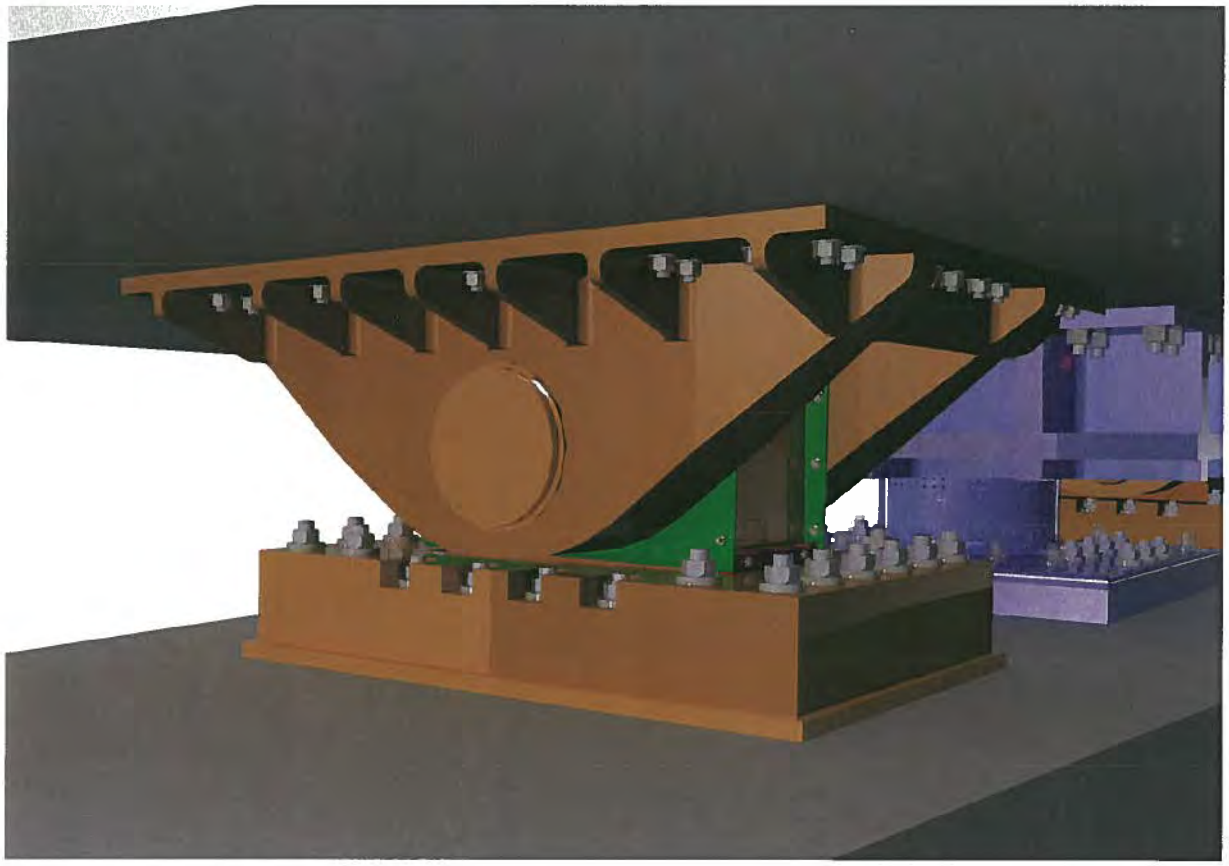
San Francisco-Oakland Bay Bridge

Self-Anchored Suspension Span (SFOBB-SAS)

THE SAN FRANCISCO-OAKLAND
BAY BRIDGE
SEISMIC SAFETY PROJECTS



SEISMIC EVALUATION OF SAS AT E2 BENT PRIOR TO COMPLETION OF SHEAR KEYS S1 & S2

July 9, 2013

T.Y. LIN INTERNATIONAL
MOFFATT & NICHOL ENGINEERS
a joint venture

To all:

This is the text I offer based on the request you gave me. I really tried to keep it short and simple but at the same time incorporate some meat (via numbers that could be backed up). Please recognize that if we get ABF to shim the bearings we can meet the basic 1500 year motions, but I don't get a confident plastic mechanism that I started pushing in the late 1980 from the offshore industry, which is good seismic design practice but not a statewide requirement (e.g., CT still uses shearwalls and seats).

It needs to be accompanied by an image of the Pier E2 bearings and shear keys, and likely a SAS GP to support references to Pier E2 and shear keys and bearings (e.g., S1-S2).

If you have any questions call me today I am headed to XKT and then the construction site.

Regards, brian

510-385-7648

This paper is to briefly summarize the safety of the Self-Anchored-Suspension bridge segment with respect to the expected performance of the San-Oakland Bay Bridge during a design level earthquake assuming the S1 and S2 shear key work currently underway is not fully completed by the time of seismic safety opening. In simplified terms, the bridge system between the orthotropic box girder superstructure and the concrete Pier E2 bentcap has enough strength capacity to carry 1500 year period design level earthquake motion generated shear forces, overwhelmingly driving a shift of public traffic to the replacement bridge from the old bridge based on a desire for public safety.

The bridge capacity to carry those demand loads at Pier E2 is overdesigned for 140% of the worst of six different 1500 year return period earthquake time-history generated loads. The design criteria of the East Spans of the Bay Bridge is based upon 1500 year return period motions, which excides the national standards of 1000 year return period motions. This can be read as there is a 40% extra capacity in the "as-designed" system at Pier E2 above the lifeline criteria that is above the national standard. In simple terms, the system at Pier E2 was not designed to the bare minimum and there was a significant reserve incorporated into the design that we should recognize at this time as leaders consider opening day alternatives. This extra design reserve is important to recognize when accounting for the fact that in construction there has developed a temporary reduction in capacity due to the Pier E2 threaded rod problem. The temporary reduction in strength capacity of the Pier E2 system due to the 2008 rods fractures is less than the overdesign. Therefore, leadership can advance increase public safety by opening the bridge as soon as feasible.

From bridge computer demand analysis models, earthquake lateral demands at the top of Pier E2 can be very simply summarized as 120 MN of force transversely and 50 MN of force longitudinally. If it is conservative assumed that the S1 and S2 shear keys are completely ineffective, the S3 and S4 shear keys are only effective in the transverse direction and the B1, B2, B3 and B4 bearings are temporarily shimmed to engage them at zero relative displacement, lateral capacity to carry the 120 lateral demand is estimated at [2 * (42) + 4 * (30)] = 204 MN. Clearly, 204 MN is greater than 120 MN. Similarly, in the longitudinal direction the four shimmed bearings provide a capacity of [4 * (15)] = 60 MN and 60 MN is greater than 50 MN. These simple calculations demonstrate the new bridge provides well-above standard seismic safety even if the S1 and S2 shear key work is not complete.

The existing bridge is not design for the most basic "no-collapse" seismic safety criteria that is typically employed in modern bridge design. The old bridge is at risk in large Bay Area earthquakes as was demonstrated during the 1989 Loma Prieta Earthquake. The modest interim retrofit was developed to address the most fundamental seismic risks up to a limit of 25 million dollars. It was a good investment but was never intended to address long-term seismic risks associated with even a standard of 1000 year return period "no-collapse" criteria.

This summarizing discussion demonstrates that the San Francisco – Oakland Bay Bridge East Spans Replacement Structure offers significantly superior seismic safety to the public compared to the old bridge. From a technical perspective, it can be relatively easily concluded that the public should be moved onto the new structure at the first practical opportunity even if the S1 and S2 shear key work is not complete. It should be clear that the S1-S2 work is valuable as it provides the level of extra safety, reliability and toughness that was envisioned in the original design by bridge earthquake specialists and should be completed on an expedited schedule.

CCO No. 331 – E2 Bearing Shimming Details (883S1 of 1204)

Caltrans Metric

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	SF	80	13.2/13.9	883SI	1204

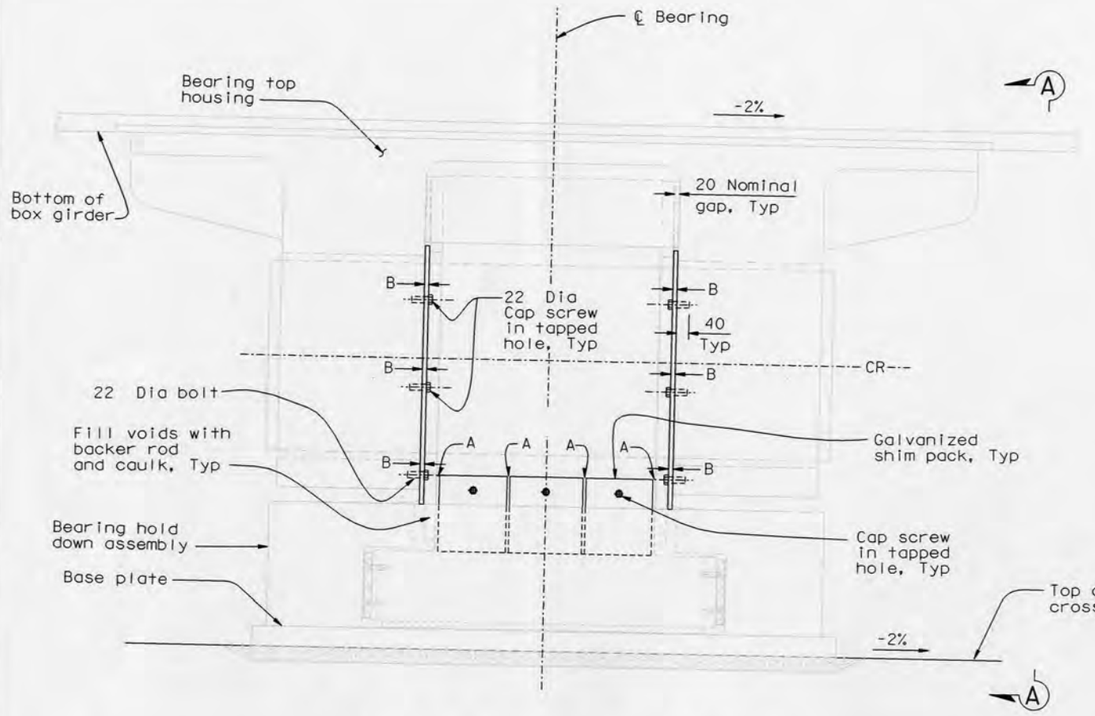
REGISTERED ENGINEER - CIVIL

07-03-13

PLANS APPROVAL DATE

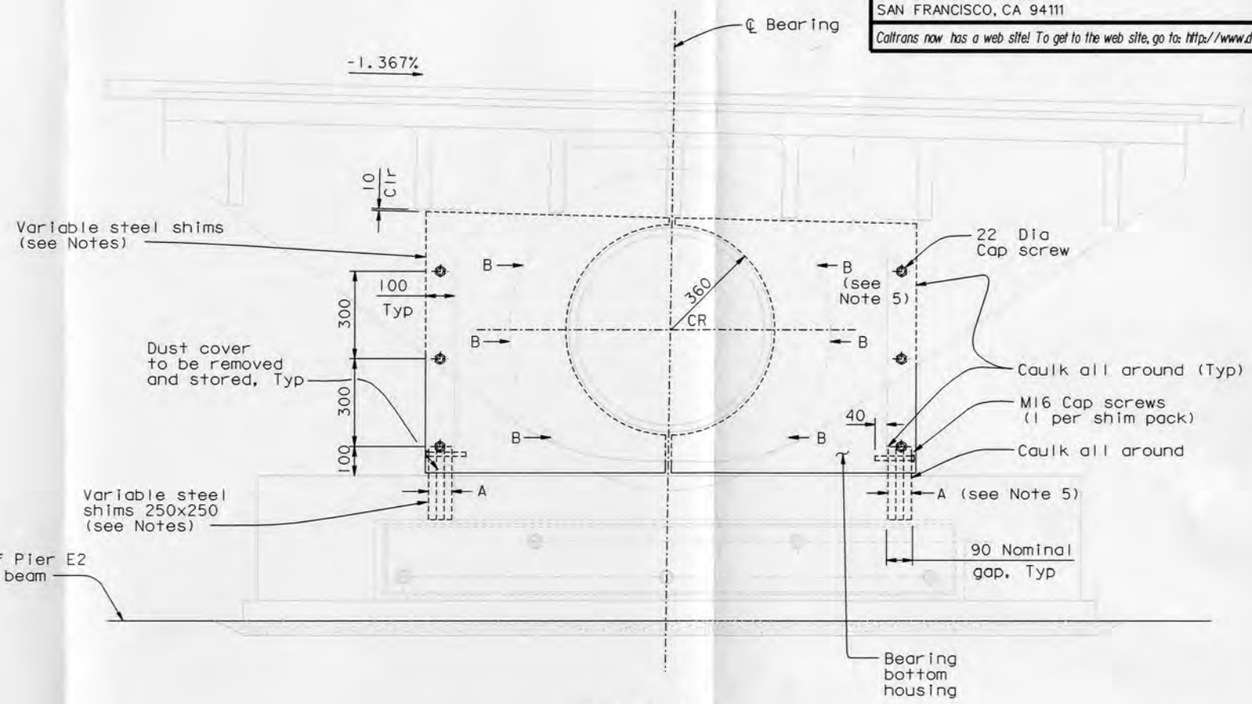
Registered Professional Engineer — Marwan N. Nader — No. C 054426 — Exp. 12/31/13 — CIVIL — State of California

T.Y. LIN / MOFFATT & NICHOL
825 BATTERY STREET
SAN FRANCISCO, CA 94111



DETAIL OF BEARING ASSEMBLY

1:10



VIEW A-A

1:10

INSTALLATION SEQUENCE FOR BEARING SHIMS:

NOTE: Shimming shall be completed prior to SSO.

