

# Teaching Target Value Design: A Simulation

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# Introduction

- Target value design
  - Active involvement of client
  - Early involvement of the contractor in the design process
  - Collaboration between client, contractor, and client
- Utilization of TVD in the construction industry hinges on imparting hands-on knowledge to the young construction professionals
- This paper discusses the development and testing of a TVD simulation exercise at CEPT University, Ahmedabad in India

# Simulation Development

- Demand for construction managers in India
  - Offering masters level courses (Master of Technology – M.Tech.) in the domain of Construction Engineering and Management (MCEM)
- Development and testing of simulation
  - A studio course named “Construction Project Formulation and Appraisal” in MCEM Program at CEPT University
  - 24 students taking part in this studio
    - Comprising of engineers and architects, with / without prior work experience
    - 4 students in each student group playing role of designer, contractor and client
  - Instructors provided a list of potential projects to be appraised in this studio

# Simulation Development

- Development of simulation
  - Instructor has provided the formats for preparation of project brief and design brief
  - Each student group was instructed to select a specific portion of their construction project for the purpose of detailed design
  - Students were told to design either of the following: structural system, MEP system, and lighting system.

# Development of Design Option – D1

- Student playing the role of Client was instructed to develop a project brief for the selected component
- Developed project brief was communicated to the designer via email
- Email communication to the instructor, with an aim to understand the information flow among the team members
- Student playing the role of Designer has finalised the design brief in consultation with the Client members
  - Designer has developed the Design in 2D format (D1)
  - Noted the number of requests for information (RFI) sought and total duration of complete design
- Contractor team member estimated the cost of D1, this cost was named as market cost (C1)

# Development of Design Option – D2

- Involving collaborative working between these team members
  - Students were exposed to the concept of Target Value Design
- Instructors have decided to use the power of Building Information Modeling (BIM) for providing cost feedback during the design process (Nguyen et al., 2018)
- Involve BIM modelers in the preparation of D2
- BIM modeler was a new addition to the existing team, expected to play a passive role in the simulation exercise
  - Present during the process of development of D2 by showing visualisation of design changes suggested by the team and its effect on cost
- Students were instructed to keep the project brief and the design brief, prepared as part of Round – Round – 1, unchanged
- Each group of students was asked to communicate the time taken for the development of D2 and confirmation of D2 with the owner. The team has calculated the cost of D2, which is called the Actual Cost of Design (C2)
- Groups were asked to understand the difference between the market cost, target cost and the actual cost for their projects

# Simulation Testing

Table 1: Project component and detailed design component developed by the groups

S. No.	Project	Project Component	Detail Design Component
1.	Garment Factory, Ranoda	Design Studio	Lighting system and Mechanical ventilation system
2.	ITC Narmada	Hotel Room	Lighting system
3.	Redevelopment of Gandhinagar Railway Station	Meeting Room	Mechanical ventilation system
4.	Vadodara Mumbai Expressway	Toilet Block	Plumbing system
5.	Surat Metro Rail	Ticket Counter	Lighting system
6.	Aquatics Gallery, Science City	Aquarium Tank	Lighting system

