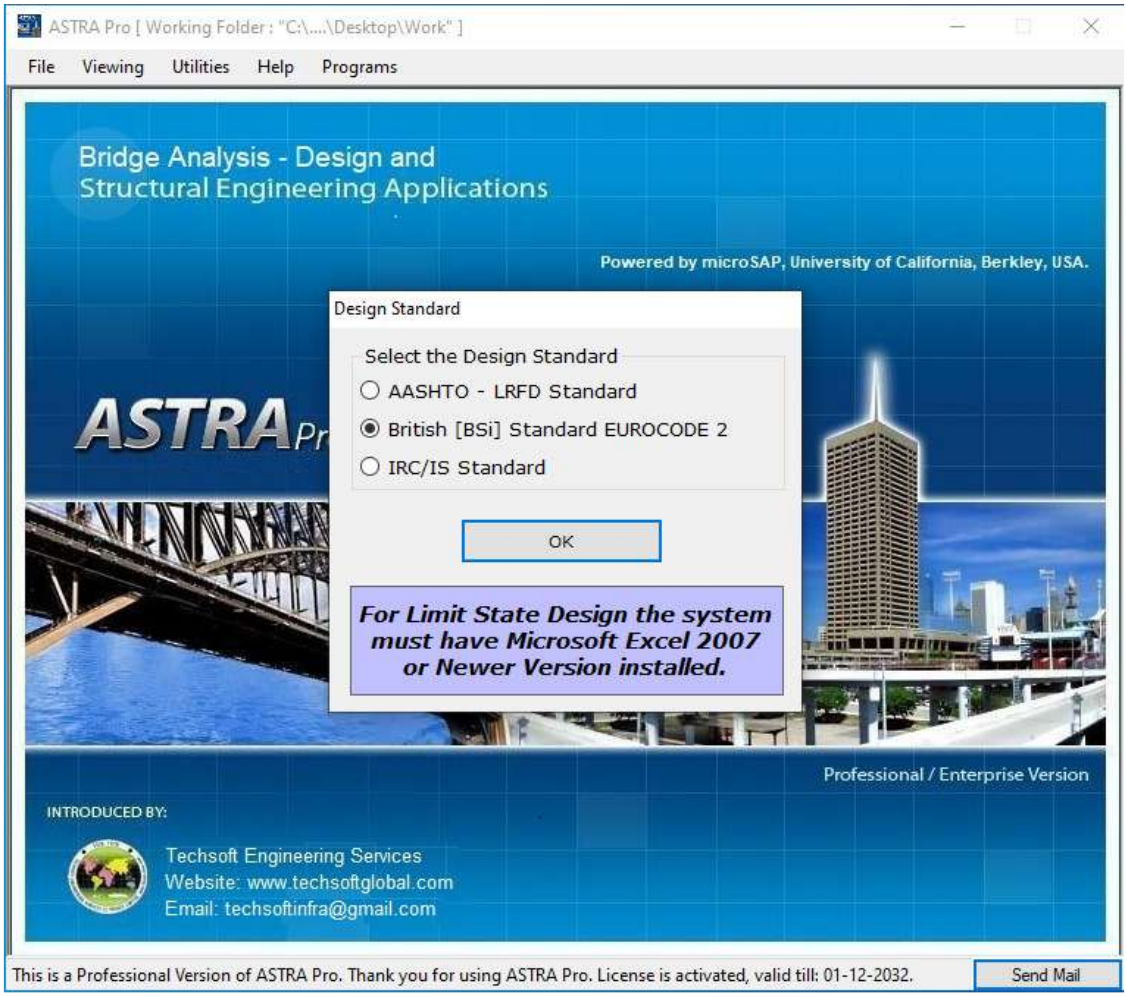
ASTRA Pro®

The versatile 'Bridge and Structure Design Software' featuring structural analysis and design of various Bridges with sample editable detail CAD drawings/MS-Excel Worksheet Detail Design Reports for Superstructure, Substructures, Foundations, Culverts, Box-Pushed Underpasses with Fixed Load, Moving Vehicle Live Load & Seismic Load etc. Analysis and Design of RE Wall, RCC Tunnel Lining with Portal and Ribs and RCC Framed Buildings, BoQ etc. Stream Hydrology, Synthetic Unit Hydrograph, Hydrological analysis. The options are available to select the design standard as AASHTO LRFD, BS/Eurocode2 and BD 37/01 with HA & HB Live Load, and IRC 112 and IRC 6 Class Live Load combinations, Deck Slab Design with Transverse Analysis by Effective Width method, Grillage Model Analysis for Bridge Deck-Girder, Load-Deflection Stage Analysis for Bridge Rating, Dynamic analysis and Orthotropic analysis with GUI based modeling.

[Operating Systems: Microsoft Windows Win10/11 with 32/64 Bit, Minimum 4 GB RAM, 100 GB HD Space]



In Bridge Engineering various software products are available in the market, but the uniqueness of ASTRA Pro lies in its simplicity for applications of Grillage Analysis and Transverse Analysis of Bridge Deck Superstructure with moving vehicle Live Load, by effective width method. ASTRA Pro has its own powerful CAD engine making drawings compatible to AutoCAD and is best appreciated for its Features, Completeness, Versatility, Fast Processing, Simplicity, Formatted detail report.

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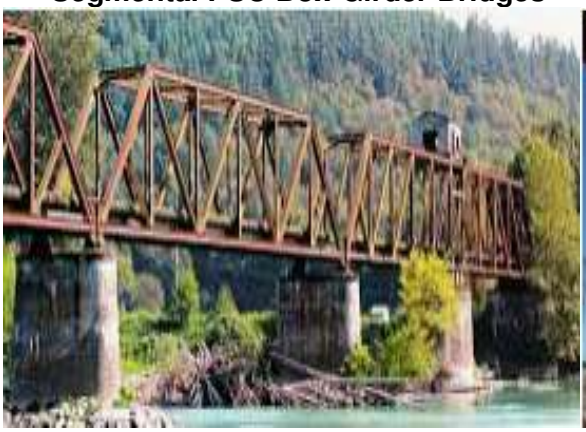
ASTRA Pro - Ultimate software for Bridge Engineering applications

RCC T-Girder Bridges

PSC I-Girder Bridges

Segmental PSC Box-Girder Bridges

Balanced Cantilever Bridges



Steel Truss Bridges

Composite Bridges

Long-Span Cable Suspension Bridges

Long-Span Cable Stayed & Extra dosed Bridges

Our highly demanded software product ASTRA Pro is distributed as **Professional License** on Personal Name and as **Enterprise License** on Organization's Name, with different Terms and conditions. Each License has three versions as below:

i. **Standard Version** with Analyses, Design of various Bridges and a set of sample editable CAD Drawngs,
ii. **Express version** with Analysis, Design of various Bridges & Structures and a set of sample editable CAD Drawngs,
iii. **Premium Version** with Analysis, Design of various Bridges, Structures, Bridge Geometry in straight and curved alignments, Balanced Cantilever Bridge and a set of sample editable CAD Drawings.

Interested users are requested to download, install software ASTRA Pro from our web site www.techsoftglobal.com and evaluate the product before procuring. The various tutorial videos are available in channel 'Techsoft Forum' in YouTube and in the Main-screen 'Help' of ASTRA Pro.

ASTRA Pro for Analysis and Design of Bridges available with Standard/Express/Premium Version

- Design of **RCC 'T' Girder Bridge and RCC Slab Bridge** with moving load analysis
- Design of **Composite Bridge with Single/Multi-Span in Straight/Curved Layout**, with Orthotropic analysis
- Design of **PSC (Pre Stressed Concrete) 'I' Girder and Box Girder Bridges**, with analysis
- Design of **Segmental PSC Box Girder Bridge** with analysis
- Design of **Continuous PSC Box Girder Bridge** with analysis (in IRC standard only)
- Design of **Steel Built up Plate Girder Railway Bridges** with analysis
- Design of **Steel Warren/Pratt/Baltimore/K Type Truss Bridges (Open Web Girder)** on BS, IS and US Steel Sections,
- Design of **Long span Cable Stayed** and **Rope Cable Suspension Bridges** with Analysis
- Design of **Extra-dosed Bridges** and **Steel Arch Suspension** with Analysis
- Design of **RCC Abutments and Pier with Open and Pile Foundations**
- Design of **POT/PTFE Bearings** for Verso-Mono Axial Longitudinal Bearing, Verso-Mono Axial Transverse Bearing, Verso Bi-Axial Bearing and Verso Fixed Bearing,
- Design of **RCC Well Foundations and Pile Foundations** with Sub soil strata wise data and structural design,
- Computing **Stream Hydrology & Synthetic Unit Hydrograph (SUH)** with DTM, Contours of Up-stream Terrain,
- Computing **Scour Depth & Founding Depth** by Hydrological calculations for River Bridges,
- Utilities like Geotechnical data processing, Seismic zone wise Coefficient calculation etc.
- General Arrangement of **RCC Box Culvert**.
- General Arrangement of **RCC Slab Culvert**,
- General Arrangement of **Single & Multi Pipe Culvert**,
- General Arrangement of **RCC Road Underpass**,
- Design of **RCC Box Pushed Underpass** under railway tracks and Road

The designs are produced with Detail Stepwise Reports and Complete set of sample General Arrangement and Reinforcement Detail drawings editable to design drawings In-built CAD graphics system is applied for 3D Structural View, Drawing and Bar Schedules etc. Main screen 'Help' provides with various **Tutorial Videos, Users manual, Design Manual** etc.

ASTRA Pro for Analysis and Design of Structures available with Express/Premium Versions

Applications for Static & Seismic Analysis, Limit State Design and Drawings of RCC Structures:

- **Design of RCC Tunnel Lining** with Portal, Steel Ribs and Tunnel Lining based RQD and Rock Mass Rating.
- **Design of RCC Panel Type Reinforced Earth Walls** following BS 8006,
- **Design of RCC Retaining Walls** as cantilever and propped cantilever.
- **Design of RCC Framed Building** with Floor slabs. RCC Beams, Columns, Staircase, Isolated/Pile/Raft Foundation
- **Design of Steel Transmission, Cable Car and Microwave Towers**
- **Design of RCC / PSC Jetty** with editable drawings.
- **Dynamic Analysis of Block and Frame type machine foundations** for Eigen Values, Time History and Response Spectrum

ASTRA Pro for Design of Bridge Geometry and Balanced Cantilever Bridge available with Premium Version

- Design of **Bridge Geometry for Bridges on Straight and Curved alignments (Premium Version)**
- Analysis & Design of **Balanced Cantilever Bridge by using Cast-in-Place Segmental PSC Box-Girders (Premium Version)**

Various designs are produced with Detail Report and complete set of sample reinforcement detailing CAD drawings,

ASTRA Pro Structural Analysis Suite (Common in all versions with Full Set of Examples)

CAD Modeling in GUI and Analysis of Bridge Deck & Structures with on screen details by "View Structure":

- Static Analysis of Structures for Joint Load, Member Load, Area Load, Repeat Load, Floor Load etc.
- Analysis for structures with Beam, Truss, Plate/Shell, Solid and Boundary elements
- Grillage Analysis of Bridge Deck with Dead Load, Super Imposed Dead Load and Vehicle/Rail Live Loads
- Dynamic Analysis of Structures for Eigen Values, Response Spectra and Time History Analysis,,
- Orthotropic Analysis for Steel Girder RCC Deck Slab Composite Bridges
- Non-Linear Stage Analysis for Bridges and Structures,
- Analysis of Multi Storied Building Frame Structures for Member End Forces & Support Reactions,

ASTRA Pro features for the analysis, design and provides detail analysis as well as design calculations with a complete set of editable sample CAD construction drawings for various Bridges, Culverts, Underpasses, Structures, Bridge Bearings (various types of POT/PTFE and Elastomeric Bearings), RCC Tunnel Lining (with RCC Portal, Steel Ribs, Shotcrete) RCC Retaining Wall, Reinforced Earth Wall, Multi storied framed building, etc.

ASTRA Pro software is based on Grillage modelling and analysis of Deck-Girder superstructure by using Finite Element Method for structural analysis. The Non-Linear Stage, Orthotropic and Dynamic Analysis for Bridges are done in the simplest way. Finally by choosing the analysis results the design is done. Taking user's General Arrangement Data in Dialog box model is created making that editable in GUI and finally processes the selected analysis to generate Detail Analysis Report with on screen display of results and visual presentation of 3D dynamic rotation view and animated model for Load deflection. Next, the structural detail design is done with step wise Design Report. A set of sample editable structural detail CAD drawings is provided for the selected bridge. The sample drawings are convertible to design drawings by drawing converter or by editing manually.

In analysis suite, there are 'Normal Analysis', 'Stage Analysis' and 'Dynamic Analysis', out of these analysis the 'Normal Analysis' is mandatory other analyses are optional. The 'Stage Analysis' is also known as Non Linear Analysis or P-Delta Analysis or Force Deflection Analysis. The analysis is carried out for 5-stages, if the design life of the bridge is 100 years then each five stages shall be of 20 years and shall give forces and deflections by applying Dead Load, Superimposed Dead Load and Live on the deflected shape of the previous stage.

Initially (immediately after construction) if the allowable deflection for a bridge span is 'Span/1500' that is to be tested by on-site load test on the bridge. If the deflection is within span/1500 then the load capacity (rating capacity) is partly alright. Next, upon unloading the bridge span in stages if the deflection recovery is found up to 85%, then the load capacity (rating capacity) is finally alright.

This load test is to be conducted after 20, 40, 60, 80, and 100 years of age of the bridge, if the respective deflections are within the values found by stage analysis then the condition of the bridge is alright at that respective ages, otherwise other Non-Destructive Tests (NDT) may be carried out and decision may be taken whether to go for rehabilitation or replacement of the bridge. The deflection may be by the deformation in the superstructure, substructure or bearing and that may be observed by reading from sensors attached at strategic locations of the bridge.

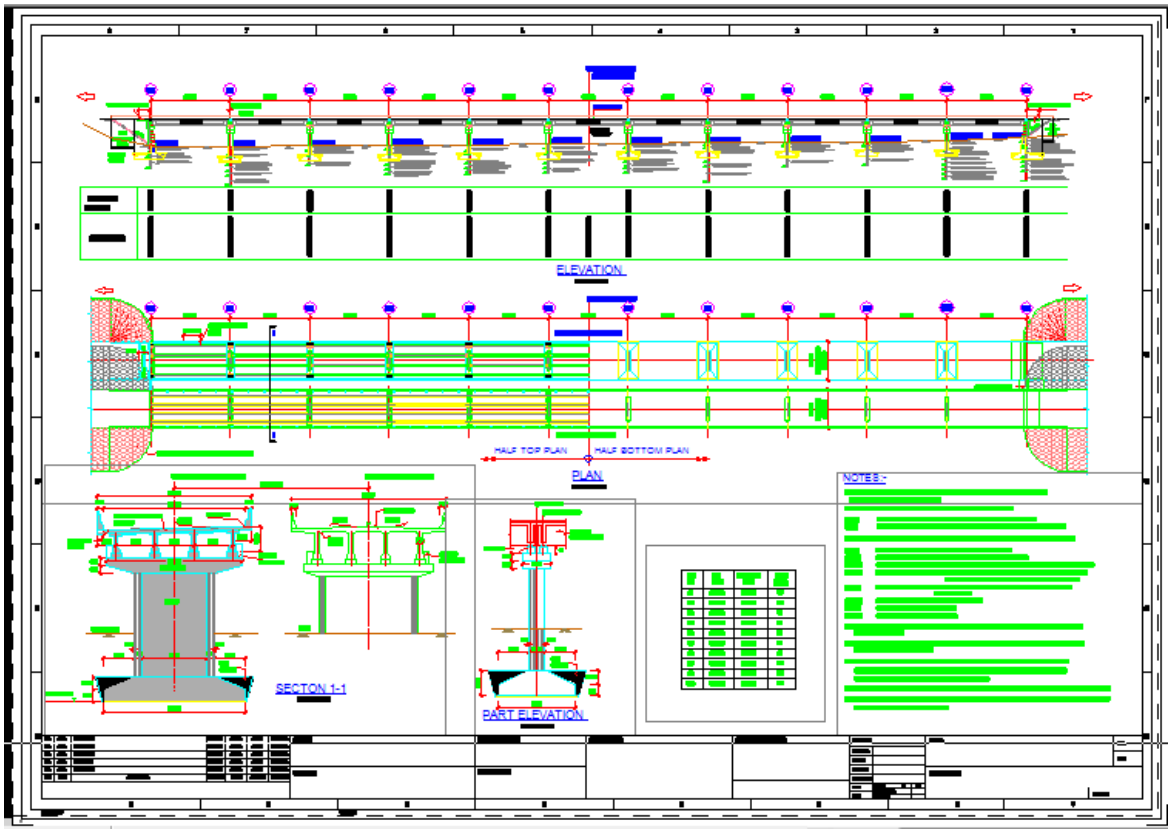
Next, user has to go to section 'Design Forces' in ASTRA Pro and select 'Normal Analysis', and then select 'Design on Analysis' to get the design results in respect of selected design forces. The sample CAD drawings may be edited as necessary, as per user's design data and the design results.

For various Tutorial Videos in 'YouTube' in Channel 'Techsoft Forum' please use the link below:
https://www.youtube.com/channel/UCLY751jDWngqMfhKrlRcVwA/playlists,
(Press 'Ctrl' key and click on the link)

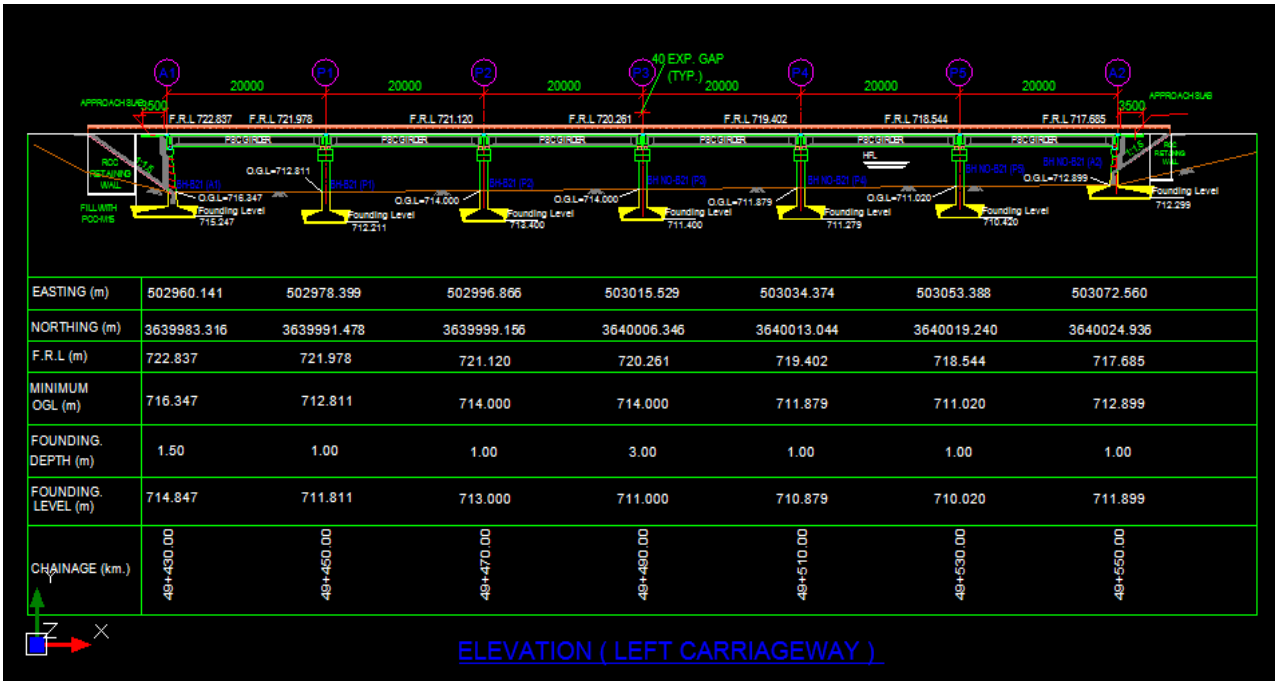
Text Book is also available as "Computer Aided Bridge Engineering" at website:
https://novapublishers.com/shop/computer-aided-bridge-engineering-detail-design-of-pre-stressed-concrete-i-girder-box-girder-bridges/
Contact: Ms. Lisa Gambino, Email: marketing@novapublishers.com

All "Book Tutorials" by ASTRA Pro are available at Website:
www.roadbridgedesign.com

ASTRA Pro provides CAD drawings for Bridge General Arrangements (GAD)



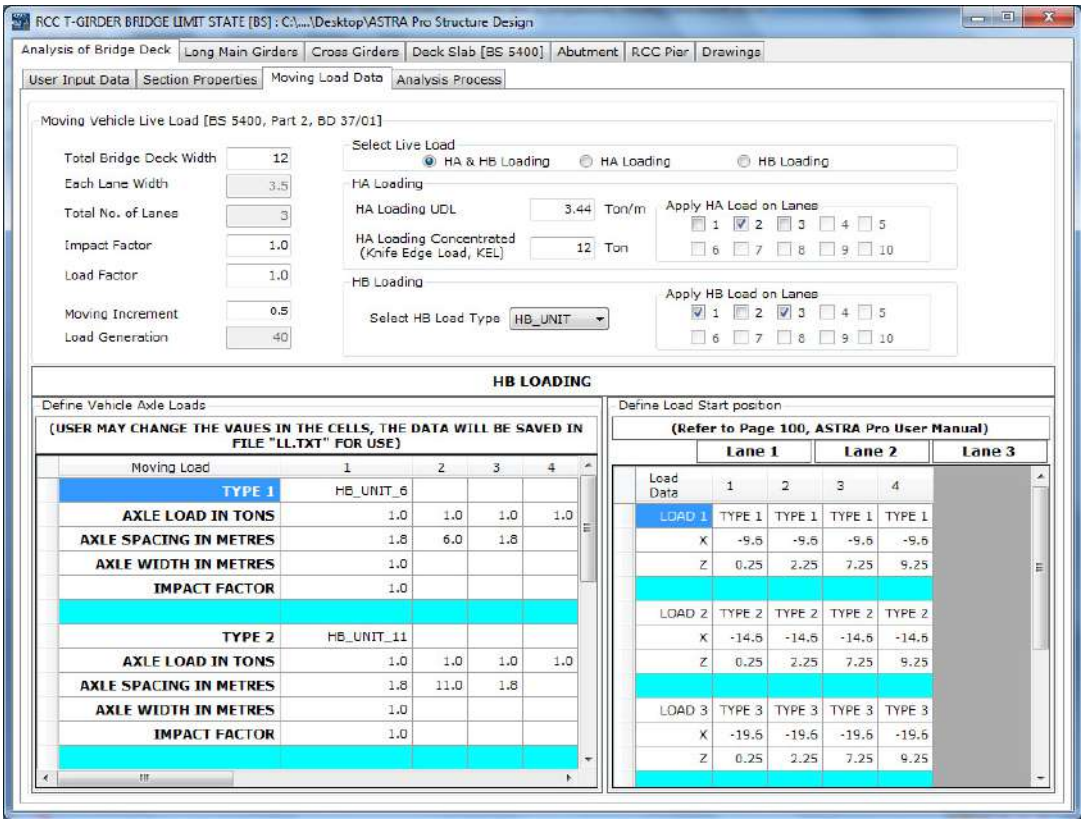
The General Arrangement Drawing (GAD) in ELEVATION with Most informative details on Original Ground Level, Depth & RL of Foundations, Coordinates for Easting and Northing of the Control Line, Bore Holes numbers, expansion joints etc.