1. On one OBG (EB or WB), install longitudinal and transverse shimming on both bearings.
2. On the same OBG and for one temporary bearing at a time, transfer the load to the permanent bearing and remove temporary bearing shimming. Repeat for both temporary bearings.
3. Repeat Steps 1 & 2 for the remaining OBG.

NOTES:

1. Shims shall be galvanized.
2. Each shim shall be PTFE coated on one side.
3. Provide for each shim pack 4 shims tapered at 1/40 maximum, as required per survey.
4. Shim tight to within 2 mm, total of all plies.
5. Variable shims shall be fabricated and provided based on field measurements of gaps in the bearing assembly. Gap "A" in the lower housing is 90 mm nominal. Gap "B" in the upper housing is 20 mm nominal.

E2 BEARING SHIMMING

CONTRACT CHANGE ORDER NO. ____
SHEET ___ OF ___

REQUESTS FOR INFORMATION NOT ADDRESSED IN THIS CCO REMAIN IN FORCE

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

A. Akinsanya / W. Long
DESIGN OVERSIGHT
SIGN OFF DATE 07/03/13

MARK	DATE	DESCRIPTIONS	BY	CH'D	CCO#
0	07/03/13	SHIMMING OF E2 BEARINGS	GB	MN	331

REVISIONS

	BY	CHECKED
DESIGN	G. Baker	N. Vo
DETAILS	G. Baker	N. Vo
QUANTITIES	G. Baker	N. Vo

PREPARED FOR THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

M. Nader
PROJECT ENGINEER

BRIDGE NO. 34-0006L/R
KILOMETER POST 13.2/13.9

SAN FRANCISCO OAKLAND BAY BRIDGE
EAST SPAN SEISMIC SAFETY PROJECT
SELF-ANCHORED SUSPENSION BRIDGE
(SUPERSTRUCTURE & TOWER)

PIER E2 BEARING DETAILS NO. 1A

Rev. Date: 5-18-98

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04
EA 0120F1

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 07/03/13

SHEET 466SI OF

FILE => L:\BB\04-012001\SAS\Contract Plans and CCO\CCO\CCO#331\1-Original 07-01-13\DGN\akbrg01a.dgn

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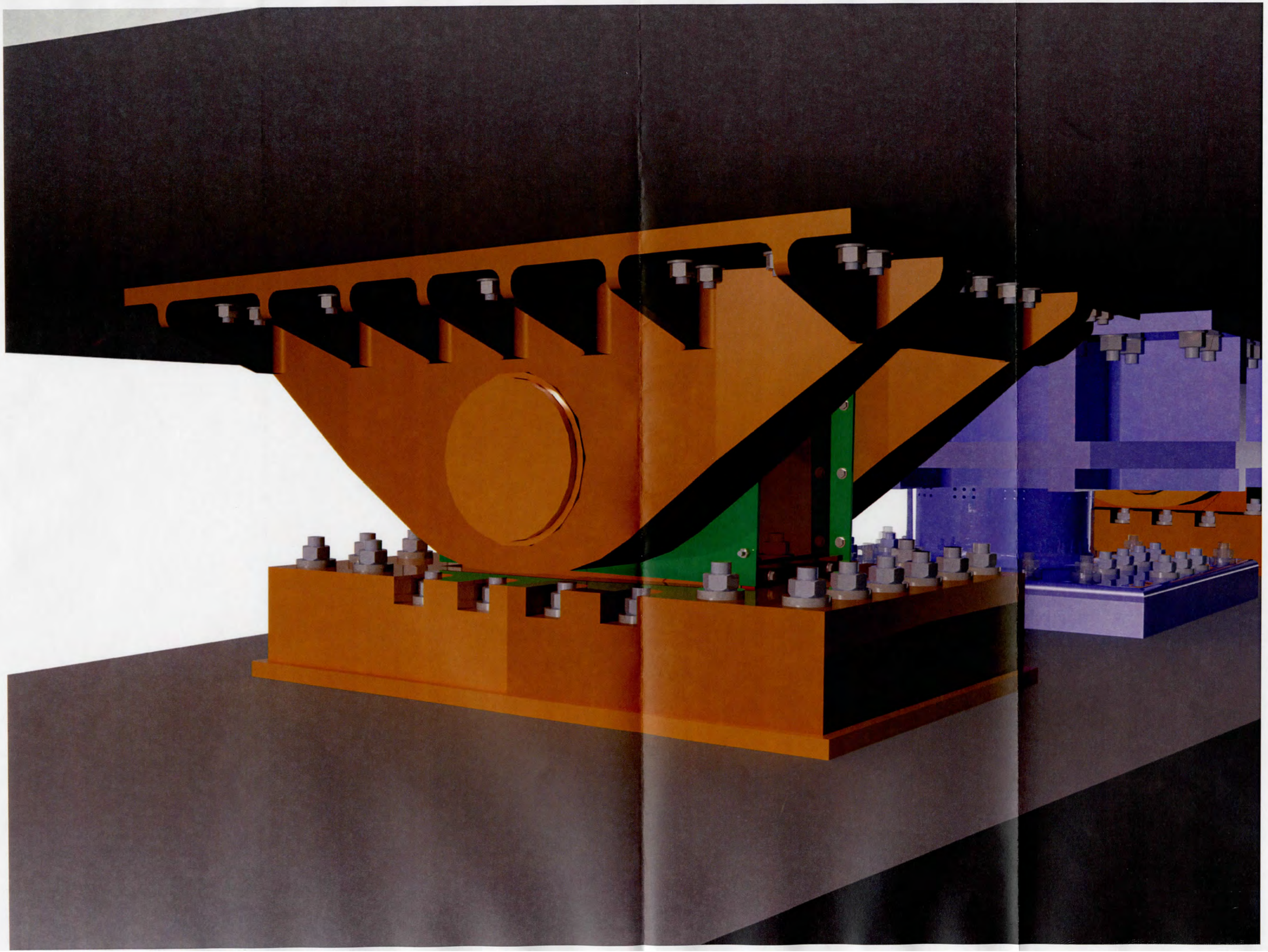
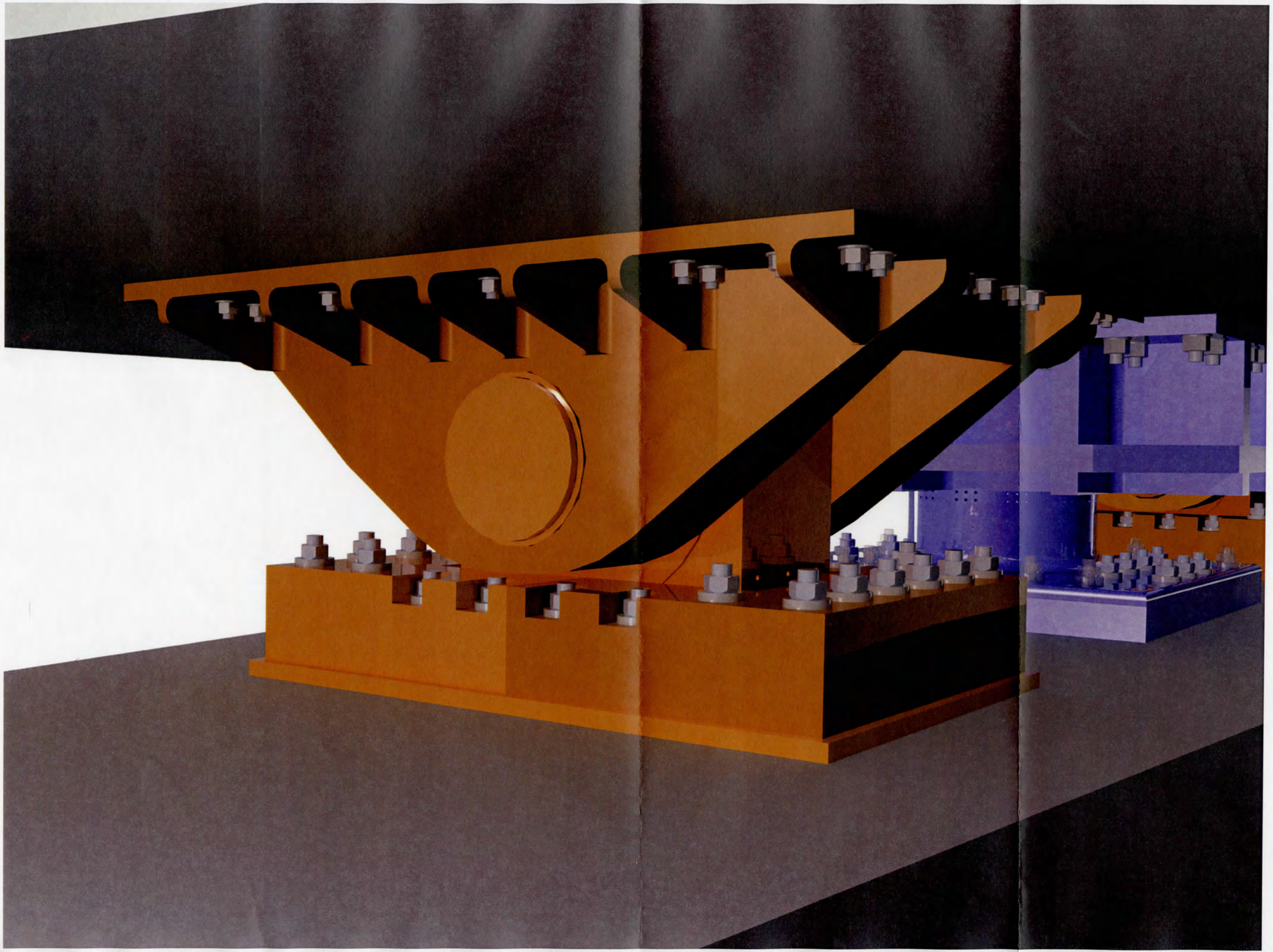
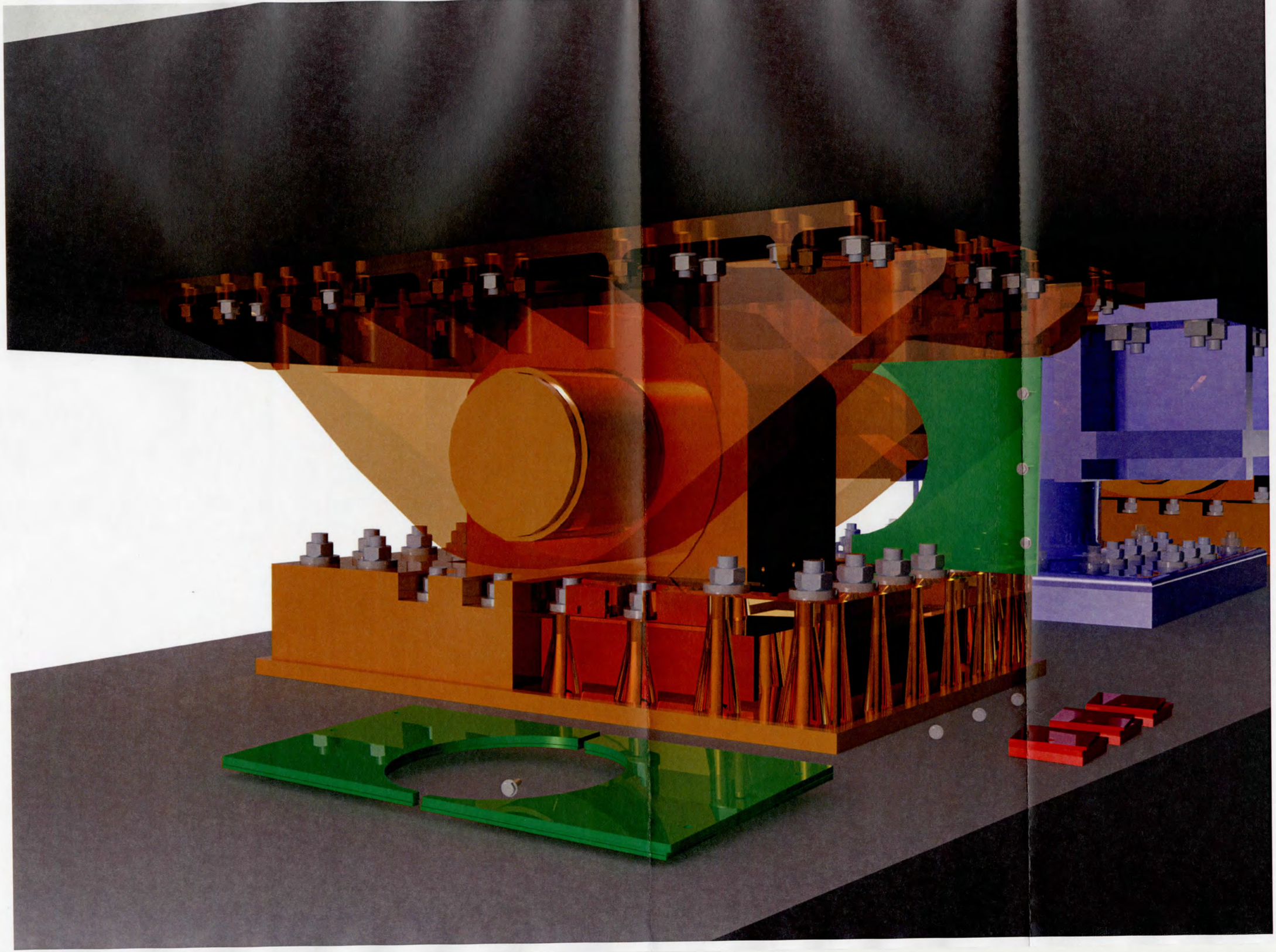
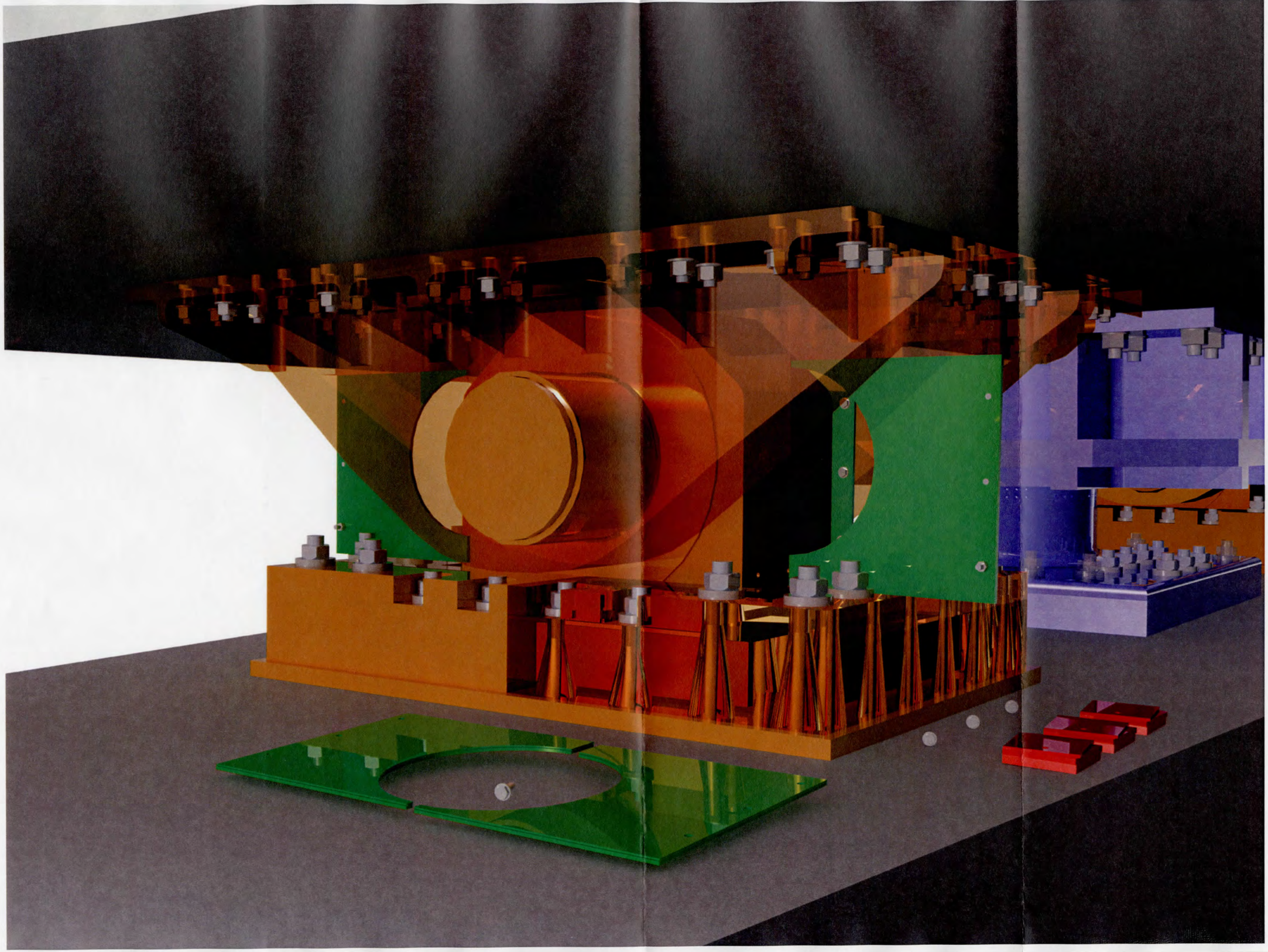
USERNAME => orivero

