2014 IDEERS

Rules for Graduate Teams

The List of Rule Revisions

Version No.	Date	Remarks
V1	2014-07-16	None
V2	2014-09-12	The size of wooden baseboard was changed from 350mm × 500mm × 6 mm to 370mm × 520mm × 6 mm. (Please see page 1, 2, 7)

The content presented below serves as primary rules for this competition. However, if events occur that are not covered or clearly defined by these rules, the organizers reserve the right of final interpretation.

1.Introduction

The competition of the postgraduate teams is focused on how to apply the advanced technology to build a seismic structure. Teams can use their great creations, with the concepts of energy dissipation and/or seismic isolation, to build a seismic structure. Besides, the model must satisfy the requirements of space, usability and economic aspects.

2.Configuration of Structural Model

- The construction area of the structural model is rectangular which is 310mm wide and 460mm long. The model must be built on the wooden baseboard (MDF ; 370mm × 520mm × 6 mm) provided by IDEERS. (A space of 20 mm around the edges of the baseboard should be left completely clear, such that the model can be fixed onto the shaking-table by screws). The structural model could be of any shape, but nothing is permitted to exceed the boundary of the construction area.
- If the isolation system is adopted, the floor diaphragm above the isolation system is limited to be a transparent acrylic plate (thickness equal to or larger than 5mm), to demonstrate the detail of the isolation system. For other floor diaphragms of the structural model, the diaphragm is limited to be a wooden plate (MDF) with the thickness equal to or larger than 5mm.
- The structural model is limited to have three stories. The size and shape of each floor is free, however, the total area of the floor diaphragms (1^{st} floor + 2^{nd} floor + 3^{rd} floor + roof) is limited between 280000 mm^2 ~ 320000 mm^2. The area of floor diaphragms should take the load of mass blocks (the interior areas surrounded by the columns of the lower floor). The total area must be determined by the referee. The model whose total floor area violates the limitation will be disqualified.
- The height of each story level (the distance between the top of the lower diaphragm of the story level to the bottom of the upper diaphragm) is limited to be equal to or larger than 200mm.
- Each floor diaphragm (1^{st} floor + 2^{nd} floor + 3^{rd} floor + roof) must be attached with four steel blocks (100 mm × 100 mm × 30 mm and 2.5kg each). Totally 16 steel blocks (40kg) are used in each model. The steel blocks can only be glued onto the floor diaphragm by

hot-melted PVC glue provided by IDEERS. The set of two steel blocks on the same diaphragm can be overlapped by the hot-melted PVC glue.

- The steel blocks should be glued directly on the floor plate, and they are not permitted to contact with other model elements.
- The concept of energy dissipation and/or seismic isolation system must be adopted to design the structural model.
- Teams are required to provide the design drawings of the structural model, and the calculation sheet of the total floor area.

3.Materials and Tools

Material Provided by IDEERS

- Wooden plate (MDF):370×520×6 mm ×1 (Baseboard.)
- Wooden plate (MDF):310×460×6 mm ×4 (floor plate)
- Acrylic plate: 310×460×6 mm ×1 (transparent acrylic floor plate to demonstrate the detail of the isolation system.)
- Wooden stick (MDF): 6×6×400 mm
- PVC hot melt glue stick

Tool provided by IDEERS

- Utility knife
- Hacksaw
- Measuring tape
- PVC hot melt glue gun

Materials and Tools provided by Teams

- Only the floor diaphragm with thickness ≧ 5mm can be counted in the calculation of floor area. Team can use the wooden plate or acrylic plate (thickness ≧ 5mm) prepred by themselves.
- Except the thickness and total area of the floor diaphragms, the other model elements are could be of any size and shape.
- Teams have to present all of the materials and the devices of seismic isolation and/or energy dissipation system that will be used to build the structural model during the conference. Only the reported and approved materials (by judges) can be used.
- Teams can use any tools prepared by them.