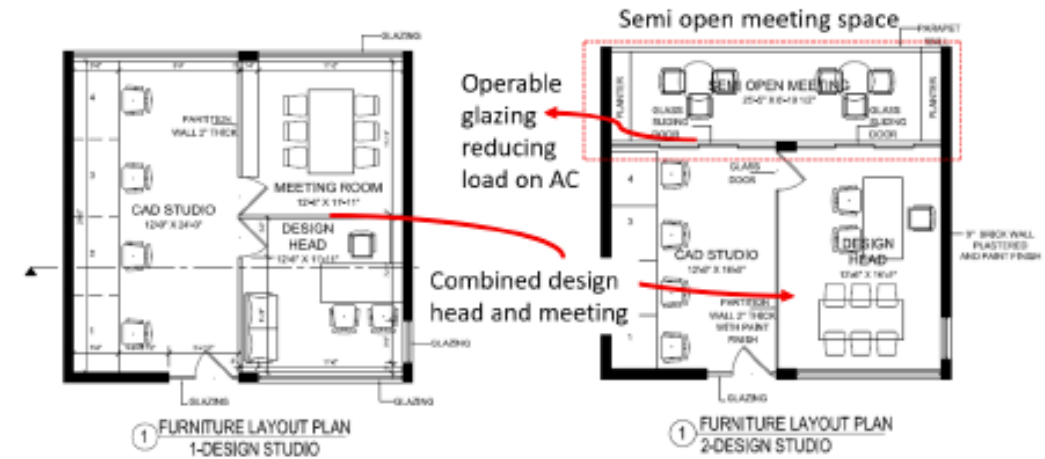


Figure 1: Comparison of Design Options D1 and D2 Garment Factory Project

Table 2: Types of change and the associated costs for the project component

S. No.	Project	Type of Change	Market Cost in USD (C1)	Target Cost in USD	Actual Cost in USD (C2)
1.	Garment Factory, Ranoda	Material Type Layout or space Specifications	16,353.09	13,082.94	13,499.59
2.	ITC Narmada	Material Type Layout or space	75,635.55	64,292.27	60,854.81
3.	Redevelopment of Gandhinagar Railway Station	Material Type Methods or Systems	49,371.29	41,965.59	39,114.97
4.	Vadodara Mumbai Expressway	Material Type Layout or space	11,123.53	10,011.17	9,086.18
5.	Surat Metro Rail	Material Type Layout or space Specifications	5,915.66	5,324.10	5,206.81
6.	Aquatics Gallery, Science City	Material Type Specifications	4,852.63	4,367.52	4,174.47

