



**Asia-Pacific Robot Contest 2006**

**Kuala Lumpur**

# **THEME & RULES**

Last updated 06.12.2005

# 2006 Kuala Lumpur Contest

## Theme and Rules

The aim of this contest is to design and build a team of robots comprising manual and automatic machines, to compete according to the rules set out below.

### *Building the World's Tallest Twin Towers*

The 88-storey 452m high PETRONAS Twin Towers is currently the tallest twin towers in the world and the most prominent landmark of Kuala Lumpur City Centre (KLCC). Located strategically in the heart of vibrant city of Kuala Lumpur, this steel and glass encased superstructure soon become a must-see place for visitors to the city. Interestingly, the two towers are connected by a skybridge for visitors who wish to have a glimpse of Kuala Lumpur from the top.

Its completion in 1996 signifies one of the milestones towards Malaysia achieving Vision 2020. The twin towers house the PETRONAS corporate headquarters and offices. The Suria Mega Shopping Mall is designed as a hub of retail and entertainment. The contemporary offerings of the *Dewan Filharmonik Petronas* add the kaleidoscope of activities of the Twin Towers. Well planned parks, greens and gazebos reflect the possible harmonious balance of nature and steel that design can create.

The main objective of this contest is to simulate the construction of the twin towers and its surrounding by a team of robots using polystyrene builder blocks. The first team to complete one of the twin towers and two 'skybridge' towers thus considered "SIAP" will be the winner. Duration of the game is three minutes.

*\*" SIAP" is the Malay word for fit or available for action or use*

## A. GAME DESCRIPTION AND RULES

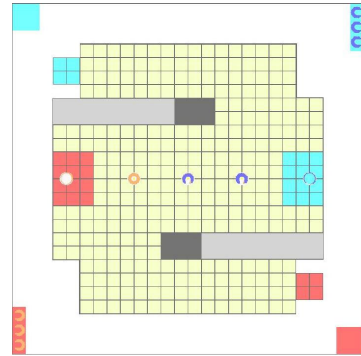
### OBJECTIVE:

To accomplish “SIAP” or accumulate more points than your opponent within a specified time limit.

### 1. THE GAME FIELD

1.1 The game is played on a square game field, which is surrounded by a wooden fence .

1.2 It consists of a Manual Area and an Automatic Area.



1.3 Automatic Area

1.3.1 Only Automatic Machine(s) may be operated in the Automatic Area.

1.3.2 The Automatic Area is divided into five (5) zones namely Automatic Machine Start Zone, Highway Zone, Building Site Zone, No Entry Zone and Tower Zone.

1.3.3 There are two (2) **Automatic Start Zones**, one (1) for each team, and these are located at two (2) corners diagonally apart from each other in the Automatic Zone

- 1.3.4 The **Automatic Machine Start Zone** is connected to **the Building Site Zone** via a **Highway Zone**.
- 1.3.5 The **Building Site Zone** is located in the middle of Automatic Area. The Blue Tower, Red Tower and three (3) Skybridge Towers are located in this zone.
- 1.3.6 The **Tower Zone** for each team is located at each end of the Building Site Zone, and Blue Tower and Red Tower are located in each of its zones.
- 1.3.7 Only your own automatic and manual machines are allowed within the Tower Zone and its surfaces above it. It is a violation if an opponent's machine enters this zone.
- 1.3.8 The **No Entry Zone** separates the Highway Zone and the Building Site Zone. Automatic or manual machines are NOT allowed into these zones. It is a violation if they do so. There are two (2) No-Entry Zones.
- 1.3.9 Adjacent to the No-Entry zones are the **One-Point Scoring Bins**. Only automatic machine(s) are allowed to either place or pick the builder blocks inside these scoring bins.

#### 1.4 Manual Area

- 1.4.1 The Manual Area surrounds the Automatic Area.

- 1.4.2 **Builder Blocks Stocking Areas** for teams are located at the corners of the game field, at a forward direction from their respective Manual Start Zones .
- 1.4.3 Before the start of a game, seven (7) builder blocks are arranged in a line in a stack of 2–3–2 formation, with the opening of the builder blocks facing outwards.
- 1.4.4 Builder Blocks Stocking Area and the space above it is exclusively for own team's machine only .
- 1.4.5 **Manual Machine Start Zone** is located in the Manual Zone. There are two Manual Start Zones, one for each team. These Manual Machine Start Zones are located at two corners diagonally apart from each other.

## 2. MACHINES

Each team must design and construct either or both handmade Manual Machine and Automatic Machine(s) to compete in the contest. There is no restriction on the number of Automatic Machine(s) but only one (1) Manual Machine is allowed for each team.

### 2.1. Manual Machine

- 2.1.1 The Manual Machine has to be operated via remote control using a cable connected to it or remote control using infrared rays, visible rays or sound waves. Controlling using radio waves are not allowed.

- 2.1.2 When operating via cable, the connecting point of the cable to the machine must be at least 1000mm from the ground. However, the length of the cable from the Manual Machine to the control box must not exceed 3000mm.
- 2.1.3 Manual machines are only permitted to enter the Manual Zone and their own Tower Zone. They can touch the floor and space above it.
- 2.1.4 The operator of the manual machine is only permitted to control the machine from within the Manual Zone.
- 2.1.5 Manual machines are not allowed to enter or extend its part into other areas such as Highway Zone, Building Site Zone, No Entry Zone, One-Point Scoring Bin and the opponent's Tower Zone.
- 2.1.6 Team members are not allowed to touch the Manual Machine once the game begins.
- 2.1.7 Operators are not allowed to ride on their manual machine. It is a violation if they do so.
- 2.1.8 Manual machines are not allowed to touch opponent's builder block.
- 2.1.9 In the interest of fair play and competitive spirit the referee will decide on the 'right of way' for manual machine.

## 2.2 Automatic Machine(s)

- 2.2.1 Automatic Machine(s) must be autonomous.
- 2.2.2 Anything that separates from an Automatic Machine is considered to be another automatic machine, and therefore must also be autonomous.
- 2.2.3 Before the game begins, a maximum of six (6) builder blocks for each team can be preloaded into Automatic Machines.
- 2.2.4 Automatic Machines are allowed to go into any zones except the opponent's Tower Zone and No-Entry Zone.
- 2.2.5 Once automatic machine(s) has been positioned in their respective Auto Start Zones after setting up time has elapsed, they MUST NOT be repositioned. Each Automatic Machine must be started by one operation.
- 2.2.6 Once a game begins, all Automatic Machines may be started one by one, but all start actions must finish within 20 seconds.
- 2.2.7 The team member(s) responsible for starting the machines must then leave the game field and stand outside the game field's wooden fence immediately.
- 2.2.8 Automatic Machines that do not start in the prescribed period shall be left in the Auto Start Zone until the match ends.

