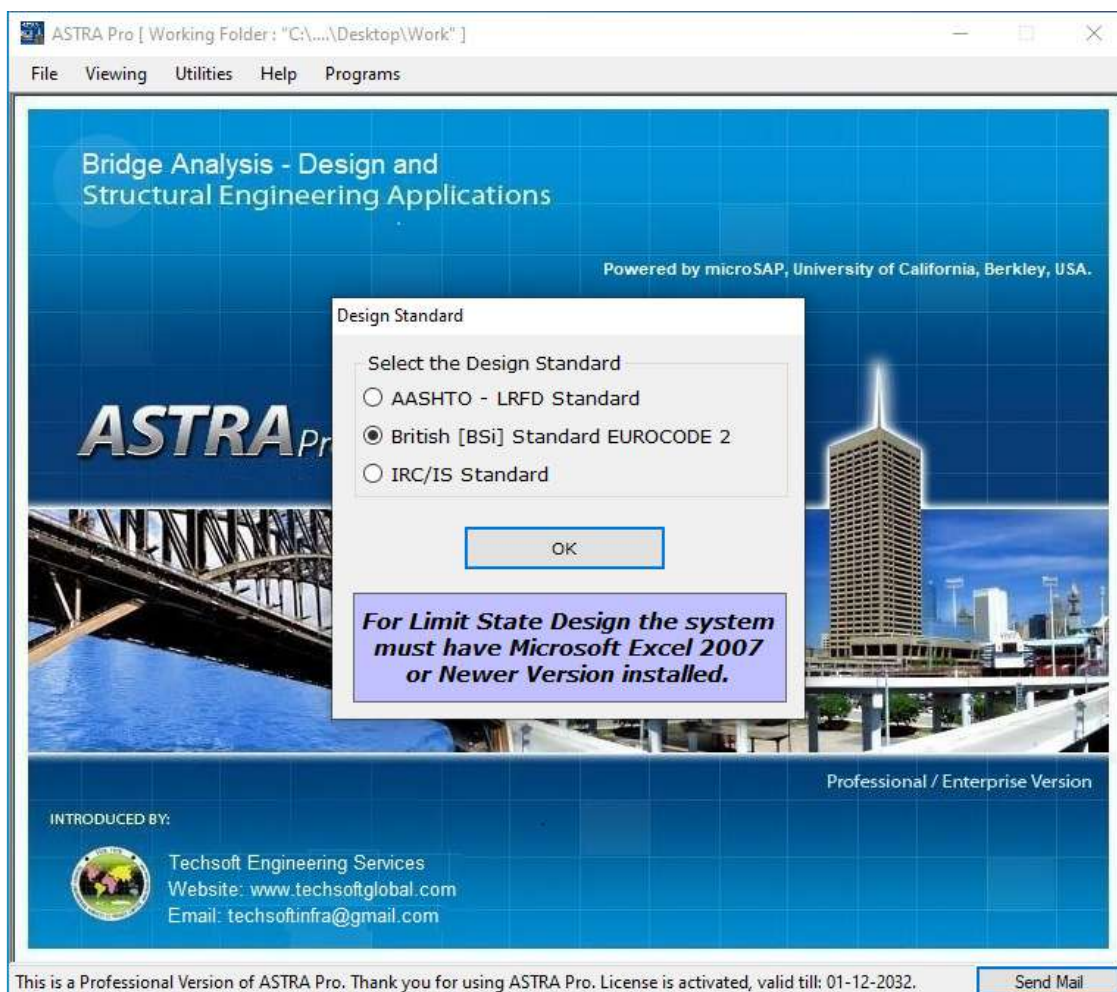


ASTRA Pro®

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 Drawngs.

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:

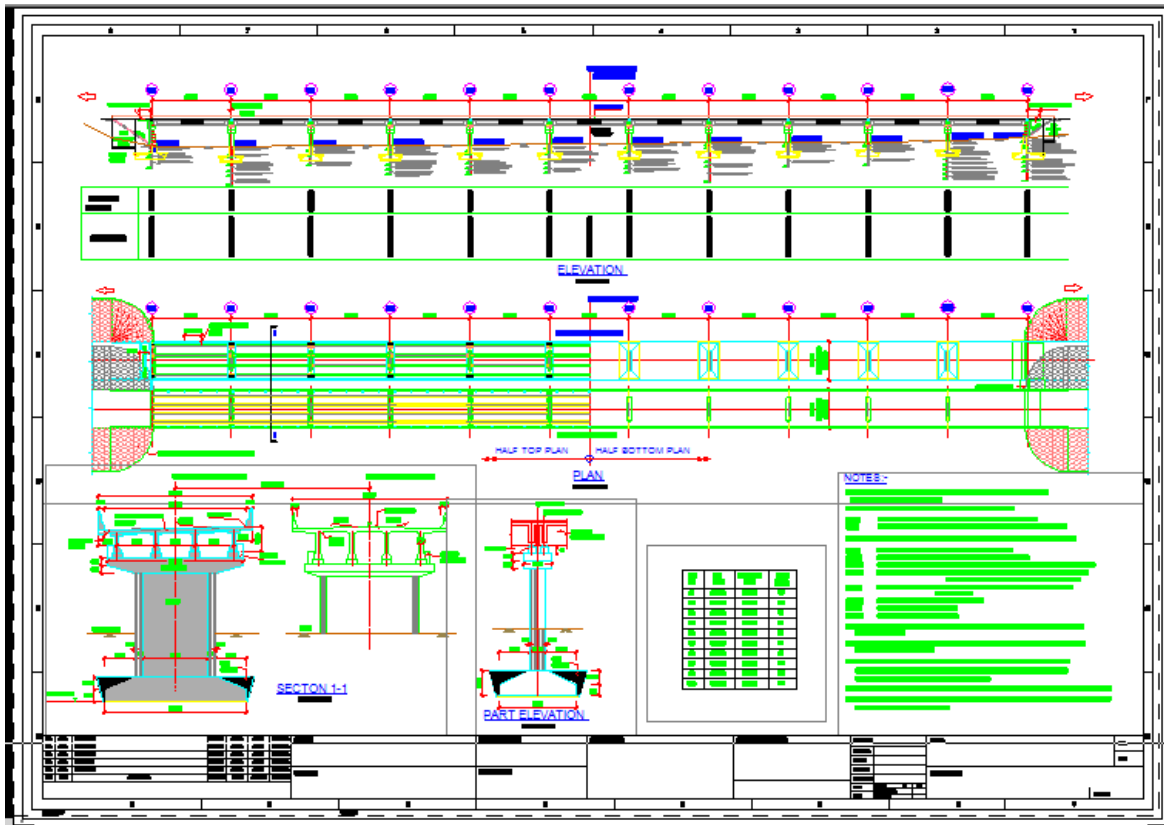
<https://novapublishers.com/shop/computer-aided-bridge-engineering-detail-design-of-pre-stressed-concrete-i-girder-box-girder-bridges/>

Contact: Ms. Lisa Gambino, Email: marketing@novapublishers.com

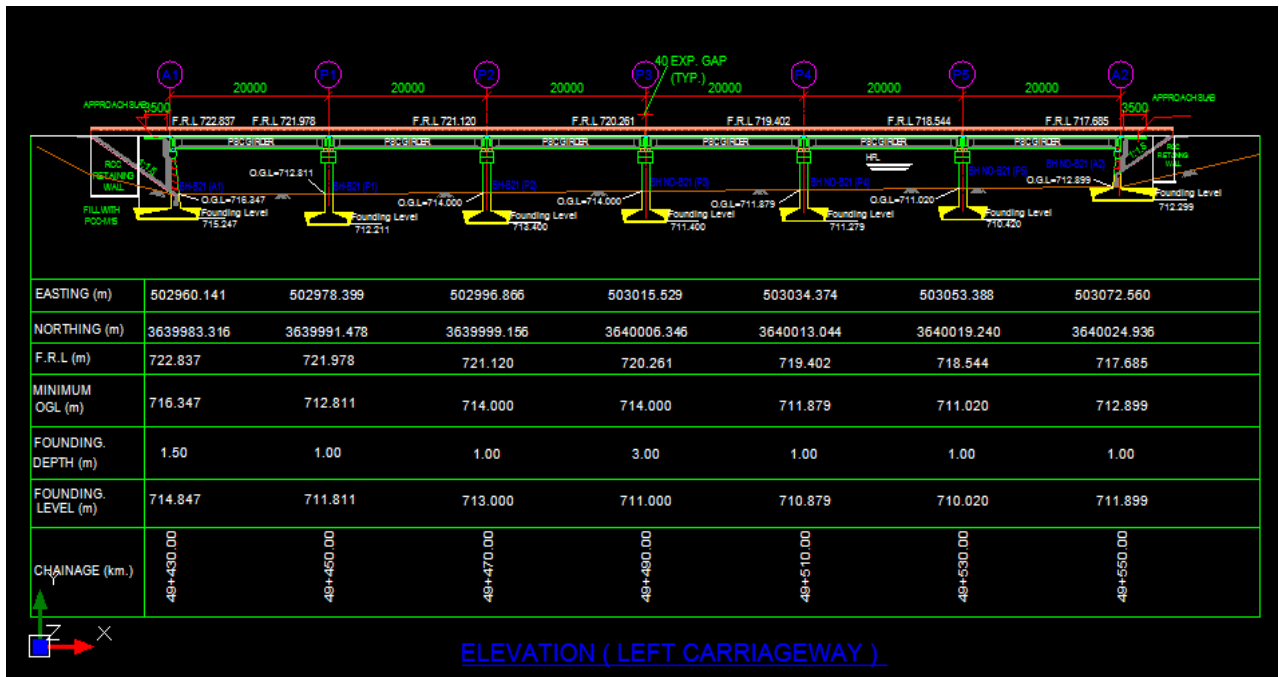
All "Book Tutorials" by ASTRA Pro are available at Website:

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.



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

RCC T-GIRDER BRIDGE LIMIT STATE [BS] : C:\...Desktop\ASTRA Pro Structure Design

Analysis of Bridge Deck | Long Main Girders | Cross Girders | Deck Slab [BS 5400] | Abutment | RCC Pier | Drawings

User Input Data | Section Properties | Moving Load Data | Analysis Process

Moving Vehicle Live Load [BS 5400, Part 2, BD 37/01]

Total Bridge Deck Width: 12
 Each Lane Width: 3.5
 Total No. of Lanes: 3
 Impact Factor: 1.0
 Load Factor: 1.0
 Moving Increment: 0.5
 Load Generation: 40

Select Live Load: HA & HB Loading HA Loading HB Loading

HA Loading
 HA Loading UDL: 3.44 Ton/m
 HA Loading Concentrated (Knife Edge Load, KEL): 12 Ton

Apply HA Load on Lanes: 1 2 3 4 5
 6 7 8 9 10

HB Loading
 Select HB Load Type: HB_UNIT

Apply HB Load on Lanes: 1 2 3 4 5
 6 7 8 9 10

HB LOADING

Define Vehicle Axle Loads
 (USER MAY CHANGE THE VALUES IN THE CELLS, THE DATA WILL BE SAVED IN FILE "LL.TXT" FOR USE)

Moving Load	1	2	3	4
TYPE 1 HB_UNIT_6				
AXLE LOAD IN TONS	1.0	1.0	1.0	1.0
AXLE SPACING IN METRES	1.8	6.0	1.8	
AXLE WIDTH IN METRES	1.0			
IMPACT FACTOR	1.0			
TYPE 2 HB_UNIT_11				
AXLE LOAD IN TONS	1.0	1.0	1.0	1.0
AXLE SPACING IN METRES	1.8	11.0	1.8	
AXLE WIDTH IN METRES	1.0			
IMPACT FACTOR	1.0			

Define Load Start position
 (Refer to Page 100, ASTRA Pro User Manual)

	Lane 1	Lane 2	Lane 3
LOAD 1 TYPE 1	-9.5	-9.5	-9.5
LOAD 2 TYPE 2	-14.5	-14.5	-14.5
LOAD 3 TYPE 3	-19.5	-19.5	-19.5

British Standard Design of RCC Deck Slab

RCC T-GIRDER BRIDGE LIMIT STATE [BS] : C:\...Desktop\ASTRA Pro Structure Design

Analysis of Bridge Deck | Long Main Girders | Cross Girders | Deck Slab [BS 5400] | Abutment | RCC Pier | Drawings

Analysis | Design of Deck Slab | Cantilever Slab Design

Design Loads & Forces | Transverse Bending Resistance | Flexural Cracking | Shear Calculation | Figures

Dead Load Effect for the unit width

$W = \text{Dead Load} + \text{SIDL}$

$L = 0.963 \text{ m}$

Bending Moment Diagram

Shear Force Diagram

Dead Load Effect for the unit width

30 units of HB Loading is to be used for Bending Effect

Transverse Dispersion

Top of Road Surface

Neutral Axis = 0.090 m

$W = 126.66 \text{ kN/m}$

$c/l = 0.5911 \text{ m}$

$L = 0.963 \text{ m}$

Create Design Report | View Design Report in Text Format

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

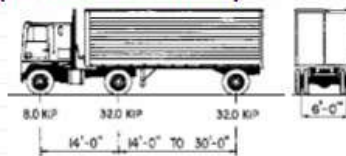
LRFD Limit States

◆ 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: ⇒



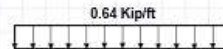
or

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



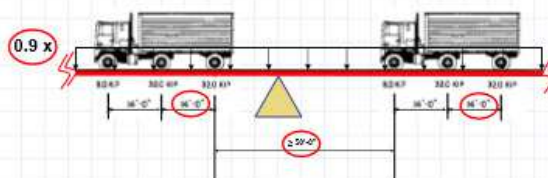
superimposed on

◆ 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:

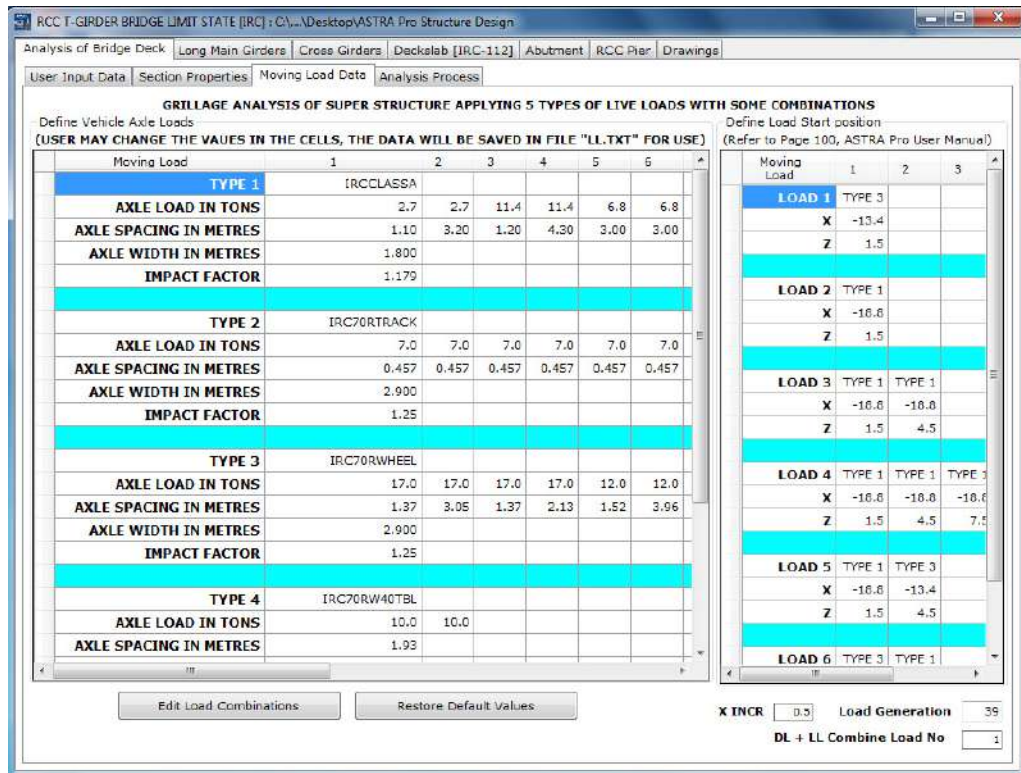


IRC 6 Class Load Combinations

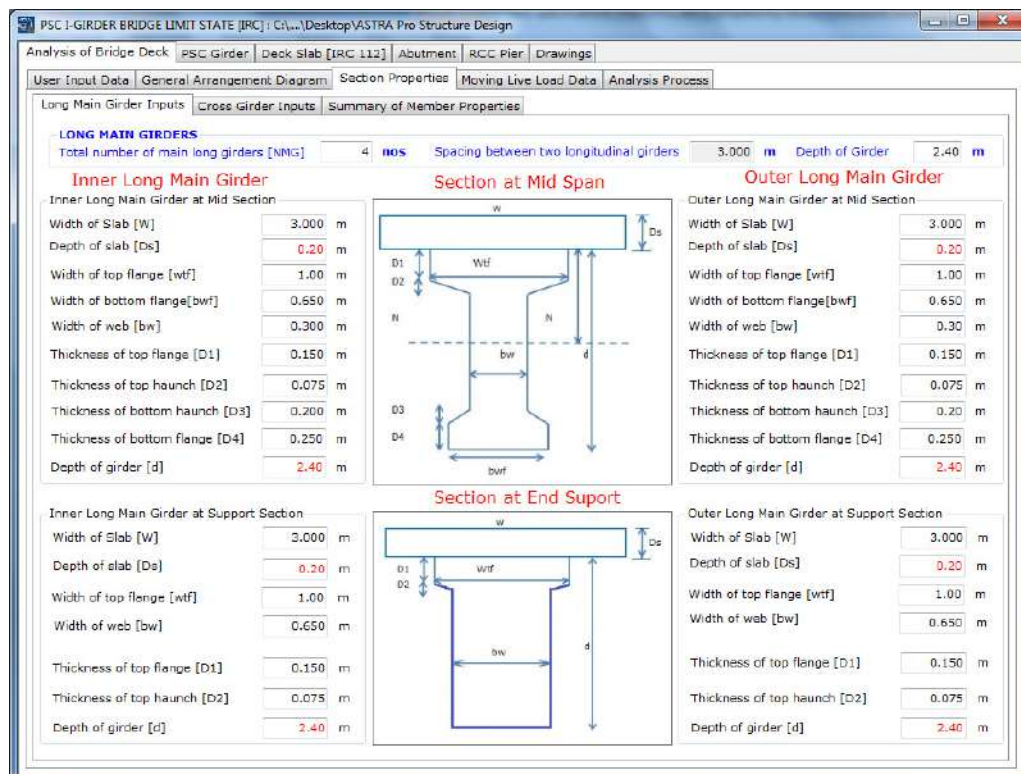
Table 2 Live Load Combinations IRC:6-2014

