INVICUS Engineering

Civil Infrastructure Design

Bangalore - Houston - Austin - West Palm Beach, USA

Invicus India is a multi faceted corporation, headquartered in Bangalore, India with offices in Houston, Austin and West Palm Beach, USA.

Our infrastructure and management-consulting arm, specializes in developing effective engineering solutions for the civil infrastructure industry in the United States and in India.

We are a client-oriented firm with a strong commitment to satisfying the unique needs of the client. Our success and growth are a reflection of our dedication to providing a quality and timely solution.

Today's engineering demands multidisciplinary skills and sensitivity to the environment and the communities it impacts.

Invicus epitomizes all those qualities and strives to make this universe that we all share a better place to live in.

Through our in-house consultants and strategic alliance partners, we provide technical expertise in the areas of:

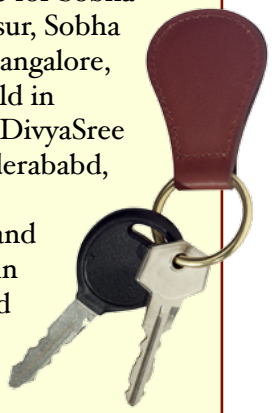
- Civil Infrastructure Planning, Design & Management
- Real Estate Development & Land Planning for Residential, Commercial, Mixed use, IT Parks, SEZs and Hybrid facilities; Urban Planning & Highway Engineering
- Transportation Facility Planning & Design; Traffic and Pavement Engineering
- Hydrological & Hydraulic Investigations
- General Civil Engineering & Project, Program and Construction Management

Unlock Value

Invicus' list of clients is testimony to the reputation that it has built over the past years.

India's most respected names in the real estate industry including Sobha, Prestige, DivyaSree, Epsilon, Sterling, Raheja and Mantri, to name a few have used Invicus' planning, design and management capabilities to deliver world class projects.

Invicus has delivered the infrastructure for Sobha City in Thrissur, Sobha Lifestyle in Bangalore, Sobha Emerald in Coimbatore, DivyaSree Orion in Hyderababd, DivyaSree Technopark and Technopolis in Bangalore and Prestige Tech Park, Bangalore among others.



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Civil Infrastructure Services

TYPICAL SCOPE OF ENGAGEMENT

Responsibility. Invicus provides planning and design services for the civil infrastructure component of Real Estate projects. Invicus' scope of services includes:

Conceptual Engineering Plan – Paving, Grading, and Drainage Plans. Invicus performs engineering calculations for evaluating pre and post development conditions and design the required drainage requirements based on the criteria of the local and state regulatory agencies, and water distribution and wastewater services. Invicus evaluates the existing utilities related to water and sewer connections in the vicinity of the proposed project.

Construction Plans, Specifications and Estimates. Based on the Client-approved and municipality-approved final site plan, Invicus designs and prepares construction plans and cost estimates for the on-site paving, grading, drainage, water distribution system, wastewater collection system, electrical systems, telecommunication networks, traffic signage and pavement markings and erosion control (landscaped areas) for the proposed facility. The plans will meet the requirements of international standards keeping in perspective the requirements of the local municipalities and the relevant permitting agencies.

Project Program and Construction Management. Invicus brings global best practices including project scope, schedule and cost controls ensuring best value to the client.

Local Agency Review Meetings. Invicus works closely with the client and all the stakeholders to facilitate communication during the planning and design phase. This process will minimize potential problems that could arise during construction.

INVICUS' SCOPE OF PRELIMINARY & DETAILED DESIGN

REPRESENTATIVE PROJECTS

- DivyaSree Orion, Hyderabad
- DivyaSree TechnoPark
- DivyaSree Technopolis
- Sobha City, Kerala
- Sobha Lifestyle
- Sobha Emerald, Coimbatore
- Prestige Exora
- Pretsige Valdel
- Vittal Mallya Road
- Mantri Varthur
- Mantri Agara
- Mantri Sun
- Sterling Villa Grande
- Sterling Gera Residences
- Advantage Raheja, J W Marriott, Bangalore
- Advantage Raheja Resort, Kerala
- Patel Realty, Neo Town
- Epsilon, Bangalore