- 2.2.9 Automatic machine must move forward into the Building Site zones upon starting off. It is a violation if they do not do so.
- 2.2.10 Automatic machines are allowed to touch opponent's builder block.
- 2.2.11 Once a machine starts, team members are not allowed to touch the machine.
- 2.2.12 A team's Automatic Machines are not allowed to communicate with each other in any way.

## 2.3 Method of Control

- 2.3.1 Only one operator for each team is allowed to control the Manual Machine in the Game Field.
- 2.3.2 Automatic Machine operators are only allowed to enter the game field to start the machines, including during a "retry".
- 2.3.3 For Automatic Machine(s), a "retry" is permitted once per game for each team. After a team calls for a "retry" and referee grants it, any team members are allowed to reset and restart any Automatic Machine(s) from the Auto Start Zone.
- 2.3.4 All restart actions must be finished within 20 seconds. The team member(s) responsible for starting the machines must then leave the game field and stand outside the game field's wooden fence immediately.



## 2.4 Power Supply

2.4.1 Each team shall prepare its own power supply for all its machines during the games.

2.4.2 Power supply that is considered dangerous or unsuitable by the technical committee shall not be permitted.

## 2.5 Weight

2.5.1 All automatic and manual machines including their power sources, cables, remote controller and other parts of each machine shall be weighed prior to competition.

2.5.2 The total allowable weight of all machines for each team to be used in the game field must **not exceed 50kg**.

2.5.3 Once 'weighing-in' has been done and the equipment are deemed fit for competition, the equipment shall be registered for competition.

2.5.4 Only registered equipment are allowed for the competition.

## 2.6 Size

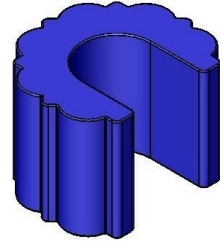
- 2.6.1 There is a size limit for the Manual and Automatic machines at their respective Start Zones, before a game commences.
- 2.6.2 Once the Manual and Automatic Machines leave their Start Zones after the game begins, their size and form may change freely.

### **3. TEAM MEMBERS**

- 3.1. Each team shall comprise of four (4) members consisting of three (3) students and one (1) instructor, from the same university, polytechnic or college.
- 3.2. Only these three (3) students are permitted to enter the Game Field.
- 3.3. Team members must be enrolled in their University/Polytechnic at the time of the international contest. Exceptions are allowed for those who were enrolled in a University/Polytechnic at the time of the domestic contest.
- 3.4. Postgraduates are not eligible to enter the competition.

### **4. THE BUILDER BLOCKS**

- 4.1 The builder blocks are made of low density polystyrene and are coated with emulsion paint red, for the Red Team, and blue, for the Blue Team.



- 4.2 A team shall not use the opponent's Building Blocks.

## 5. MATCHES

### 5.1. The Tournament

The contest is played according to the format below:

- Preliminary round in groups: round robin
  - Winner from each group shall advance to the Quarter -Final stage.
- Quarter-finals: knock out
  - Winner from each Quarter Final shall advance to the Semi -Final stage.
- Semi-finals: knock out
  - Winner from each Semi-Final shall advance to the Final stage.
- Final

The organizer may change the format if required.

## 5.2. The Duration of Matches

5.2.1 Each match shall last for three (3) minutes.

5.2.4 Setting of the machines shall be completed within one (1) minute after receiving the signal for setting, before the match begins.

5.2.2 The first team to achieve “**SIAP**” wins the match regardless of the point collected by the opponent. The match ends when “SIAP” is achieved.

## 5.3. SIAP

SIAP is achieved when :

5.3.1 A team has stacked eight (8) own builder blocks on its own tower, AND

5.3.2 Claimed ownership on at least two (2) of the three (3) ‘skybridge’ towers by:

a) Owning topmost builder block for those skybridge towers;

b) Those skybridge towers are stacked with at least two (2) builder blocks.

- c) At the Skybridge Towers, only builder blocks stacked up to three (3) levels or layers (in height) are considered for points

5.3.3 A teams' machines do not touch the skybridge tower OR the Builder Blocks stacked onto it.

#### 5.4. Points Awarded

5.4.1 When no "SIAP" is achieved, points are calculated when the match ends.

5.4.2 For Towers and Skybridge Towers, a block is said to have been successfully stacked and gains point(s) when its bottom (flat) surface rests on another block at the towers or Tower base or the acrylic cylinder of the Skybridge. No points shall be awarded if a block touches the floor or any part of own robot.

5.4.3 Any builder block stacked on the towers or left in the scoring bins without touching own machine, can gain point(s). Points are awarded as follows:

<i>Location</i>	<i>Points per block</i>
i) Manual Scoring Bin	1
ii) Twin Tower	1
iii) Skybridge (Left or Right)	2
iv) Skybridge (Middle)	5

5.4.4 At the Skybridge Towers, only builder blocks stacked up to three (3) levels or layers (in height) are considered for points.

## 5.5. Deciding the Winner

The winner of the match will be decided based on the following conditions:

- 5.5.1 The team first accomplishing “SIAP” wins the match.
- 5.5.2 In the case that neither team accomplishes “SIAP”, the team that scores more points wins. This is done by adding up all the points awarded and subtracting points for violations.
- 5.5.3 In the case of a draw, the winner of the match will be decided by the following rules:
  - 5.5.3.1 The team that scored more points on the middle skybridge tower wins the match.
  - 5.5.3.2 The team that scored more points on the right and left sky bridge towers wins the match.
  - 5.5.3.3 The team that scored more points in the One-Point Scoring Bin wins the match.
  - 5.5.3.4 In the case of no clear winner can be selected by the above order, the head referee will decide the winner by judging on the stacking alignment of builder blocks in the following manner:

- a) Orientation of the building blocks on the tower blocks. They should face the same direction.
- b) The centre-point offset of the builder blocks to the tower pole should be small.
- c) If it is still a draw, the winner shall be decided by the head referee.

## **6. VIOLATIONS AND DEDUCTION OF POINTS**

Once a game begins, the following actions will be regarded as violations and one (1) point will be deducted for each instance.