S.NO	NO. OF LANES FOR DESIGN PURPOSE	CARRIAGEWAY WIDTH (CW) & LOADING ARRANGEMENT
1.	1 LANE	<p>$4.25\text{m} < \text{CW} < 5.3\text{m}$</p> <p>CLASS A</p> <p>1.8</p> <p>0.15 (MIN.)</p> <p>CASE 1 : CLASS A - 1 LANE</p>
2.	2 LANES	<p>$5.3\text{m} < \text{CW} < 9.6\text{m}$</p> <p>CLASS 70R(W)</p> <p>1.2 (MIN.)</p> <p>CASE 1 : CLASS 70R (W)</p>
		<p>$5.3\text{m} < \text{CW} < 9.6\text{m}$</p> <p>CLASS A</p> <p>1.8</p> <p>0.15 (MIN.)</p> <p>1.2 (MIN.)</p> <p>CASE 2 : CLASS A - 2 LANES</p>
3.	3 LANES	<p>$9.6\text{m} < \text{CW} < 13.1\text{m}$</p> <p>CLASS A</p> <p>1.8</p> <p>0.15 (MIN.)</p> <p>1.2 (MIN.)</p> <p>CASE 1 : CLASS A - 3 LANES</p>
		<p>$9.7\text{m} < \text{CW} < 13.1\text{m}$</p> <p>CLASS A</p> <p>1.8</p> <p>0.15 (MIN.)</p> <p>1.2 (MIN.)</p> <p>7.25 (MIN.)</p> <p>CLASS 70R(W)</p> <p>1.2 (MIN.)</p> <p>(NO OTHER VEHICLE PERMITTED IN THIS ZONE)</p> <p>CASE 2 : CLASS A - 1 LANE + CLASS 70R (W)</p>

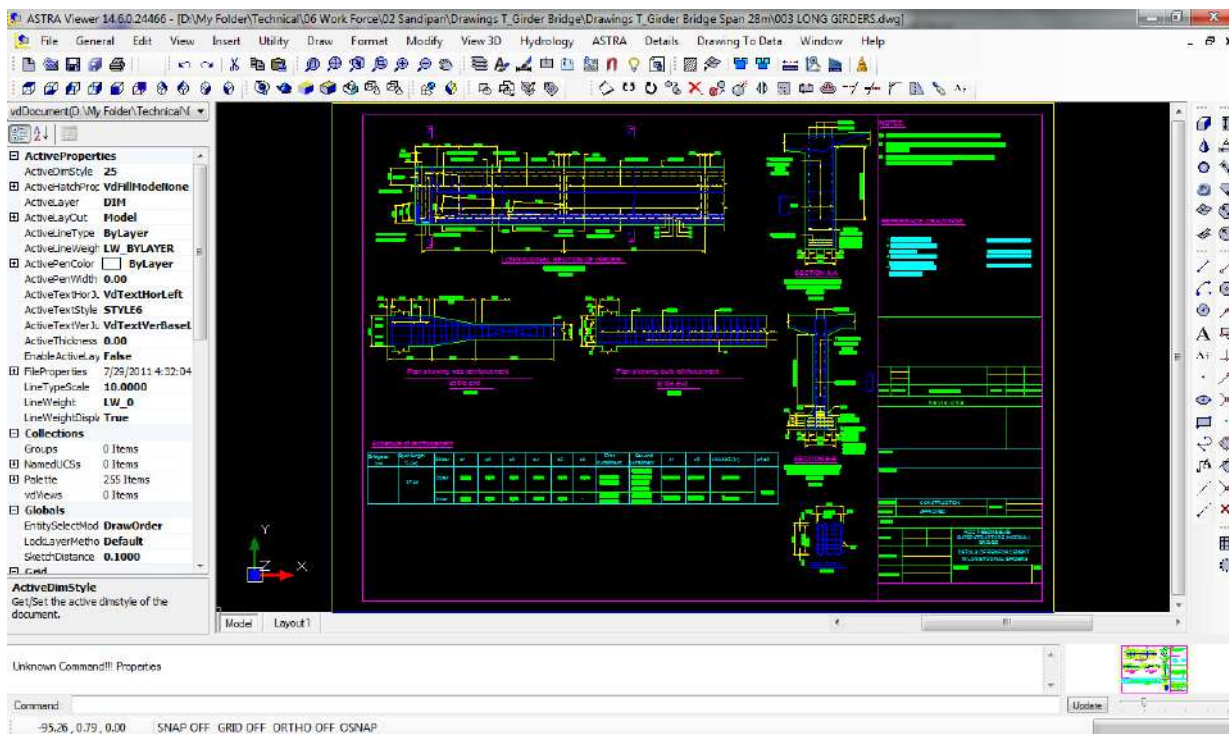
Input for Live Loads for either IRC 6 Class or BD 37/01 or AASHTO-LRFD Combinations is very simple in ASTRA Pro



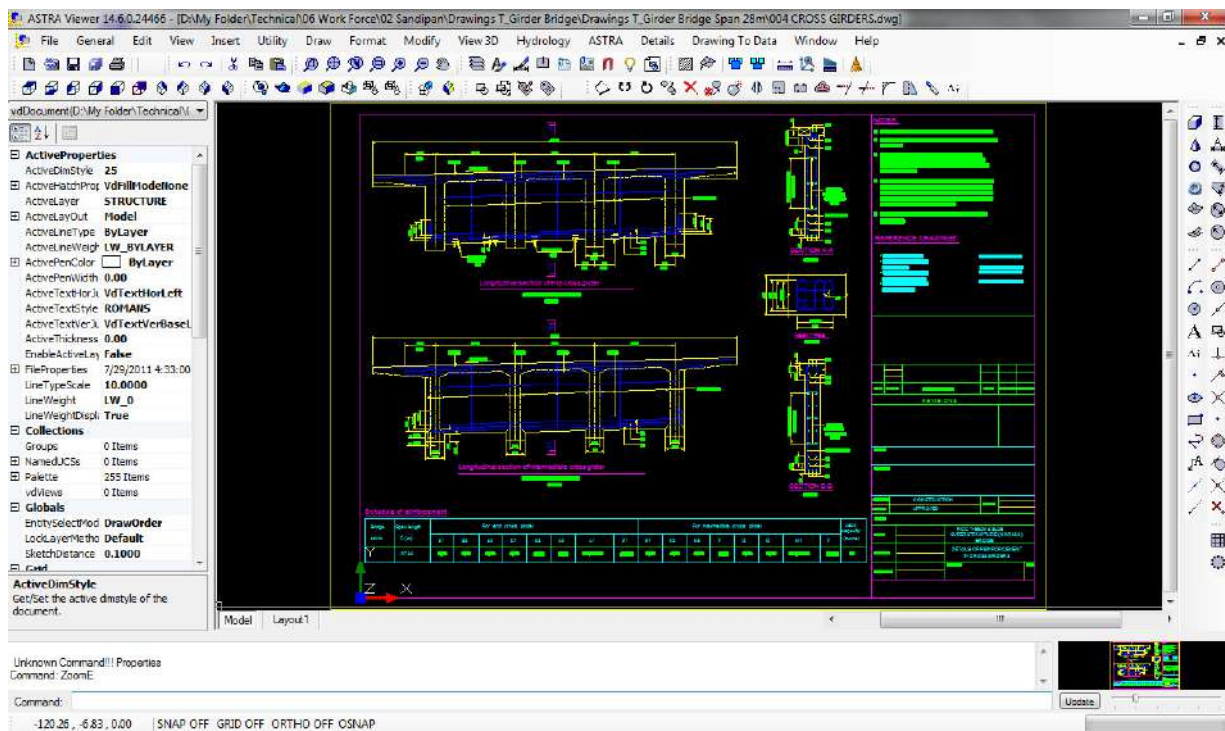
For RCC 'T' or PSC 'I' Girder the Main Long Girder is designed with applied Loading



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



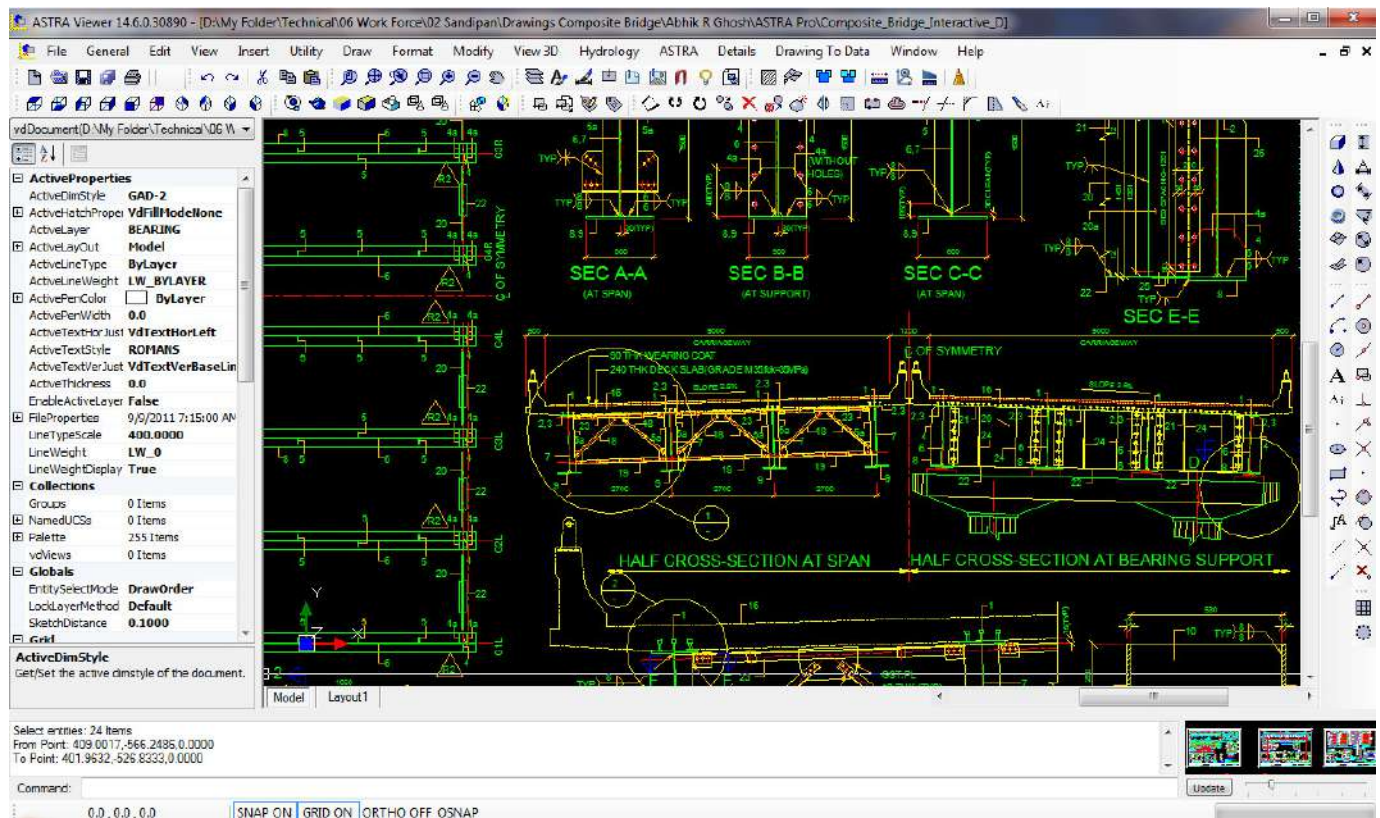
Structural Detailing and complete set of sample CAD drawings are provided with the Detail Design Calculations. Detail information for Construction are also provided in the Drawings



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

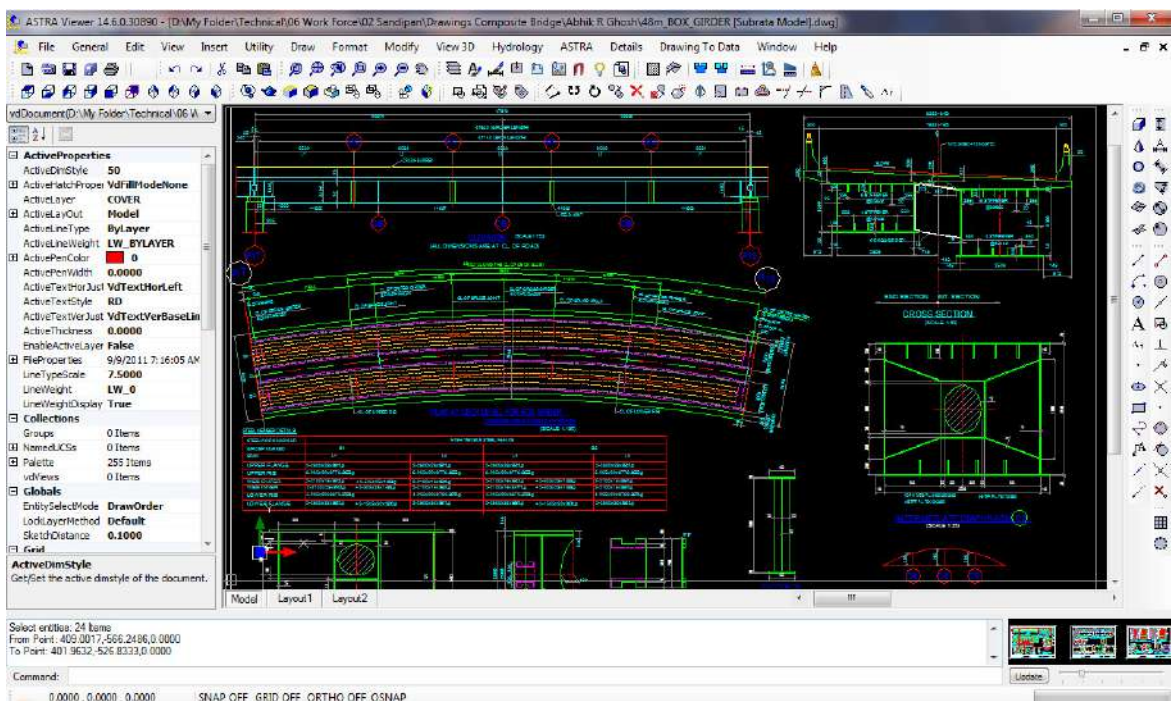
For Trucks heavily loaded with stone aggregates, sand, marble slabs, cement bags, steel members etc. when negotiates curve the centrifugal force is very high. If the transverse force is considered same as straight bridge, by ignoring the effect of centrifugal force then the design of the Bridge and Bearing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

The essential considerations in this design are:

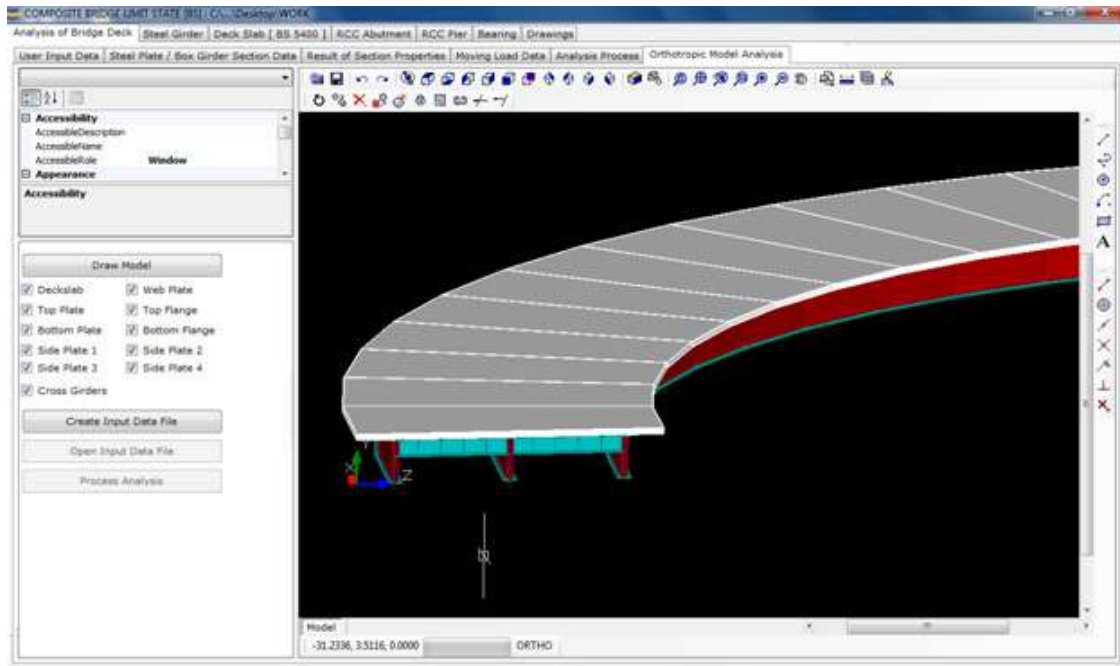
- Modelling of the bridge as a curved super-structure ASTRA with three span continuous structure
- Applying transverse force at support nodes with correctly selected POT/PTFE Bearings obtained from the X and Z direction components of the centrifugal force.
- Construction drawings for Composite Road Bridge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



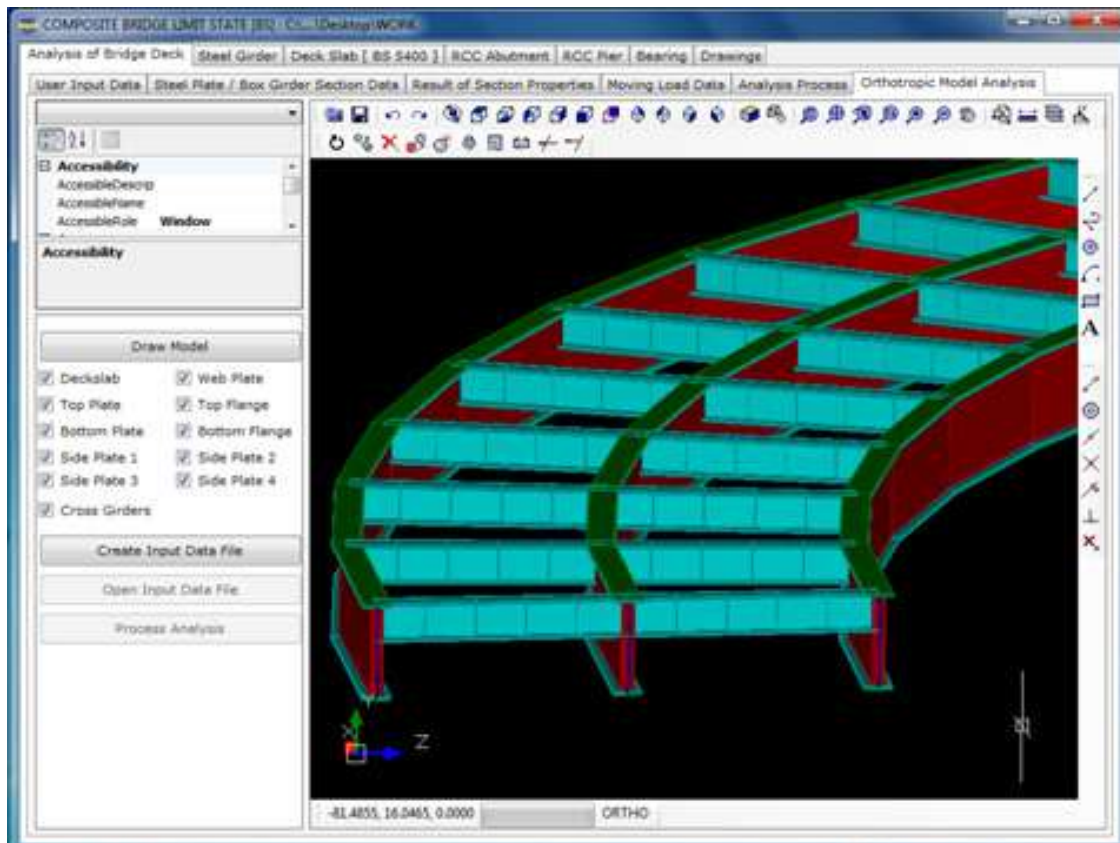
The related editable CAD drawings for Steel Plate or Box Girder are provided to convert as per design.



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



ANALYSIS OF PSC GIRDER BRIDGE (LIMIT STATE METHOD) - C:\... \Desktop\WORK

PSC Girder | Deck Slab | Abutment | RCC Pier | Drawings

User Input Data | General Arrangement Diagram | User Input for Dimension Details of PSC 'I' Girder | Moving Live Load Data | Analysis Process | Girder Design

Analysis: LIVE LOAD ANALYSIS

Open Analysis File: LIVE LOAD ANALYSIS

Buttons: Create Analysis Data, Process Analysis, View Analysis Data, View Analysis Report, View Structure, View Moving Load

Analysis Results | Reaction Forces

No User Input in this page | Calculated Values from Analysis

LIVE LOAD ANALYSIS 1 : 1 LANE TYPE 3 MOST ECCENTRIC

MAXIMUM BH & CORRS. SF			
BH SEC. (1-1)	146,100 t-m	SF SEC. (1-1)	28,400 t
BH SEC. (2-2)	96,500 t-m	SF SEC. (2-2)	18,070 t
BH SEC. (3-3)	153,100 t-m	SF SEC. (3-3)	44,240 t
BH SEC. (4-4)	236,300 t-m	SF SEC. (4-4)	28,830 t
BH SEC. (5-5)	230,500 t-m	SF SEC. (5-5)	7,830 t

MAXIMUM SF & CORRS. BH			
BH SEC. (1-1)	34,820 t-m	SF SEC. (1-1)	71,340 t
BH SEC. (2-2)	85,390 t-m	SF SEC. (2-2)	62,960 t
BH SEC. (3-3)	348,200 t-m	SF SEC. (3-3)	40,070 t
BH SEC. (4-4)	236,300 t-m	SF SEC. (4-4)	28,830 t
BH SEC. (5-5)	230,500 t-m	SF SEC. (5-5)	12,640 t

Design Forces

Total Support Reaction on the Pier (W1) **875,596 kN**

Moment at Supports in Longitudinal Direction (Mx1) **3260,799 kN-m**

Moment at Supports in Transverse Direction (Mz1) **660,148 kN-m**

Support Reactions

Dead Load Support Reaction per unit width of Abutment/Pier **59,478 kN/m**

Live Load Support Reaction per unit width of Abutment/Pier **56,259 kN/m**

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.

ASTRA Viewer 14.6.0.20722 | D:\... \PSC Girder final Drawings\PSC Girder Reinforcement Details.dwg

File | General | Edit | View | Insert | Utility | Draw | Format | Modify | View3D | Design Utils | Hydrology | ASTRA | Details | Drawing To Data | Window | Help

vdDocument[D:\My Folder\Technical\Work\...]

Active Properties

- ActiveDimStyle: 1-10
- Active Hatch Properties: VdHatchModelNone
- Active Layer: 0
- Active LayOut: Model
- Active Line Type: ByLayer
- Active Line Weight: LW_BYLAYER
- Active Pen Color: Yellow
- Active Pen Width: 0.0000
- Active Text Horizontal: VdTextHorLeft
- Active Text Style: Standard
- Active Text Vertical: VdTextVerBaseline
- Active Thickness: 0.0000
- Enable Active Layer: False
- File Properties: 9/30/2012 2:54:14 PM
- Line Type Scale: 10.0000
- Line Weight: LW_0
- Line Weight Display: True

Collections

- Groups: 0 Items
- Named UCSs: 0 Items
- Palette: 255 Items
- Views: 0 Items

Globals

- Entity Select Mode: DrawOrder
- Lock Layer Method: Default
- Sketch Distance: 0.1000

Cad

ActiveDimStyle: Get/Set the active dimstyle of the document.

Command: Zoom/W

First corner: 27630.2698,-16737.7658,0.0000

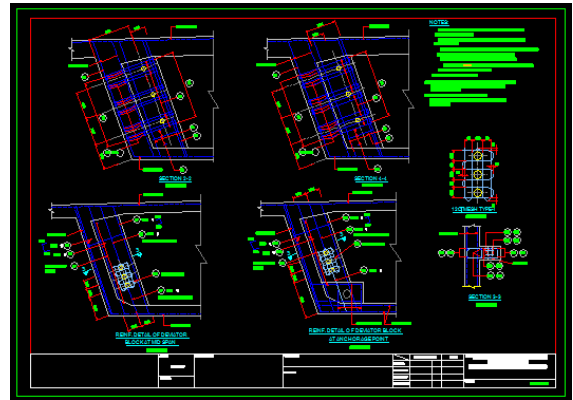
Other corner: 48681.6849,29577.9501,0.0000

Command: 26736.2684, -29516.5011, 0.0000 | SNAP OFF | GRID OFF | ORTHO OFF | OSNAP

The image shows a detailed CAD drawing of a pre-stressed concrete girder bridge reinforcement. It includes a plan view of the bridge deck with reinforcement bars, cross-sections of the girders showing internal reinforcement, and a table of reinforcement details. The drawing is displayed in a software interface with various toolbars and property panels.

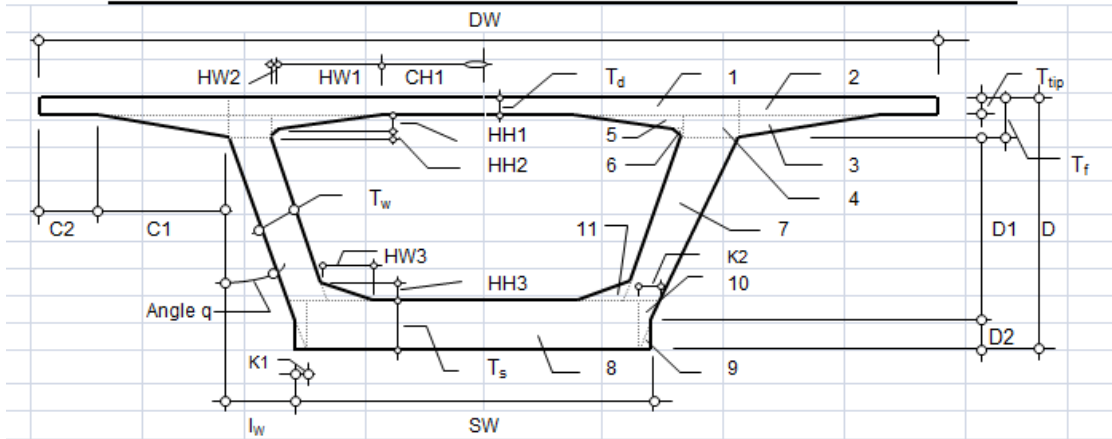
Bridge Design – Design of Pre-stressed Concrete (PSC) Box Girder Bridges for Elevated Road Corridors and Metro Rails with Detail step wise design calculation report and editable CAD drawings.

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



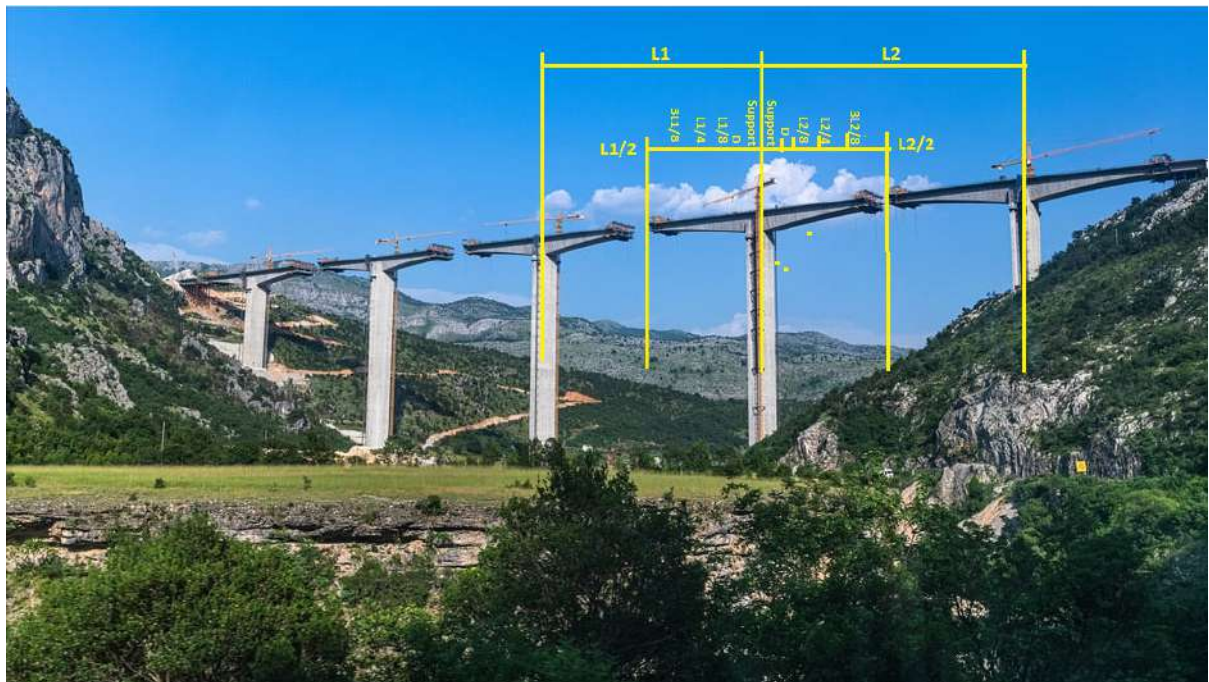
- NOTE :
1. ALL DIMENSIONS ARE TO BE GIVEN IN METERS
 2. CELLS SHADED ARE NOT BE GIVEN ANY INPUT

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.



