



## Project Summary

### Organization:

Tata Consulting Engineers

### Solution:

Land Development

### Location:

Dharampur, Gujarat, India

### Project Objective:

- Utilize innovative technologies to support conceptual design of an INR 1.8 billion ashram and surrounding infrastructure, ensuring ecological preservation for over a century.
- Optimize project delivery, operations, and maintenance costs of site facilities.
- Sync engineering and spirituality to ensure the completed development embraces the sanctity and principles of a religious culture.

### Products used:

MicroStation®, Bentley Map®, GEOPAK, InRoads®, MXROAD®, Bentley PowerCivil for India, STAAD®, and Haestad

## Fast Facts

- The digital terrain models produced using Bentley 3D technology facilitated optioneering and sustainable solutions for a site with significant sloping terrain and topographical challenges.
- Using Bentley's interoperable software applications in a collaborative 3D environment ensured seamless information mobility among all stakeholders, enabling TCE to integrate engineering with the client's spiritual aspirations.

## ROI

- Collaborative modeling, as well as Bentley's road and site design applications, enabled the team to create 3D presentations for the client contributing to almost 40 percent reduction in project costs.
- Using Bentley's civil design software to perform cost benefit analysis to arrive at the best-fit solutions significantly minimized operation and maintenance costs of the facilities.
- TCE delivered an optimal land development plan using Bentley technology to overcome terrain challenges, preserve ecology, and maximize energy efficiency and space utilization.

# Tata Consulting Engineers Provides Scalable Terrain Models to Propel Land Development and Infrastructure Plan for 223-acre Spiritual Center

Bentley Software Delivers Cost-effective Solutions for an Integrated, Sustainable Ashram

## A Non-traditional Engineering Project

Shrimad Rahchandra Mission (SRM) Committee retained Tata Consulting Engineers (TCE), a leading Indian engineering and consulting firm, to design an ashram and surrounding infrastructure to serve as the mission's international headquarters for a place of cultural activity and religious study. The INR 1.8 billion project required TCE to provide a master land development and infrastructure plan for a 223-acre spiritual complex that would be sustainable for over 100 years. To ensure an engineering and design approach consistent with the SRM movement, TCE had to understand the principles and practices of Jainism and the operations of its spiritual hermitage, the ashram. "We went over there, sat with them, meditated with them, and realized that this is not a traditional planning, engineering, or architectural project. They want something different—something that is alive and unique," explained Sandeep Zade, assistant general manager at TCE.

The proposed spiritual complex included a temple, a meditation center with seating capacity for 5,000 people, a lake and amphitheater, a museum, library, classrooms, a welcome center, and a specially designated area for large gatherings of over 15,000 people, in addition to a dining hall capable of serving 6,000 guests at a time. On-site studio apartments and one-, two-, and three-BHK residences and villas serve as accommodations at the ashram to suit every budget and need of its guests. With a 5.57 million total square-foot build area to be designed on sloping terrain to accommodate large visitor capacities, and operate at maximum energy efficiency, TCE relied on Bentley site analysis and design software to meet these challenges, the ecological constraints, and unique spiritual demands for this ashram development project.

## 3D Visualization Facilitates Optioneering

The land development site posed topographical limitations being hemmed in by valleys with slopes ranging between five and 35 percent, and an elevation difference of 80 meters. To determine the workable space of the site, TCE performed a slope analysis of the area using Bentley PowerCivil for India. Explained Zade, "We used Bentley PowerCivil to generate 3D digital terrain models and determined that only 30 percent of the area is workable."

Having identified a constructable area, TCE was now faced with effectively utilizing the terrain slope for the placement of the utilities, roads, and buildings. The ashram had to be designed to preserve the existing ecology, minimize noise, ensure zero water discharge, and provide effective solid waste management and eliminate construction waste. It also had to accommodate pedestrian traffic of up to 8,000 visitors daily while considering constraints for elderly accessibility.

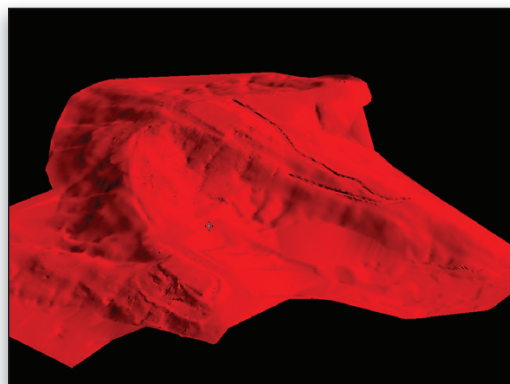
Using Bentley's 3D technology, TCE gathered data, produced models, performed clash detection and analysis, and delivered conceptual, schematic, and detailed designs to the SRM

Committee as 3D visualizations to determine cost-effective, organic options for development.