- 6.1 Manual Machine or its operator touches the floor of outside their permissible zones.
- 6.2 Manual Machine extends over into Highway or Building Site Zones.
- 6.3 Automatic Machine or Manual Machine enters opponent Tower Zone or the space above the zone.
- 6.4 Manual Machine touches its own team's Automatic Machines.
- 6.5 Manual Machine touches opponent's builder block(s).

- 6.6 Automatic or manual machine enters the No -Entry Zone or the space above the zone.
- 6.7 Automatic machine moves into the manual zone immediately upon starting off.
- 6.8 If above violations continue (Clauses 6.1, 6.2, 6.3, 6.4, 6.5 , 6.6 and 6.7), one (1) point will be deducted for every five (5) seconds.

**When three (3) points are deducted, the team will be disqualified.**

## **7. DISQUALIFICATION**

The following behavior shall be considered for disqualification by the referee.

- 7.1 Causing or attempting to cause damage to the game field, its equipment, or the opponent's machines, including the materials arrangement of the opponent's building blocks.
- 7.2 Riding on the Manual Machine.
- 7.3 Manual Machine touching the opponent's Automatic Machine in any zone.



7.4 Making false start more than once.

7.5 Performing any act against the spirit of fair play.

7.6 Any behavior violating the Rule Book .

## **8. SAFETY**

8.1 All machines must be built so that they will not harm the operators, the referees, match officials, audience and the opponent's equipment.

8.2 To ensure safety, when using a laser beam, it must be less than a Class 2 laser, and used in a way that will not harm any operators, the referees, match officials, audience and the opponent's equipment.

## **9. COSTS OF PRODUCTION AND CARRIAGE**

9.1 Cost of production

The committee shall provide US\$1000 as a subsidy for machine construction to each committee member organization.

9.2 Cost of carriage

- 9.2.1 The transport company , specified by the committee, will ship the machine. Details will be announced later.

## **10. OTHERS**

- 10.1 For any other behavior not specified in the rules, referees are given full authority to make the decision and the decision is final in the event of a dispute.
- 10.2 Any amendments to the rules will be announced by the Contest Committee.
- 10.3 All teams are encouraged to decorate their machines with their country's national symbols.
- 10.4 Only handmade machines are allowed in the contest.

## **11. AWARDS**

Prizes shall include awards for the winners, runner-ups, best technology, best idea and best artistic design and ABU Robocon award.

## **12. NOTICE ON MACHINE DESIGN AND CONSTRUCTION**

Followings are the points to be kept in mind when constructing machines. In every case, sufficient attention must be paid to avoid possible danger.

- 12.1 Each team shall avoid machines damaging the game field or its equipments.
- 12.2 For official supplementary information on the contest rules, the Contest Committee will release FAQ (Frequently Asked Questions).
- 12.3 Each participating country will be asked to prepare a five-minute videotape, which explains the structure and the movement of the participating teams' machines. The Contest Committee will verify whether each participating machine complies with the rules through viewing the videotapes, prior to the shipment of the machines.

## **13. QUESTIONS REGARDING THEME AND RULES**

Questions regarding theme and rules should be addressed by e-mail to the Committee in English. They can be contacted at these addresses:

`dzakaria@gmail.com`

`zalinda@sirim.my`

`azhar@sirim.my`

#### **14. FAQ (Frequently Asked Question)**

Supplementary information (FAQ) on rules can be found at the Robocon Official Homepage.

**`http://www.abu.org.my/programme/robocon/robocon.htm`**

**`http://www.robofest.org.my/robocon2006`**

Contest Rules designed by Technical Advisory Group:

A. Prof. Ahmad Zakaria, Universiti Kuala Lumpur

Prof Mohd. Marzuki Mustafa, National University Malaysia

Dr Amir Akramin Shafie, International Islamic University

& ABU Contest Committee

## B. TECHNICAL DESCRIPTION

### 1. THE GAME FIELD

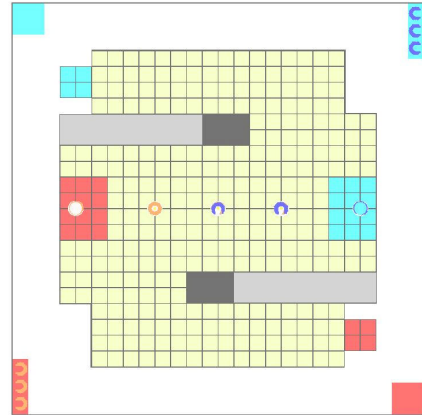
1.1. Total Area: 13000mm x 13000mm.  
*See Figure 1 and Figure 2 for details.*

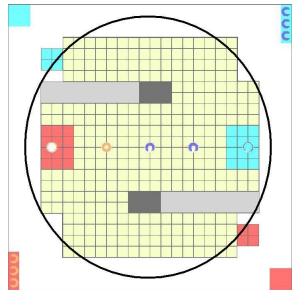
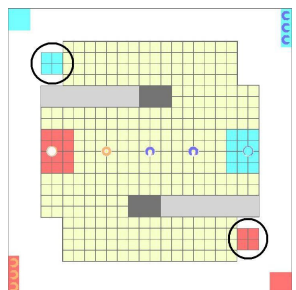
1.2. The floor of the Game Field shall be made of a 2 mm thick vinyl sheeting.

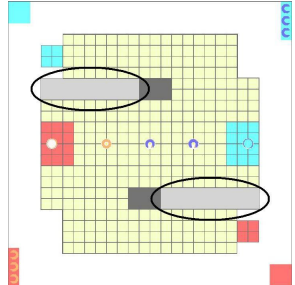
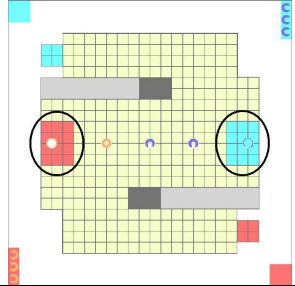
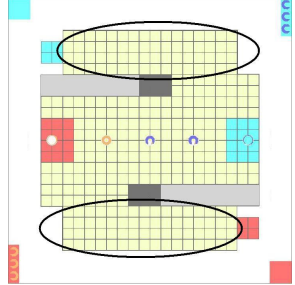
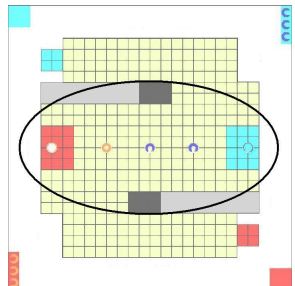
1.3. If the surface of the Game Field needs to be joined, it shall be joined using non-reflective vinyl tape.