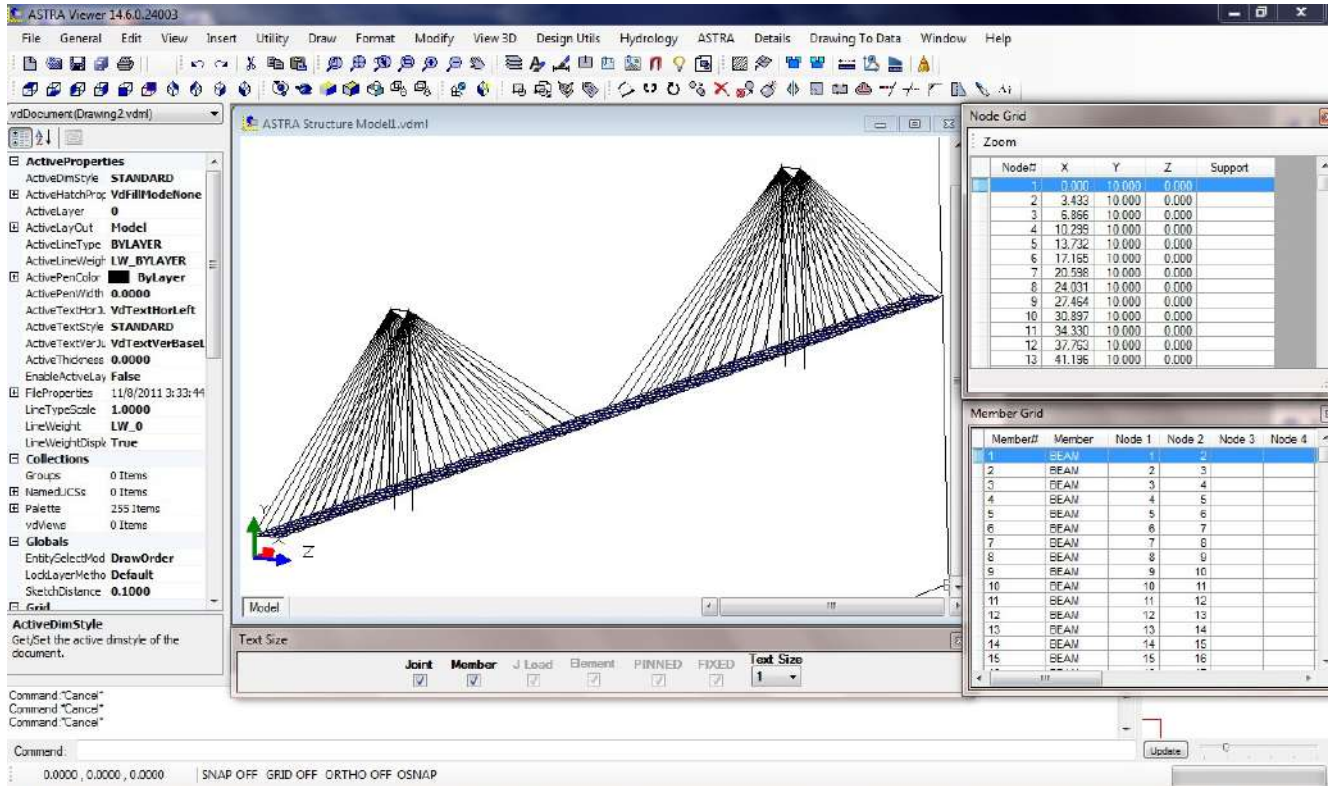
Balanced Cantilever Bridge



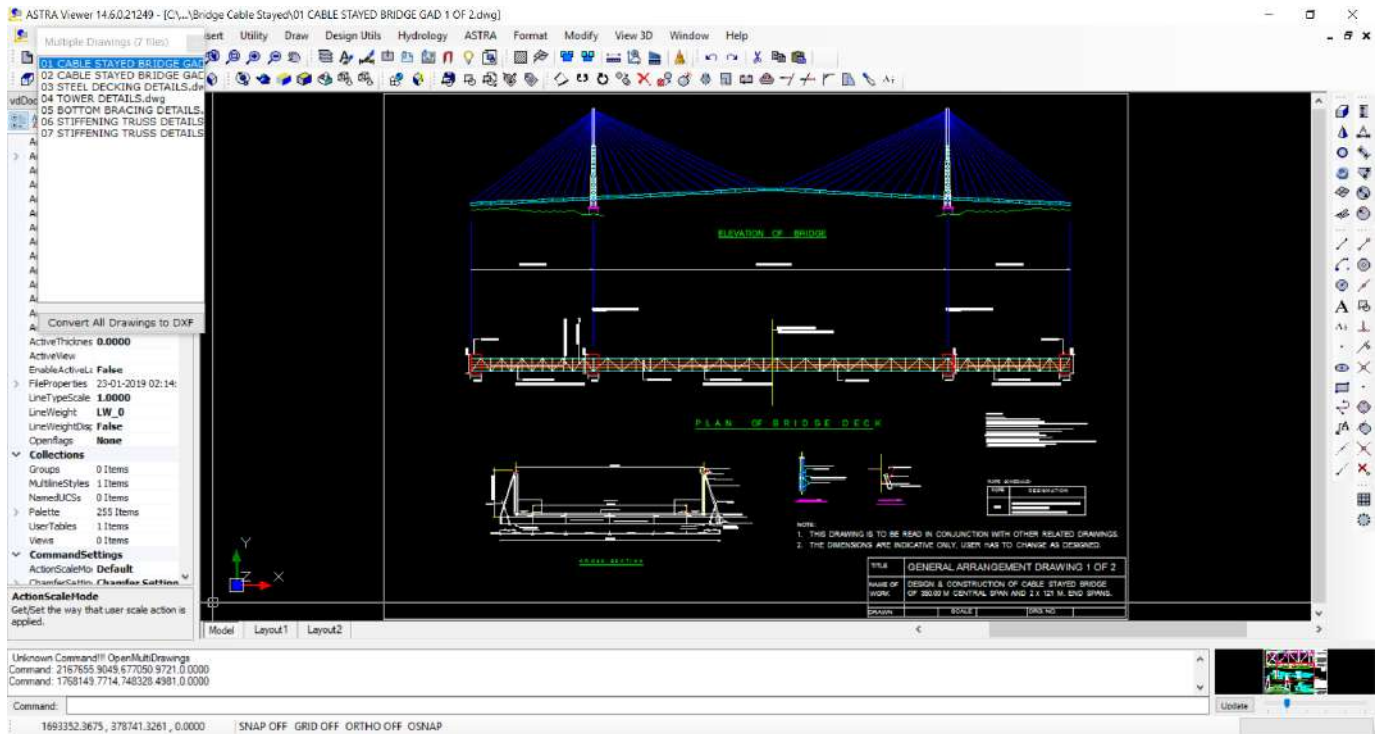
Concept for “Model Analysis-Design-Construction” of Balanced Cantilever Bridge

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'.

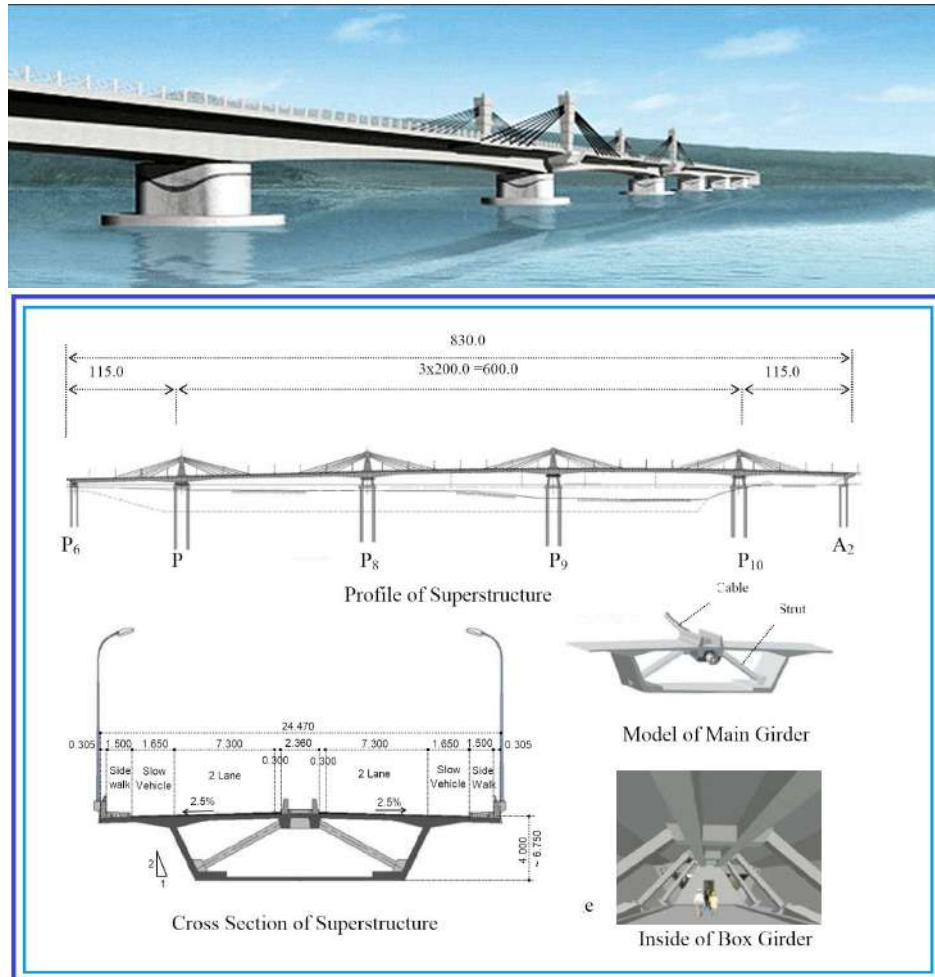
Bridge Design - Design of Cable Stayed Bridge is done with PSC Box Girder and Stay Cables with Non-linear Stage Analysis.



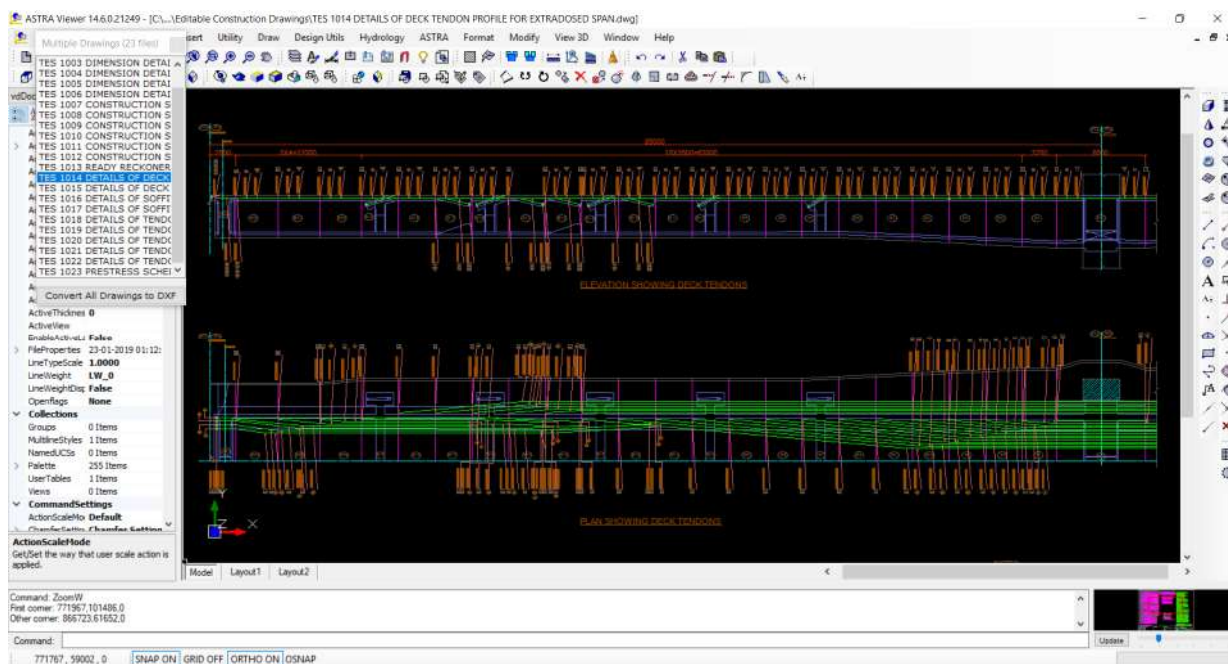
The General Arrangement drawing is provided for PSC Box Girder Deck with Steel Towers



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.

DESIGN OF STEEL TRUSS MEMBERS : C:\TEST\DESIGN TRUSS BRIDGE\TRUSS BRIDGE DL+SIDL+70R WHEEL LOAD

General Data Load + Analysis Complete Design

Super Imposed Dead Load [SDL]

Name	Length	Breadth	Depth	N	Vol	Gamma	Weight
DECK SLAB	51.00	2.700	0.200	2	55.080	24.000	1321.920
KERB	51.00	0.300	0.510	2	15.606	24.000	374.544
FOOTPATH SLAB	51.00	1.880	0.100	2	19.176	24.000	460.224
OUTER BEAM	51.00	0.150	0.510	2	7.803	24.000	187.272
WEARING COAT	51.00	3.750	0.000	2	382.500	2.000	765.000

Remove Remove All

Truss Structure Data

Save Load file and Write Load in Analyse input file

Member Group: **_XGIRDER** Member No: **105 TO 148** Member Type: **Cross Girder** Add to List

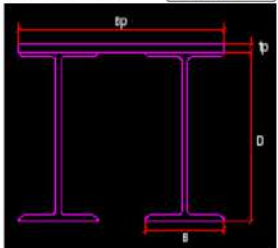
Member Group	Member Type	Section Type	No Of Member	Member Length	Weight / Metre	Weight
_XGIRDER	CrossGirder	Section6	44	1.025	0.2237	10.5713
_STRINGER	StringerBeam	Section5	30	5.000	0.2237	34.0453
_L0L1	BottomChord	Section4	4	5.000	0.0697	10.2824
_L1L2	BottomChord	Section4	4	5.000	0.2237	22.6024
_L2L3	BottomChord	Section4	4	5.000	0.2237	24.9556
_L3L4	BottomChord	Section4	4	5.000	0.2237	28.4854

Additional Percent for Gusset, Lacing etc. 24.42 % Remove Remove All

Total no of Joints at Truss Floor Level 22 Run Analysis

View Member Load File View Analysis Report File View Design Report File View Drawings Close

Define Section Select Section Section 1



2 x ISJB 150

TOP PLATE Width 500 Thickness 22

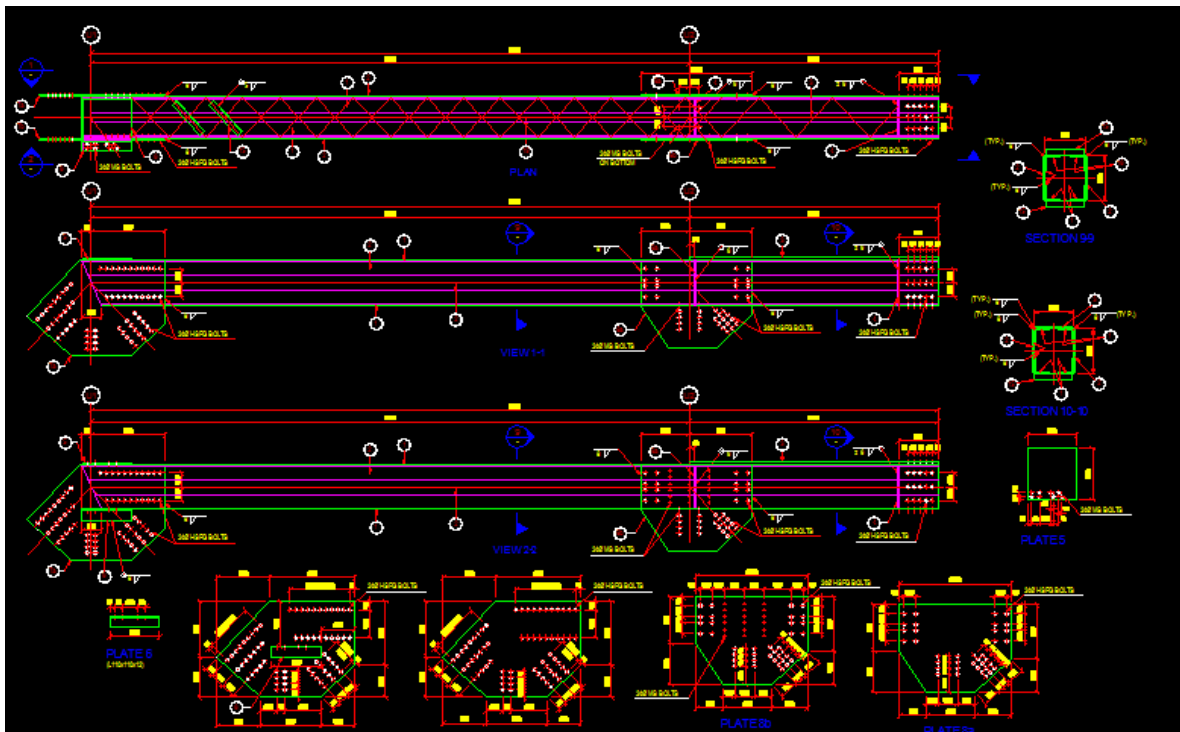
BOTTOM PLATE Width 0 Thickness 0

SIDE PLATES Width 0 Thickness 0

VERTICAL STIFFENER PLATES Width 0 Thickness 0

Lateral Spacing 0 Bolt Dia 0 No of Bolts 0

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

DESIGN OF STEEL TRUSS MEMBERS : C:\TEST\DESIGN TRUSS BRIDGE\TRUSS BRIDGE DL+SIDL+70R WHEEL LOAD

General Data | Load + Analysis | Complete Design

Lacing for Compression Member

Lacing Angle: 60 °(Degrees)

Lacing Plate width [bl]: 50

Thickness [tl]: 10 mm.

Bolt/Rivet Diameter [d2]: 16 mm.

Number per row [nr]: 4 N/Sq.mm

Rivet/Bolt Shear strength [fs]: 100 N/Sq.mm

Bearing strength [fb]: 300 N/Sq.mm

Connection for Tensile force.

Bolt/Rivet Diameter [d]: 20 mm

Minimum Number of rivets/bolts per row [nr]: 3

Width of Gusset Plate [bg]: 210 mm.

Thickness of Gusset Plate [tg]: 12 mm.

