



MANUAL

INTERNATIONAL ROOF TRUSS DESIGN COMPETITION 2019



UNIVERSITAS
GADJAH MADA



8th
CIVIL
IN ACTION

PREFACE

This manual is made as a guideline on joining the International Roof Truss Design Competition 2019 “Application of steel roof truss to accelerate the process of reconstruction of damaged residential area caused by natural disaster” as series of event at 8th Civil in Action of Study Program of Civil and Environmental Engineering Department, Faculty of Engineering, Universitas Gadjah Mada. International Roof Truss Design Competition 2019 consist of proposal selection stage and final stage for 12 qualified teams who passed the proposal selection.

This manual contain explanation and regulation about the International Roof Truss Design Competition 2019 that must be obeyed by the participants and binding them nor the committee. This manual is used by the board of jury and committee as judgement reference for determining the winner of the competition.

This manual is subjected to change in condition by Majority of Jury in period of time which is not adverse the participants and will be announced in Civil in Action website.

Regards

Committee

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CHAPTER I. GENERAL REQUIREMENTS

Article 1

By the regulation, it means:

- a) A **steel roof truss** is a structural framework of steel designed to bridge the space above a room and to provide support for a roof.
- b) The roof truss span is axis to axis placement length.
- c) Participants are active undergraduate students of national/private either local university or foreign university, which is legally registered to join the competition.
- d) Proposal selection stage is participant proposal checking and judging stage.
- e) Final stage is constructing roof truss according to the design of qualify participant from proposal selection stage, roof truss load testing, and presentation.
- f) Working space is work area of constructing roof truss restricted by boundaries line according to the competition regulation.
- g) Board of jury consist of jury determined by the committee, the judgement made by the board of jury is absolute and inviolable.
- h) Civil in Action website is <http://civilinaction.com/>.
- i) Zone time used is Indonesia Western Time (GMT+7).
- j) Committee is event organizer of International Roof Truss Design Competition 2019.

CHAPTER II. COMPETITION NAME

Article 2

International Roof Truss Design Competition 2019

INTERNATIONAL ROOF TRUSS

CHAPTER III. COMPETITION THEME

Article 3

Application of Steel Roof Truss to Accelerate The Process of Reconstruction of Damaged Residential Area Caused By Natural Disaster

CHAPTER IV. BACKGROUND

Article 4

Lately, Indonesia has been damaged by disasters that have had a major impact on the affected area, damage to buildings, especially infrastructure such as houses and public buildings, this has made the recovery process not run fast.

Lies between the Indian And Pacific Ocean has made Indonesia regularly faces the hardship of many natural disasters, including earthquakes, tsunami, landslide and many more. Lives losses, economic losses, and also infrastructure damages are among of many costs that are resulted by the natural disaster. The government, who holds the responsibility on handling the aftermath of the disaster, is obliged to be prepared on mitigating such losses, including reconstruct damaged area.

However, the difference geographic condition in Indonesia has often hindered the reconstruction process. It can be seen in many occurrences that reconstruction process might take a very long time. Thus, a solution is needed to solve this issue.

Fortunately, civil engineers has proposed one method that could help accelerate reconstruction process. The engineers found that the application of steel-roof truss could be one of many solutions of this longstanding problem.

To speed up the process of reconstructing the building, fast and efficient work is needed, especially on roof truss work. Roof truss work using wood generally takes one to two weeks of work. By using steel material, we can cut down the processing time of the roof truss, which in turn can make the reconstruction process faster.

Accelerating the reconstruction process will have a significant impact on various aspects of disaster mitigation. Therefore, the need for understanding through direct learning about the acceleration of reconstruction that we realized in the 2019 International Roof Truss Design Competition as a forum in developing aspects of innovation, sustainability and agility in creating roof truss structures for students.

International Roof Truss Competition is an event innovation from national level to international level. This competition is attended by all undergraduate Civil Engineering college students from all around the world. The best twelve teams will be chosen and invited to assemble, present, and test their own roof truss directly.