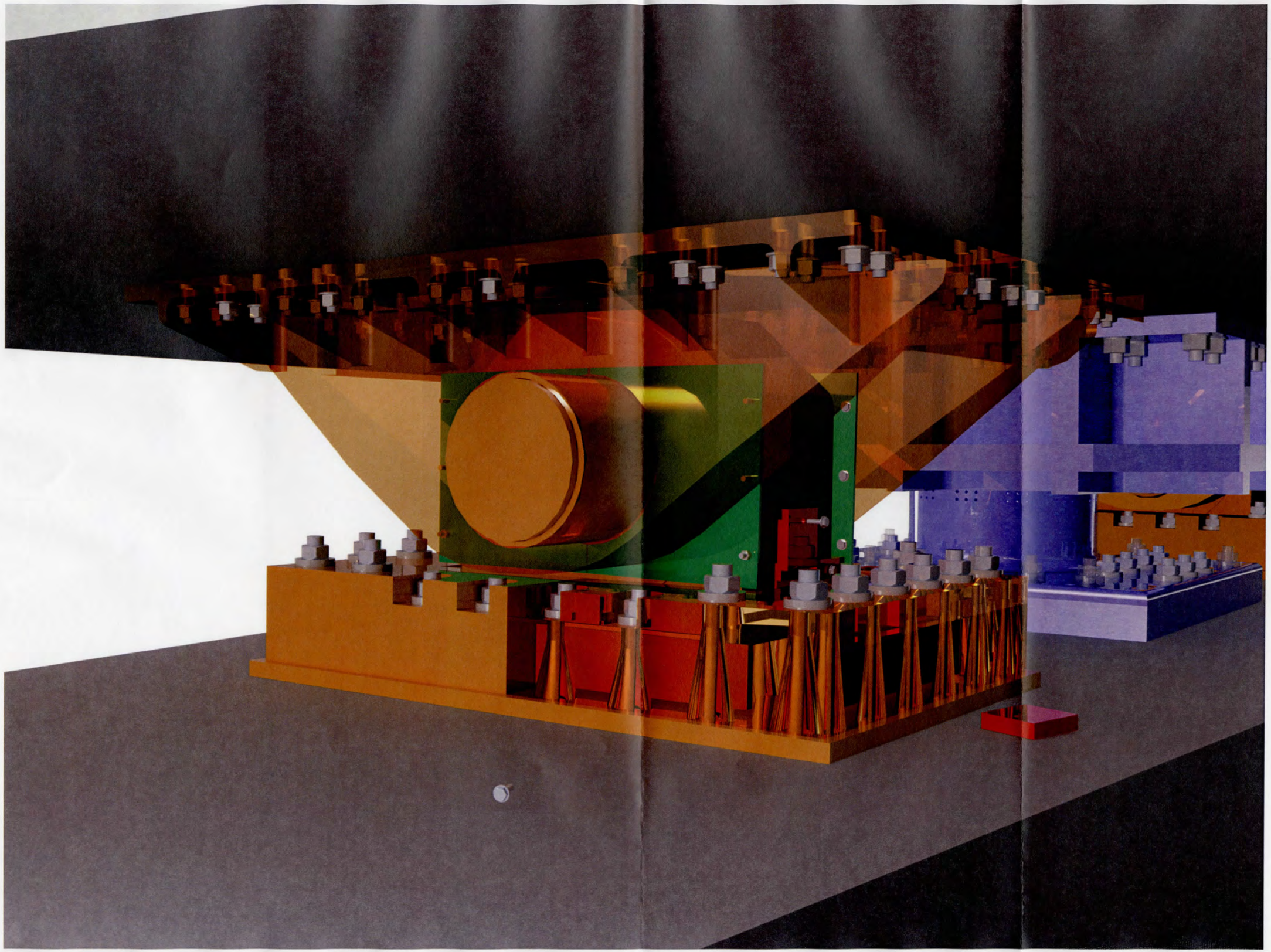
Shim Installation Sequence

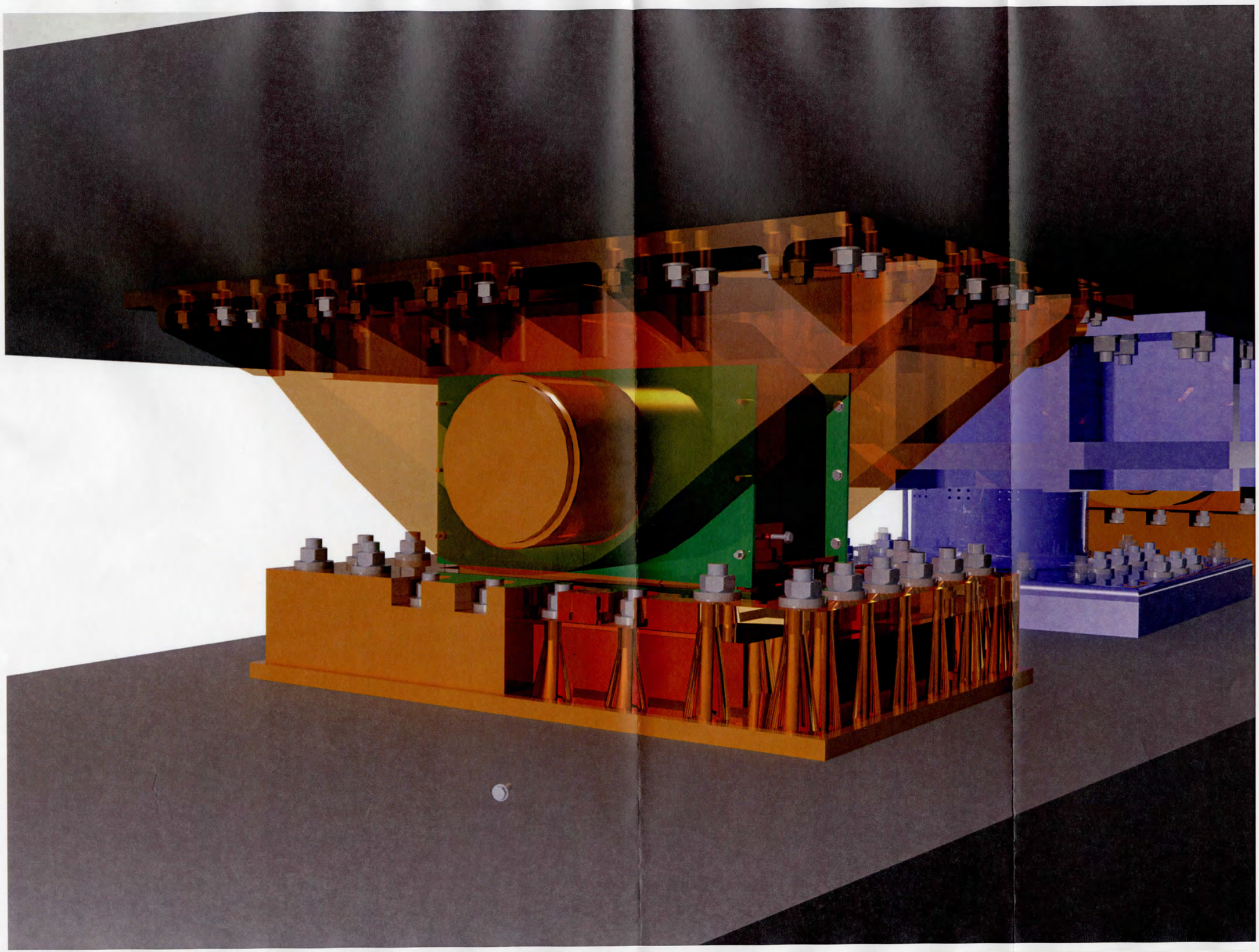




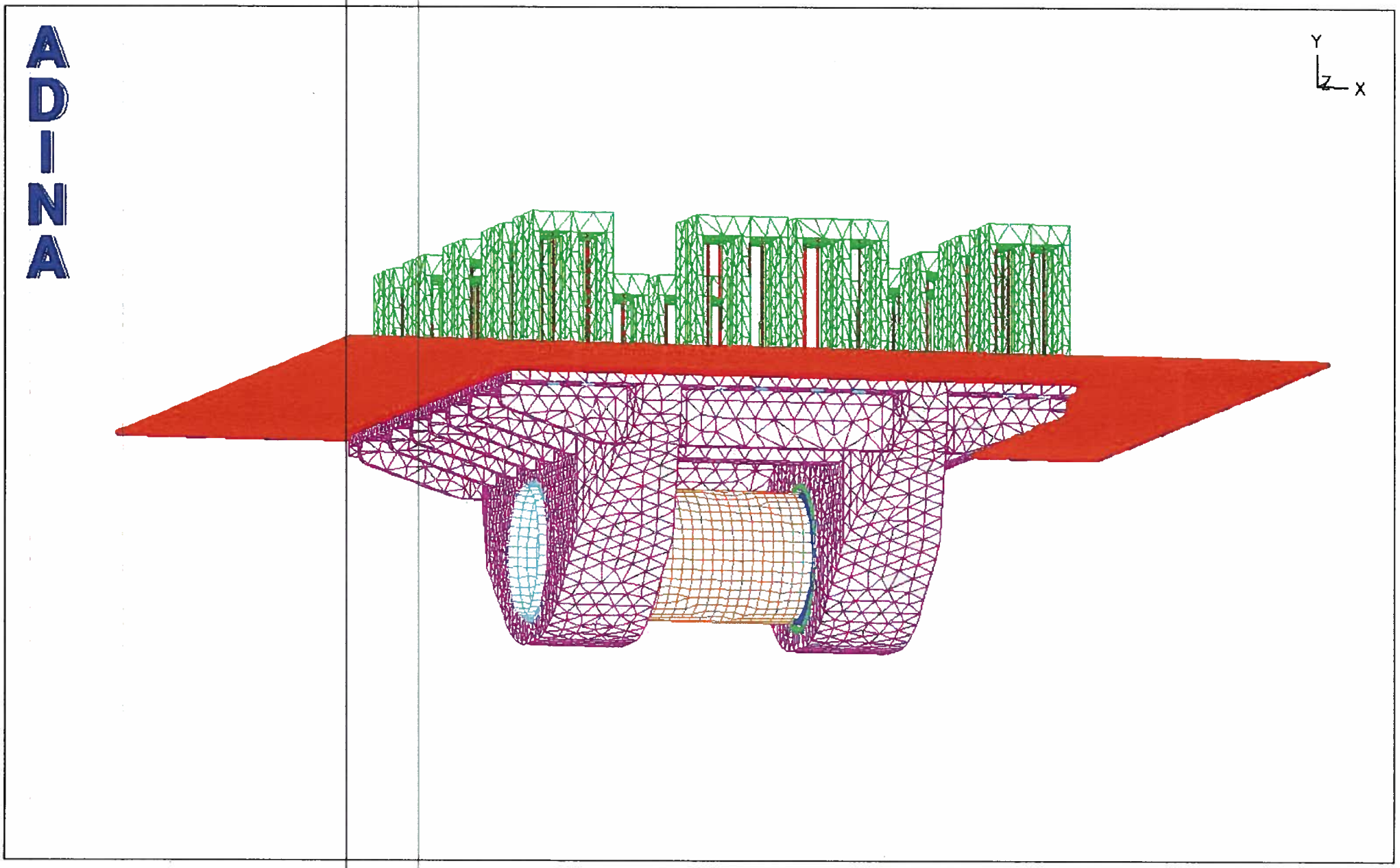








Upper Housing FEM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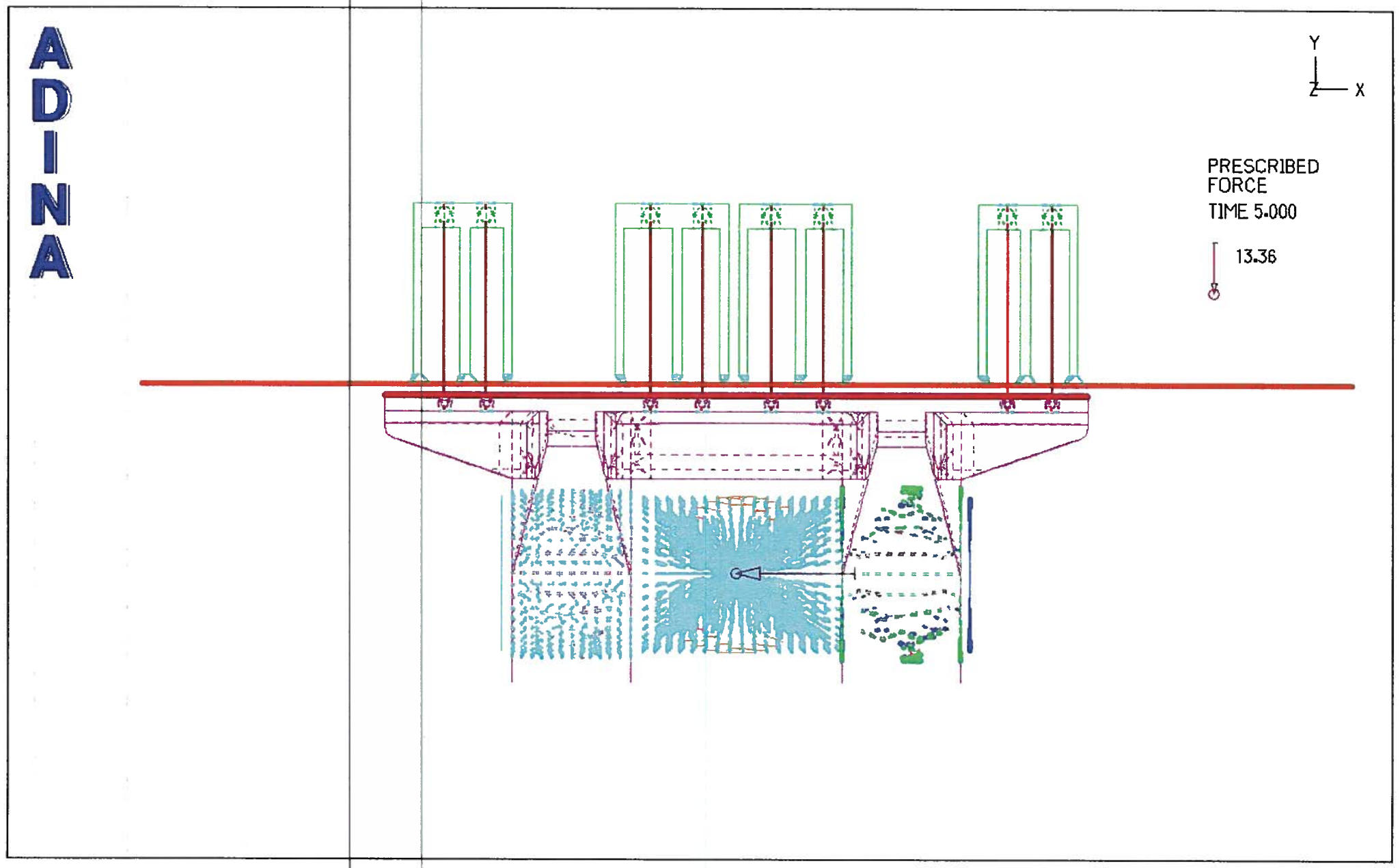
