

Simulation of Pinch_Roll_asm

Date: 18 November 2011

Designer: Solidworks

Study name: Study 1

Analysis type: Static

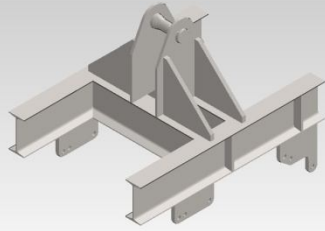


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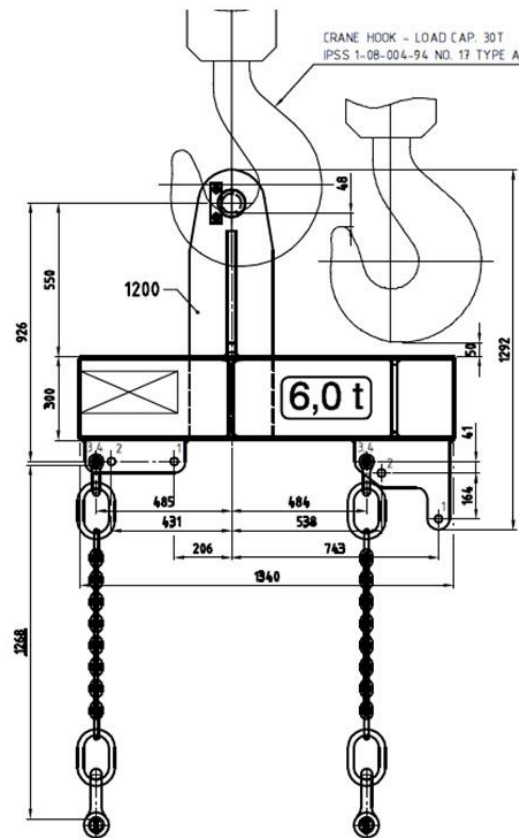
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Description

1. Type: Pinch Roll Beam
2. Optimize the structure of lifting beam and the plate thickness.
3. Use Indian standard sections instead of composite structure of plates.
4. Criterion for Optimization: The optimized beam should be suitable to hold the load with F.O.S. more than 4 on UTS.

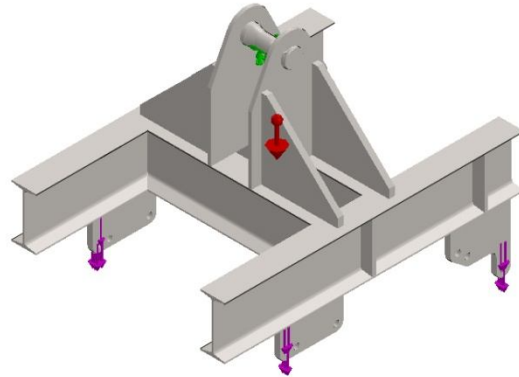
Loading Conditions

LOAD CONDITION - CHAIN TO BE CONNECTED IN EVERY HOLE.



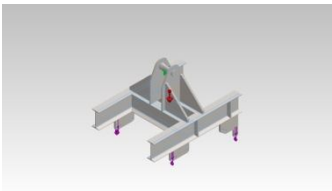
Comments:
Load = 10T

Model Information



Model name: Pinch_Roll_asm_3
Current Configuration: Default

Solid Bodies

Document Name and Reference	Treated As	Volumetric Properties	Document Path
Cut-Extrude1 	Solid Body	Mass:1204.96 lb Volume:4276.05 in^3 Density:0.281793 lb/in^3 Weight:1204.14 lbf	M:\Downloads\Rud\Final\3 d pinch roll\Pinch_Roll_asm_3.SL DPRT

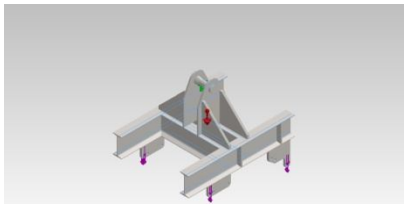
Study Properties

Study name	Study 1
Analysis type	Static
Mesh type	Solid Mesh
Thermal Effect:	On
Thermal option	Include temperature loads
Zero strain temperature	298 Kelvin
Include fluid pressure effects from SolidWorks Flow Simulation	Off
Solver type	FFEPlus
Inplane Effect:	Off
Soft Spring:	Off
Inertial Relief:	Off
Incompatible bonding options	Automatic
Large displacement	Off
Compute free body forces	On
Friction	Off
Use Adaptive Method:	Off
Result folder	SolidWorks document (M:\Downloads\Rud\Final\3d pinch roll)

Units

Unit system:	SI (MKS)
Length/Displacement	mm
Temperature	Celsius
Angular velocity	Rad/sec
Pressure/Stress	N/mm ² (MPa)

Material Properties

Model Reference	Properties	Components
	Name: Plain Carbon Steel Model type: Linear Elastic Isotropic Default failure criterion: Max von Mises Stress Yield strength: 2.20594e+008 N/m ² Tensile strength: 3.99826e+008 N/m ² Elastic modulus: 2.1e+011 N/m ² Poisson's ratio: 0.28 Mass density: 7800 kg/m ³ Shear modulus: 7.9e+010 N/m ² Thermal expansion coefficient: 1.3e-005 /Kelvin	SolidBody 1(Cut-Extrude1)(Pinch_Roll_asm_3)
Curve Data:N/A		

Resultant Forces

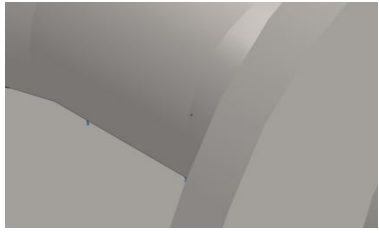
Reaction Forces

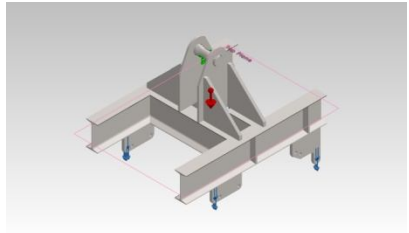
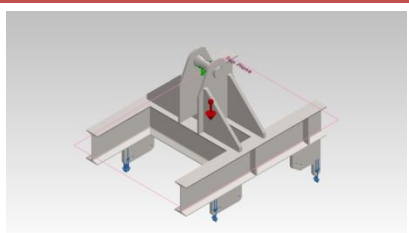
Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N	21.2703	103394	-9.08594	103394

Reaction Moments

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N-m	0	0	0	0

Loads and Fixtures

Fixture name	Fixture Image	Fixture Details		
Fixed-1		Entities: 1 face(s) Type: Fixed Geometry		
Resultant Forces				
Components	X	Y	Z	Resultant
Reaction force(N)	21.2703	103394	-9.08594	103394
Reaction Moment(N-m)	0	0	0	0

Load name	Load Image	Load Details
Force-1		Entities: 4 face(s), 1 plane(s) Reference: Top Plane Type: Apply force Values: ---, ---, -10000 kgf
Gravity-1		Reference: Top Plane Values: 0 0 -9.81 Units: SI

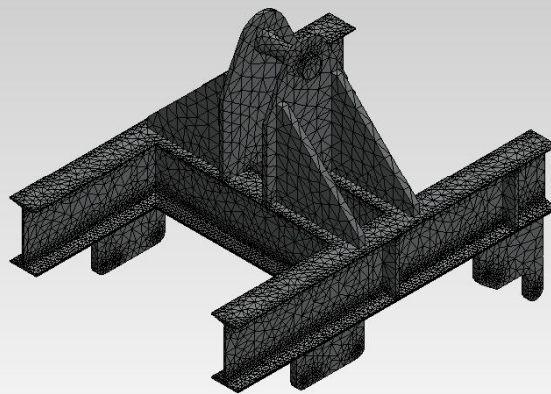
Mesh Information

Mesh type	Solid Mesh
Mesher Used:	Curvature based mesh
Jacobian points	4 Points
Maximum element size	59.4937 mm
Minimum element size	11.8987 mm
Mesh Quality	High

Mesh Information - Details

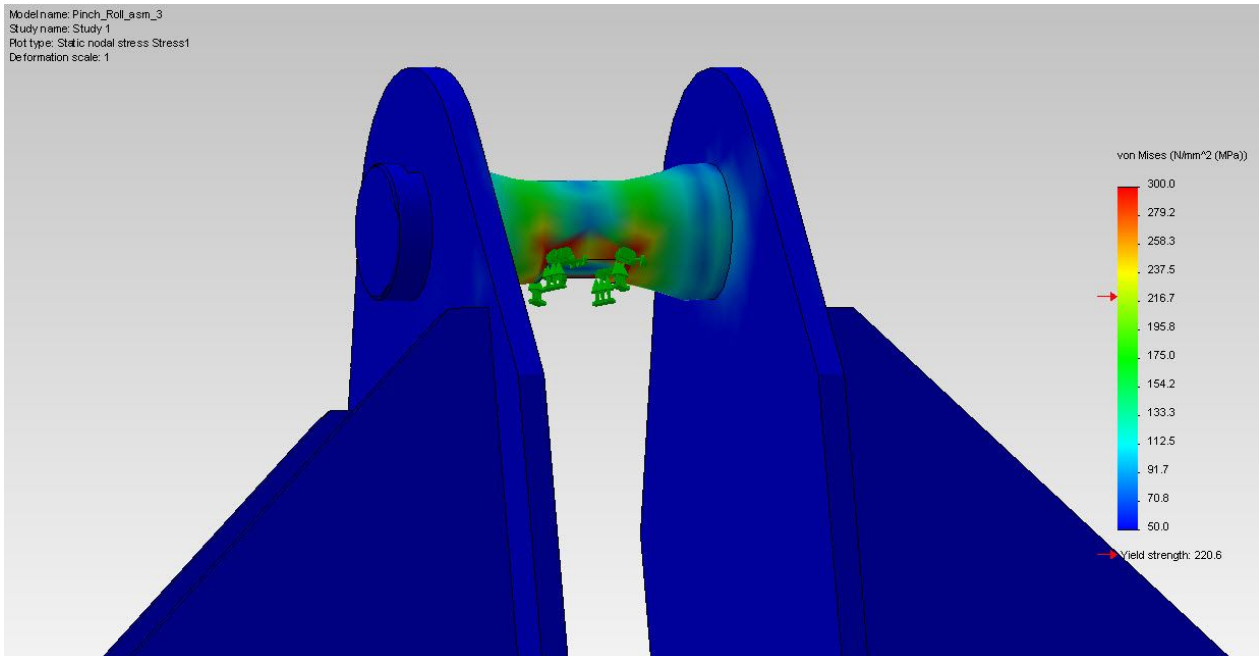
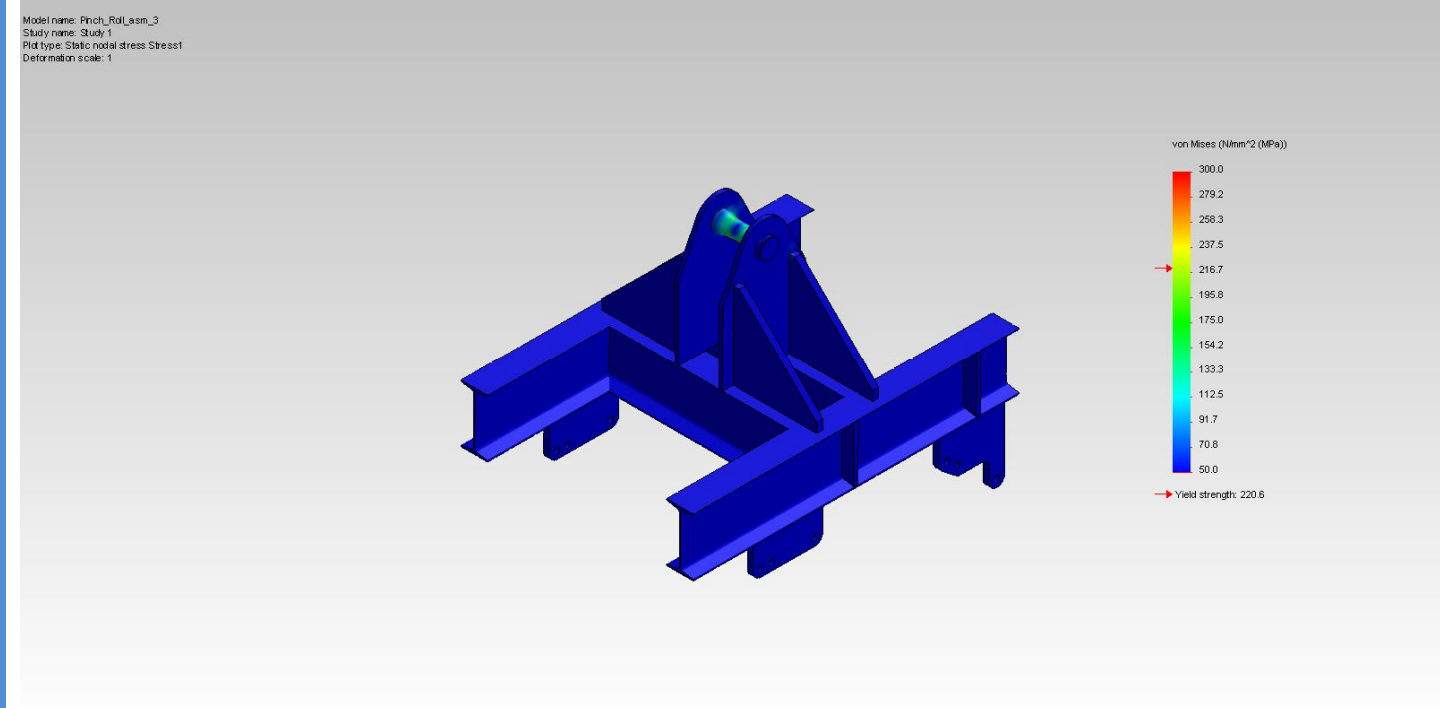
Total Nodes	168778
Total Elements	86486
Maximum Aspect Ratio	156.67
% of elements with Aspect Ratio < 3	64.3
% of elements with Aspect Ratio > 10	5.24
% of distorted elements(Jacobian)	0
Time to complete mesh(hh:mm:ss):	00:00:38
Computer name:	□"

Model name: Pinch_Roll_Asm_3
Study name: Study1
Mesh type: Solid mesh



Study Results

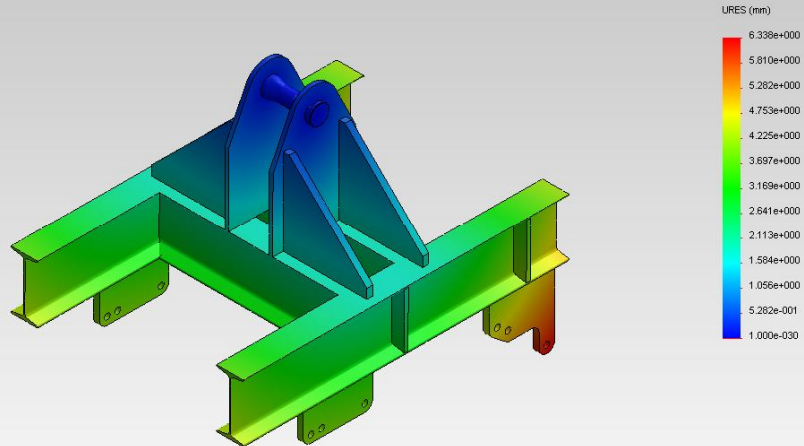
Name	Type	Min	Max
Stress1	VON: von Mises Stress	0.00329525 N/mm ² (MPa) Node: 192	577.044 N/mm ² (MPa) Node: 38632



Pinch_Roll_asm_3-Study 1-Stress-Stress1

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0 mm Node: 1	6.33784 mm Node: 28278

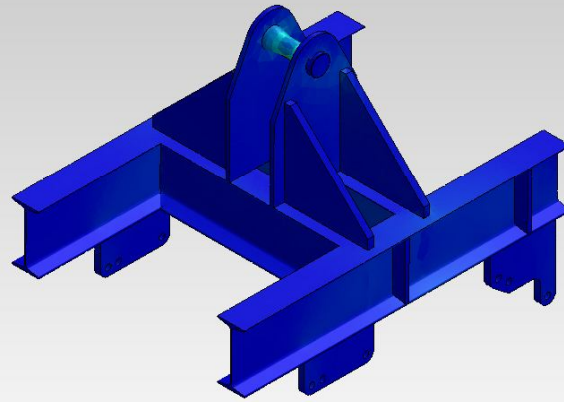
Model name: Pinch_Roll_asm_3
 Study name: Study 1
 Plot type: Static displacement: Displacement1
 Deformation scale: 1



Pinch_Roll_asm_3-Study 1-Displacement-Displacement1

Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	1.69333e-008 Element: 4808	0.00190048 Element: 377

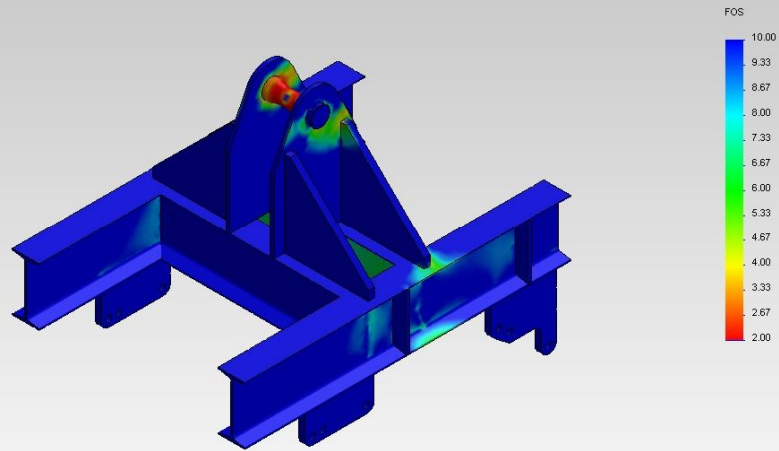
Model name: Pinch_Roll_Asm_3
 Study name: Study 1
 Plot type: Static strain Strain1
 Deformation scale: 1



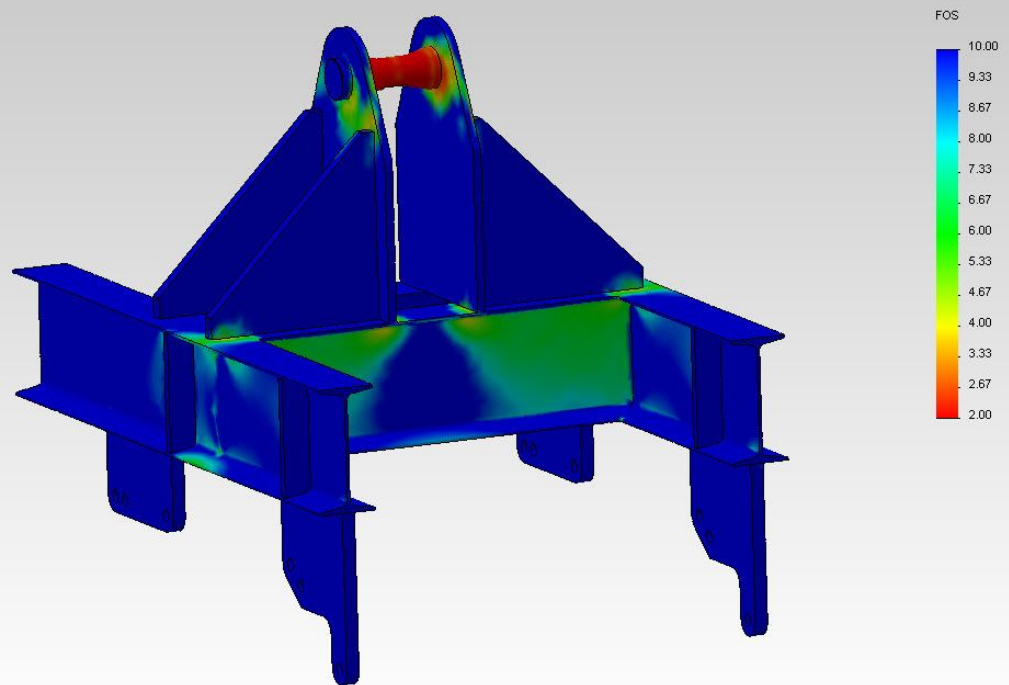
Pinch_Roll_asm_3-Study 1-Strain-Strain1

Name	Type	Min	Max
Factor of Safety1	Max von Mises Stress	0.382283 Node: 38632	66943 Node: 192

Model name: Pinch_Roll_asm_3
 Study name: Study 1
 Plot type: Factor of Safety Factor of Safety1
 Criterion: Max von Mises Stress
 Factor of safety distribution: Min FOS = 0.38



Model name: Pinch_Roll_asm_3
 Study name: Study 1
 Plot type: Factor of Safety Factor of Safety1
 Criterion: Max von Mises Stress
 Factor of safety distribution: Min FOS = 0.38



Pinch_Roll_asm_3-Study 1-Factor of Safety-Factor of Safety1

Conclusion & Recommendations:

The Result shows that the Pinch Roll Beam can take up to 10T load and does satisfy over FOS 4.0

There are minor areas where FOS fails due to localization of load.

1) Top hinged Pin -> shows Yield Stress below 220 N/mm².

This can be ignored since the material used is Forged and is much stronger than overall material taken for the test.

2) Maximum deformation is about 6.33 mm.