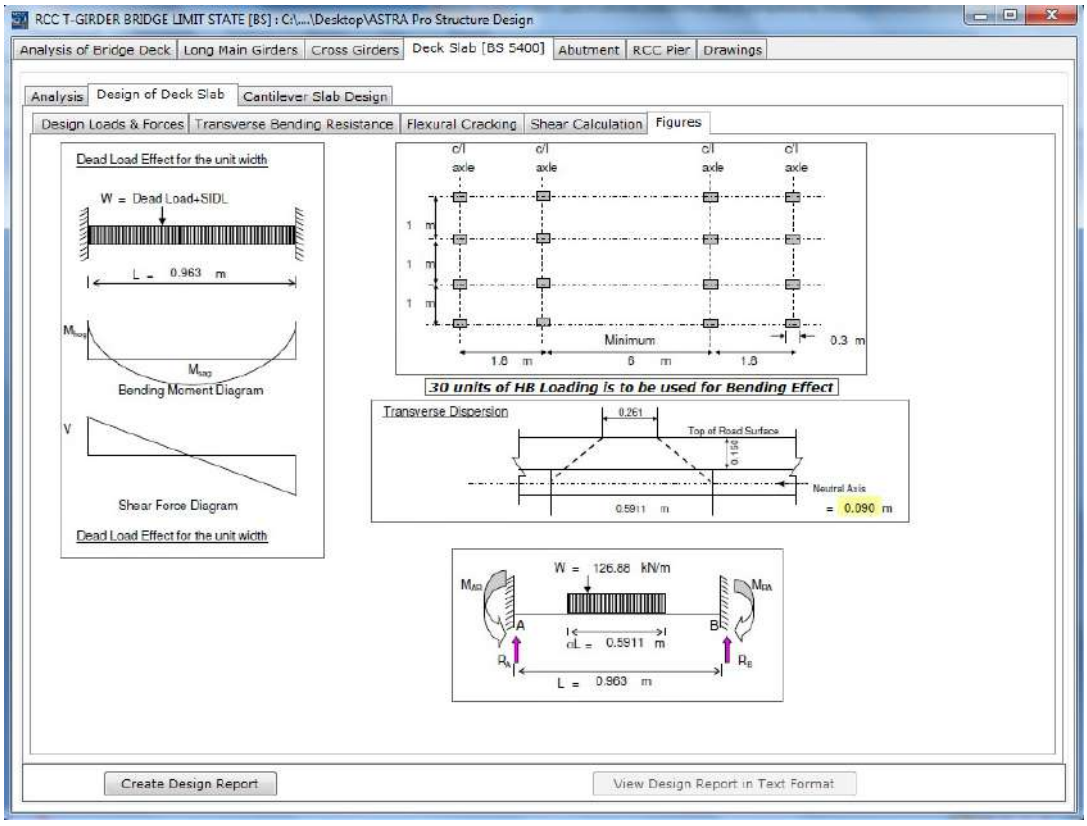
EASTING (m)	502960.141	502978.399	502996.866	503015.529	503034.374	503053.388	503072.560
NORTHING (m)	3639983.316	3639991.478	3639999.156	3640006.346	3640013.044	3640019.240	3640024.936
F.R.L (m)	722.837	721.978	721.120	720.261	719.402	718.544	717.685
MINIMUM OGL (m)	716.347	712.811	714.000	714.000	711.879	711.020	712.899
FOUNDING. DEPTH (m)	1.50	1.00	1.00	3.00	1.00	1.00	1.00
FOUNDING. LEVEL (m)	714.847	711.811	713.000	711.000	710.879	710.020	711.899
CHAINAGE (km.)	49+430.00	49+450.00	49+470.00	49+490.00	49+510.00	49+530.00	49+550.00

ELEVATION (LEFT CARRIAGEWAY)

British Standard HA & HB Loading following BD 37/01 in ASTRA Pro



British Standard Design of RCC Deck Slab



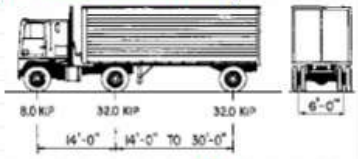
American Association of State Highway and Transportation Officials (AASHTO) for Load Resistance Factor Design (LRFD)

LRFD Limit States

- The LRFD Specifications require examination of several load combinations corresponding to the following limit states:
  - **SERVICE LIMIT STATE**
    relating to stress, deformation, and cracking
  - **FATIGUE & FRACTURE LIMIT STATE** relating to stress range and crack growth under repetitive loads, and material toughness
  - **STRENGTH LIMIT STATE**
    relating to strength and stability
    - (CONSTRUCTIBILITY)
  - **EXTREME EVENT LIMIT STATE**
    relating to events such as earthquakes, ice load, and vehicle and vessel collision

Basic LRFD Design Live Load
HL-93 -- (Article 3.6.1.2.1)

- Design Truck: ⇒

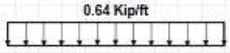


or or

- Design Tandem:
  Pair of 25.0 KIP axles spaced 4.0 FT apart

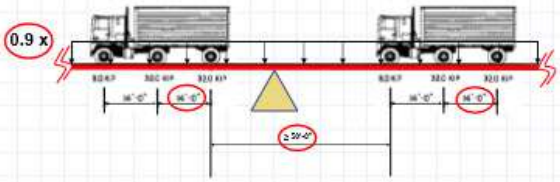
superimposed on +

- Design Lane Load 0.64 KLF uniformly distributed load



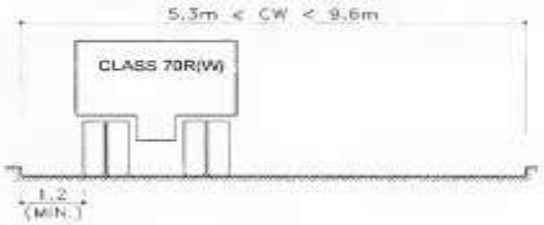
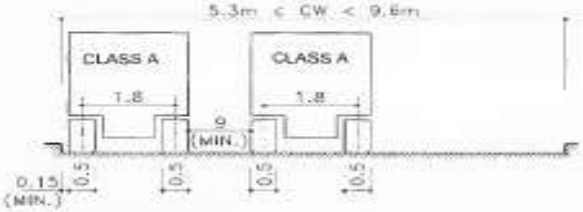
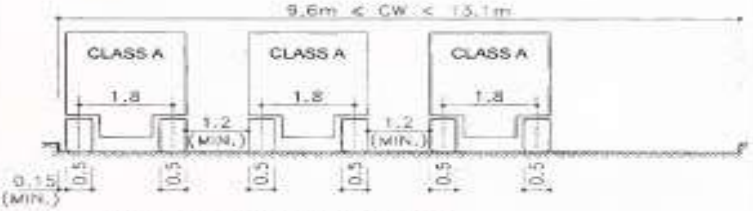
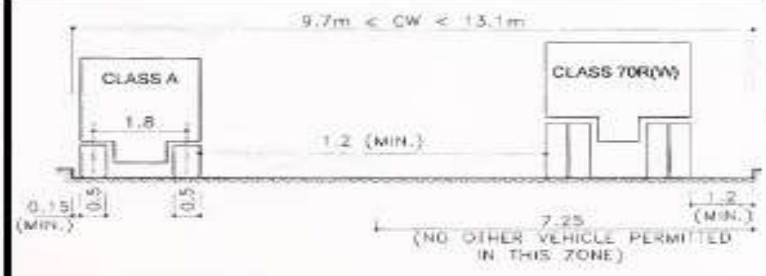
LRFD Negative Moment Loading
(Article 3.6.1.3.1)

- For negative moment (between points of permanent-load contraflexure) & interior-pier reactions, check an additional load case:

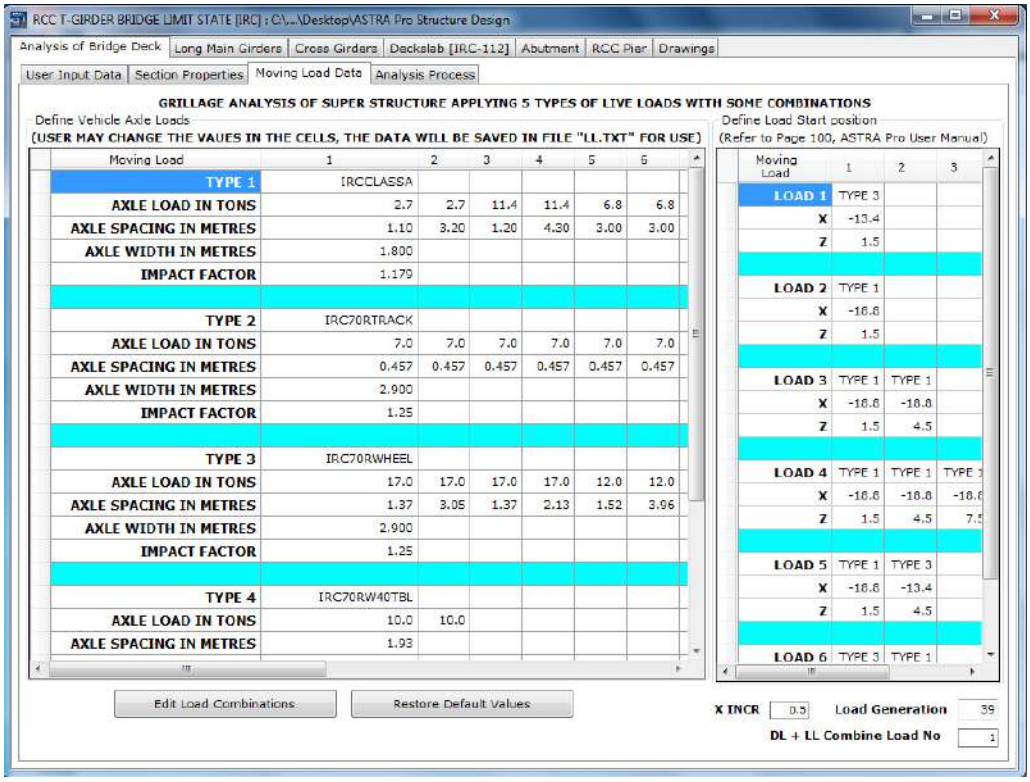


IRC 6 Class Load Combinations

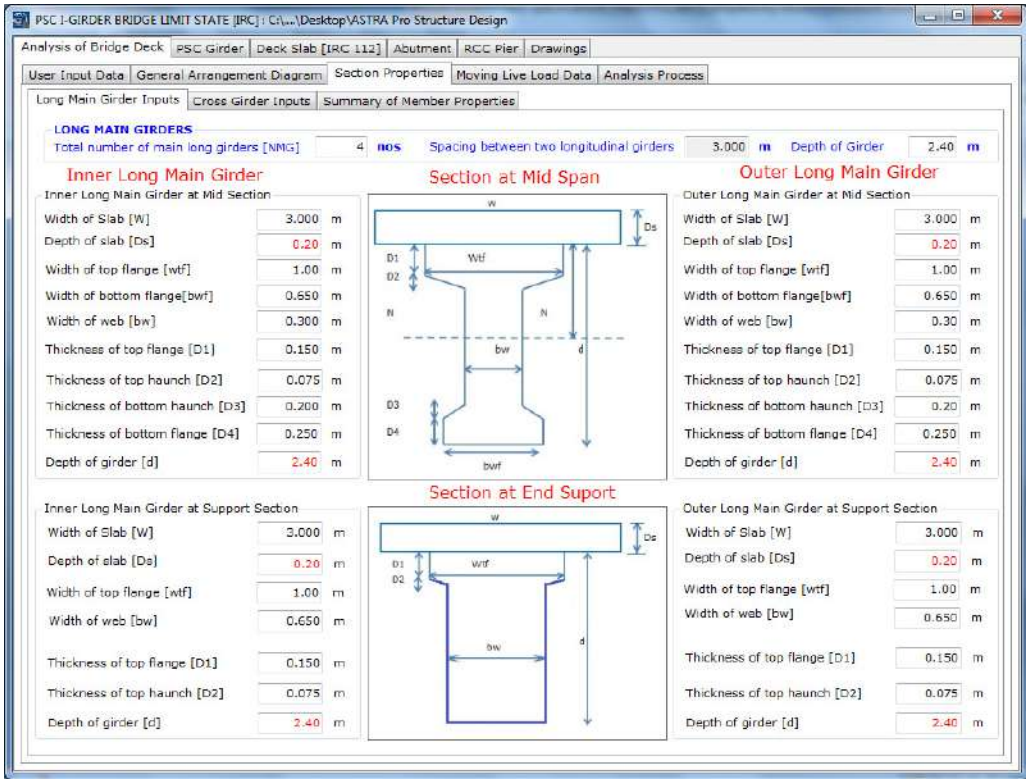
Table 2 Live Load Combinations IRC:6-2014

S.NO	NO. OF LANES FOR DESIGN PURPOSE	CARRIAGEWAY WIDTH (CW) & LOADING ARRANGEMENT
1.	1 LANE	 CASE 1 : CLASS A - 1 LANE
2.	2 LANES	 CASE 1 : CLASS 70R (W)
		 CASE 2 : CLASS A - 2 LANES
3.	3 LANES	 CASE 1 : CLASS A - 3 LANES
		 CASE 2 : CLASS A - 1 LANE + CLASS 70R (W)

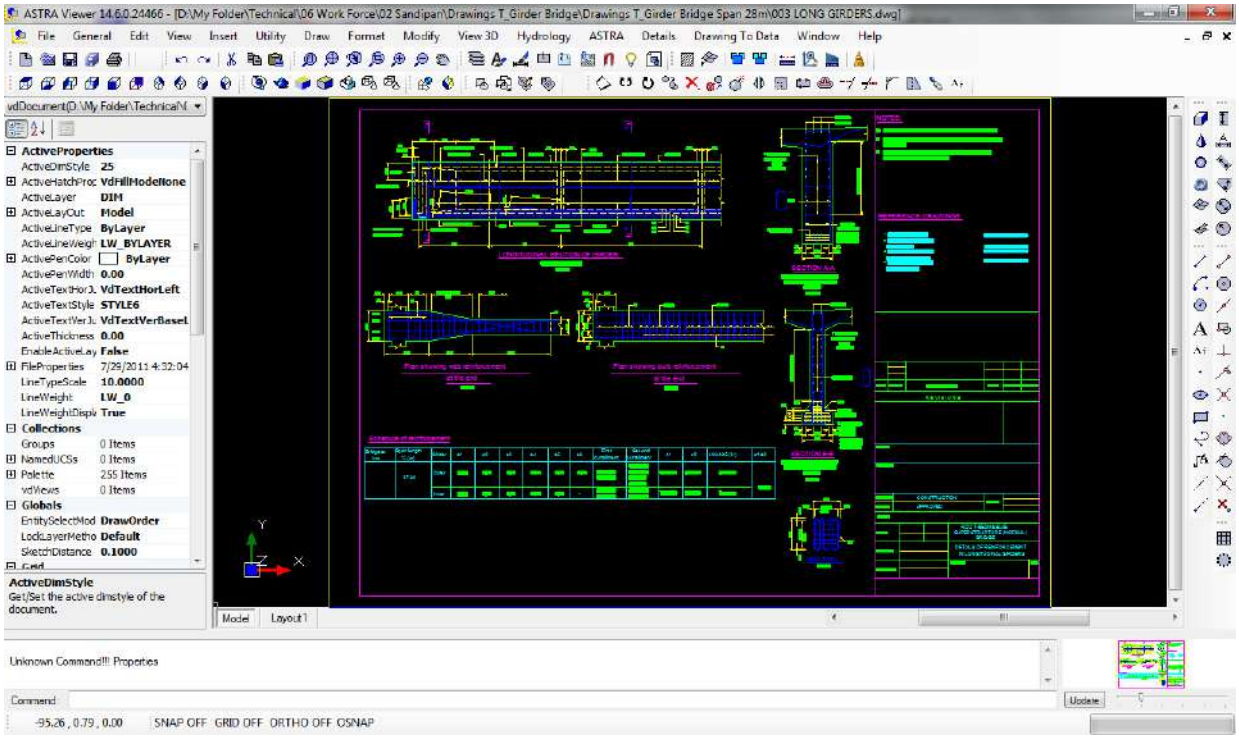
Input for Live Loads for either IRC 6 Class or BD 37/01 or AASHTO-LRFD Combinations is very simple in ASTRA Pro



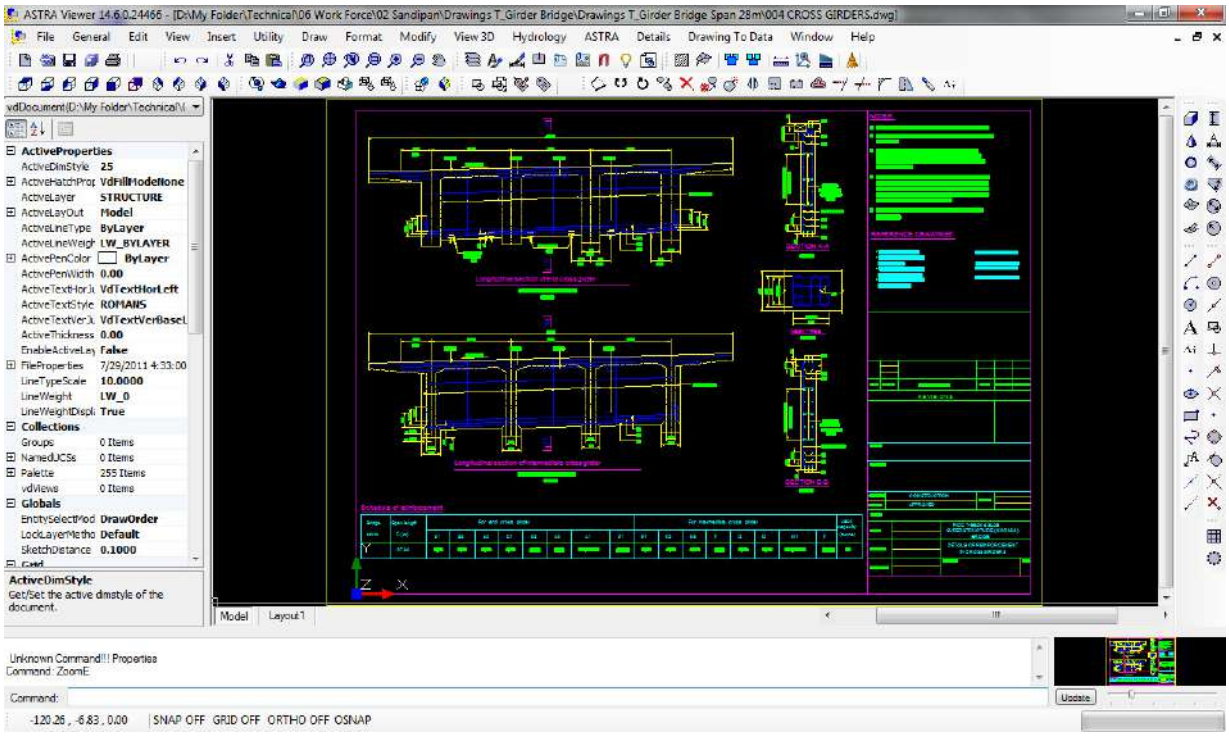
For RCC 'T' or PSC 'I' Girder the Main Long Girder is designed with applied Loading