CHAPTER V. TIME AND COMPETITION PLACE

Article 5

Day, Date : Wednesday, 11th September – Friday, 13th September 2019
Place : Pusat Kebudayaan Koesnadi Hardjasoemantri Universitas Gadjah Mada

CHAPTER VI. TIMELINE

Article 6

13 th May 2019	Open Registration and Proposal Submission
25 th June 2019	Close Registration
28 th June 2019	Close Proposal Submission
30 th June – 2 nd July 2019	Proposal Revision
3 rd July – 14 th July 2019	Proposal Judgement by Board of Jury
15 th July 2019	Participant Announcement for the Final Stage
15 th July – 21 st July 2019	Top 12 Finalist Re-Registration
11 th September 2019	Technical Meeting
12 th September 2019	Opening Civil in Action 8 th and Presentation
13 th September 2019	Roof Truss Construction and Roof Truss Load Testing
14 th September 2019	Seminar Nasional Civil in Action 8 th and Closing

CHAPTER VII. COMPETITION SCHEDULE

Article 7

Wednesday, 11th September 2019

15.00 – 15.30	Participant Arrival
15.30 – 15.40	Opening
15.40 – 16.00	Speech
16.00 – 17.00	Competition Technical and Judgment System Presentation
17.00 – 17.30	Roof Truss Load Testing demo with the load testing instrument
17.30 – 18.00	Presentation and Roof Truss Load Testing order drawing

Thursday, 12th September 2019

08.00 – 11.00	Opening Ceremony Civil in Action 8 th
11.00 – 12.30	Break
12.30 – 17.00	Presentation

Friday, 13th September 2019

08.30 – 10.10	Roof Truss Construction
10.10 – 10.30	Roof Truss Checking
10.30 – 10.45	Roof Truss Revision
10.45 – 11.00	Roof Truss Sealing
11.00 – 13.00	Break
13.00 – 15.30	Roof Truss Load Testing
15.30 – 16.00	Break
16.00 – 18.00	Roof Truss Load Testing

Saturday, 14th September 2019

07.00 – 15.30	Seminar Nasional Civil in Action 8 th
15.30 – 17.00	Announcing Competition Winners, Closing Ceremony

**Competition Schedule may change at time by the committee policy*

CHAPTER VIII. PARTICIPANT PROVISION

Article 8

1. Participants are active undergraduate students of national/private either local or foreign university.
2. Each team may consist of maximum 3 people from one national/private either local or foreign university along with 1 supervisor. Team members are allowed to come from different Department with at least 1 person from Civil Engineering Department.
3. The teams are not allowed to use same/similar name to their university.
4. Each university are allowed to send more than 1 team.

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CHAPTER IX. REGISTRATION

Article 9

1. Registration opened from 13th May 2019 until 25th June 2019, with registration fee of 350.000 rupiah for Indonesian team and USD 35 for non-Indonesian team.
2. Payment can be done by transferring through Mandiri account with account number 137-00-1273483-2 and swift code BMRIIDJA for international transaction on behalf of KELUARGA MAHASISWA TEKNIK SIPIL at the latest on 25th June 2019.
3. Participants are obligated to give confirmation to the committee contact person after making payment and upload Payment Slip in Civil in Action website. The committee

will approve the payment and the participant are allowed to upload all competition files at the time after confirmation.

4. At the time of submission, Participants enclose:
 - a. Registration Form
 - b. University Student Identification Card
 - c. Recommendation Letter from Each University
 - d. Photo with size of 3x4 cm
 - e. Proposal of the roof truss design
 - f. Design/Drawing of the roof truss in a single A4 paper
 - g. Detail of joint (each joint in a single A4 paper)

All competition files are handed in soft copy as a PDF and uploaded through Civil in Action website at the latest on 28th June 2019.

5. Participants who already submitted all competition files required need to give confirmation to the committee contact person.

CHAPTER X. COMPETITION SYSTEM

Article 10

1. Participants design the roof truss with provided materials in accordance with the design load, innovative and efficient design.
2. Participants are obligatory to make a proposal with maximum of 10 pages which consist of:
 - Title
 - Preface
 - List of Content
 - List of Picture
 - List of Table
 - Chapter 1 Preliminary
 - Background
 - Aim
 - Benefit/Advantage
 - Chapter 2 Theory