4.Usability Rules

- In a real building, you would need windows and doors in every story. Therefore, for each story of the model, the space for four windows and two doors should be left. The size of each widows is 120mm wide, 120mm high. The size of each door is 40mm wide, 160mm high. If team does not leave enough and right space for the windows and doors, a penalty of 5% of the score will be given for each door and window.

5.Seismic design

- A list of all structural materials and the devices of seismic isolation and/or energy dissipation system prepared by teams should be reported during the registration. Then the registered stuff can be used.
- IDEERS encourage teams to use various kinds of material or elements to increase the seismic behavior of the model. All kinds of registered parts, elements and devices can be used. But the connection between the seismic elements and structure has to be done only the model construction day.

6.Competition Rules

- Teams should give a presentation about the concept of their energy dissipation system and/or base-isolation system of the model. If the concept is not qualified to be energy dissipation and/or base isolation, teams should provide a new design and be approved by the judges before AM 9:00 on model construction day.
- The design seismic strength of the upgraded model is 1000gal. The shake table tests include 400, 800, 900, 950, 1000, 1050, 1100, 1200gal. If the model fails in the 400gal test, it will be considered as disqualified with no ranking.
- If the model collapses (more than half columns are failed) during the test, the model is considered as failure.
- If seismic isolation system is used and the isolation system exceed the allowable stroke during the shaking test, the model is considered as failure because of the disallowable stroke.
- If anything takes apart form the structural model and moves beyond the boundary of construction area (310mm × 460mm), the model is considered as failure.

7.Score rules:

S= *P1* × *P2* × S_A × S_H × *P* × *C* × *A*

- **Score for presentation（P1）:（70%~100%）**

P1=70%+(A1+A2+A3+A4)*30%

A1: Concept of the energy dissipation and/or base-isolation system （0~40%）

A2: Numerical simulation （0~25%）

A3: Experimental validation （0~25%）

A4: Presentation quality （0~10%）

- **Validation of design concept（P2）:（0%~100%）**

Teams should provide the validation procedure and one sheet (A4 size) of the validation items (40% of P2). During the shake table test, judges will use the individual validation sheet to validate the seismic system and give the score (60% of P2).

P2=B1+B2

1. B1 (Presentation): Team provide the corresponding validation procedure of their seismic upgrade system (40% of P2)
2. B2 (Competition day): Validation of the seismic upgrade system (60% of P2)

Teams should provide a clear way to validate the behavior (ex: deformation of the seismic upgraded system) of their seismic upgraded system when the excitation exceed 400gal. The more simple, clear and quantified inspection ways will get higher score. During the shake table test, the behavior of the seismic system will be validated by the sensing system (designed and constructed by individual team).

For example, a team with base-isolation system may propose that the maximum stroke will be more than 30mm when the excitation exceeds 400gal. Then, they design a clear measurement system (B1=40%). During the 400~1000gal shake table test, the stroke should exceed 30mm and be sensed by the measurement system (B2=60%).

- **Score for Floor Area（S_A）**

A_F =0.5×(A_{3F} + A_{RF})/A_{1F}

Total area requirement: 280000 $mm^2 \leqq A_{1F}+ A_{2F} + A_{3F} + A_{RF} \leqq 320000mm^2$

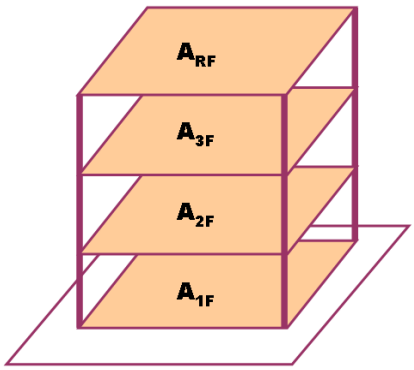
A_{1F}：Area of the 1st floor

A_{2F}：Area of the 2nd floor

A_{3F}：Area of the 3rd floor

A_{RF}：Area of the roof floor

Score of Area	$A_F \leqq 1$	$1< A_F \leqq 1.1$	$1.1< A_F \leqq 1.2$	$1.2< A_F$
S_A	100%	105%	110%	120%



- **Score for Total Height（S_H）**

$H=H_1+H_2+H_3$，

H_1：The height of 1st floor level

H_2：The height of 2nd floor level

H_3：The height of 3rd floor level

Score of Total Height	$600mm \leqq H<650mm$	$650mm \leqq H<700mm$	$700mm \leqq H$
S_H	100%	110%	120%

- **Penalty（P）**

P = (100%-N×5%)

N：The lack number of the window and door

- **Comfortable（C）**

  C = 1.2 ：after 400gal test，The water level higher than the Base line.