Bridge Design - RCC ‘T’ Girder Bridges for various Spans on British Standard Eurocode 2 and IRC 112

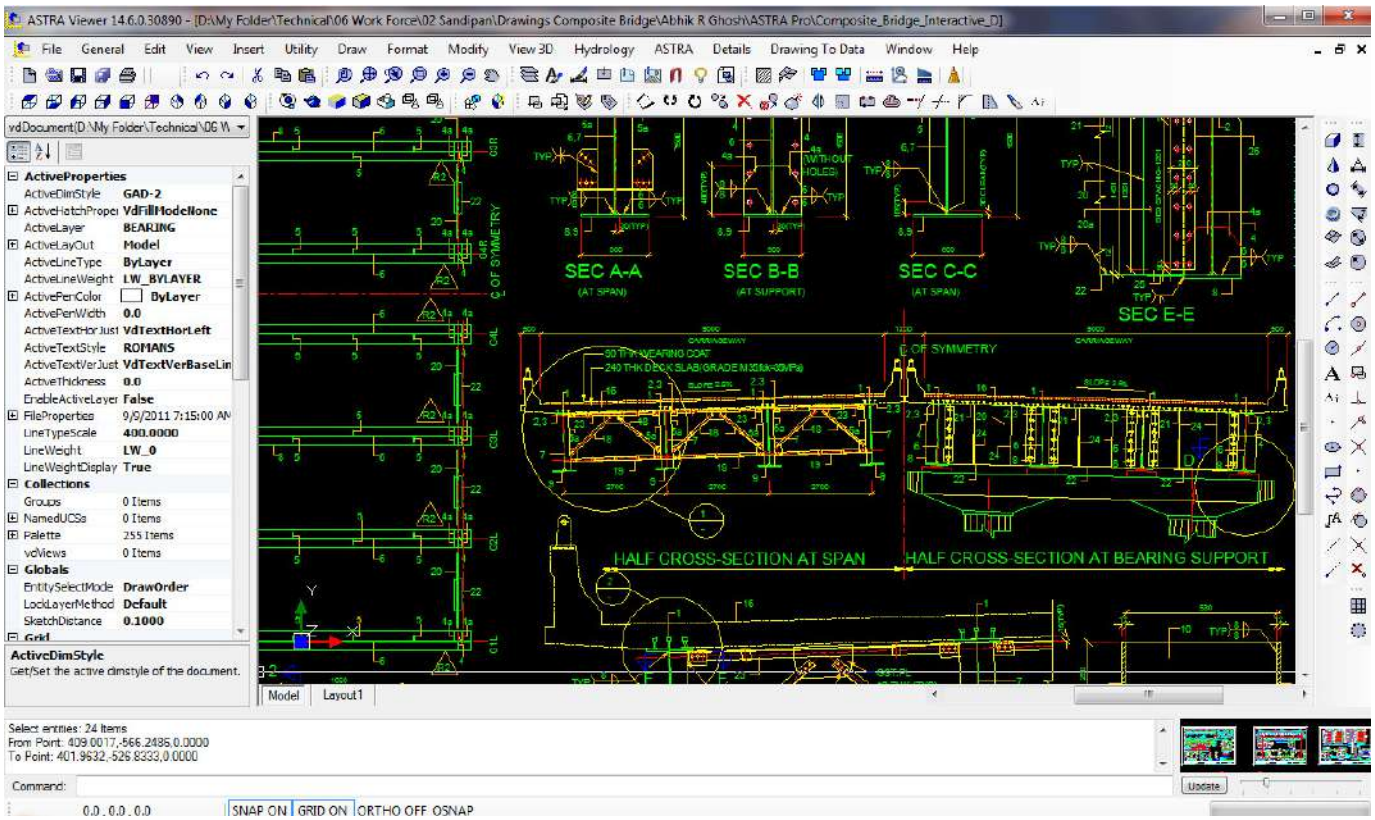


Structural Detailing and complete set of sample CAD drawings are provided with the Detail Design Calculations. Detail information for Construction are also provided in the Drawings



Bridge Design - Composite Bridges with RCC Deck Slab and Steel Plate or Box Girders is designed with Shear Connectors etc. with step wise detail design calculation report and editable structural detail drawing

Construction drawings for Composite Road Bridge with Steel Plate Girder and RCC Deck Slab



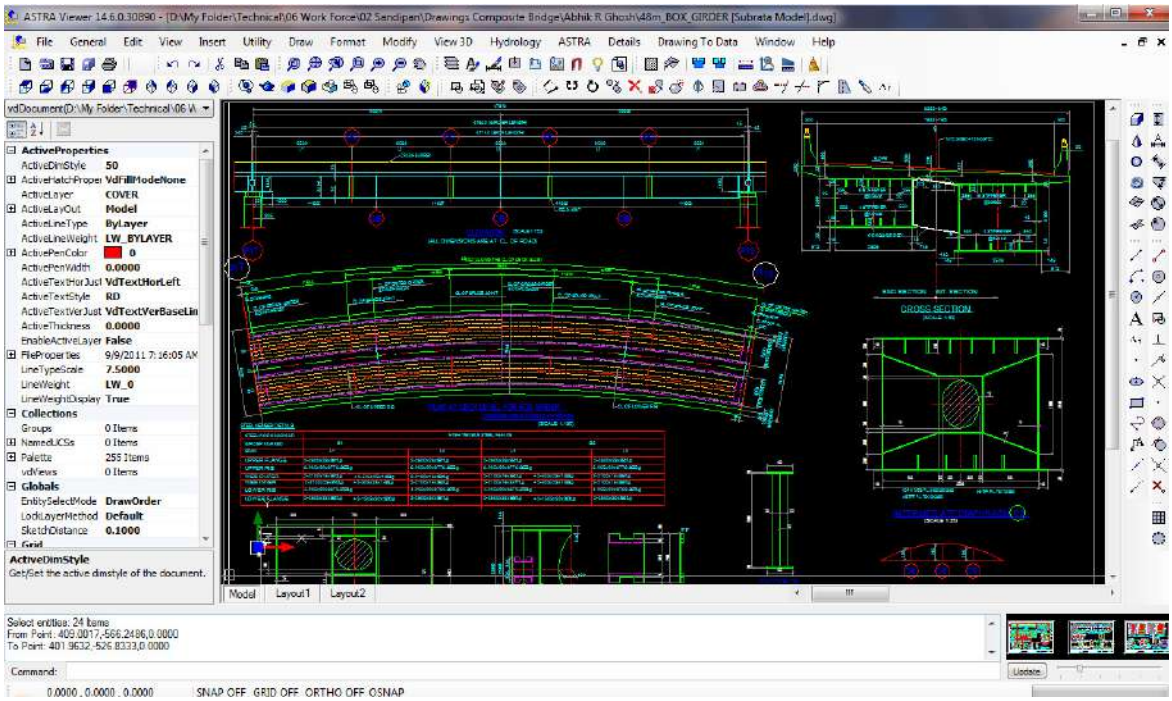
Bridge Design – Design of Composite Bridge in Curved Alignment

For Trucks heavily loaded with stone aggregates, sand, marble slabs, cement bags, steel members etc. when negotiates curve the centrifugal force is very high. If the transverse force is considered same as straight bridge, by ignoring the effect of centrifugal force then the design of the Bridge and Bearing is incorrect resulting fall of the curved span.

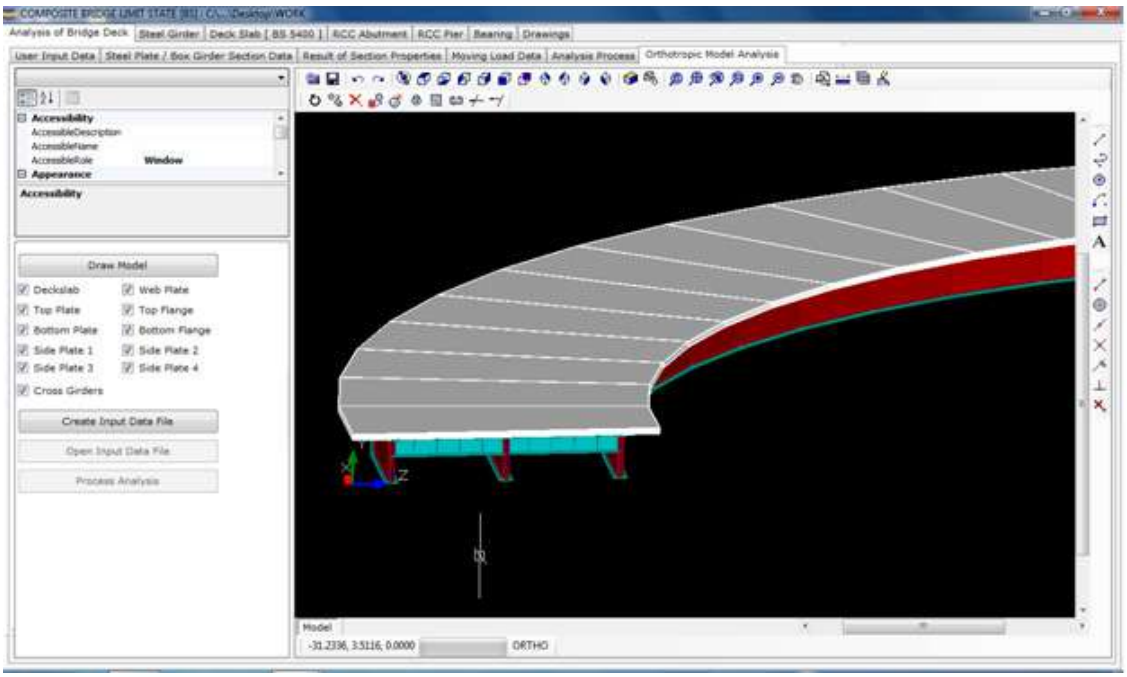
The essential considerations in this design are:

- **Modelling of the bridge as a curved super-structure with three span continuous structure**
- **Applying transverse force at support nodes with correctly selected POT/PTFE Bearings obtained from the X and Z direction components of the centrifugal force.**
- **Construction drawings for Composite Road Bridge with Steel Box Girder and RCC Deck Slab**

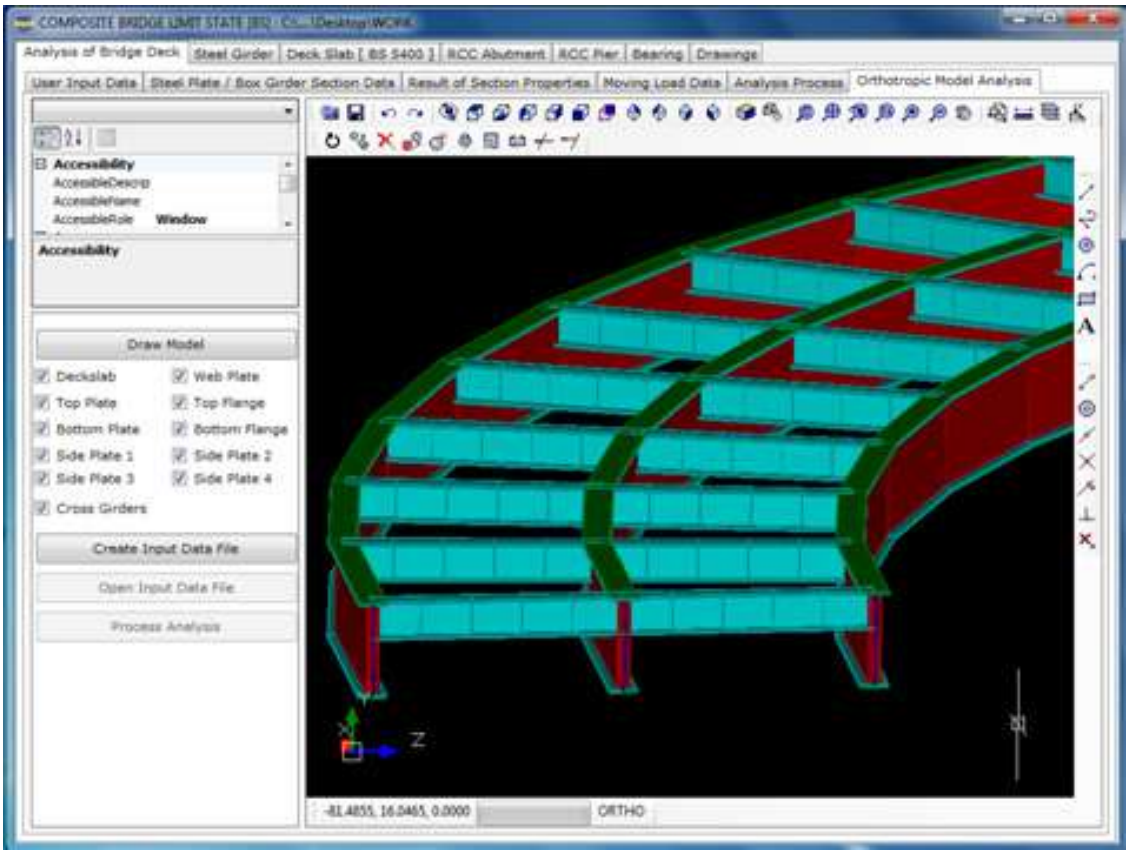
The related editable CAD drawings for Steel Plate or Box Girder are provided to convert as per design.



Orthotropic Analysis of Composite Bridges: **Design of Continuous and Curved Three-Span Composite Bridge with Steel Girders and Concrete Deck Slab may be done with Orthotropic Analysis as per British, AASHTO-LRFD and IRC Standard.**

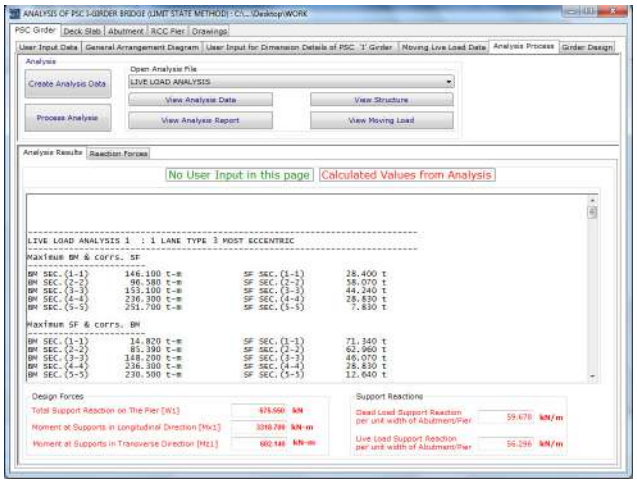


Model View by Graphical User Interface (GUI): **View of Model for Orthotropic Analysis for Multi-span Continuous Curved Spans with various options as available on the left panel of the GUI Window.**

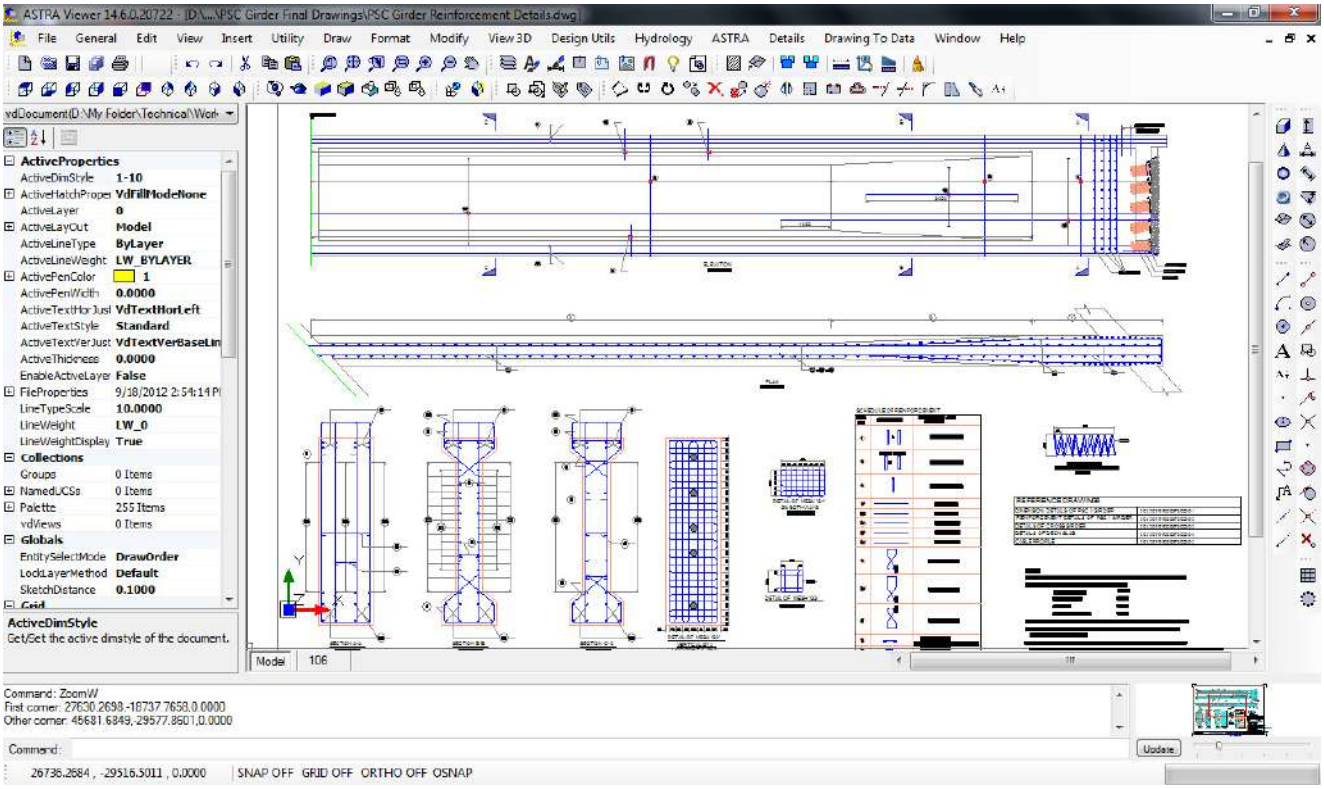


Bridge Design – Pre Stressed Concrete (PSC) 'I' Girder Bridges for various Spans

Bridge Design with ASTRA Pro for Pre-Stressed Concrete Girder Bridge Superstructure is done by receiving user input data in dialog boxes relevant to the desired structure and Loading and obtaining Bending Moments, Shear Force etc from Structural Analysis for DL + SIDL loading + Moving Load by ASTRA Pro using Standard or User defined Vehicle in 1/2/3 or more lanes of moving load at user given increments



Pre Stressed Post Tensioned Concrete Girder Bridge with detail step wise design calculation report and complete set of sample CAD drawings are provided convertible to design drawings.

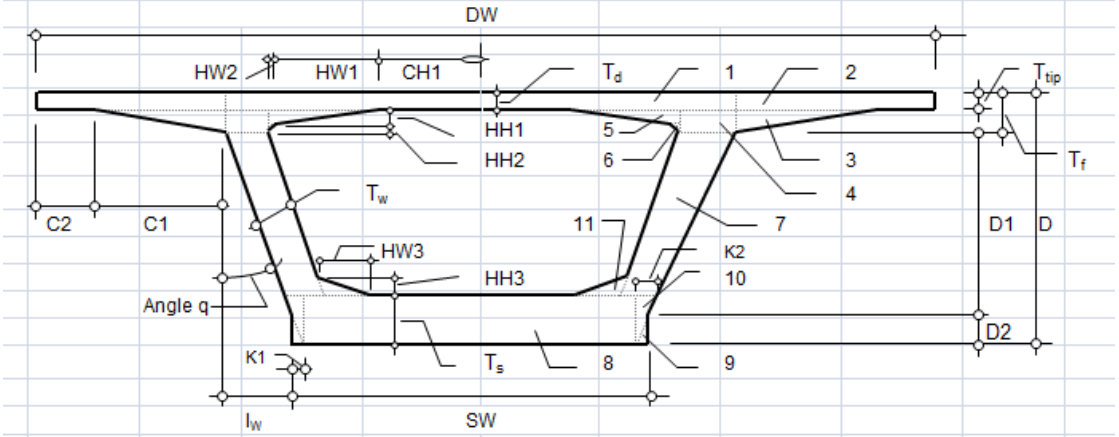


Bridge Design – Design of Pre-stressed Concrete (PSC) Box Girder Bridges for Elevated Road Corridors and Metro Rails with Detail step wise design calculation report and editable CAD drawings.

The procedure starts with Analysis for DL, SIDL, Live Load (Multi lane vehicle moving load), then stepwise design considering temperature, creep shrinkage etc. for Flexure, Shear including Blister Blocks etc. and finally producing editable CAD drawings with relevant structural & construction details.

The detail step wise calculations are provided in MS-Excel Worksheet.

