

TARGET VALUE DESIGN: DEVELOPMENT AND TESTING OF A VIRTUAL SIMULATION

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AGENDA



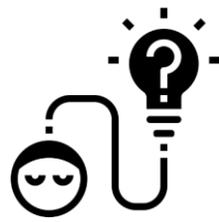
- Introduction
- TVD Simulation
- Simulation Development
- Simulation Testing
- Post Simulation Discussion
- Conclusion

INTRODUCTION



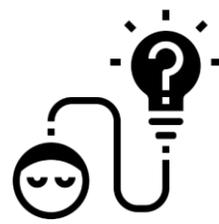
- Serious game and simulations being explored since 1980s.
- Instil the concepts and principles of lean construction effectively.
- COVID-19 pandemic impacted lean simulation and games that were previously played in-person.
- Need for an online simulation to teach TVD despite social distancing requirements.

TVD SIMULATION



- Target Value Design (TVD) evolved from *target costing* or *genka kikaku*.
- Involves continuous, collaborative cross-disciplinary appraisal of design proposals.
- Improve overall value cost, design, risk, constructability, quality, and time.
- Early collaboration of stakeholders, setting a target cost and rigorous estimating are key requirements.

TVD SIMULATION



- The Target Value Design (TVD) simulation is inspired by the “marshmallow design challenge” (Skillman 2014).
- Widely used by educators to impart principles of TVD, such as market cost, target cost, collaboration, etc.
- This paper discusses development & testing of a virtual TVD simulation at CEPT University, which is an improvised version of TVD marshmallow tower game (Rybkowski et al. 2016).

Reference –

Skillman, P. (2014) “Peter Skillman Marshmallow Design Challenge.” <<https://www.youtube.com/watch?v=1p5sBzMtB3Q>> (March 25, 2021).
Rybkowski, Z. K., Munankami, M. B., Shepley, M. M., and Fernández- Solis, J. L. (2016). Development and testing of a lean simulation to illustrate key principles of target value design: A first run study. IGLC 2016 - 24th Annual Conference of the International Group for Lean Construction, 133-142.

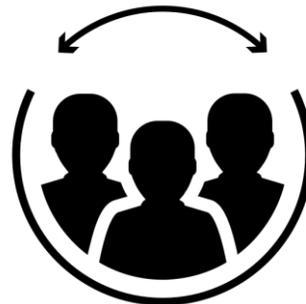
SIMULATION DEVELOPMENT



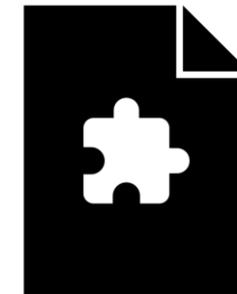
- Involves the design, construction and costing of a tower.
- Tower Specification - 26 cm height and 12 cm base width.
- Round 1 - Traditional mode
- Round 2 – Collaborative mode
- Time – 75 mins.(Both rounds)



Google Slides used as the online platform



Team of 3-4 Participant
1-Designer,
1-Contractor,
1-2 Owners.



Materials Required
TVD Game Template, Cost Sheet Template and Instruction Slides.

Instruction Slides

General Instructions

- Your game template contains a Square, a Rectangle and a Triangle of different sizes
- Your task is to construct a tower with the help of the shapes given in the template.
- The height of tower should be 26m. The base of the tower should be 12m.
- The completed structure should be completely packed with the shapes and there should not be any voids.
- The dimensions of the shapes are given and you can make use of this for design.
- While constructing the tower, please copy and paste the shapes from the "Resources" template (Ctrl+C then Ctrl+V)

General Instructions

- No one should reshape or resize the shapes in your game template.
- However, you can resize any one of the shape for finishing (only once).
- Resizing should be done by reducing the size of the shape and in no terms shall anyone increase the size of any shape.
- Also, you can rotate the size if you wish.