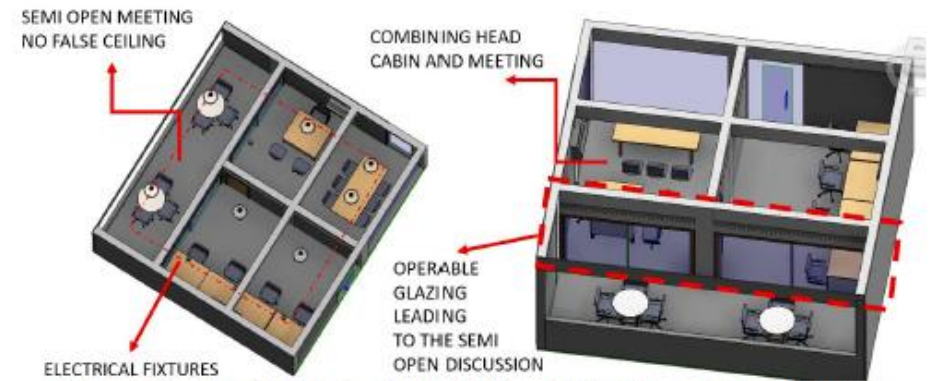


Figure 2: Revit model showing Design Option – D2 for Garment Factory Project



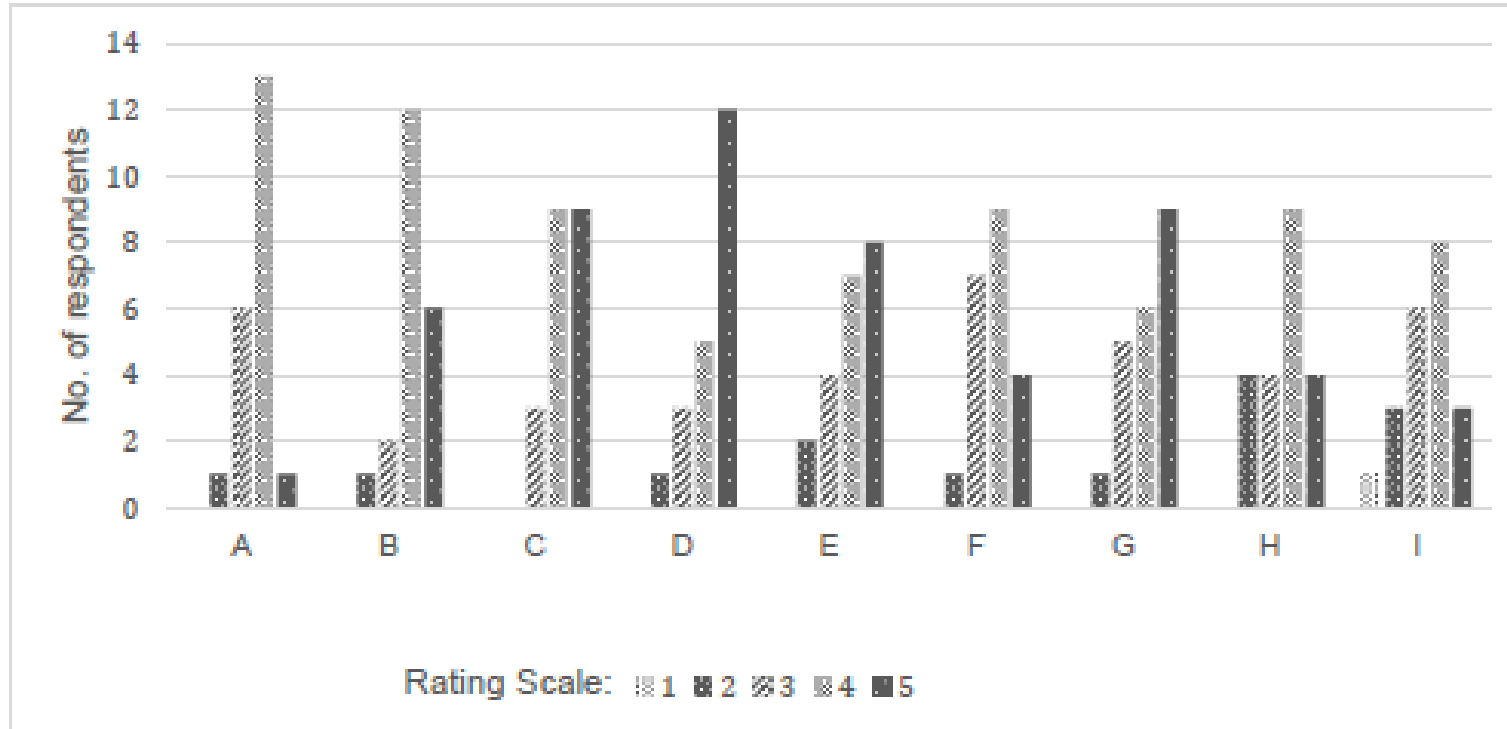


Figure 3: Histogram showing participant's response to questions about IPD

- A – Mutual respect and trust, B – Mutual benefit and reward,
- C – Collaborative innovation and decision making,
- D – Early involvement of key partners, E – Early goal definition
- F – Intensified planning, G – Open communication
- H – Appropriate technology, I - Organisation and leadership

## PARTICIPANT'S RESPONSE TO QUESTIONS ABOUT TVD

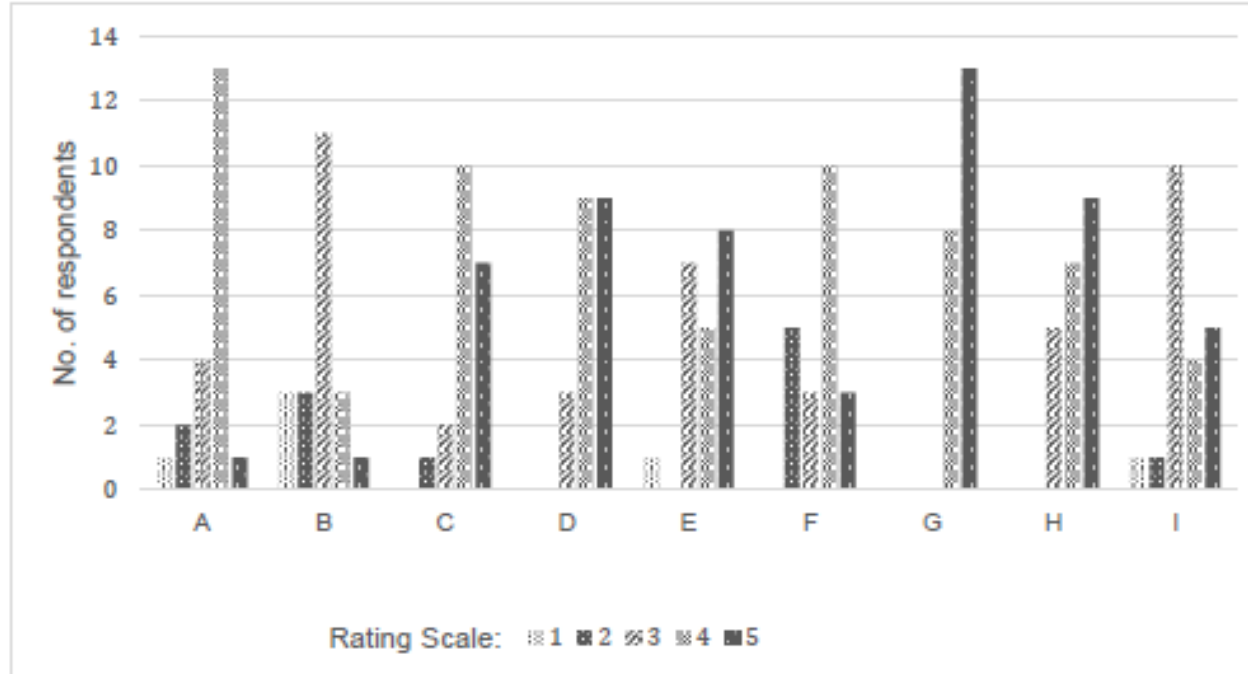


Figure 4: Histogram showing participant's response to questions about TVD

- A – Project business care and decisions, B – Feasibility study
- C – Client is an active member of the team
- D – Understanding the values of customer, E – Relational contract between parties
- F – Costs & schedule targets cannot be exceeded and only customer can change scope
- G – Continuous estimating & budgeting through collaboration among team members
- H – Frequent update of estimates among teams, I – Co-location