CALCULATION OF SECTION PROPERTIES OF SINGLE CELL BOX GIRDER

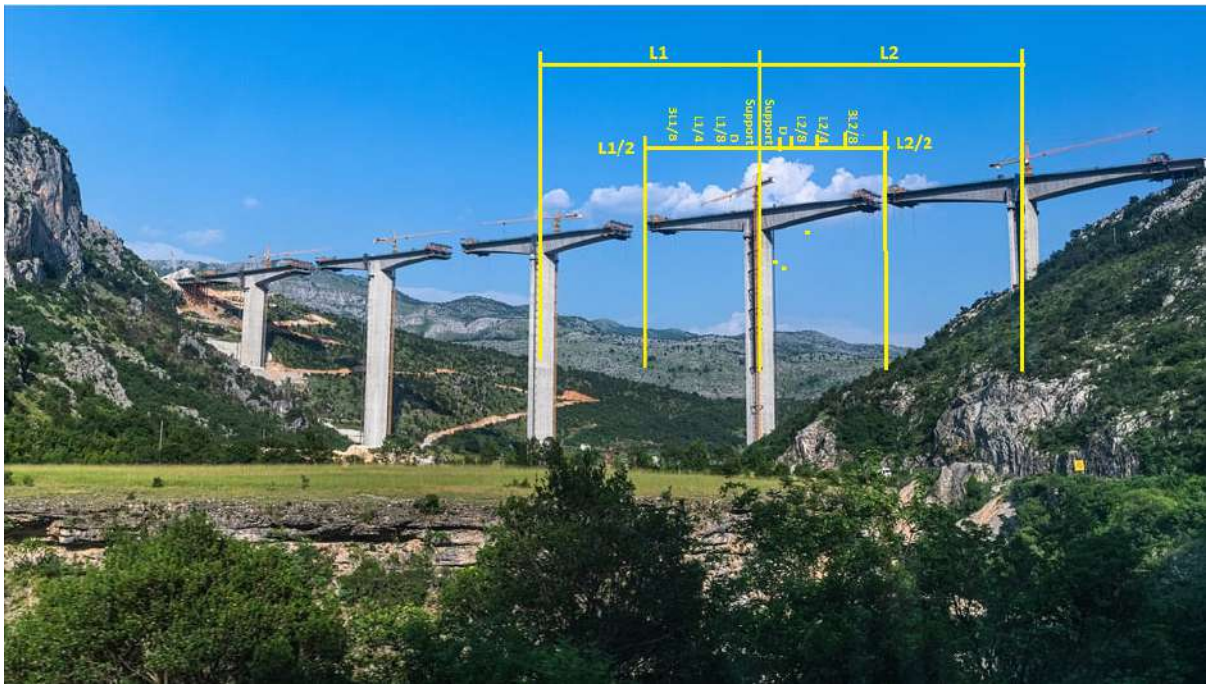


NOTE : 1. ALL DIMENSIONS ARE TO BE GIVEN IN METERS
2. CELLS SHADED ARE NOT BE GIVEN ANY INPUT

SECTION		Support	D away from support	L/8	L/4	3L/8	L/2
Web Inclination, θ(deg)		17.6501	17.6501	17.6501	17.6501	17.6501	17.6501
Total Depth	D	2.500	2.500	2.500	2.500	2.500	2.500
	DW	9.750	9.750	9.750	9.750	9.750	9.750

Balanced Cantilever Bridge 'ASTRA Pro – Premium' version features for Construction of Balanced Cantilever Bridge by using Cast-in-Place Segmental PSC Box-Girders along with reports on Structural Analysis and Design, a set of (approx. 100) Sample Editable CAD Drawings for construction of Balanced Cantilever Bridge.

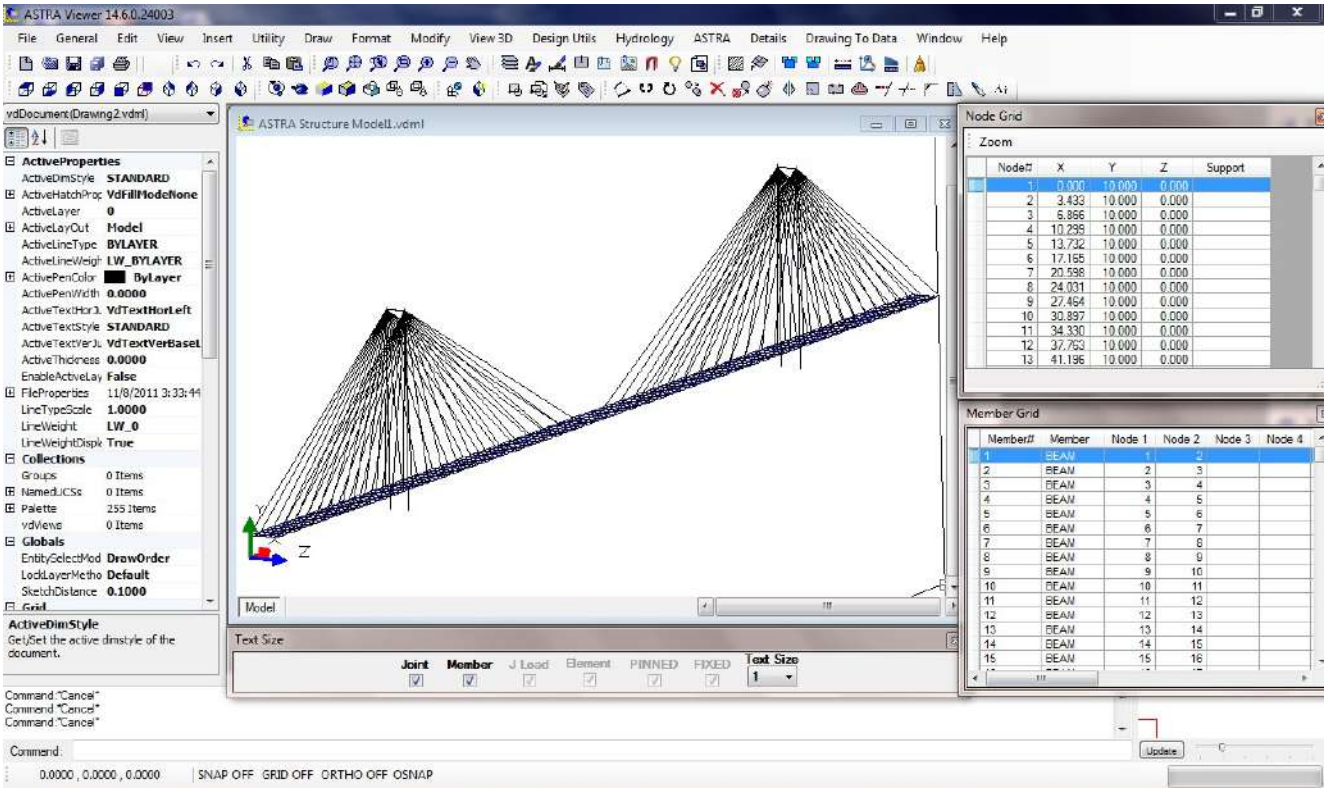
Balanced Cantilever Bridge



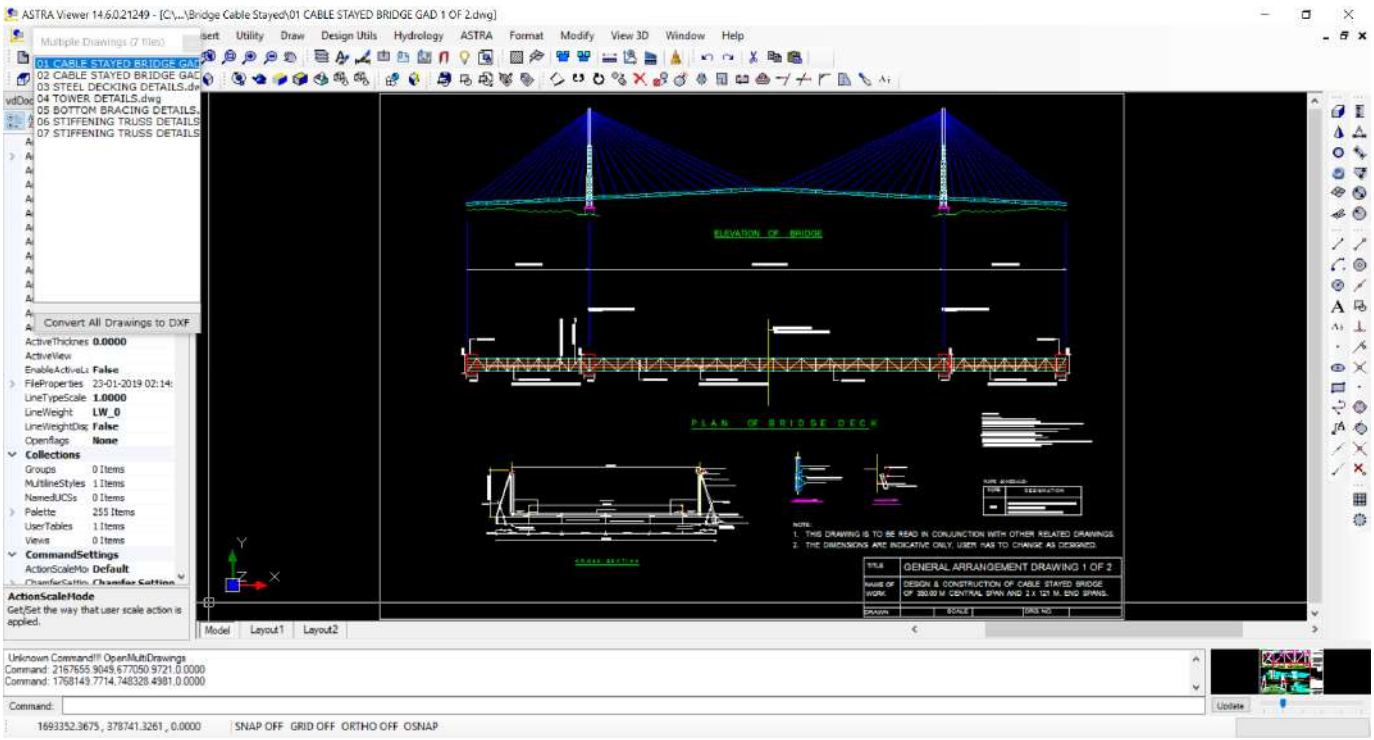
Concept for "Model Analysis-Design-Construction" of Balanced Cantilever Bridge

The module contains the 'Method Statement' about the work sequence for the construction of Open Foundation, Piers and Superstructure of Balanced Cantilever Bridge. For the design the software 'ASTRA Pro Premium' is used, and a set of editable sample drawings are provided with software ASTRA Pro Premium, this software may be downloaded from its company website www.techsoftglobal.com. After downloading the software may be installed in the system. The software provides analysis, design on analysis and sample editable CAD drawings under the section 'Drawings'.

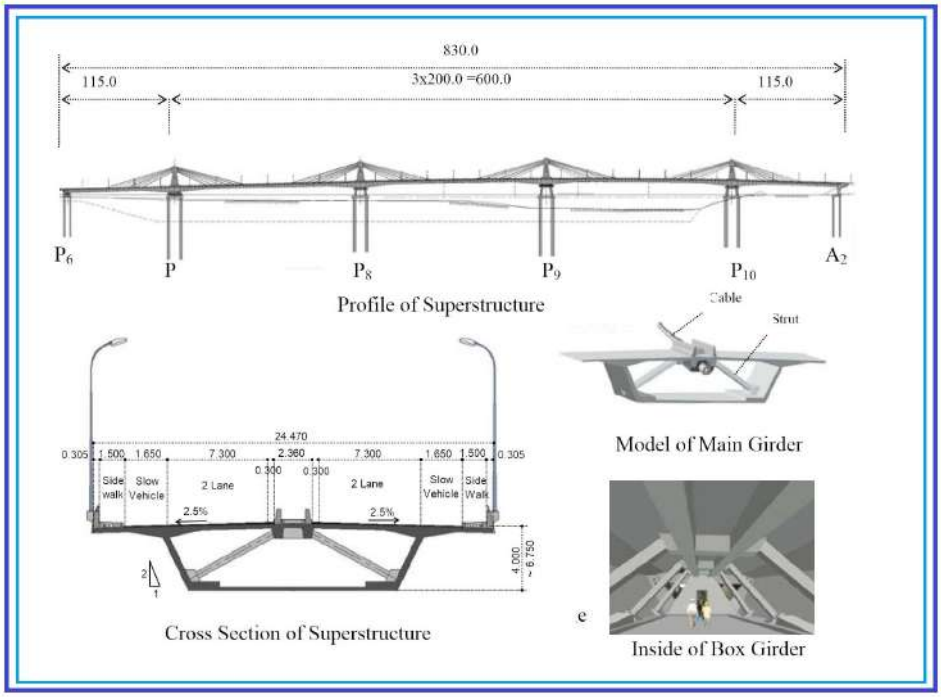
Bridge Design - Design of Cable Stayed Bridge is done with PSC Box Girder and Stay Cables with Non-linear Stage Analysis.



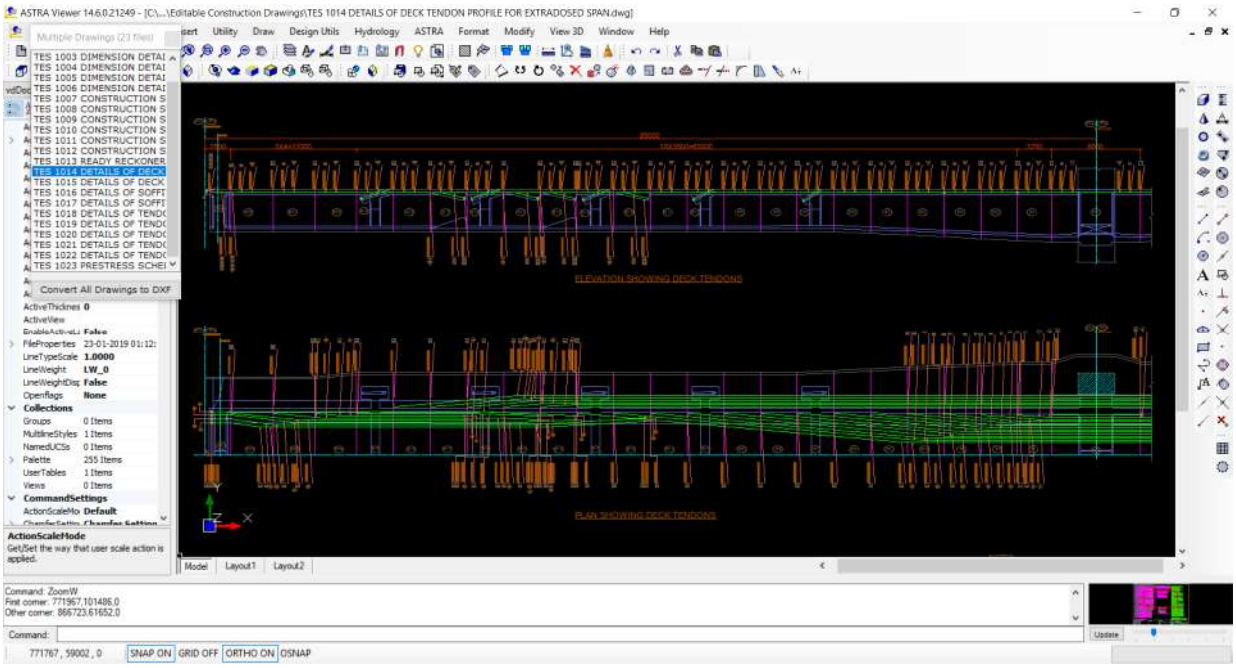
The General Arrangement drawing is provided for PSC Box Girder Deck with Steel Towers



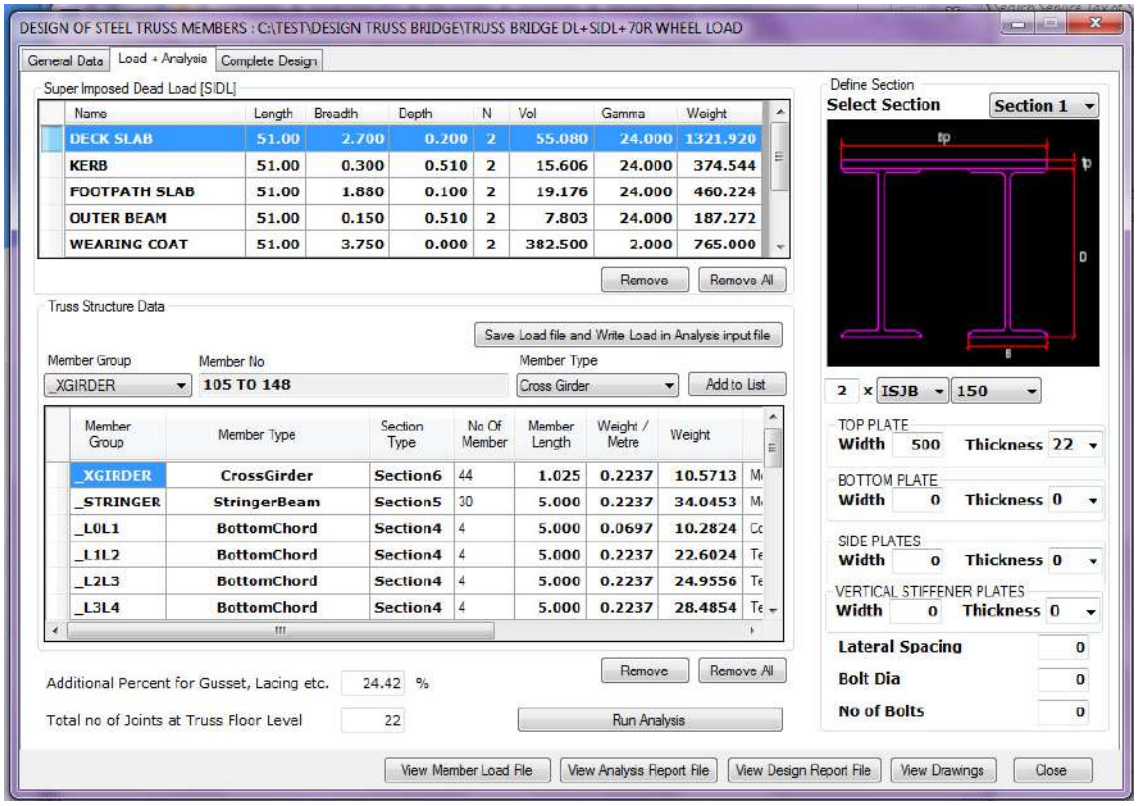
Bridge Design - Design of Extradosed Cable Stayed Bridge is done with PSC Box Girder and Stay Cables with Non-linear Stage Analysis.