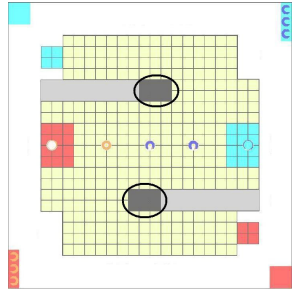
1.4. The Game Field is surrounded by a wooden fence 100mm (H) x 30mm (W).

1.5. The Automatic Area

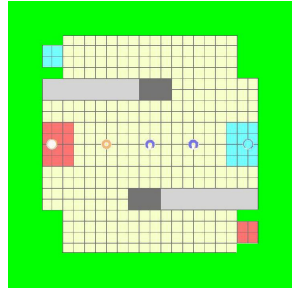
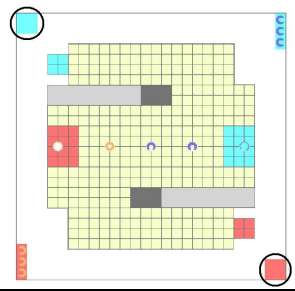
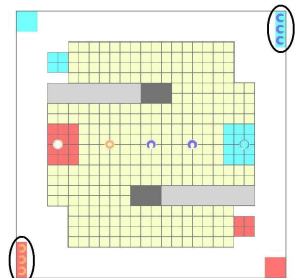


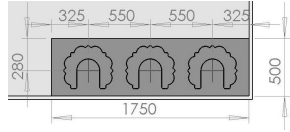
	<i>Description</i>	<i>Quick Location on Game Field</i>
1.5.1	This area is marked with 30mm -thick gridlines with the exception of the No-Entry Zones and 1-Point Scoring Bins.	
1.5.2	The centerline of the gridlines are spaced 500mm apart.  Gridline Colour: White	
1.5.3	There are two (2) <b>Automatic Machine Start Zones</b> . Each zone is 1000mm x 1000mm in size (i.e. 2 x 2 grid).  Colour: Blue Colour: Red.	

	<i>Description</i>	<i>Quick Location on Game Field</i>
1.5.4	<p>There are two (2) <b>No Entry Zones</b>. Each zone is 4500mm x 1000mm in size. Colour: Black (matt finish).</p> <p>It has a wooden fence 100mm (H) x 30mm (W) on the inside perimeter.</p>	
1.5.5	<p>There are two (2) <b>Tower Zones</b>. Each zone is 1500mm x 2000mm in size (i.e. 3 x 4 grid). Colour: Blue Colour: Red.</p>	
1.5.6	<p>There are two (2) <b>Highway Zones</b>. Each zone is 8000mm x 2000mm in size (i.e. 16 x 4 grid). Colour: Green.</p>	
1.5.7	<p>The <b>Building Site Zone</b> is where the twin towers and three skybrid ge towers are located. This zone is located on the middle third of the game field. Colour: Green.</p>	

	<i>Description</i>	<i>Quick Location on Game Field</i>
1.5.8	<p>There are two (2) <b>One-Point Scoring Bins</b>. Each bin is 1500mm x 1000mm in size.</p> <p>Colour: White</p> <p>It has a wooden fence 100mm (H) x 30mm (W) on the inside perimeter.</p>	

## 1.6. The Manual Area

	<i>Description</i>	<i>Quick Location on Game Field</i>
1.6.1	<p>The Manual Area completely surrounds the Automatic Area.</p> <p>Colour: Light Green</p>	
1.6.2	<p>There are two (2) <b>Manual Machine Start Zones</b>. Each zone is 1000mm x 1000mm in size (i.e. 2 x 2 grid).</p> <p>Colour: Blue</p> <p>Colour: Red.</p>	
1.6.3	<p>There are two (2) <b>Builder Block Stocking Areas</b>. Each zone is 500mm x 1750mm in size.</p> <p>Colour: Blue</p> <p>Colour: Red</p>	

	<i>Description</i>	<i>Quick Location on Game Field</i>
1.6.4	The Builder Blocks are stacked in a straight line in a 2-3-2 formation, i.e. the middle stack contains 3 blocks, with the sides having 2 blocks each. <i>See Figure 7 for stocking arrangement.</i>	

## 2. MACHINES

### 2.1. Manual Machine

2.1.1 Quantity: One (1) only.

2.1.2 Method of Control: Remote Control / Manual

2.1.3 Maximum envelope size at the Manual Start Zone: 1000mm (L) x 1000mm (W) x 2500mm (H)

### 2.2. Automatic Machine

2.2.1 Quantity: One (1) or more.

2.2.2 Method of Control: Fully Autonomous

2.2.3 Maximum envelope size of all automatic machines at the Auto Start Zone: 1000mm (L) x 1000mm (W) x 2000mm (H)

### 2.3. Power Supply

2.3.1 Voltage of the machines' electrical supply must not exceed 24 VDC.

### 2.4. Weight



- 2.4.1 The total allowable weight of all machines for each team to be used in the game field must **not exceed** 50kg. All automatic and manual machines including their power sources, cables, remote controller and other parts of each machine must be within this weight limitation.

## 2.5. Shipping

- 2.5.1 For shipping, the machines must be packed in ONE CRATE measuring 1500mm (L) x 1500mm (W) x 1500mm (H).

## 3. BUILDER BLOCKS

	<i>Description</i>	<i>Specification</i>
3.1	Material	: Low density polystyrene.
3.2	General Dimensions	: 450mm outside diameter x 300mm high. <i>See Figure 6 for details.</i>
3.3	Weight:	: $380 \pm 20$ grams
3.4	Colour	: Blue - for the blue team, Red - for the red team.
3.5	Minimum quantity for each game	: 26

