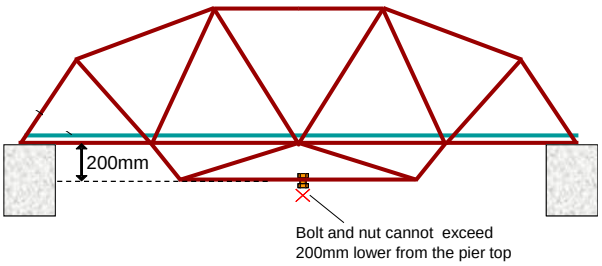

Fig. 10.5 Clearance

10.8 Bridge length

If the bridge length is shorter than 4000 mm, additional weight will be assigned according to:

$$\textbf{Additional Weight} = \frac{\textbf{4000}}{\textbf{Bridge Length(mm)}} \times \textbf{Current Bridge weight} \times \textbf{0.05}$$

10.9 Gloves, Helmet, and Goggles

If any team member does not wear any of the protection equipment, i.e. gloves, helmet, or goggles, additional construction time of 10 second per equipment will be applied.

10.10 Others

The other issues are determined by the judges' discussion.

10.11 Penalty table

No.	Violation	Penalty
1	To drop a fastener (bolt, nut, washer) (2.8)	5 sec
2	To drop a fastener tool (spanner, wrench, ratchet) (2.8)	10 sec
3	To drop a bridge member (2.8)	20 sec
4	To drop a unit of connected bridge members. A group of connected bridge members must be held by one or some constructors if the chain of bridge members is unstable.	20 sec
5	To throw a bridge member, tool, nut or a bolt (5.4)	20 sec
6	A ground builder enters to the river To touch or step the river boundary is regarded as an entry to the river. (2.8)	5 sec
7	A barge exits the river (2.8)	5 sec
8	A constructor exits the construction site (10.3)	5 sec
9	Bridge material, or tool exits the construction site (10.3)	5 sec

10	A constructor carries 2-4 bridge members and 2 constructor carries 4 bridge members.(5.4) The bridge is carried by constructor. (Slide is OK)	Return back to the staging yard
11	A hinged member exists.(2.5)	+20kgf
12	A screwed or tapped member exists (2.7)	30 sec
13	A bolt or nut preliminarily attached to the bridge member by welding exists and make them tight.(2.7)	20 sec
14	Bridge width violates its regulation (2.1)	+10 kgf
15	A constructor conducts assembly works without self-support. (another constructor sustains his or her arm or body) (5.5)	Judges warn the constructor to stop it.
16	A bolt or nut is not separated from bridge members before the construction starts. (5.3)	10 sec
17	A colored bolt or nut is tightened. (5.5)	10 sec
18	A ready-component bolt or nut is not colored. (2.5)	20 sec
19	Vehicle running space is not provided. (2.9)	+10kgf
20	Repair works after the timed construction (5.7)	Add (time for modification) * 1.5
21	Gloves do not cover the whole fingers (5.3)	10 sec per constructor
22	Size of bridge member violation (10.1)	Additional weight penalty given
23	Bridge clearance violation (10.5)	Additional weight penalty given
24	Not enough space to install spreader plate (2.1)	+5kgf
25	Bridge length violation (10.8)	Additional weight penalty given
26	A constructor does not wearing gloves, helmets, or goggles (10.9)	10 sec per equipment