BELT CONVEYORS

Engineering, Design & Detailing

SUPPORTS, WALKWAYS, STRUCTURES, PULLEYS
CHUTES, TRANSFER TOWERS

AS1657
AS4024
AS1755
AS4100

Design & Detailing

Since 2012 R3 has been designing and detailing conveyor systems for bulk material handling industries for all global markets. Whether you're looking for a single conveyor or a complete conveyor system, we can offer you a customized Solution tailored to your handling needs. We can provide handling systems for both new projects and existing systems. Whether you are a company with your own detailing office, a fabrication facility or a one-man operation we can provide your design and detailing needs.

R3 Plant Design provide cost-effective shop floor drawings with DXF & NC files to reduce lead-time.
We have skilled and specialized mechanical drafting and design team members headed by an Engineering Manager with 15 years of **Australian drawing office experience. Conveyors:**

- Horizontal, Inclined & Curved Belt conveyors
- Belt Feeders
- Fixed & Radial Stackers
- Shuttling Conveyors
- Underground mining conveyors, hazardous and non-hazardous zone & long conveyors up to 5km
- Sidewall conveyors
- Pulley & take up mechanism design
- Transfer chutes, Transfer towers & Service Platforms
- Walkways & structures

Our Service Includes.

- General Arrangement Drawings
- Generating Tender Models
- Conveyor Calculation report
- Structural analysis & Report
- 3D BIM Modelling & Clash Detection
- Layout out drawings.
- Fabrication Drawings
- Base plate & Anchor plate calculations.
- DXF Files for Plate work
- NC Files for Cutting & Drilling
- Erection Plans
- Material Lists/Take-Offs & Tonnage Estimations
- Anchor Bolt Drawings
- Connection Details
- Bolt List

Benefits of BIM:

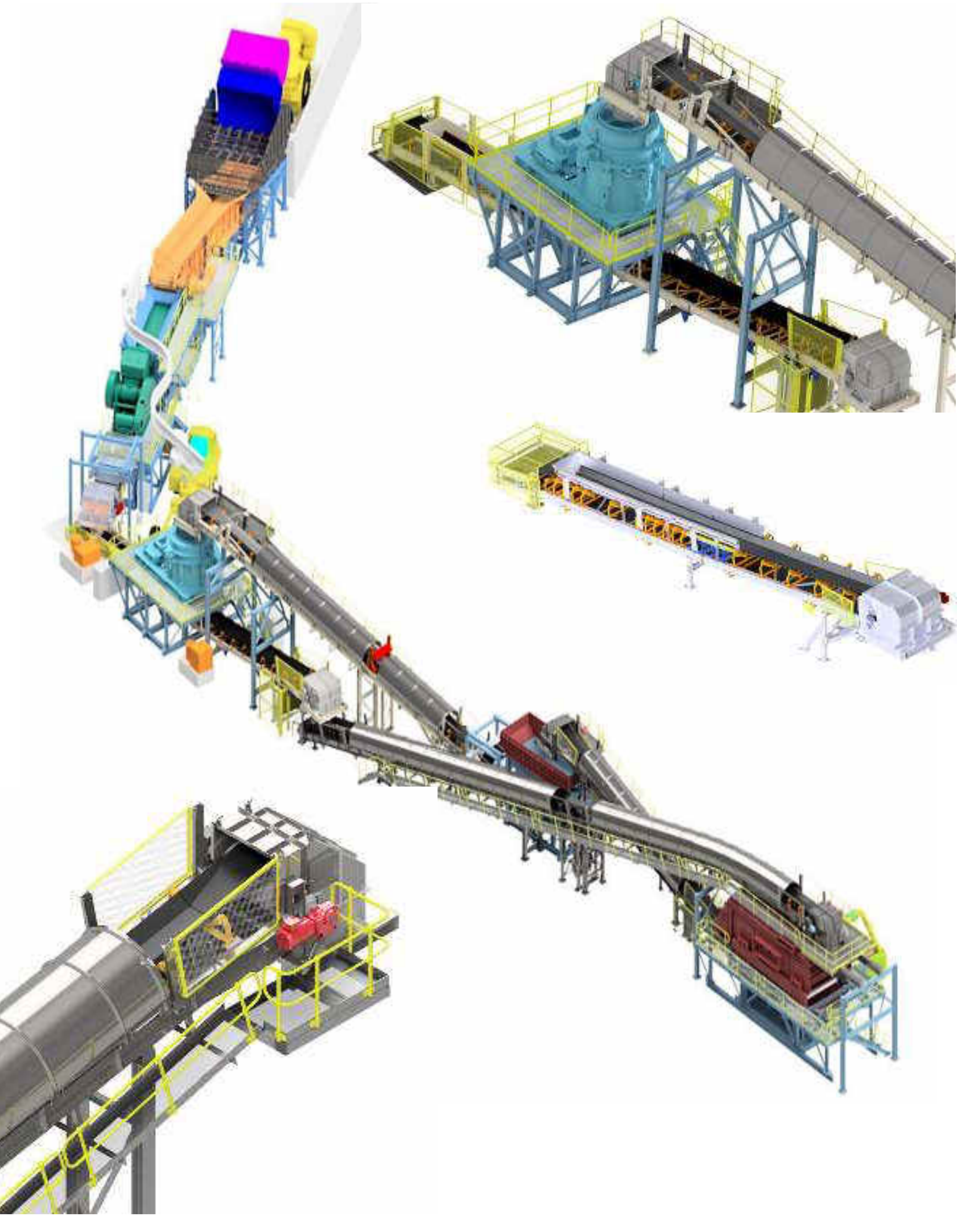
Our Building Information Modelling (BIM) service provides our clients with an intelligent 3D model, and we carry out a virtual construction analysis to test for construct-ability and potential conflicts. This analysis allow us to accurately predict how various equipment's and structures will integrate on-site, thus eliminating costly time delays due to onsite clashes and design changes.

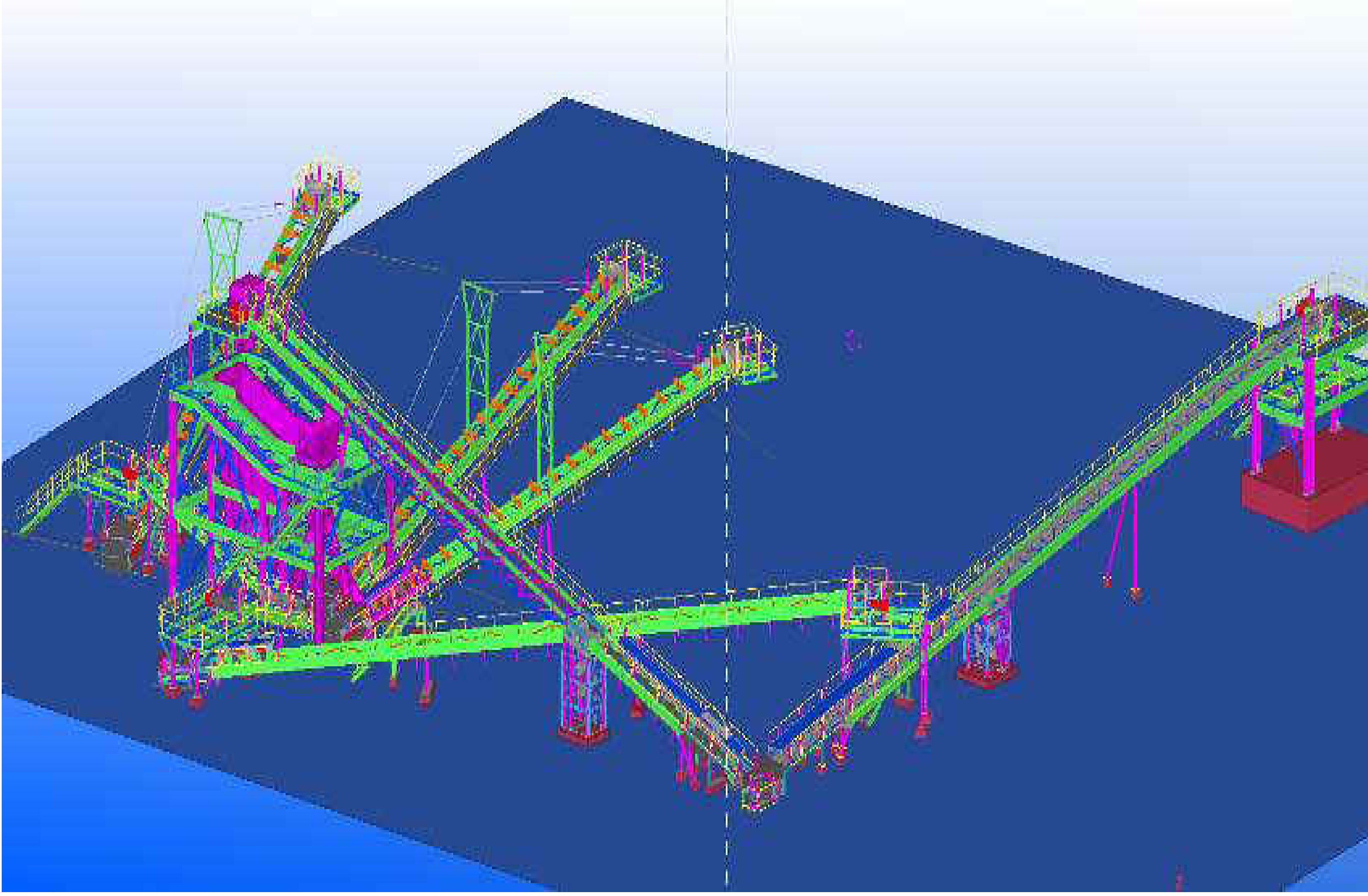
Winning Projects:

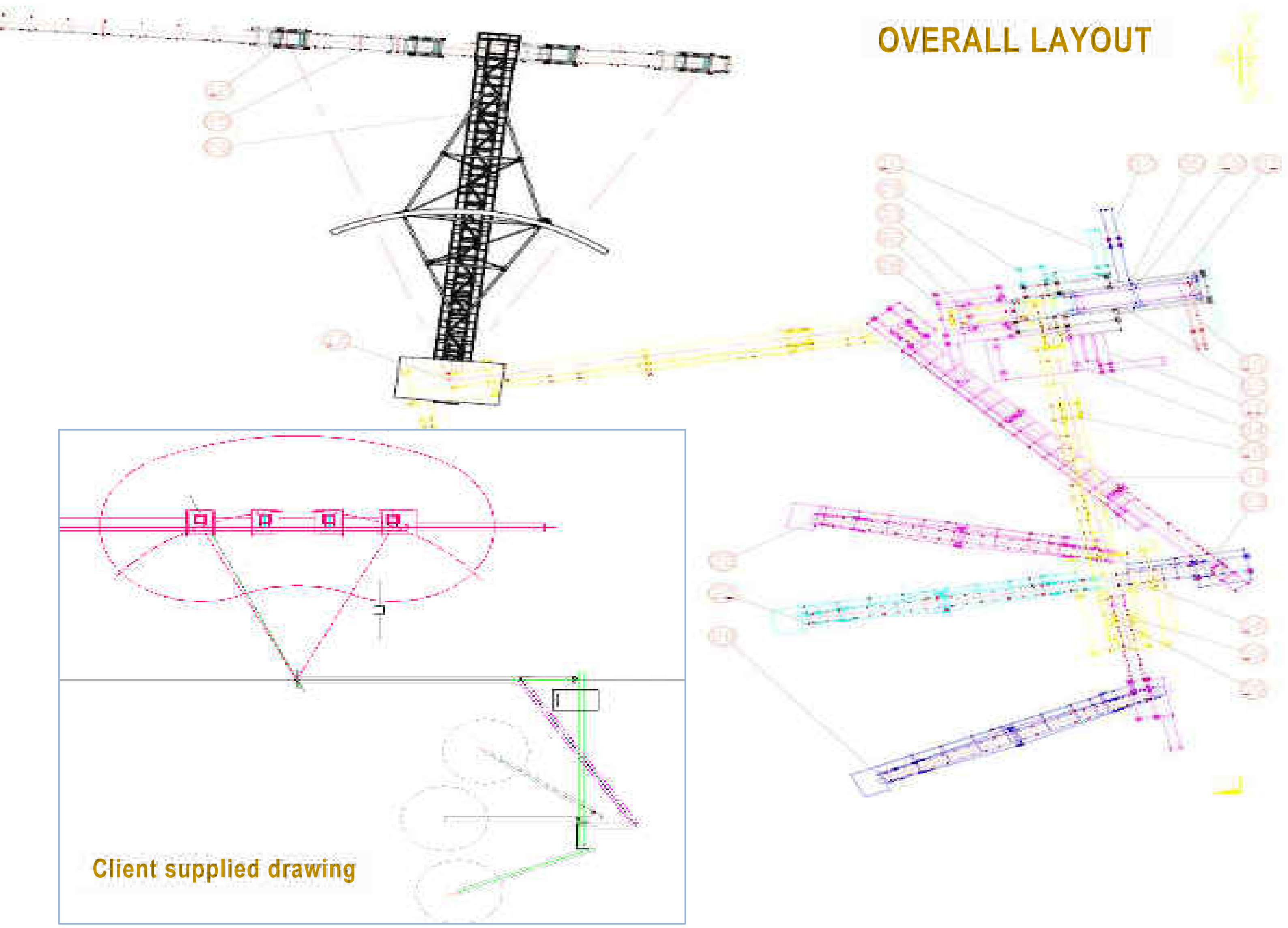
With our Engineering and drafting capabilities, we help our clients to enhance their business by introducing new equipment's into their product line.
We provide significant cost savings to projects by utilizing local Engineering's, modelers and detailers, which helps our clients to win competitive projects.