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- Chapter 3 Roof Truss Design
 - Material Specification
 - Design Load Analysis
 - Structural Failure Analysis
 - Chapter 4 Drawing
 - Reference
3. Background, watermark, header and footer on proposal should not contain team identity and university identity.
 4. Twelve teams with the best proposal will qualify to join the final stage. The final stage will be held at 11th September until 13th September 2019.
 5. The qualified finalist will be contacted through each contact person of the team and will be announced through Civil in Action website on 15th July 2019.
 6. For the finalists who qualify the proposal selection, are obligated to re-register by upload Re-registration Form in Civil in Action website at the latest by 21st July 2019. Finalists who do not re-register until the time determined will be disqualified and the position will be replaced by another team.
 7. The replacement team will be taken from rank 13th, 14th, 15th, et cetera on proposal judgement.
 8. The replacement team will be contacted by committee at 22nd July 2019. The confirmation due date is at 25th July 2019.
 9. Roof truss that constructed on the final stage must compatible with the design printed on the proposal.

CHAPTER XI. PARTICIPANT FACILITIES

Article 11

For participants who qualify for the final stage (top 12) will receive various facilities including:

1. Welcoming Party and Technical Meeting
2. Participant Certificate
3. Supervisor Certificate
4. Snack and Lunch for 2 days
5. Working space by 3x3 meters size for each team for constructing the roof truss
6. Two power source (electric socket/plug in) for each team at construction time
7. A table for each team at assembling time

8. Transportation from and to hotel, and all the venues needed for the competition
9. Winner Prize:
 - Winner I 800 USD + trophy + certificate
 - Winner II 500 USD + trophy + certificate
 - Winner III 300 USD + trophy + certificate
 - Most Innovative Category Winner 100 USD + trophy + certificate
10. Seminar Nasional Civil in Action 8th Ticket

CHAPTER XII. PROVISION AND CRITERIA

Article 12

DIMENSION

The Example of Outer Frame:

Figure 1:

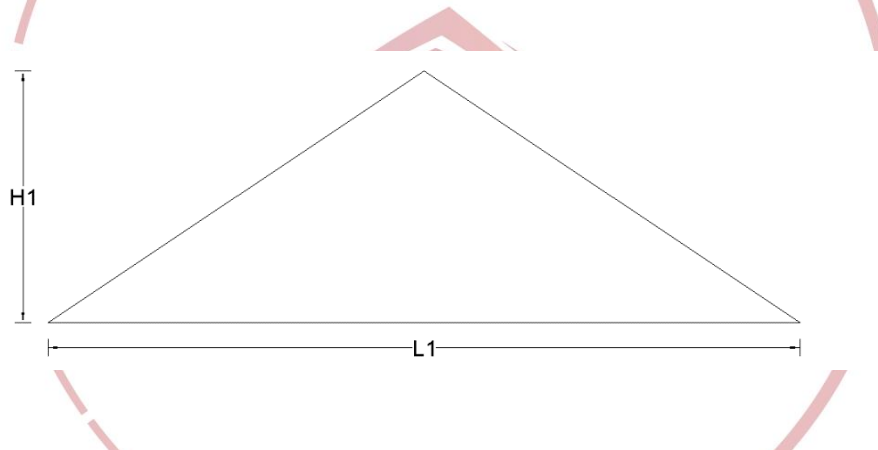


Figure 2:

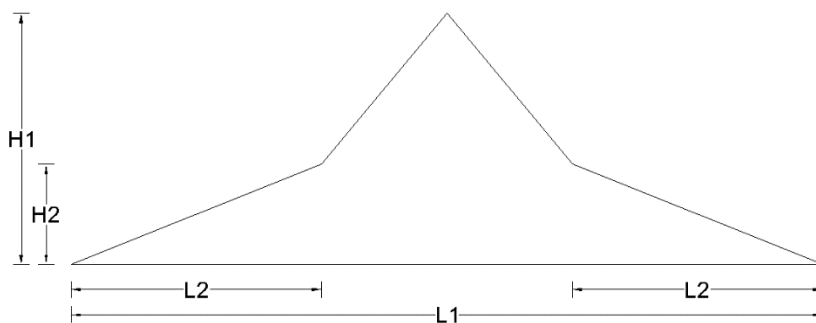
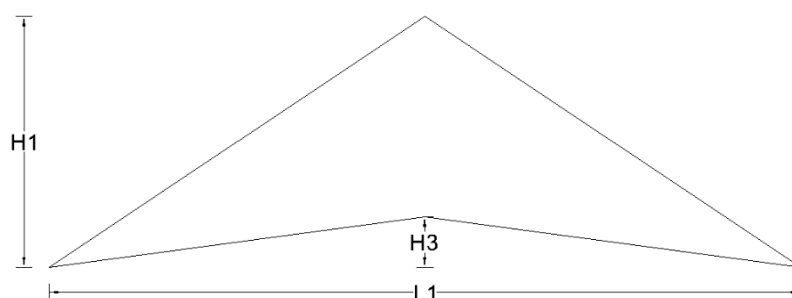
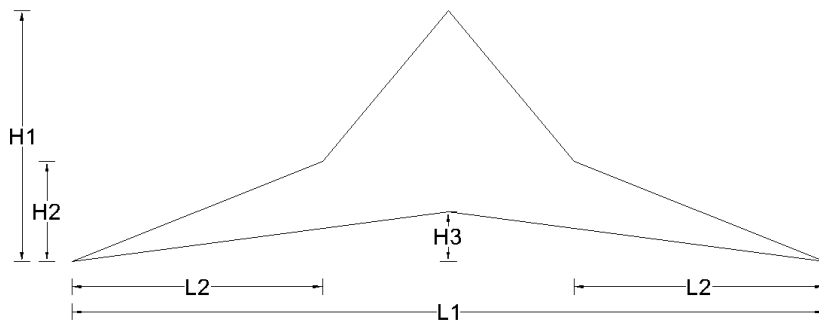


Figure 3:

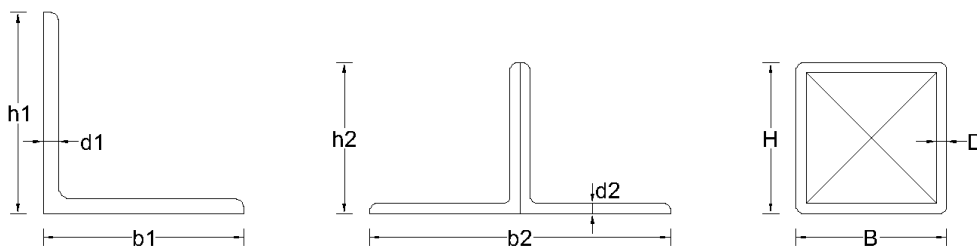


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Figure 4:



Section Profile:



L1 = Total Length of Truss **	= 1500 mm (± 20 mm)
L2 = Length of Lower Frame **	= 450 – 600 mm (± 5 mm)
L3 = Length of Bottom Chord**	= Max. 450 mm (± 5 mm)
H1 = Total Height of Truss **	= 400 mm – 500 mm (± 5 mm)
H2 = Height of Lower Frame **	= 100 mm – 200 mm (± 2 mm)
H3 = Height of Bottom Frame **	= Max. 100 mm (± 2 mm)
b1 = Largest Width of L-Profile Steel Bar *	= Max. 40 mm (2 mm tolerance)
b2 = Largest Width of Double L-Profile Steel Bar *	= Max. 60 mm (2 mm tolerance)
B = Largest Width of Hollow Steel Bar *	= Max. 30 mm (2 mm tolerance)
h1 = Largest Height of L-Profile Steel Bar *	= Max. 40 mm (2 mm tolerance)
h2 = Largest Height of Double L-Profile Steel Bar *	= Max. 30 mm (2 mm tolerance)
H = Largest Height of Hollow Steel Bar *	= Max. 30 mm (2 mm tolerance)
d1 = Largest Thickness of L-Profile Steel Bar *	= Max. 3 mm (0.2 mm tolerance)
d2 = Largest Thickness of Double L-Profile Steel Bar *	= Max. 2 mm (0.2 mm tolerance)
D = Largest Thickness of Hollow Steel Bar *	= Max. 2 mm (0.2 mm tolerance)

*) Dimension measured from outer frame (not from axis) to the other outer frame

***) Dimension measured from axis to the other axis

Article 13

GENERAL

1. Roof truss must be formed into Triangular.
2. The joint of truss that is allowed only bolt with/without plate.
3. Outer frame of the truss must be appropriate as the criteria on Article 12.
4. The truss must be constructed effectively as design load.
5. Participants can define the design load by themselves but cannot be less than 450 kg or more than 500 kg.
6. Design must be innovative and fulfilled the rules and regulations on **Chapter XII**.