Figure 1. Instruction slide template

RESOURCES

Square-1



Square-2



Square-3



Rectangle-1



Rectangle-2



Rectangle-3



Triangle-1



Triangle-2



Triangle-3

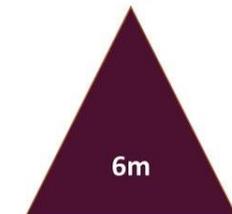


Figure 2. Resource sheet

TVD Game Playing Templates

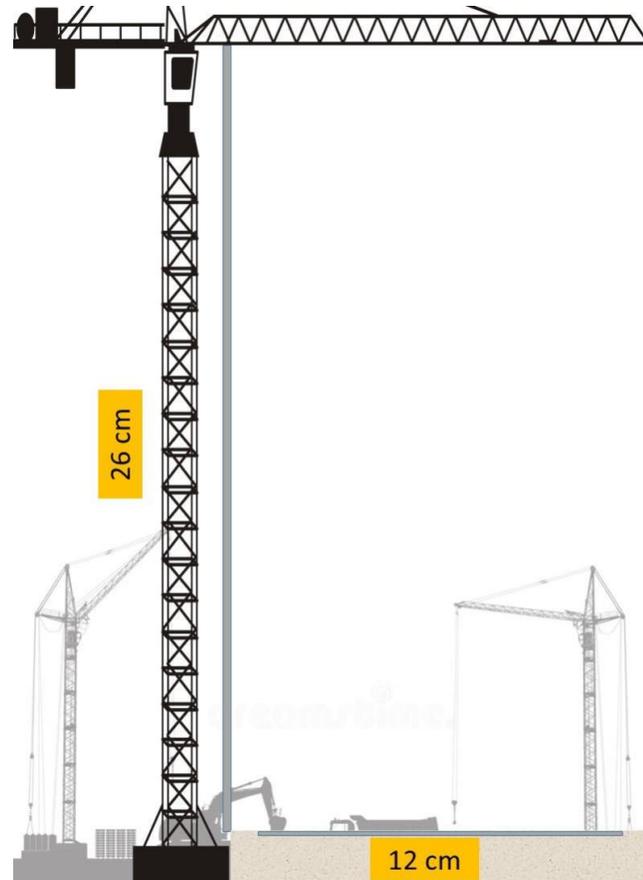


Figure 2. Tower construction template

RFI_CLIENT TO DESIGNER

Queries

1. *Is there any possibility to increase stepping in the tower?*

Answer

1. *Yes, will revise the design*

RFI_DESIGNER TO CLIENT

Queries

1. *Do you want stepping in the tower?*
2. *Is the revised design alright?*
3. *Do you have any color preferences for the building?*

Answer

1. *yes you can provide stepping if needed.*
2. *yes, ready for the construction.*
3. *yes, give blue color to the tower, with gradient effect-dark at base and light at top.*

Client's Brief

Instructions:

Client wants to build a 26 cm high tower. The base of the tower should be 12 cm.

1. Need a broader base.
2. The width should decrease as height increases and a conical top finish is required.
3. Proper decrease in widths so that the tower looks good. (i.e.) Good aesthetic appeal is required.
4. Preferring two cones in the top.

Timings:

1. Client Brief - 5.15-5.20 = 5 minutes
2. Design + Revision suggestion + Revision of design - 5.20-5.48 = 28 minutes
3. Construction - 5.48-6.00 = 12 minutes

Figure 2. RFI and Client's brief template

Cost Sheet Template

- The Cost Sheet Template consisted of a table itemizing pre-defined cost rates of each shape, the number of shape variants used in final construction of the tower, and the total cost of tower.

Cost Sheet (Round-1)				Cost Sheet (Round-2)			
Item Name	Unit Cost (\$)	Nos. of Units	Subtotal	Item Name	Unit Cost (\$)	Nos. of Units	Subtotal
Square 1	\$ 3.00	0	\$ 0.00	Square 1	\$ 3.00	6	\$ 18.00
Square 2	\$ 10.00	3	\$ 30.00	Square 2	\$ 10.00	3	\$ 30.00
Square 3	\$ 20.00	2	\$ 40.00	Square 3	\$ 20.00	0	\$ 0.00
Rectangle 1	\$ 5.00	0	\$ 0.00	Rectangle 1	\$ 5.00	2	\$ 10.00
Rectangle 2	\$ 15.00	3	\$ 45.00	Rectangle 2	\$ 15.00	5	\$ 75.00
Rectangle 3	\$ 30.00	2	\$ 60.00	Rectangle 3	\$ 30.00	0	\$ 0.00
Triangle 1	\$ 2.00	0	\$ 0.00	Triangle 1	\$ 2.00	1	\$ 2.00
Triangle 2	\$ 5.00	0	\$ 0.00	Triangle 2	\$ 5.00	0	\$ 0.00
Triangle 3	\$ 15.00	1	\$ 15.00	Triangle 3	\$ 15.00	0	\$ 0.00
Profit (10%)			\$ 19.00	Profit (10%)			\$ 13.50
Total Cost			\$ 209.00	Total Cost			\$ 148.50
Target Cost = 20% lower than Total cost			\$ 167.00				

Figure 3. Cost Sheet Template

SIMULATION TESTING

- Simulation was tested on 22 students in a studio entitled “Construction Project Formulation and Appraisal.”
- As a result of shared workspace, the hosting facilitators were able to observe the progress of each team on Google Slides as they played the simulation.