Shear strength [fs]: 100 N/Sq. mm

Bearing strength [fb]: 300 N/Sq.mm

Tearing strength [ft]: 150 N/Sq.mm

Shear Connector: ISMC 150

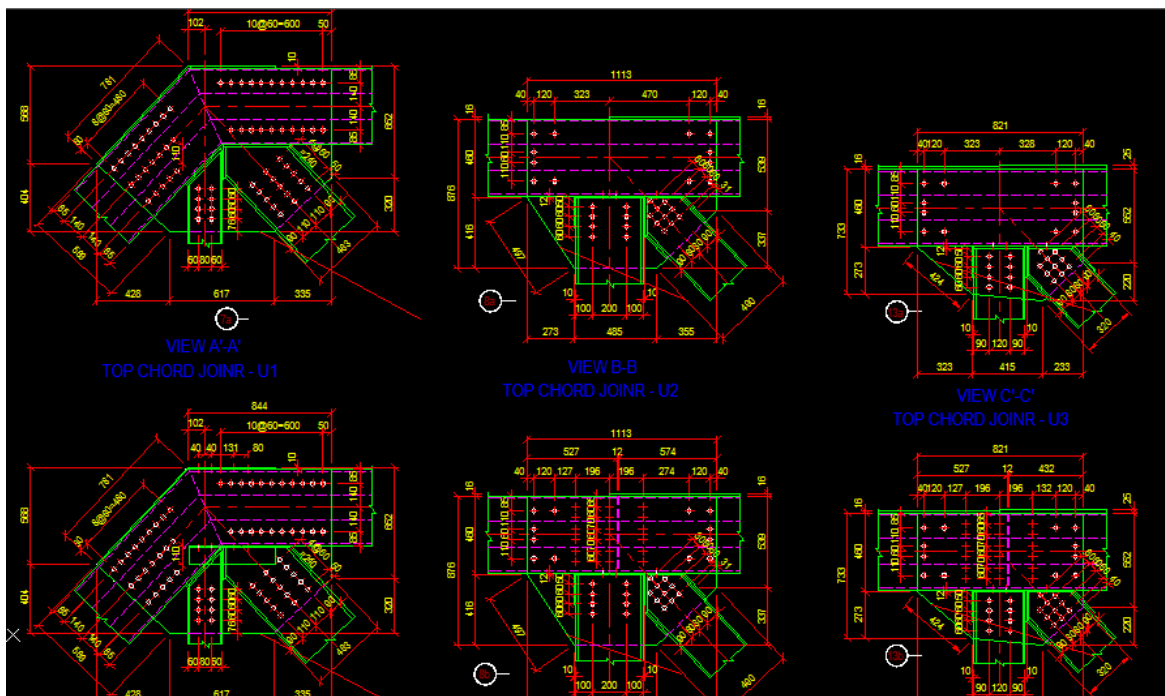
Member Design Option : ALL

Process

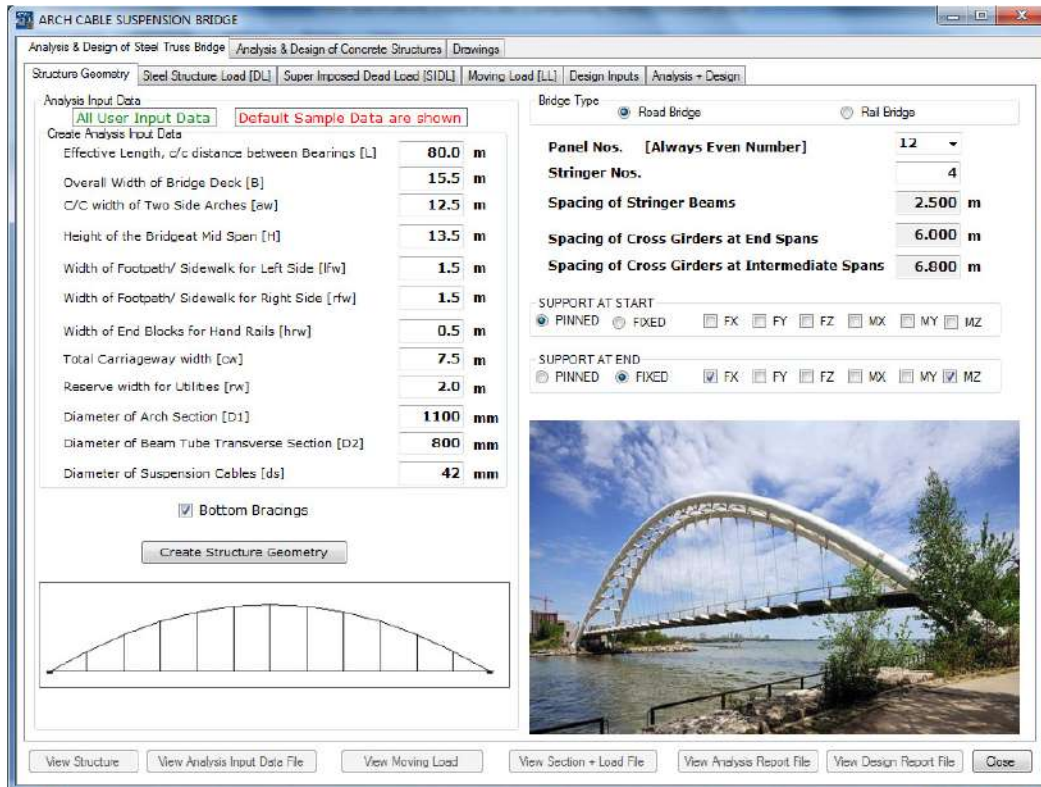
Member Group	Member Type	Compression Force (kN)	Capacity	Tensile Force (kN)	Capacity	Moment (kN-m)
XGIRDER	CrossGirder	724.70	0.00	724.70	0.00	690.20
_STRINGER	StringerBeam	189.20	0.00	516.50	0.00	516.50
_L0L1	BottomChord	1483.43	3358.29	2766.24	3412.80	0.00
_L1L2	BottomChord	0.00	0.00	1816.16	3412.80	0.00
_L2L3	BottomChord	0.00	0.00	4225.18	4312.80	0.00
_L3L4	BottomChord	0.00	0.00	4877.60	5662.80	0.00
_L4L5	BottomChord	0.00	0.00	4977.47	6112.80	0.00
_U1U2	TopChord	3572.02	2908.39	0.00	0.00	0.00

View Member Load File | View Analysis Report File | View Design Report File | View Drawings | Close

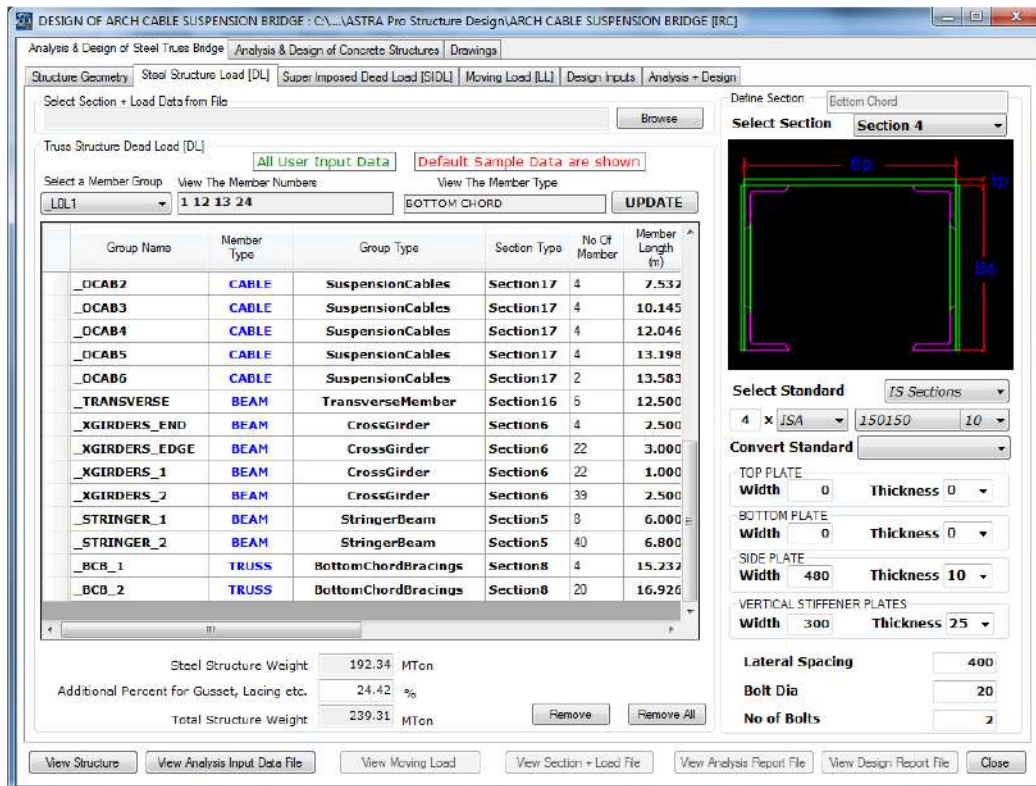
Steel Truss Bridge design with Fabrication/Shop drawings with Details of Member Connections in editable CAD form



Bridge Design - Steel Arch Cable Suspension Bridge



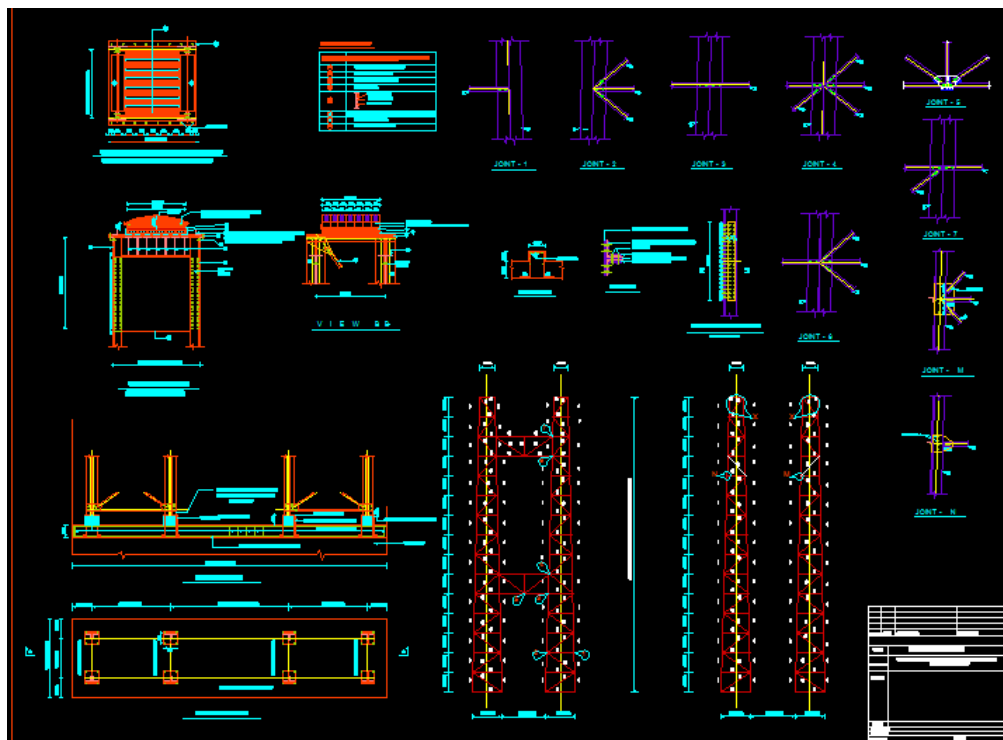
Member group wise standard or Built up sections may be defined



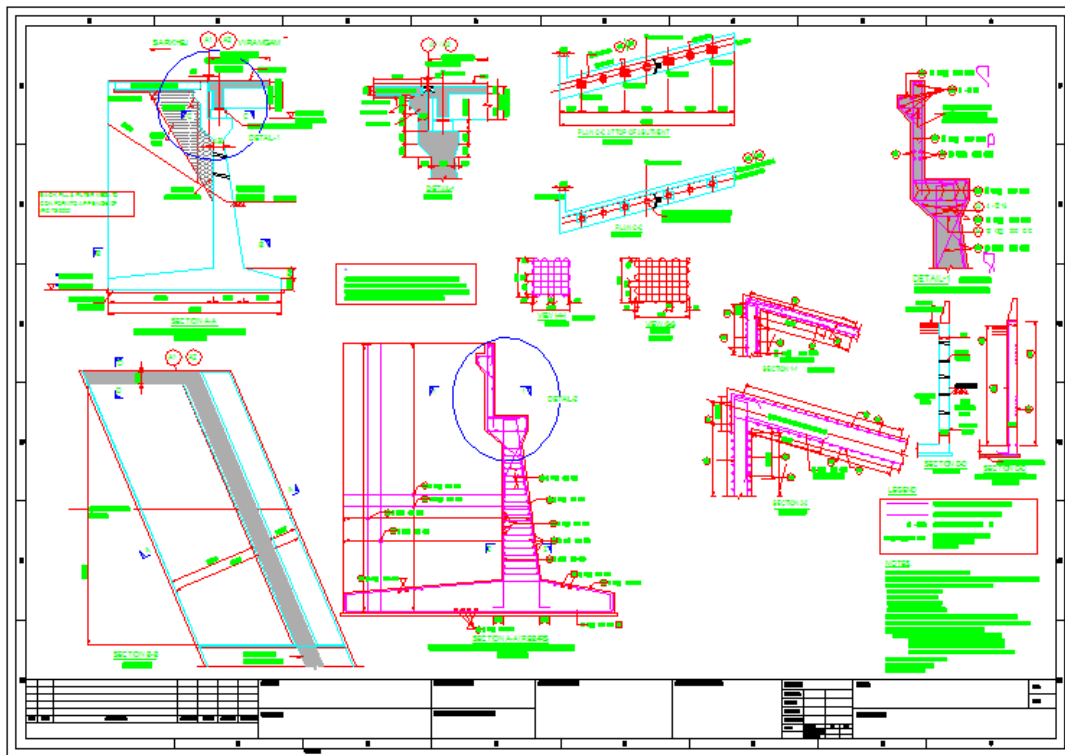
Bridge Design - Rope Cable Suspension Bridge



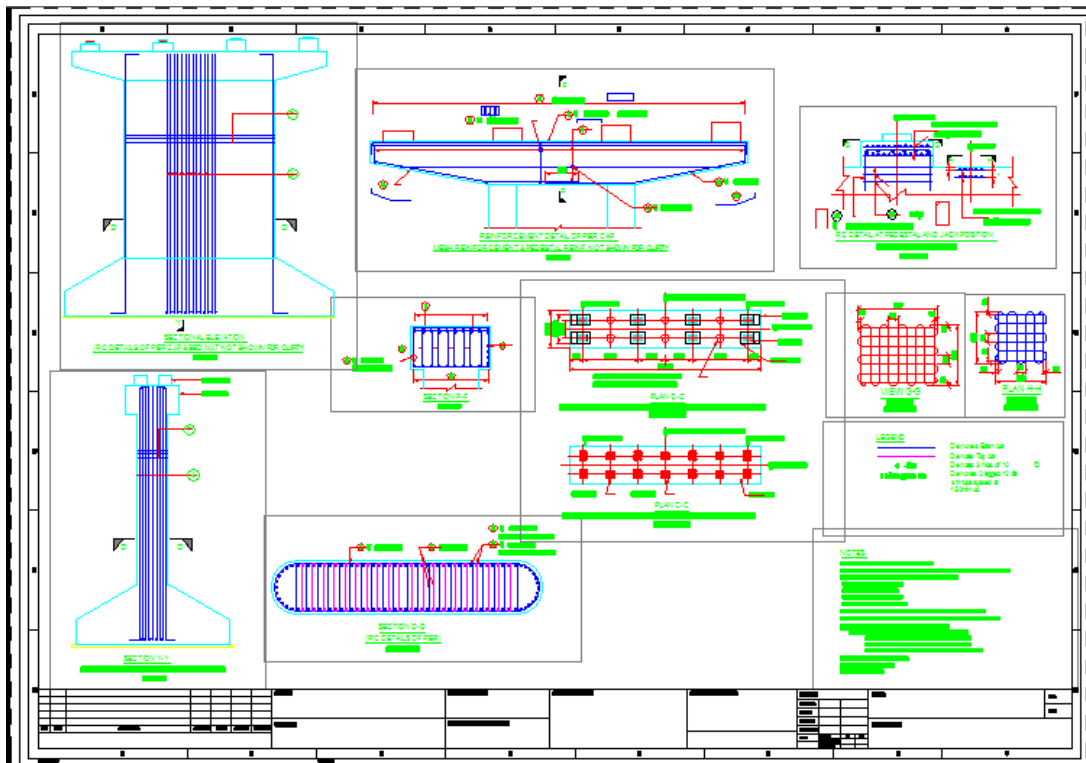
The Design of Steel Tower for Rope Cable Suspension Bridge is available with detail construction Drawings.



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.