Article 14

MATERIAL

1. The material which is used to construct the truss are cold-formed steel, plate, and bolt. Steel is used to construct all of the truss frame including tension bar, compression bar, or zero force bar. Participants are requested to provide their own.
2. The steel should already be cut in the designed length, but should not be given a hole.
3. The quality of the steel should be considered to achieve the best performance while maintaining minimum weight.
4. The maximum length/the longest steel that can be used for the bottom frame is 400 mm (measured from end point to the other end point) so the segment of bottom frame that has span more than 400 mm must use the joint.
5. The effectiveness of steel use will be included in assessment.
6. Materials of the joint is bolt with/without plate.
7. Diameter of the bolt has to appropriate with participant's design and can be measured with structure analysis. The maximum diameter of the bolt should be 3/8" or 9.525 mm.
8. Maximum length of the bolt is 5 cm (measured from end point to the other end point).
9. Minimum amount of the bolts are 20 pcs.
10. Plate should be made of steel. The required plate may already be in the form of design, but should not be given a hole.
11. Nail, glue, string, and wire are prohibited to be used by the participants.
12. All materials will be checked by the committee on technical meeting.

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CHAPTER XIII. TECHNICAL MEETING

Article 15

1. Day, date : Wednesday, 11th September 2019
Time : 15.30 – 18.00
Location : Ruang Sidang Biru, Civil and Environmental Engineering
Department Building 3rd floor Faculty of Engineering
Universitas Gadjah Mada
2. Participants are requested to attend the technical meeting.
3. Participants are requested to dress well, polite, and courteous, wear shoes and use the attributes of the respective universities.
4. Technical meeting is the review of rules and regulations during the competition, technical of construction and load testing of roof truss, and the scoring system. Committee will give an opportunity for participants to ask about anything that has mentioned above.

CHAPTER XIV. ROOF TRUSS CONSTRUCTION

Article 16

The configuration of truss which is made by the participant must appropriate with the design in proposal. If that configuration does not appropriate with the proposal, participants will get penalty. The penalty is 50% score decrement from total score.

1. Participants are expected to attend in location on time.
2. Participants are requested to prepare their material and the committee will check it based on **Article 14**.
3. Participants are allowed to carry tools, except dangerous tools that can damage the facilities provided by the committee. Only **Electrical Drills** are allowed to be used as electrical tool and committee will only prepare the electric socket. If participants bring electrical tools other than electrical drill, the tool will be confiscated by the committee.
4. The construction spot will be prepared by the committee, with an area of 3x3 meters.
5. During the construction time, participants are prohibited to leave the construction spot. Participants who want to leave the building must ask permission to the committee.
6. During the construction time, no one can be inside the construction spot except the member of the team, even the lecturer.

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7. During the construction time, participants are only allowed to make an interaction with the other team member and the committee.
8. During the construction time, participants are prohibited to borrow tools, stuffs, or materials from others.
9. The allocation time for constructing the truss is 100 minutes. Participants are expected to manage the time well so the truss could be done in time.
10. The construction time is assessed. After completing the construction, participants have to immediately report to the committee.
11. Processes undertaken in the construction spot including; joint installation and truss assembly.
12. If the truss has not done yet until the time limit, then:
 - If the outer frame as the figure on **Article 12** has not been constructed, participants are considered fail to finish the construction.
 - If the outer frame as the figure on **Article 12** has been constructed, that truss is validated.
13. If the truss does not fulfil the rules and regulation, committee will give time to revise the truss (max 15 minutes). The time use for revising the truss is also one of the assessment. Participants who do not have to revise their truss will get 100 points, meanwhile participants who have to revise the truss will get point based on the revision time used.

CHAPTER XV. OCCUPATIONAL SAFETY AND HEALTH (OSH)

Article 17

1. Participants are requested to pay attention about OSH during construction and even bring the equipment that can support safety. The minimum equipment if OSH that participants are requested to bring:
 - Gloves
 - Safety Glasses
 - Helmet
 - Mask
 - Vest
 - OSH Sign
2. The condition and completeness of OSH equipment are include in assessment.

3. Committee will prepare the first aid and Student Health Unit.
4. Participants are responsible for their safety.
5. The winner of the most complete OSH category based on the assessment of the OSH equipment that participants has brought and used.