Z
X


ADINA
Y
Z
X
PRESCRIBED
FORCE
TIME 5.000
13.36

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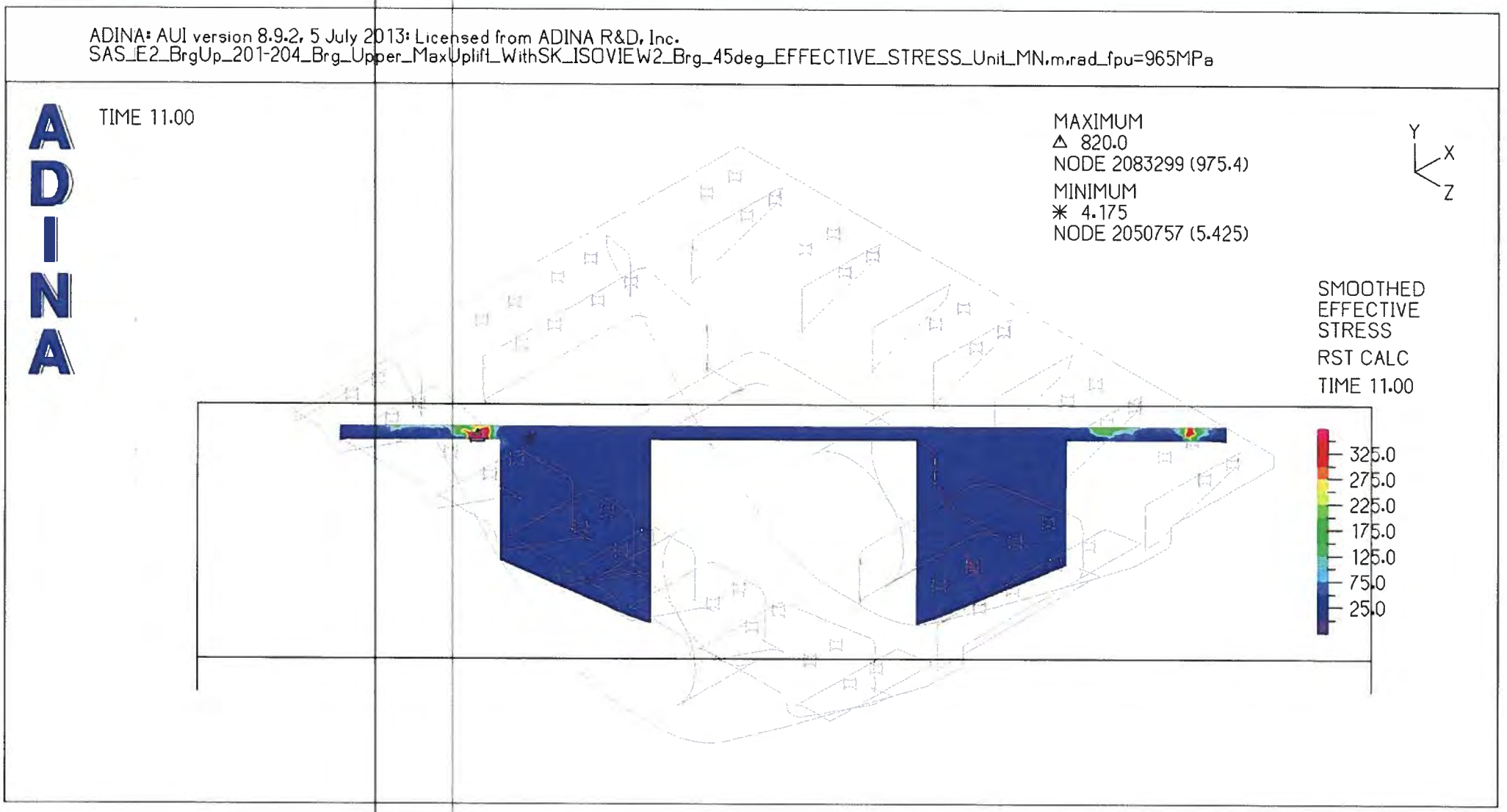

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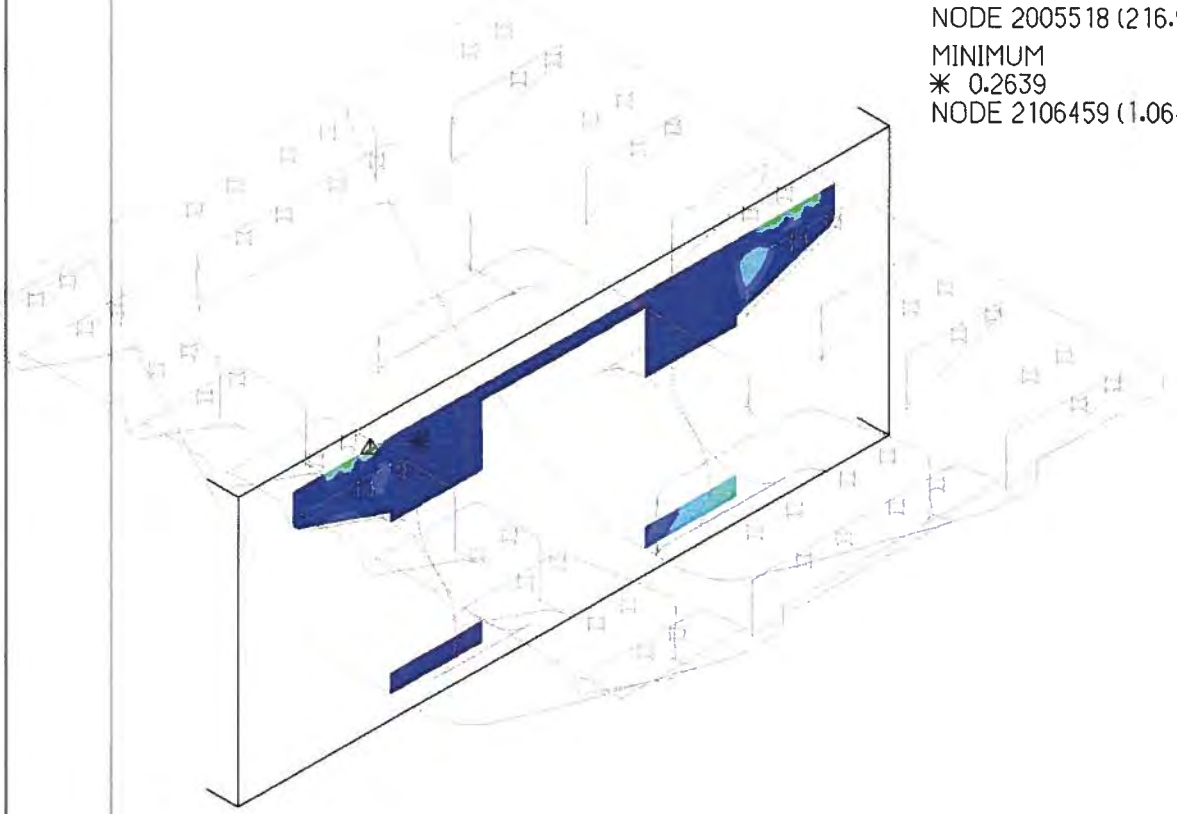