## PARTICIPANT'S RESPONSE TO QUESTIONS ABOUT BIM

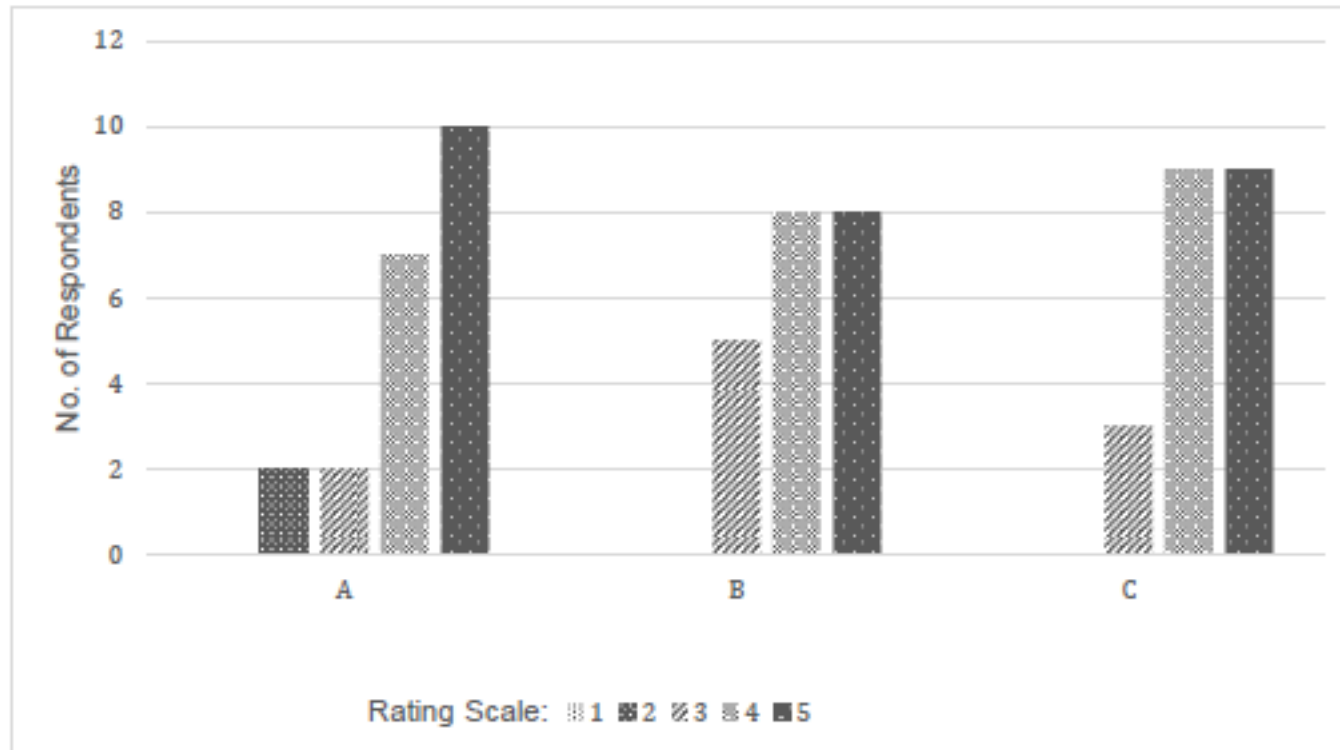


Figure 5: Histogram showing participant's response to questions about BIM

A – BIM in developing D2, B – Role of BIM modeler in the design process

C – BIM in providing rapid cost feedback while developing multiple design alternatives

# Conclusion

- Simulation exercise
  - Useful to the students in imparting hands-on knowledge on working in the environment envisaged in TVD, as well as benefits by this innovative Lean tool
- Involving BIM modeler in the design process, which not only tries to depict the revamped cost feedback process, as discussed by (Nguyen et al. 2018) but also simulates TVD experience of the real-life project in the classroom environment
- Exercise can be further developed and improved by including more number of construction systems in the detailed design, as well as standardizing some of the design components