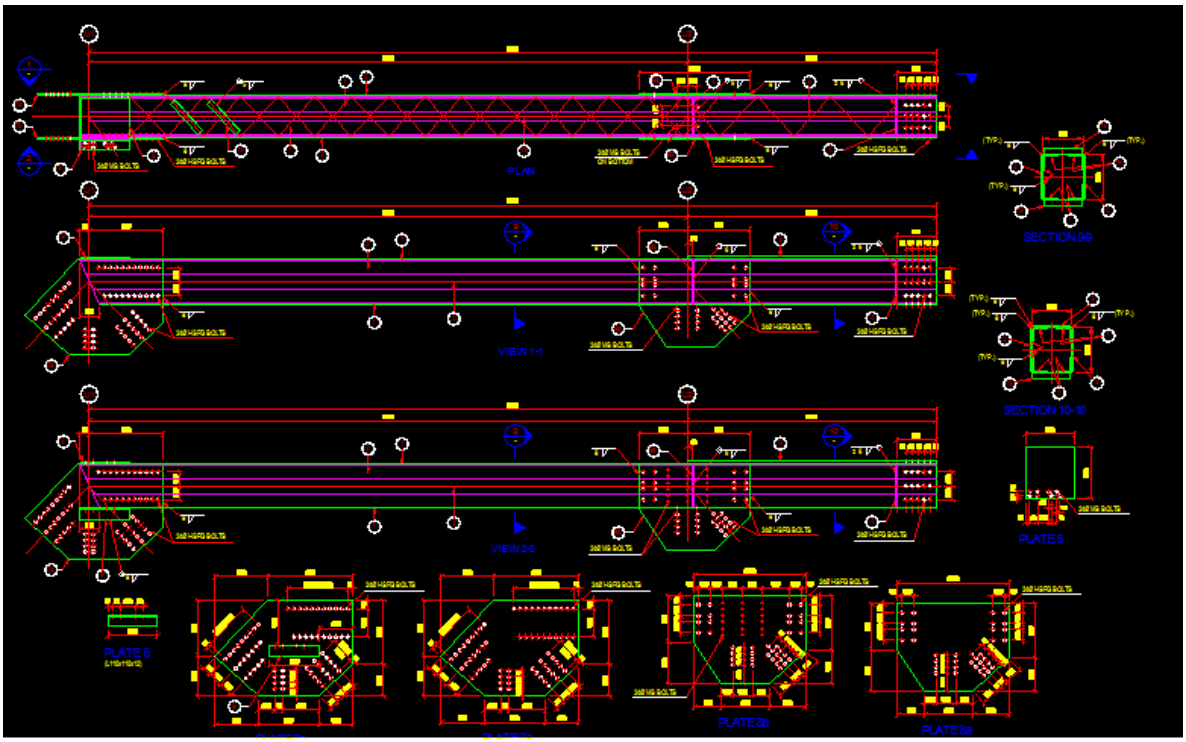
Cable Profile and Most Comprehensive Set of Sample Construction Drawings



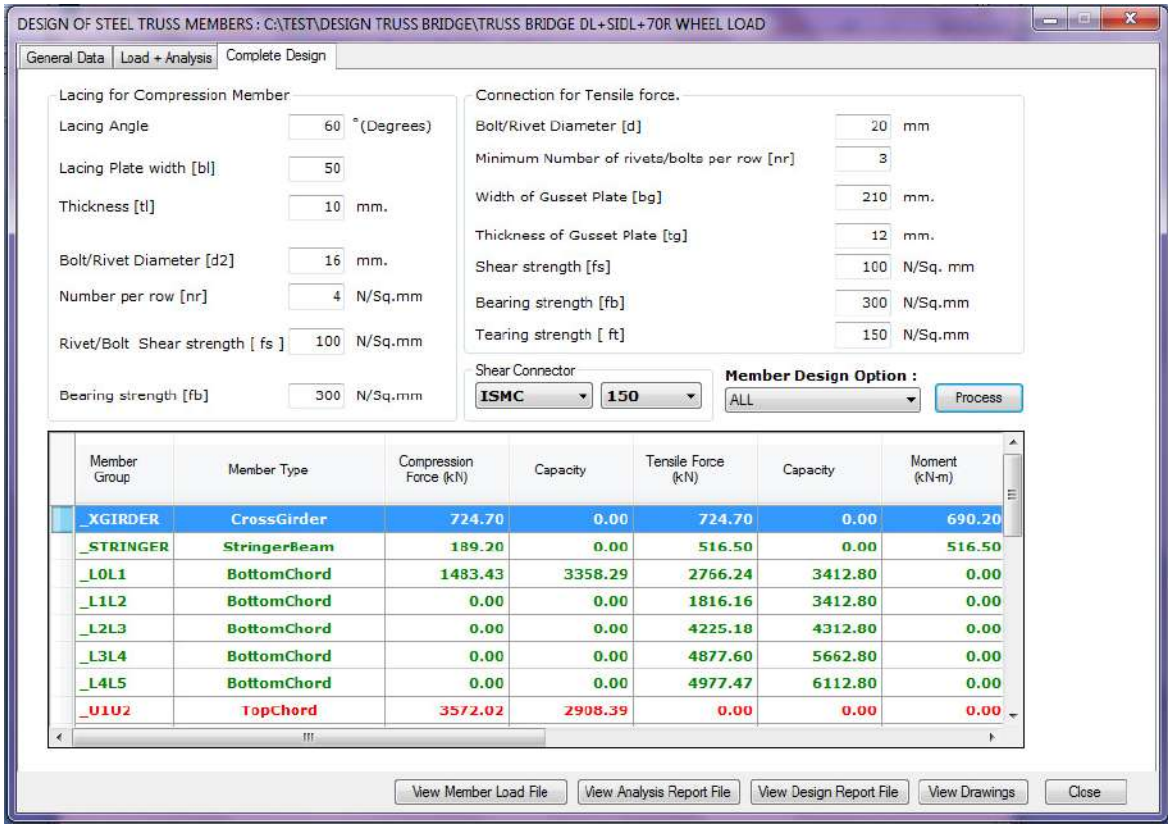
Bridge Design - Steel Truss Open Web Girder Bridges with Self Weight Computation, Superimposed Dead Load, Vehicle Live Load, Analysis for Member groups, Structural design of Top Chord, Bottom Chord, Vertical &, Diagonal members, Stringer Beam, Cross Girders, Top & Bottom Chord Bracings with Built up sections and production of complete volume of Text Report on Load Computation, Analysis for Truss & Beam Members and Structural Design.



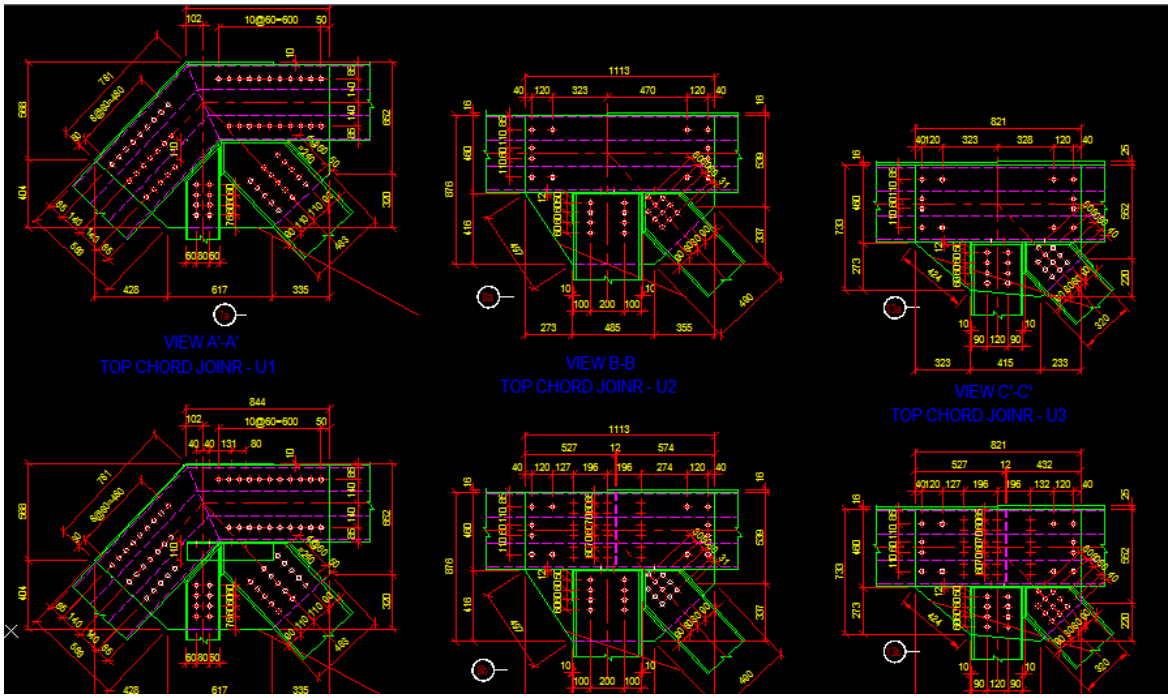
Steel Truss Bridge design with Fabrication/Shop drawings in editable CAD form



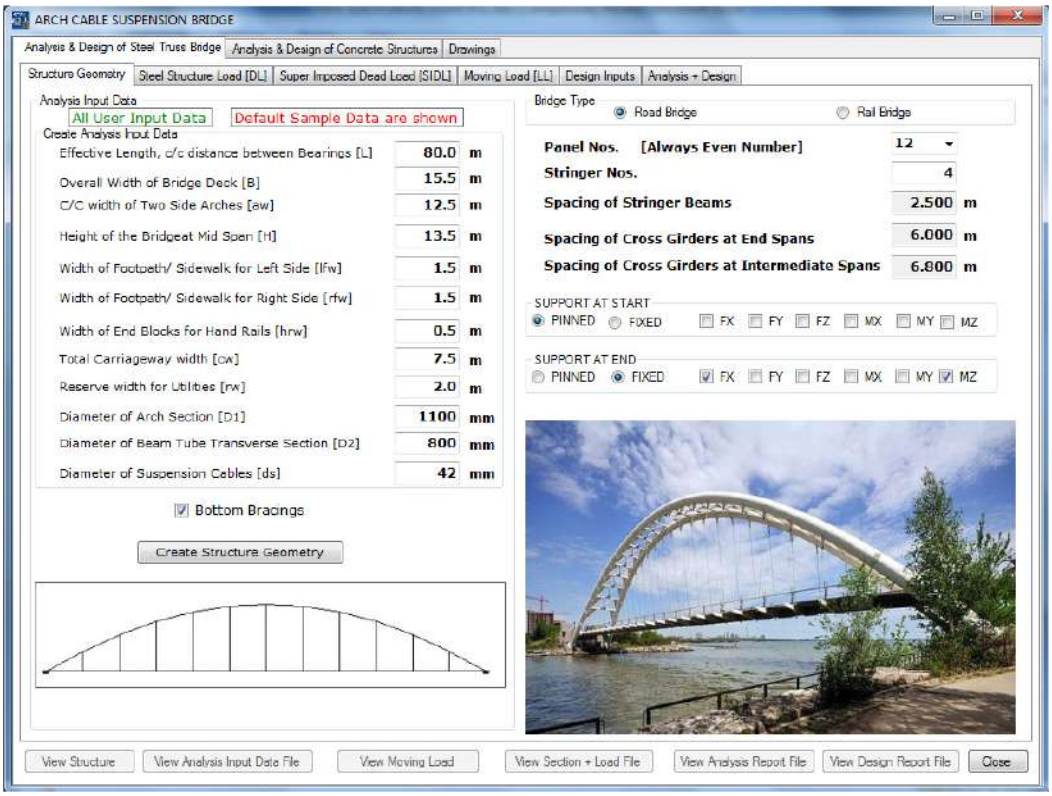
The Design of Steel Truss Highway / Railway Bridges In ASTRA Pro the design of Steel Truss Road / Railway Bridges are done in largest form compared to various works presently available. The Detail Calculation for Design of Lacings, Bolted / Riveted / Welded Connections with Gusset Plates, Detail Report for Load Computation, Structural Analysis, Structural Design and production of Complete set of Structural Steel Fabrication detail drawings in CAD



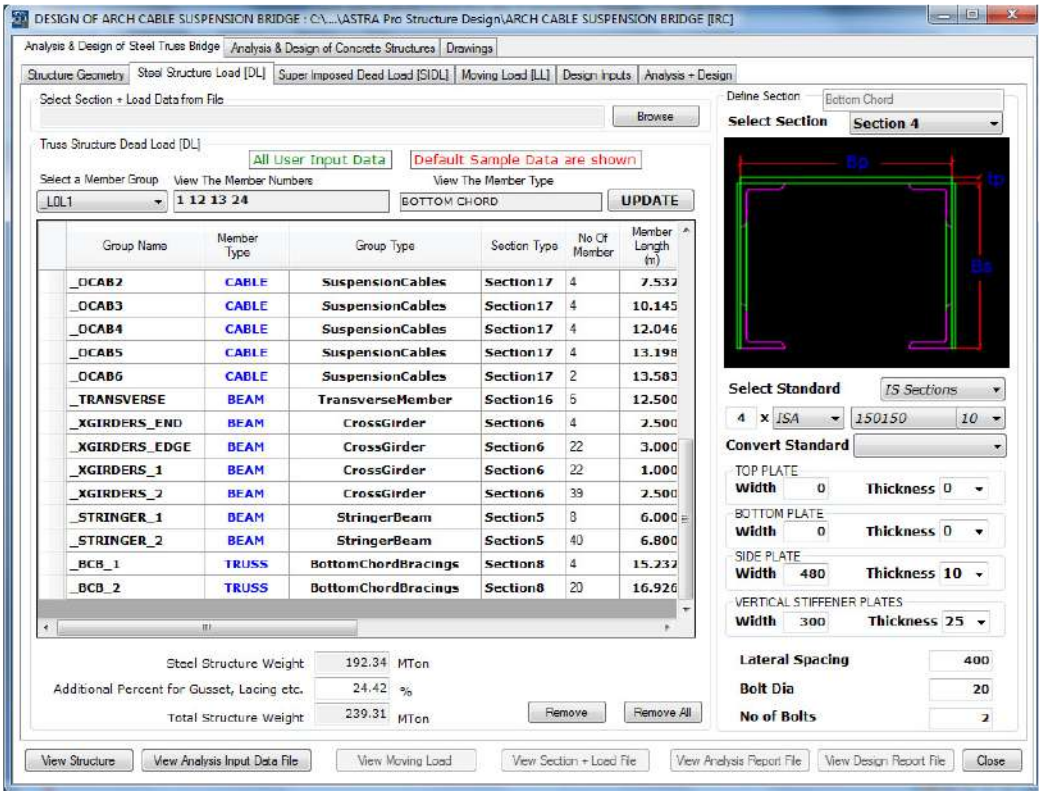
Steel Truss Bridge design with Fabrication/Shop drawings with Details of Member Connections in editable CAD form



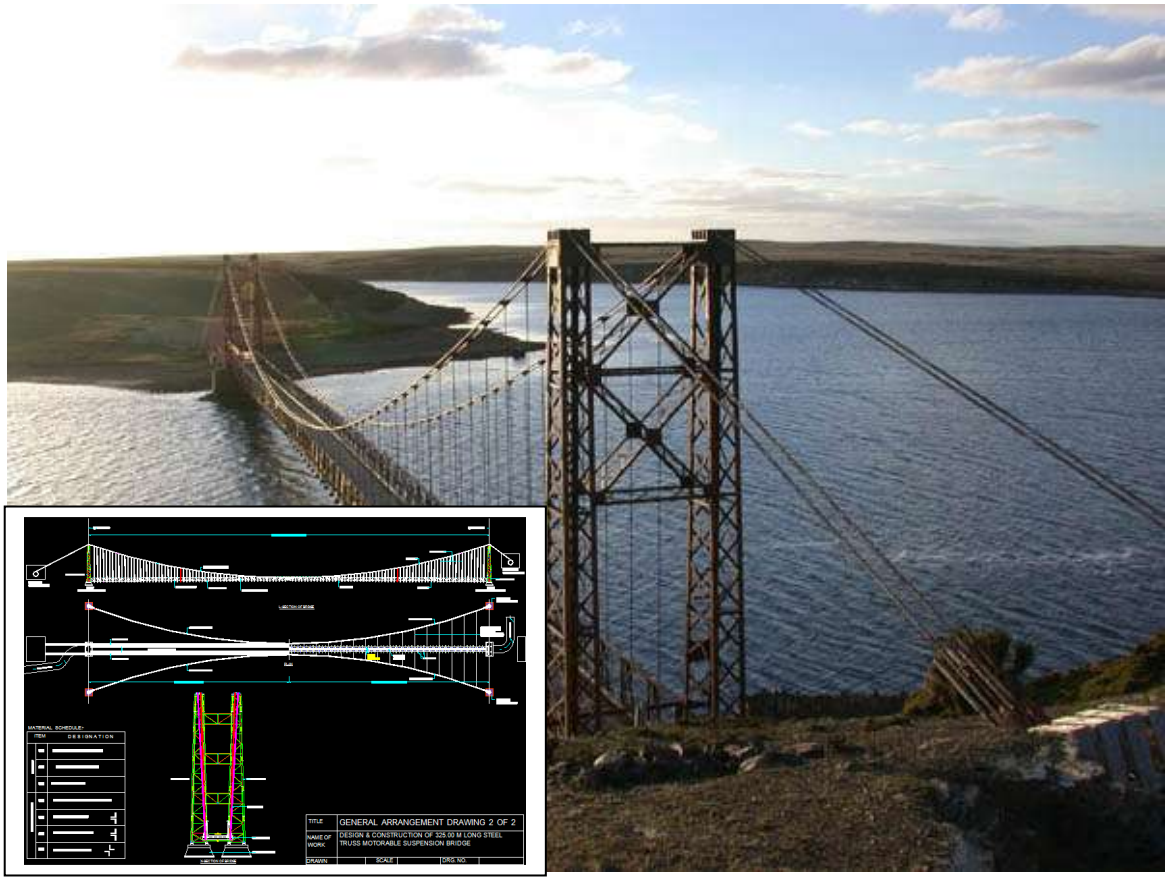
Bridge Design - Steel Arch Cable Suspension Bridge



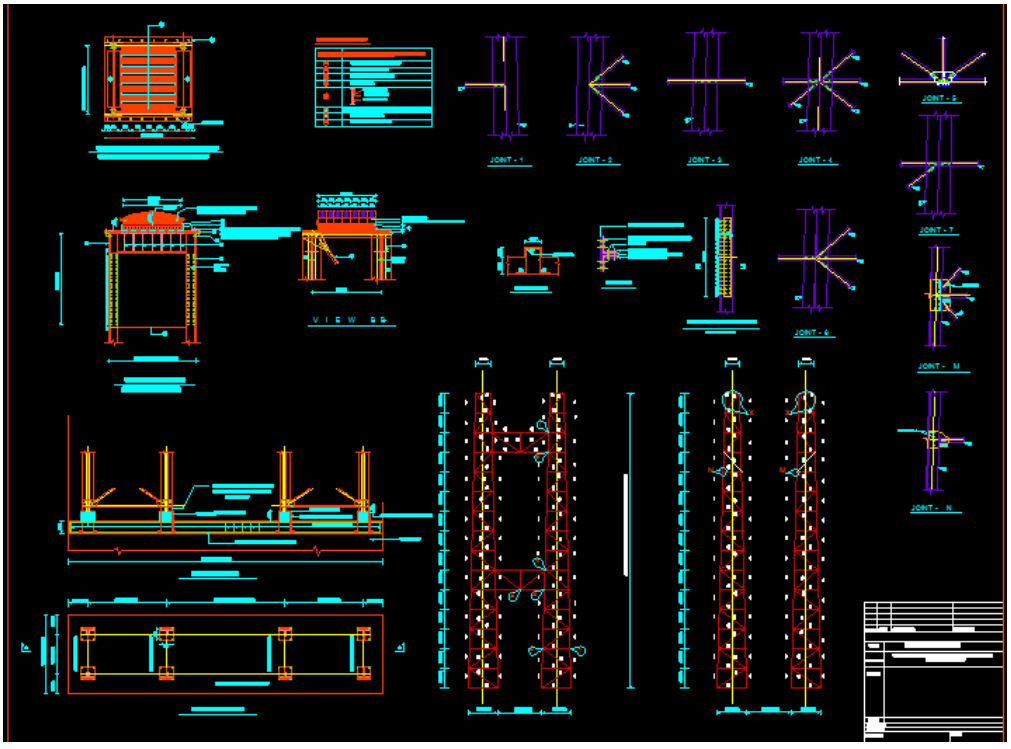
Member group wise standard or Built up sections may be defined



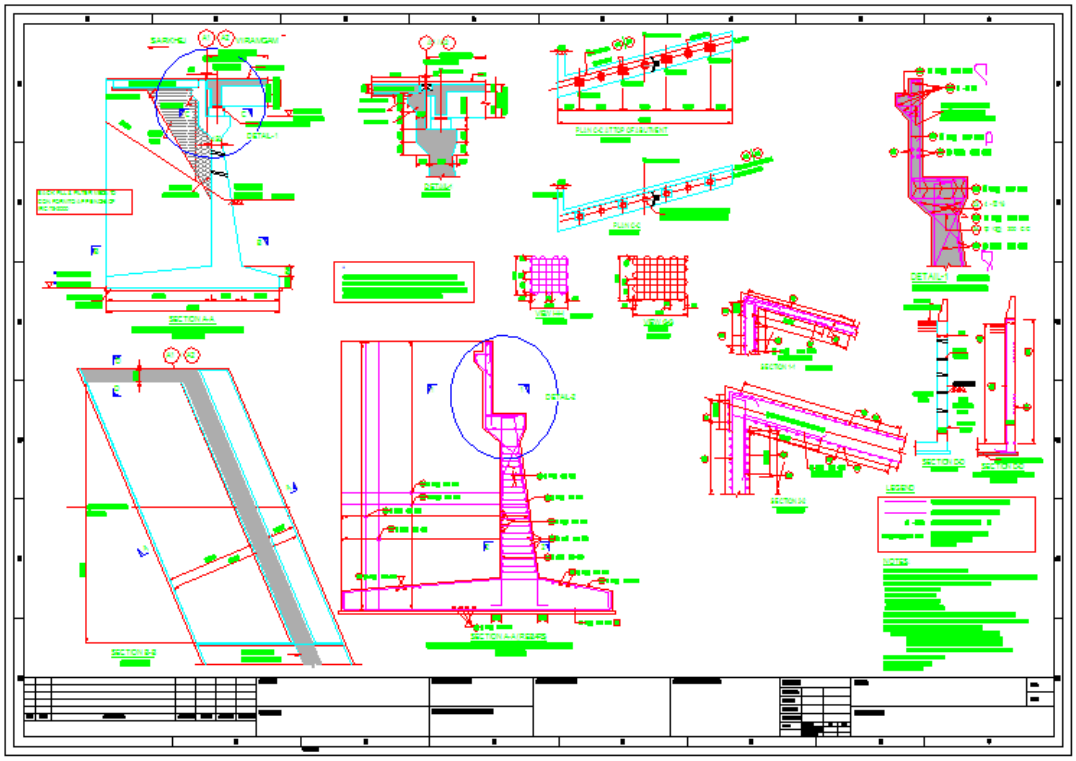
Bridge Design - Rope Cable Suspension Bridge



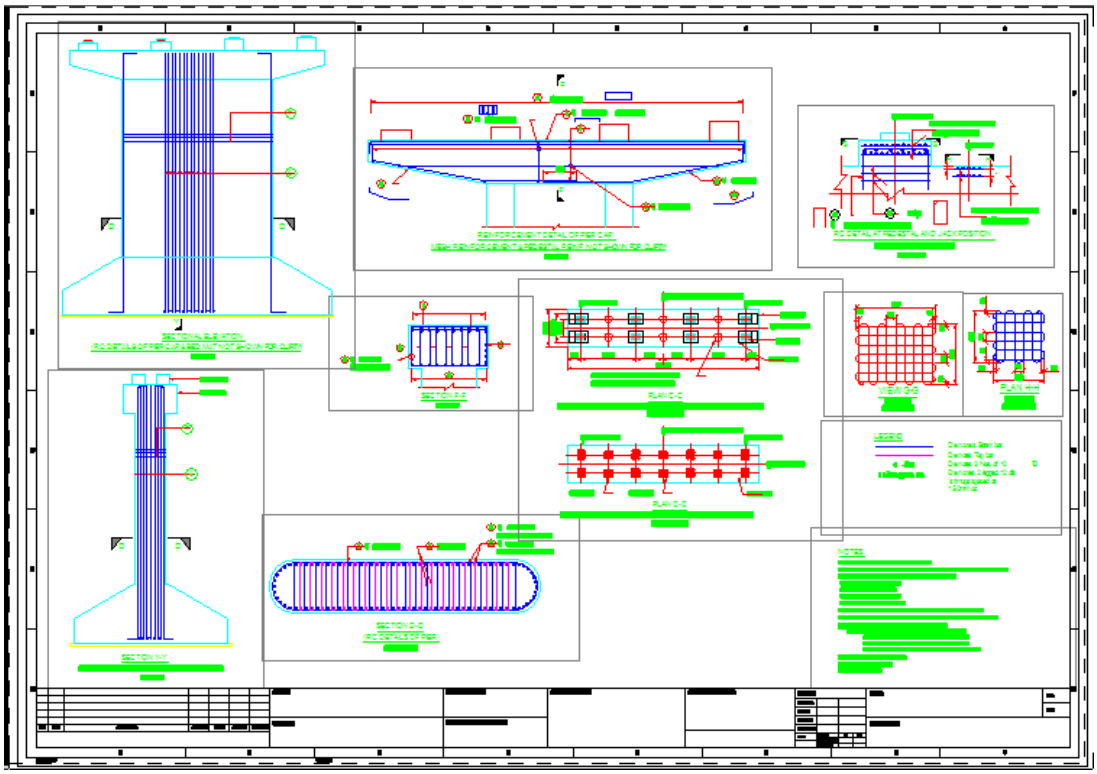
The Design of Steel Tower for Rope Cable Suspension Bridge is available with detail construction Drawings.