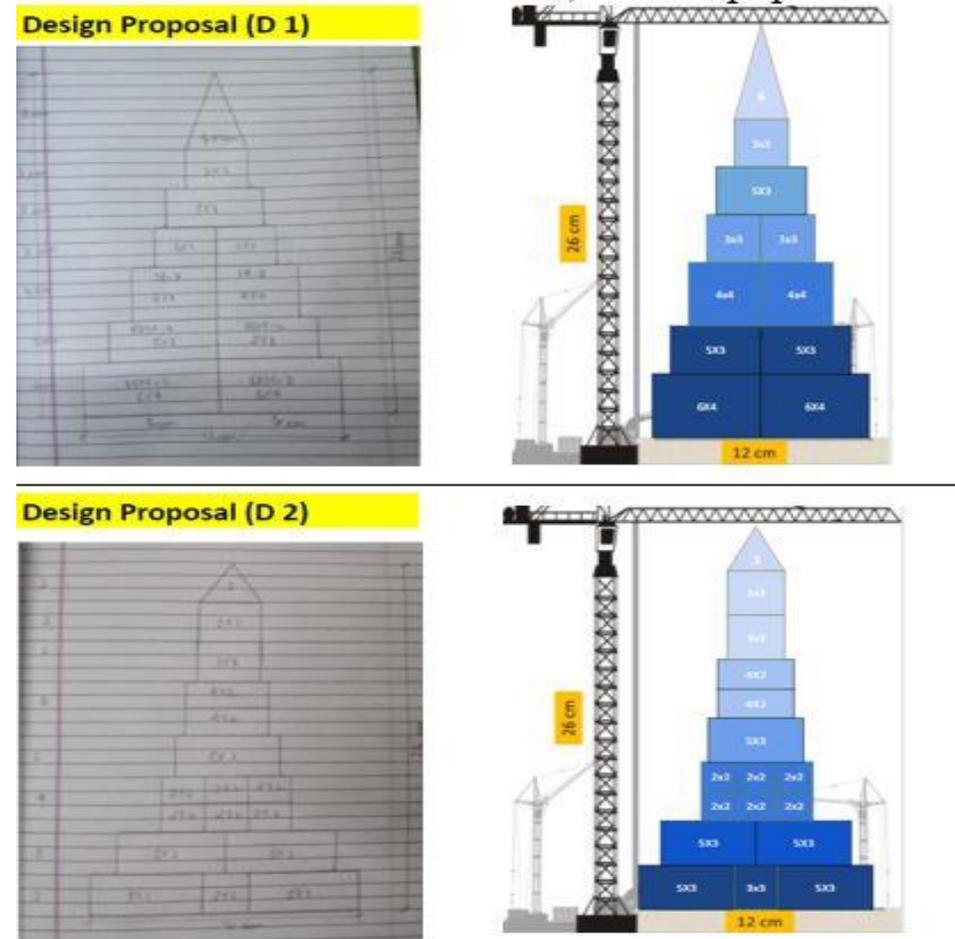


Figure 4. Designs prepared and actual towers constructed for Round 1 and Round 2

COST SHEET

	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6
Cost (C1)	278	218	248	248	215	209
Market Cost	236					
Allowable Cost	189					
Declared Target Cost	250	190	220	200	170	190
Average Target Cost	203					
Cost (C2)	230	173	194	194	176	149

Table 1. Comparative Cost Statement

All figures are in USD

POST SIMULATION DISCUSSION

The students were asked to rate various parameters in a survey form consisting of 23 questions in total explaining:

- A. Mutual respect and trust
- B. Mutual benefit and reward
- C. Collaborative innovation and decision making
- D. Early involvement of key partners
- E. Intensified planning
- F. Open communication
- G. Owner is an active member of the team
- H. Understanding the value of customer
- I. Continuous estimating and budgeting through collaboration among team members