## 4. CONSTRUCTION OF TOWERS

### 4.1 Twin Towers

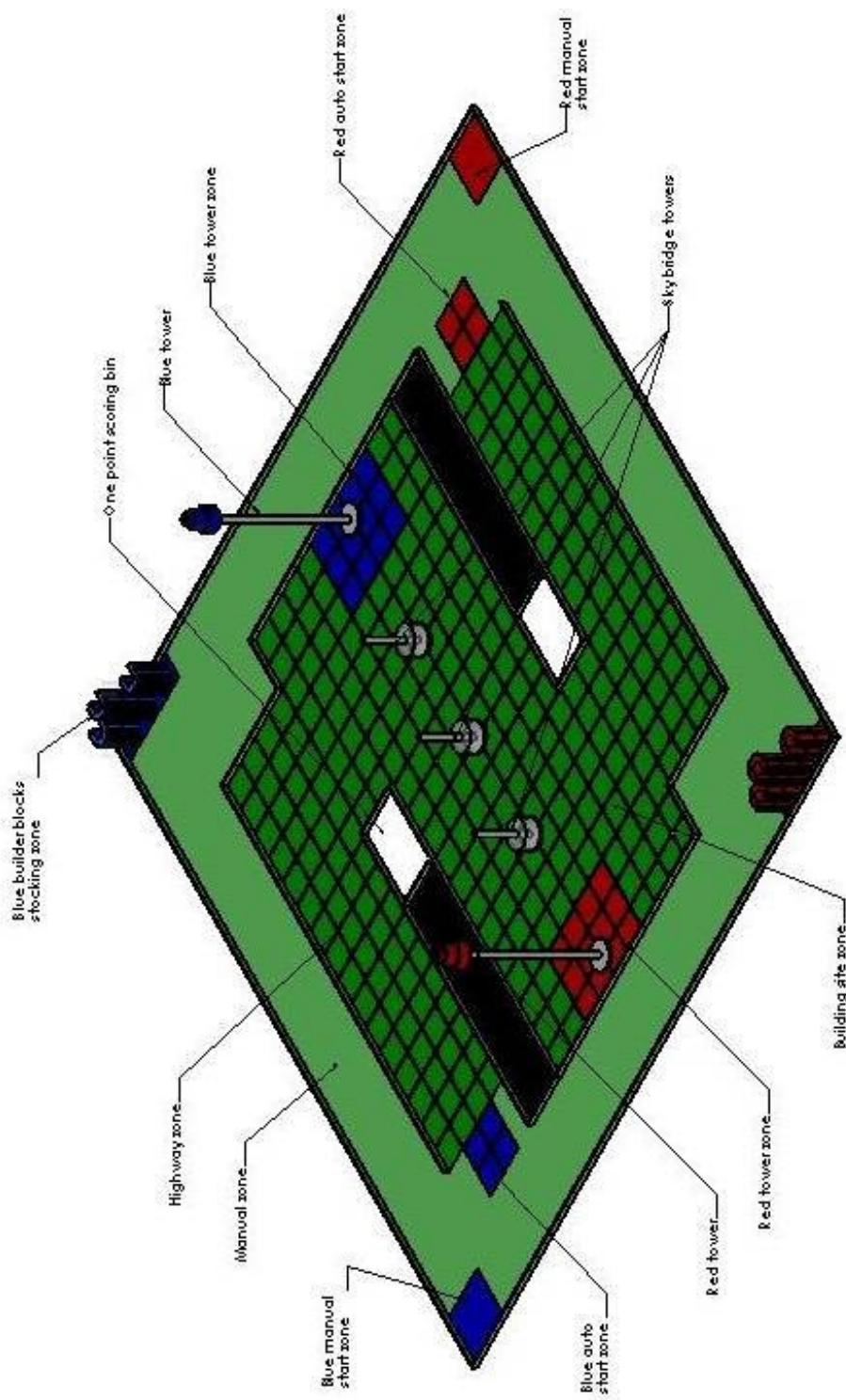
<i>Description</i>	<i>Specification</i>
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	<i>Description</i>	<i>Specification</i>
4.1.1	General Description	: Base plate diameter of 500mm x 50mm thick with a tower pole reaching a height of 3000mm. <i>See Figure 3 and Figure 5 for details.</i>
4.1.2	Material	: Mild Steel Plate, Aluminium Hollow Tube and Low density polystyrene.
4.1.3	Weight:	: Approximately 86 kilograms
4.1.4	Colour	: Blue Apex - for the blue team, Red Apex - for the red team. Silver – Base Plate and Aluminium tube.
4.1.5	Quantity	: 2

## 4.2 Skybridge Towers

	<i>Description</i>	<i>Specification</i>
4.2.1	General Dimensions	: Base plate diameter of 500mm x 50mm thick with a tower pole reaching a height of 1050mm. A clear Acrylic cylinder elevates the ‘base’ to 350mm height. <i>See Figure 4 for details.</i>
4.2.2	Material	: Mild Steel Plate, Aluminium Hollow Tube and Clear Acrylic
4.2.3	Weight:	: Approximately 82 kilograms
4.2.4	Colour	: Silver – Base Plate and Aluminium tube.
4.2.5	Quantity	: 3

Figure 1: 3D VIEW OF THE GAME FIELD



Note: For the Builder Blocks layout please refer to in Figure 7.