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NODE 2005518 (216.9)
MINIMUM
✳ 0.2639
NODE 2106459 (1.064)

Y
X
Z

SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 11.00

325.0
275.0
225.0
175.0
125.0
75.0
25.0

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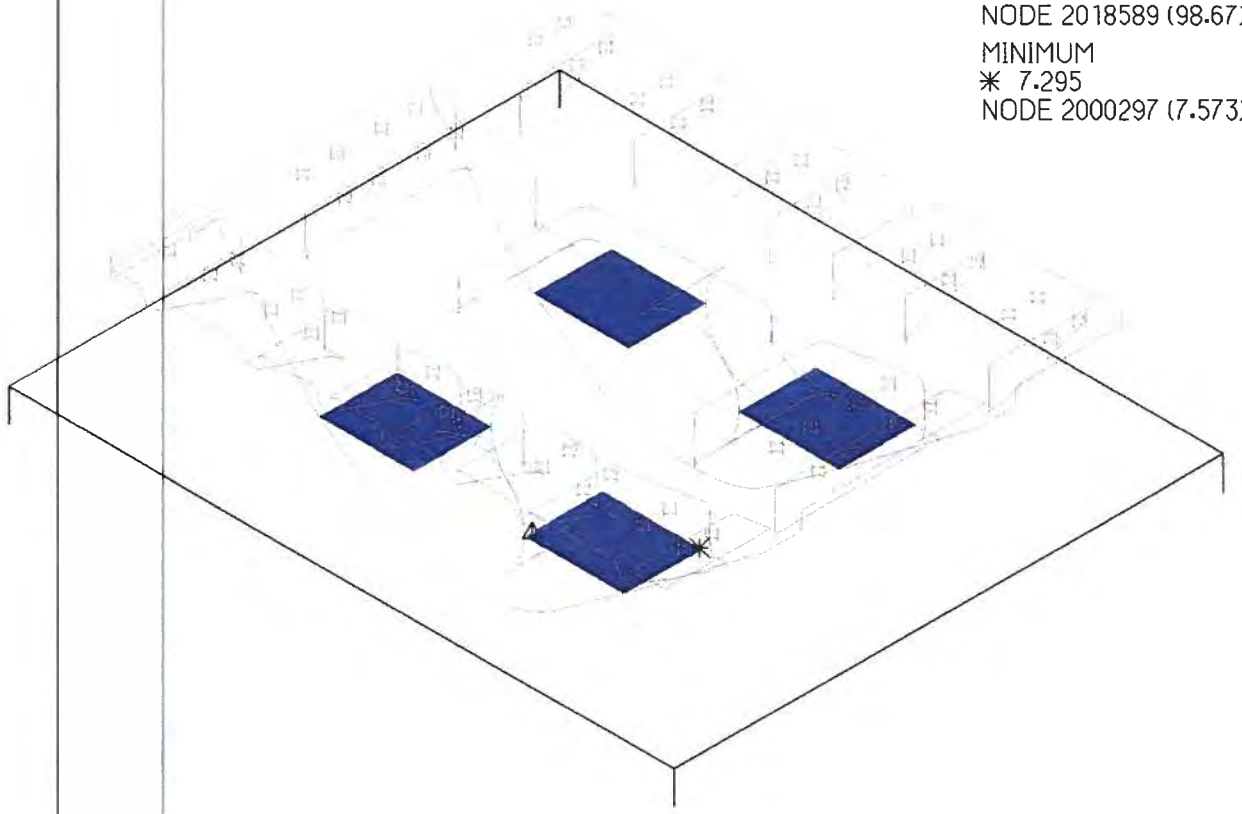

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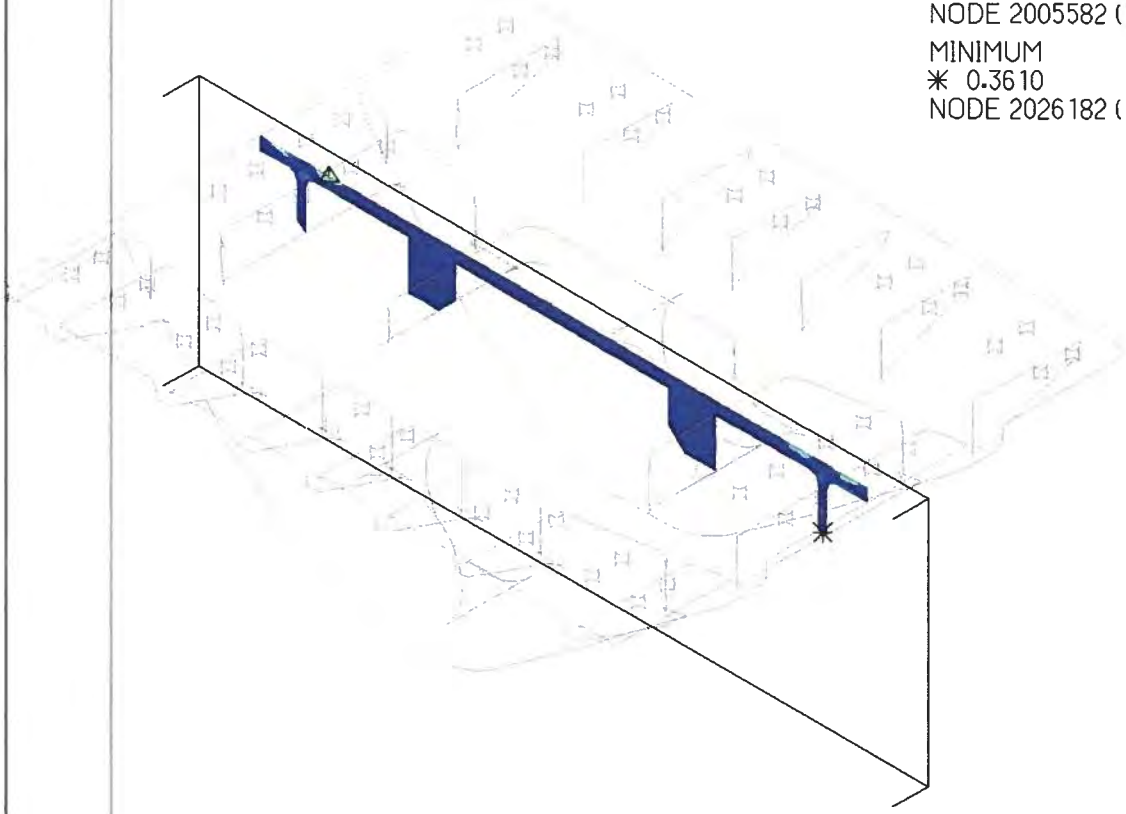

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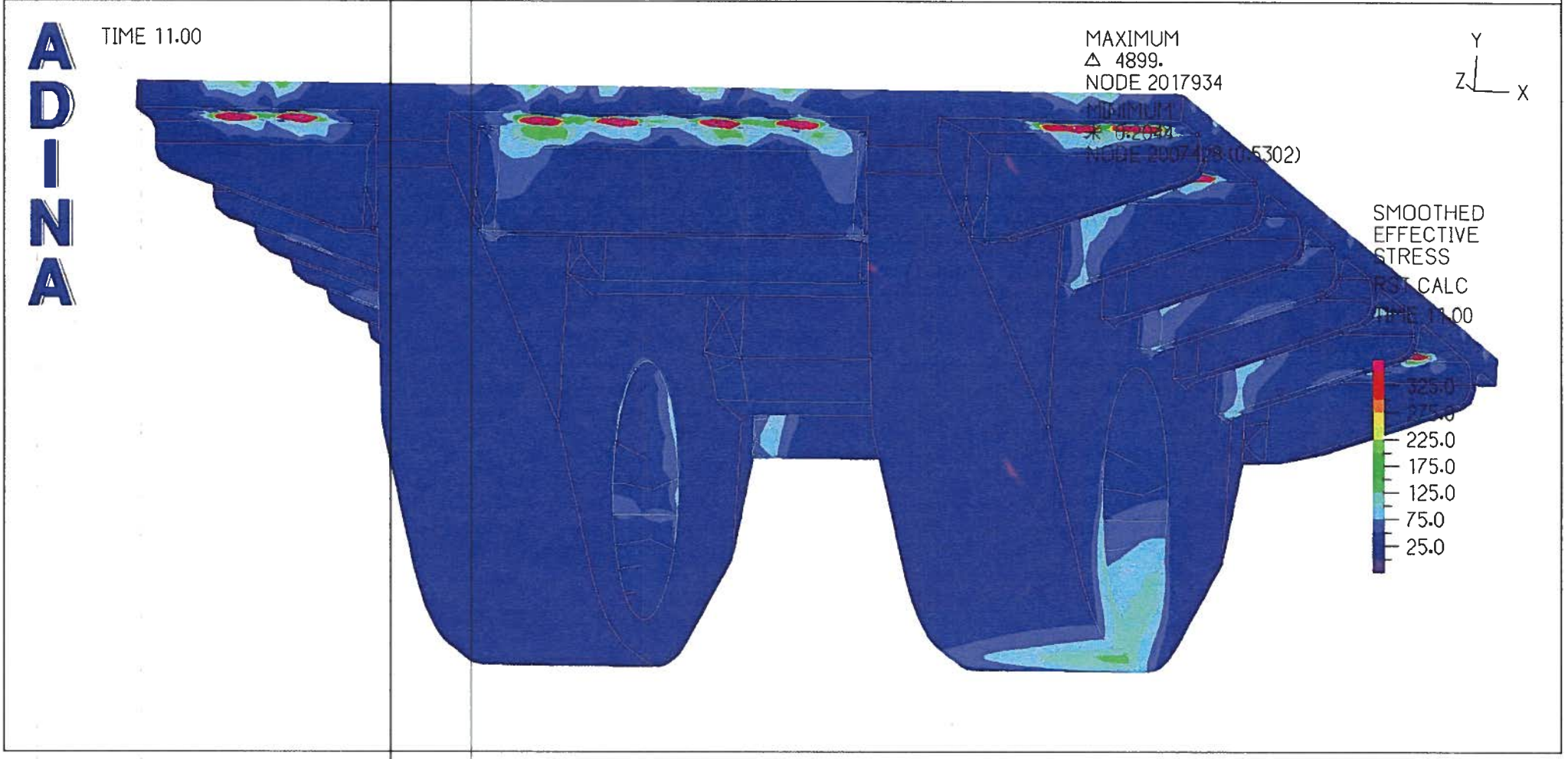

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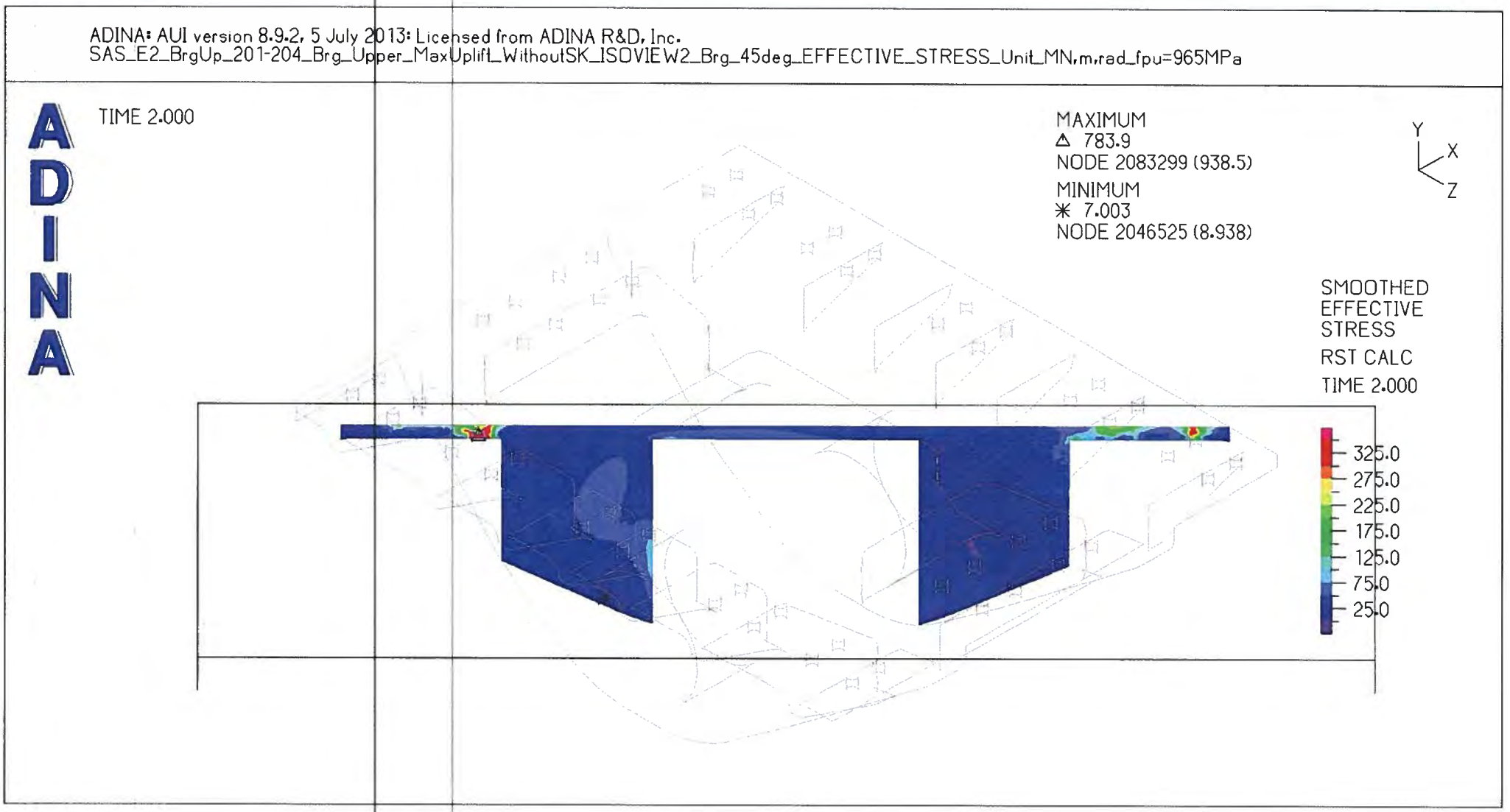