  C = 1.0 ：after 400gal test，The water level lower than the Base line.

  For the 400gal test, a cup of water is attached on the top of each model before shaking. After the test, the model having water level higher than the base line can get 20% score rewards. The base line is 40mm lower than the upper edge of the cup.

- **Accuracy of the seismic strength（A）**

PGA	400	800	900	950	1000	1050	1100	1200
A	30%	45%	75%	85%	100%	90%	80%	50%

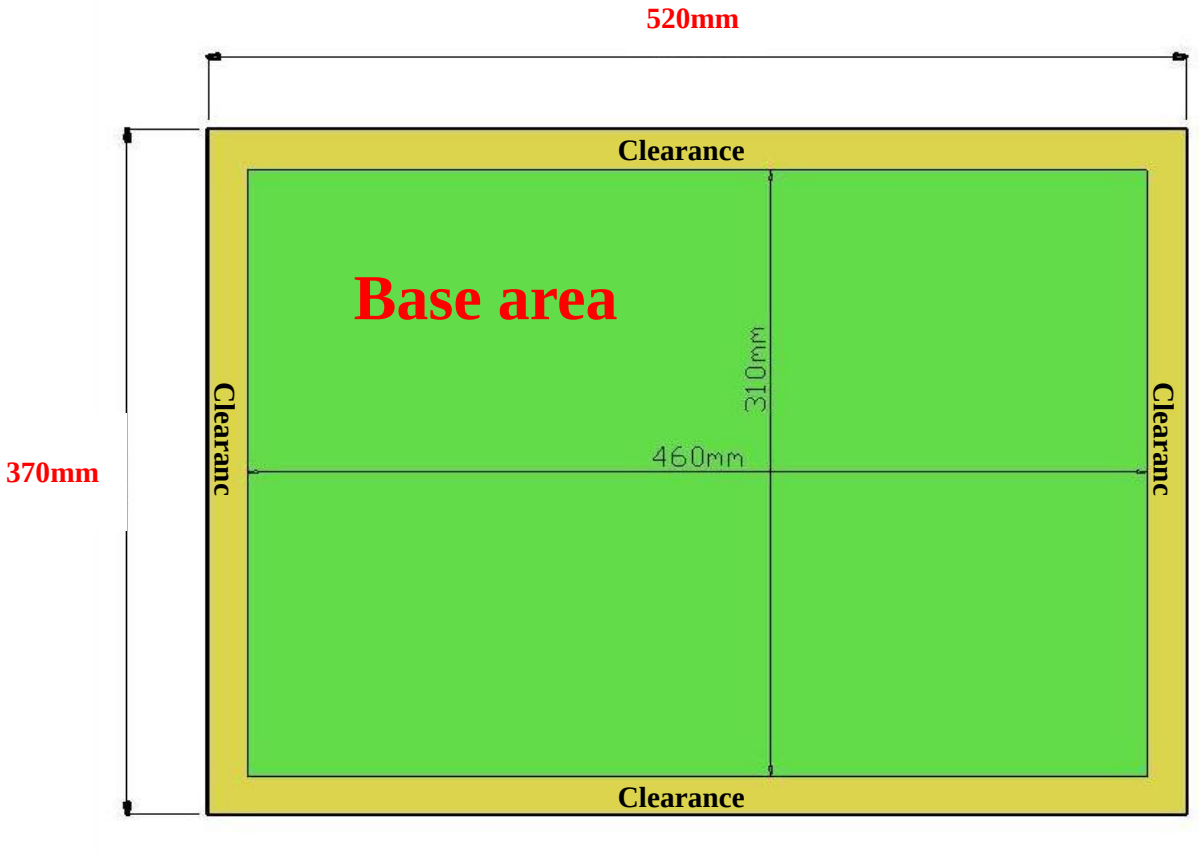