**Figure 2: PLAN AND ELEVATION VIEWS OF THE GAME FIELD**

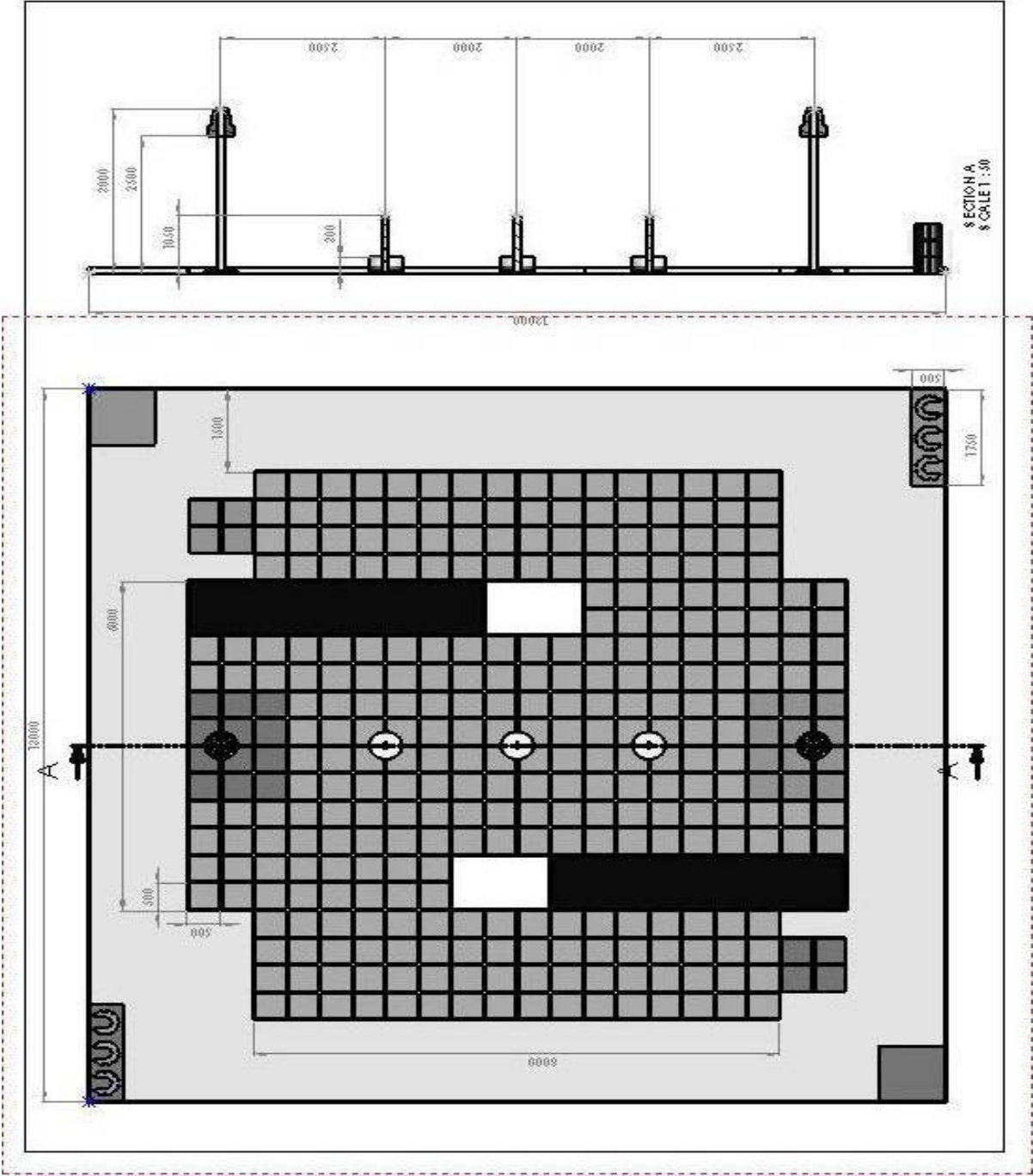


Figure 3: TOWER BLOCK