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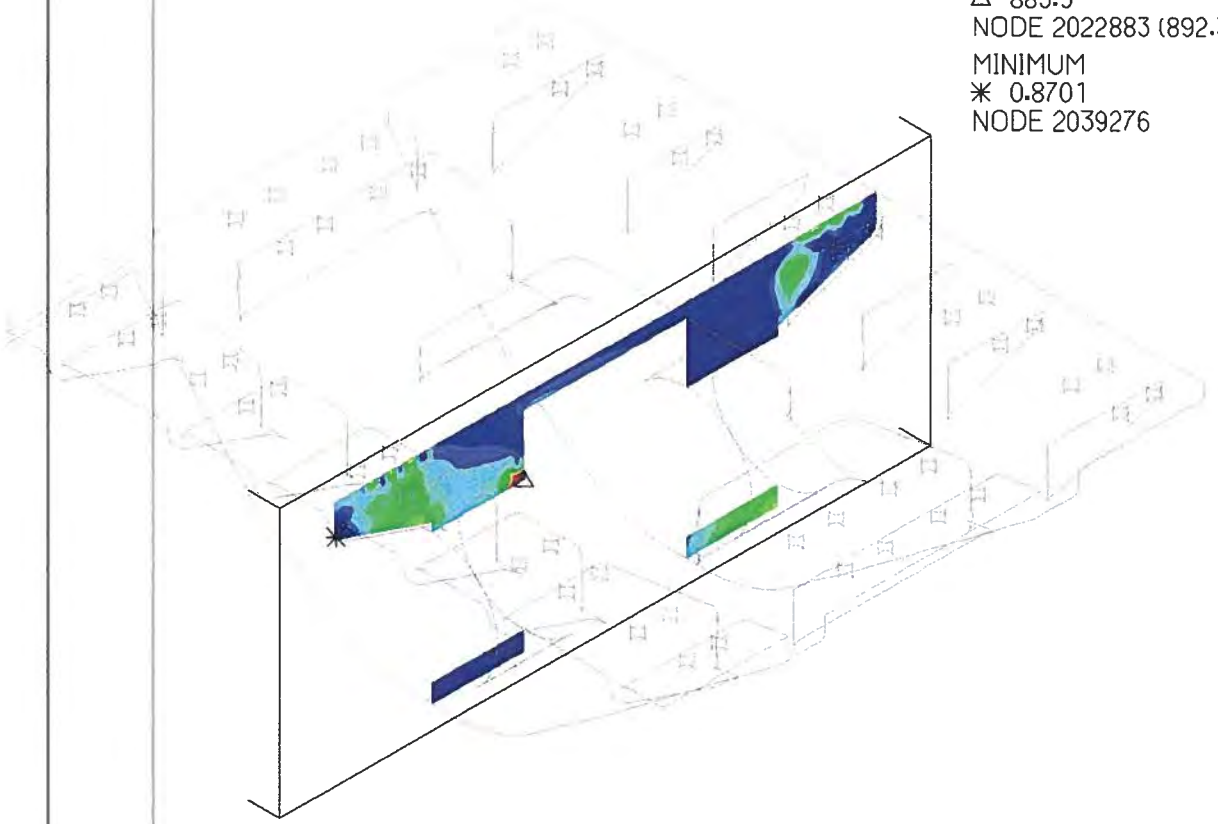

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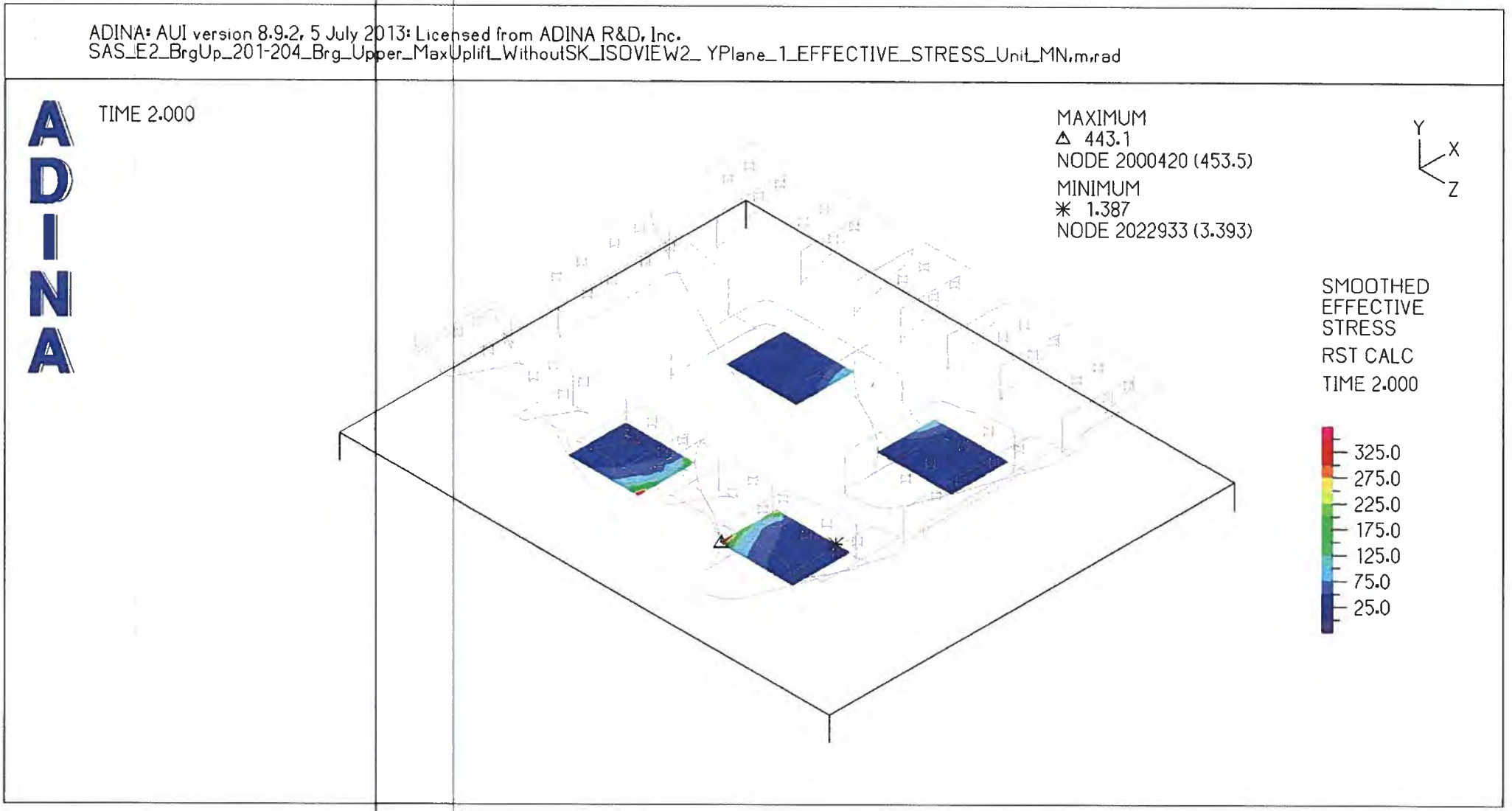

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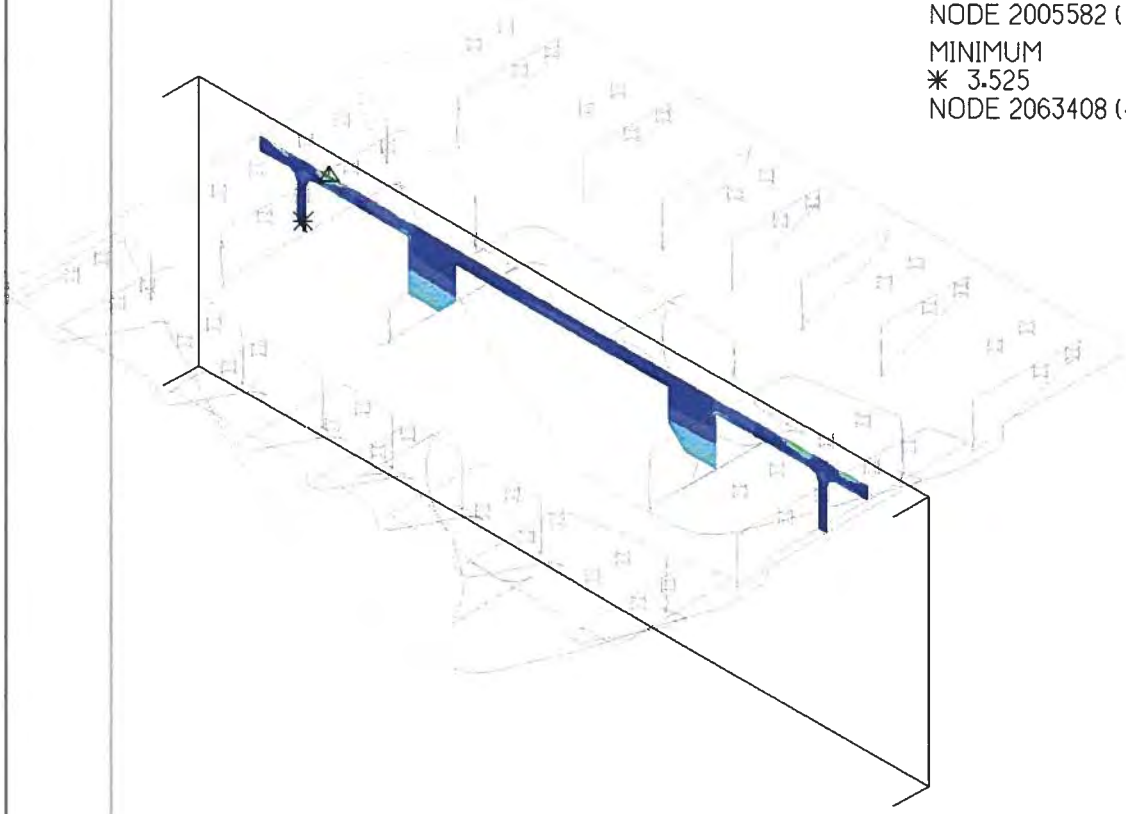

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△ 197.5
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MINIMUM
✳ 3.525
NODE 2063408 (4.618)

Y
X
Z

SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 2.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

