



ESS-0189422.3, Part 1(2)

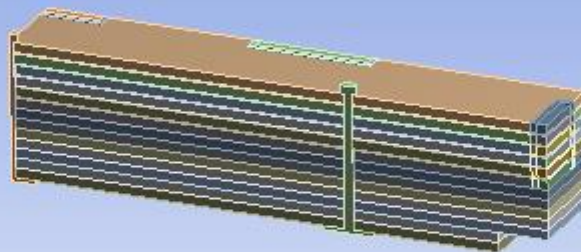
Roof Blocks Simulation - Hanging

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Save Project Before Solution	No
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Model

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ANSYS
R18.0
Academic



0,00 1000,00 (mm)
500,00



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Report Not Finalized

Not all objects described below are in a finalized state. As a result, data may be incomplete, obsolete or in error. View first state problem. To finalize this report, edit objects as needed and solve the analyses.

Units

TABLE 1

Unit System	Metric (mm, kg, N, s, mV, mA) Degrees rad/s Celsius
Angle	Degrees
Rotational Velocity	rad/s
Temperature	Celsius

Model (C4)

Geometry

TABLE 2
Model (C4) > Geometry

Object Name	Geometry
-------------	----------

State	Fully Defined
Definition	
Source	C:\Ansys\Bunker project\Roof_blocks_calculations\6\Roof_blocks_files\dp0\Geom\DM\Geom.agdb
Type	DesignModeler
Length Unit	Meters
Element Control	Program Controlled
Display Style	Body Color
Bounding Box	
Length X	2700, mm
Length Y	737, mm
Length Z	440, mm
Properties	
Volume	7,6218e+008 mm ³
Mass	3606, kg
Scale Factor Value	1,
Statistics	
Bodies	66
Active Bodies	66
Nodes	620417
Elements	159737
Mesh Metric	None
Basic Geometry Options	
Parameters	Independent
Parameter Key	
Attributes	Yes
Attribute Key	
Named Selections	Yes
Named Selection Key	
Material Properties	Yes
Advanced Geometry Options	
Use Associativity	Yes
Coordinate Systems	Yes
Coordinate System Key	
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Attach File Via Temp File	Yes
Temporary Directory	C:\Users\dawidpatrzalek\AppData\Roaming\Ansys\v180
Analysis Type	3-D

Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

TABLE 3
Model (C4) > Geometry > Parts

Object Name	HDPE_s lab.1	HDPE_s lab.2	Steel_sl ab.1	Pin.1	Pin.2	HDPE_s lab.3	HDPE_s lab.4	HDPE_s lab.5	HDPE_s lab.6
State	Meshed								
Graphics Properties									
Visible	Yes								
Transparency	1								
Definition									
Suppressed	No								
Stiffness Behavior	Flexible								
Coordinate System	Default Coordinate System								
Reference Temperature	By Environment								
Behavior	None								
Material									
Assignment	HDPE		S235	S355		HDPE			
Nonlinear Effects	Yes								
Thermal Strain Effects	Yes								
Bounding Box									
Length X	2450, mm		2700, mm	250, mm	125, mm	2700, mm			
Length Y	50, mm			737, mm		50, mm			
Length Z	440, mm			125, mm		440, mm			
Properties									
Volume	5,3835e+007 mm³		5,9335e+007 mm³	1,128e+006 mm³	5,64e+005 mm³	5,9335e+007 mm³			
Mass	51,682 kg		465,78 kg	8,8547 kg	4,4274 kg	56,962 kg			
Centroid X	1225,1 mm		1350,2 mm	1700, mm	29,044 mm	1350,2 mm			
Centroid Y	25, mm	75, mm	125, mm	218,17 mm		175, mm	225, mm	275, mm	325, mm
Centroid Z	-220,25 mm		-220,23 mm	-29,037 mm	-29,044 mm	-220,23 mm			

Moment of Inertia Ip1	8,4284e+005 kg·mm²	7,5976e+006 kg·mm²	6,0627e+005 kg·mm²	3,0409e+005 kg·mm²	9,2913e+005 kg·mm²
Moment of Inertia Ip2	2,6675e+007 kg·mm²	2,9043e+008 kg·mm²	21936 kg·mm²	6198,7 kg·mm²	3,5517e+007 kg·mm²
Moment of Inertia Ip3	2,5854e+007 kg·mm²	2,8303e+008 kg·mm²	6,1582e+005 kg·mm²	3,0457e+005 kg·mm²	3,4612e+007 kg·mm²
Statistics					
Nodes	94785	32245	2158	2614	22990
Elements	19384	18598	1055	536	3990
Mesh Metric	None				

TABLE 4
Model (C4) > Geometry > Body Groups

Object Name	Welded_bodies
State	Meshed
Graphics Properties	
Visible	Yes
Definition	
Suppressed	No
Assignment	Multiple Materials
Coordinate System	Default Coordinate System
Bounding Box	
Length X	2700, mm
Length Y	325, mm
Length Z	440, mm
Properties	
Volume	3,5614e+008 mm ³
Mass	2795,7 kg
Centroid X	1350,2 mm
Centroid Y	512,5 mm
Centroid Z	-220,28 mm
Moment of Inertia Ip1	7,0287e+007 kg·mm ²
Moment of Inertia Ip2	1,7434e+009 kg·mm ²
Moment of Inertia Ip3	1,7236e+009 kg·mm ²
Statistics	
Nodes	301870
Elements	84820
Mesh Metric	None
CAD Attributes	
DMBodyGroup	10

TABLE 5
Model (C4) > Geometry > Welded_bodies > Parts

Object Name	Weld. 1	Weld. 2	Weld. 3	Weld. 4	Weld. 5	Weld.6	Weld.7	Weld.1 0	Weld.1 1	Weld.1 4	Weld.1 5
State	Meshed										
Graphics Properties											
Visible	Yes										

Transparen- cy	1										
Definition											
Suppresse- d	No										
Stiffness Behavior	Flexible										
Coordinate System	Default Coordinate System										
Reference Temperatur- e	By Environment										
Behavior	None										
Material											
Assignment	Welds										
Nonlinear Effects	Yes										
Thermal Strain Effects	Yes										
Bounding Box											
Length X	5,0001 mm				500, mm	250, mm	500, mm	250, mm	500, mm	250, mm	
Length Y	5, mm										
Length Z	250, mm				5, mm						
Properties											
Volume	6250, mm³				12500 mm³	6250, mm³	12500 mm³	6250, mm³	12500 mm³	6250, mm³	
Mass	4,9062e-002 kg				9,8125 e-002 kg	4,9062 e-002 kg	9,8125 e-002 kg	4,9062 e-002 kg	9,8125 e-002 kg	4,9062 e-002 kg	
Centroid X	2697,5 mm				1350, mm	125, mm	1350, mm	125, mm	1350, mm	125, mm	
Centroid Y	402,5 mm	457,5 mm	512,5 mm	567,5 mm	622,5 mm	402,5 mm		457,5 mm		512,5 mm	
Centroid Z	-125, mm				-437,5 mm						
Moment of Inertia Ip1	255,64 kg·mm²				0,4088 5 kg·mm²	0,2044 3 kg·mm²	0,4088 5 kg·mm²	0,2044 3 kg·mm²	0,4088 5 kg·mm²	0,2044 3 kg·mm²	
Moment of Inertia Ip2	255,64 kg·mm²				2044,5 kg·mm²	255,64 kg·mm²	2044,5 kg·mm²	255,64 kg·mm²	2044,5 kg·mm²	255,64 kg·mm²	
Moment of Inertia Ip3	0,20444 kg·mm²				2044,5 kg·mm²	255,64 kg·mm²	2044,5 kg·mm²	255,64 kg·mm²	2044,5 kg·mm²	255,64 kg·mm²	
Statistics											
Nodes	681				1311	681	1311	681	1311	681	
Elements	88				172	88	172	88	172	88	
Mesh Metric	None										

TABLE 6
Model (C4) > Geometry > Welded bodies > Parts

Object Name	Weld .18	Weld .19	Weld .22	Weld .23	Steel_sl ab.18	Steel_sl ab.21	Steel_sl ab.24	Steel_sl ab.27	Steel_sl ab.30	Steel_sl ab.32	Steel_sl ab.42
State	Meshed										
Graphics Properties											

Visible	Yes										
Transparency	1										
Definition											
Suppressed	No										
Stiffness Behavior	Flexible										
Coordinate System	Default Coordinate System										
Reference Temperature	By Environment										
Behavior	None										
Material											
Assignment	Welds				S235						
Nonlinear Effects	Yes										
Thermal Strain Effects	Yes										
Bounding Box											
Length X	500, mm	250, mm	500, mm	250, mm	2700, mm					560, mm	
Length Y	5, mm				50, mm						
Length Z	5, mm				440, mm					50, mm	
Properties											
Volume	12500 mm³	6250, mm³	12500 mm³	6250, mm³	5,4375e+007 mm³					1,4e+006 mm³	
Mass	9,8125e-002 kg	4,9062e-002 kg	9,8125e-002 kg	4,9062e-002 kg	426,85 kg					10,99 kg	
Centroid X	1350, mm	125, mm	1350, mm	125, mm	1347,6 mm					1350, mm	
Centroid Y	567,5 mm		622,5 mm		375, mm	430, mm	485, mm	540, mm	595, mm	650, mm	375, mm
Centroid Z	-437,5 mm				-209,42 mm					-415, mm	
Moment of Inertia Ip1	0,40885 kg·m m²	0,20443 kg·m m²	0,40885 kg·m m²	0,20443 kg·m m²	6,4268e+006 kg·mm²					4579,2 kg·mm²	
Moment of Inertia Ip2	2044,5 kg·m m²	255,64 kg·m m²	2044,5 kg·m m²	255,64 kg·m m²	2,5799e+008 kg·mm²					2,8949e+005 kg·mm²	

Moment of Inertia Ip3	2044,5 kg·m m²	255,64 kg·m m²	2044,5 kg·m m²	255,64 kg·m m²	2,5174e+008 kg·mm²						2,8949e+005 kg·mm²
Statistics											
Nodes	1311	681	1311	681	37258	37236	37153	37243	37276	61078	3246
Elements	172	88	172	88	7107		7086	7104		37834	540
Mesh Metric	None										

TABLE 7
Model (C4) > Geometry > Welded_bodies > Parts

Object Name	Steel_slab.44	Steel_slab.46	Steel_slab.48	Steel_slab.50	Steel_slab.52	Steel_slab.2	Steel_slab.4	Steel_slab.12	Steel_slab.14	Steel_slab.16	Steel_slab.28
State	Meshed										
Graphics Properties											
Visible	Yes										
Transparency	1										
Definition											
Suppressed	No										
Stiffness Behavior	Flexible										
Coordinate System	Default Coordinate System										
Reference Temperature	By Environment										
Behavior	None										
Material											
Assignment	S235										
Nonlinear Effects	Yes										
Thermal Strain Effects	Yes										
Bounding Box											
Length X	280, mm	310, mm			620, mm		560, mm		620, mm	50, mm	
Length Y	50, mm										
Length Z	50, mm	80, mm					50, mm		80, mm	280, mm	
Properties											

Volum e	7,e+005 mm³		5,4e+005 mm³			1,08e+006 mm³		1,4e+006 mm³		1,08e+006 mm³	7,e+005 mm³
Mass	5,495 kg		4,239 kg			8,478 kg		10,99 kg		8,478 kg	5,495 kg
Centroi d X	140, mm		174,44 mm			1350, mm					2675, mm
Centroi d Y	430, mm	485, mm	375, mm	430, mm	485, mm	375, mm	485, mm	430, mm	485, mm	430, mm	650, mm
Centroi d Z	-415, mm		-380,56 mm					-415, mm		-380,56 mm	-140, mm
Momen t of Inertia Ip1	2289,6 kg·mm²		1879,8 kg·mm²			4181,4 kg·mm²		4579,2 kg·mm²		4181,4 kg·mm²	37045 kg·mm²
Momen t of Inertia Ip2	37045 kg·mm²		40421 kg·mm²			3,3883e+005 kg·mm²		2,8949e+005 kg·mm²		3,3883e+005 kg·mm²	37045 kg·mm²
Momen t of Inertia Ip3	37045 kg·mm²		40307 kg·mm²			3,3819e+005 kg·mm²		2,8949e+005 kg·mm²		3,3819e+005 kg·mm²	2289,6 kg·mm²
Statistics											
Nodes	1684		746			2258	2217	3246		2258	1684
Elemen ts	276		84			327	321	540		327	276
Mesh Metric	None										

TABLE 8
Model (C4) > Geometry > Welded_bodies > Parts

Object Name	Steel_slab.31	Steel_slab.33	Steel_slab.35	Steel_slab.37	Steel_slab.39	Steel_slab.41	Steel_slab.43	Steel_slab.45	Steel_slab.47	Steel_slab.49	Steel_slab.51
State	Meshed										
Graphics Properties											
Visible	Yes										
Transparency	1										
Definition											
Suppressed	No										
Stiffness Behavior	Flexible										
Coordinate System	Default Coordinate System										
Reference Temperature	By Environment										
Behavior	None										

Material											
Assign ment	S235										
Nonlin ear Effects	Yes										
Therm al Strain Effects	Yes										
Bounding Box											
Length X	50, mm					310, mm			620, mm		
Length Y	50, mm										
Length Z	280, mm					80, mm					
Properties											
Volum e	7,e+005 mm³					5,4e+005 mm³			1,08e+006 mm³		
Mass	5,495 kg					4,239 kg			8,478 kg		
Centroi d X	2675, mm					174,44 mm			1350, mm		
Centroi d Y	375, mm	430, mm	485, mm	540, mm	595, mm	540, mm	595, mm	650, mm	540, mm	595, mm	650, mm
Centroi d Z	-140, mm					-380,56 mm					
Mome nt of Inertia Ip1	37045 kg·mm²					1879,8 kg·mm²			4181,4 kg·mm²		
Mome nt of Inertia Ip2	37045 kg·mm²					40421 kg·mm²			3,3883e+005 kg·mm²		
Mome nt of Inertia Ip3	2289,6 kg·mm²					40307 kg·mm²			3,3819e+005 kg·mm²		
Statistics											
Nodes	1684	2040	1684	2040		746			2262		2236
Eleme nts	276	345	276	345		84			330		327
Mesh Metric	None										

TABLE 9
Model (C4) > Geometry > Welded_bodies > Parts

Object Name	Steel_slab.55	Steel_slab.56	Steel_slab.57	Steel_slab.58	Steel_slab.59	Steel_slab.66	Steel_slab.67	Steel_slab.3	Steel_slab.5	Steel_slab.7	Steel_slab.9
State	Meshed										
Graphics Properties											
Visible	Yes										
Transparency	1										
Definition											

Suppressed	No										
Stiffness Behavior	Flexible										
Coordinate System	Default Coordinate System										
Reference Temperature	By Environment										
Behavior	None										
Material											
Assignment	S235										
Nonlinear Effects	Yes										
Thermal Strain Effects	Yes										
Bounding Box											
Length X	560, mm		280, mm			560, mm	280, mm	80, mm			
Length Y	50, mm										
Length Z	50, mm							310, mm			
Properties											
Volume	1,4e+006 mm³		7,e+005 mm³			1,4e+006 mm³	7,e+005 mm³	5,4e+005 mm³			
Mass	10,99 kg		5,495 kg			10,99 kg	5,495 kg	4,239 kg			
Centroid X	1350, mm		140, mm			1350, mm	140, mm	2640,6 mm			
Centroid Y	540, mm	595, mm	540, mm	595, mm	375, mm	650, mm		375, mm	430, mm	485, mm	540, mm
Centroid Z	-415, mm							-174,44 mm			
Moment of Inertia Ip1	4579,2 kg·mm²		2289,6 kg·mm²			4579,2 kg·mm²	2289,6 kg·mm²	40308 kg·mm²			
Moment of Inertia Ip2	2,8949e+005 kg·mm²		37045 kg·mm²			2,8949e+005 kg·mm²	37045 kg·mm²	40421 kg·mm²			
Moment of Inertia Ip3	2,8949e+005 kg·mm²		37045 kg·mm²			2,8949e+005 kg·mm²	37045 kg·mm²	1879,8 kg·mm²			
Statistics											

Nodes	3246	1684	3246	1684	746	772	746	772
Elements	540	276	540	276	84	87	84	87
Mesh Metric	None							

TABLE 10
Model (C4) > Geometry > Welded_bodies > Parts

Object Name	Steel_slab.11	Steel_slab.13
State	Meshed	
Graphics Properties		
Visible	Yes	
Transparency	1	
Definition		
Suppressed	No	
Stiffness Behavior	Flexible	
Coordinate System	Default Coordinate System	
Reference Temperature	By Environment	
Behavior	None	
Material		
Assignment	S235	
Nonlinear Effects	Yes	
Thermal Strain Effects	Yes	
Bounding Box		
Length X	80, mm	
Length Y	50, mm	
Length Z	310, mm	
Properties		
Volume	5,4e+005 mm³	
Mass	4,239 kg	
Centroid X	2640,6 mm	
Centroid Y	595, mm	650, mm
Centroid Z	-174,44 mm	
Moment of Inertia Ip1	40308 kg·mm²	
Moment of Inertia Ip2	40421 kg·mm²	
Moment of Inertia Ip3	1879,8 kg·mm²	
Statistics		
Nodes	772	746
Elements	87	84
Mesh Metric	None	

Coordinate Systems

TABLE 11
Model (C4) > Coordinate Systems > Coordinate System

Object Name	Global Coordinate System	Coordinate System	Coordinate System 2
State	Fully Defined		
Definition			
Type	Cartesian		
Coordinate System ID	0,		
Coordinate System		Program Controlled	
Suppressed		No	

Origin			
Origin X	0, mm	18,579 mm	0, mm
Origin Y	0, mm	322,93 mm	
Origin Z	0, mm	-1,1064e-013 mm	-18,579 mm
Define By		Geometry Selection	
Geometry		Defined	
Directional Vectors			
X Axis Data	[1, 0, 0,]		
Y Axis Data	[0, 1, 0,]		
Z Axis Data	[0, 0, 1,]		
Principal Axis			
Axis		X	
Define By		Global X Axis	
Orientation About Principal Axis			
Axis		Y	
Define By		Default	
Transformations			
Base Configuration		Absolute	
Transformed Configuration		[18,579 322,93 -1,1064e-013]	[0, 322,93 -18,579]

Symmetry

TABLE 12
Model (C4) > Symmetry

Object Name	<i>Symmetry</i>
State	Fully Defined

TABLE 13
Model (C4) > Symmetry > Symmetry Region

Object Name	Symmetry Region	Symmetry Region 2
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	56 Faces	36 Faces
Definition		
Scope Mode	Manual	
Type	Symmetric	
Coordinate System	Coordinate System	Global Coordinate System
Symmetry Normal	Z Axis	X Axis
Suppressed	No	

Connections

TABLE 14
Model (C4) > Connections

Object Name	<i>Connections</i>
State	Fully Defined
Auto Detection	
Generate Automatic Connection On Refresh	Yes
Transparency	
Enabled	Yes

Object Name	Contacts
State	Fully Defined
Definition	
Connection Type	Contact
Scope	
Scoping Method	Geometry Selection
Geometry	All Bodies
Auto Detection	
Tolerance Type	Value
Tolerance Value	1, mm
Use Range	No
Face/Face	Yes
Cylindrical Faces	Include
Face/Edge	No
Edge/Edge	No
Priority	Include All
Group By	Bodies
Search Across	Bodies
Statistics	
Connections	17
Active Connections	17

Model (C4) > Connections > Contacts > Contact Regions											
Object Name	Frictional - HDPE_slab.1 To HDPE_slab.2	Frictional - HDPE_slab.1 To Pin.1	Frictional - HDPE_slab.1 To Pin.2	Frictional - HDPE_slab.2 To Steel_slab.1	Frictional - Steel_slab.1 To HDPE_slab.3	Frictional - Pin.1 To Steel_slab.32	Frictional - Pin.2 To Steel_slab.32	Frictional - HDPE_slab.3 To HDPE_slab.4	Frictional - HDPE_slab.4 To HDPE_slab.5	Frictional - HDPE_slab.5 To HDPE_slab.6	Frictional - HDPE_slab.6 To Steel_slab.18
State	Fully Defined										
Scope											
Scoping Method	Geometry Selection										
Contact	1 Face										
Target	1 Face										
Contact Bodies	HDPE_slab.1			HDPE_slab.2	Steel_slab.1	Pin.1	Pin.2	HDPE_slab.3	HDPE_slab.4	HDPE_slab.5	HDPE_slab.6
Target Bodies	HDPE_slab.2	Pin.1	Pin.2	Steel_slab.1	HDPE_slab.3	Steel_slab.32		HDPE_slab.4	HDPE_slab.5	HDPE_slab.6	Steel_slab.18
Definition											
Type	Frictional										
Friction Coefficient	0,2										

Scope Mode	Automatic	Manual	Automatic	Manual	Automatic
Behavior	Program Controlled				
Trim Contact	Program Controlled				
Trim Tolerance	1, mm		1, mm		1, mm
Suppressed	No				
Advanced					
Formulation	Program Controlled				
Detection Method	Program Controlled				
Penetration Tolerance	Program Controlled				
Elastic Slip Tolerance	Program Controlled				
Normal Stiffness	Program Controlled				
Update Stiffness	Program Controlled				
Stabilization Damping Factor	0,				
Pinball Region	Program Controlled				
Time Step Controls	None				
Geometric Modification					
Interface Treatment	Add Offset, No Ramping				
Offset	0, mm				
Contact Geom	None				

etry Corre ction	
Target Geom etry Corre ction	None

TABLE 17
Model (C4) > Connections > Contacts > Contact Regions

Object Name	Frictional - HDPE_slab.6 To Steel_slab.42	Frictional - HDPE_slab.6 To Steel_slab.48	Frictional - HDPE_slab.6 To Steel_slab.2	Frictional - HDPE_slab.6 To Steel_slab.31	Frictional - HDPE_slab.6 To Steel_slab.59	Frictional - HDPE_slab.6 To Steel_slab.3
State	Fully Defined					
Scope						
Scoping Method	Geometry Selection					
Contact	1 Face					
Target	1 Face					
Contact Bodies	HDPE_slab.6					
Target Bodies	Steel_slab.42	Steel_slab.48	Steel_slab.2	Steel_slab.31	Steel_slab.59	Steel_slab.3
Definition						
Type	Frictional					
Friction Coefficient	0,2					
Scope Mode	Automatic					
Behavior	Program Controlled					
Trim Contact	Program Controlled					
Trim Tolerance	1, mm					
Suppressed	No					
Advanced						
Formulation	Program Controlled					
Detection Method	Program Controlled					
Penetration Tolerance	Program Controlled					
Elastic Slip Tolerance	Program Controlled					
Normal Stiffness	Program Controlled					
Update Stiffness	Program Controlled					
Stabilization Damping Factor	0,					
Pinball Region	Program Controlled					
Time Step Controls	None					

Geometric Modification	
Interface Treatment	Add Offset, No Ramping
Offset	0, mm
Contact Geometry Correction	None
Target Geometry Correction	None

Mesh

TABLE 18
Model (C4) > Mesh

Object Name	<i>Mesh</i>
State	Solved
Display	
Display Style	Body Color
Defaults	
Physics Preference	Mechanical
Relevance	0
Element Midside Nodes	Program Controlled
Sizing	
Size Function	Adaptive
Relevance Center	Medium
Element Size	25,0 mm
Initial Size Seed	Active Assembly
Transition	Slow
Span Angle Center	Medium
Automatic Mesh Based Defeaturing	On
Defeature Size	Default
Minimum Edge Length	5,0 mm
Quality	
Check Mesh Quality	Yes, Errors
Error Limits	Standard Mechanical
Target Quality	Default (0.050000)
Smoothing	High
Mesh Metric	None
Inflation	
Use Automatic Inflation	None
Inflation Option	Smooth Transition
Transition Ratio	0,272
Maximum Layers	5
Growth Rate	1,2
Inflation Algorithm	Pre
View Advanced Options	No
Advanced	
Number of CPUs for Parallel Part Meshing	Program Controlled
Straight Sided Elements	No
Number of Retries	Default (4)
Rigid Body Behavior	Dimensionally Reduced
Mesh Morphing	Disabled

Triangle Surface Mesher	Program Controlled
Topology Checking	No
Pinch Tolerance	Please Define
Generate Pinch on Refresh	No
Statistics	
Nodes	620417
Elements	159737

TABLE 19
Model (C4) > Mesh > Mesh Controls

Object Name	Body Sizing	Body Sizing 2	Body Sizing 3	Body Sizing 4	MultiZone
State	Fully Defined				
Scope					
Scoping Method	Geometry Selection				
Geometry	15 Bodies	18 Bodies		2 Bodies	1 Body
Definition					
Suppressed	No				
Type	Element Size				
Element Size	3, mm	12,5 mm	25, mm	15, mm	
Method					MultiZone
Mapped Mesh Type					Hexa
Surface Mesh Method					Program Controlled
Free Mesh Type					Not Allowed
Element Midside Nodes					Use Global Setting
Src/Trg Selection					Automatic
Source Scoping Method					Program Controlled
Source					Program Controlled
Sweep Size Behavior					Sweep Element Size
Sweep Element Size					Default
Advanced					
Defeature Size	Default				
Behavior	Hard	Soft	Hard	Soft	
Preserve Boundaries					Protected
Mesh Based Defeaturing					Off
Minimum Edge Length					16,5 mm
Write ICEM CFD Files					No

Named Selections

TABLE 20
Model (C4) > Named Selections > Named Selections

Model (5/7) - Named Selections - Named Selections		
Object Name	Spreader_bar_supports	Blocks_supports
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	1 Face	
Definition		
Send to Solver	Yes	
Visible	Yes	

Program Controlled Inflation	Exclude	
	Statistics	
Type	Imported	
Total Selection	1 Face	
Surface Area	3163,6 mm²	88000 mm²
Suppressed	0	
Used by Mesh Worksheet	No	

Static Structural (C5)

TABLE 21
Model (C4) > Analysis

Object Name	<i>Static Structural (C5)</i>
State	Solved
Definition	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
Options	
Environment Temperature	22, °C
Generate Input Only	No

TABLE 22
Model (C4) > Static Structural (C5) > Analysis Settings

Object Name	<i>Analysis Settings</i>
State	Fully Defined
Step Controls	
Number Of Steps	1,
Current Step Number	1,
Step End Time	5, s
Auto Time Stepping	On
Define By	Substeps
Initial Substeps	100,
Minimum Substeps	20,
Maximum Substeps	1000,
Solver Controls	
Solver Type	Program Controlled
Weak Springs	Off
Solver Pivot Checking	Program Controlled
Large Deflection	On
Inertia Relief	Off
Rotordynamics Controls	

Coriolis Effect	Off
Restart Controls	
Generate Restart Points	Program Controlled
Retain Files After Full Solve	No
Combined Restart Files	Program Controlled
Nonlinear Controls	
Newton-Raphson Option	Program Controlled
Force Convergence	Program Controlled
Moment Convergence	Program Controlled
Displacement Convergence	Program Controlled
Rotation Convergence	Program Controlled
Line Search	Program Controlled
Stabilization	Off
Output Controls	
Stress	Yes
Strain	Yes
Nodal Forces	No
Contact Miscellaneous	No
General Miscellaneous	No
Store Results At	All Time Points
Analysis Data Management	
Solver Files Directory	C:\Ansys\Roof_blocks_calculations\Roof_blocks_by_Dawid\Roof_blocks_files\dp0\SY S\MECH\
Future Analysis	None
Scratch Solver Files Directory	
Save MAPDL db	No
Delete Unneeded Files	Yes

Nonlinear Solution	Yes
Solver Units	Active System
Solver Unit System	mm

TABLE 23
Model (C4) > Static Structural (C5) > Accelerations

Object Name	<i>Acceleration</i>
State	Fully Defined
Scope	
Geometry	All Bodies
Definition	
Define By	Components
Coordinate System	Global Coordinate System
X Component	Tabular Data
Y Component	49050 mm/s ² (ramped)
Z Component	0, mm/s ² (ramped)
Suppressed	No

FIGURE 1
Model (C4) > Static Structural (C5) > Acceleration

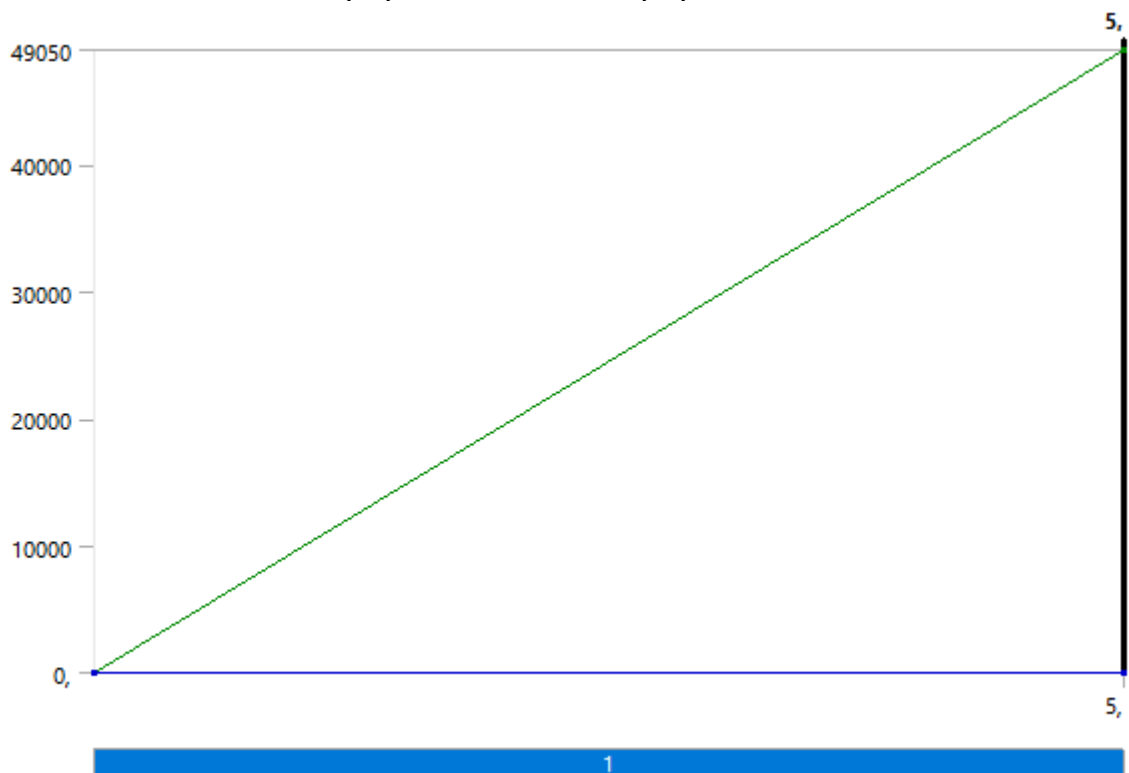


TABLE 24
Model (C4) > Static Structural (C5) > Acceleration

Steps	Time [s]	X [mm/s ²]	Y [mm/s ²]	Z [mm/s ²]
1	0,	0,	0,	0,
	5,		49050	

TABLE 25
Model (C4) > Static Structural (C5) > Loads

Object Name	<i>Fixed Support</i>
State	Fully Defined
Scope	
Scoping Method	Named Selection
Named Selection	Spreader_bar_supports
Definition	
Type	Fixed Support
Suppressed	No

Solution (C6)

TABLE 26
Model (C4) > Static Structural (C5) > Solution

Object Name	<i>Solution (C6)</i>
State	Solved
Adaptive Mesh Refinement	
Max Refinement Loops	1,
Refinement Depth	2,
Information	
Status	Done
MAPDL Elapsed Time	7 h 24 m
MAPDL Memory Used	35,935 GB
MAPDL Result File Size	4,3276 GB
Post Processing	
Beam Section Results	No

TABLE 27
Model (C4) > Static Structural (C5) > Solution (C6) > Solution Information

Object Name	<i>Solution Information</i>
State	Solved
Solution Information	
Solution Output	Displacement Convergence
Newton-Raphson Residuals	0
Identify Element Violations	0
Update Interval	2,5 s
Display Points	All
FE Connection Visibility	
Activate Visibility	Yes
Display	All FE Connectors
Draw Connections Attached To	All Nodes
Line Color	Connection Type
Visible on Results	No
Line Thickness	Single
Display Type	Lines

FIGURE 2
Model (C4) > Static Structural (C5) > Solution (C6) > Solution Information

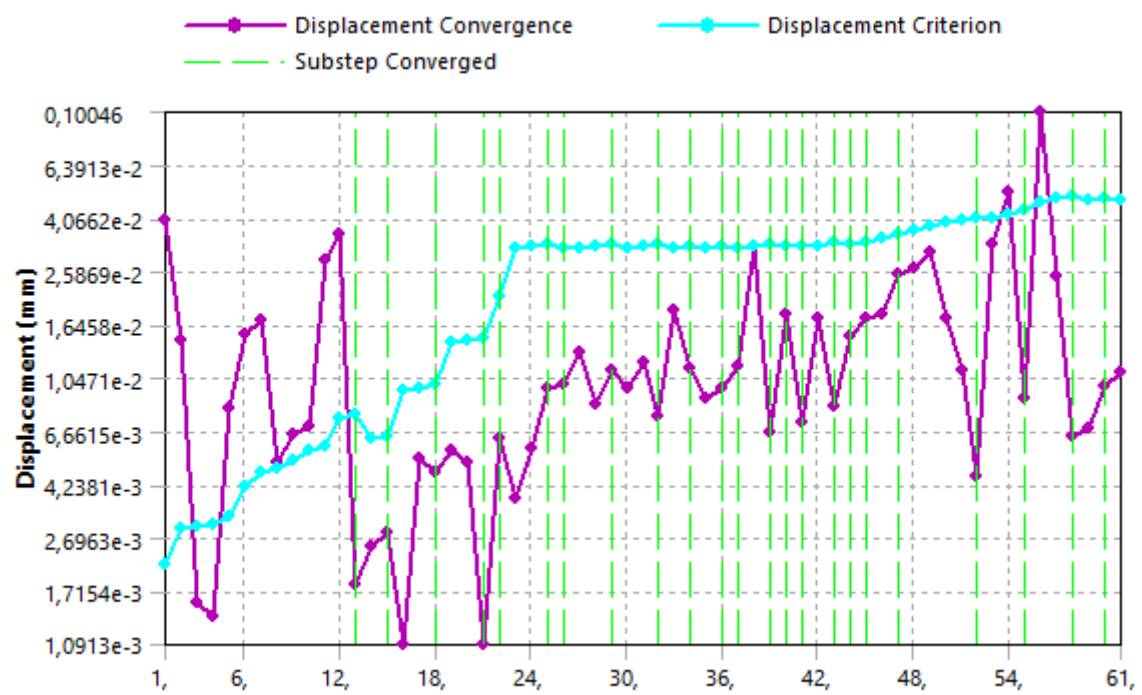


FIGURE 3
Model (C4) > Static Structural (C5) > Solution (C6) > Solution Information

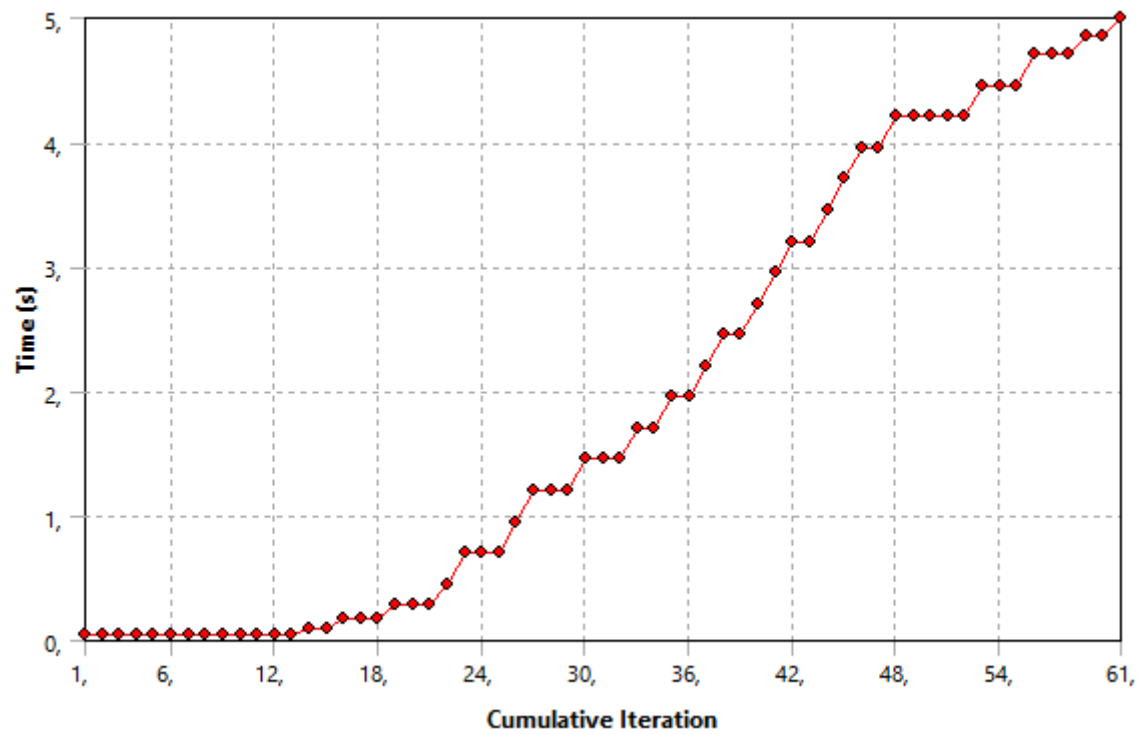


TABLE 28
Model (C4) > Static Structural (C5) > Solution (C6) > Results

Object Name	Total Deformation, 1G	Y Axis Deformation, 1G	Pins Stress, 2G	Pins Stress, 3G	Spreader Bar Support, 2G	Spreader Bar Support, 3G	Welds Strain, 2G	Welds Strain, 3G	HDPE slabs stress
State	Solved								
Scope									
Scoping Method	Geometry Selection								
Geometry	All Bodies		2 Bodies		1 Body		15 Bodies		6 Bodies
Definition									
Type	Total Deformation	Directional Deformation	Equivalent (von-Mises) Stress			Equivalent Elastic Strain		Equivalent (von-Mises) Stress	
By	Time								
Display Time	1, s		2, s	3, s	2, s	3, s	2, s	3, s	Last
Calculate Time History	Yes								
Identifier									
Suppressed	No								
Orientation		Y Axis							
Coordinate System		Global Coordinate System							
Results									
Minimum	0, mm	-2,4092 mm	0,25711 MPa	0,49294 MPa	2,2838e-003 MPa	2,2151e-003 MPa	5,6675e-006 mm/mm	8,7722e-006 mm/mm	5,8044e-005 MPa
Maximum	2,4107 mm	1,8603e-003 mm	58,249 MPa	87,758 MPa	221,29 MPa	230,77 MPa	1,4457e-003 mm/mm	1,3816e-003 mm/mm	3,0987 MPa
Minimum Occurs On	Steel_slab.32	HDPE_slab.1	Pin.1		Steel_slab.32		Weld.4	Weld.2	HDPE_slab.6
Maximum Occurs On	HDPE_slab.1	Steel_slab.32	Pin.2		Steel_slab.32		Weld.19	Weld.18	HDPE_slab.1
Minimum Value Over Time									
Minimum	0, mm	-13,3 mm	6,3675e-003 MPa		8,3391e-005 MPa		1,2638e-007 mm/mm		8,1143e-007 MPa
Maximum	0, mm	-0,11708 mm	0,79498 MPa		8,2379e-003 MPa		1,6847e-005 mm/mm		1,6111e-004 MPa
Maximum Value Over Time									
Minimum	0,11716 mm	9,2877e-005 mm	1,4557 MPa		16,387 MPa		1,4507e-004 mm/mm		3,0537e-002 MPa
Maximum	13,307 mm	1,1148e-002 mm	148,96 MPa		246,77 MPa		1,583e-003 mm/mm		3,0987 MPa
Information									
Time	1, s		2, s	3, s	2, s	3, s	2, s	3, s	5, s
Load Step	1								

Substep	7	11	15	11	15	11	15	24
Iteration Number	26	36	41	36	41	36	41	61
Integration Point Results								
Display Option		Averaged						
Average Across Bodies		No						

FIGURE 4
Model (C4) > Static Structural (C5) > Solution (C6) > Total Deformation, 1G

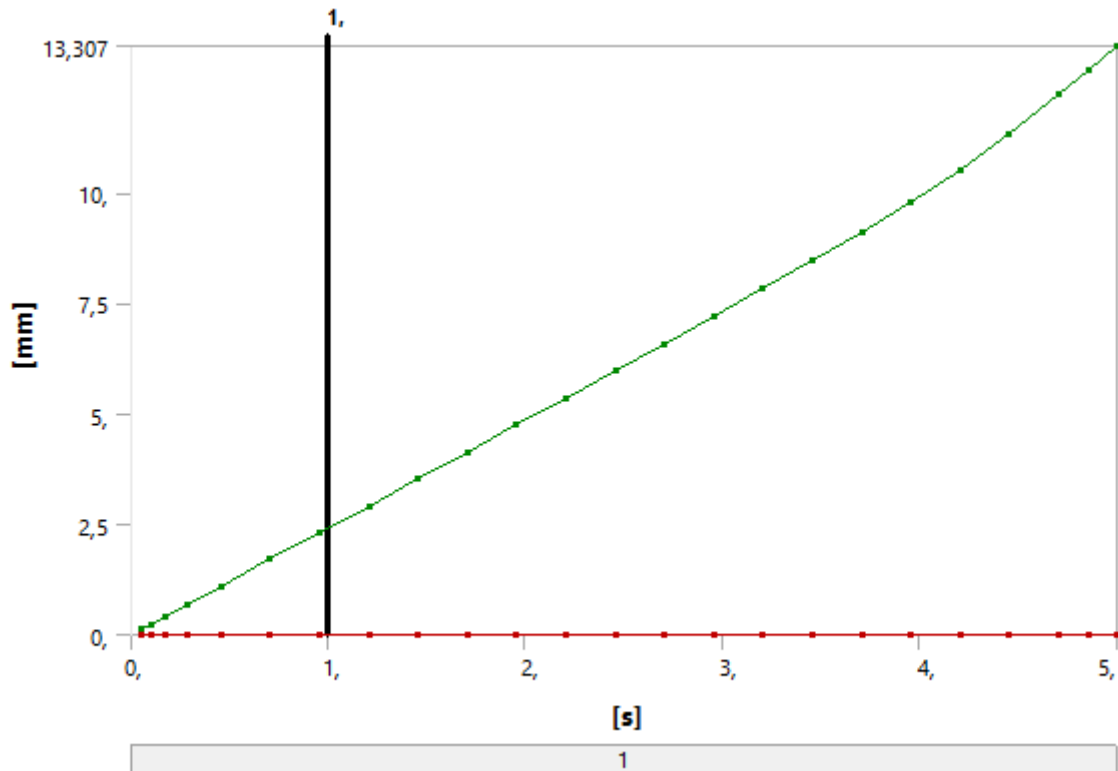


TABLE 29
Model (C4) > Static Structural (C5) > Solution (C6) > Total Deformation, 1G

Time [s]	Minimum [mm]	Maximum [mm]
5,e-002	0,	0,11716
0,1		0,23836
0,175		0,42202
0,2875		0,69339
0,45625		1,0985
0,70625		1,7019
0,95625		2,3044
1,2063		2,9118
1,4563		3,5181
1,7063		4,1251
1,9563		4,7325
2,2062		5,3391
2,4562		5,9601
2,7062		6,5757
2,9562		7,1955

3,2062		7,8245
3,4562		8,4573
3,7062		9,1009
3,9562		9,7673
4,2062		10,493
4,4562		11,294
4,7062		12,205
4,8531		12,751
5,		13,307

FIGURE 5

Model (C4) > Static Structural (C5) > Solution (C6) > Total Deformation, 1G > Figure

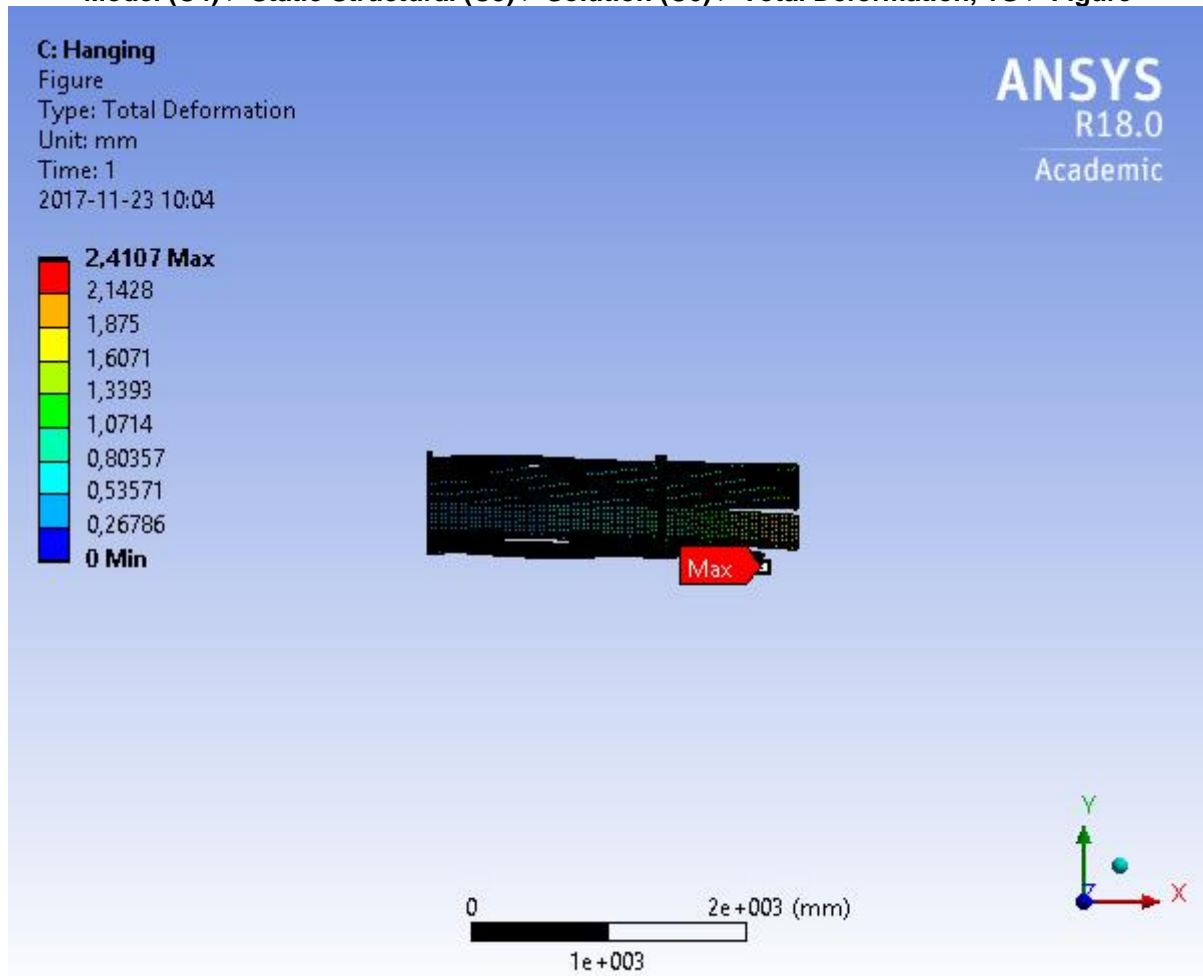


FIGURE 6

Model (C4) > Static Structural (C5) > Solution (C6) > Y Axis Deformation, 1G

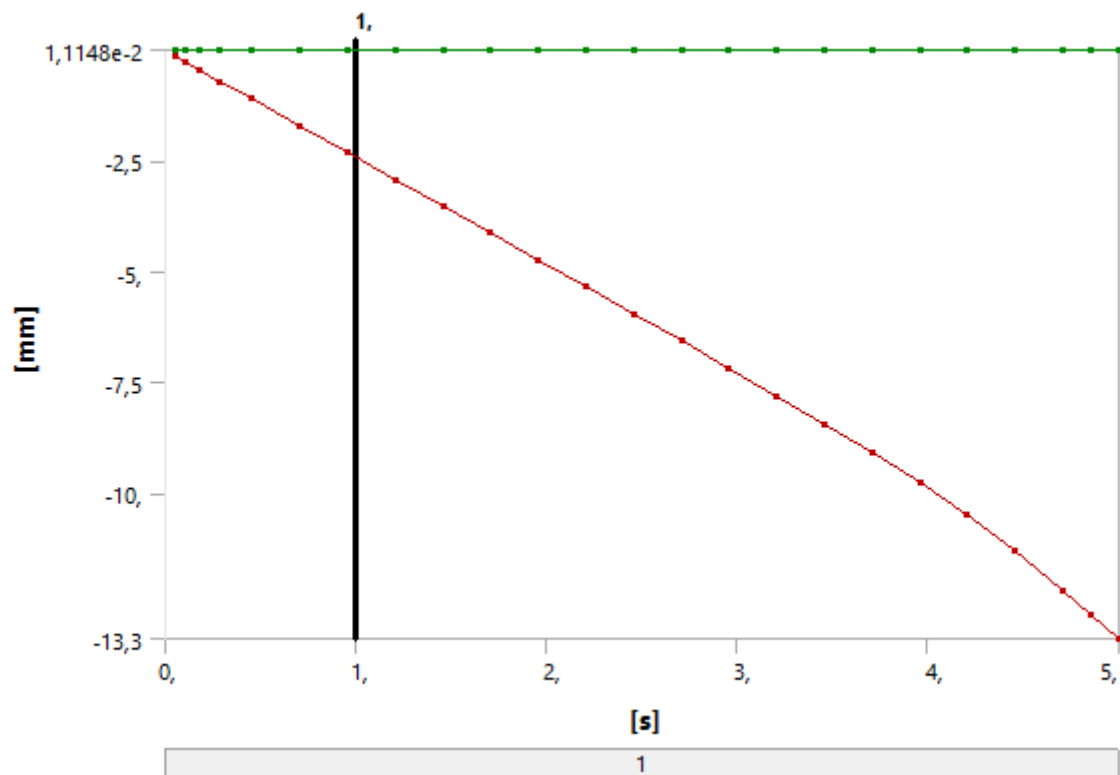


TABLE 30
Model (C4) > Static Structural (C5) > Solution (C6) > Y Axis Deformation, 1G

Time [s]	Minimum [mm]	Maximum [mm]
5,e-002	-0,11708	9,2877e-005
0,1	-0,2382	1,8586e-004
0,175	-0,42174	3,2534e-004
0,2875	-0,69293	5,347e-004
0,45625	-1,0977	8,4871e-004
0,70625	-1,7008	1,3147e-003
0,95625	-2,3029	1,779e-003
1,2063	-2,91	2,2436e-003
1,4563	-3,5159	2,7044e-003
1,7063	-4,1226	3,1629e-003
1,9563	-4,7296	3,619e-003
2,2062	-5,3359	4,0718e-003
2,4562	-5,9566	4,5255e-003
2,7062	-6,5719	4,9806e-003
2,9562	-7,1914	5,4392e-003
3,2062	-7,8201	5,8998e-003
3,4562	-8,4526	6,3677e-003
3,7062	-9,0959	6,848e-003
3,9562	-9,762	7,3679e-003
4,2062	-10,487	8,0208e-003
4,4562	-11,288	8,8081e-003
4,7062	-12,198	9,8341e-003
4,8531	-12,744	1,046e-002
5,	-13,3	1,1148e-002

FIGURE 7
Model (C4) > Static Structural (C5) > Solution (C6) > Y Axis Deformation, 1G > Figure

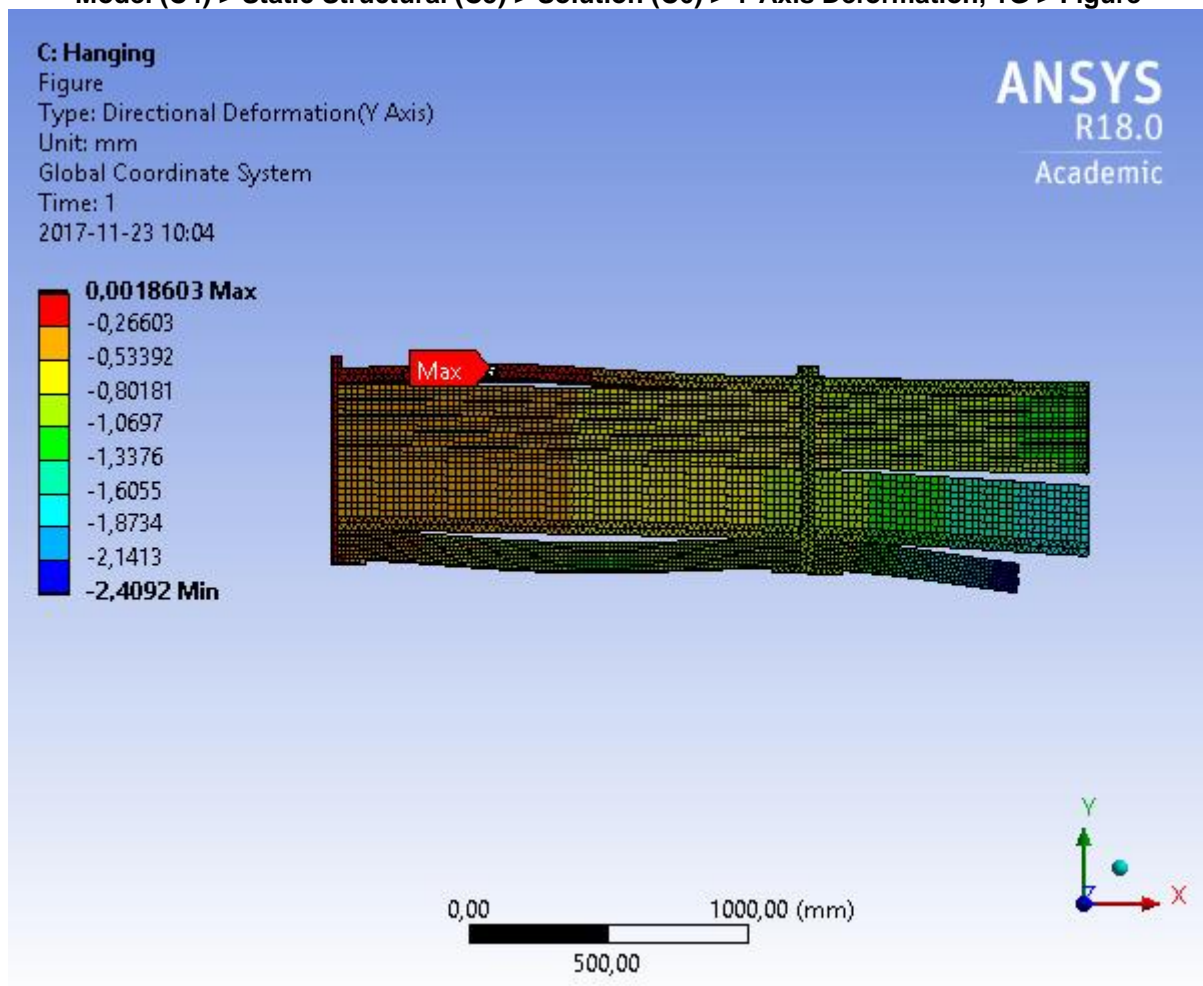


FIGURE 8
Model (C4) > Static Structural (C5) > Solution (C6) > Pins Stress, 2G

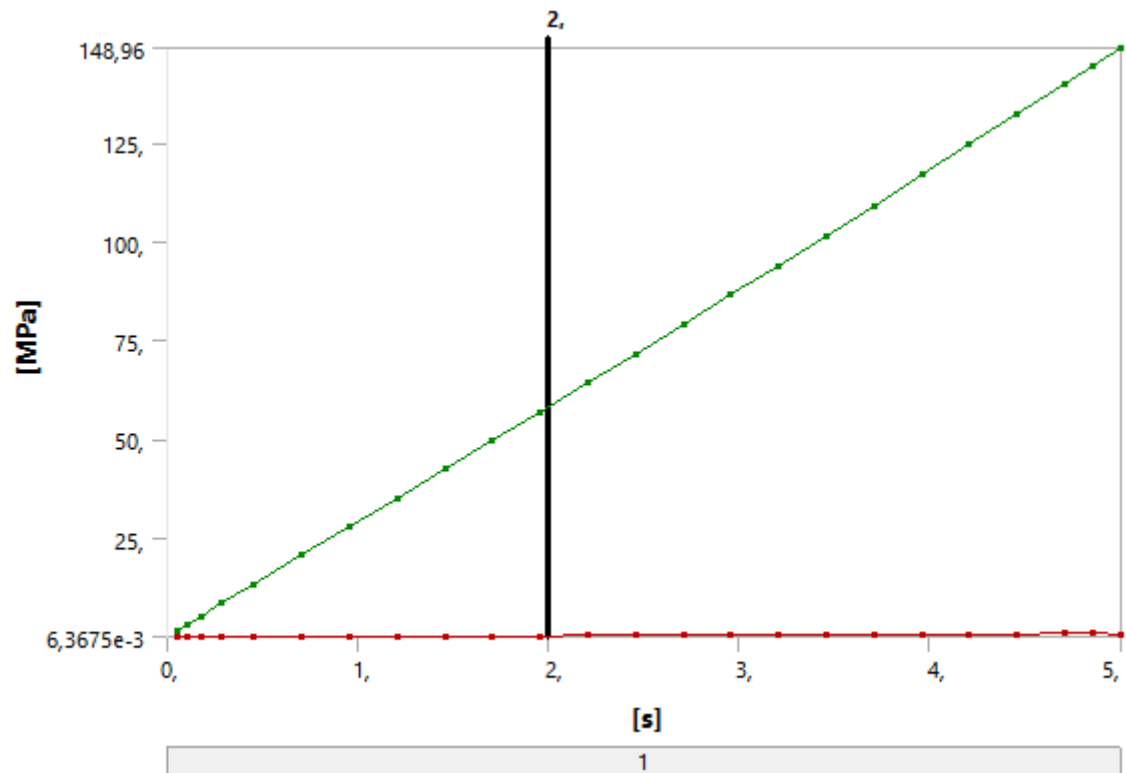


TABLE 31
Model (C4) > Static Structural (C5) > Solution (C6) > Pins Stress, 2G

Time [s]	Minimum [MPa]	Maximum [MPa]
5,e-002	6,3675e-003	1,4557
0,1	1,27e-002	2,912
0,175	2,2239e-002	5,0982
0,2875	3,657e-002	8,3692
0,45625	5,7985e-002	13,27
0,70625	9,0012e-002	20,541
0,95625	0,12187	27,807
1,2063	0,15441	35,078
1,4563	0,18671	42,366
1,7063	0,21907	49,662
1,9563	0,25147	56,967
2,2062	0,28369	64,292
2,4562	0,42392	71,687
2,7062	0,46622	79,065
2,9562	0,49634	86,459
3,2062	0,48626	93,882
3,4562	0,49584	101,56
3,7062	0,49653	109,16
3,9562	0,40169	116,8
4,2062	0,59385	124,49
4,4562	0,69793	132,23
4,7062	0,77568	139,89
4,8531	0,79498	144,42
5,	0,57959	148,96

FIGURE 9
Model (C4) > Static Structural (C5) > Solution (C6) > Pins Stress, 2G > Figure

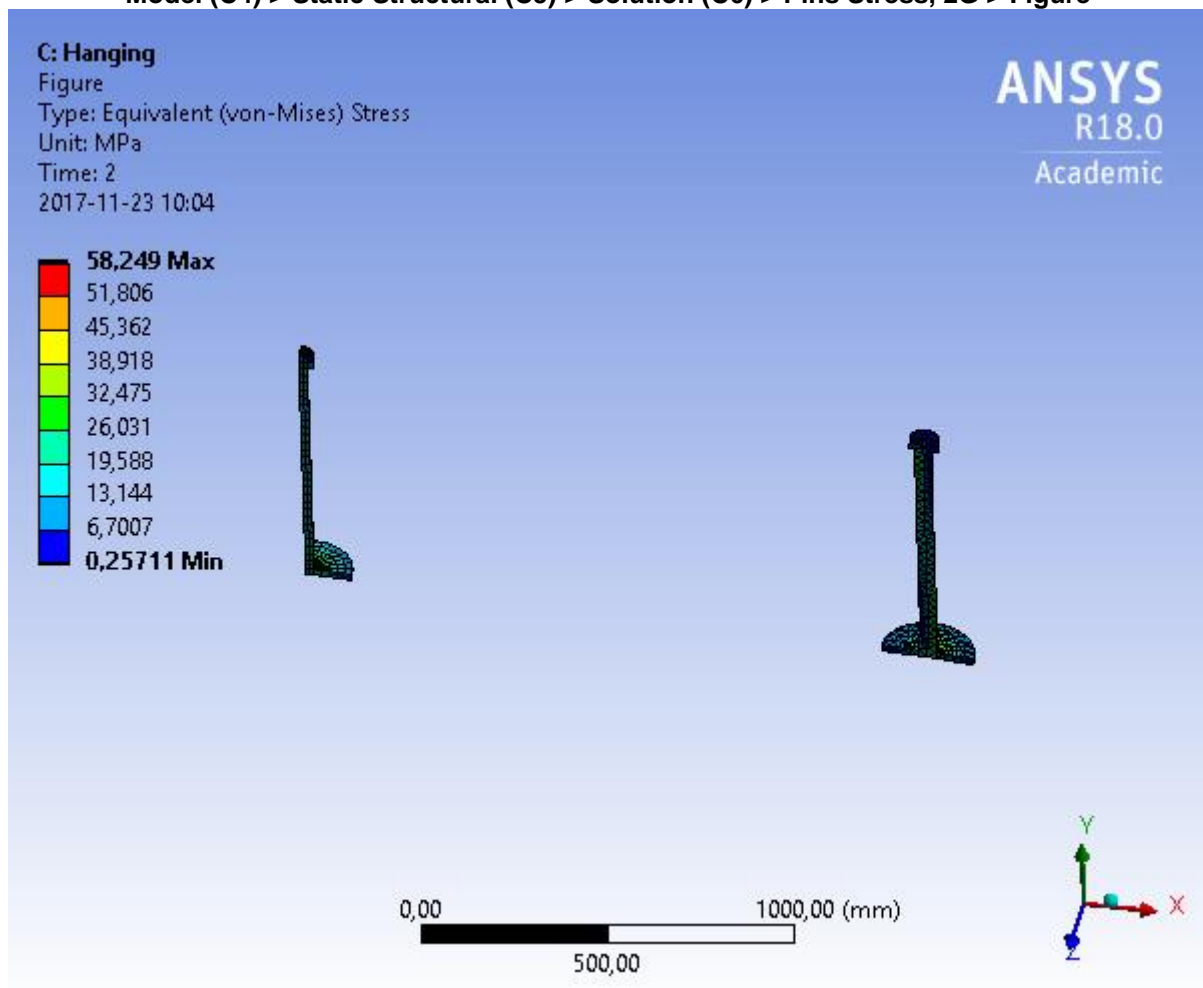


FIGURE 10
Model (C4) > Static Structural (C5) > Solution (C6) > Pins Stress, 3G

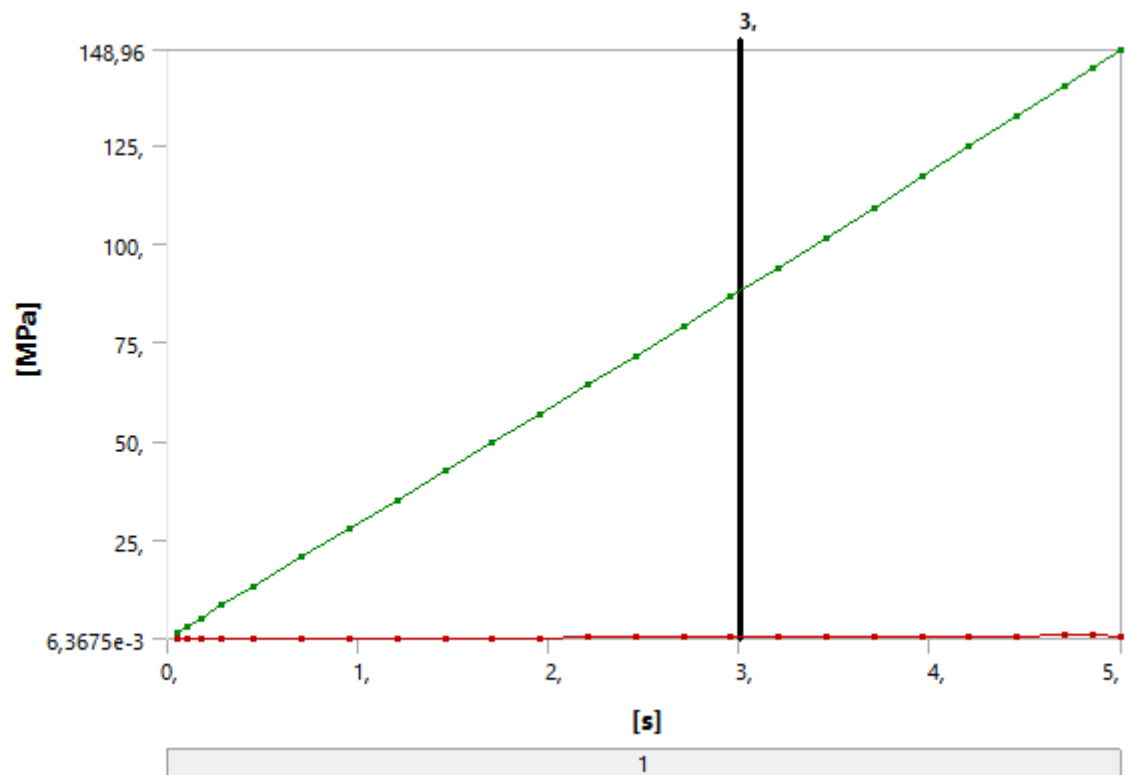


TABLE 32
Model (C4) > Static Structural (C5) > Solution (C6) > Pins Stress, 3G

Time [s]	Minimum [MPa]	Maximum [MPa]
5,e-002	6,3675e-003	1,4557
0,1	1,27e-002	2,912
0,175	2,2239e-002	5,0982
0,2875	3,657e-002	8,3692
0,45625	5,7985e-002	13,27
0,70625	9,0012e-002	20,541
0,95625	0,12187	27,807
1,2063	0,15441	35,078
1,4563	0,18671	42,366
1,7063	0,21907	49,662
1,9563	0,25147	56,967
2,2062	0,28369	64,292
2,4562	0,42392	71,687
2,7062	0,46622	79,065
2,9562	0,49634	86,459
3,2062	0,48626	93,882
3,4562	0,49584	101,56
3,7062	0,49653	109,16
3,9562	0,40169	116,8
4,2062	0,59385	124,49
4,4562	0,69793	132,23
4,7062	0,77568	139,89
4,8531	0,79498	144,42
5,	0,57959	148,96

FIGURE 11
Model (C4) > Static Structural (C5) > Solution (C6) > Pins Stress, 3G > Figure

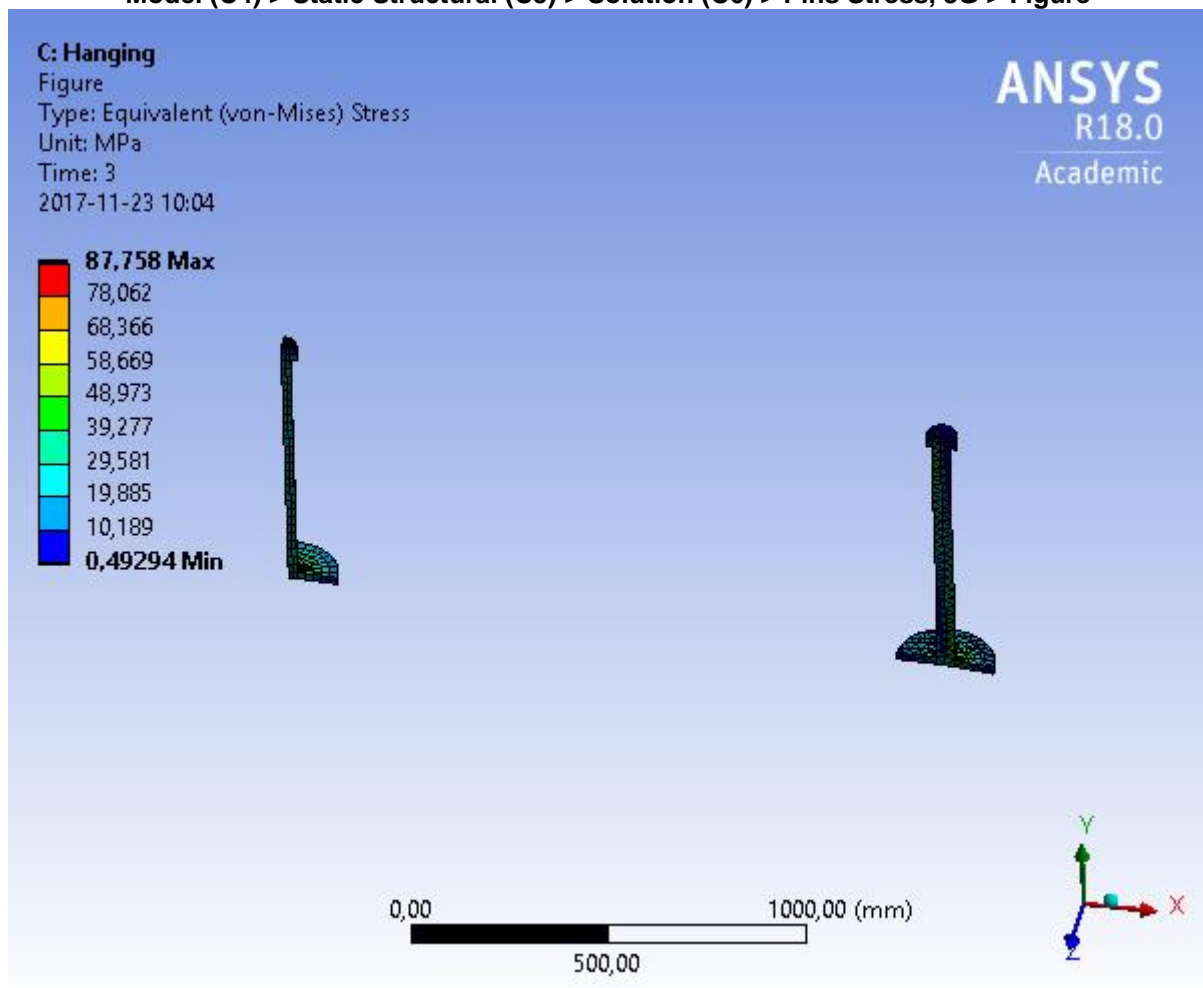


FIGURE 12
Model (C4) > Static Structural (C5) > Solution (C6) > Spreader Bar Support, 2G

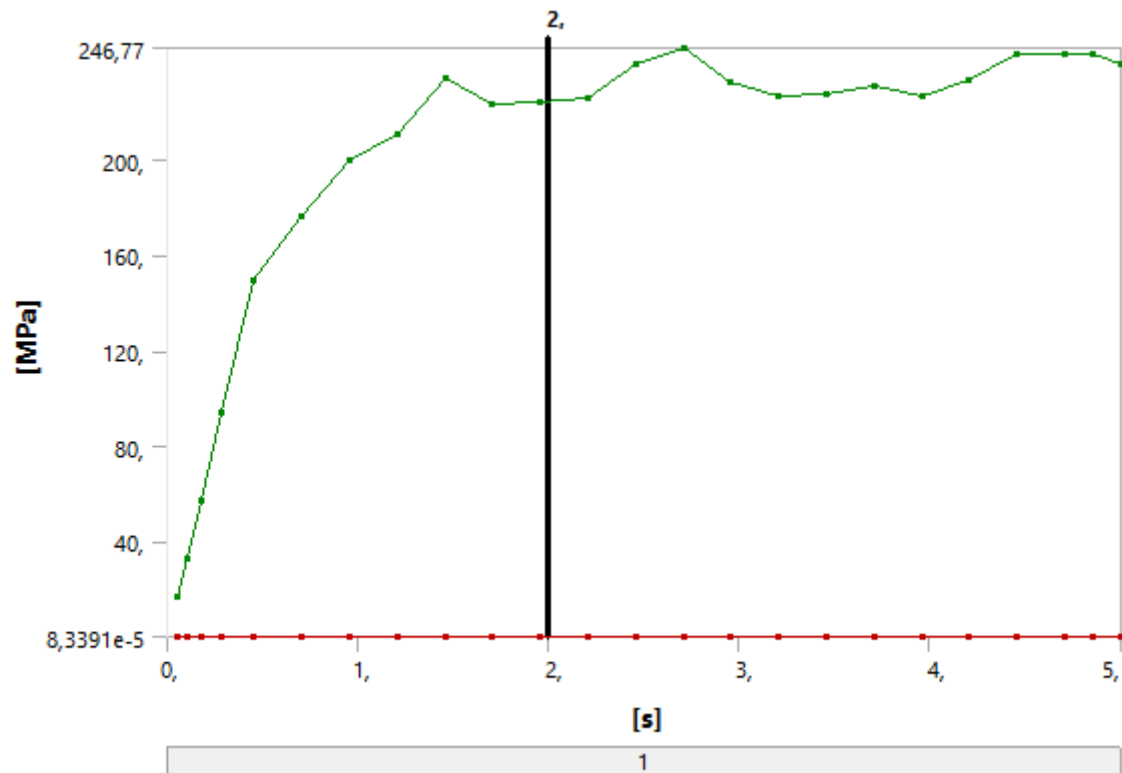


TABLE 33
Model (C4) > Static Structural (C5) > Solution (C6) > Spreader Bar Support, 2G

Time [s]	Minimum [MPa]	Maximum [MPa]
5,e-002	8,3391e-005	16,387
0,1	1,6592e-004	32,775
0,175	2,8788e-004	57,351
0,2875	4,6603e-004	94,209
0,45625	7,196e-004	149,47
0,70625	1,0819e-003	175,95
0,95625	1,3923e-003	199,94
1,2063	1,6858e-003	210,87
1,4563	1,9301e-003	234,18
1,7063	2,1211e-003	223,64
1,9563	2,2715e-003	224,43
2,2062	2,3429e-003	225,78
2,4562	2,3672e-003	240,31
2,7062	2,3247e-003	246,77
2,9562	2,243e-003	232,82
3,2062	2,098e-003	226,88
3,4562	1,968e-003	227,58
3,7062	1,856e-003	231,06
3,9562	1,8848e-003	226,83
4,2062	2,3097e-003	232,98
4,4562	3,465e-003	243,85
4,7062	5,2484e-003	244,39
4,8531	6,5849e-003	244,06
5,	8,2379e-003	240,01

FIGURE 13

Model (C4) > Static Structural (C5) > Solution (C6) > Spreader Bar Support, 2G > Figure

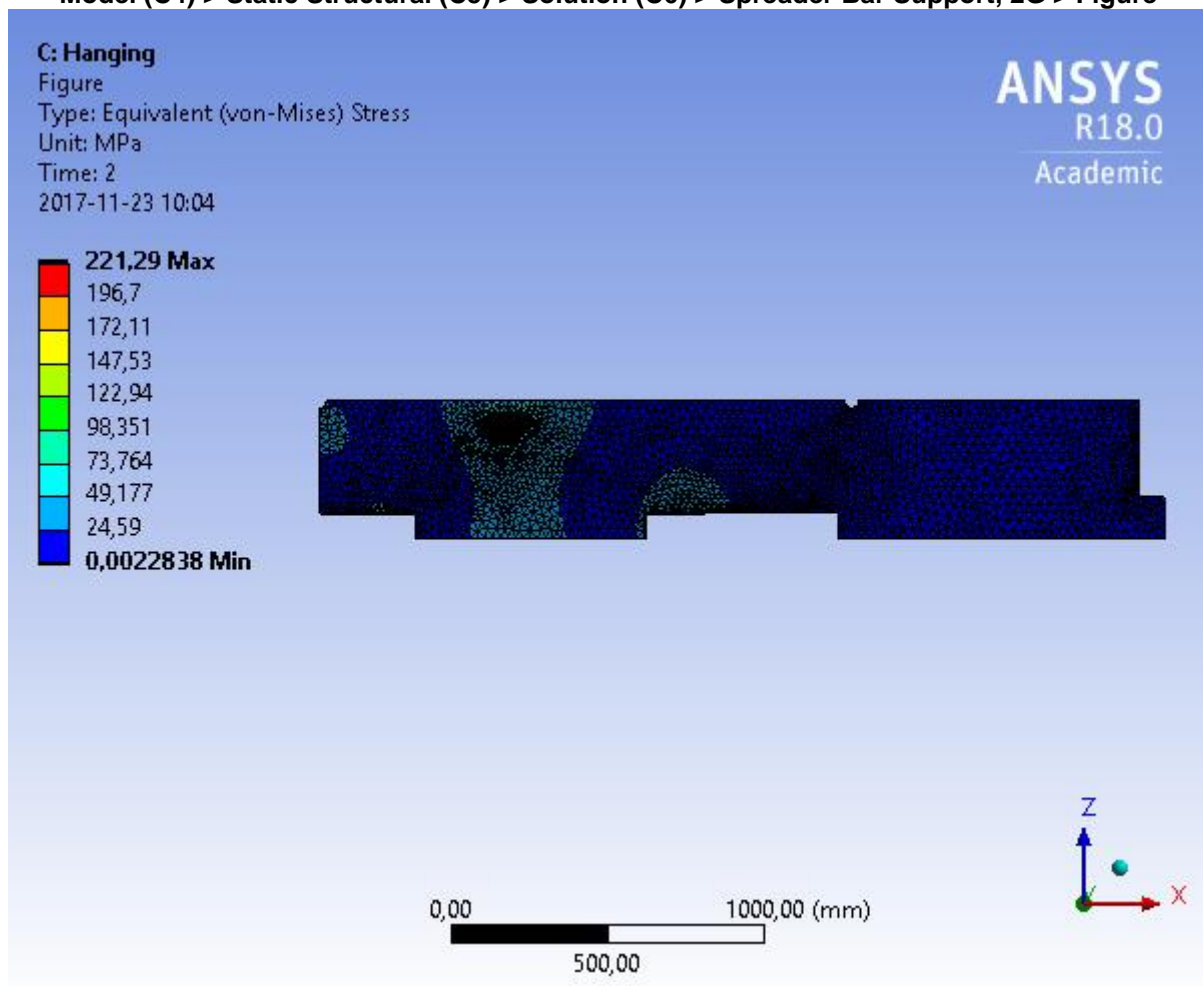


FIGURE 14

Model (C4) > Static Structural (C5) > Solution (C6) > Spreader Bar Support, 3G

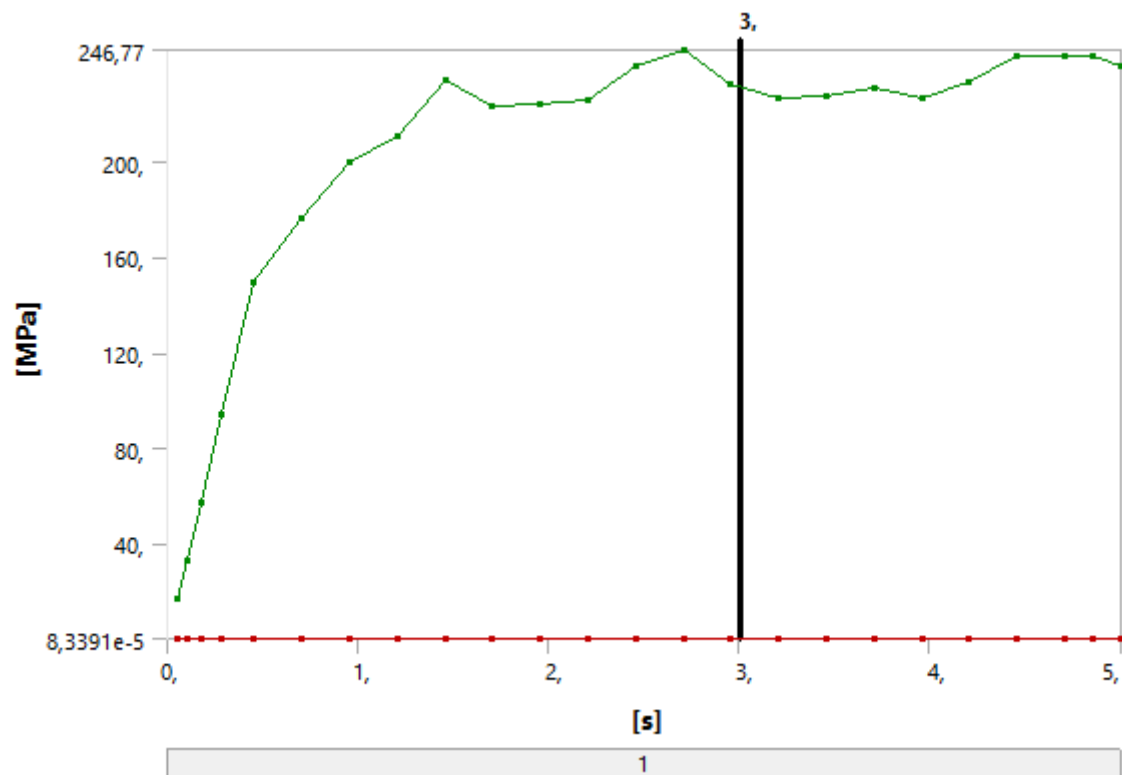


TABLE 34
Model (C4) > Static Structural (C5) > Solution (C6) > Spreader Bar Support, 3G

Time [s]	Minimum [MPa]	Maximum [MPa]
5,e-002	8,3391e-005	16,387
0,1	1,6592e-004	32,775
0,175	2,8788e-004	57,351
0,2875	4,6603e-004	94,209
0,45625	7,196e-004	149,47
0,70625	1,0819e-003	175,95
0,95625	1,3923e-003	199,94
1,2063	1,6858e-003	210,87
1,4563	1,9301e-003	234,18
1,7063	2,1211e-003	223,64
1,9563	2,2715e-003	224,43
2,2062	2,3429e-003	225,78
2,4562	2,3672e-003	240,31
2,7062	2,3247e-003	246,77
2,9562	2,243e-003	232,82
3,2062	2,098e-003	226,88
3,4562	1,968e-003	227,58
3,7062	1,856e-003	231,06
3,9562	1,8848e-003	226,83
4,2062	2,3097e-003	232,98
4,4562	3,465e-003	243,85
4,7062	5,2484e-003	244,39
4,8531	6,5849e-003	244,06
5,	8,2379e-003	240,01

FIGURE 15

Model (C4) > Static Structural (C5) > Solution (C6) > Spreader Bar Support, 3G > Figure

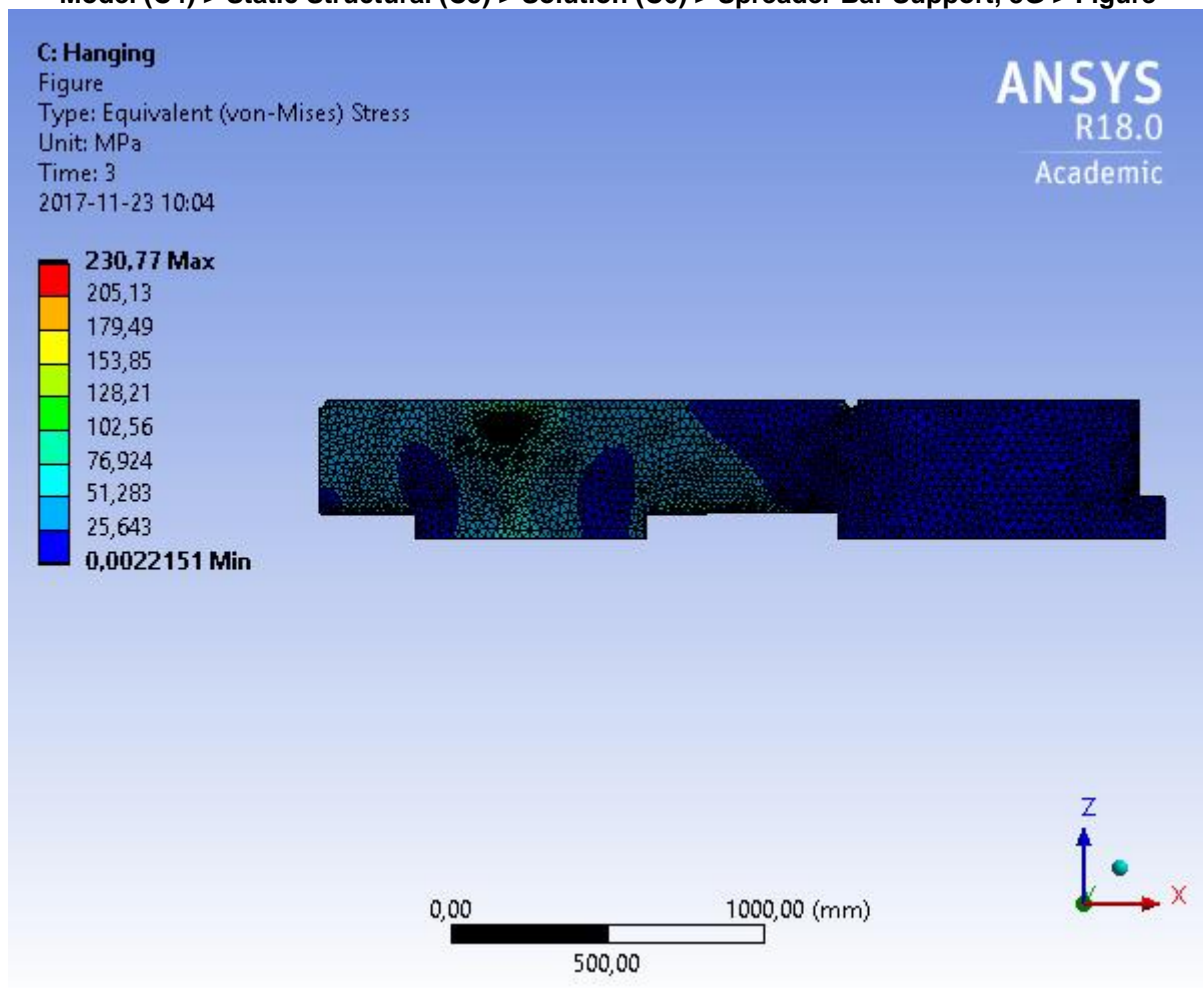


FIGURE 16

Model (C4) > Static Structural (C5) > Solution (C6) > Welds Strain, 2G

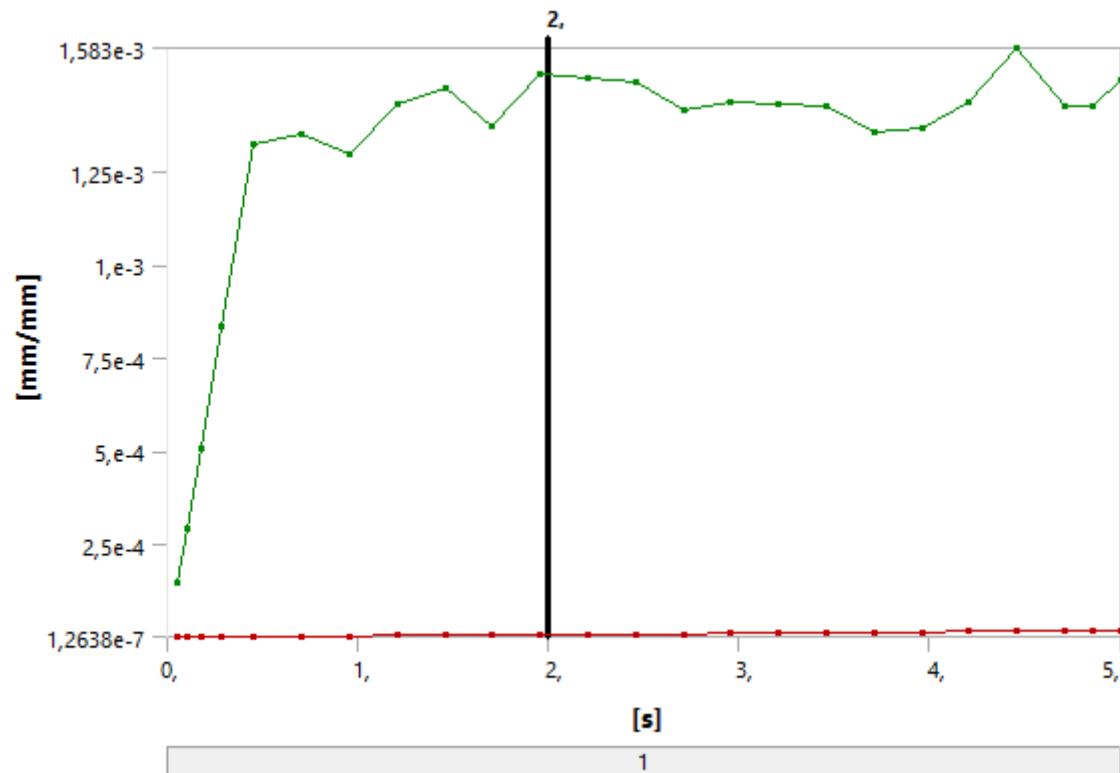


TABLE 35
Model (C4) > Static Structural (C5) > Solution (C6) > Welds Strain, 2G

Time [s]	Minimum [mm/mm]	Maximum [mm/mm]
5,e-002	1,2638e-007	1,4507e-004
0,1	2,5353e-007	2,9014e-004
0,175	4,4583e-007	5,0773e-004
0,2875	7,3763e-007	8,3404e-004
0,45625	1,1832e-006	1,3233e-003
0,70625	1,8593e-006	1,3532e-003
0,95625	2,5589e-006	1,2968e-003
1,2063	3,2743e-006	1,4312e-003
1,4563	4,007e-006	1,474e-003
1,7063	4,7586e-006	1,3721e-003
1,9563	5,5281e-006	1,5138e-003
2,2062	6,3248e-006	1,5022e-003
2,4562	7,126e-006	1,4925e-003
2,7062	7,8603e-006	1,4157e-003
2,9562	8,6307e-006	1,436e-003
3,2062	9,4397e-006	1,4347e-003
3,4562	1,0299e-005	1,4258e-003
3,7062	1,127e-005	1,3582e-003
3,9562	1,258e-005	1,3672e-003
4,2062	1,4662e-005	1,4374e-003
4,4562	1,4844e-005	1,583e-003
4,7062	1,6693e-005	1,4291e-003
4,8531	1,6754e-005	1,4272e-003
5,	1,6847e-005	1,4965e-003

FIGURE 17

Model (C4) > Static Structural (C5) > Solution (C6) > Welds Strain, 2G > Figure

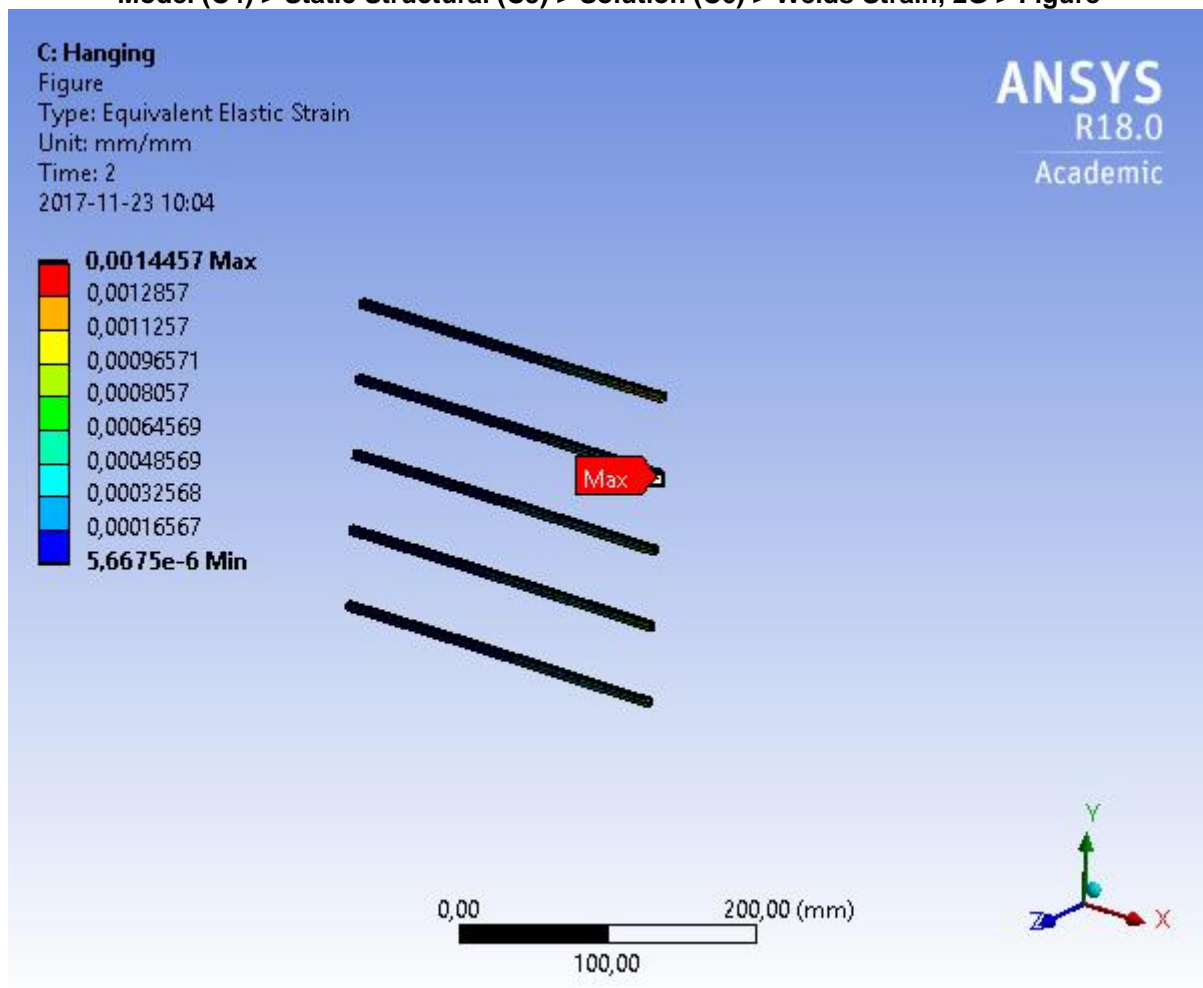


FIGURE 18

Model (C4) > Static Structural (C5) > Solution (C6) > Welds Strain, 3G

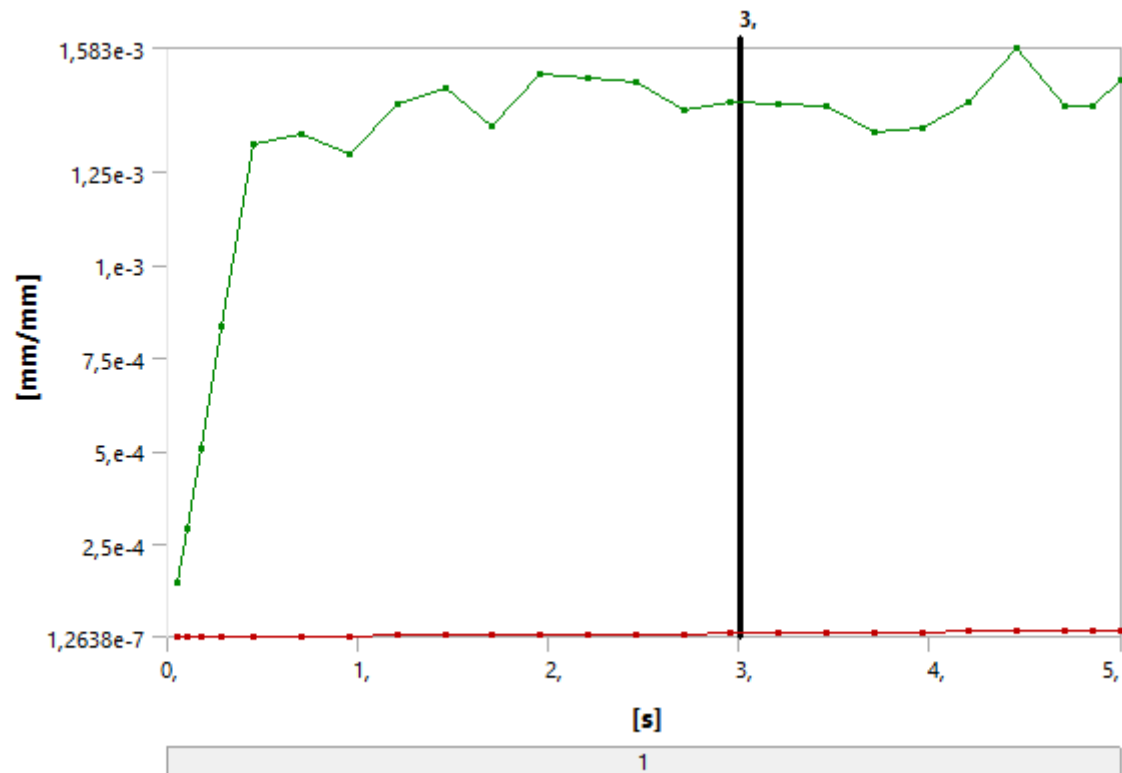


TABLE 36
Model (C4) > Static Structural (C5) > Solution (C6) > Welds Strain, 3G

Time [s]	Minimum [mm/mm]	Maximum [mm/mm]
5,e-002	1,2638e-007	1,4507e-004
0,1	2,5353e-007	2,9014e-004
0,175	4,4583e-007	5,0773e-004
0,2875	7,3763e-007	8,3404e-004
0,45625	1,1832e-006	1,3233e-003
0,70625	1,8593e-006	1,3532e-003
0,95625	2,5589e-006	1,2968e-003
1,2063	3,2743e-006	1,4312e-003
1,4563	4,007e-006	1,474e-003
1,7063	4,7586e-006	1,3721e-003
1,9563	5,5281e-006	1,5138e-003
2,2062	6,3248e-006	1,5022e-003
2,4562	7,126e-006	1,4925e-003
2,7062	7,8603e-006	1,4157e-003
2,9562	8,6307e-006	1,436e-003
3,2062	9,4397e-006	1,4347e-003
3,4562	1,0299e-005	1,4258e-003
3,7062	1,127e-005	1,3582e-003
3,9562	1,258e-005	1,3672e-003
4,2062	1,4662e-005	1,4374e-003
4,4562	1,4844e-005	1,583e-003
4,7062	1,6693e-005	1,4291e-003
4,8531	1,6754e-005	1,4272e-003
5,	1,6847e-005	1,4965e-003

FIGURE 19
Model (C4) > Static Structural (C5) > Solution (C6) > Welds Strain, 3G > Figure

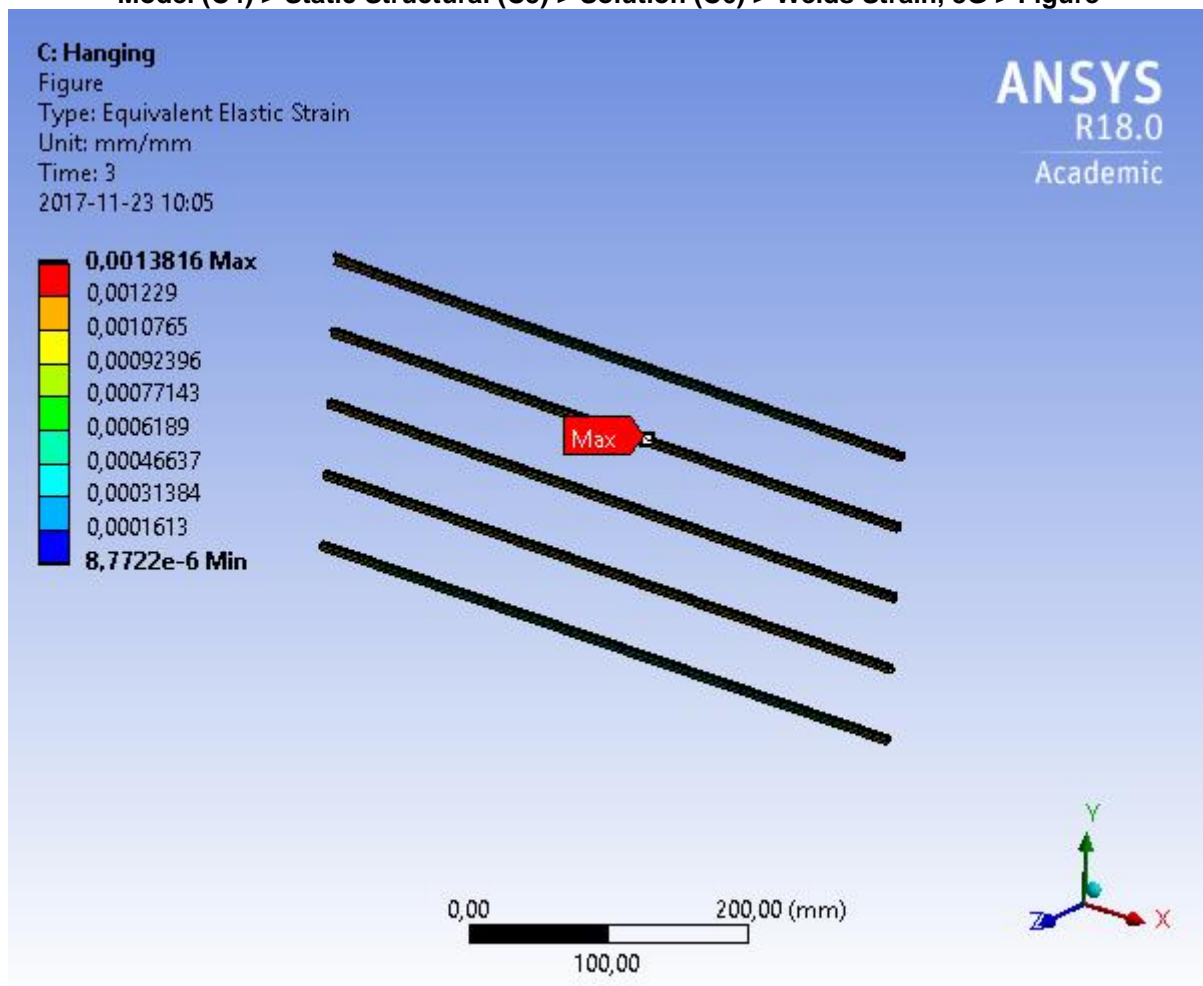


FIGURE 20
Model (C4) > Static Structural (C5) > Solution (C6) > HDPE slabs stress

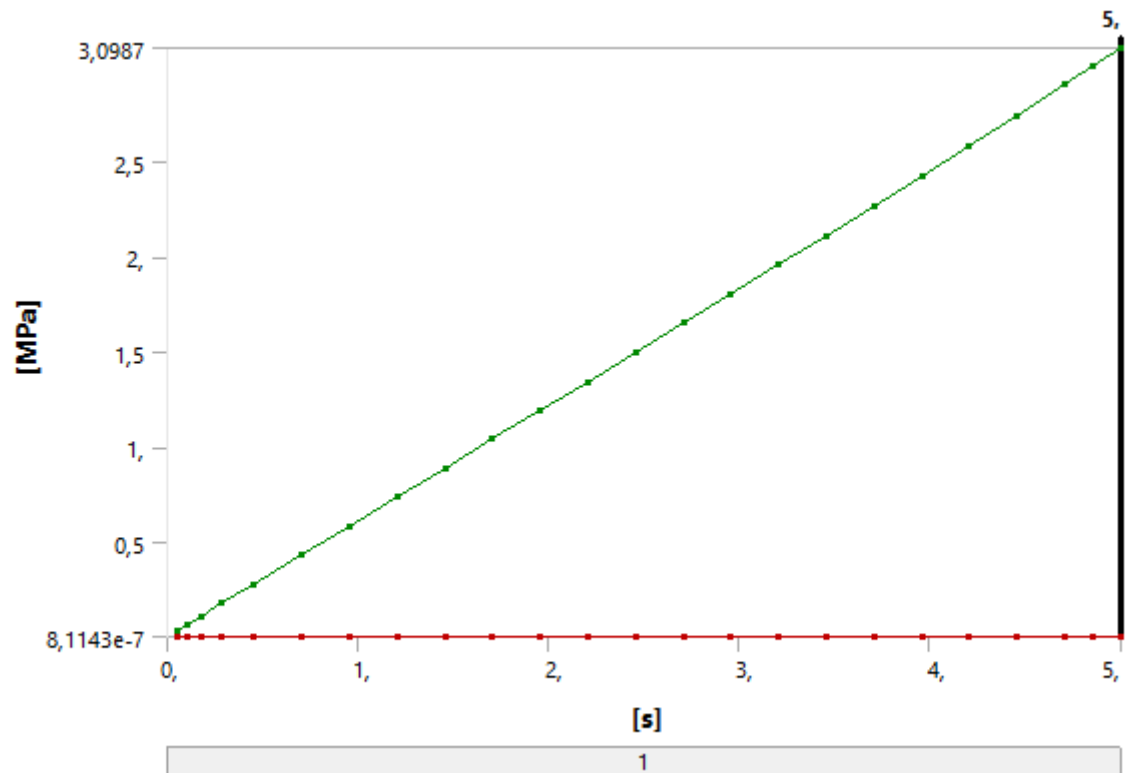
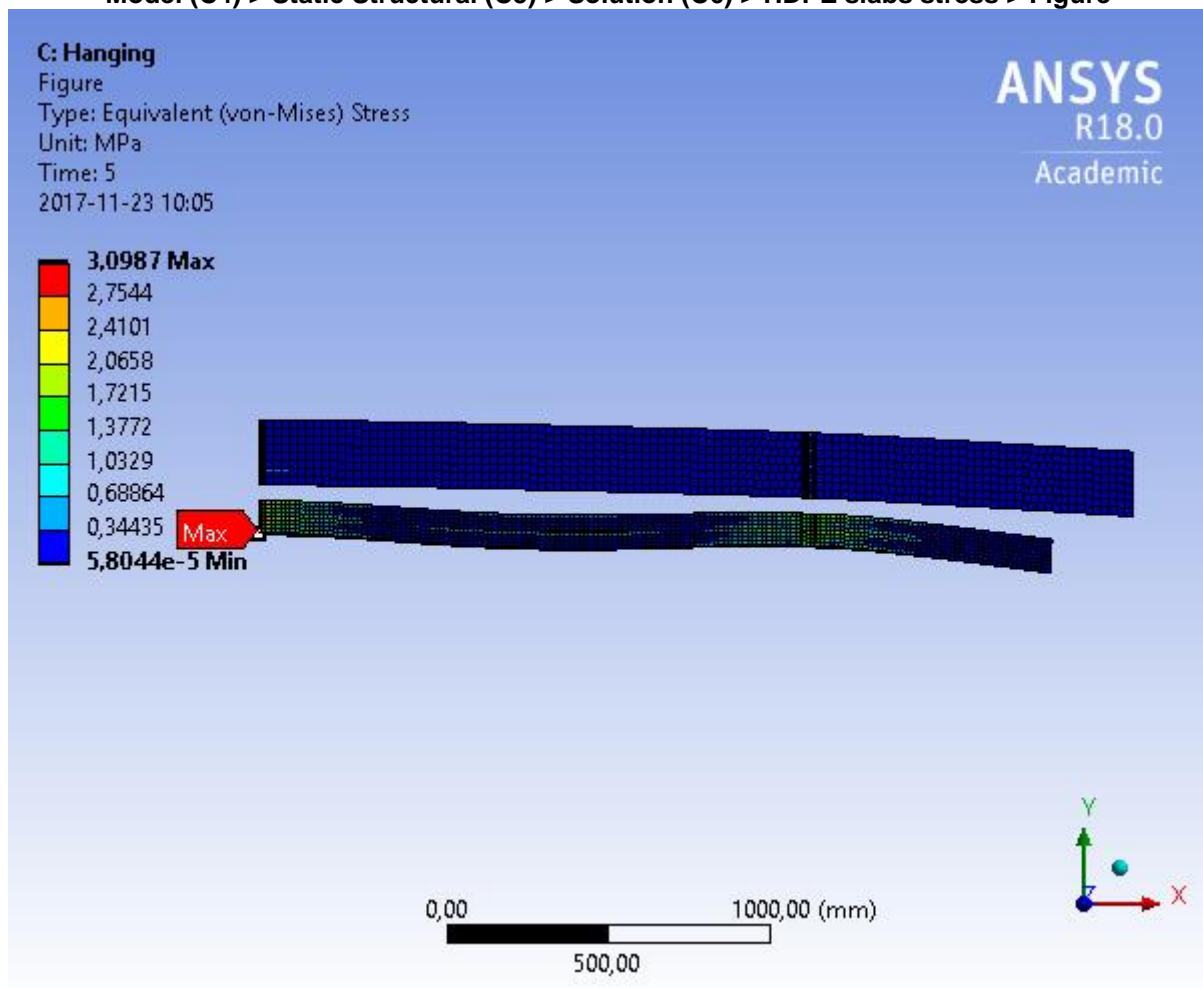


TABLE 37
Model (C4) > Static Structural (C5) > Solution (C6) > HDPE slabs stress

Time [s]	Minimum [MPa]	Maximum [MPa]
5,e-002	8,1143e-007	3,0537e-002
0,1	3,4536e-006	6,098e-002
0,175	6,3441e-006	0,10669
0,2875	9,404e-006	0,17508
0,45625	1,4275e-005	0,27754
0,70625	2,4968e-005	0,42959
0,95625	3,4663e-005	0,58153
1,2063	4,3762e-005	0,73355
1,4563	4,6876e-005	0,88591
1,7063	6,1986e-005	1,0383
1,9563	5,89e-005	1,1909
2,2062	7,2388e-005	1,3434
2,4562	8,9399e-005	1,4973
2,7062	9,8452e-005	1,6502
2,9562	9,6737e-005	1,8028
3,2062	1,0799e-004	1,9558
3,4562	1,114e-004	2,1097
3,7062	1,2543e-004	2,2663
3,9562	1,4439e-004	2,4227
4,2062	1,2865e-004	2,5817
4,4562	1,6111e-004	2,7433
4,7062	7,2726e-005	2,906
4,8531	5,4751e-005	3,002
5,	5,8044e-005	3,0987

FIGURE 21

Model (C4) > Static Structural (C5) > Solution (C6) > HDPE slabs stress > Figure



Material Data

HDPE

TABLE 38

HDPE > Constants

Density	9,6e-007 kg mm ⁻³
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TABLE 39

HDPE > Color

Red	Green	Blue
132,	139,	179,

TABLE 40

HDPE > Compressive Ultimate Strength

Compressive Ultimate Strength MPa
27,

TABLE 41

HDPE > Compressive Yield Strength

Compressive Yield Strength MPa

27,

TABLE 42
HDPE > Tensile Yield Strength

Tensile Yield Strength MPa
27,

TABLE 43
HDPE > Tensile Ultimate Strength

Tensile Ultimate Strength MPa
27,

TABLE 44
HDPE > Isotropic Elasticity

Temperature C	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
	1200,	0,46	5000,	410,96

TABLE 45
HDPE > Bilinear Isotropic Hardening

Yield Strength MPa	Tangent Modulus MPa	Temperature C
27,	0,	20,

S235

TABLE 46
S235 > Constants

Density	7,85e-006 kg mm ⁻³
Coefficient of Thermal Expansion	1,2e-005 C ⁻¹
Specific Heat	4,34e+005 mJ kg ⁻¹ C ⁻¹
Thermal Conductivity	6,05e-002 W mm ⁻¹ C ⁻¹
Resistivity	1,7e-004 ohm mm

TABLE 47
S235 > Color

Red	Green	Blue
132,	139,	179,

TABLE 48
S235 > Compressive Ultimate Strength

Compressive Ultimate Strength MPa
0,

TABLE 49
S235 > Compressive Yield Strength

Compressive Yield Strength MPa
215,

TABLE 50
S235 > Tensile Yield Strength

Tensile Yield Strength MPa
215,

TABLE 51
S235 > Tensile Ultimate Strength

Tensile Ultimate Strength MPa
360,

TABLE 52
S235 > Isotropic Secant Coefficient of Thermal Expansion

Zero-Thermal-Strain Reference Temperature C
22,

TABLE 53
S235 > Alternating Stress Mean Stress

Alternating Stress MPa	Cycles	Mean Stress MPa
3999,	10,	0,
2827,	20,	0,
1896,	50,	0,
1413,	100,	0,
1069,	200,	0,
441,	2000,	0,
262,	10000	0,
214,	20000	0,
138,	1,e+005	0,
114,	2,e+005	0,
86,2	1,e+006	0,

TABLE 54
S235 > Strain-Life Parameters

Strength Coefficient MPa	Strength Exponent	Ductility Coefficient	Ductility Exponent	Cyclic Strength Coefficient MPa	Cyclic Strain Hardening Exponent
920,	-0,106	0,213	-0,47	1000,	0,2

TABLE 55
S235 > Isotropic Elasticity

Temperature C	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
	2,e+005	0,3	1,6667e+005	76923

TABLE 56
S235 > Isotropic Relative Permeability

Relative Permeability
10000

TABLE 57
S235 > Bilinear Isotropic Hardening

Yield Strength MPa	Tangent Modulus MPa	Temperature C
225,	0,	20,

S355

TABLE 58
S355 > Constants

Density	7,85e-006 kg mm ⁻³
Coefficient of Thermal Expansion	1,2e-005 C ⁻¹
Specific Heat	4,34e+005 mJ kg ⁻¹ C ⁻¹
Thermal Conductivity	6,05e-002 W mm ⁻¹ C ⁻¹

Resistivity	1,7e-004 ohm mm
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TABLE 59
S355 > Color

Red	Green	Blue
132,	139,	179,

TABLE 60
S355 > Compressive Ultimate Strength

Compressive Ultimate Strength MPa
0,

TABLE 61
S355 > Compressive Yield Strength

Compressive Yield Strength MPa
315,

TABLE 62
S355 > Tensile Yield Strength

Tensile Yield Strength MPa
315,

TABLE 63
S355 > Tensile Ultimate Strength

Tensile Ultimate Strength MPa
470,

TABLE 64
S355 > Isotropic Secant Coefficient of Thermal Expansion

Zero-Thermal-Strain Reference Temperature C
22,

TABLE 65
S355 > Alternating Stress Mean Stress

Alternating Stress MPa	Cycles	Mean Stress MPa
3999,	10,	0,
2827,	20,	0,
1896,	50,	0,
1413,	100,	0,
1069,	200,	0,
441,	2000,	0,
262,	10000	0,
214,	20000	0,
138,	1,e+005	0,
114,	2,e+005	0,
86,2	1,e+006	0,

TABLE 66
S355 > Strain-Life Parameters

Strength Coefficient MPa	Strength Exponent	Ductility Coefficient	Ductility Exponent	Cyclic Strength Coefficient MPa	Cyclic Strain Hardening Exponent
920,	-0,106	0,213	-0,47	1000,	0,2

TABLE 67
S355 > Isotropic Elasticity

Temperature C	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
	2,e+005	0,3	1,6667e+005	76923

TABLE 68
S355 > Isotropic Relative Permeability

Relative Permeability
10000

TABLE 69
S355 > Bilinear Isotropic Hardening

Yield Strength MPa	Tangent Modulus MPa	Temperature C
225,	0,	20,

Welds

TABLE 70
Welds > Constants

Density	7,85e-006 kg mm ⁻³
Coefficient of Thermal Expansion	1,2e-005 C ⁻¹
Specific Heat	4,34e+005 mJ kg ⁻¹ C ⁻¹
Thermal Conductivity	6,05e-002 W mm ⁻¹ C ⁻¹
Resistivity	1,7e-004 ohm mm

TABLE 71
Welds > Color

Red	Green	Blue
132,	139,	179,

TABLE 72
Welds > Compressive Ultimate Strength

Compressive Ultimate Strength MPa
0,

TABLE 73
Welds > Compressive Yield Strength

Compressive Yield Strength MPa
125,

TABLE 74
Welds > Tensile Yield Strength

Tensile Yield Strength MPa
125,

TABLE 75
Welds > Tensile Ultimate Strength

Tensile Ultimate Strength MPa
230,

TABLE 76
Welds > Isotropic Secant Coefficient of Thermal Expansion

Zero-Thermal-Strain Reference Temperature C
22,

TABLE 77
Welds > Alternating Stress Mean Stress

Alternating Stress MPa	Cycles	Mean Stress MPa
3999,	10,	0,
2827,	20,	0,
1896,	50,	0,
1413,	100,	0,
1069,	200,	0,
441,	2000,	0,
262,	10000	0,
214,	20000	0,
138,	1,e+005	0,
114,	2,e+005	0,
86,2	1,e+006	0,

TABLE 78
Welds > Strain-Life Parameters

Strength Coefficient MPa	Strength Exponent	Ductility Coefficient	Ductility Exponent	Cyclic Strength Coefficient MPa	Cyclic Strain Hardening Exponent
920,	-0,106	0,213	-0,47	1000,	0,2

TABLE 79
Welds > Isotropic Elasticity

Temperature C	Young's Modulus MPa	Poisson's Ratio	Bulk Modulus MPa	Shear Modulus MPa
	2,e+005	0,3	1,6667e+005	76923

TABLE 80
Welds > Isotropic Relative Permeability

Relative Permeability
10000

TABLE 81
Welds > Bilinear Isotropic Hardening

Yield Strength MPa	Tangent Modulus MPa	Temperature C
225,	0,	20,