Figure 1: Top view of the MDF base board

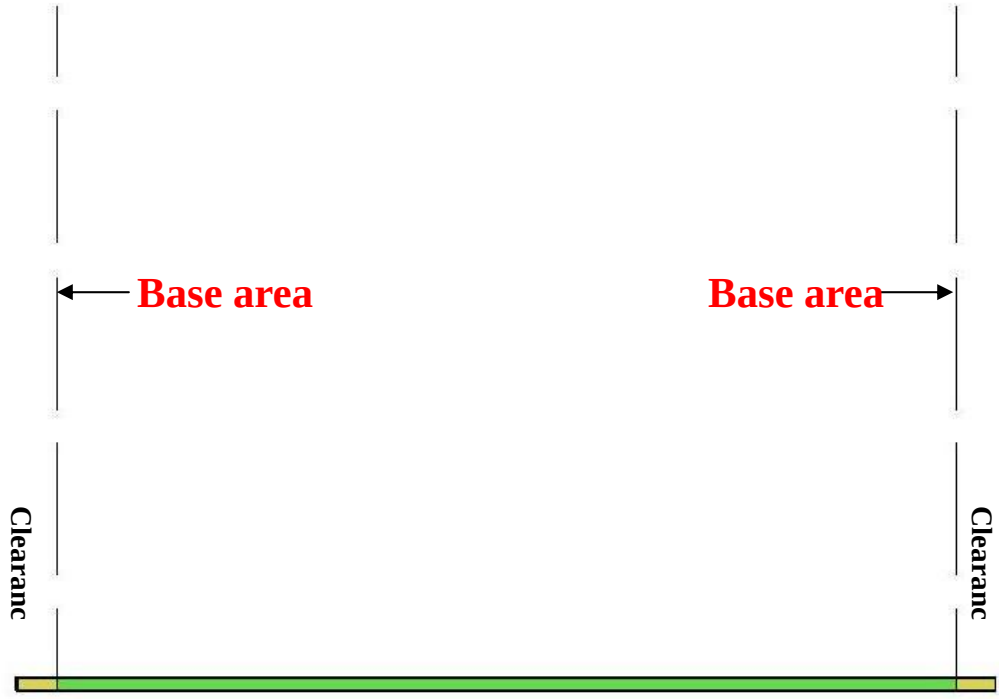


Figure 2: Side view of the MDF base board

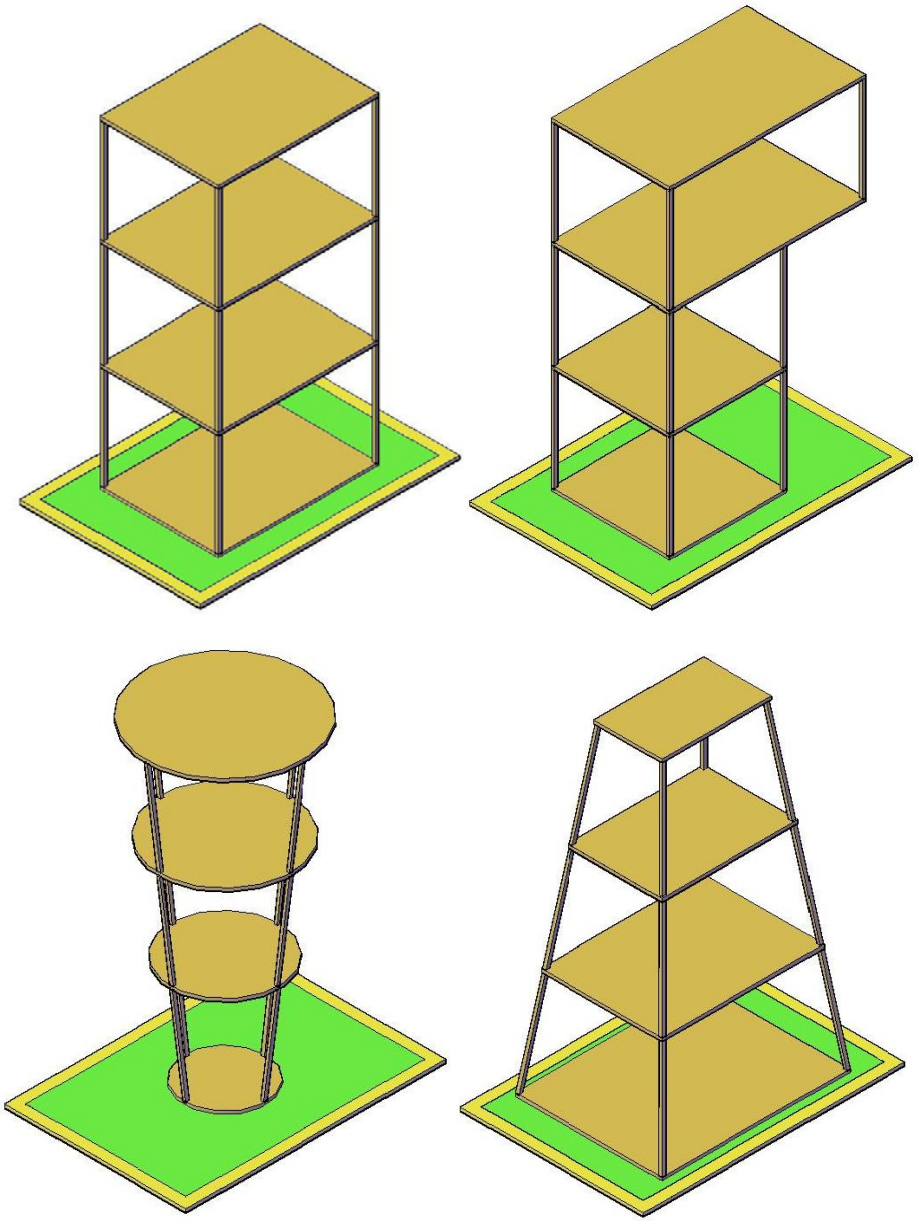


Figure 3：Samples of the model

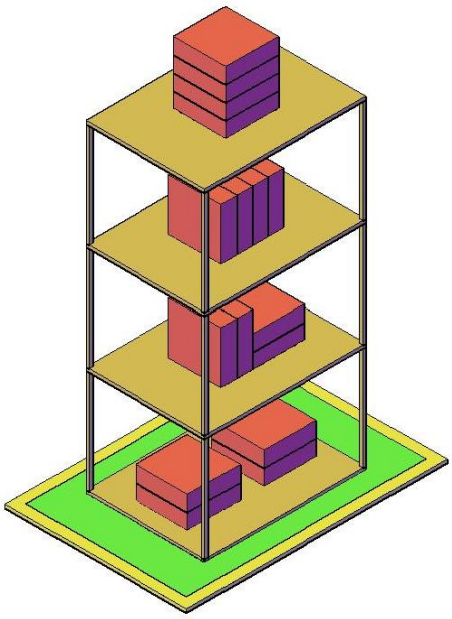