Bridge Design - RCC Bridge Abutment with detailed design calculation on span lodged and dislodged conditions and taking seismic effects with Structural Detail Drawings in editable CAD form.

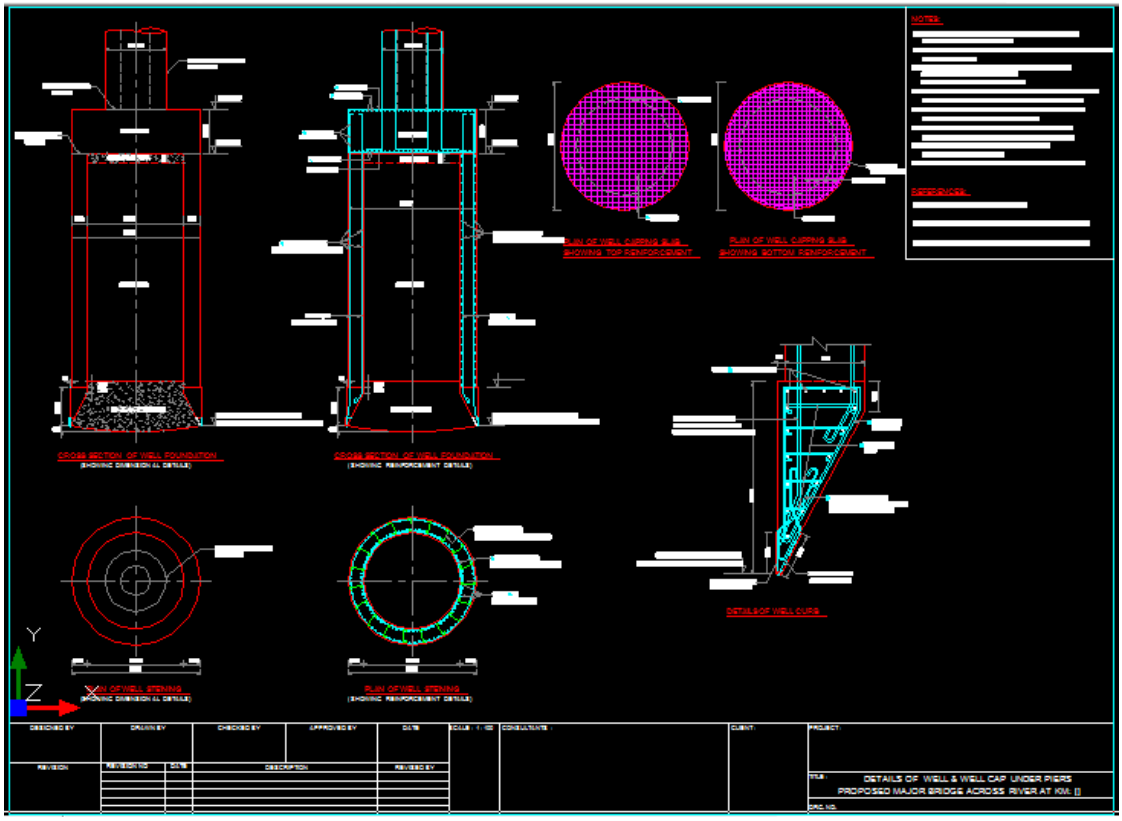


Bridge Design - RCC Bridge Pier with RCC Pier Cap and RCC Open Foundation for Fixed Load, Live Load, Seismic Force, Water Current Force with Structural Details CAD Drawings.

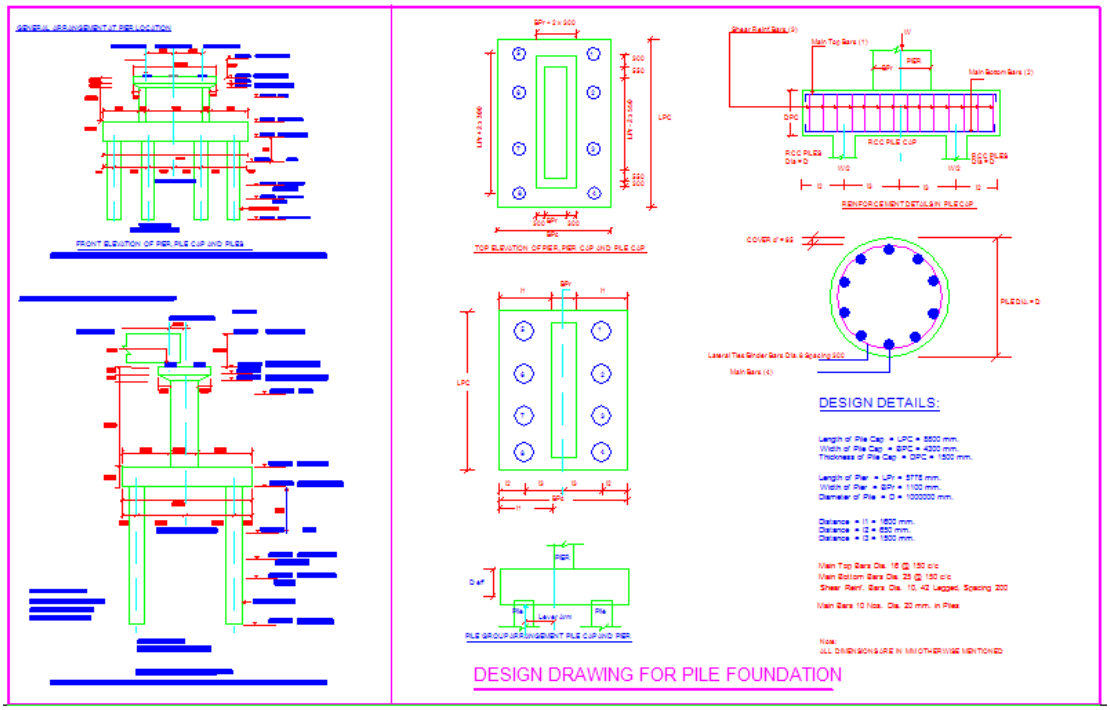


Bridge Design - RCC Well Foundation

With detailed design calculation with Scour Depth, Foundation Depth etc.



Bridge Design - RCC Pile Foundations for bridges from soil structure interaction and structural capacity. The pile capacity is determined from Skin Friction and End Bearing considering the pile passing through various soil strata, next Structural design for reinforcements. The CAD drawing contains design based structural detailing.



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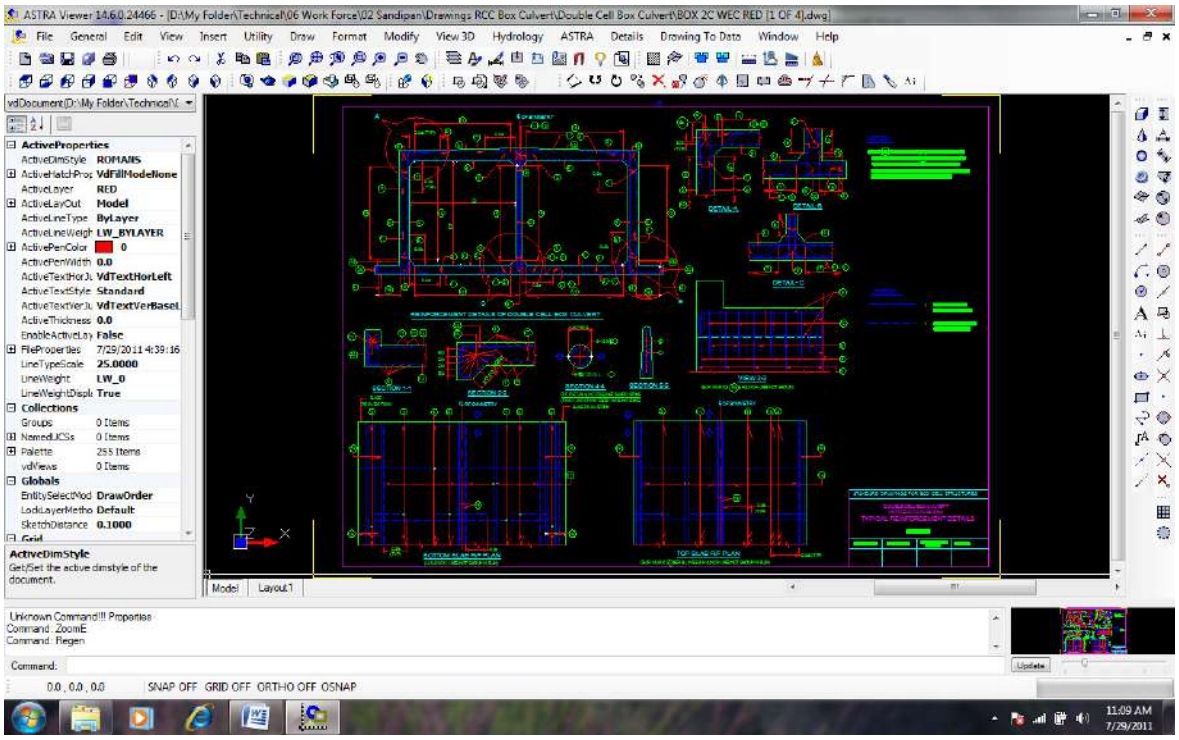
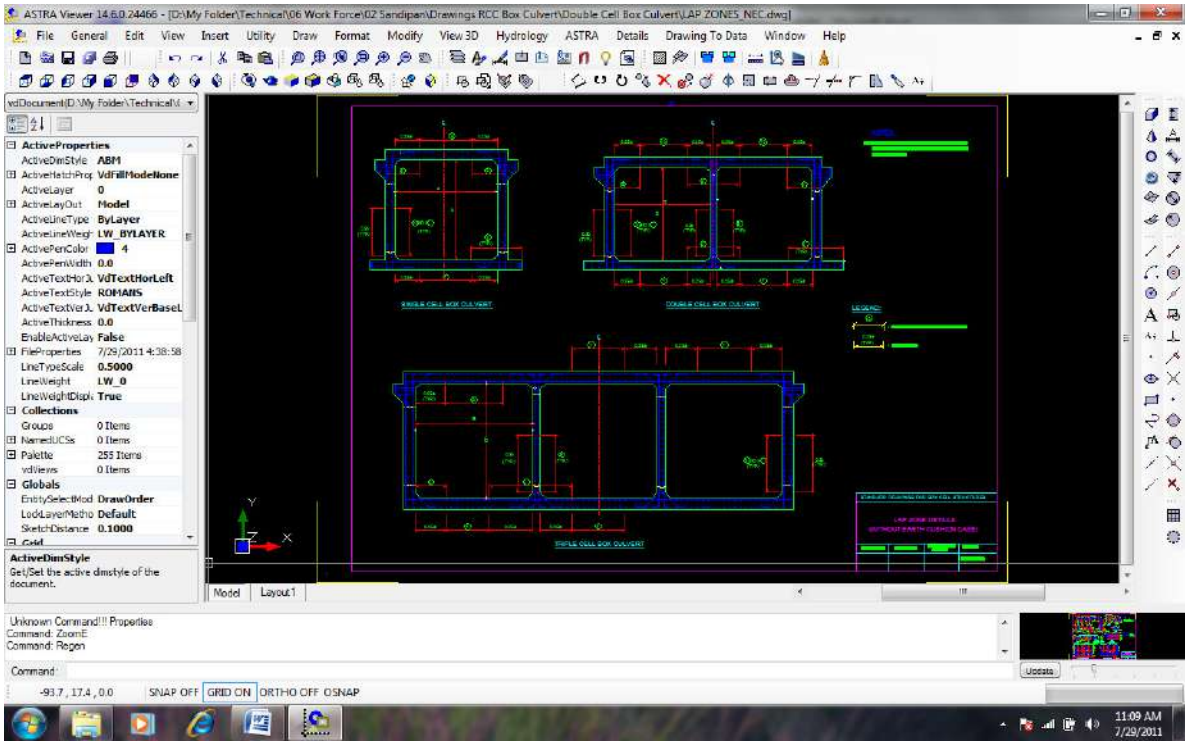
Bridge Design - RCC Box Culverts

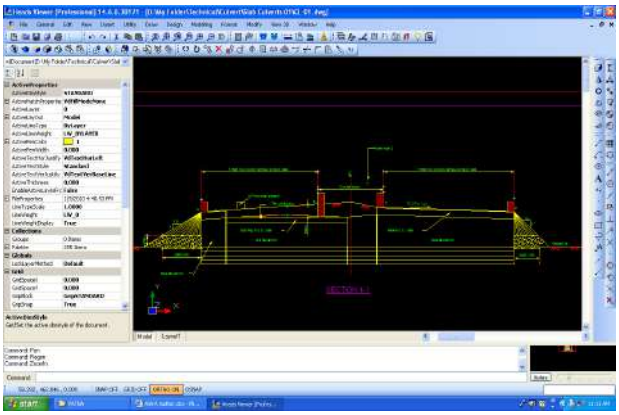
RCC Box Underpasses with earth cushion and without approach slab to the top slab.

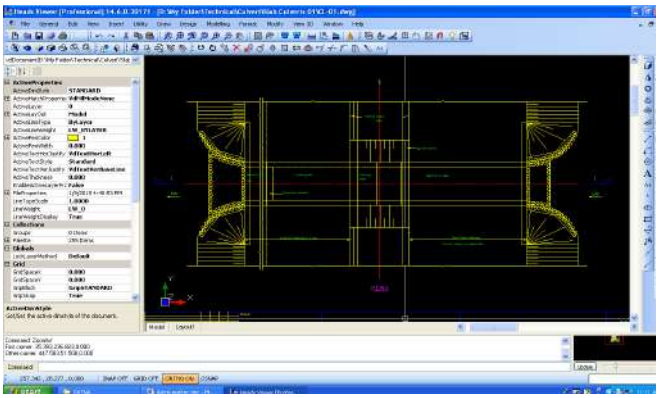


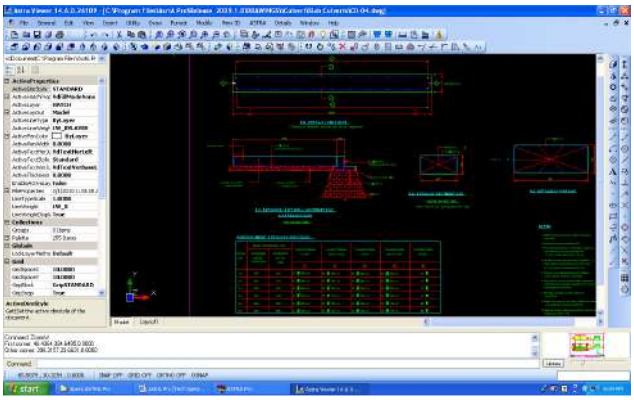
RCC Box Culverts / Underpasses without earth cushion and provision of approach slab on the top slab.

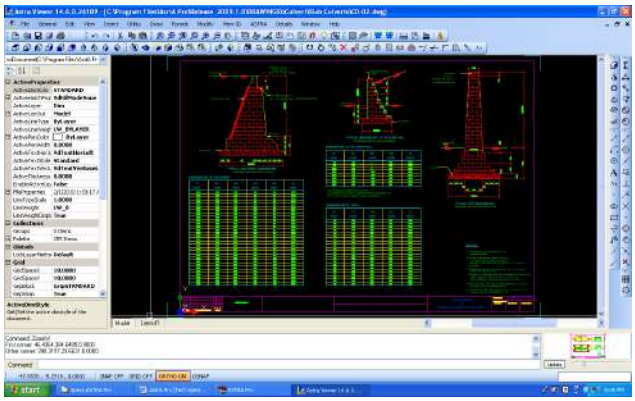


Bridge Design - RCC Slab Culverts / Pipe Culverts / RCC Slab Bridges

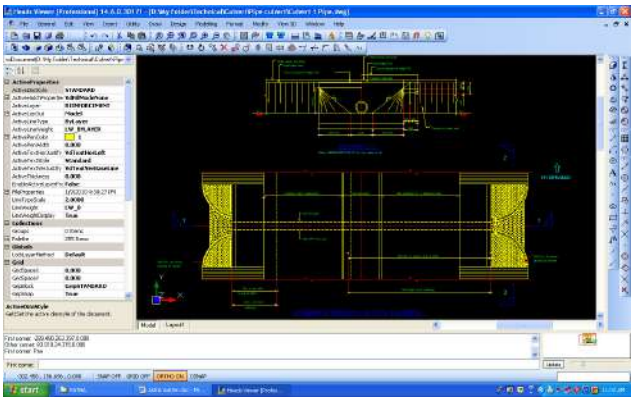


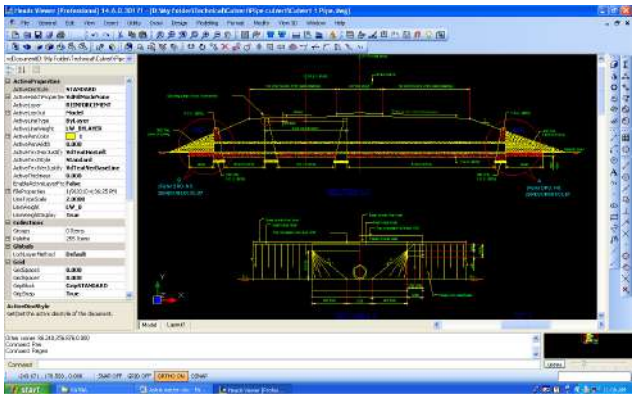


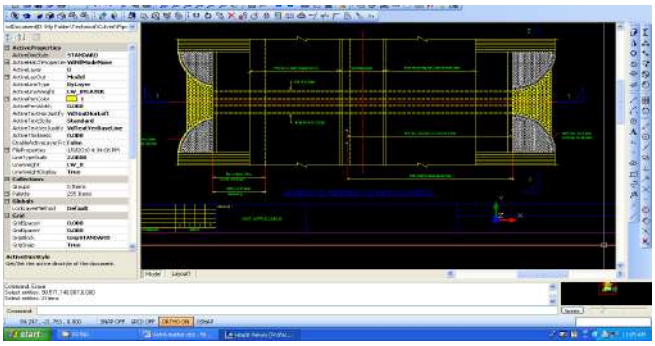


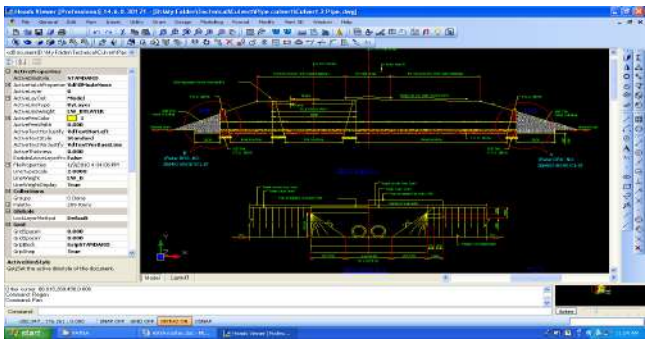


RCC Pipe Culverts (NP3 or NP 4) with detail design calculation report and Drawings for new construction or widening of RCC Pipe Culvert with drawings in editable CAD form.