INTERSTATE 10 KATY FREEWAY RECONSTRUCTION PROGRAM, TEXAS, USA

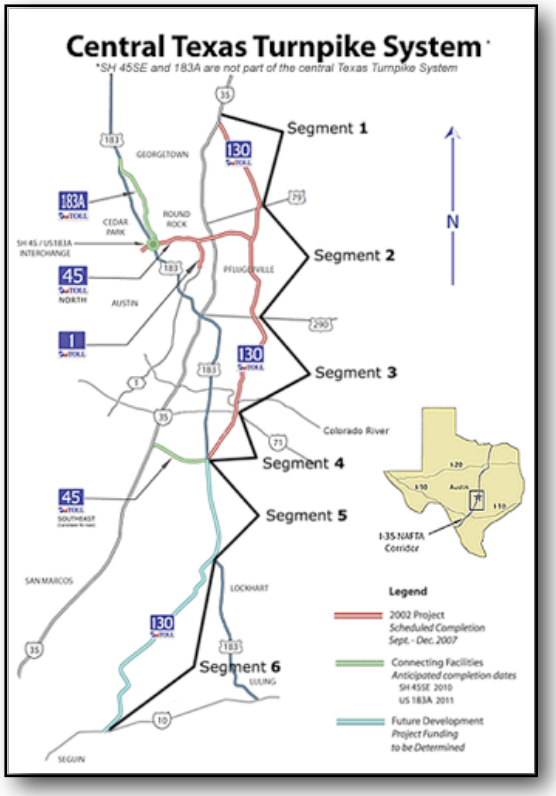
The USD 1.7 Billion, IH 10 Katy Freeway reconstruction project is a landmark project for the Houston district of TxDOT and involves the widening of Interstate 10 from its existing condition to a 22-lane facility with an 8 to 12 lane divided highway, 4 managed lanes to be used as HOT lanes (High Occupancy and/or Toll) and 3 to 4 lane frontage roads in each direction. The project includes 22 miles of urban freeway with 2 fully directional interchanges and 52 grade separations. The existing reversible HOV lane has been replaced with a 4- lane managed facility.

As a member of the program management team with Parsons Brinckerhoff, our consultants have been providing program management, roadway design and CADD support services. Program management functions have included development of the program management plan, schematic advancement, project kickoffs, design concept conferences, section design oversight and inter agency coordination. Providing roadway design support to the team, our consultants have been involved with roadway & drainage design, development of corridor wide design criteria and standards, redesign of the Beltway 8 interchange, development of overall traffic control concepts, design reviews at milestone submittals, CADD criteria development, electronic document control and file management and PS&E development. On the CADD front, our consultants have been providing Microstation and Geopak expertise, with one of our senior consultants serving as the corridor wide CADD Manager. In the construction phase, our consultants have provided construction management support in the areas of schedule updates, development and implementation of Request for Information (RFI) and Change Order processes, review of shop drawings, construction oversight and supervision, utility coordination and management and maintenance and updates of as-built drawings.