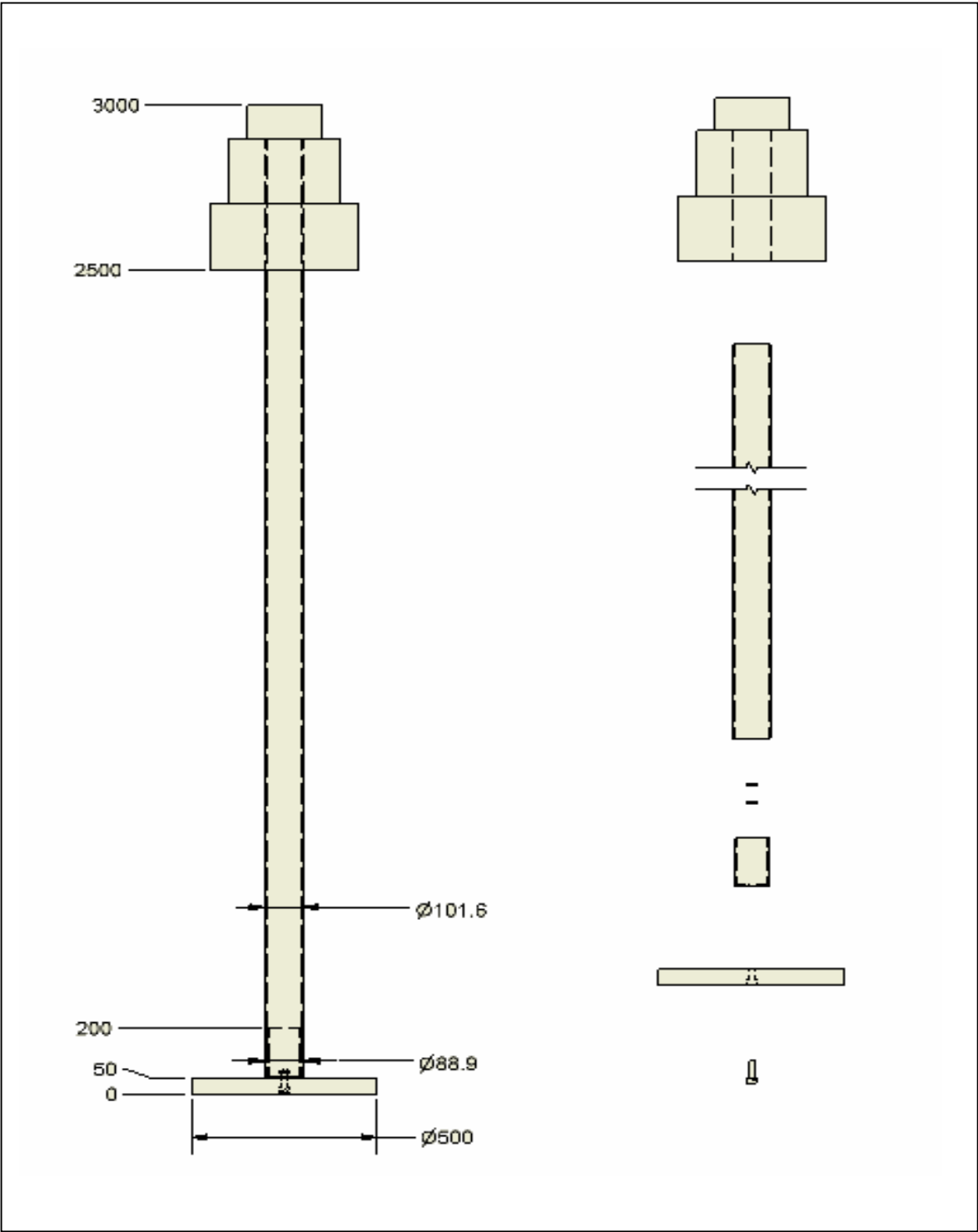
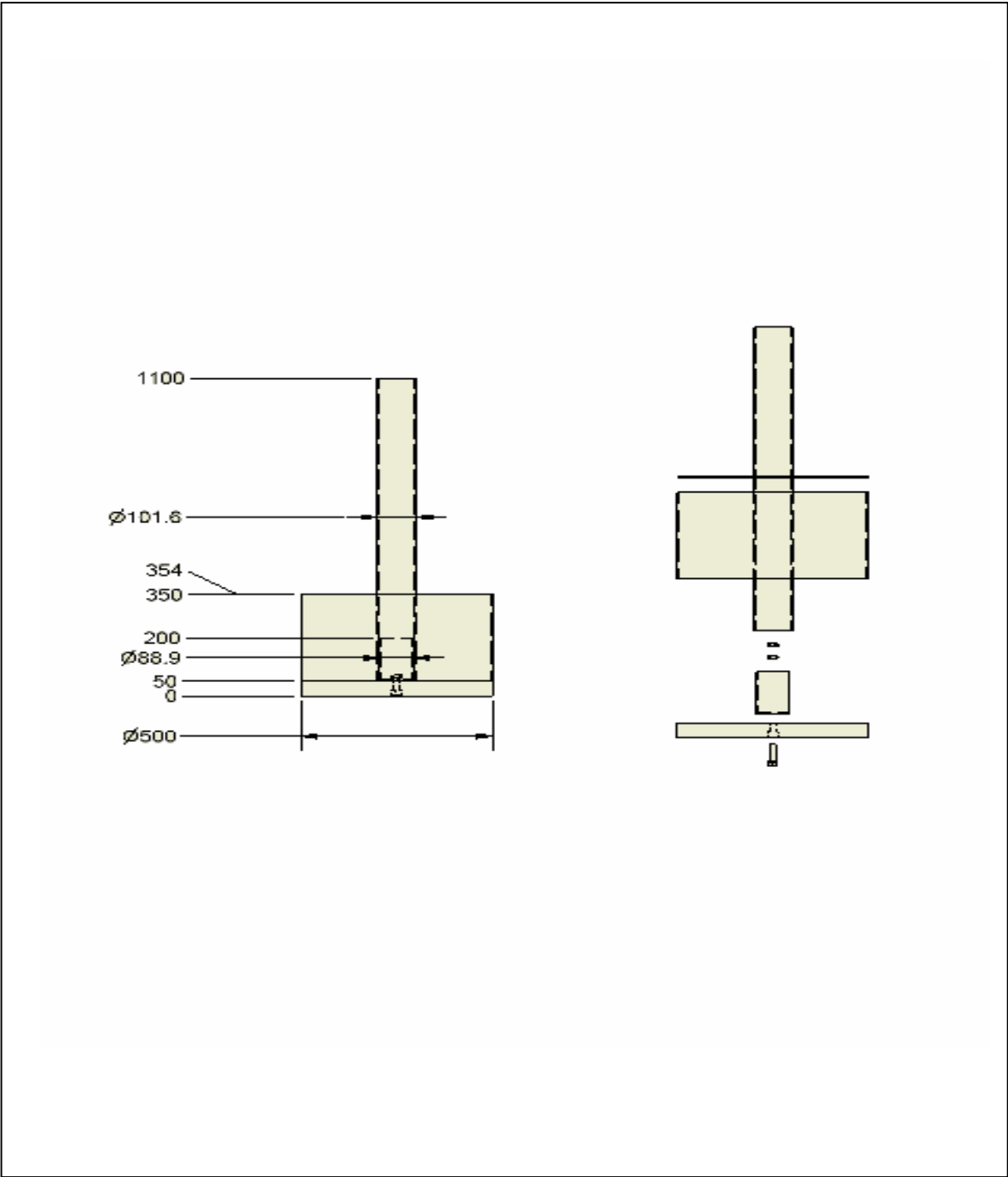
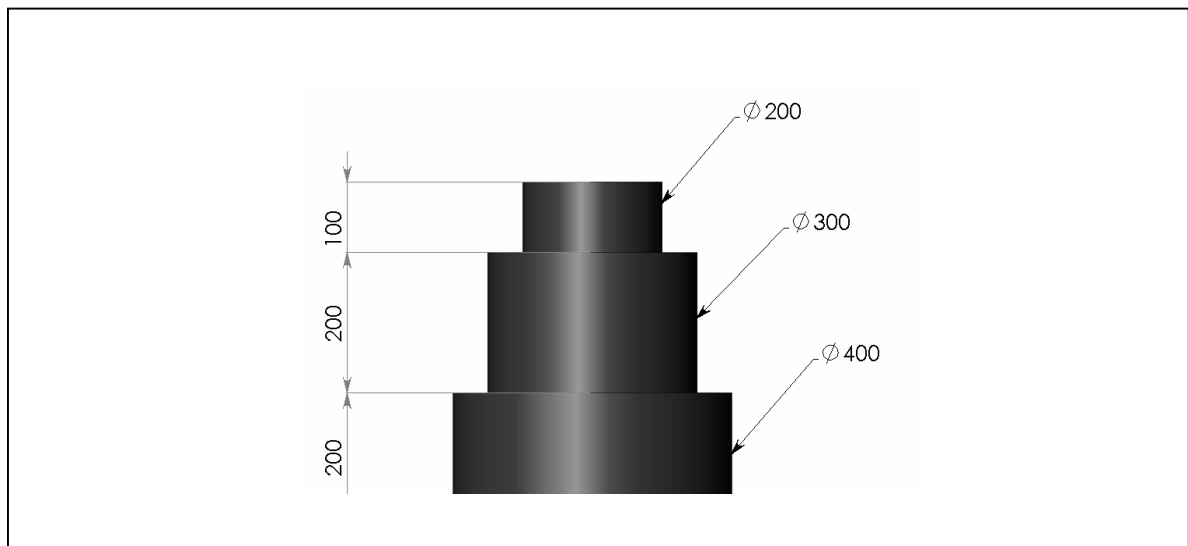