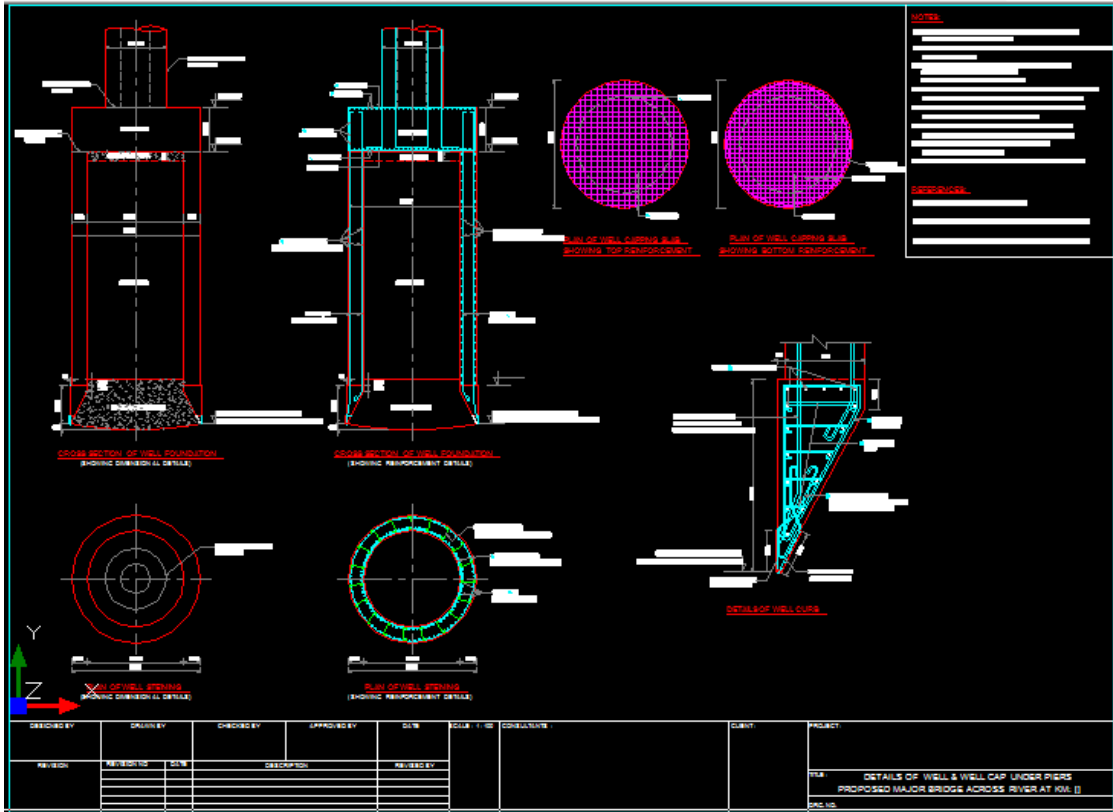


Bridge Design - RCC Bridge Pier with RCC Pier Cap and RCC Open Foundation for Fixed Load, Live Load, Seismic Force, Water Current Force with Structural Details CAD Drawings.

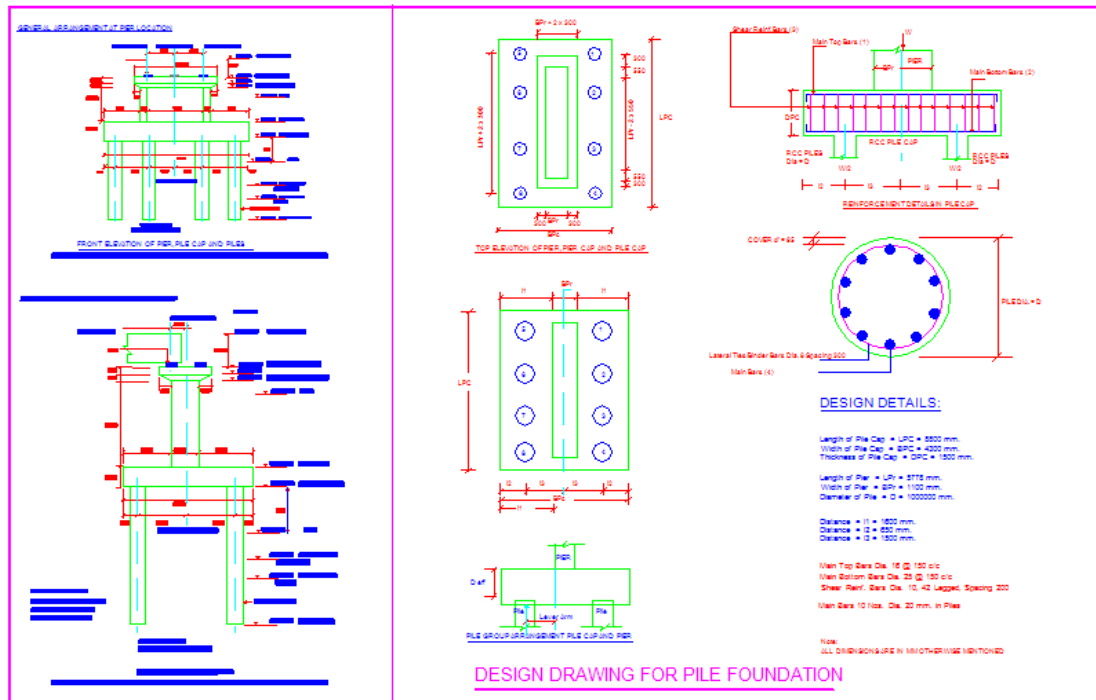


Bridge Design - RCC Well Foundation

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

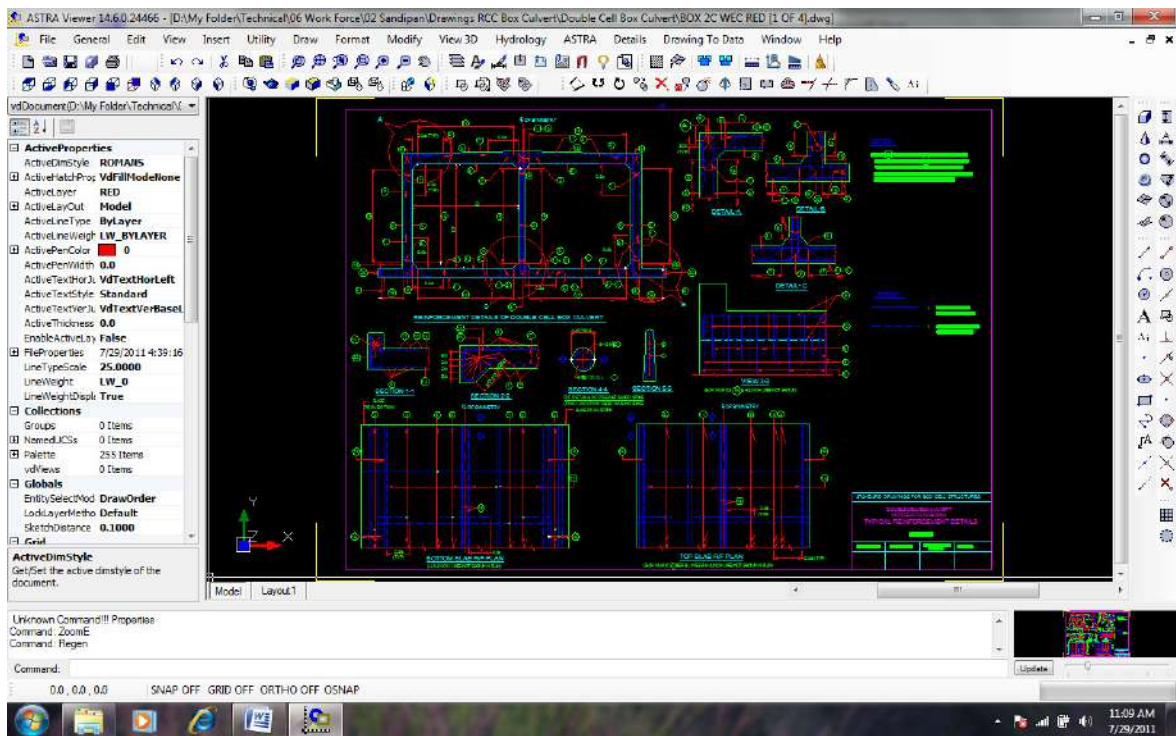


Bridge Design - RCC Pile Foundations for bridges from soil structure interaction and structural capacity. The pile capacity is determined from Skin Friction and End Bearing considering the pile passing through various soil strata, next Structural design for reinforcements. The CAD drawing contains design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

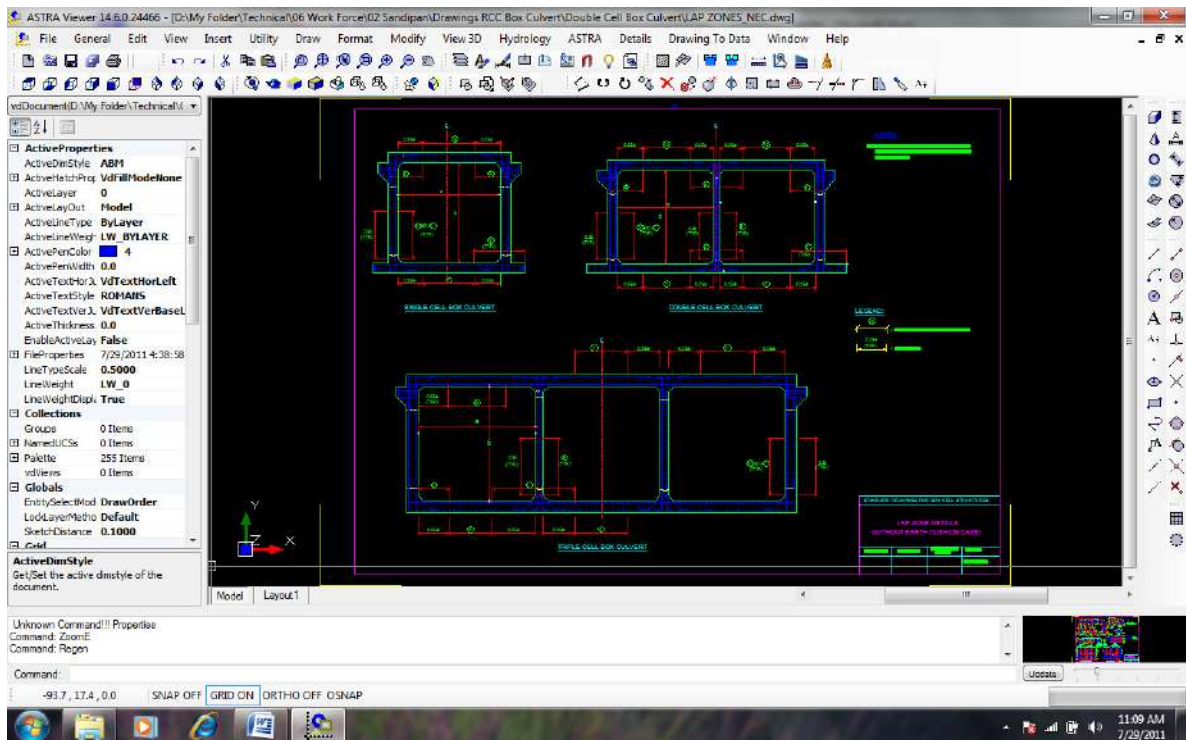


Bridge Design - RCC Box Culverts

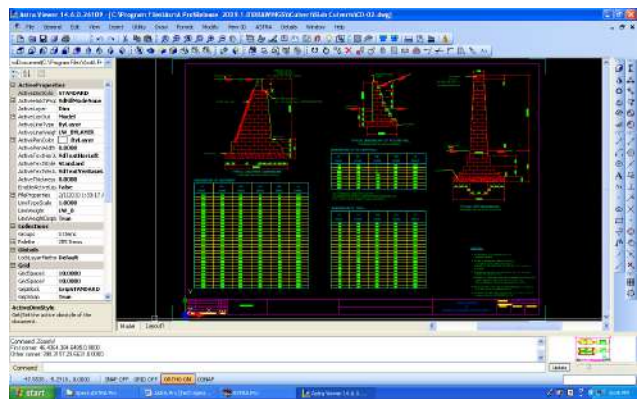
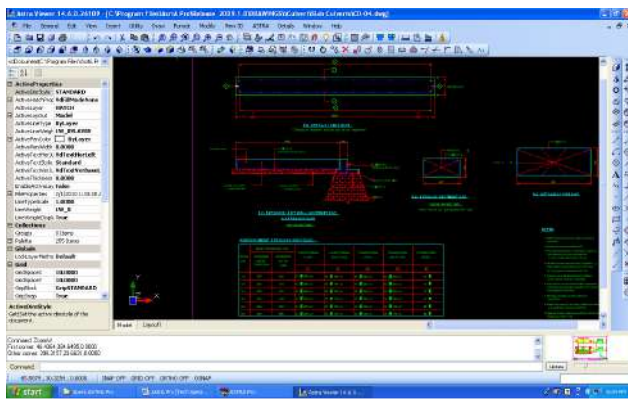
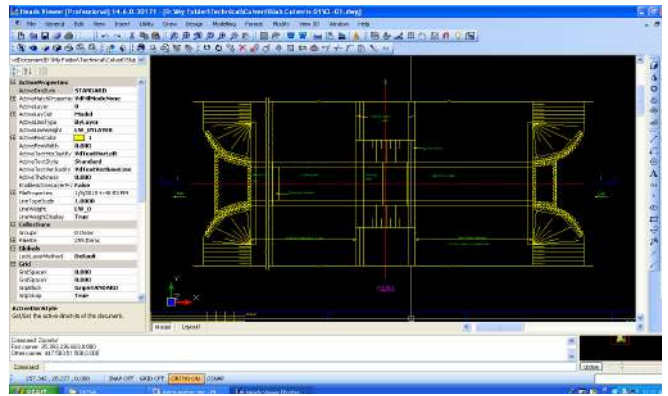
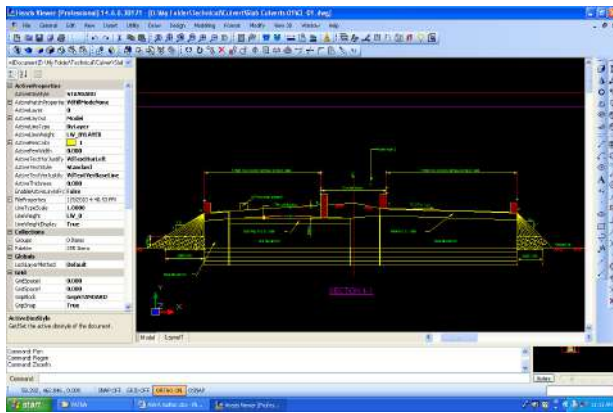
RCC Box Underpasses with earth cushion and without approach slab to the top slab.



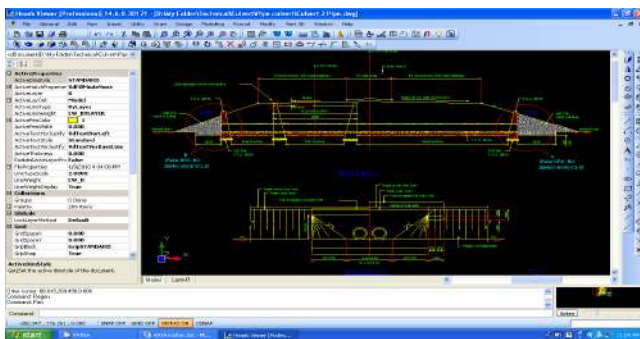
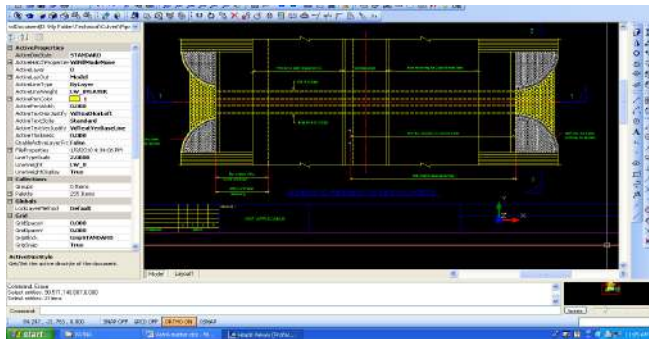
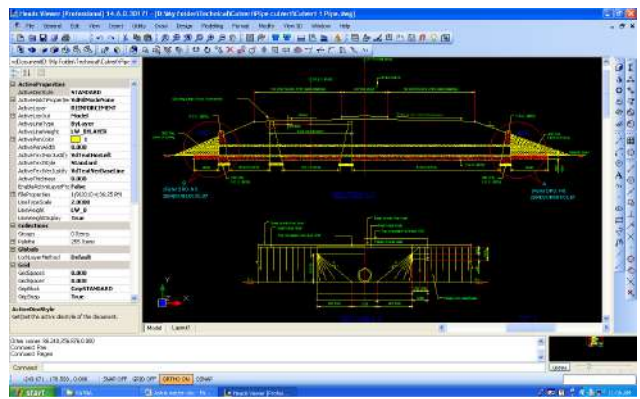
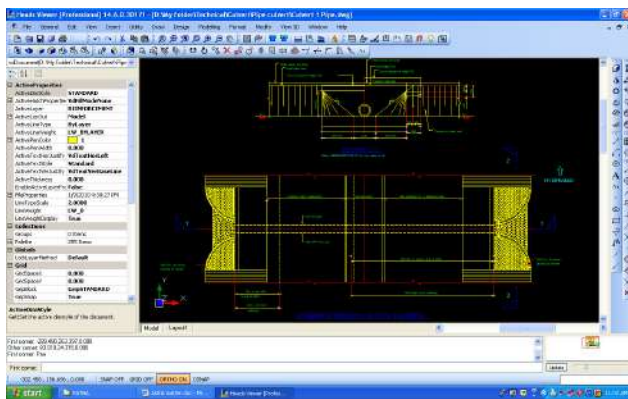
RCC Box Culverts / Underpasses without earth cushion and provision of approach slab on the top slab.