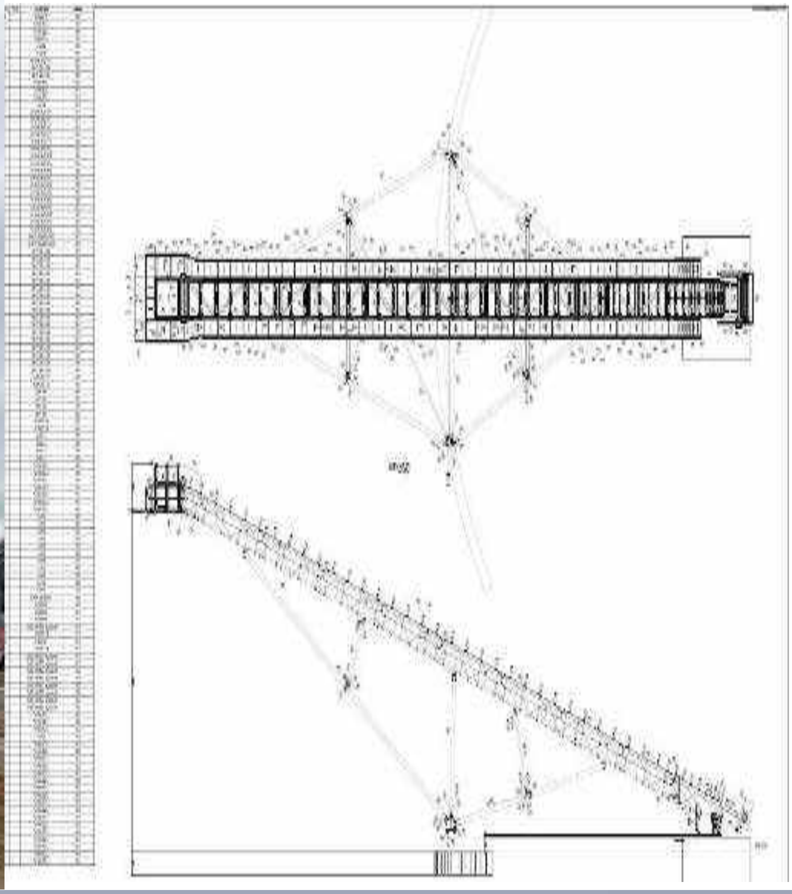
Save time

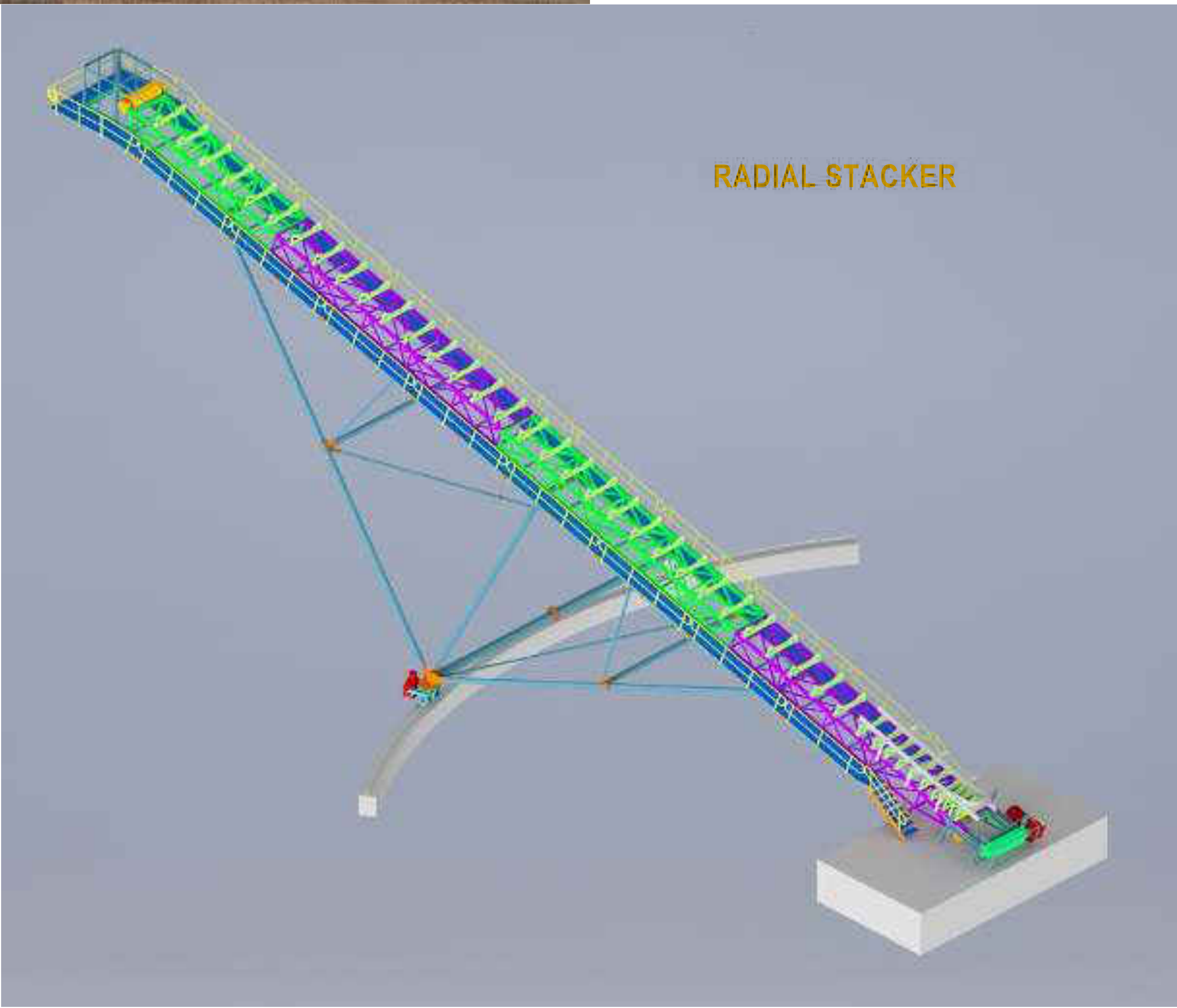
Overall design time reduces when people are working on your project in shifts in turn reducing project lead-time. Moreover, if any urgent design changes are tube made in Australia, would be addressed by following morning benefiting from different time zones.