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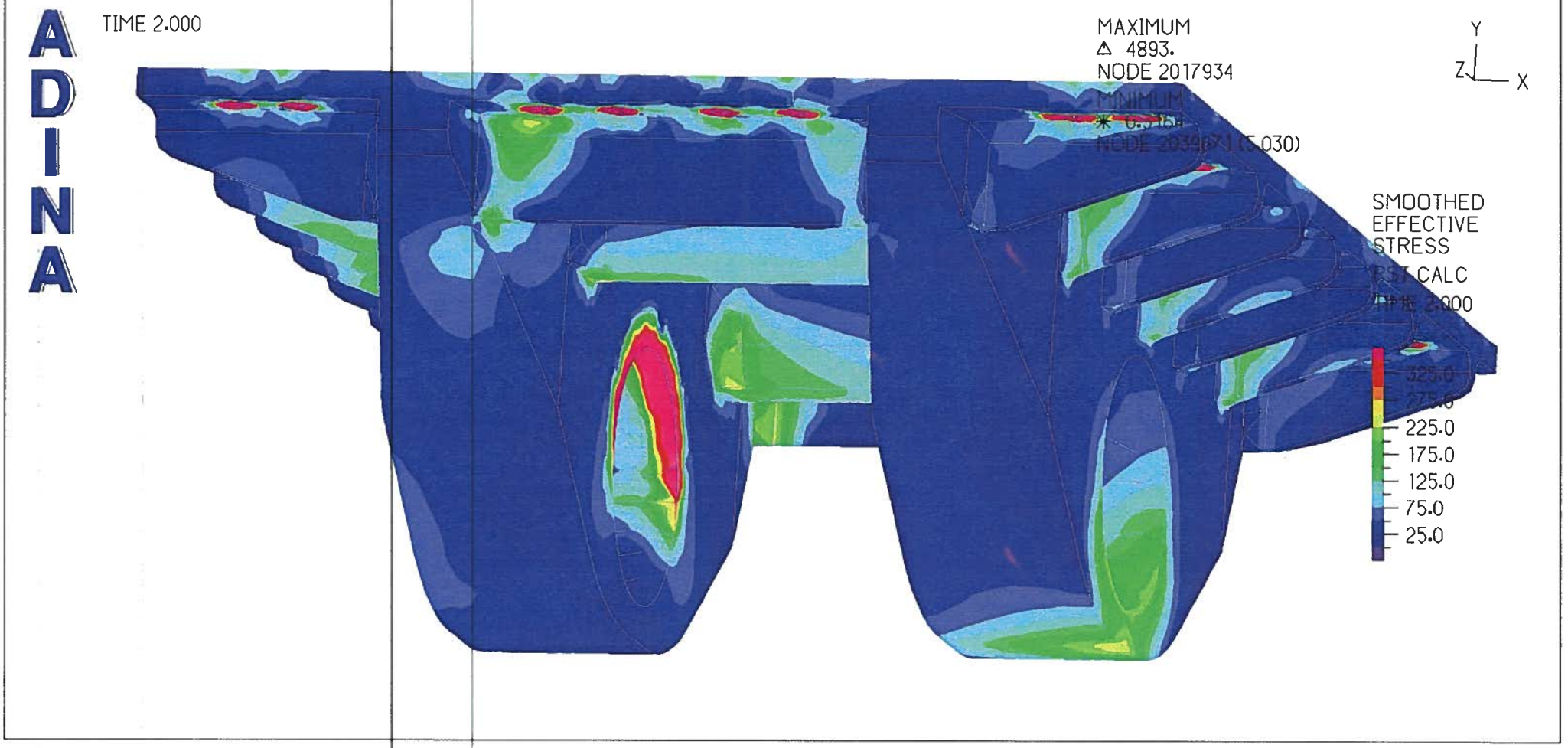

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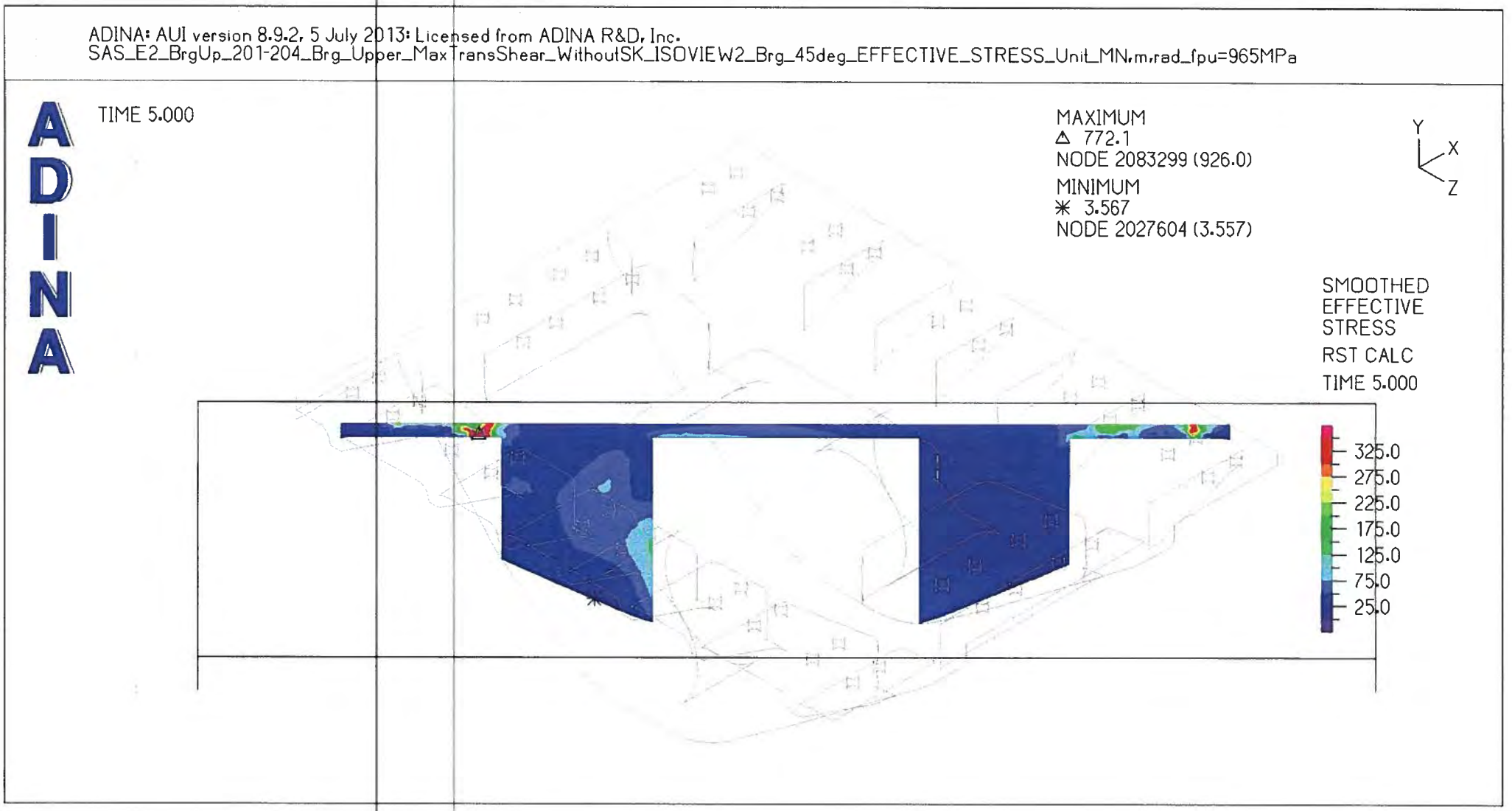

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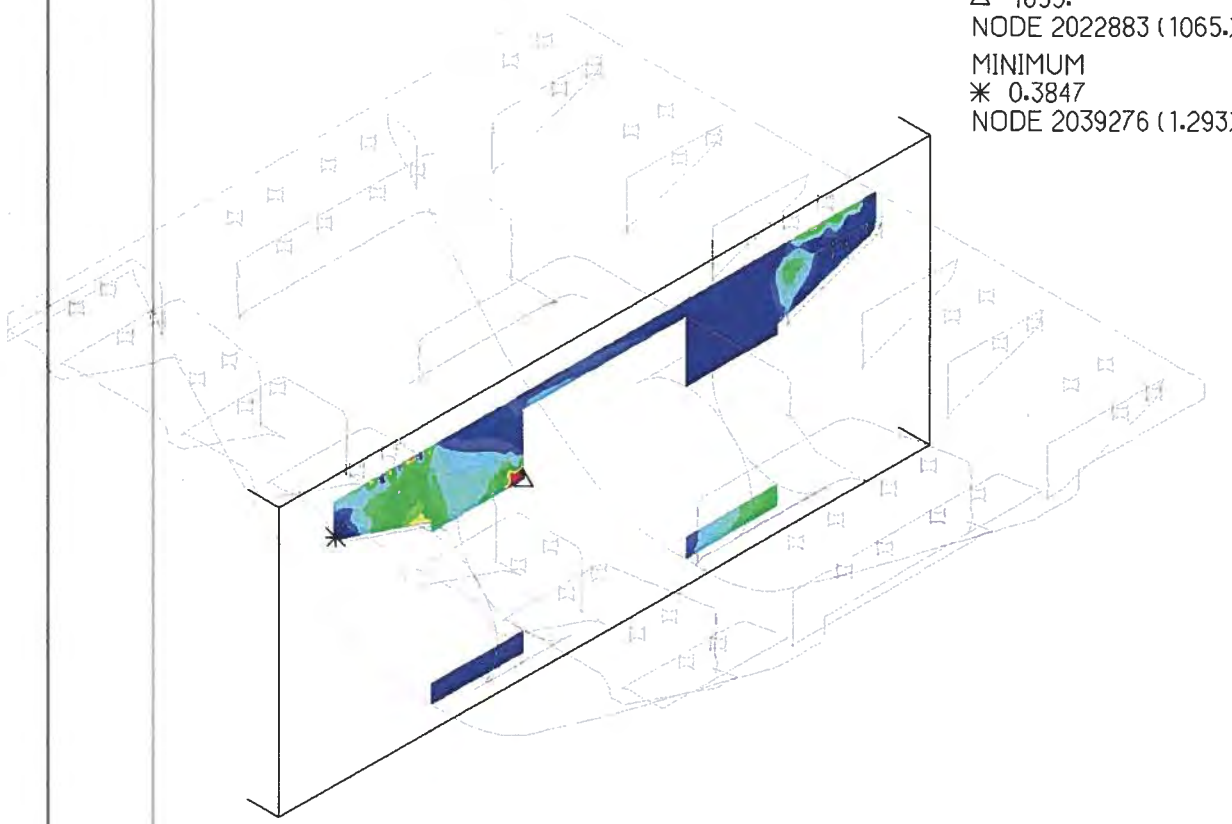

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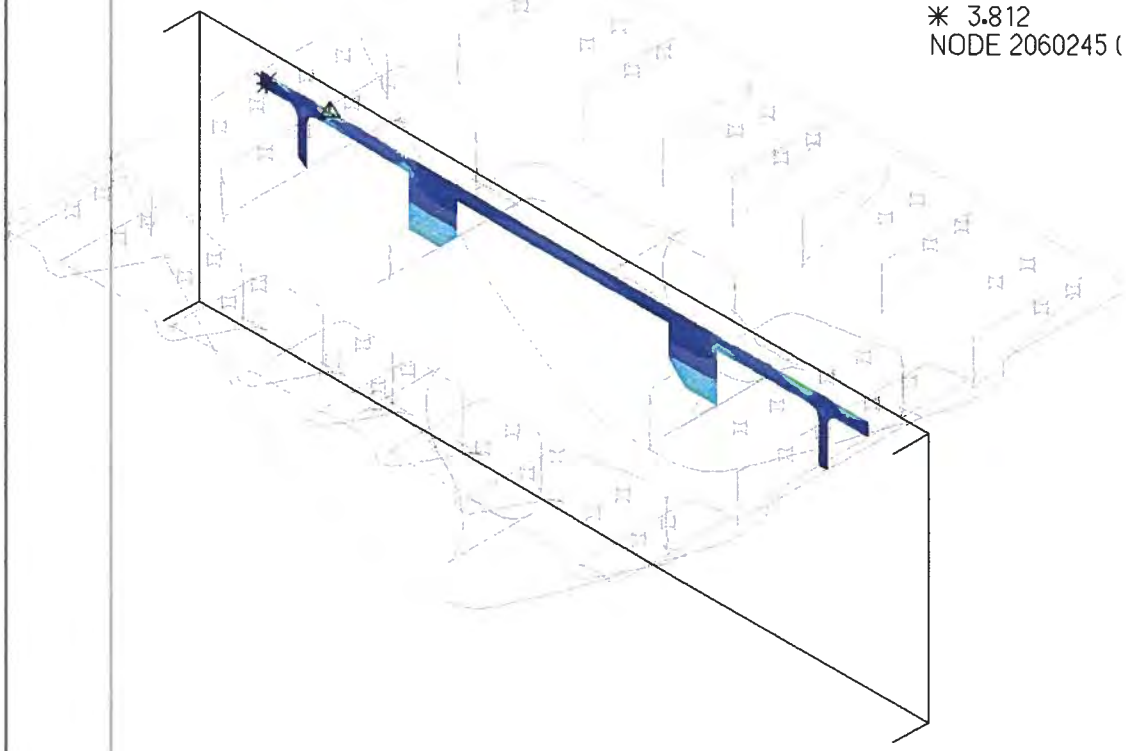

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MINIMUM
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NODE 2060245 (12.60)

Y
X
Z

SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 5.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