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

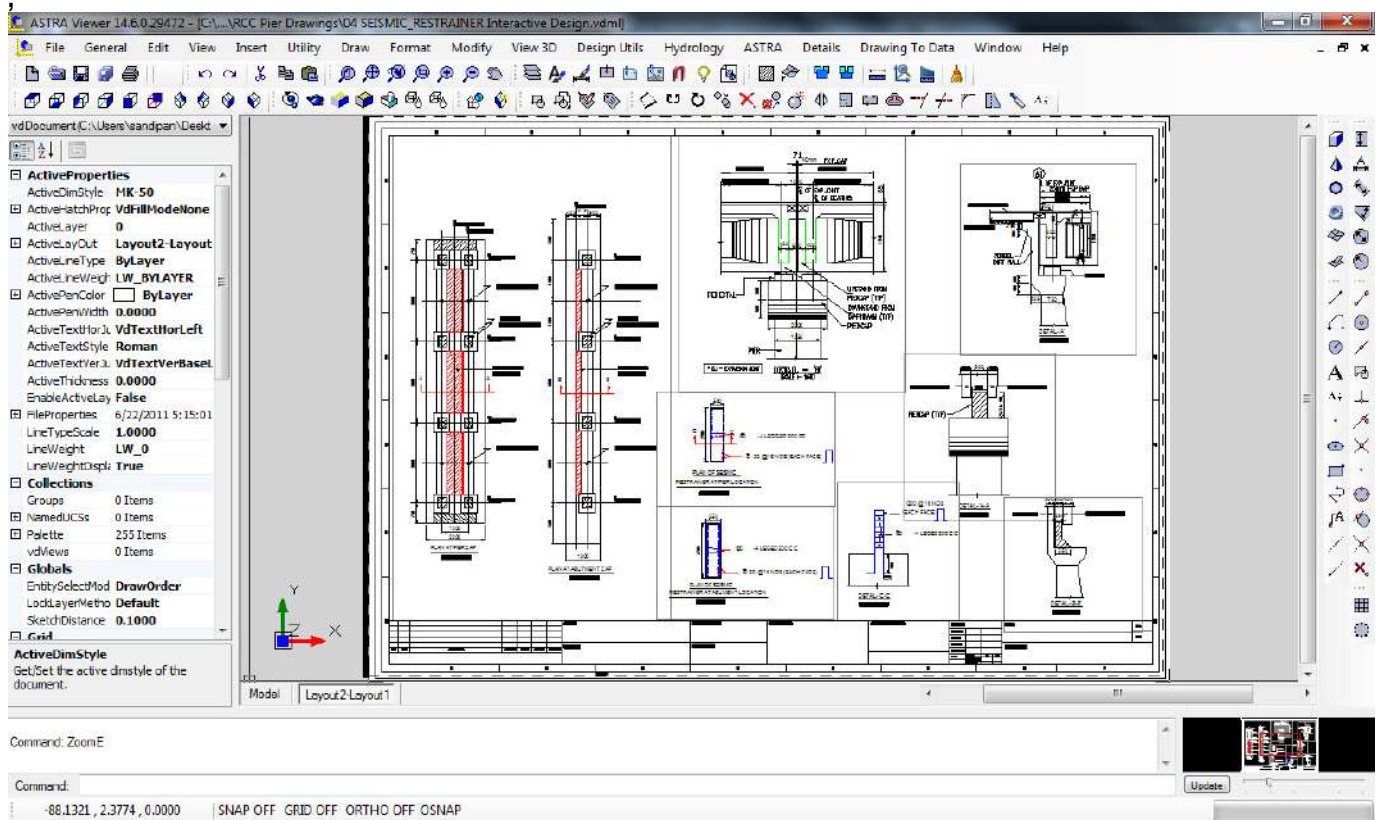


RCC Pipe Culverts (NP3 or NP 4) with detail design calculation report and Drawings for new construction or widening of RCC Pipe Culvert with drawings in editable CAD form.



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/Stopppers are provided as CAD drawing.

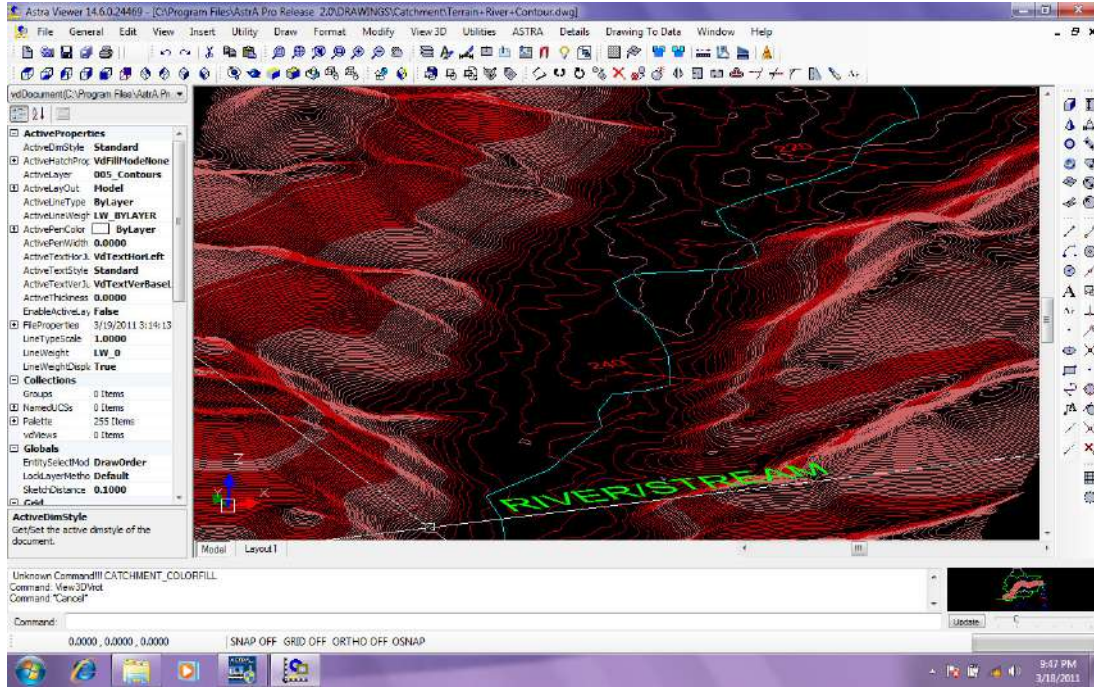


Details of Subsoil Exploration with processing of all related Soil Testing results and Graphical Plotting are available in section known as Geotechnics

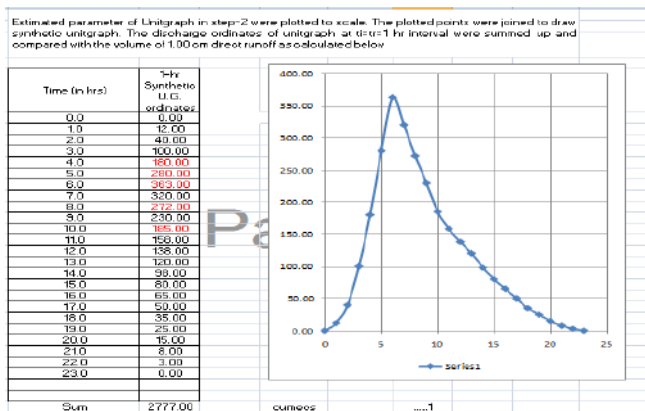
Pit No.	Location (Chainage) km	Description	Grain Size Analysis										Soil Classification	Free Swell Index	Laboratory CBR Test									
			Gravel (%)				Silt (%)			Clay (%)					Maximum Dry Density (gms/cc)	O.M.C. (%)	At 95% Proctor Density				At 97% Proctor Density			
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Field Moisture Content (%)		Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	On 4 days soaked samples					On 4 days soaked samples							
							Moisture Content (%)	Shrinkage (%)				2.5mm penetration					5.0mm penetration	2.5mm penetration	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	2.058	9.1	1.937	9.4	10.7	12.6	2.000	9.4	13.3	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	1118.35	Yellowish / reddish brown silty clay with traces of sand	-	14.7	68.1	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.



Hydraulic Calculations

USER'S DATA

High Flood Level (HFL)	67.370 m	Low Water Level (LWL)	62.570 m
River Bed Cross Section Data		Lowest Bed Level (LBL)	61.970 m
Distance from Reference Point to various points across cross section of river at bridge location (m)		Scour Depth Observed (SDO)	5.40 m
		Observed Velocity (V1)	2.20 m/sec
		Slope of River (S)	0.000769
		Value of n	0.03
		Factor for Discharge for Foundation Depth (F1)	1.3
		Proposed Water way (L)	37.5 m
		Silt Factor (Ksb)	1.0
		Factor for Foundation depth over Scour Depth (F2)	1.33

SL. N	(1)	(2)
1	126.933	67.370
2	132.933	64.170
3	138.933	62.388
4	145.430	61.570
5	151.933	62.250
6	157.933	63.370

Working Folder Process Report Close

ASTRA Pro (Structure Design Optional Suite)

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).

Tunnel Lining Design

Data Input | Analysis | Design | Drawings

Data Input | Computed RMR | Create Data

Project Name : **DESIGN JOB #01**

Tunnel Section

Length of Section [L]	45.000	m
Base Width [W]	10.750	m
Total Height [H]	7.375	m
No. of Angular Segment	10	nos
No. of Length Segment	45	nos
Element Thickness	0.50	m
Upper Semi Circular Radius [r = W/2]	5.375	m
Lower Straight height [h = H - r]	2.000	m

3. RMR Rating Increments based on Spacing of discontinuous Joints

Joint Spacing (m)	Rock Mass Rating Increment
> 3	30
1 - 3	25
0.3 - 1.0	20

1. RMR Rating Increments based on Compressive Strength

Point Load Index	Unconfined Compressive Strength (MPa)	Rock Mass Rating Increment
> 8	> 200	15
4 - 8	100 - 200	12
2 - 4	50 - 100	7
1 - 2	25 - 50	4
-	10 - 25	2
-	3 - 10	1
-	< 3	0

2. RMR Rating Increments based on Drill Core Quality

RQD%	Rock Mass Rating Increment
91 - 100	20
76 - 90	17
51 - 75	13
25 - 50	8
< 25	3

4. RMR Rating Increments based on Joint Condition

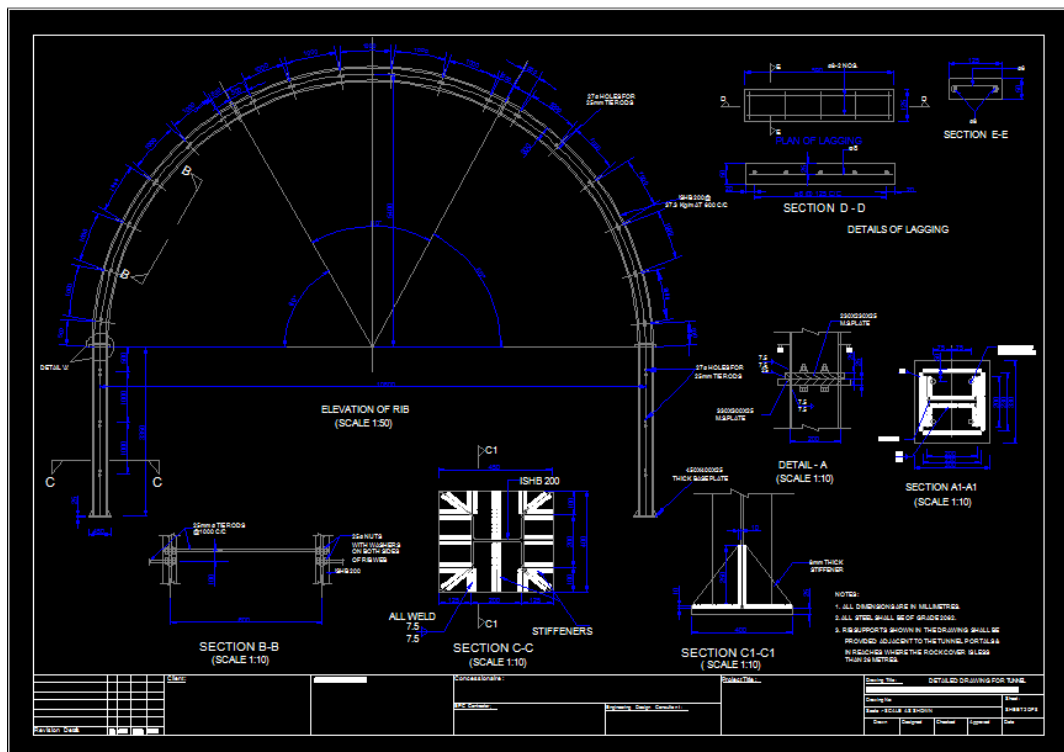
Joint Description	RMR Increment
Very rough surfaces of limited extent (hard wall rock)	25
Slightly rough surfaces, aperture < 1 mm (hard wall rock)	20
Slightly rough surface, aperture < 1 mm (soft wall rock)	12
Smooth surface of gauge filling 1 - 5 mm thick or aperture of 1 to 5 mm, joints extending more than several metres	6
Open joints filled with > 5 mm gauge or open > 5 mm joints extending more than several metres	0

5. RMR Rating Increments based on Ground Water Condition

Ground Water Condition	Inflow per 10m Tunnel Length (litre/minute)	Joint Water Pressure divided by major principal stress	Rock Mass Rating Increment
Dry	0	0	10
Moist	25	0.0 to 0.2	7
Water under moderate Pressure	25 - 125	0.2 to 0.5	4
Severe Water Problems	125	0.5	1

6. RMR based on adjustment in Discontinuities / Joint Orientation

Influence of Orientation of the work	RMR Rating Increment for Tunnel	RMR Rating Increment for Portal
Very Favourable	0	0
Favourable	-2	-2
Fair	-5	-7
Unfavourable	-10	-15
Very Unfavourable	-12	-25

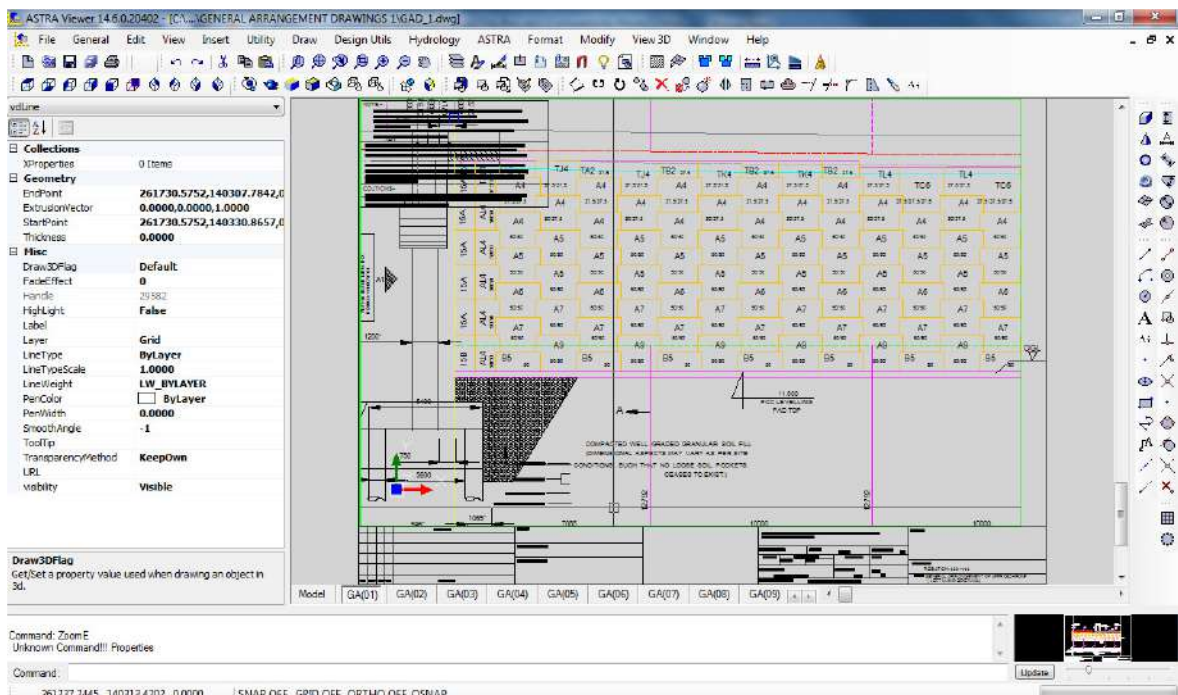


Design of Structures – Reinforced Earth Walls

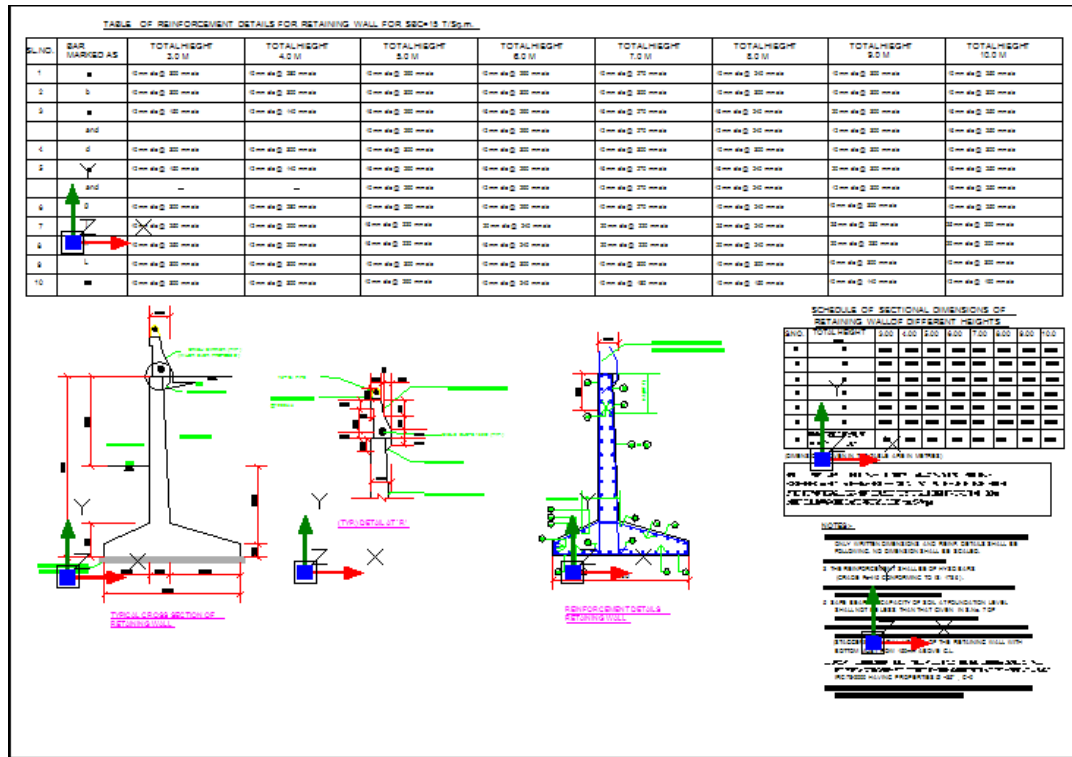
ASTRA Pro Structural Design features for Analysis and Design of Reinforced Earth Walls by using Polymer Geostrips (BS 8006).