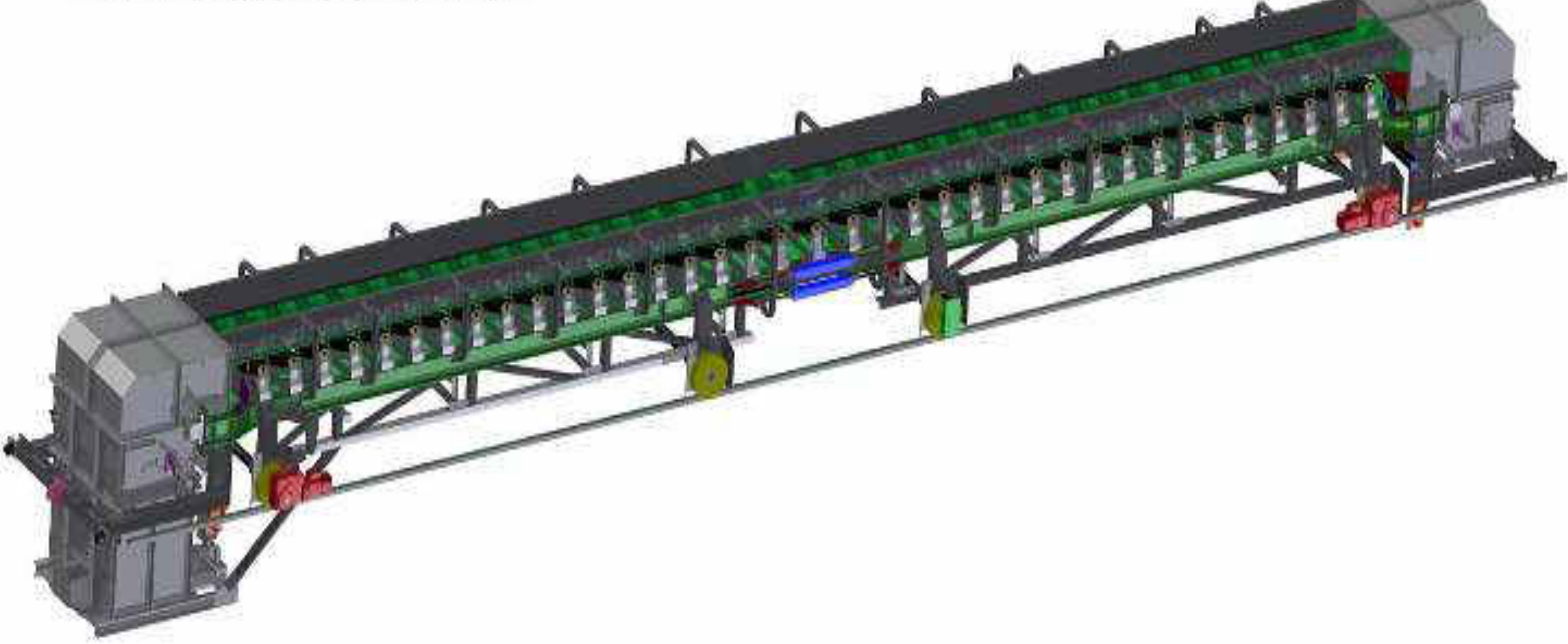


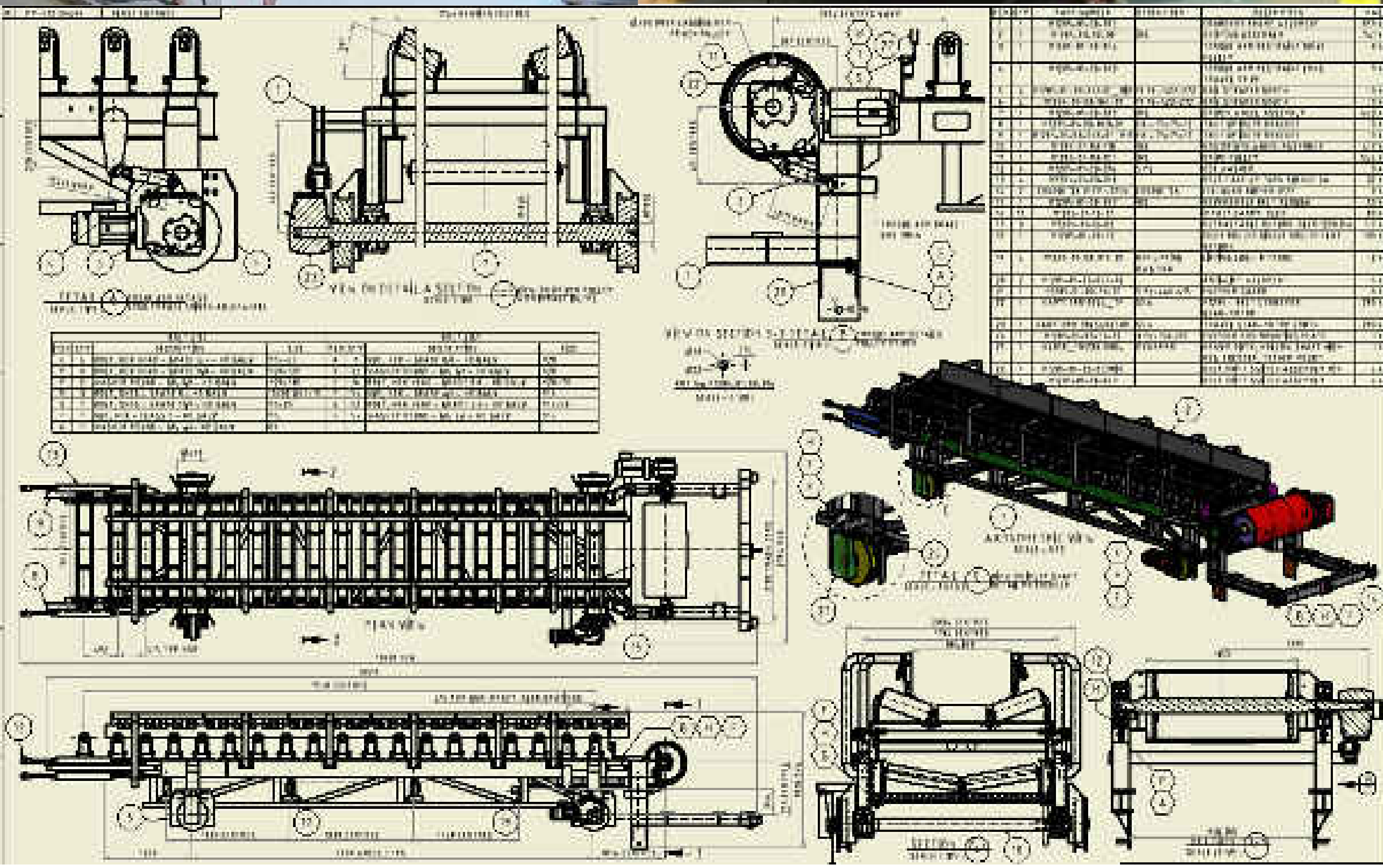

OVERALL LAYOUT
Client supplied drawing

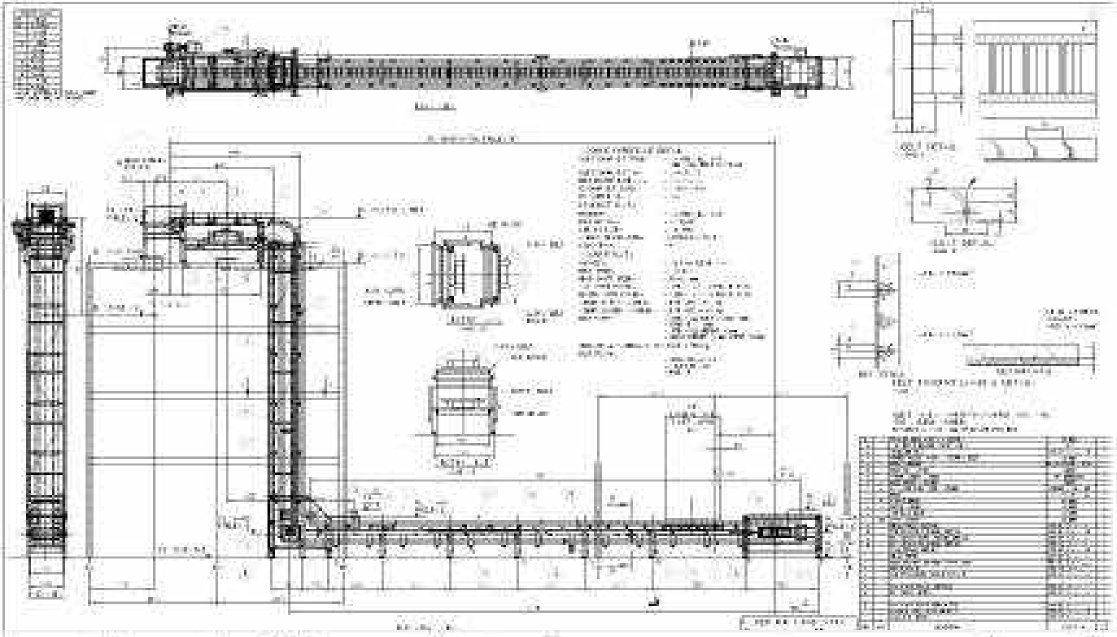


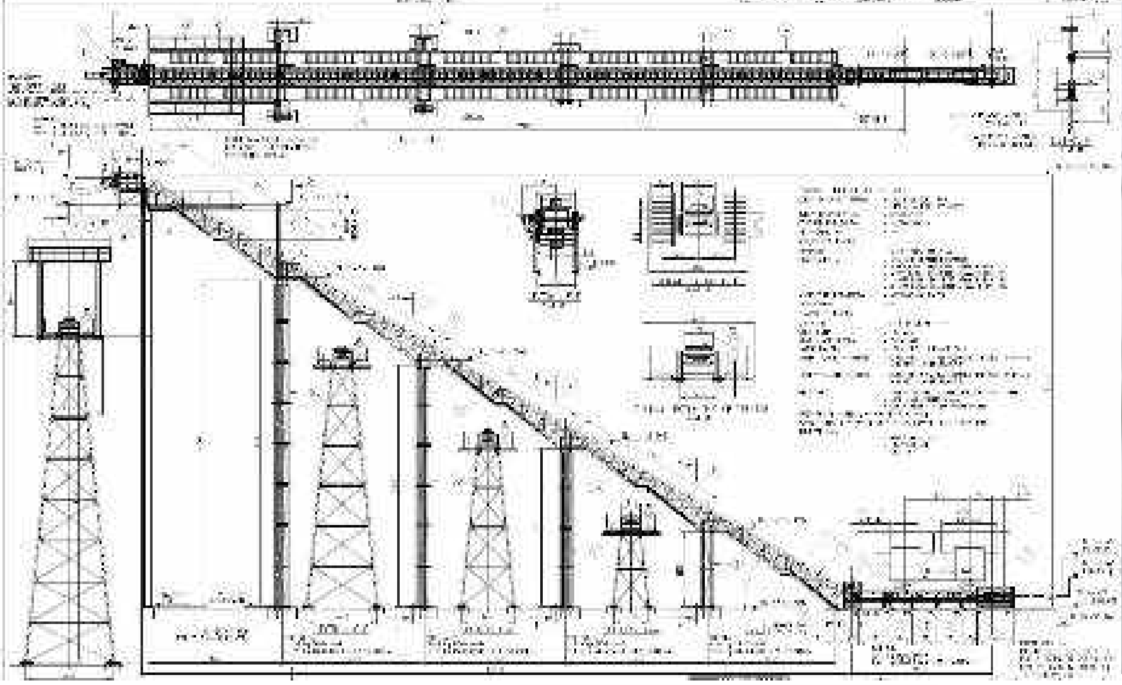

RADIAL STACKER

SHUTTLING CONVEYOR

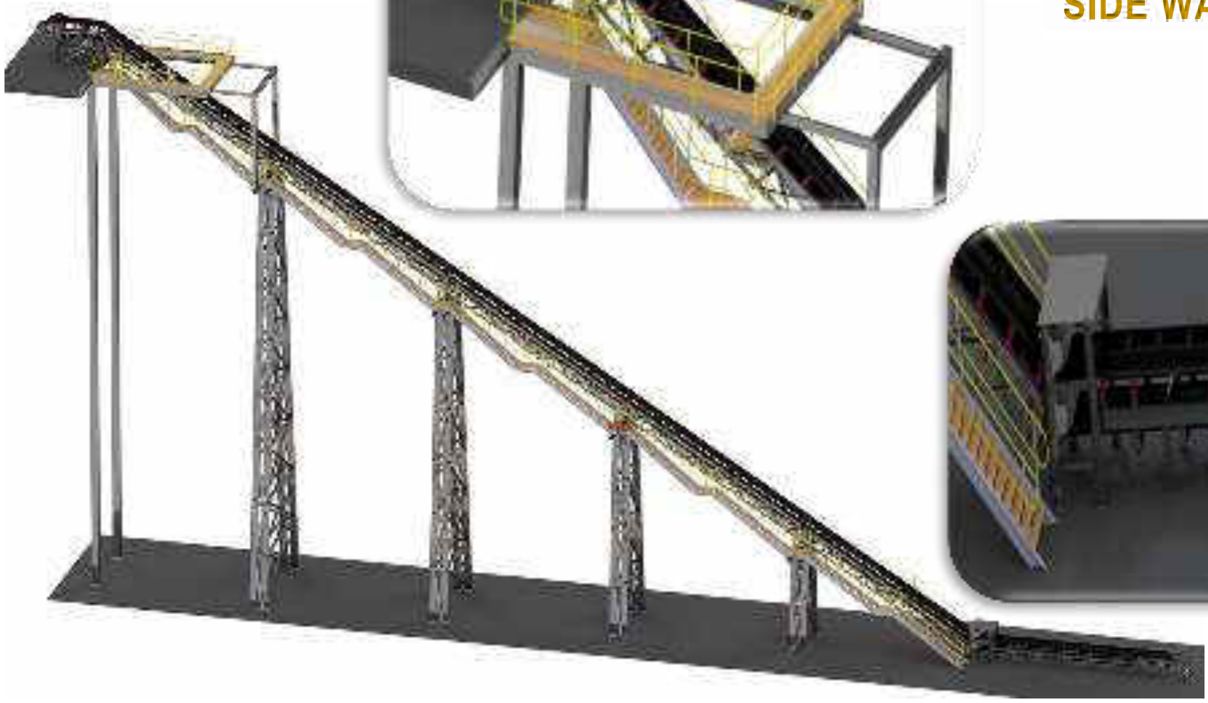


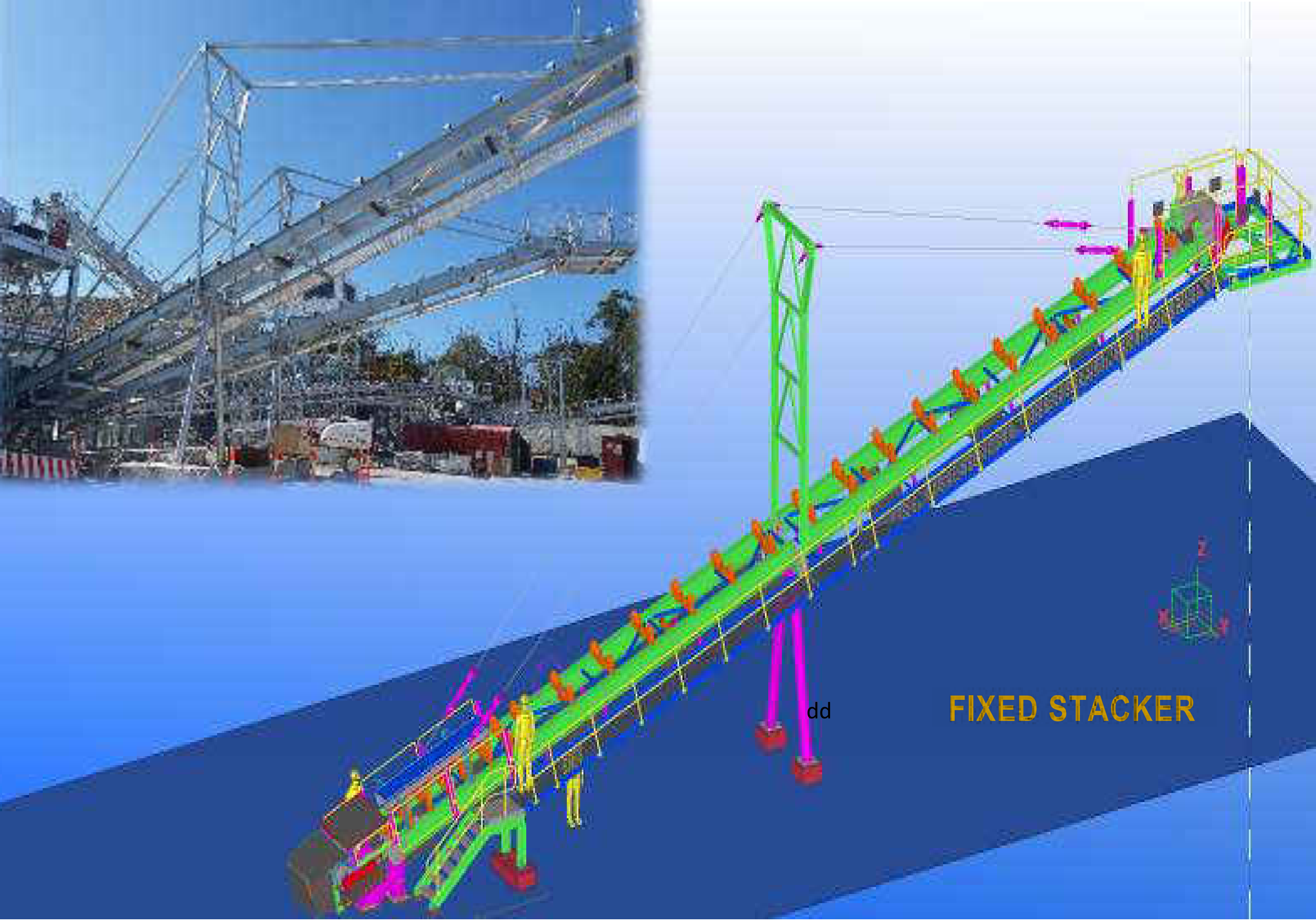


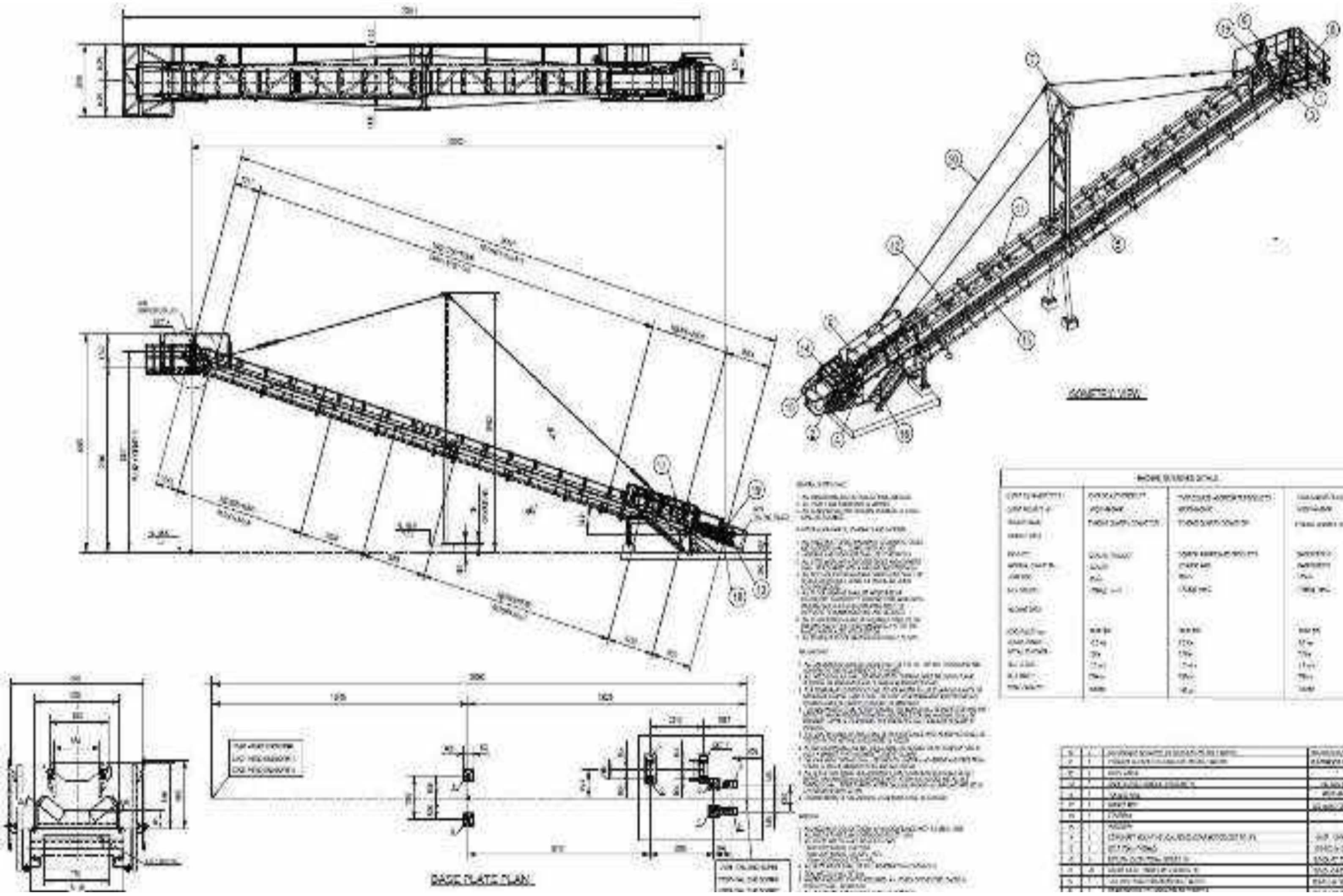




SIDE WALL CONVEYOR







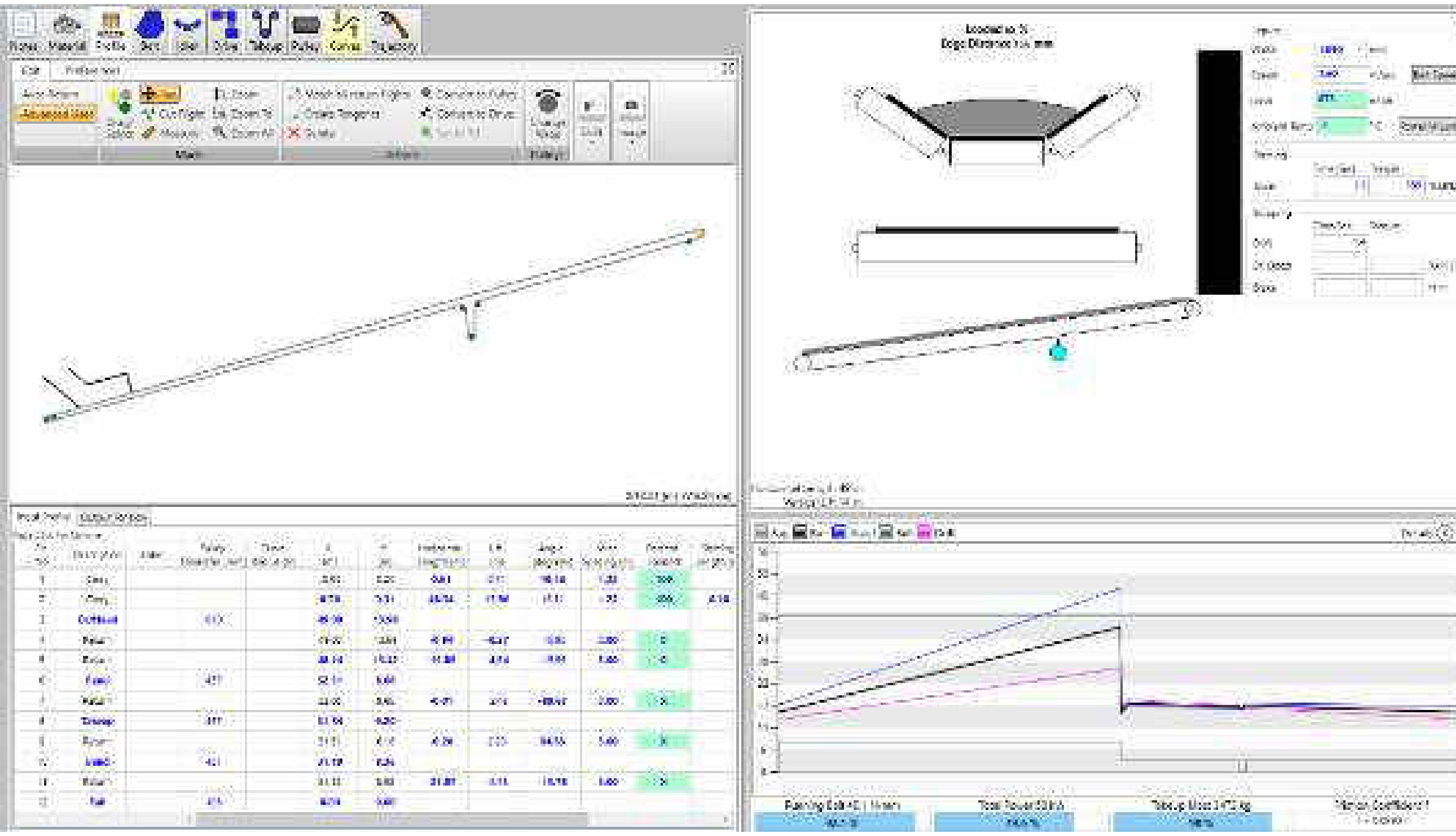
BELT CONVEYORS – Design & Detailing

Conveyor calculations and standards

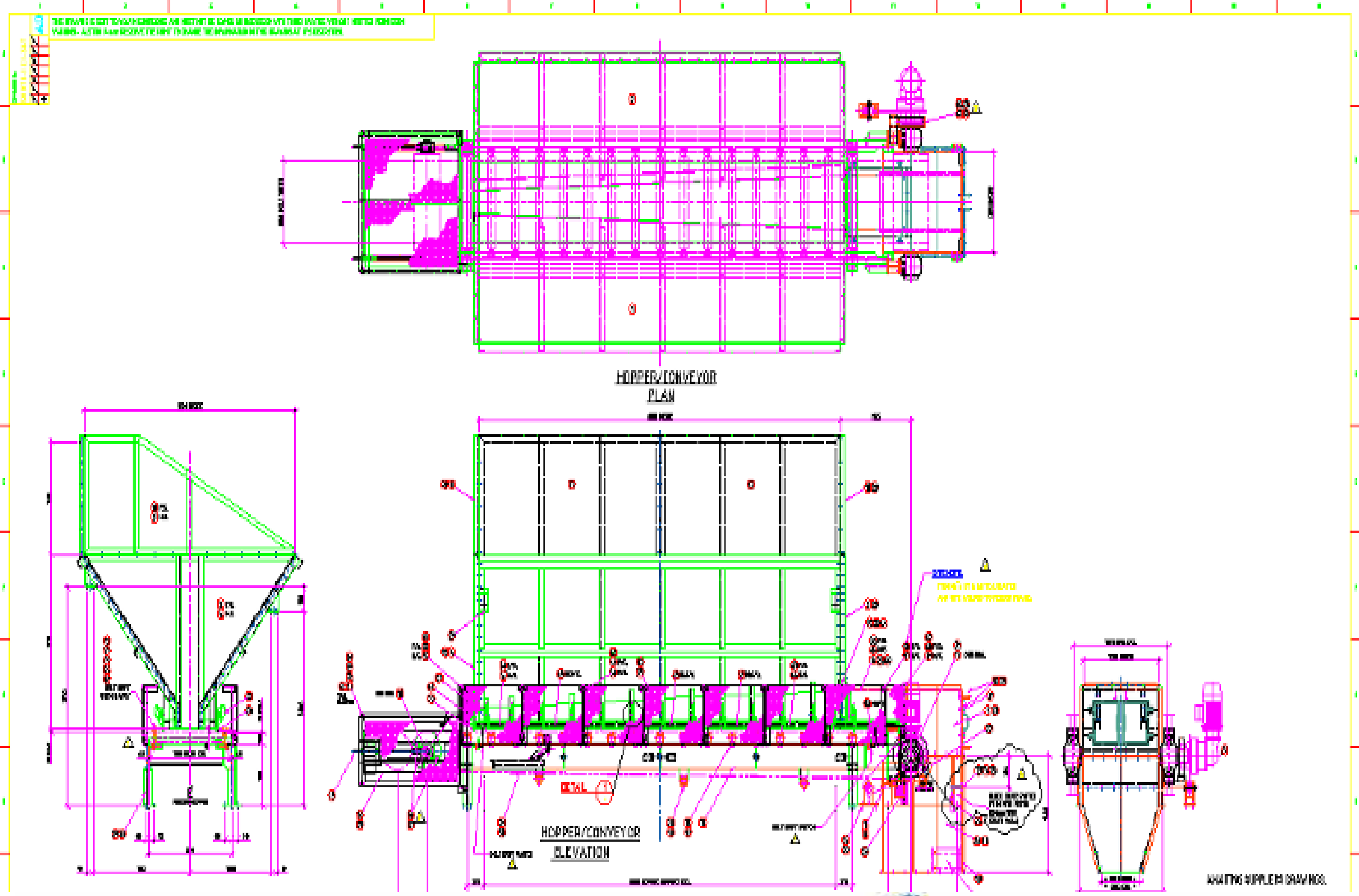
For Australian applications we consistently design to the following Australian Standards, please let us know if your application requires another standards

- AS1657 Walkways maintenance and access platforms
- AS4024-2015 Safety of Machinery
- AS1755-2000 Conveyor Safety Requirements
- AS4100 Steel Structures
- AS1359 Rotating Electrical Machines,
- AS1470 Health & Safety at Work,
- AWS D 1.1 Structural Steel Welding, American standard
- AS 1554.1 Structural Steel Welding, Australian standard
- AS3990 Mechanical Equipment – Steelwork,
- Occupational Safety and Health Act 1996
- Mines Safety and Inspection Act 1994
- Mines Safety and Inspection Regulations 1995

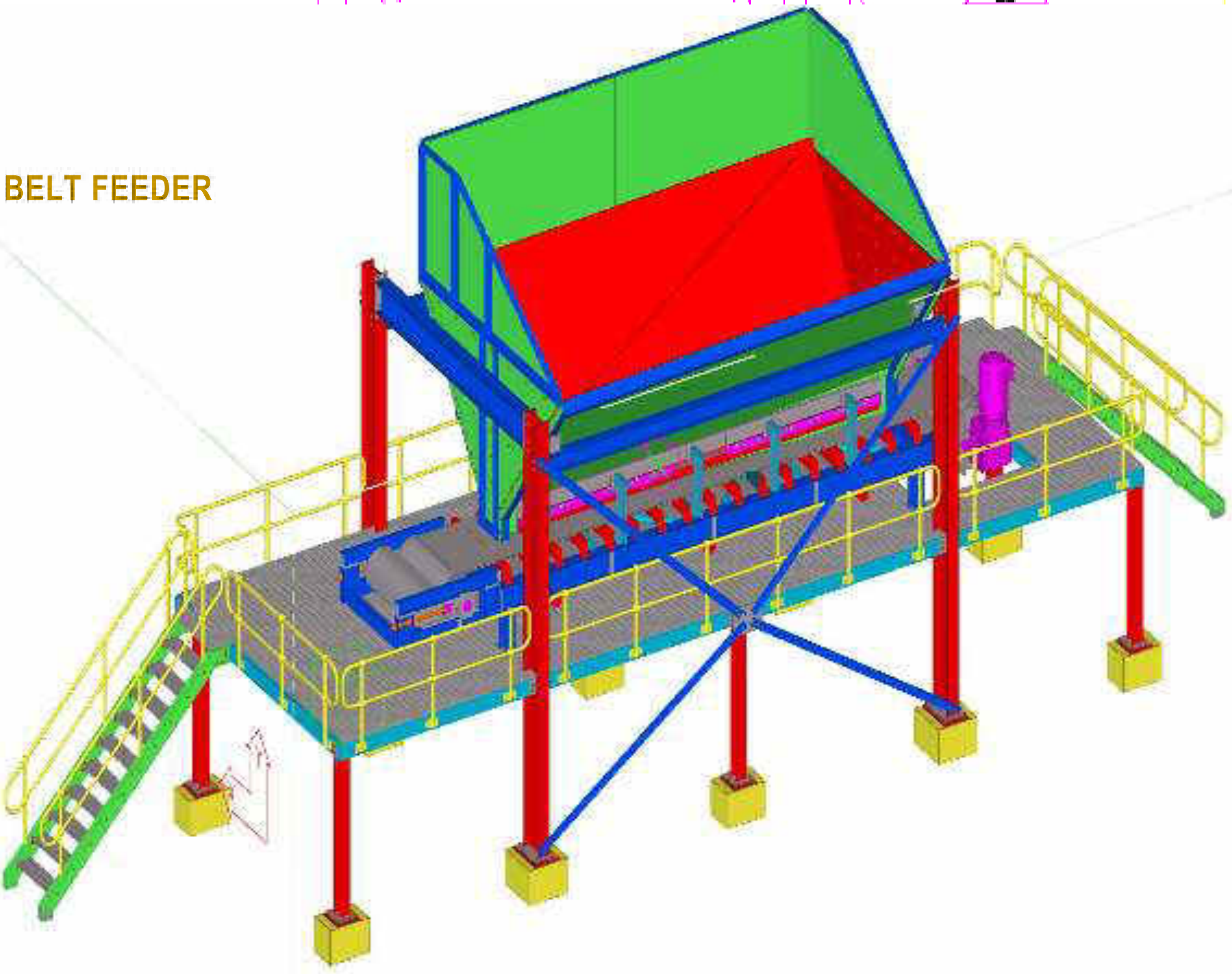
Our sophisticated conveyor calculation tool provides complete tension and power analysis. Features include:



- Overall profile configurations, during all operating modes.
- Identification of belt and conveyor interface issues.
- Take up tensions, multiple drives, and split-power situations.
- Roller analysis.
- Belt selection tool - recommends carcass, cover grade, and cover gauge.
- Detailed belt data sheets including roll weight and



BELT FEEDER



Feeder Section Properties

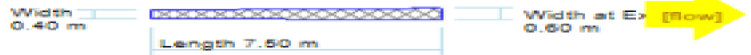
Estimated Feed Rate	mtph	76
Discharge Opening		
Opening Height	m	0.045
Opening Width	m	0.600
Effective Height	m	0.044
Actual Cross Section Area	m2	0.027
Effective Cross Section	m2	0.026

Feeder Section Forces

Material Shear Force Calculation Method:CEMA
Conveyor Friction Calculation Method:CEMA Universal (7th)

		[initial]	[Running]
Material Vertical Force	N	35,304	27,449
Material Shear	N	12,850	9,991
Material Acceleration	N	0	11
Material Elevation	N	427	427
Idler Friction - Hopper	N	983	819
Idler Friction - Extended	N	273	273
Skirtboard - Hopper	N	1,343	1,044
Skirtboard - Extended	N	102	102
Total Resistance	N	15,979	12,668
Required Power	kW		6.7

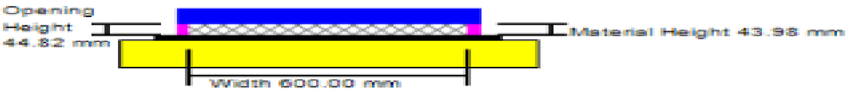
TOP VIEW OF HOPPER OPENING



SIDE VIEW OF HOPPER OPENING

FEEDER CALCULATIONS

CROSS SECTION VIEW OF HOPPER DISCHARGE



General

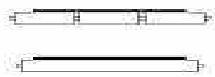
Belt Width	mm	750
Belt Speed	m/sec	0.50
Load	mtph	76
Ambient Temp	° C	20
Total Mass	kg	12112
Total HS Inertia	kg-m²	0
Calculation Method		CEMA Universal (7th)
Friction Force	kN	0.4
Lift Force	kN	0.6
Misc Drag	kN	13.8
Friction Factors		
Equivalent DIN f		0.0239

Material

Description		Crushed ore
Density	kg/m³	1600
Surcharge Angle	deg	10.0
Actual Area	m ²	0.026
Percent Loaded	%	234
Edge Distance	mm	0
Bed Depth	mm	33
Lump Size	mm	30
Chute Drop Height	m	1.83
Impact Energy	N-m	1.0

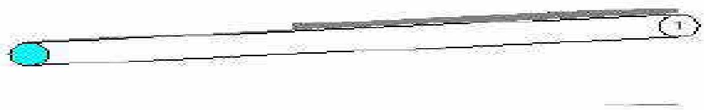
Idlers

		Carry	Return
Specification			
Description		B4	B4
Estimated No of Idlers		47	6
Belt Width	mm	762	762
No of Rolls		3	1
Angle	deg	0.0	0.0
Roll Diameter	mm	102	102
Type		Fixed	Fixed
Rotating Weight	kg	9.9	8.8
Bearing Type		Roller	Roller
Rating	N	1824	734
Max Actual Load	N	1145	476
Max Calc Load	N	1236	493
RPM		94	94
Min L10 Life	hr	7850226	598910
Ave L10 Life	hr	7850226	600583
Vert. Misalign	mm	3.175	3.175
Angular Install Tolerance	mm	12.700	12.700
Forward Tilt	deg	0.0	0.0
Mfg. Tolerance	mm	2.540	2.540
Idler/Belt Friction		0.50	0.50
Seal Drag -Kis	Nm	0.17	0.17
Speed Factor -Kiv	N-m/rpm	0.0000	0.0000
Load Factor -Ciw	mm-N/N	0.03454	0.03454
Drag Multiplier		1.00	1.00
Kt Multiplier		1.01	1.01



Profile

Horizontal Length	m	19
Vertical Lift	m	3

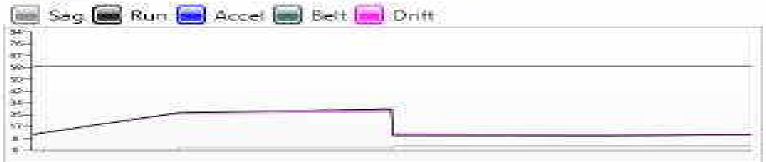


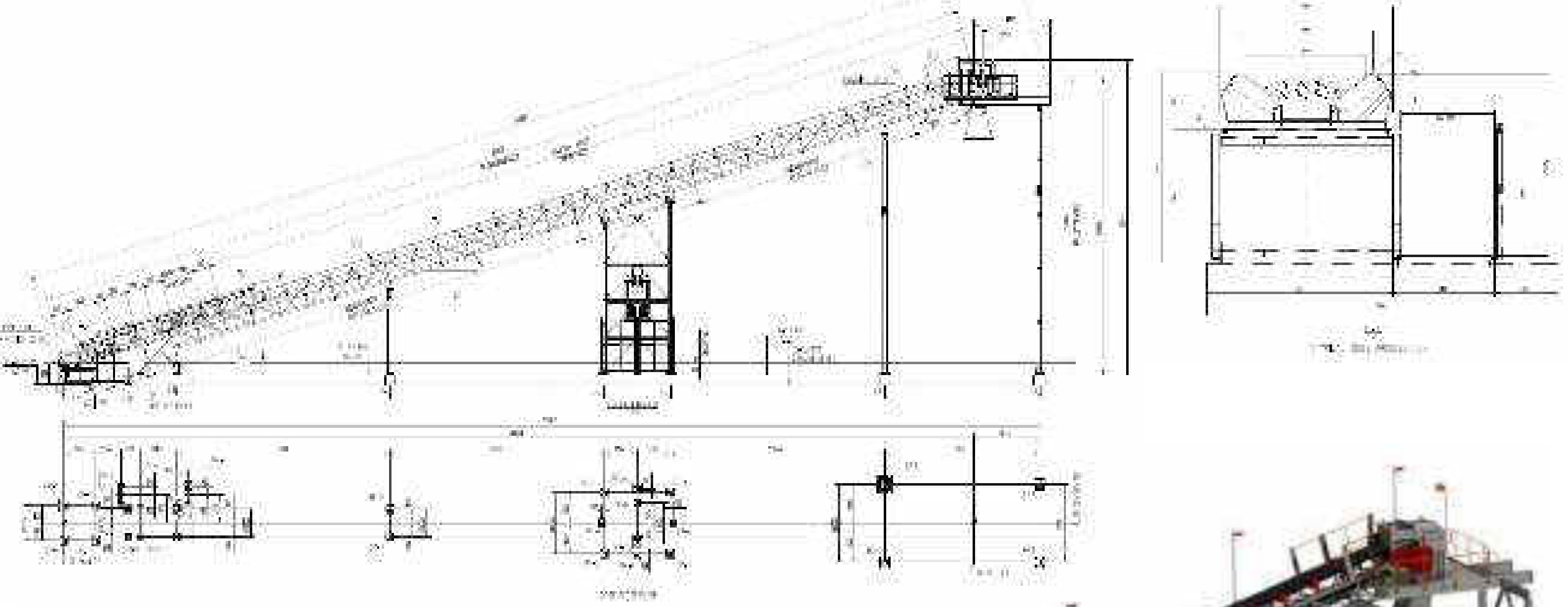
Takeup

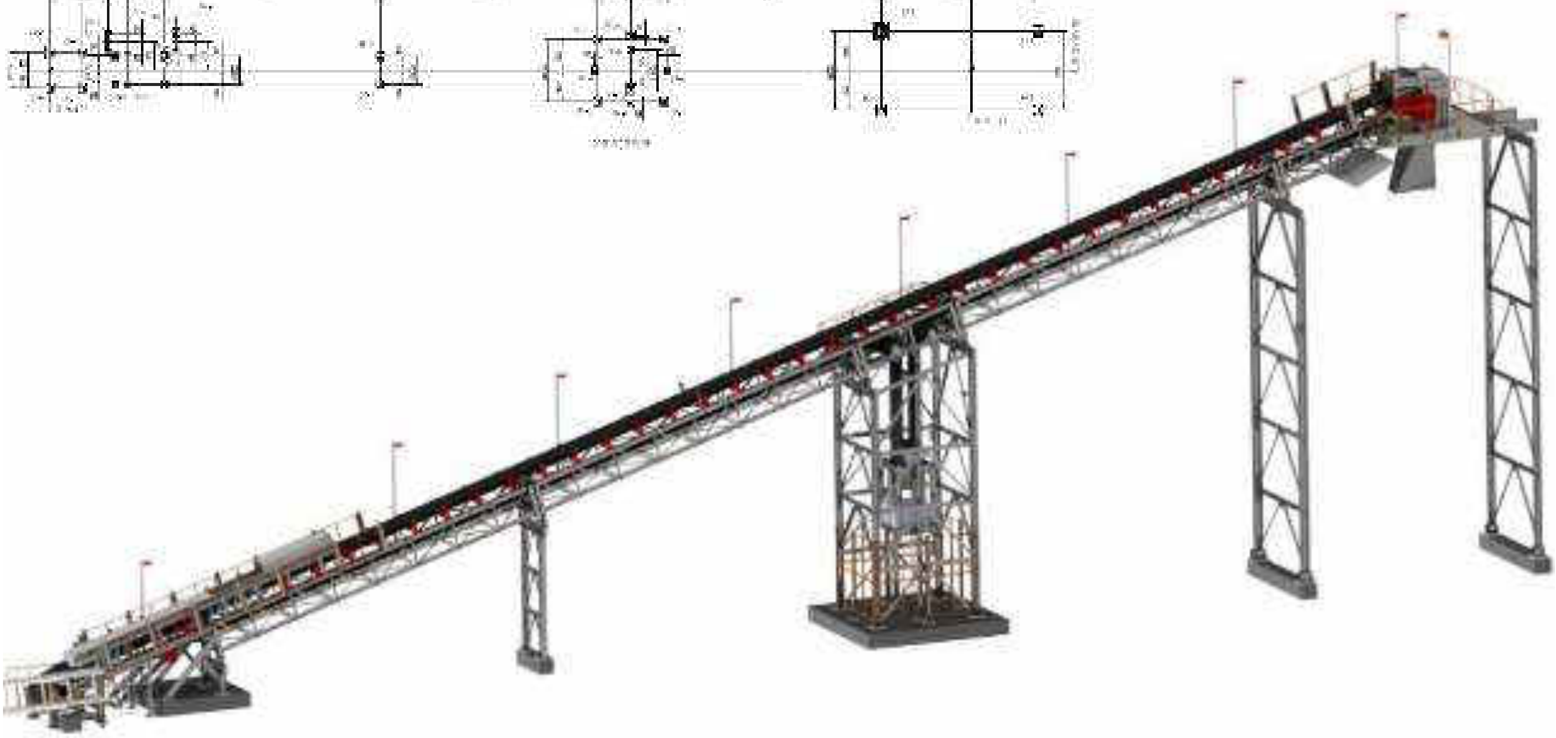
Type		Manual
Tension	kN	8.6
No of Pulleys		1
Weight	kg	1749
Selected Due To		Run Slip
Approx. Carriage Travel Due To		(Refer To Belt Manufacturer)
Permanent	m	0.11
Total	m	0.11

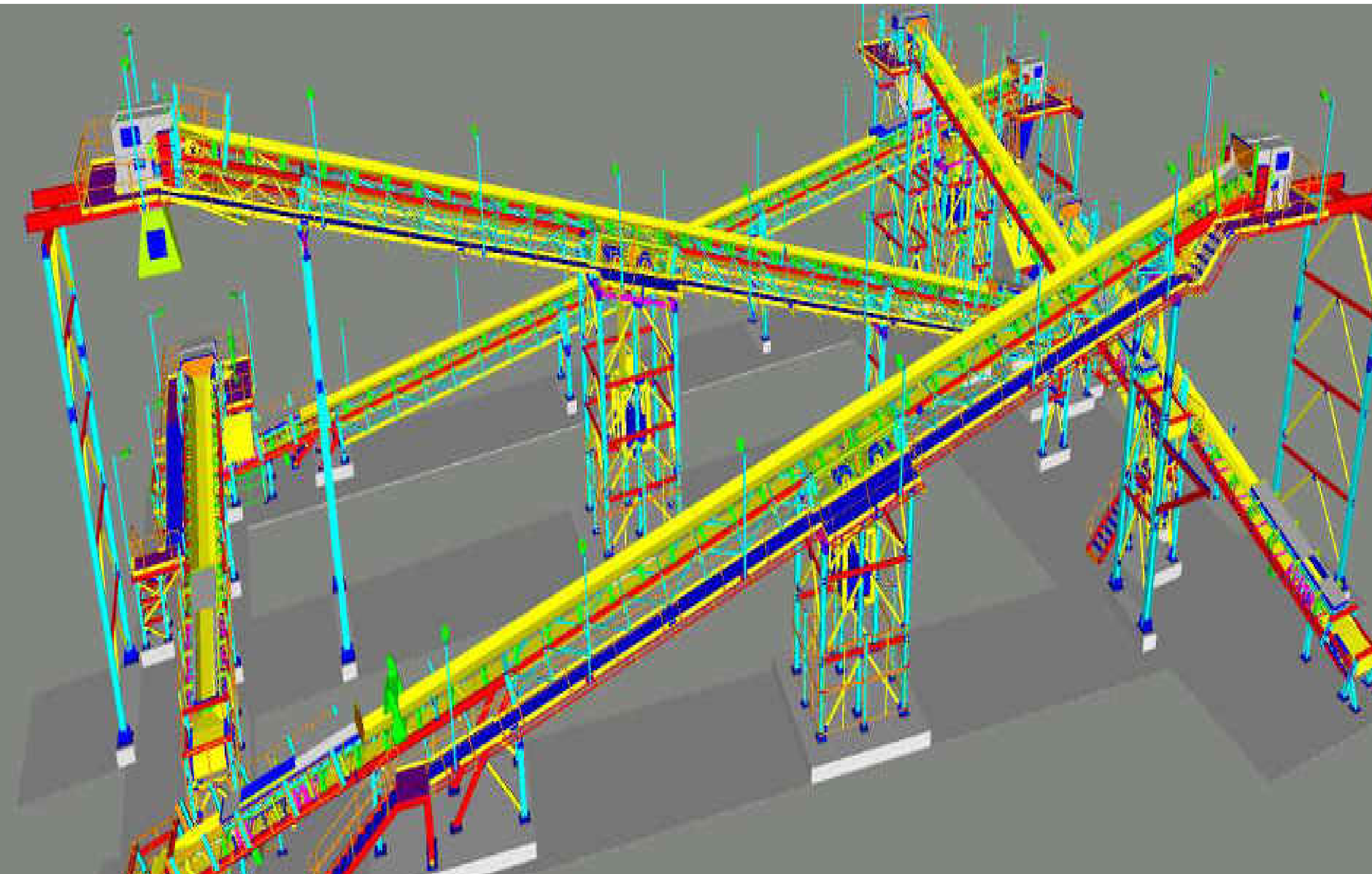
Belt

Type		Fabric-ISO
Description		3/EP600
Cover Gauge	mm	9.0 x 4.0
Rating	kN /(N/mm)	45 / 60
Safety/DesignFactor		10.00
Elastic Modulus	N/mm	8138
Weight	kg/m	15.9
Apparent Length	m	40
Max Run Ten	kN / N/mm / %	22.1 / 29 / 49
Max Accel Ten	kN / N/mm / %	22.3 / 30 / 50
Max Decel Ten	kN / N/mm / %	20.7 / 28 / 46



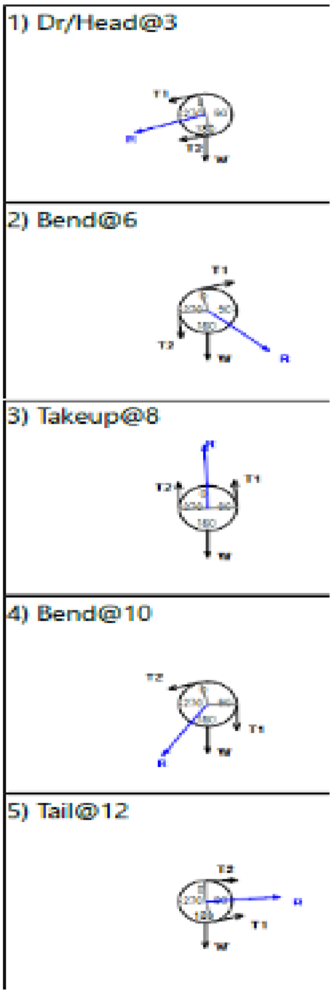






Pulley

Pulley No.	1	2	3	4	5
Flight Description	Dr/Head	Bend	Takeup	Bend	Tail
Label					
Location	3	6	8	10	12
Same As (Pulley No.)					
Tension (T1) (kN)	65.9	44.5	44.1	45.0	43.3
Tension (T2) (kN)	43.4	44.7	44.5	45.3	43.6
T1 Incoming Angle (degrees)	345.0	345.5	86.8	88.7	165.2
Wrap Direction	Clockwise	Counter	Clockwise	Counter	Clockwise
Wrap Angle (degrees)	184.2	78.6	181.9	103.5	193.9
T2 Outgoing Angle (degrees)	169.1	266.8	268.7	345.2	359.1
Pulley Weight (kg)	873.36	446.47	446.47	446.47	470.88
Resultant Force (kN)	111.5	59.2	84.2	74.5	85.7
Resultant Force Angle (degrees)	252.34	129.78	357.67	215.07	85.22
Pulley Diameter (mm)	782	606	606	606	606
Lagging Gauge (mm)	12.0	12.0	12.0	12.0	12.0
Lagging Type	Diamond	Diamond	Diamond	Diamond	Diamond
Face Width (mm)	1200	1200	1200	1200	1200
Pulley RPM (RPM)	37.91	48.50	48.50	48.50	48.50
Bearing Centers B (mm)	1700	1500	1500	1500	1700
Dimension A (mm)	377	264	264	264	364
Shaft Length (mm)	2476	1730	1730	1730	1930
Shaft Material	1045	1045	1045	1045	1045
Key Type	Profiled	None	None	None	None
Shaft Diameter (mm)	170	140	140	140	140
Bearing Bore (mm)	130	110	110	110	110
Bearing Type	Roller	Roller	Roller	Roller	Roller
Dynamic Capacity (N)	738368.0	453696.0	453696.0	453696.0	453696.0
Overhung Load (N)	0.0				
Shaft Deflection	0.0012	0.0010	0.0014	0.0013	0.0020
Shaft Safety Factor	2.03	5.05	3.55	4.02	2.53
Bearing L10 Life (hrs) (hr)	2379737	3015410	931749	1403835	877304
Backstop Required?	Yes				
Min Backstop Rating	14729				
Backstop Torque	5593				



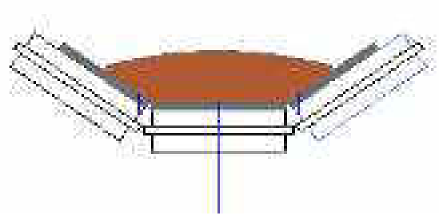
Units

Please note that the resulting rating for the idler set is dependent upon the load distribution on each roll. Be sure to input the maximum expected load (conveyor capacity) to ensure calculations represent the load distribution from the required design conditions.

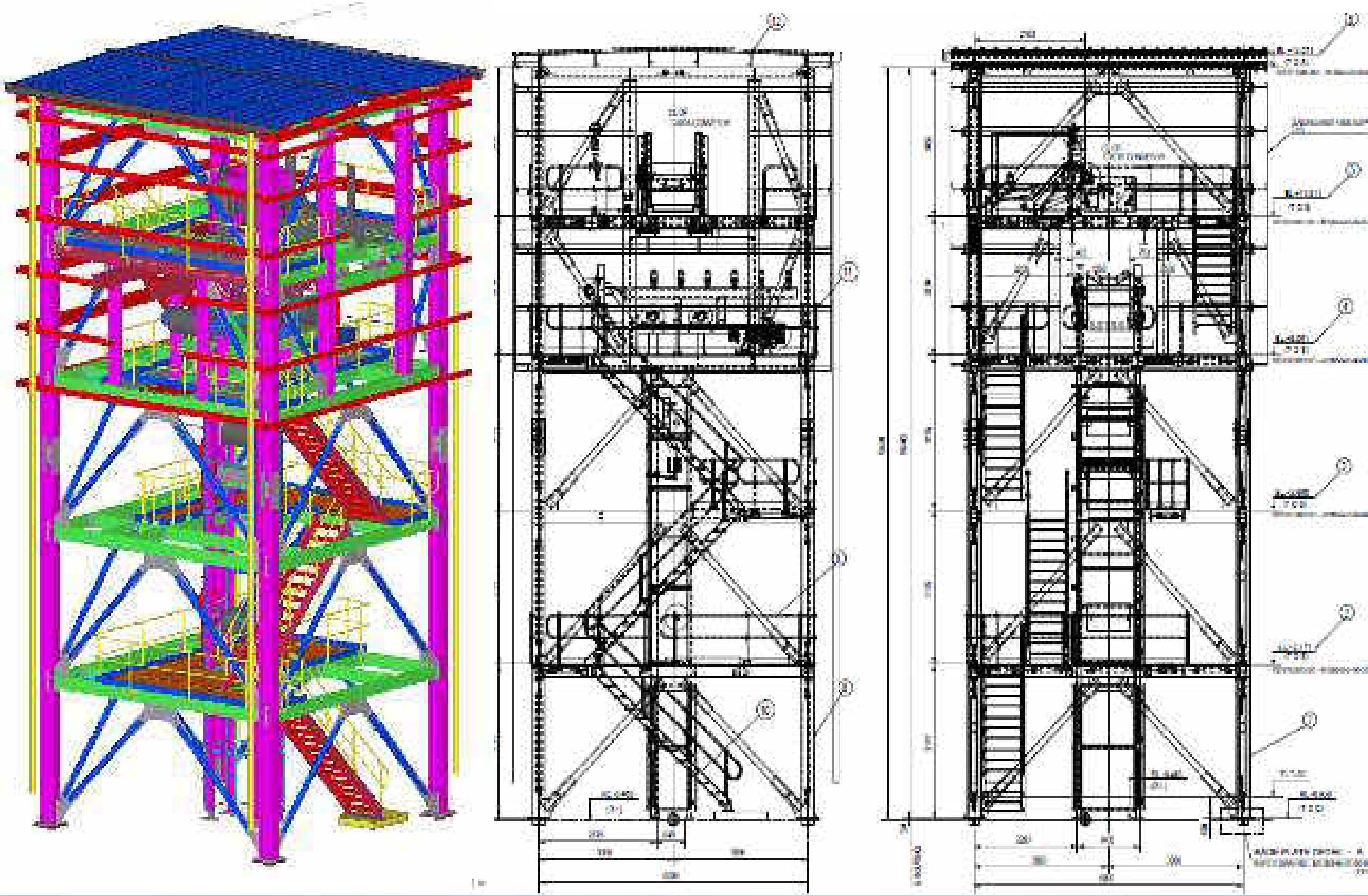
Important BA Inputs	-
Idler Set Rating (N)	4953.0
Rotating Weight (kg)	17.2
Seal Drag - Avg Per Roll (Ks) (N-m)	0.21
Speed Factor - Avg Per Roll (kv) (N-m/rpm)	0.0003
Load Factor - Avg Per Roll (Cw) (N-mm/N)	0.0406

Belt Width (mm)	1050
Belt Weight (kg/m)	22.0
Belt Speed (m/s)	1.60
Idler Spacing (m)	1.22
Conveyor Capacity (mtph)	673
Material Density (kg/m^3)	1600.05
Material Surcharge (deg)	15.0
No. Rolls	3
Roll Gap (mm)	25.4
Design Life (hrs)	60000
Failure Probability (%)	10
Grease Kinematic Viscosity @40C (mm^2/s)	125
Grease Contamination Factor (0.1-0.9)	0.1

Design Concerns With Input Idler Set Will Be Listed Here:



-	Idler Roll 1	Idler Roll 2	Idler Roll 3
Roll Length (mm)	402.1	402.1	402.1
Roll Diameter (mm)	127.0	127.0	127.0
Roll Angle (deg)	35.0	0.0	-35.0
Left Bearing Description	6205	6205	6205
Left Bearing Type	Ball	Ball	Ball
Left Bearing Bore (mm)	25.0	25.0	25.0
Left Bearing OD (mm)	52.0	52.0	52.0
Left Bearing Fatigue Load Limit (Pu) (N)	335.0	335.0	335.0
Left Bearing Dynamic Load Rating (C) (N)	14000.0	14000.0	14000.0
Left Bearing Static Load Rating (Co) (N)	7800.0	7800.0	7800.0
Left Bearing Load (N)	28.9	585.9	171.1
Left Bearing Load At Design Life (N)	5412.3	2823.7	5209.7
Left Bearing Required Dynamic Load Rating ...	74.7	2904.8	459.9
Left Bearing Impact Safety Factor ()	270.21	13.31	45.58
Left Bearing Life (hrs)	395473848404	6717503	1692919846
Right Bearing Description	6205	6205	6205
Right Bearing Type	Ball	Ball	Ball
Right Bearing Bore (mm)	25.0	25.0	25.0
Right Bearing OD (mm)	52.0	52.0	52.0
Right Bearing Fatigue Load Limit (Pu) (N)	335.0	335.0	335.0
Right Bearing Dynamic Load Rating (C) (N)	14000.0	14000.0	14000.0
Right Bearing Static Load Rating (Co) (N)	7800.0	7800.0	7800.0
Right Bearing Load (N)	171.1	585.9	28.9
Right Bearing Load At Design Life (N)	5209.7	2823.7	5412.3
Right Bearing Required Dynamic Load Ratin...	459.9	2904.9	74.7
Right Bearing Impact Safety Factor ()	45.58	13.31	270.21
Right Bearing Life (hrs)	1692977594	6717462	395459037310
Shaft ID at Bearing (mm)	7.9	7.9	7.9
Shaft OD Between Bearings (mm)	25.0	25.0	25.0



Structural Design

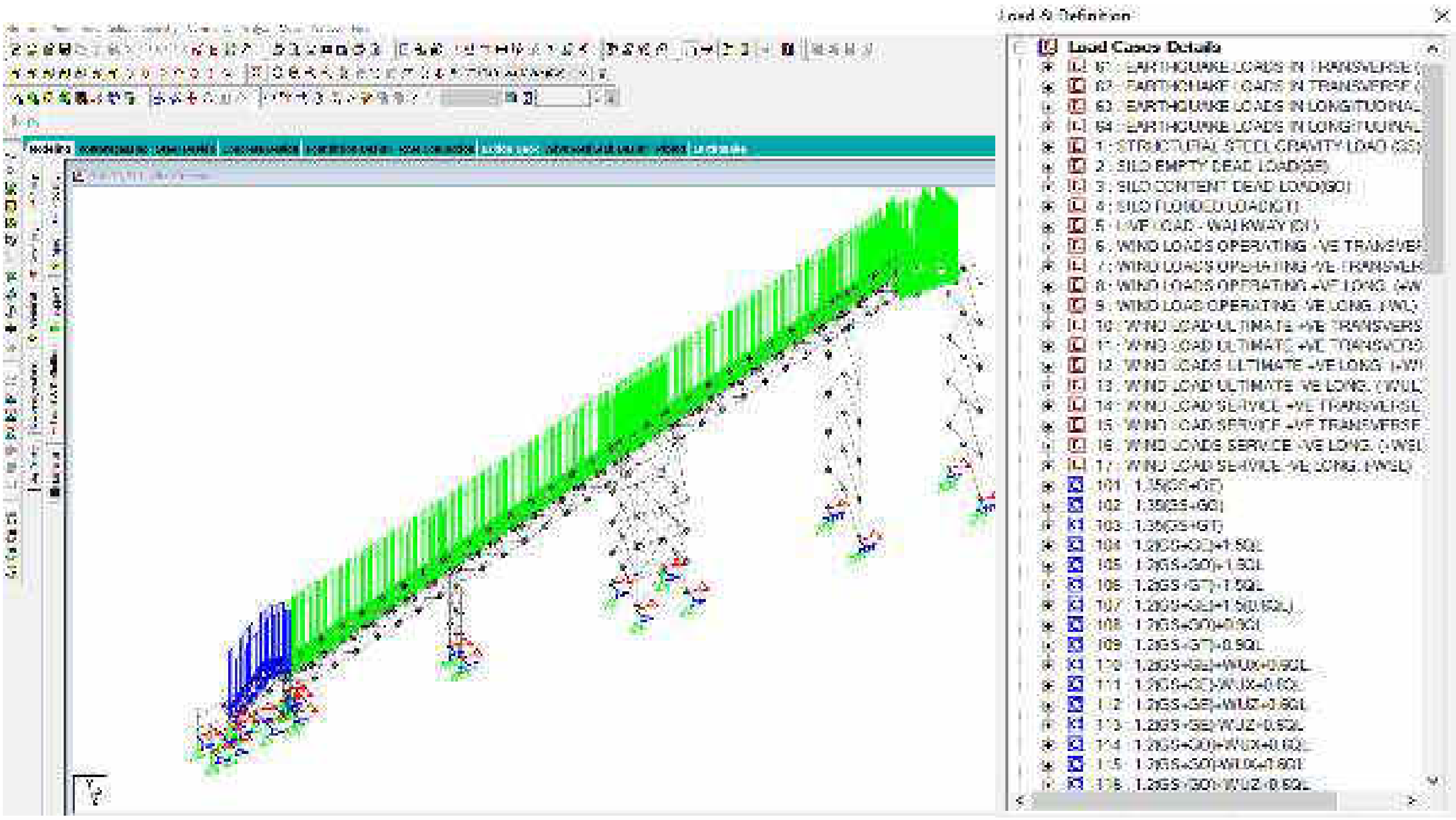
We provide optimized structure designs & reports for conveyors and steel structures.

Our design drawing adheres to Australian, AISC and IS Standards as required by our clients.

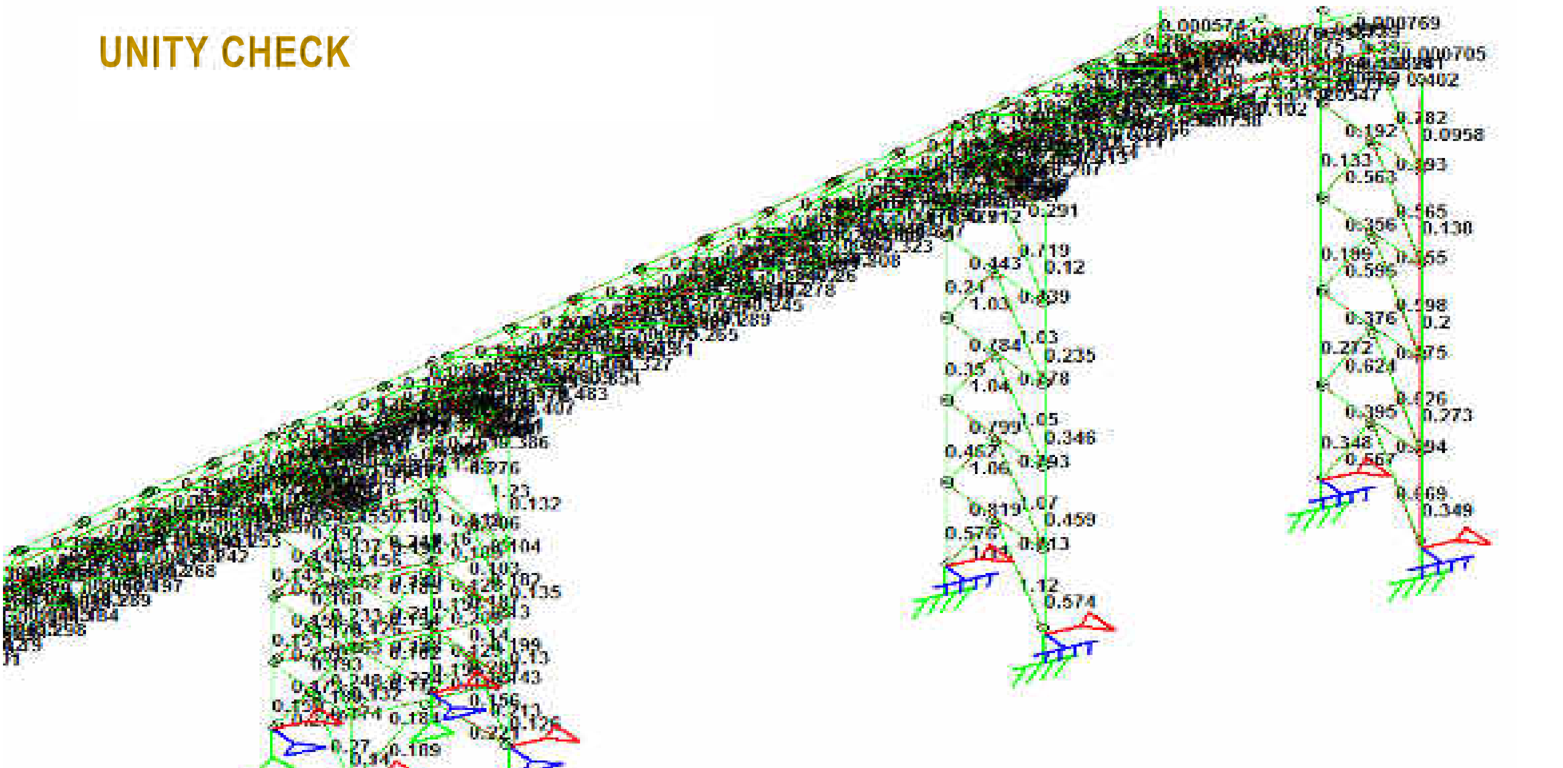
Connection Design with details Design calculations & reports

CODE AND STANDARD

- AS/NZS 1170.0-2002 Structural design actions – Part 0, General principles
- AS/NZS 1170.2-2002 Structural design actions – Part 2, Wind actions
- AS 1170.4-2007 Structural design actions – Part 4, Earthquake actions in Australia
- AS 4100-1998 Steel structures



UNITY CHECK



DESIGN METHOD

Structure analyzing using the finite element computer program, subjected to independent loads.

Software also performs a combined bending and axial load unity check in accordance

With Australian Standard AS4100-steel structures.

Seismic Load Calculation - Equivalent Static Method [Per Clause 6.2, AS1170.4-2007]

Design base shear $V = C_d(T_1)W_t$ [Clause 6.2.1]

Where,

$C_d(T_1)$ = horizontal design action coefficient
= $C(T_1)S_p/\mu$ = 0.016

$C(T_1)$ = value of the elastic site hazard spectrum
= $k_pZC_h(T_1)$ = 0.042

$C_h(T_1)$ = value of the spectral shape factor for the fundamental natural period of the structure (calculated below)

k_p = probability factor [Table 3.1]
= 1.00

Z = hazard factor [Table 3.2]
= 0.05 [Figure 3.2(c)]

W_t = seismic weight of the structure [Clause 6.2.2]

S_p = structural performance factor [Clause 6.5]
= 0.77

μ = structural ductility factor [Clause 6.5]
= 2.00 [Considering 'Ordinary moment-resisting frames(limited ductile)]

T_1 = natural period of the structure [Clause 6.2.3]
= $1.25k_th_n^{0.75}$
= 1.048s

k_t = 0.110 [for moment-resisting steel frames]
= 0.075 [for moment-resisting concrete frames]
= 0.060 [for eccentrically-braced steel frames]
= 0.050 [for all other structures]
= 0.110

h_n = height from base of the structure to the uppermost seismic weight or mass (in metres)

Wind Pressures Calculation [Per AS/NZS 1170.2-2002]

Wind region : A4 [Non-cyclonic]
Average recurrence interval (R) : 250 Years
Terrain category : Category 2
Density of air (ρ_{air}) : 1.20 kg/m^3

Regional wind speed (V_R) : 44 m/s [Ultimate Limit States]
: 44 m/s [Serviceability Limit States]

Wind direction multipliers (M_d):

Cardinal directions								
N	NE	E	SE	S	SW	W	NW	Any Direction
0.90	0.85	0.90	0.90	0.95	0.95	0.95	0.90	1.00

Shileding multiplier (M_s) : 1.0 [Considered conservatively]
Topographic multiplier = Max(M_h, M_{lee}) (M_t) : 1.0

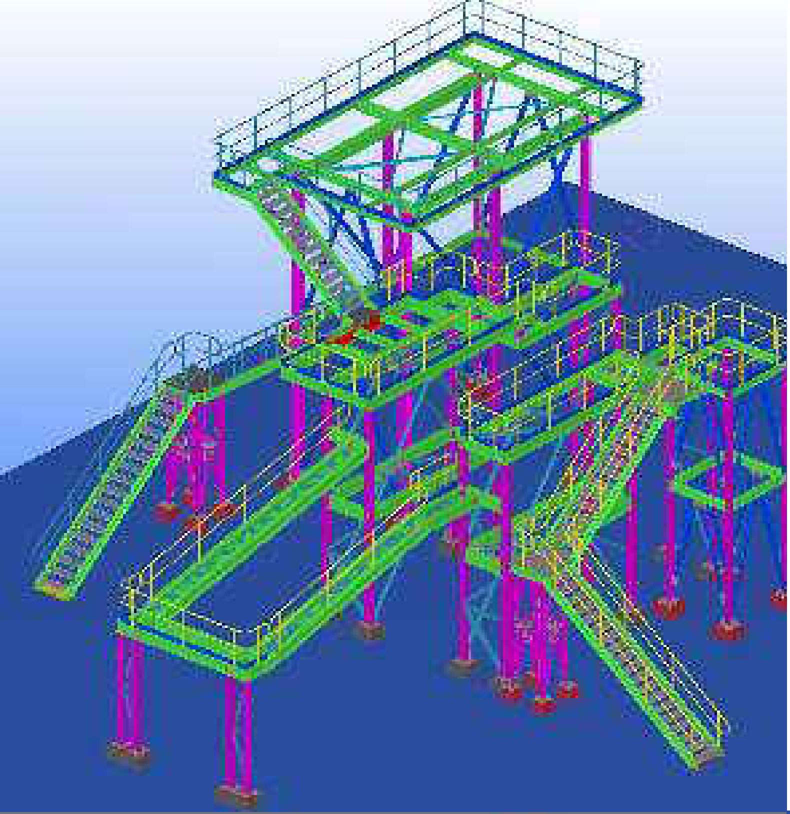
Where,

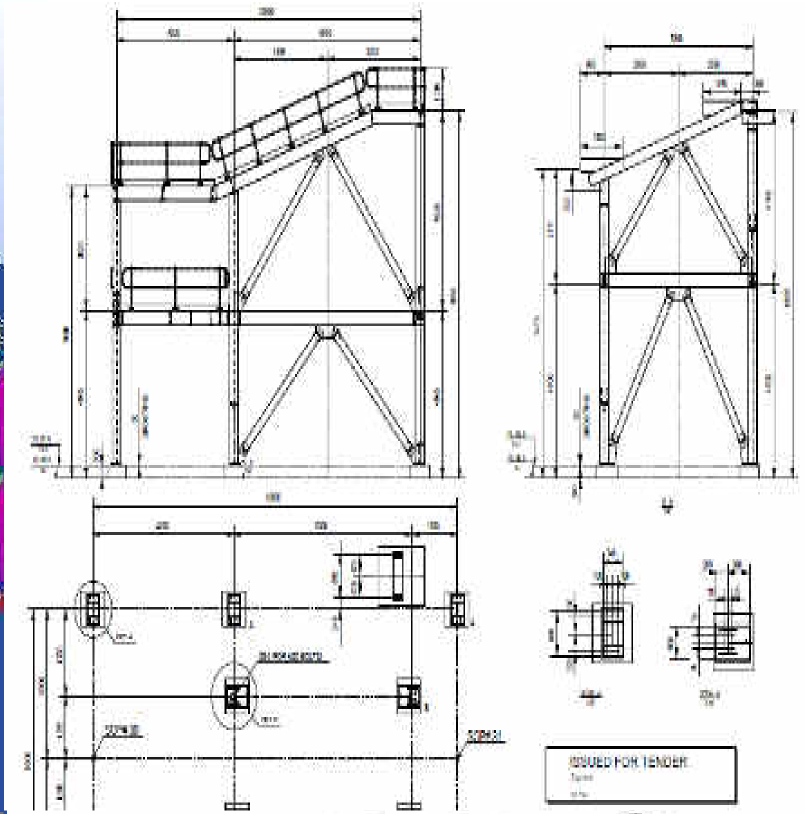
M_h = hill-shape multiplier
= 1.0 [for an assumed $H/2L_u$ value < 0.05]

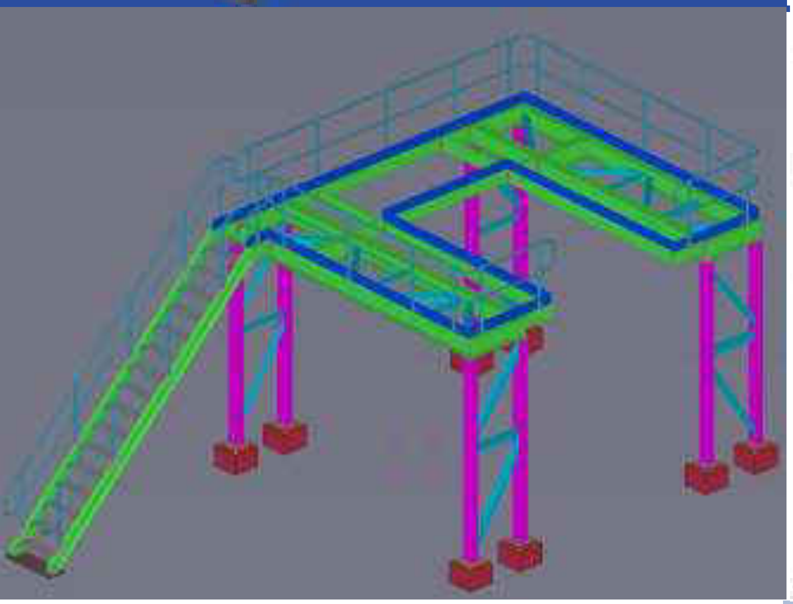
M_{lee} = lee multiplier
= 1.0

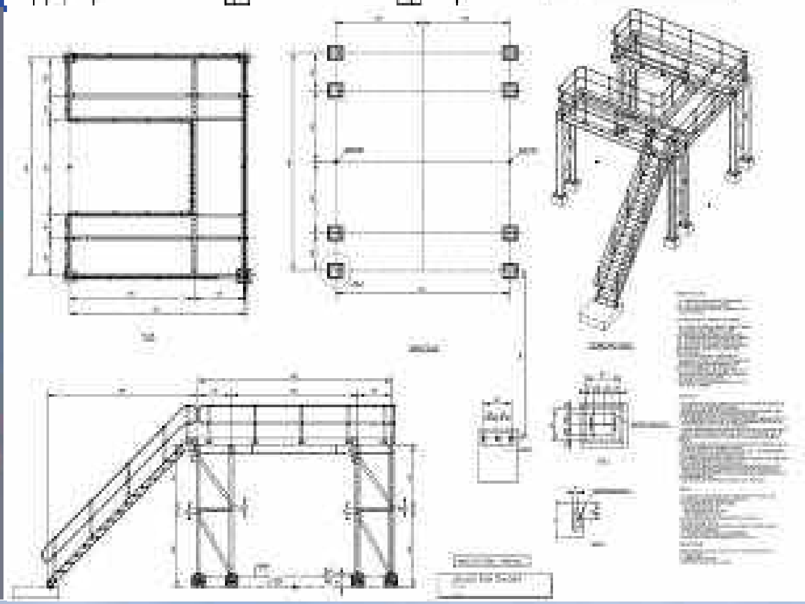
Site wind speeds ($V_{sit,\beta}$):

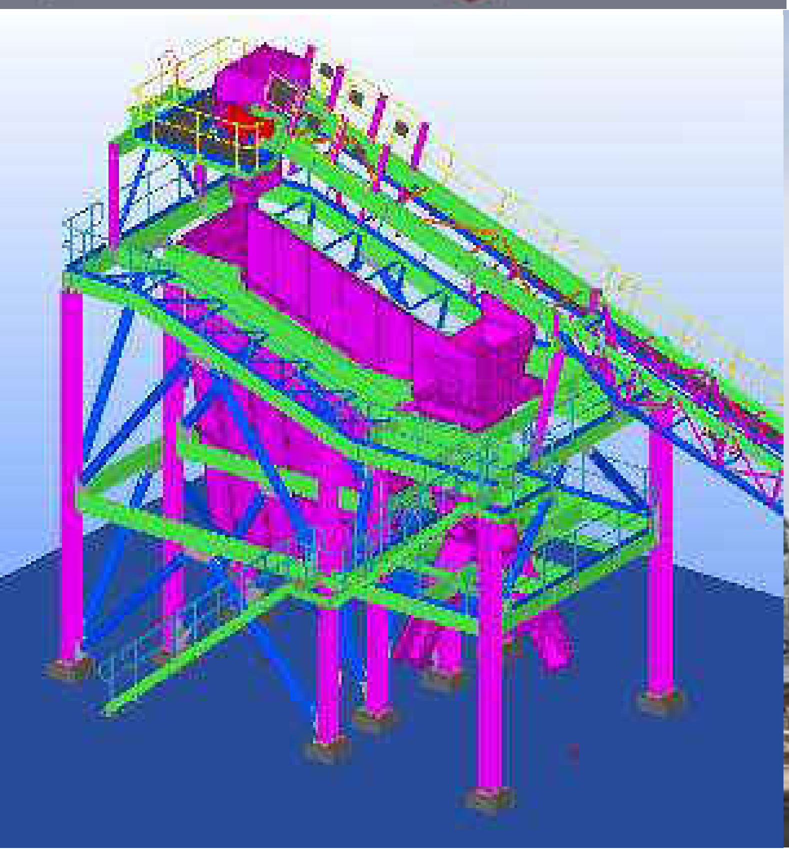
Site wind speeds are calculated as ($V_{sit,\beta}$) = $V_R\ M_d\ (M_{z,cat}\ M_s\ M_t)$
Dynamic response factor (C_{dyn}) = 1.0 [Considered conservatively]
Aerodynamic shape factor (C_{fig}) = -0.6
Design wind speed ($V_{des,\theta}$) = 48 m/s
Pressure at the specified elevation [in N/m^2] (p) = $(0.5\ \rho_{air})\ [V_{des,\theta}]^2\ C_{fig}\ C_{dyn}$
= -0.813 kN/m^2




ISSUED FOR TENDER





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R3 Plant design founded By Anthony Foster, in 2010 collaborating with an Indian design company. The goal was to build a cost effective design and detailing company specializing in belt conveyors and structures. It is a unique combination of Australian design with Indian modelling and detailing team to meet the challenges of the Global Market. Nowadays the company is involved in various projects and expanding business activities to Europe Australia and South Africa.

Founder member, Anthony Foster has over 20 years' experience in designing belt conveyors & structures. He started his career at Worley Parsons in Australia as a Design Engineer and has worked at various senior levels in India and South Africa.

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