Figure 4: Arrangement of the mass blocks

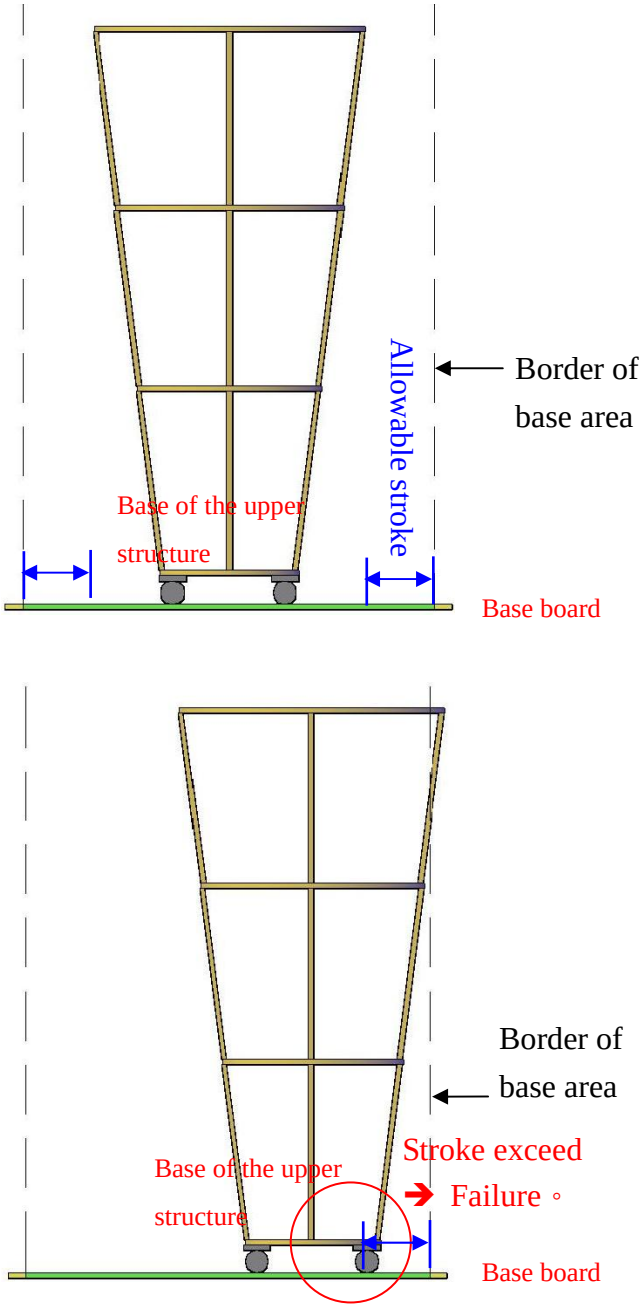


Figure 5: Illustration of the allowable stroke of the isolation system

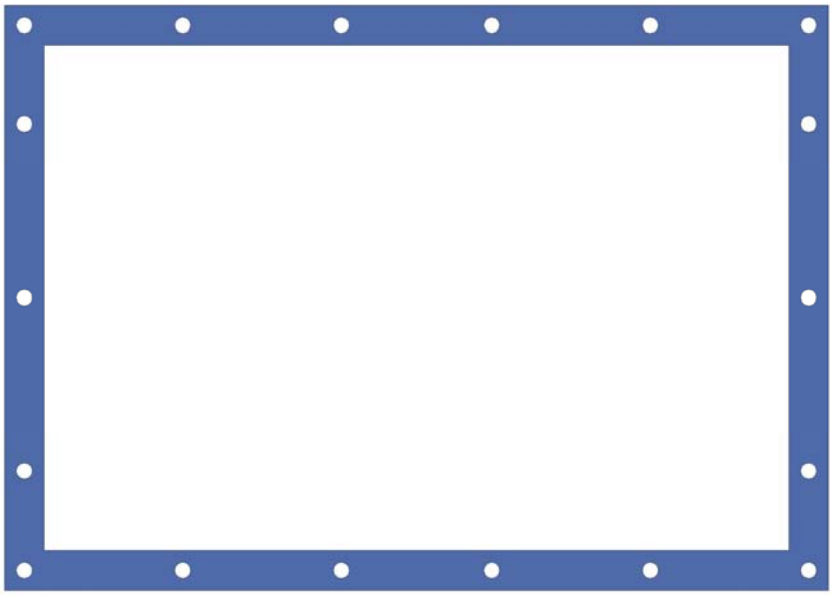


Figure 6. The clamping strip for fixing the base board.