SH 130 TOLL ROAD, TEXAS, USA

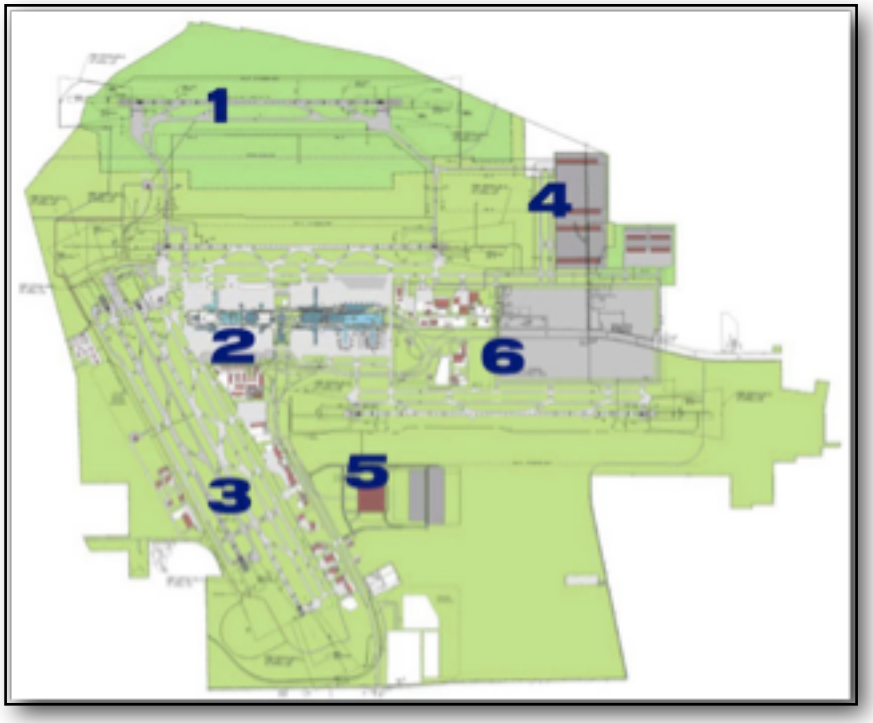
The USD 1.1 Billion, SH 130 Program consists of a 91 mile long fully access controlled, grade separated tollway facility. As Central Texas has grown, so has its traffic congestion. SH 130, a project of the Texas Department of Transportation, is intended to relieve traffic in the area by creating a commuter and NAFTA corridor alternative to Interstate 35 (I-35). When completed, SH 130 will extend from north of Georgetown east of metropolitan Austin to I-10 near Seguin.

Lone Star Infrastructure is a consortium of engineering and construction firms with world-wide experience specifically organized to deliver SH 130. Organized as a joint venture between Fluor Corporation, Balfour Beatty Construction and T.J. Lambrecht Co., the LSI team includes more than a dozen firms who are leaders in their fields of design engineering, utility relocation, public outreach and environmental planning, all of whom are committed to the successful completion of SH 130. IndAus Infra, through its parent company The Menon Consortium, is playing a vital role in the design of the project.



AIRSIDE IMPROVEMENTS PROGRAM, GEORGE BUSH INTERCONTINENTAL AIRPORT, HOUSTAN, TEXAS, USA

Conceptual Design of Appurtenances for 8L-26R Runway Alternatives. Appurtenances include A.O.A. perimeter fence, perimeter roads, service roads, determination of developable infield area using tower sidelines and Part 77 contours, access roads, taxiway bridges, utility corridor, location of ARFF and Airfield Ground Maintenance facilities, demolition of existing structures, utilities and infrastructure and area requiring clearing and grubbing.