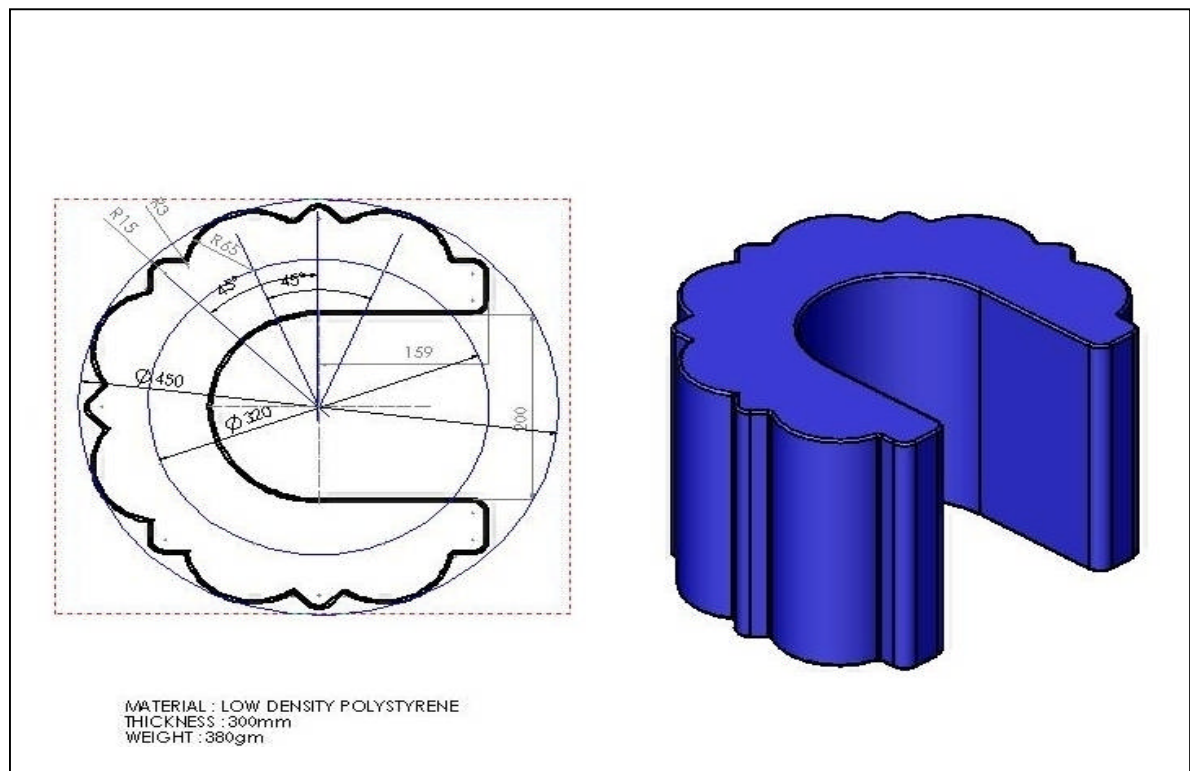
Figure 4: SKYBRIDGE TOWER



**Figure 5: TOWER BLOCK APEX**

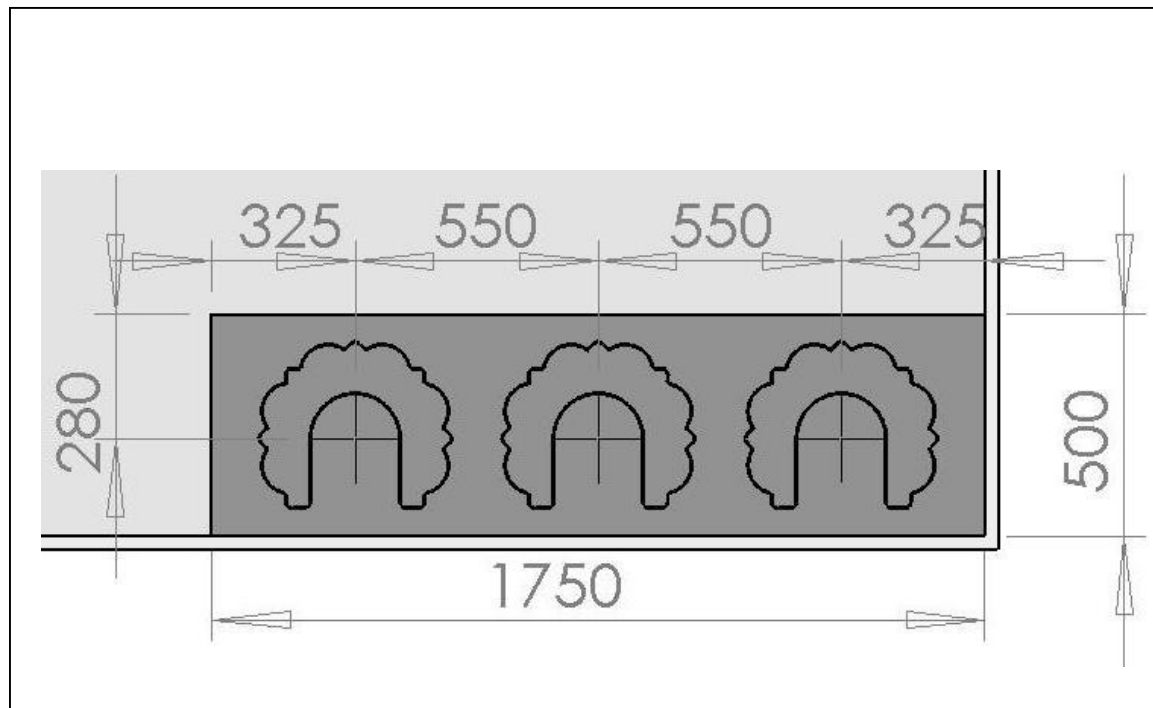


**Figure 6: THE BUILDER BLOCK**





**Figure 7: THE BUILDER BLOCK STOCKING AREA**



## SUMMARY OF DO's AND DON'T's

	General		Entry into Specific Zones								Touch				
	Manual Area	Automatic Area	Highway Zone	Building Site Zone	No Entry Zone	Tower Zone		One-Point Scoring Bin	Builder Block Stocking Area		Opponent's Building Block	Manual Machine		Automatic Machine	
						own	opponent		own	opponent		own	opponent	own	opponent
Automatic Machine	✓	✓	✓	✓	✗	✓	✗	✓	✓	✗	✓				
Clause	2.2.4	1.3.1; 2.2.4	2.2.4	2.2.4	1.3.8; 2.2.4; 6. 6	1.3.7; 2.2.4	2.2.4; 6.3	1.3.9; 2.2.4	1.4.4	1.4.4	2.2.10				
Manual Machine	✓	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	n/a		✗	✗
Clause	2.1.3	1.3.1	2.1.5; 6.2	2.1.5; 6.2	1.3.7; 2.1.5; 6. 6	1.3.7; 2.1.3	2.1.5; 6.3	1.3.9; 2.1.5	1.4.4	1.4.4	2.1.8; 6. 5			6.4	7.3
Manual Machine Operator	✓														
Clause	2.1.4														

Legend	Description
✓	Permissible
✗	Not Permissible