Bridge Design - Seismic Restrainers

In case of transverse force larger than the capacity of Bearings the Seismic Restrainers may be provided on Abutment / Pier, Details of Seismic Restrainers/Stoppers are provided as CAD drawing.

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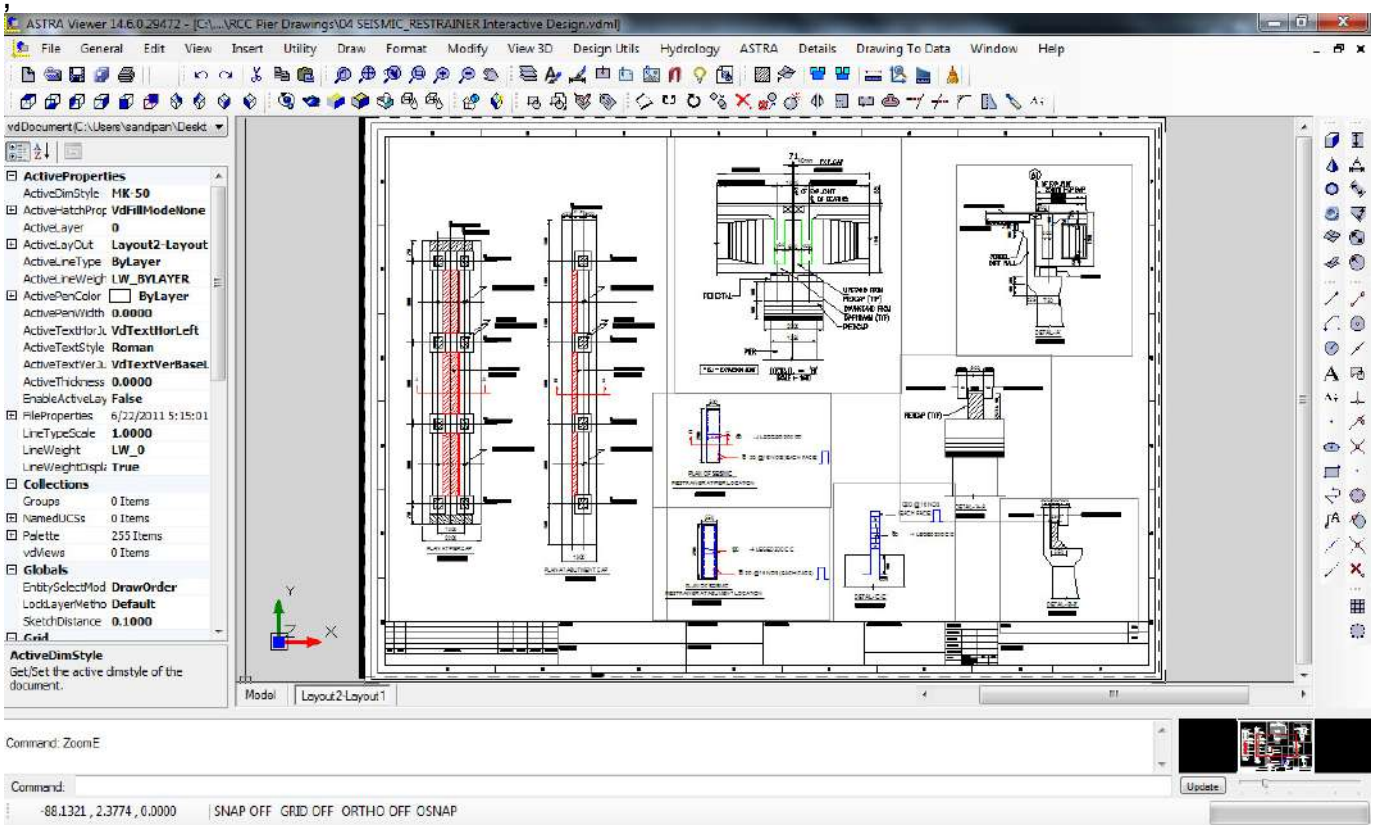
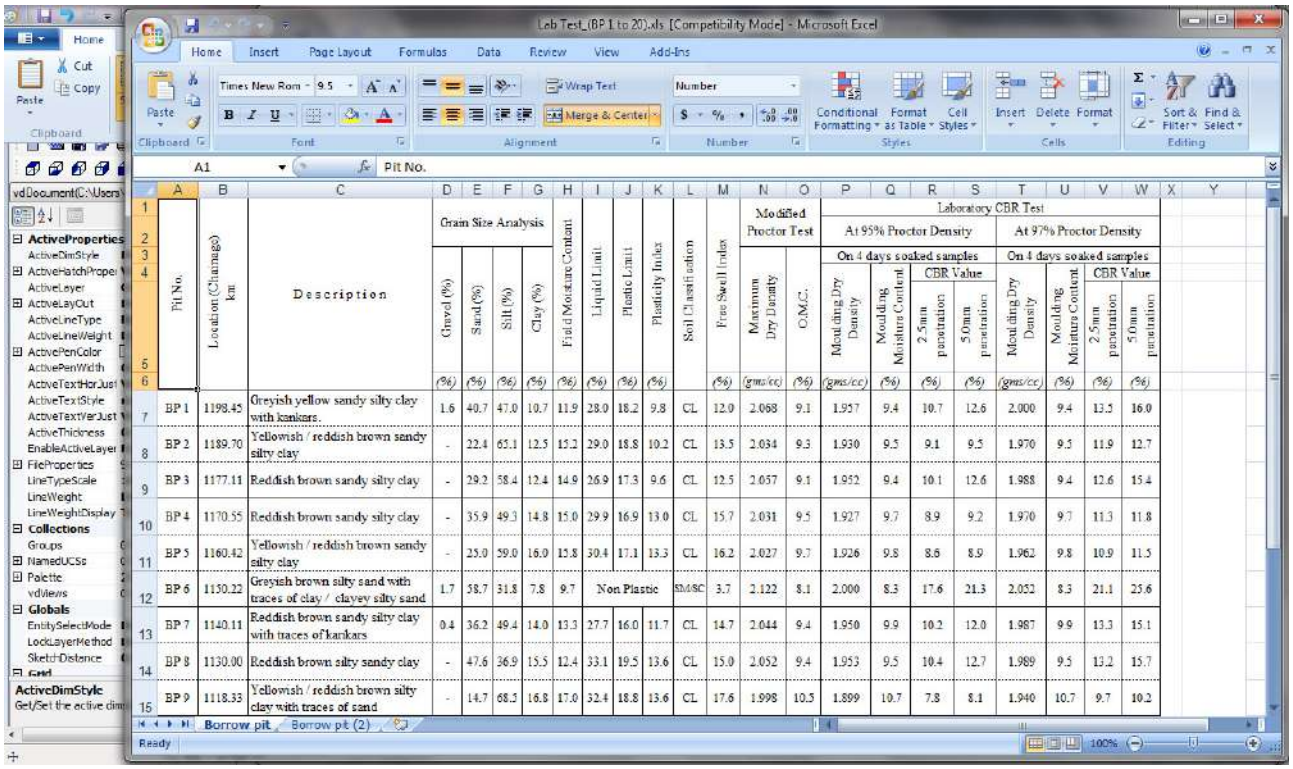


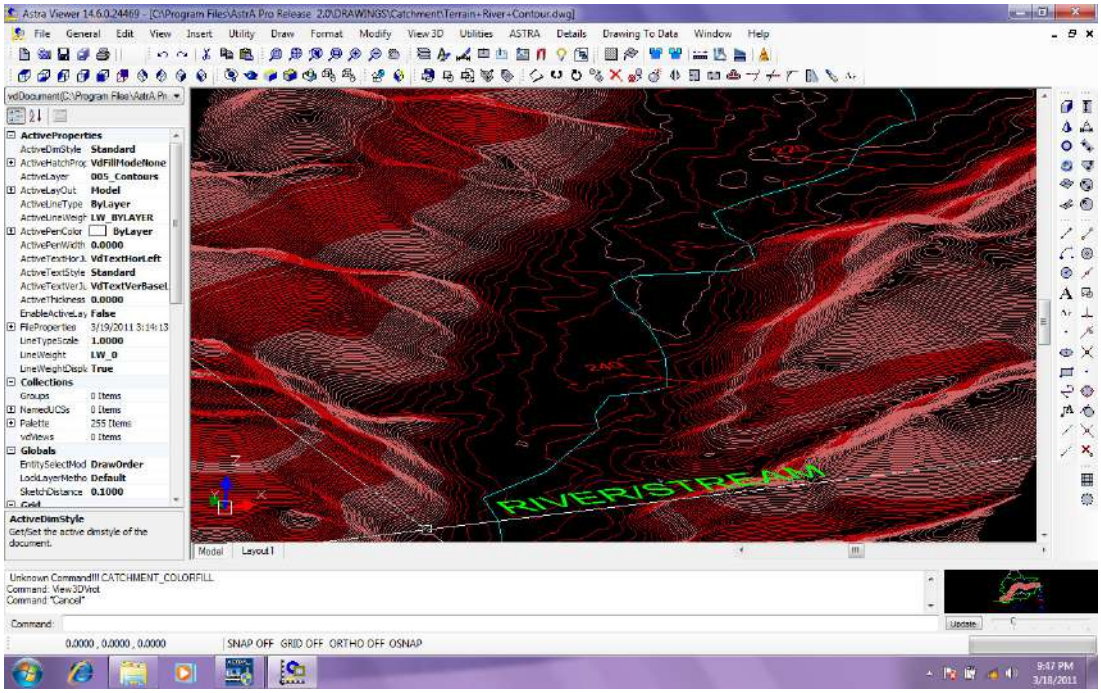
Details of Subsoil Exploration with processing of all related Soil Testing results and Graphical Plotting are available in section known as Geotechnics



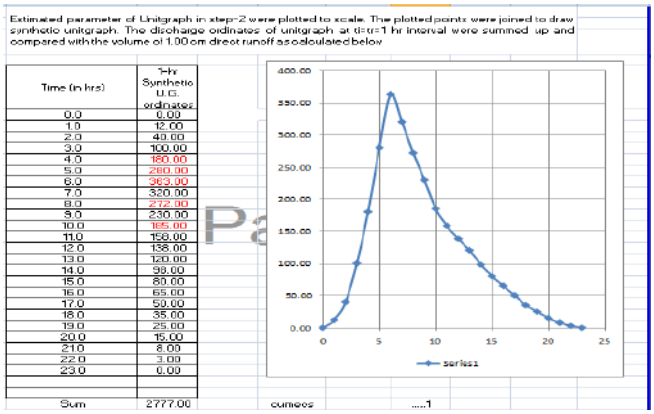
Pit No.	Location (Chainage) km	Description	Grain Size Analysis: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Field Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Soil Classification	Free Swell Index (%)	Modified Proctor Test: Maximum Dry Density (gms/cc)	O.M.C. (%)	Laboratory CBR Test: At 95% Proctor Density, On 4 days soaked samples: Moulding Dry Density (gms/cc)	Moulding Moisture Content (%)	CBR Value: 2.5mm penetration (%)	CBR Value: 5.0mm penetration (%)	At 97% Proctor Density, On 4 days soaked samples: Moulding Dry Density (gms/cc)	Moulding Moisture Content (%)	CBR Value: 2.5mm penetration (%)	CBR Value: 5.0mm penetration (%)
BP 1	1198.45	Greyish yellow sandy silty clay with kankars.	1.6	40.7	47.0	10.7	11.9	28.0	18.2	9.8	CL	12.0	2.068	9.1	1.957	9.4	10.7	12.6	2.000	9.4	13.5	16.0
BP 2	1189.70	Yellowish / reddish brown sandy silty clay	-	22.4	65.1	12.5	15.2	29.0	18.8	10.2	CL	13.5	2.034	9.3	1.930	9.5	9.1	9.5	1.970	9.5	11.9	12.7
BP 3	1177.11	Reddish brown sandy silty clay	-	29.2	58.4	12.4	14.9	26.9	17.3	9.6	CL	12.5	2.057	9.1	1.952	9.4	10.1	12.6	1.988	9.4	12.6	15.4
BP 4	1170.55	Reddish brown sandy silty clay	-	35.9	49.3	14.8	15.0	29.9	16.9	13.0	CL	15.7	2.031	9.5	1.927	9.7	8.9	9.2	1.970	9.7	11.3	11.8
BP 5	1160.42	Yellowish / reddish brown sandy silty clay	-	25.0	59.0	16.0	13.8	30.4	17.1	13.3	CL	16.2	2.027	9.7	1.926	9.8	8.6	8.9	1.962	9.8	10.9	11.5
BP 6	1150.22	Greyish brown silty sand with traces of clay / clayey silty sand	1.7	58.7	31.8	7.8	9.7	Non Plastic			SM/SC	3.7	2.122	8.1	2.000	8.3	17.6	21.3	2.052	8.3	21.1	25.6
BP 7	1140.11	Reddish brown sandy silty clay with traces of kankars	0.4	36.2	49.4	14.0	13.3	27.7	16.0	11.7	CL	14.7	2.044	9.4	1.950	9.9	10.2	12.0	1.987	9.9	13.3	15.1
BP 8	1130.00	Reddish brown silty sandy clay	-	47.6	36.9	15.5	12.4	33.1	19.5	13.6	CL	15.0	2.052	9.4	1.953	9.5	10.4	12.7	1.989	9.5	13.2	15.7
BP 9	1118.33	Yellowish / reddish brown silty clay with traces of sand	-	14.7	68.5	16.8	17.0	32.4	18.8	13.6	CL	17.6	1.998	10.5	1.899	10.7	7.8	8.1	1.940	10.7	9.7	10.2

Bridge Design - Stream Hydrology

Stream Hydrology is computed in details from Terrain Topography by transforming Transverse marcator data to Universal Tranverse marcator (UTM) data, Referring to WGS84 origin and directly downloaded from Shuttle Radar Topography Mission (SRTM) without Topo maps. Discharge Location at Bridge is measured from farthest point of the River for water discharge at the Bridge location. The environment is 3D CAD, fully compatible to other CAD softwares.

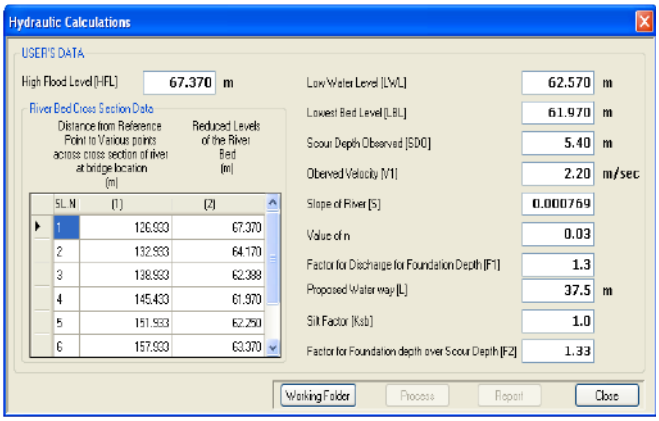


Synthetic Unit Hydrograph is plotted by comparing sum of discharge for 1 hour interval of Time and volume of 1 cm direct Runoff. The Hydrological Calculations for obtaining Scour Depth and Founding Depth for Bridge Foundations are also available.



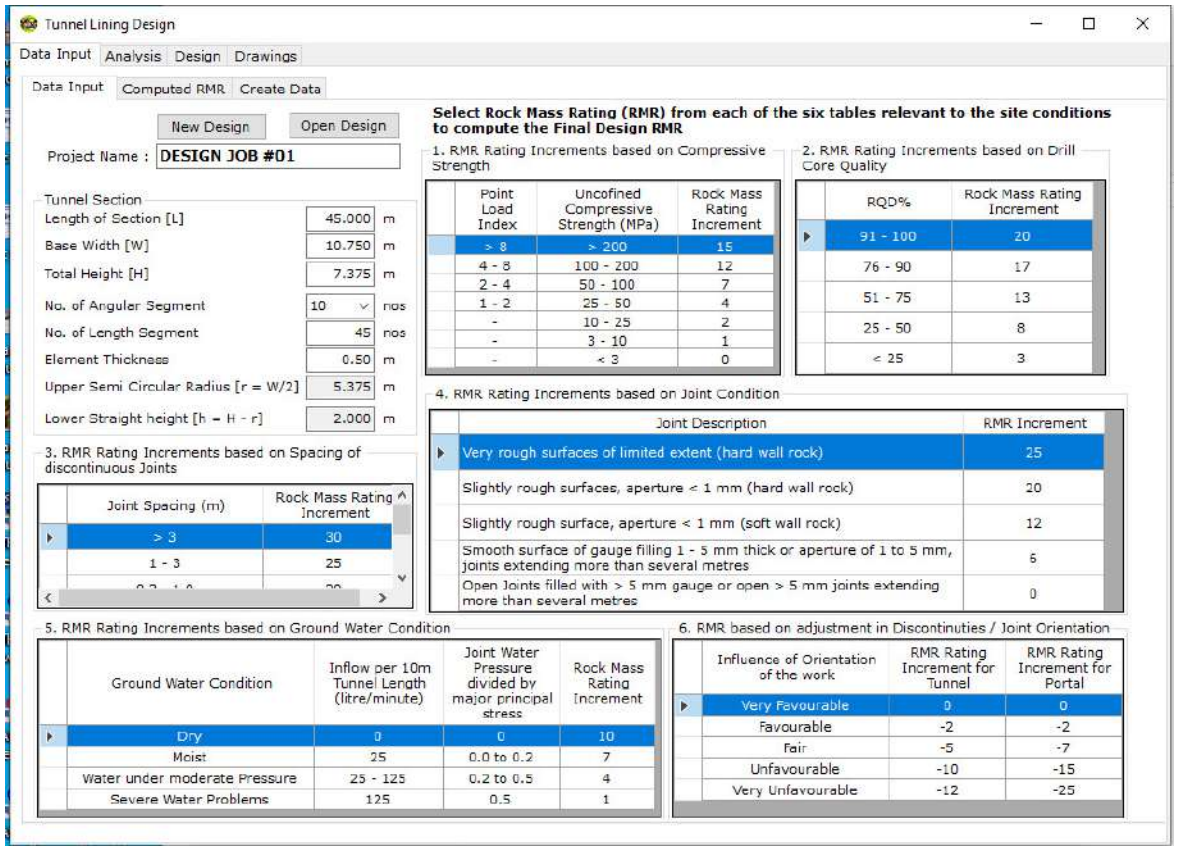
Estimated parameter of Unitgraph in step-2 were plotted to scale. The plotted points were joined to draw synthetic unitgraph. The discharge ordinates of unitgraph at dt=1 hr interval were summed up and compared with the volume of 1.00 cm direct runoff as calculated below

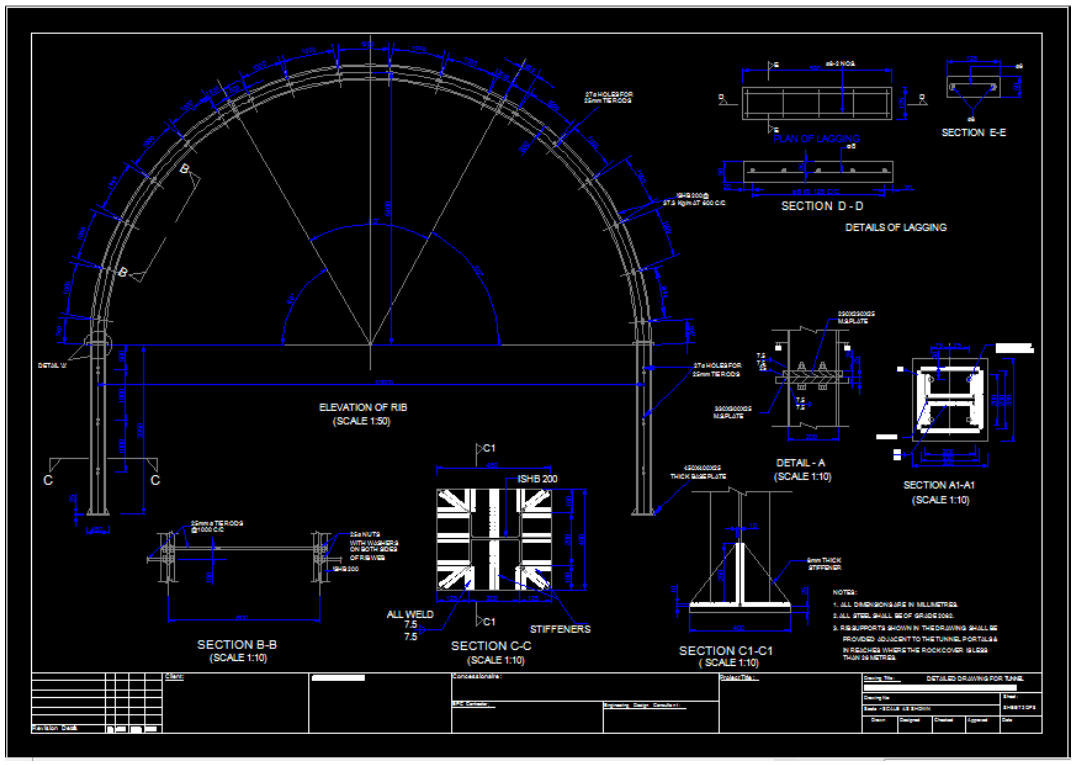
Time (in hrs)	1-hr Synthetic U.G. ordinates
0.0	0.00
1.0	12.00
2.0	40.00
3.0	100.00
4.0	180.00
5.0	280.00
6.0	363.00
7.0	320.00
8.0	272.00
9.0	230.00
10.0	195.00
11.0	168.00
12.0	138.00
13.0	120.00
14.0	98.00
15.0	80.00
16.0	65.00
17.0	50.00
18.0	35.00
19.0	25.00
20.0	15.00
21.0	8.00
22.0	3.00
23.0	0.00
Sum	2777.00



Design of Structures – RCC Tunnel Lining with Shotcrete, Steel Ribs, RCC Portals

ASTRA Pro has detail structural analysis and design of Tunnel Lining with RCC Portal, Steel Ribs and RCC Tunnel Lining with shotcrete by evaluating RQD & Rock Mass Rating (RMR).