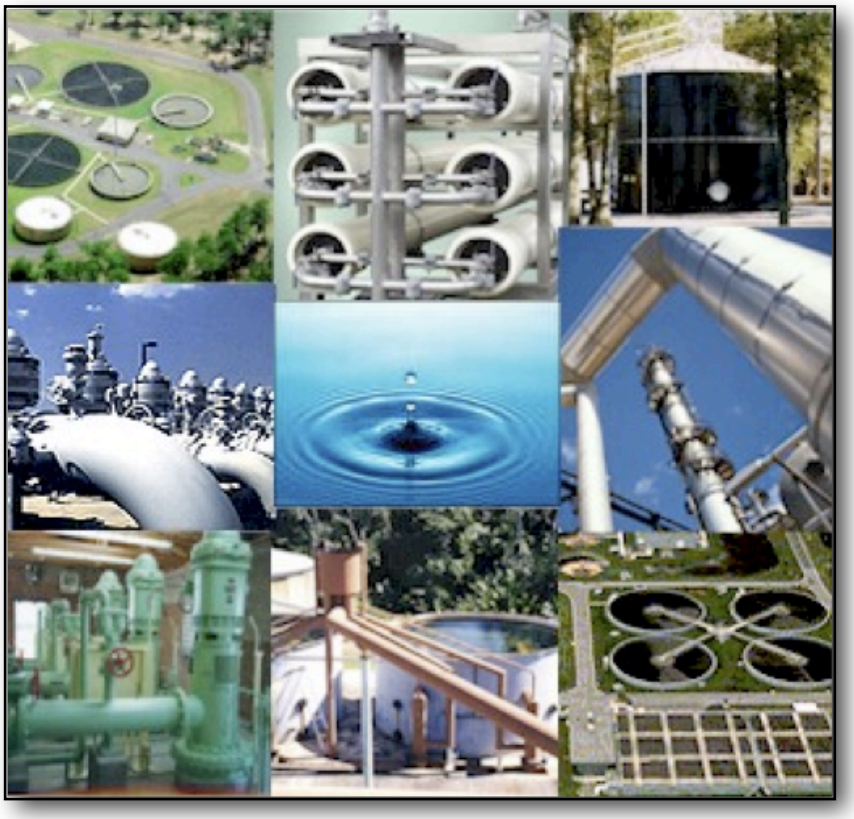


Design for the construction of new pavement for the Terminal E Ramp and upgrading the former Terminal C Southeast Ramp. The project involves installation of the fueling system (fuel lines, fuel pits, EFSO System) to serve the new Terminal "E" gates, 15,000 linear feet of 18" and 24" RCP storm sewer system and 11,000 linear feet of ¾" and 2" waterlines. The project also involves construction of new environmental station and approximately 166,000 SY of 17" concrete pavement for relocation of Southeast "C" Taxi lane and Terminal "E" apron.

GREATER HOUSTAN WASTEWATER PROGRAM, HOUSTAN, TEXAS, USA

The Greater Houston Wastewater Program (GHWP) was a five-year $1.2 billion project to control wet weather overflows in the City's sanitary sewer system. Houston's wastewater system is one of the largest in the nation, with 43 wastewater treatment plants, 5,600 miles of sewers and 320 lift stations.

Involved in all aspects of the program including project management, design management, environmental engineering and permitting support, comprehensive program management, cost-savings analysis, detailed design and construction management. The sewer rehabilitation component of the program was the largest sewer rehabilitation effort in the United States at the time. The work included conceptual design of relief and rehabilitation projects ranging from open cut to deep tunnels, slip lining, cured-in-place, deform/reform and pipe-bursting techniques. Over 150,000 feet of new sewer installed by micro tunneling was also completed in the course of the work. The development of design guidelines for underground construction to ensure standardization of designs being prepared by the design sub consultants was also accomplished. Construction Management on the program also required resource planning to optimize the capacity of available contractors (both prime, sub and minority sub) to successfully complete the work. At the peak the Program management team consisted of more than 300 staff from the City and consultants working in an integrated organization.