## Collaborative Modeling Provides Sustainable Site Solutions

Creating 3D digital terrain models with Bentley PowerCivil for India was essential to accommodate the steep slopes for building, road, and utility placement. With Bentley site planning and analysis applications, TCE utilized the sloping terrain effectively, fitting the buildings within the ridges of the elevated site. The team

analyzed sun path, wind direction, and noise to maximize ventilation, optimize energy efficiency, and ensure a tranquil environment consistent with that of an ashram.



*Utility and infrastructure planning was challenging due to the site's steep and varying slopes and the need to preserve the existing ecology.*

*“Bentley provided the tools necessary for 3D detailed design of our project data, which was effective and well-coordinated.”*

— Sandeep Zade, Assistant General Manager, Tata Consulting Engineers, Ltd.

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Using MXROAD, TCE developed an intelligent model that considered access and connecting roads for travel to and within the region, vehicle, cyclist, and pedestrian traffic and travel patterns within the ashram site—especially for the elderly—and capacity to sustain travel demands for future needs during peak season and ashram spiritual events. The software enabled the team to successfully design the roads amid the sloping site to avoid the retaining structures.

With Bentley civil design software TCE performed accurate cut fill volume analysis for site grading, optimized the retaining wall design, and ensured effective utilization of the excavated materials within the site, eliminating construction waste. The team identified the on-site dumping ground for .4 million cubic meters of excavated soil and then converted the dumping ground to an open ground theater with a capacity for 15,000 people.

Bentley’s integrated 3D technology provided TCE the tools to use the organic nature of the terrain to facilitate an integrated and sustainable utility infrastructure established relative to the core structural and civil components, while reducing the environmental footprint. Using Bentley’s Haestad products, the team gathered and analyzed data for natural sewerage and effective solid waste management. The natural slope was effectively utilized for the entire decentralized sewerage network. With a proposed zero water discharge budget for the project, TCE designed a sustainable stormwater system without disturbing the terrain, and implemented watershed to manage the flow of water using digital terrain models and catchment area delineation in PowerCivil to identify drainage patterns. “We clearly marked our catchment delineation at the right particular spot by using the drainage tools in PowerCivil,” said Zade.

### **Syncing Engineering with Spirituality**

TCE performed detailed studies of environmental impact to maintain the site as natural as possible, and to keep everything alive, preserving ecology, consistent with Jain tradition and the client’s demands. The team incorporated aspects of spirituality into their designs, and using Bentley applications to create collaborative digital terrain models, shared their development plan visually with the SRM Committee and stakeholders. The seamless flow of data in user-friendly formats enhanced information mobility and workflow processes to make optimal informed choices about current and future uses of the land.



*Sustainability, ease of use, and accessibility to the elderly were key considerations in the layout of the INR 1.8 billion ashram.*

The interoperability of Bentley software allowed TCE to create a sustainable master plan balancing infrastructure design and engineering with the aesthetic and religious requirements of an ashram. With effective tools to facilitate interaction and negotiations among TCE, spiritual leaders, stakeholders, and decision makers, the project team successfully integrated engineering with spirituality while optimizing planning, development, and management of the project area.

### **Bentley Software Drives ROI**

With the entire expense of this project being bared by devotees, some whom are indigent, the project team needed to optimize cost savings without compromising quality. Advanced 3D modeling, seamless collaboration, and effective coordination were essential in reducing project costs and saving time. TCE used MicroStation, Bentley Map, GEOPAK, InRoads, MXROAD, STAAD, and Haestad products to perform cost-benefit analysis and determine the best design solutions to ensure efficient management and operations to minimize costs. The ability to visualize models and drawings in a collaborative 3D environment saved significant costs for the retaining wall and site grading. Bentley 3D technology enabled TCE to deliver the development project at a cost savings of nearly 40 percent. Commented Zade, “We understood and considered the aspirations of [SRM], and 100 percent of the design was done using Bentley software.”