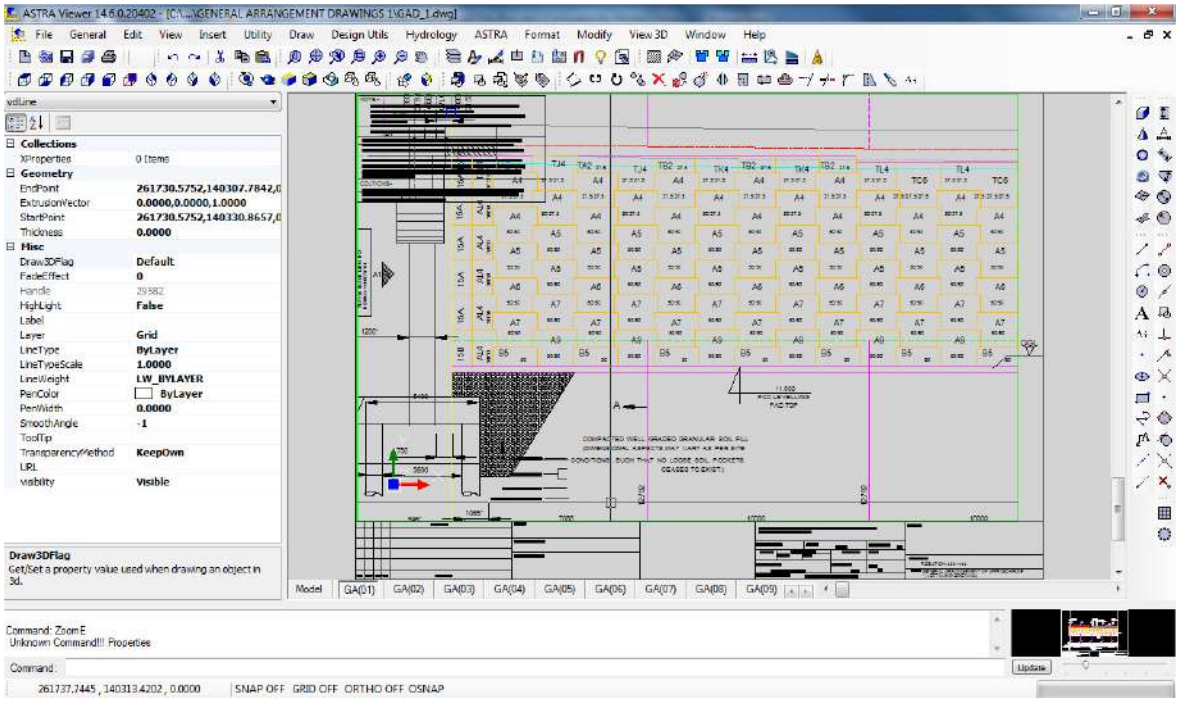




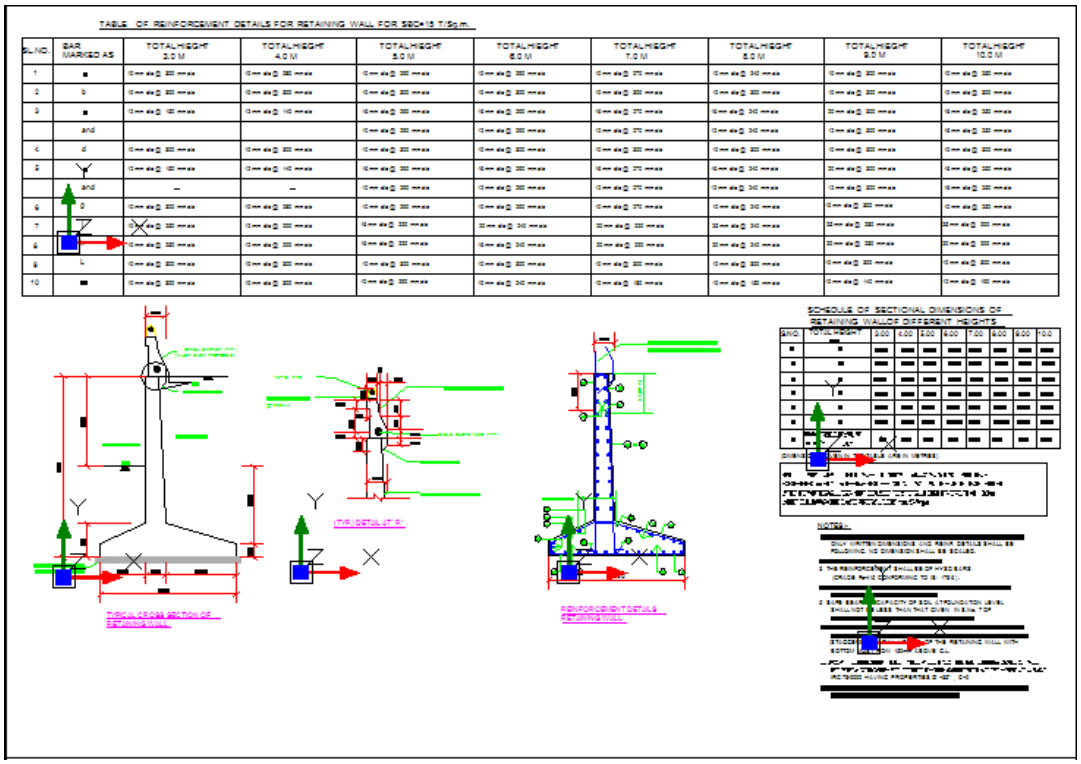
Design of Structures – Reinforced Earth Walls

ASTRA Pro Structural Design features for Analysis and Design of Reinforced Earth Walls by using Polymer Geostrips (BS 8006).

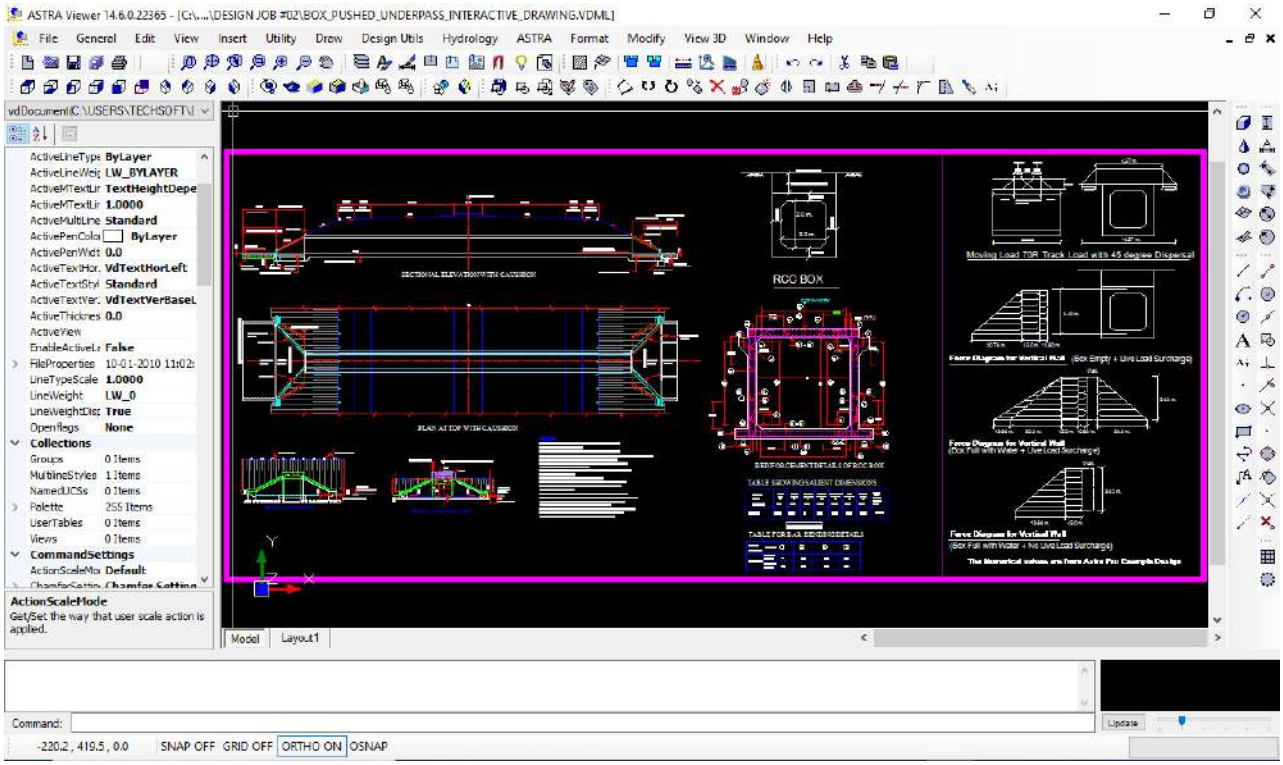
A complete set of Sample GADs and Structural drawings are provided to guide the users.



Design of Structures – **Design of RCC Retaining Wall as Cantilever and Propped Cantilever, sample CAD drawings are provided for general arrangements and structural detailing.**

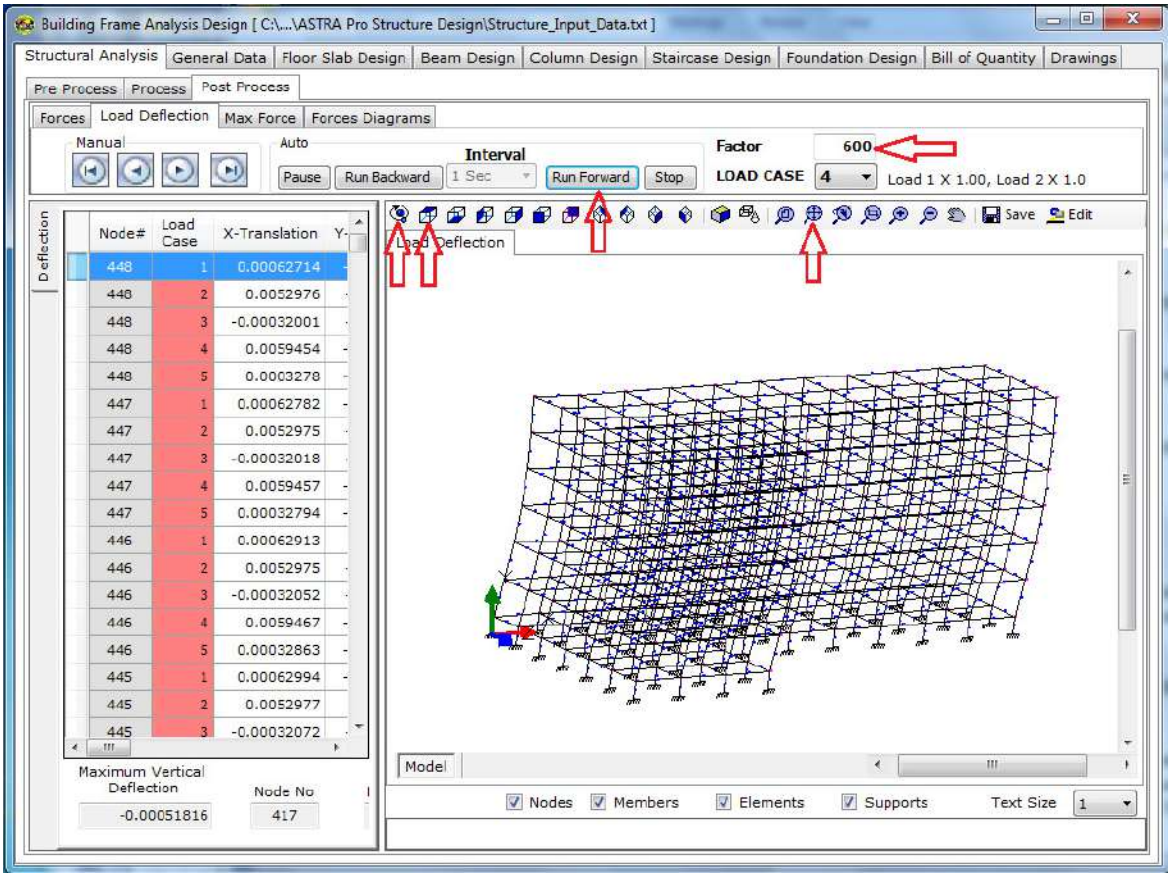


Design of Bridges – RCC Box Underpass under Railway and Highway.



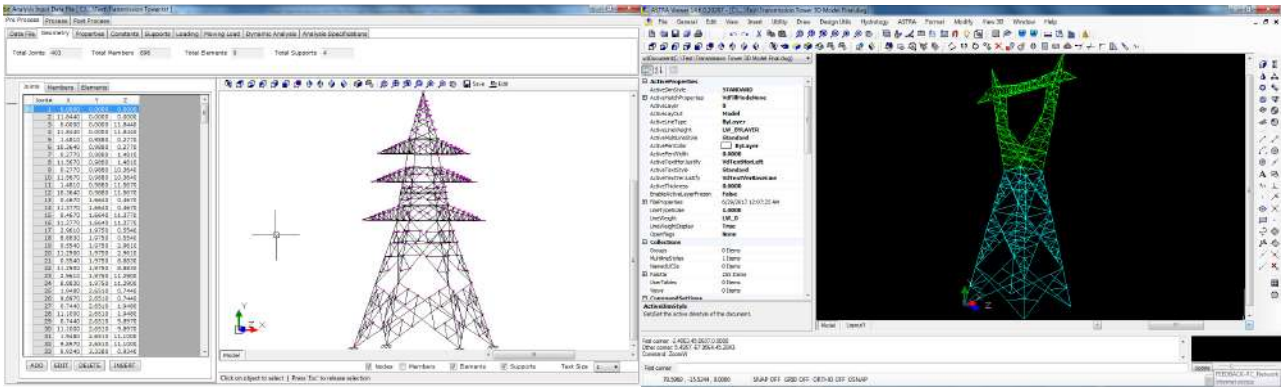
Analysis and Design for RCC Framed Buildings, ASTRA Pro features for Analysis, Design, BoQ and Construction Drawings for RCC Framed Buildings

The Building design facility is unique for structural engineers with various facilities for viewing and printing detail Reports, Force Diagrams and Construction Drawings. Design of RCC Slab, Beam, Column and Footings are done with Step by Step detail Report, relevant to Design Standards, Bill of Quantity and complete set of construction drawings.



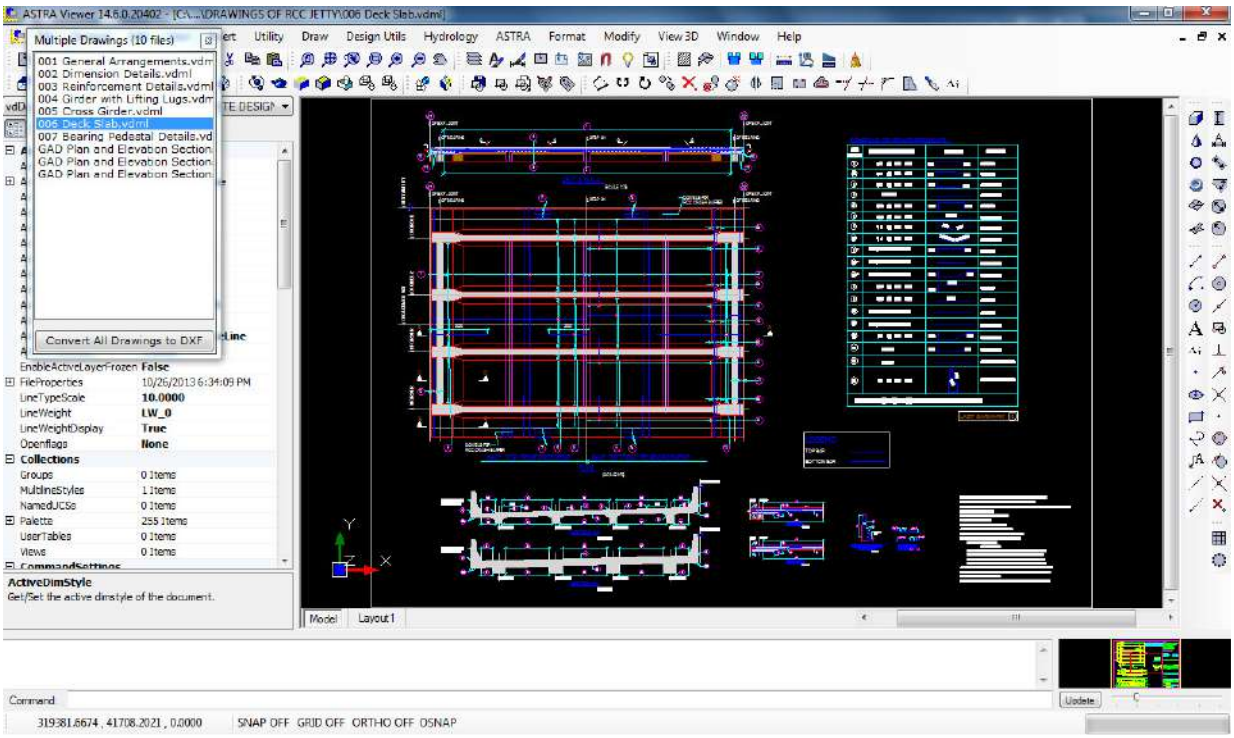
ASTRA Pro Features for design of Transmission Towers for Analysis with Cable Load, Wind Load and Seismic Load combined for twenty four predefined load cases and Design of Members and Joints.

Transmission Towers for transmission lines from Thermal, Hydroelectric, Gas, and Wind Turbine generated electric power plants and power grid substations.



ASTRA Pro features for Analyses & Design of Transmission Line, Cable Car and Microwave Towers

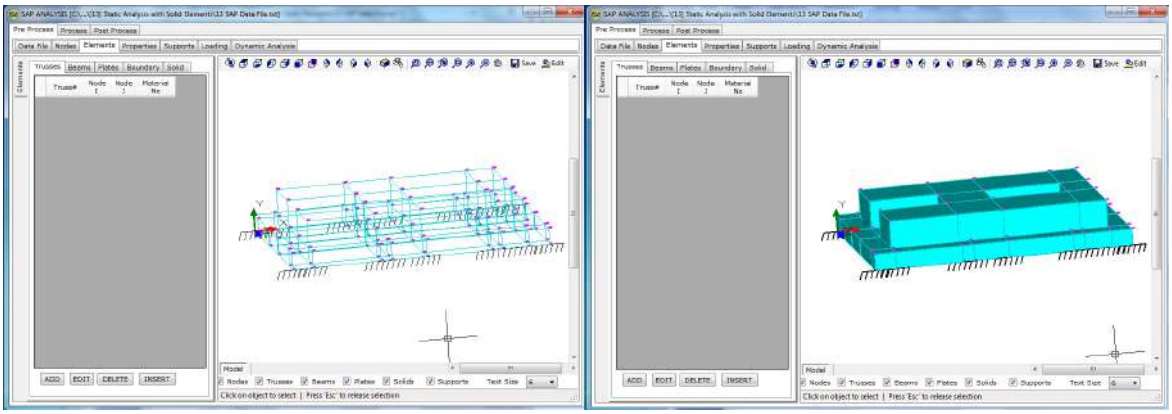
ASTRA Pro Structural Design features for Analysis and Design of Reinforced Cement Concrete and Pre Stressed Concrete Jettys with Pile Foundation, Long and Cross Girders and Deck Slab.



ASTRA Pro has very powerful static and dynamic Structural Analysis suit featuring:

- Static Analysis of Structures for Joint Load, Member Load, Area Load, Repeat Load, Floor Load etc.
- Bridge Deck Analysis with combinations of Moving Loads
- Analysis for structures with Beam, Truss, Plate/Shell, Solid and Boundary elements
- Dynamic Analysis is available for Eigen value analysis, Response Spectra analysis and Time History analysis with or without Nodal Constraints in Degrees of Freedom. The Frequency and Mode Shapes are displayed in animated views.

3D CAD Wire Mesh View and 3D Solid Filled CAD View of Structural Model of Block Type Machine Foundation for Dynamic Analysis



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