CHAPTER XVI. PRESENTATION

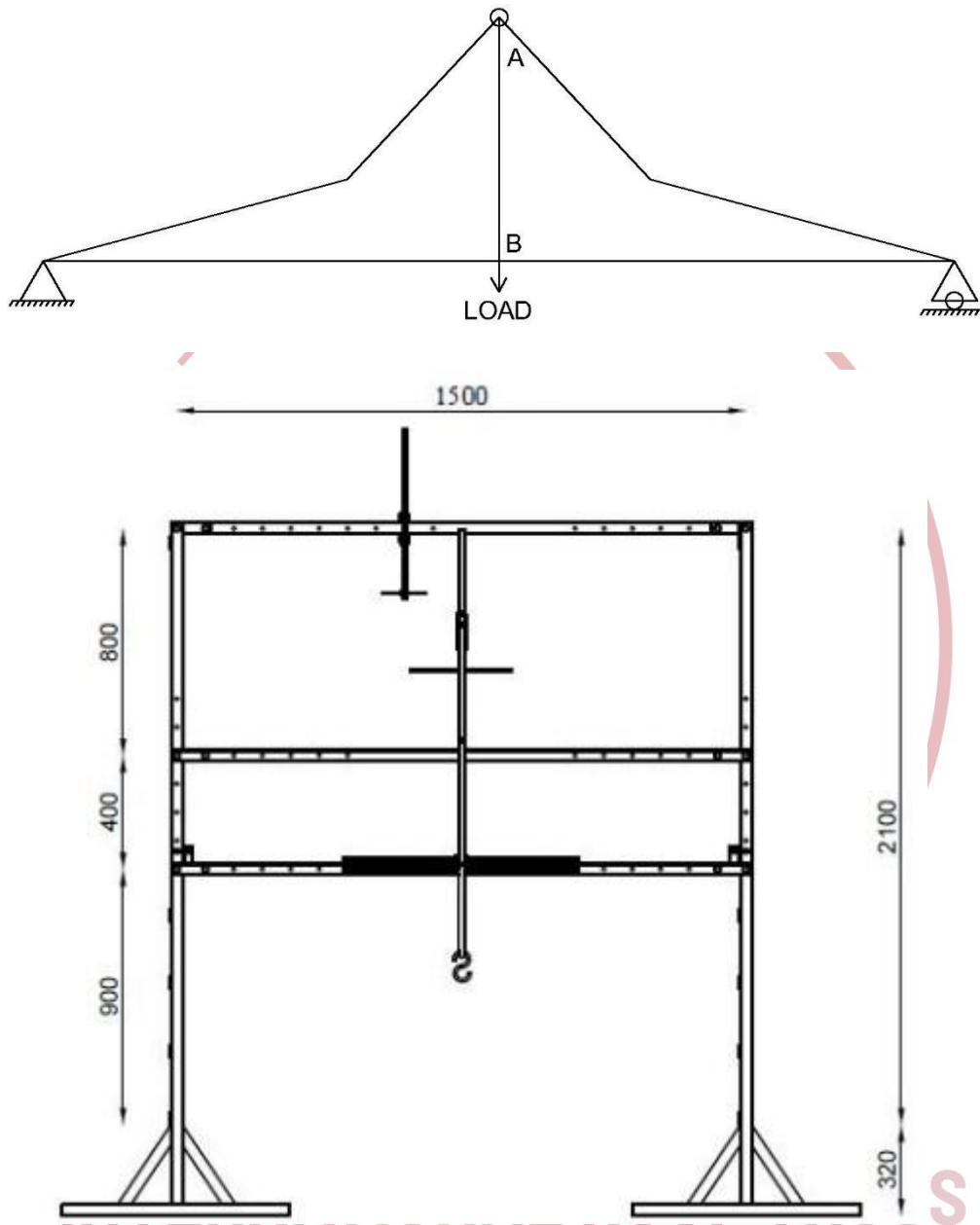
Article 18

1. Participants are to prepare the presentation file as a PPTX, PDF, or SWF and upload to Civil in Action website, deadline on 8th September 2019.
2. Each team has an opportunity to present their ideas and model (max 7 minutes), and 8 minutes for Question and Answer session by judges. If the presentation exceeds the specified time, the committee will stop the presentation.
3. Presentation material should contain:
 - Truss design and joint details
 - The advantages of forms, materials and uniqueness of the truss
 - Structure analysis
 - Planning of the dimension and the joint
4. The presentation will be displayed in private (only judges will see).