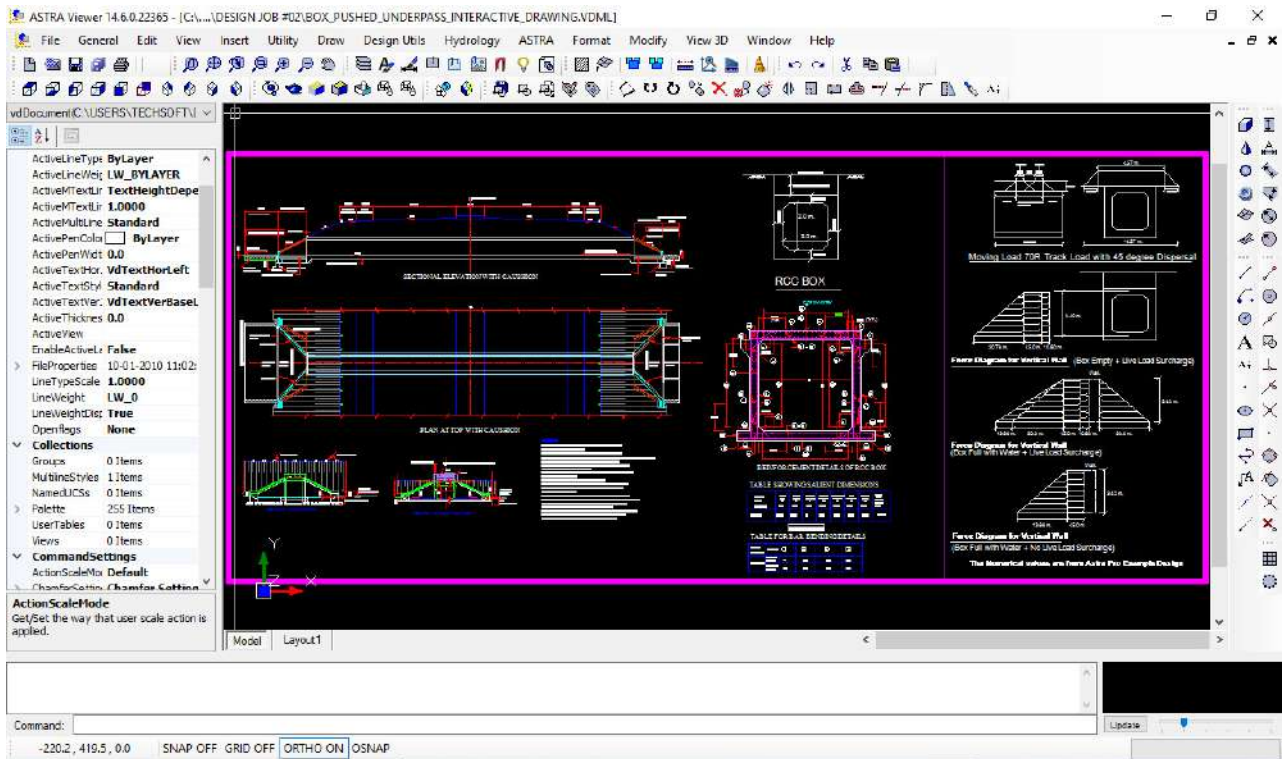
A complete set of Sample GADs and Structural drawings are provided to guide the users.



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



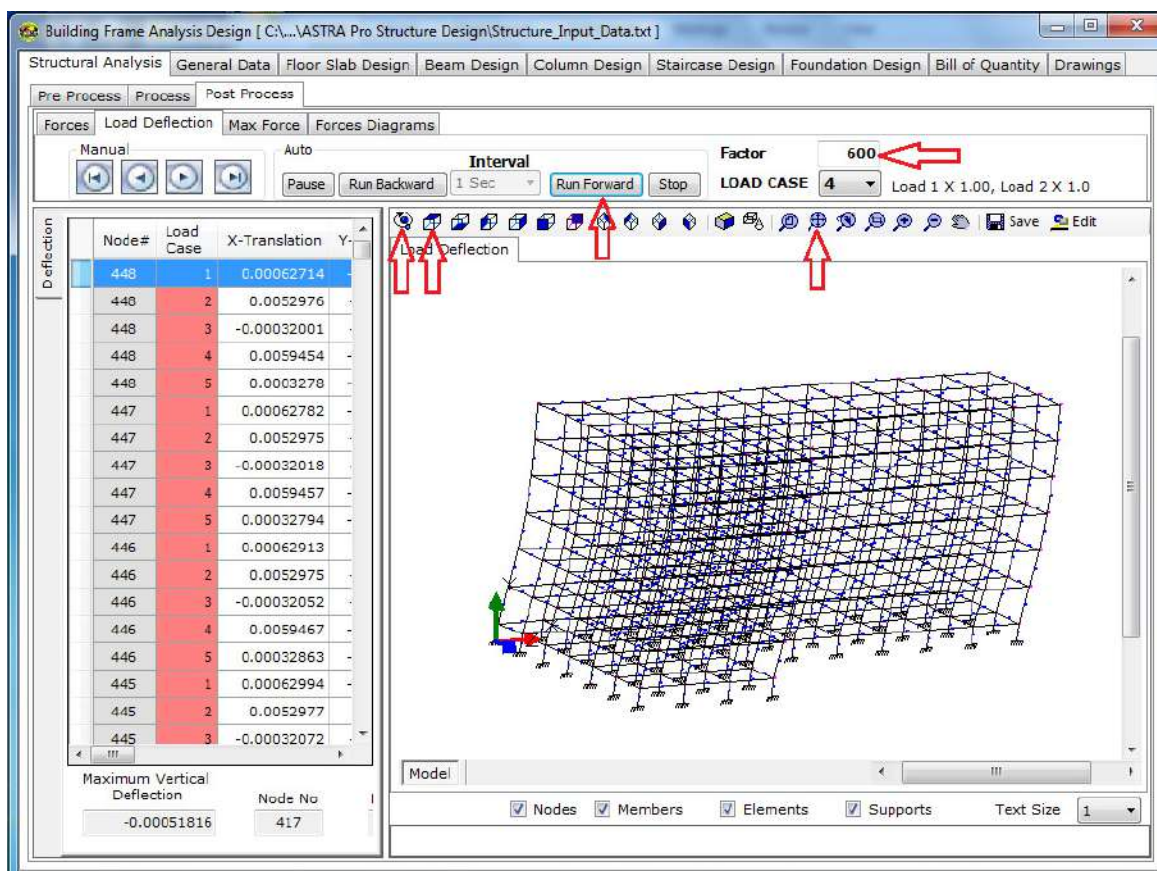
Design of Bridges – RCC Box Underpass under Railway and Highway.



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



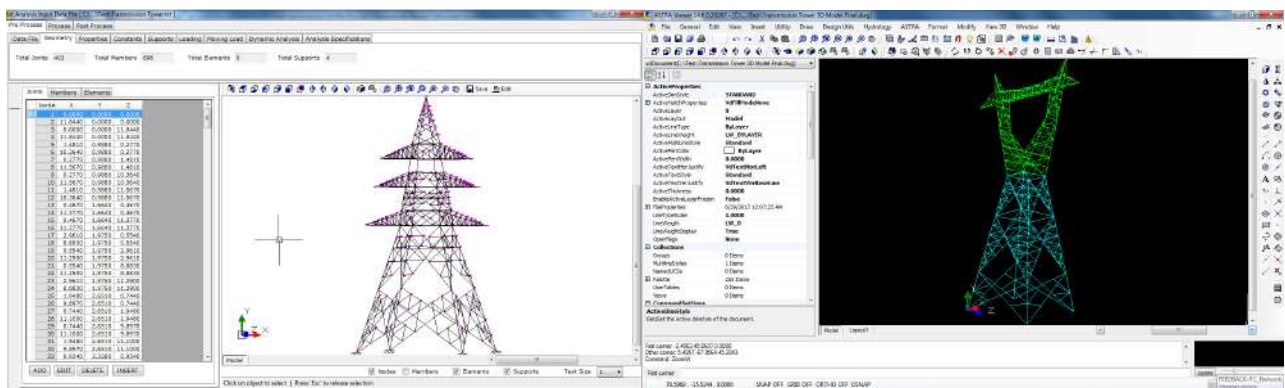
The Building design facility is unique for structural engineers with various facilities for viewing and printing detail Reports, Force Diagrams and Construction Drawings. Design of RCC Slab, Beam, Column and Footings are done with Step by Step detail Report, relevant to Design Standards, Bill of Quantity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



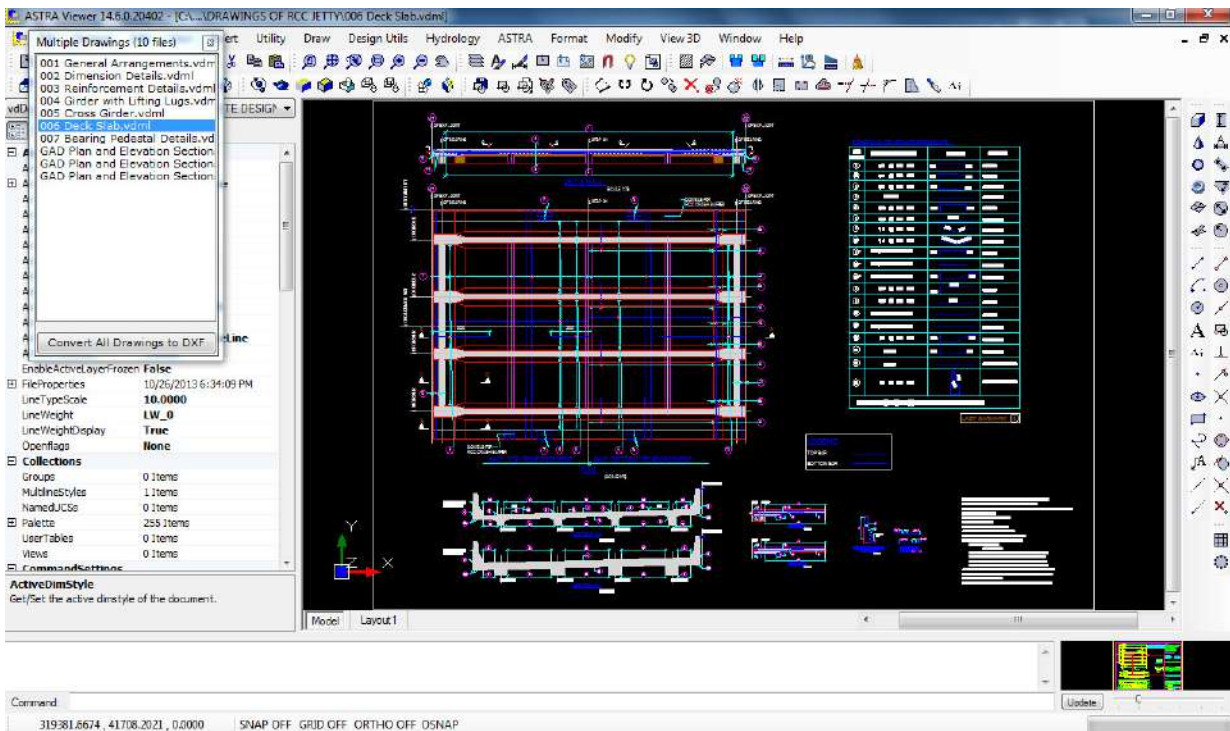
Transmission Towers for transmission lines from Thermal, Hydroelectric, Gas, and Wind Turbine generated electric power plants and power grid substations.



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



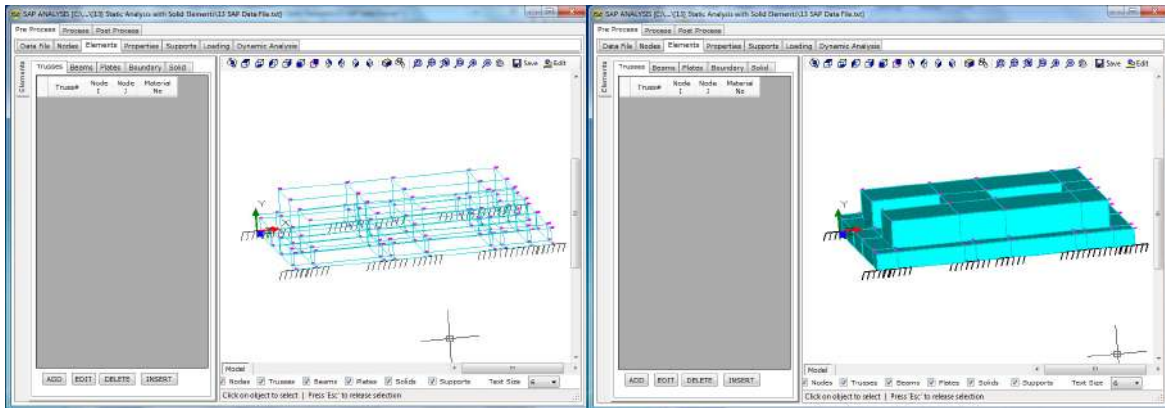
ASTRA Pro Structural Design features for Analysis and Design of Reinforced Cement Concrete and Pre Stressed Concrete Jettys with Pile Foundation, Long and Cross Girders and Deck Slab.



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



ASTRA Pro is menu driven, extremely simple, easy to learn & use and ensures fast productivity in shortest possible time, by watching Tutorial Videos as Multimedia movies, referring to Users Manual, Design Manual and Quick Reference Guide.



ASTRA Pro The software for Bridge and Structure Design.

- For technical and commercial queries, mention:

Your name, Your full address, contact/Whatsapp number, Product Name, Number of Licenses (Discount is offered for Multiple Licenses)

- To discuss on any matter, contact:

Mrs. Sangeeta

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The Text Book

Title: **Computer Aided Bridge Engineering,**

Pages: 381

Publisher: Nova Science Publishers, New York, USA

ISBN: 978-1-68507-413-5

Publisher, for Book, Software and Tutorial videos,

Web page: <https://novapublishers.com/shop/computer-aided-bridge-engineering-detail-design-of-pre-stressed-concrete-i-girder-box-girder-bridges/>

Purchase book from the publisher (Strongly recommended)

Contact: Ms. Lisa Gambino, Email: marketing@novapublishers.com

Software used: ASTRA Pro (Standard used AASHTO LRFD, Eurocode2, IRC 112, IRC 6)

Download ASTRA Pro, Users Manual, Design Manual etc. from website: www.techsoftglobal.com,

Download Book Tutorials from web site: www.roadbridgedesign.com

Tutorial videos: <https://www.youtube.com/channel/UCLY751jDWngqMfhKrIRcVwA/playlists>

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