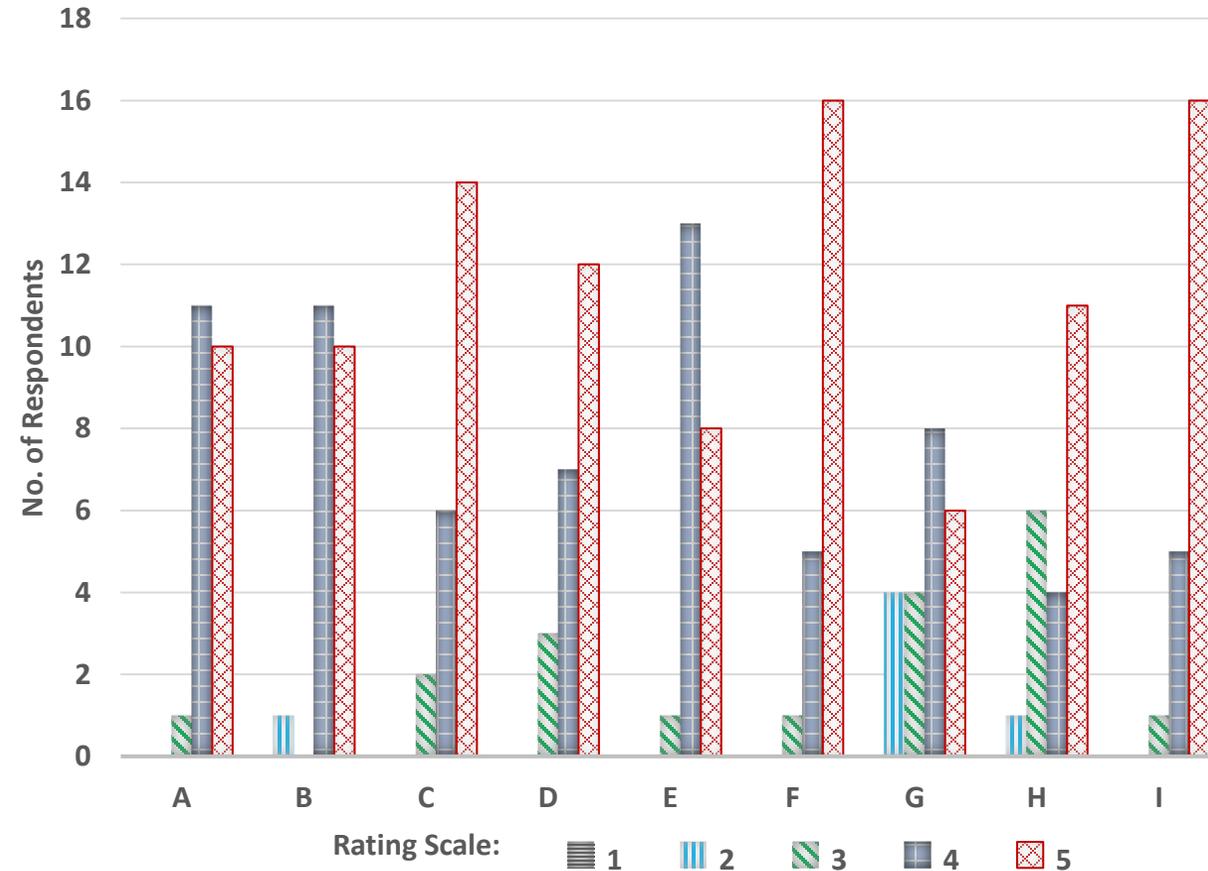


Figure 5. Histogram showing participant's response about the online TVD simulation

POST SIMULATION DISCUSSION

- It was observed that the students had developed an enhanced understanding of "collaborative innovation and decision making."
- Based on this discussion, it was evident that the simulation was effective in providing a first-hand experience of TVD concepts.
- The analysis of questionnaire responses indicates that the concept of "target costing" was understood by the participants.

CONCLUSIONS

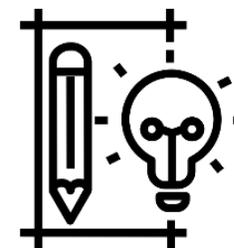
TVD promises monetary gains but also cultural shifts in terms of collaboration, transparency and teamwork.



Responses from players were positive and appeared to indicate that key concepts critical to an understanding of TVD were being imparted.



It serves as an effective replacement for the in-person simulation during the COVID-19 pandemic.





**THANK YOU FOR
YOUR ATTENTION!**

Q&A