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CHAPTER XVII. LOAD TESTING

Article 19



Unit in millimeters

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1. The order of load testing based on illustration at the technical meeting.
2. The weight of truss is measured.
3. The truss placed on the load testing instrument.
4. The measuring of deflection placed at A point and arranged on the neutral condition.
5. The load testing will be done on point A.
6. Load testing will be started from 20kg of load, then rise with interval 20 kg.

7. Deflection/deformation only measured when load testing with load of 40 kg, 80 kg, 120 kg, 160 kg, 200 kg, 240 kg, 280 kg, 320 kg, 360 kg, and 400 kg.
8. After the load reach 400 kg, load testing will be continued with interval 10 kg until the load reach the design load.
9. When the load has reached the design load and the truss has not damaged yet, load testing will be continued until 50 kg over design load or until the truss is damaged.
10. When the truss damaged before reach the design load, it will get 0 point on load testing assessment.
11. Structure is considered a damaged if one of the segment of truss get cracking or has the maximum of deflection. This decision is determined by the board of jury and inviolable.

CHAPTER XVIII. ASSESSMENT

Article 20

Assessment criteria:

A. The Proposal Selection Stage

1. Proposal Format (30%)
 - The rules of writing (20%)
Proposal is made with good and true language rules.
 - Systematical (10%)
Proposal has the good and true systematical.
2. Innovation and Creativity (70%)
 - Analysis (30%)
 - Truss Design (20%)
 - Excess of Truss (20%)
Assessment criteria; Innovation, Strength, Workability, Economic, Aesthetics.

Assessment is done by the board of jury.

B. The Final Stage: Construction, Load Testing, and Presentation

1. Construction (30%)
 - Construction Time (10%)
Assessment of construction time depends on the speed of constructing the truss.

$$\text{Score} = 100 - \frac{\text{Construction Time (second)}}{60}$$

- Revision Time (5%)

Participants who do not use revision time will get 100 point.

Participants who use revision time will get point based on the revision time.

$$\text{Score} = \frac{900 - \text{Revision Time (second)}}{900} \times 100$$

- Compatibility of Dimension (10%)

Compatibility of dimension based on measurement of the length of truss, the width of the truss and the height of the truss that fulfill the requirements in **Article 12** (Maximum points 100).

- Length (max points 40), width (max points 30), height (max points 30)
- If the dimension of the truss is not fulfill the requirements, it will get 0 point.

- Completeness of OSH (5%)

Participants who bring all the equipment of OSH that is mentioned on **Article 18** will get the maximum 100 points.

The consequences for participants who do not bring the equipment of OSH:

- Do not bring one of the OSH equipment will get maximum points 80.
- Do not bring two of the OSH equipment will get maximum points 60.
- Do not bring three of the OSH equipment will get maximum points 40.
- Do not bring four of the OSH equipment will get maximum points 20.
- Do not bring five of the OSH equipment will get 0 point.

The condition of the OSH equipment also affect the assessment.

2. Load Testing (40%)

- Compatibility of Design Load and Actual Load (15%)

Assessment based on compatibility of design load which is inserted in proposal and actual load.

$$\text{Score} = 100 - \text{Actual Load (kg)} + \text{Design Load (kg)}$$

If the actual load is less than the design load, participants will get 0 point.

- Ratio of the actual load and the weight of truss (10%)

Assessment based on ratio of the actual load and the number of the truss weight. Participant with the biggest ratio of the actual load and truss weight

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will get 100 point and the other team will get the score based on the order of the biggest to the smallest ratio.

- Ratio of the load and deflection at the load 40-400kg with the truss weight (10%)

Assessment based on ratio of the load and deflection (max) with the truss weight. Participant with the biggest ratio will get 100 points and the other team will get the score based on the order of the biggest to the smallest ratio.

- Compatibility of the planned failure and actual failure (damaged) (5%)
Assessment based on compatibility of the truss section that is planned will be experiencing failure with the section of the truss that experiencing actual failure.

$$\text{Score} = \frac{\text{Compatible Failure}}{\text{Planned Failure}} \times 100$$

3. Presentation (30%)

- Compatibility of presentation with proposal (10%)
- Mastery of the material (10%)
- Delivery of the material (10%)

The assessment will be done by the board of jury.

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