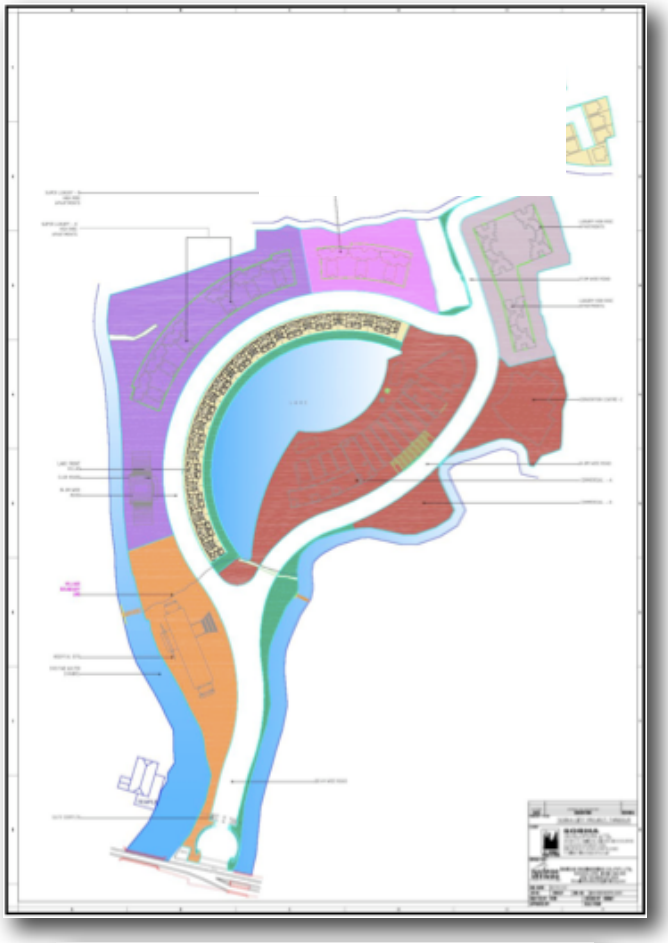


SOBHA CITY, THRISSUR

Sobha is a 55 acre mixed use community in Trichur Kerala. Invicus was tasked with designing the entire civil infrastructure for the project.

Invicus designed a 6 acre water detention facility, fed by the storm runoff from the development, that catered to the potable water requirements of the community, making it self sufficient.

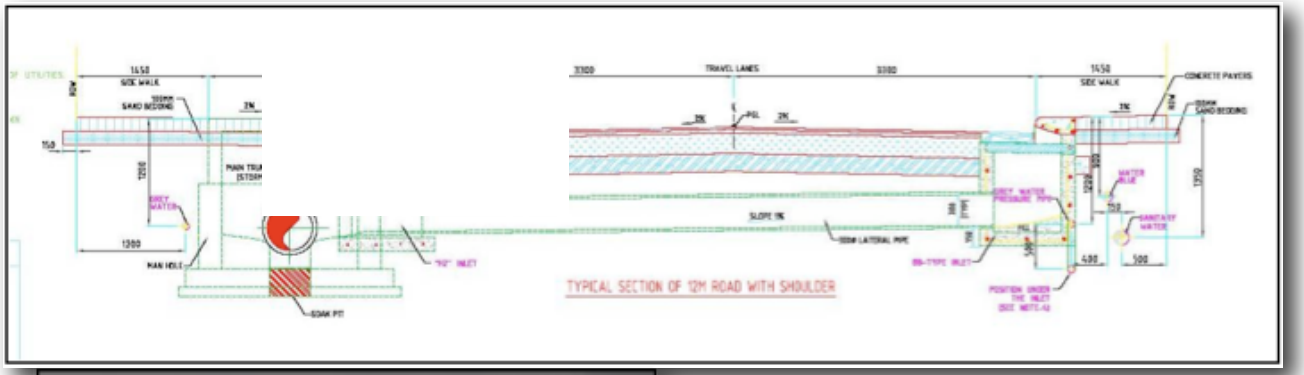
All the roads and utility systems were modeled and designed to international standards.



SOBHA LIFESTYLE

This 164 villa community nestled in Devanahalli on 59 acres falls in Sobha's presidential segment. Invicus has designed the infrastructure to international standards including a 15 million liter holding tank to serve the water requirements of the community from harvested rain water.

Invicus' storm sewer system design to international standards afforded the client a savings in cost and execution time.




Driveway with back drop of Nandi Hills


Driveway

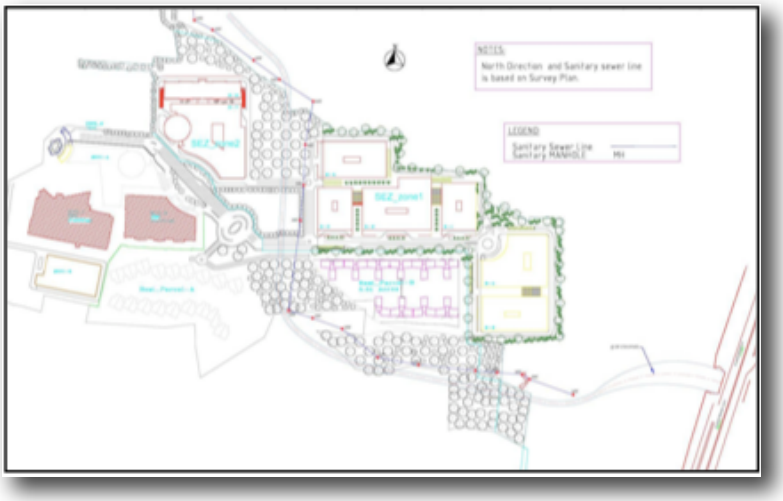

Underground Water Storage Tank


Villa Exterior

DIVYASREE TECHNOPOLIS

DivyaSree Technopolis is a 25 acre Special Economic Zone (SEZ) located in Marathahali Bangalore.