8. Model poster

- Description poster: each team is required to make a poster to describe the model. The size is that of an A4 sheet (29.7 cm long and 21 cm wide). The poster presents the creative design concepts. The name of the university/school should be placed at the top of the poster.
- Description board: each team is required to complete a description board and paste the poster onto the board within the model construction time. The board is made of the thin wooden board and wooden sticks that are provided (refer to Figure 7).

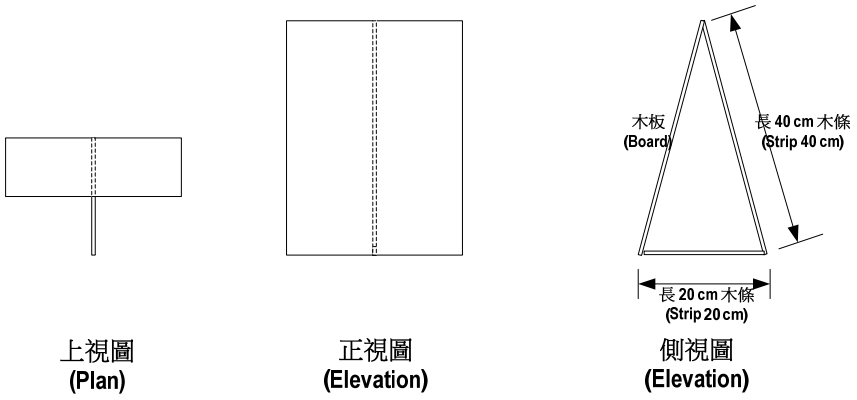


Figure 7. Description poster and board.

9. The making and installation of the team pennant

Each team must design a team pennant for their model. The pennant has to be fixed onto the model within the time limit. It can be drawn in advance or during the competition. While any shape is allowed, its size should be smaller than an A6 sheet (14.4 cm long and 10.5 cm wide, a quarter of an A4 sheet). It is to be installed on the model using the bamboo sticks provided (as optional material) within the construction time of the model.

Check Table of 2014 IDEERS for Graduate Teams

小隊編號 No.		小隊名稱 Team	

P1

*P1=70%+(A1+A2+A3+A4)*30%*

A1+A2+A3+A4	***A1*** 隔減震設計概念/Design concept（0~40%）		
	A2 數值分析/ Numerical simulation（0~25%）		
	A3 實驗驗證 / Experimental verification（0~25%）		
	A4 簡報表現 / Presentation（0~10%）		

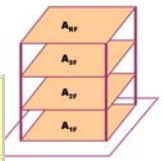
P2

P2= B1+B2

B1+B2	***B1*** 隔減震功能檢驗方法/ Function validation method (0~40%)		
	B2 隔減震功能檢驗結果/ Function validation result (0~60%)		

S_A

$A_F = 0.5 \times (A3_F + A_{RF}) / A_{1F}$



面積係數 (Score of Area)	$A_F \leqq 1$	$1 < A_F \leqq 1.1$	$1.1 < A_F \leqq 1.2$	$1.2 < A_F$
S_A	100%	105%	110%	120%

A_F

S_H

$H = H_1 + H_2 + H_3$

樓高係數 Score of Height	600mm$\leqq H$<650mm	650mm$\leqq H$<700mm	700mm$\leqq H$
S_H	100%	110%	120%

H

P

數目(No.)

P (100%-N*5%)

C

C = 1.2 ：800gal 測試後，水杯水位高過基準線。
C = 1.0 ：800gal 測試後，水杯水位低於基準線。

A

PGA	400	800	900	950	1000	1050	1100	1200
A	30%	45%	75%	85%	100%	90%	80%	50%

S

(S=P1*P2*S_A*S_H*P*C*A)

裁判:

P1=70%+(A1+A2+A3+A4)*30%

A1 隔減震設計概念/Design concept（0~40%）

A2 數值分析/ Numerical simulation（0~25%）

A3 實驗驗證 / Experimental verification（0~25%）

A4 簡報表現 / Presentation（0~10%）

B1 隔減震功能檢驗方法/ Function validation method (0~40%)

Team	A1	A2	A3	A4	B1
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裁判: