



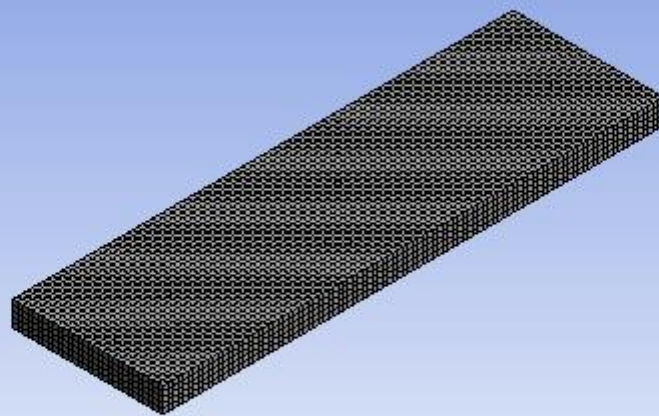
Project

| | |
|------------------------------|--------------------------|
| First Saved | Monday, November 6, 2023 |
| Last Saved | Monday, November 6, 2023 |
| Product Version | 2022 R1 |
| Save Project Before Solution | No |
| Save Project After Solution | No |

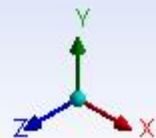
Model

06-11-2023 21:24

Ansys
2022 R1



0.00 50.00 (m)
25.00



Contents

- [Units](#)
- [Model \(A4\)](#)
 - [Geometry Imports](#)
 - [Geometry Import \(A3\)](#)
 - [Geometry](#)
 - [Solid](#)
 - [Materials](#)
 - [Coordinate Systems](#)
 - [Mesh](#)
 - [Static Structural \(A5\)](#)
 - [Analysis Settings](#)
 - [Loads](#)
 - [Solution \(A6\)](#)
 - [Solution Information](#)
 - [Results](#)
- [Material Data](#)
 - [Structural Steel](#)

Units

TABLE 1

| | |
|---------------------|--|
| Unit System | Metric (m, kg, N, s, V, A) Degrees rad/s Celsius |
| Angle | Degrees |
| Rotational Velocity | rad/s |
| Temperature | Celsius |

Model (A4)

TABLE 2

Model (A4) > Geometry Imports

| | |
|-------------|-------------------------|
| Object Name | <i>Geometry Imports</i> |
| State | Solved |

TABLE 3

Model (A4) > Geometry Imports > Geometry Import (A3)

| | |
|-------------------------------|---|
| Object Name | <i>Geometry Import (A3)</i> |
| State | Solved |
| Definition | |
| Source | C:\Users\ADMIN\AppData\Local\Temp\WB_ADMIN_7328_2\wbnew_files\dp0\SYS\DM\SYS.agdb |
| Type | DesignModeler |
| Basic Geometry Options | |
| Solid Bodies | Yes |
| Surface Bodies | Yes |
| Line Bodies | Yes |
| 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 |
| Compare Parts Tolerance | Tight |
| Analysis Type | 3-D |
| Mixed Import Resolution | None |
| Import Facet Quality | Source |
| Clean Bodies On Import | No |
| Stitch Surfaces On Import | None |
| Stitch Tolerance | 0.0000001 |
| Decompose Disjoint Geometry | Yes |
| Enclosure and Symmetry Processing | Yes |

Geometry

TABLE 4
Model (A4) > Geometry

| | |
|--------------------------------------|---|
| Object Name | Geometry |
| State | Fully Defined |
| Definition | |
| Source | C:\Users\ADMIN\Static Stractral P1_files\dp0\SYS\DM\SYS.agdb |
| Type | DesignModeler |
| Length Unit | Meters |
| Element Control | Program Controlled |
| Display Style | Body Color |
| Bounding Box | |
| Length X | 30. m |
| Length Y | 5. m |
| Length Z | 100. m |
| Properties | |
| Volume | 15000 m ³ |
| Mass | 1.1775e+008 kg |
| Scale Factor Value | 1. |
| Statistics | |
| Bodies | 1 |
| Active Bodies | 1 |
| Nodes | 71221 |
| Elements | 15000 |
| Mesh Metric | None |
| Update Options | |
| Assign Default Material | No |
| 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 |
| Analysis Type | 3-D |
| Import Facet Quality | Source |
| Clean Bodies On Import | No |
| Stitch Surfaces On Import | None |
| Decompose Disjoint Geometry | Yes |
| Enclosure and Symmetry Processing | Yes |

TABLE 5
Model (A4) > Geometry > Parts

| | |
|----------------------------|-------------------------------|
| Object Name | <i>Solid</i> |
| State | Meshed |
| Graphics Properties | |
| Visible | Yes |
| Transparency | 1 |
| Definition | |
| Suppressed | No |
| Stiffness Behavior | Flexible |
| Coordinate System | Default Coordinate System |
| Reference Temperature | By Environment |
| Treatment | None |
| Material | |
| Assignment | Structural Steel |
| Nonlinear Effects | Yes |
| Thermal Strain Effects | Yes |
| Bounding Box | |
| Length X | 30. m |
| Length Y | 5. m |
| Length Z | 100. m |
| Properties | |
| Volume | 15000 m ³ |
| Mass | 1.1775e+008 kg |
| Centroid X | -15. m |
| Centroid Y | 2.5 m |
| Centroid Z | 50. m |
| Moment of Inertia Ip1 | 9.837e+010 kg·m ² |
| Moment of Inertia Ip2 | 1.0696e+011 kg·m ² |
| Moment of Inertia Ip3 | 9.0766e+009 kg·m ² |
| Statistics | |
| Nodes | 71221 |
| Elements | 15000 |
| Mesh Metric | None |

TABLE 6
Model (A4) > Materials

| | |
|----------------------|------------------|
| Object Name | <i>Materials</i> |
| State | Fully Defined |
| Statistics | |
| Materials | 2 |
| Material Assignments | 0 |

Coordinate Systems

TABLE 7
Model (A4) > Coordinate Systems > Coordinate System

| | |
|----------------------|---------------------------------|
| Object Name | <i>Global Coordinate System</i> |
| State | Fully Defined |
| Definition | |
| Type | Cartesian |
| Coordinate System ID | 0. |

| Origin | |
|---------------------|--------------|
| Origin X | 0. m |
| Origin Y | 0. m |
| Origin Z | 0. m |
| Directional Vectors | |
| X Axis Data | [1. 0. 0.] |
| Y Axis Data | [0. 1. 0.] |
| Z Axis Data | [0. 0. 1.] |

Mesh

TABLE 8
Model (A4) > Mesh

| Object Name | <i>Mesh</i> |
|--|-----------------------|
| State | Solved |
| Display | |
| Display Style | Use Geometry Setting |
| Defaults | |
| Physics Preference | Mechanical |
| Element Order | Program Controlled |
| Element Size | 1.0 m |
| Sizing | |
| Use Adaptive Sizing | Yes |
| Resolution | Default (2) |
| Mesh Defeaturing | Yes |
| Defeature Size | Default |
| Transition | Fast |
| Span Angle Center | Coarse |
| Initial Size Seed | Assembly |
| Bounding Box Diagonal | 104.52 m |
| Average Surface Area | 1216.7 m ² |
| Minimum Edge Length | 5.0 m |
| Quality | |
| Check Mesh Quality | Yes, Errors |
| Error Limits | Aggressive Mechanical |
| Target Element Quality | Default (5.e-002) |
| Smoothing | Medium |
| 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 |
| Rigid Body Behavior | Dimensionally Reduced |
| Triangle Surface Mesher | Program Controlled |
| Topology Checking | Yes |

| | |
|---------------------------|---------------|
| Pinch Tolerance | Please Define |
| Generate Pinch on Refresh | No |
| Statistics | |
| Nodes | 71221 |
| Elements | 15000 |

Static Structural (A5)

TABLE 9
Model (A4) > Analysis

| | |
|-------------------------|-------------------------------|
| Object Name | <i>Static Structural (A5)</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 10
Model (A4) > Static Structural (A5) > Analysis Settings

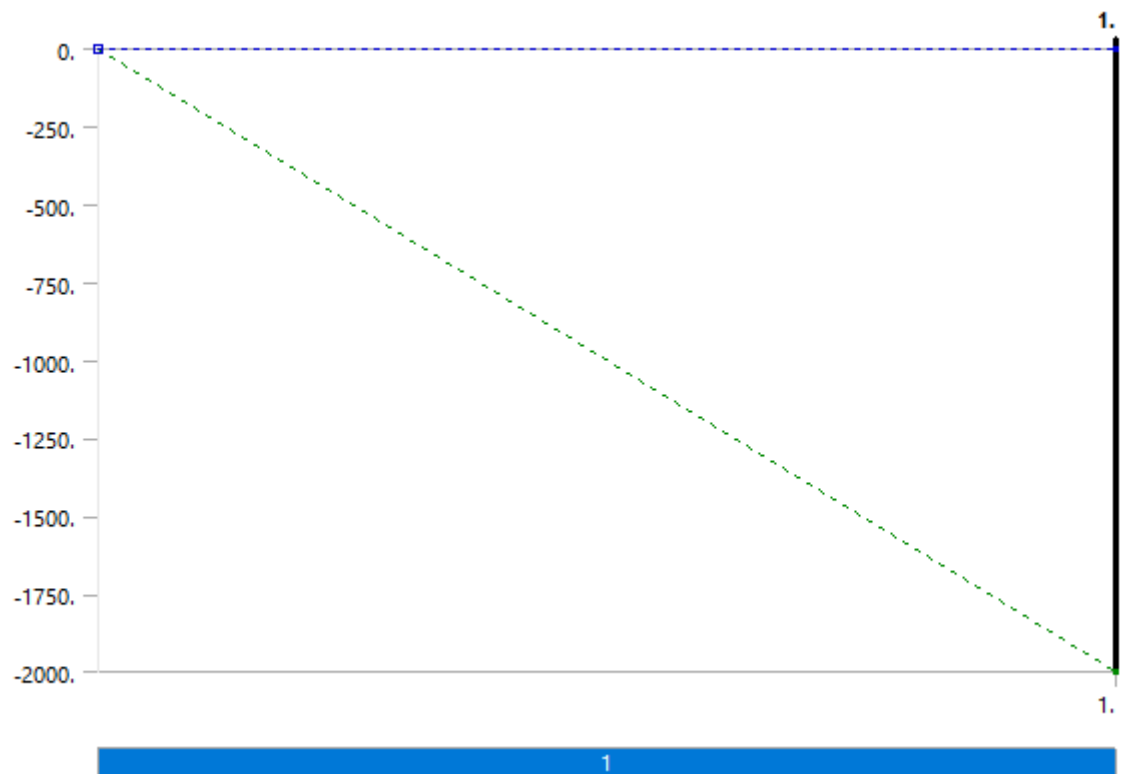
| | |
|-------------------------------|--------------------------|
| Object Name | <i>Analysis Settings</i> |
| State | Fully Defined |
| Step Controls | |
| Number Of Steps | 1. |
| Current Step Number | 1. |
| Step End Time | 1. s |
| Auto Time Stepping | Program Controlled |
| Solver Controls | |
| Solver Type | Program Controlled |
| Weak Springs | Off |
| Solver Pivot Checking | Program Controlled |
| Large Deflection | Off |
| Inertia Relief | Off |
| Quasi-Static Solution | Off |
| Rotordynamics Controls | |
| Coriolis Effect | Off |
| Restart Controls | |
| Generate Restart Points | Program Controlled |
| Retain Files After Full Solve | No |
| Combine 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 | Program Controlled |
| Advanced | |
| Inverse Option | No |

| | |
|---------------------------------|--|
| Contact Split (DMP) | Off |
| Output Controls | |
| Stress | Yes |
| Surface Stress | No |
| Back Stress | No |
| Strain | Yes |
| Contact Data | Yes |
| Nonlinear Data | No |
| Nodal Forces | No |
| Volume and Energy | Yes |
| Euler Angles | Yes |
| General Miscellaneous | No |
| Contact Miscellaneous | No |
| Store Results At | All Time Points |
| Result File Compression | Program Controlled |
| Analysis Data Management | |
| Solver Files Directory | C:\Users\ADMIN\Static Stractral P1_files\dp0\SYS\MECH\ |
| Future Analysis | None |
| Scratch Solver Files Directory | |
| Save MAPDL db | No |
| Contact Summary | Program Controlled |
| Delete Unneeded Files | Yes |
| Nonlinear Solution | No |
| Solver Units | Active System |
| Solver Unit System | mks |

TABLE 11
Model (A4) > Static Structural (A5) > Loads

| | | |
|-------------------|--------------------|--------------------------|
| Object Name | Fixed Support | Force |
| State | Fully Defined | |
| Scope | | |
| Scoping Method | Geometry Selection | |
| Geometry | 1 Face | |
| Definition | | |
| Type | Fixed Support | Force |
| Suppressed | No | |
| Define By | | Components |
| Applied By | | Surface Effect |
| Coordinate System | | Global Coordinate System |
| X Component | | 0. N (ramped) |
| Y Component | | -2000. N (ramped) |
| Z Component | | 0. N (ramped) |

FIGURE 1
Model (A4) > Static Structural (A5) > Force



Solution (A6)

TABLE 12
Model (A4) > Static Structural (A5) > Solution

| | |
|---------------------------------|----------------------|
| Object Name | <i>Solution (A6)</i> |
| State | Solved |
| Adaptive Mesh Refinement | |
| Max Refinement Loops | 1. |
| Refinement Depth | 2. |
| Information | |
| Status | Done |
| MAPDL Elapsed Time | 9. s |
| MAPDL Memory Used | 439. MB |
| MAPDL Result File Size | 17.938 MB |
| Post Processing | |
| Beam Section Results | No |
| On Demand Stress/Strain | No |

TABLE 13
Model (A4) > Static Structural (A5) > Solution (A6) > Solution Information

| | |
|---------------------------------|-----------------------------|
| Object Name | <i>Solution Information</i> |
| State | Solved |
| Solution Information | |
| Solution Output | Solver Output |
| 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 |

TABLE 14
Model (A4) > Static Structural (A5) > Solution (A6) > Results

| | | |
|---------------------------|--------------------|-------------------------------|
| Object Name | Total Deformation | Equivalent Stress |
| State | Solved | |
| Scope | | |
| Scoping Method | Geometry Selection | |
| Geometry | All Bodies | |
| Definition | | |
| Type | Total Deformation | Equivalent (von-Mises) Stress |
| By | Time | |
| Display Time | Last | |
| Calculate Time History | Yes | |
| Identifier | | |
| Suppressed | No | |
| Results | | |
| Minimum | 0. m | 3.1393e-002 Pa |
| Maximum | 3.8971e-006 m | 812.41 Pa |
| Average | 1.5571e-006 m | 151.89 Pa |
| Minimum Occurs On | Solid | |
| Maximum Occurs On | Solid | |
| Information | | |
| Time | 1. s | |
| Load Step | 1 | |
| Substep | 1 | |
| Iteration Number | 1 | |
| Integration Point Results | | |
| Display Option | | Averaged |
| Average Across Bodies | | No |

FIGURE 2
Model (A4) > Static Structural (A5) > Solution (A6) > Total Deformation

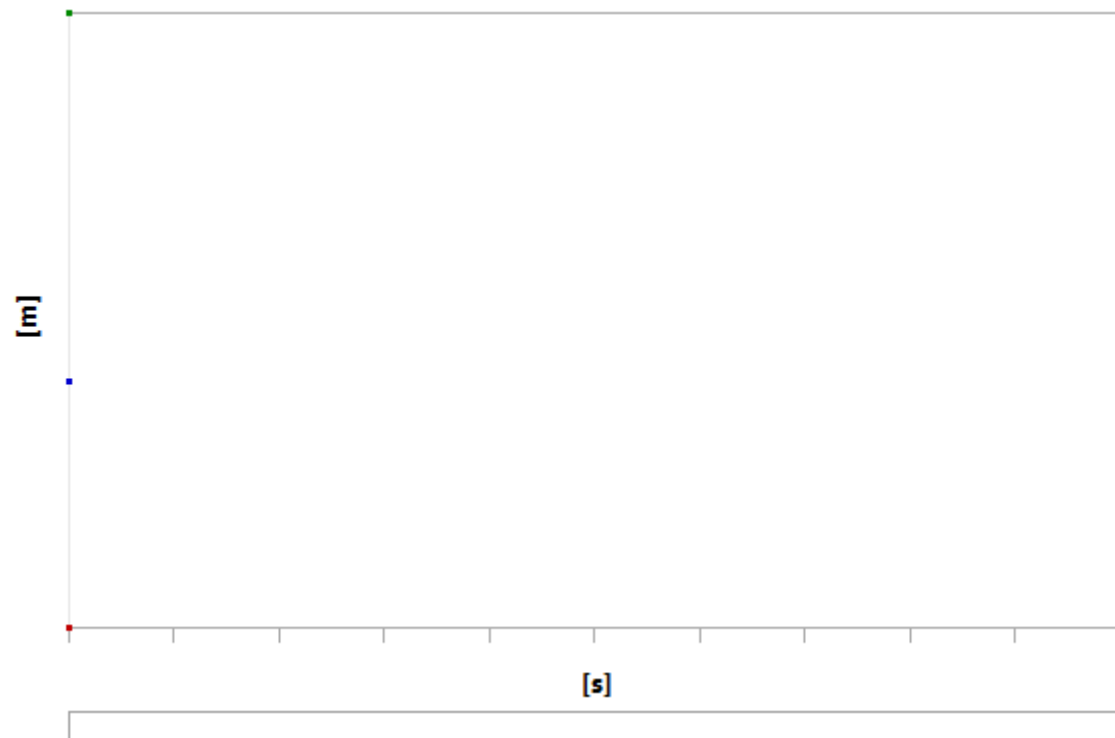


TABLE 15
Model (A4) > Static Structural (A5) > Solution (A6) > Total Deformation

| Time [s] | Minimum [m] | Maximum [m] | Average [m] |
|----------|-------------|-------------|-------------|
| 1. | 0. | 3.8971e-006 | 1.5571e-006 |

FIGURE 3
Model (A4) > Static Structural (A5) > Solution (A6) > Equivalent Stress

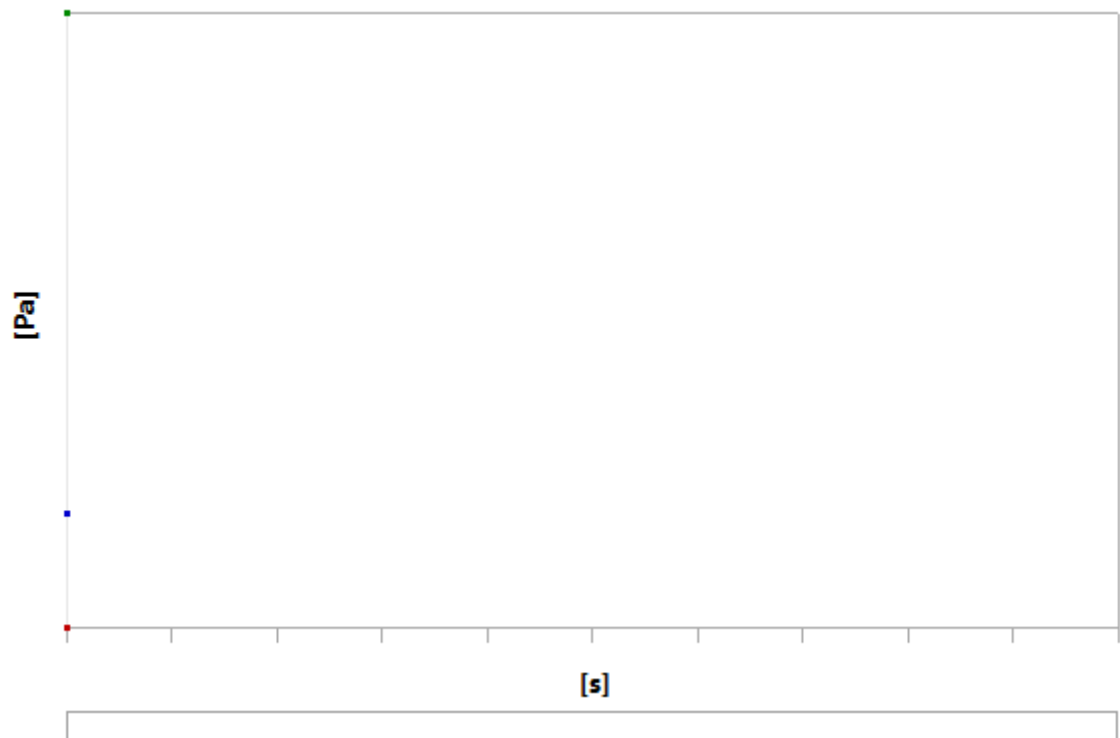


TABLE 16
Model (A4) > Static Structural (A5) > Solution (A6) > Equivalent Stress

| Time [s] | Minimum [Pa] | Maximum [Pa] | Average [Pa] |
|----------|--------------|--------------|--------------|
| 1. | 3.1393e-002 | 812.41 | 151.89 |

Material Data

Structural Steel

TABLE 17
Structural Steel > Constants

| | |
|----------------------------------|--|
| Density | 7850 kg m ⁻³ |
| Coefficient of Thermal Expansion | 1.2e-005 C ⁻¹ |
| Specific Heat | 434 J kg ⁻¹ C ⁻¹ |
| Thermal Conductivity | 60.5 W m ⁻¹ C ⁻¹ |
| Resistivity | 1.7e-007 ohm m |

TABLE 18
Structural Steel > Color

| Red | Green | Blue |
|-----|-------|------|
| 132 | 139 | 179 |

TABLE 19
Structural Steel > Compressive Ultimate Strength

| Compressive Ultimate Strength Pa |
|----------------------------------|
| 0 |

TABLE 20
Structural Steel > Compressive Yield Strength

| Compressive Yield Strength Pa |
|-------------------------------|
| 2.5e+008 |

TABLE 21
Structural Steel > Tensile Yield Strength

| Tensile Yield Strength Pa |
|---------------------------|
| 2.5e+008 |

TABLE 22
Structural Steel > Tensile Ultimate Strength

| Tensile Ultimate Strength Pa |
|------------------------------|
| 4.6e+008 |

TABLE 23
Structural Steel > Isotropic Secant Coefficient of Thermal Expansion

| Zero-Thermal-Strain Reference Temperature C |
|---|
| 22 |

TABLE 24
Structural Steel > S-N Curve

| Alternating Stress Pa | Cycles | Mean Stress Pa |
|-----------------------|---------|----------------|
| 3.999e+009 | 10 | 0 |
| 2.827e+009 | 20 | 0 |
| 1.896e+009 | 50 | 0 |
| 1.413e+009 | 100 | 0 |
| 1.069e+009 | 200 | 0 |
| 4.41e+008 | 2000 | 0 |
| 2.62e+008 | 10000 | 0 |
| 2.14e+008 | 20000 | 0 |
| 1.38e+008 | 1.e+005 | 0 |
| 1.14e+008 | 2.e+005 | 0 |
| 8.62e+007 | 1.e+006 | 0 |

TABLE 25
Structural Steel > Strain-Life Parameters

| Strength Coefficient Pa | Strength Exponent | Ductility Coefficient | Ductility Exponent | Cyclic Strength Coefficient Pa | Cyclic Strain Hardening Exponent |
|-------------------------|-------------------|-----------------------|--------------------|--------------------------------|----------------------------------|
| 9.2e+008 | -0.106 | 0.213 | -0.47 | 1.e+009 | 0.2 |

TABLE 26
Structural Steel > Isotropic Elasticity

| Young's Modulus Pa | Poisson's Ratio | Bulk Modulus Pa | Shear Modulus Pa | Temperature C |
|--------------------|-----------------|-----------------|------------------|---------------|
| 2.e+011 | 0.3 | 1.6667e+011 | 7.6923e+010 | |

TABLE 27
Structural Steel > Isotropic Relative Permeability

| Relative Permeability |
|-----------------------|
| 10000 |