Invicus was tasked with modeling the flow through the channel bisecting the property and connecting the Doddanekkundi reservoir to the Varthur lake. Invicus used state of the art modeling techniques, using the Army Corps of Engineers' River Analysis System, to come up with a unique solution that would maintain a safe passage for the flow and insulate the property from potential flooding.



DIVYASREE TECHNOPARK

DivyaSree Technopark is a 6 million Sft. Commercial enclave built over an area of 55 acres. Invicus Engineering was tasked with designing the entire civil infrastructure including the roads, storm systems, sanitary systems and other pertinent utilities.

Invicus' storm sewer system design to international standards afforded the client a savings in cost and execution time.

VITTAL MALLYA ROAD

A first of its kind model road designed by Invicus. Vittal Mallya Road is the most prestigious landmark in Bangalore today. Designed to international standards with a one foot thick continuously reinforced concrete pavement with a life of 20 years, the road has utility ducts, spare crossings, specially-abled pedestrian ramps, comprehensive storm water drainage system and for the first time a consistent width carriageway.

COST EFFECTIVE DESIGN

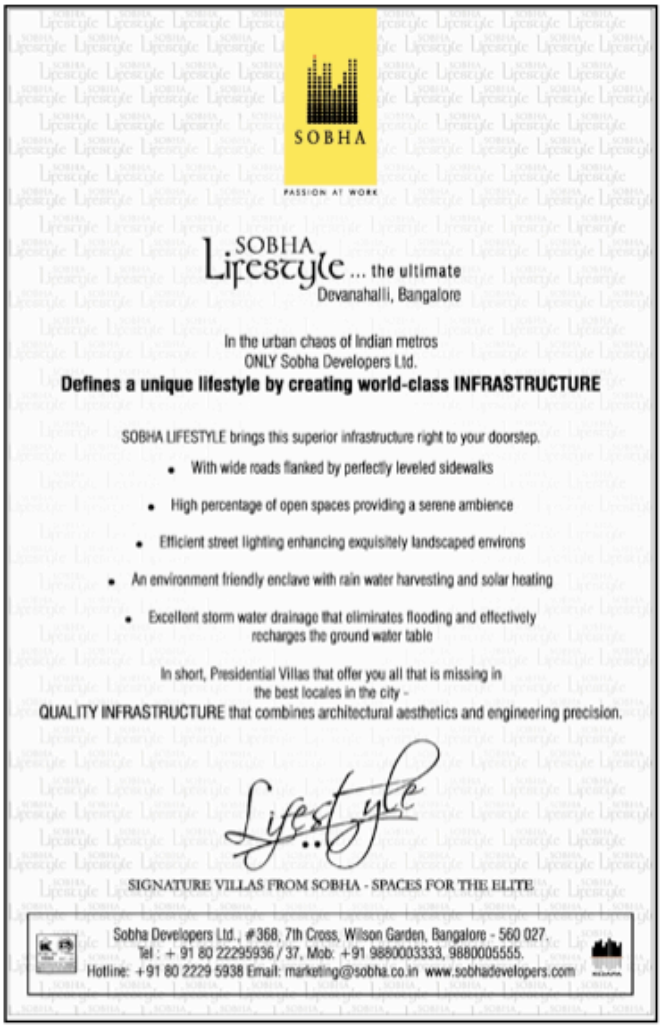
Value Engineering, is a practice that Invicus engineers follow on a day to day basis on every project. Every design goes through a rigorous process of modeling for system optimization, cost control, degree of construction difficulty and ultimately a cost to benefit analysis. A few examples of value engineering, amongst many others, that yielded a direct benefit to the client are cited below.

1. At DivyaSree Orion, spread over 45 acres on a rocky outcrop in Hyderabad, the previous designer had suggested a significant amount of rock blasting to locate all the utility systems. After a reconnaissance, Invicus engineers determined that an over ground storm sewer system and subsequent utility network could be designed by studying the hydraulics carefully. The system was designed using Houstorm, a state of the art storm water modeling software, and optimized to ensure minimal amount of localized blasting. The project was completed in record time with the utility ducts also being concealed beautifully without rock blasting. Since the client had an existing temporary setup for a client at the premises, this proved to be a significant benefit.

2. At Sobha Lifestyle, 11 bore wells drilled to an average depth of 1100 ft had yields varying from zero to 1.5 inches. This called for drastic rain water harvesting measures as the cost of tanker water would lead to spiraling maintenance costs. Invicus engineered a unique solution using state of the art hydrological and hydraulic modeling software to create a optimized storm water network and a 15 Million liter holding tank.The benefit to cost on the system was so significant that it would pay for itself in 1 year.

3. At Sobha City, the 6.5 acre engineered manmade lake has a capacity of 240 million liters. While the client mandated that the water needed to be used for potable water requirements due to the lack of a municipal connection, they also required the lake to be aesthetically pleasing. While many local hydrologists suggested a balancing lake, Invicus engineers suggested a study of the ground profile. Analyzing the data from the boring log, Invicus engineers were convinced that a balancing lake was not necessary due to the presence of an unconfined aquifer at 8 meters. Excavators hit the unconfined aquifer and the lake replenished itself automatically, eliminating the need for a balancing lake and saving the client several crores of real estate, construction cost and time.

4. At Patel Neotown, Invicus engineers modeled the storm water system using Houstorm, and reduced the number of inlets (catch basins) from 900, suggested by another consultant, to 84 for a 120 acre campus.



PROJECT APPROACH

Engineering a project to suit the clients needs while ensuring value addition using sound engineering principles has been Invicus' core philosophy. Something as simple as the water story, scripted correctly can ensure that every drop of water is conserved, while ensuring that water securitization for the township is achieved and flooding is mitigated. Roads systems designed using international standards can ensure harmony and balance between pedestrians and commuters alike, while enhancing the livability within the community.

Invicus will use state of the art modeling software to model every aspect of civil infrastructure leaving very little to thumb rules and guesswork. Every design is backed up by sound engineering judgement, will results in a cost effective solution to the client.

As the Principal in Charge, Mr. Menon will bring his 20 years of international experience as the head of a Rs. 10,000 Crore highway program and a Rs. 250 crore runway expansion program, in addition to tens of projects in land development, urban street design and civil infrastructure to bear on this project. Being a registered professional engineer in the United States, Mr. Menon's sense of professionalism, accountability and responsibility in meeting the unique needs of the client, has percolated down to the entire organization.

1. Our work begins from analyzing the topographical survey to leverage the natural contours while mitigating flooding, to analyzing the boring logs for soil characteristics.

2. We will study the external influences of the lake and adjacent properties to mitigate any ill effects of flooding within the township. We will optimize the storm water network within to create a cost effective that will never flood.

3. Invicus will analyze the external and internal traffic patterns to ensure smooth entry and egress from the township and analyze the internal circulation patters to manage driver expectations and create smooth flows through effective sight distance analyses.

4. The Water story will script the total water requirement of the community and create an optimal system that will ensure water security to the extent possible while minimizing the viability gap.

5. Looking into the future, all utilities shall be planned to minimize the network length while spare ducts and road crossings will ensure scalability with minimal conflicts. Conflict resolution of utilities will ensure smooth construction progress.

6. An international look and feel will be developed for the entire infrastructure especially the roads, sidewalks and utilities, using international standards and specifications that have been adapted to Indian conditions. These have been time tested here in Bangalore and improvised where necessary.

7. Something as simple as signing and pavements markings will be developed to ensure that commuters and pedestrians alike can find their way around the township easily. Standardization of the signage to international specifications will give the community an international look and feel. Both Vittal Mallya Road and Sobha Lifestyle are live examples of Invicus' commitment to quality engineering.

8. Through effective coordination among all the consultants, standardization of the specifications and comprehensive but easy to read plans, the client will benefit from zero delays, value engineered solutions, effective cost control and a final product that will have the look and feel of an international community.