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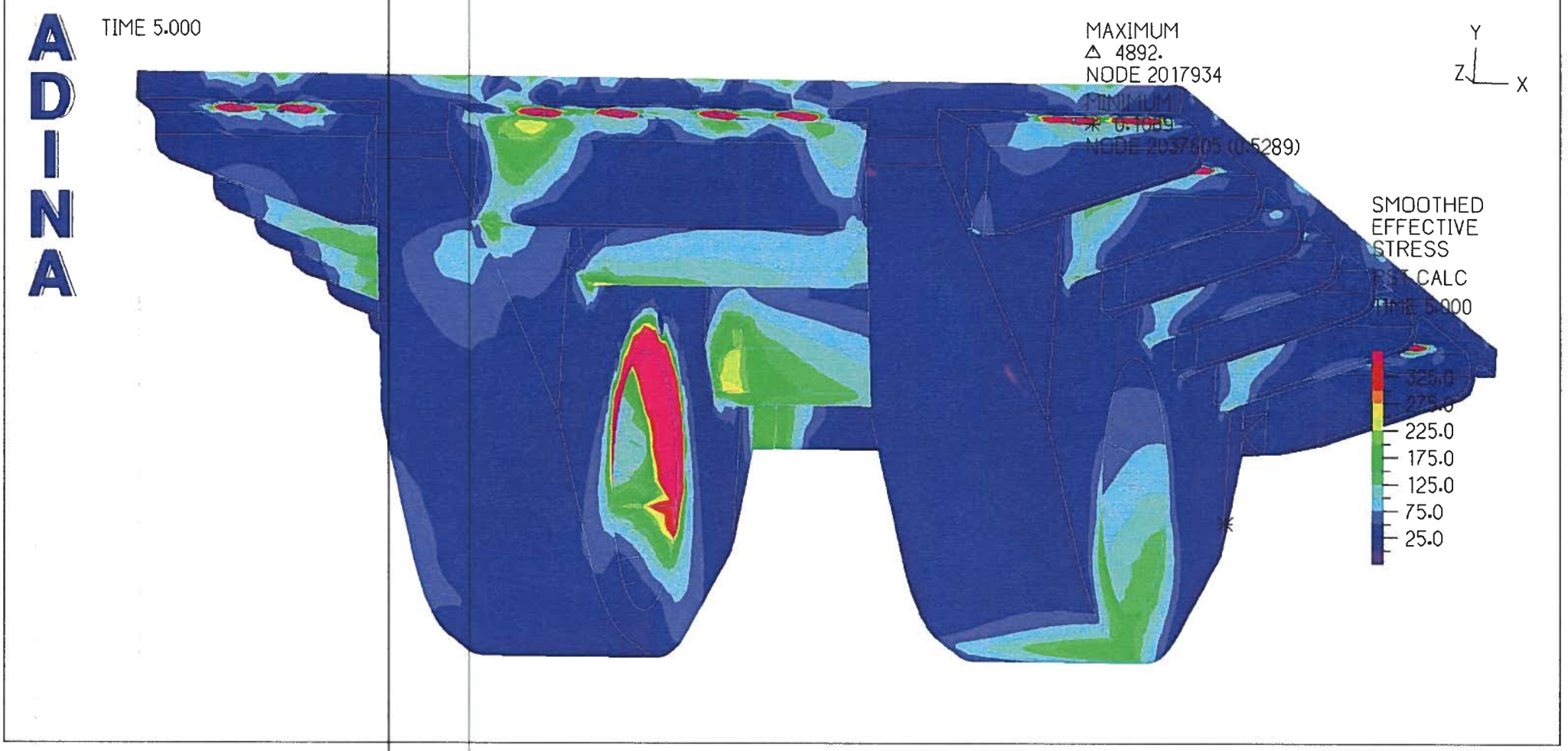

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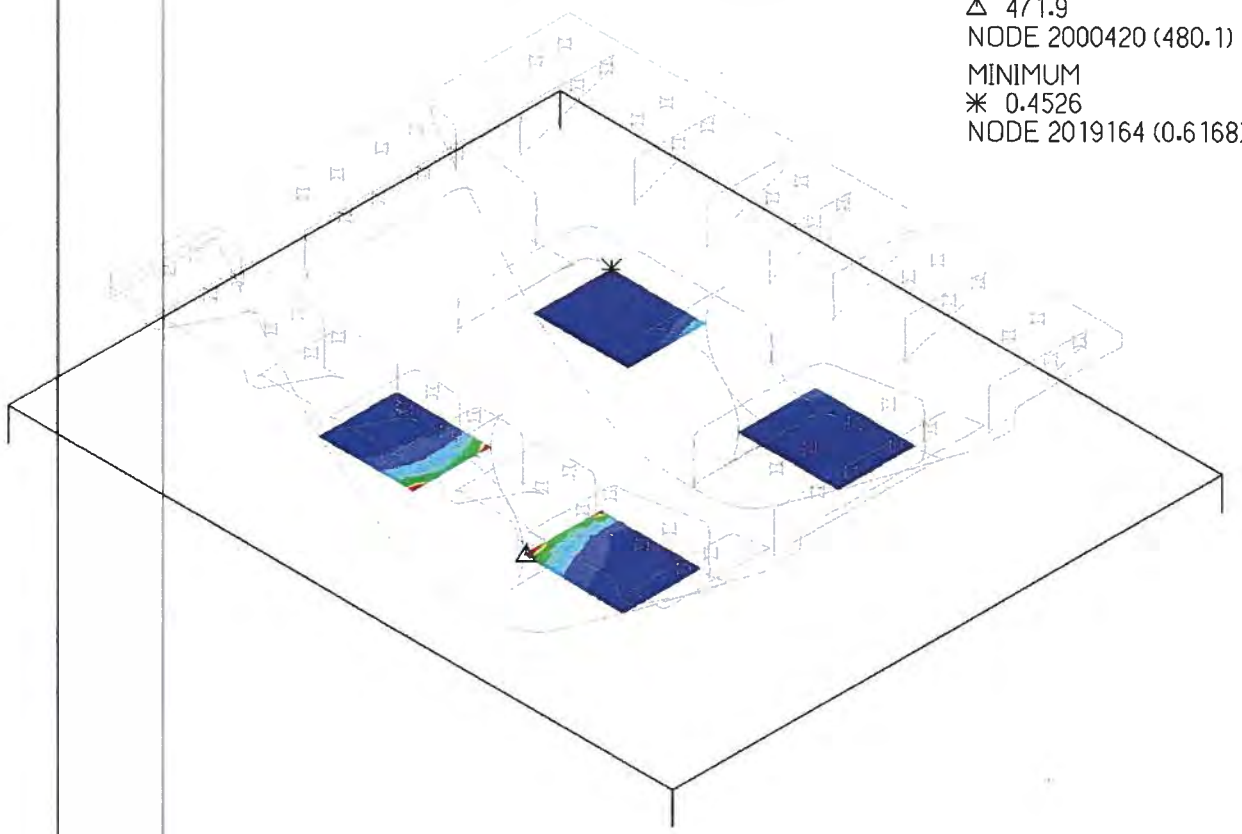
TIME 5.000



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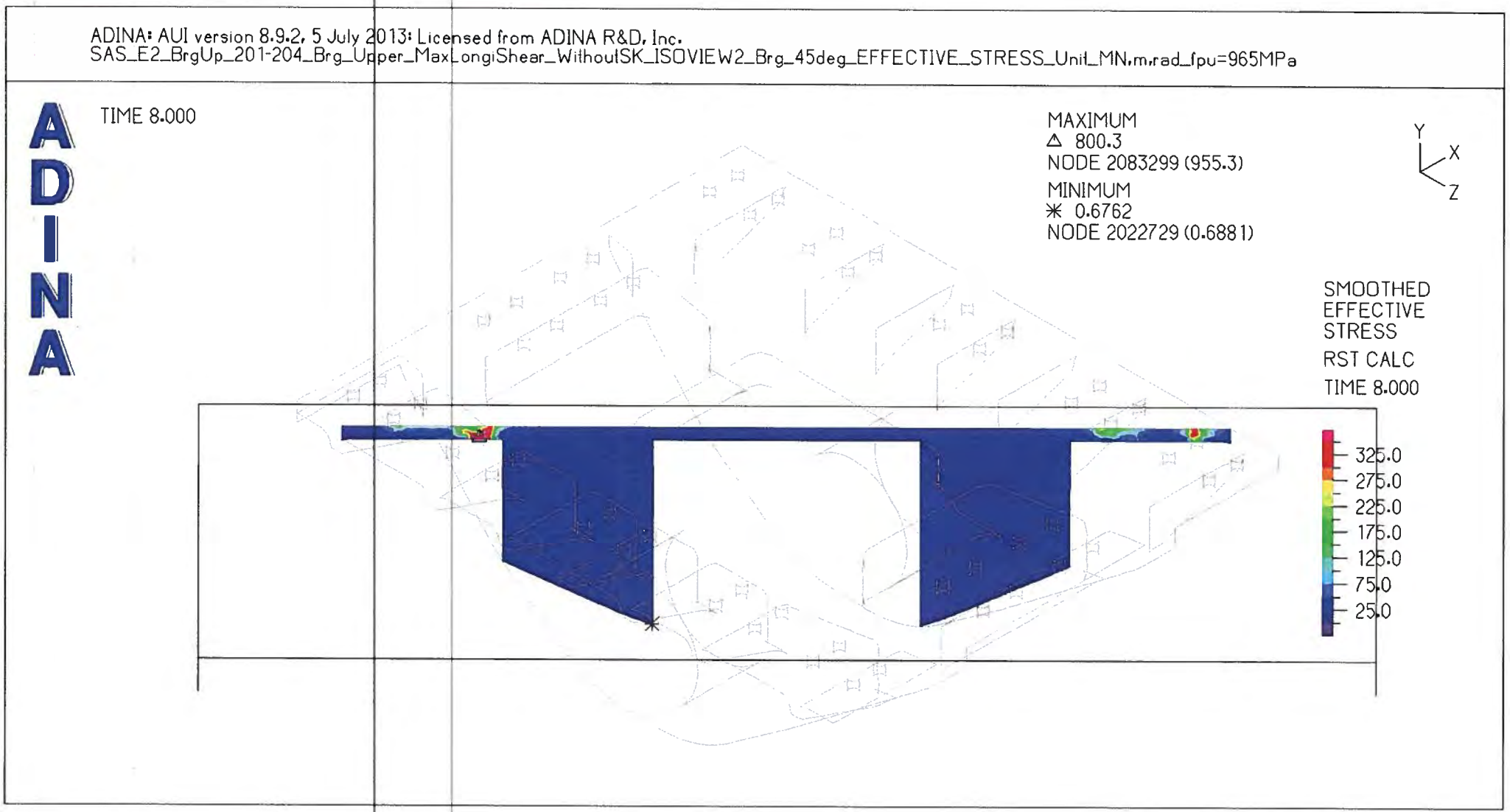

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ADINA

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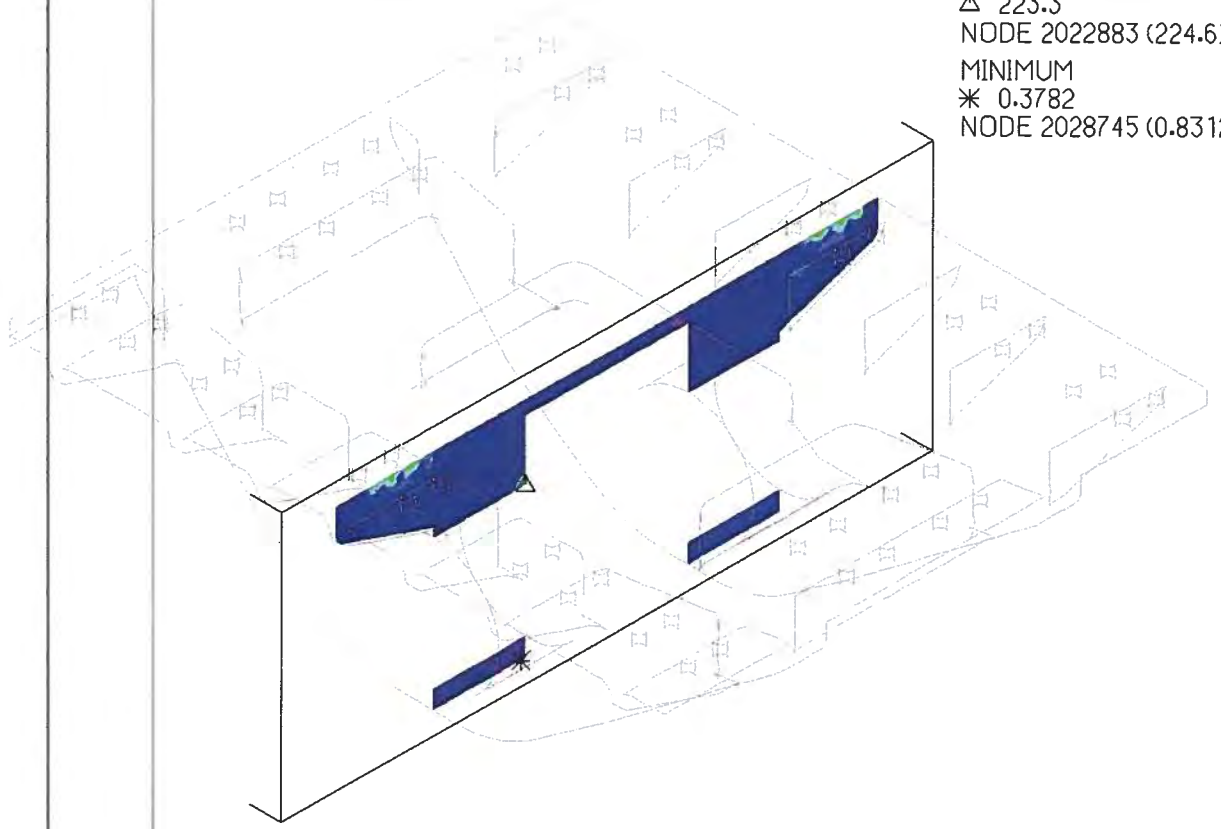

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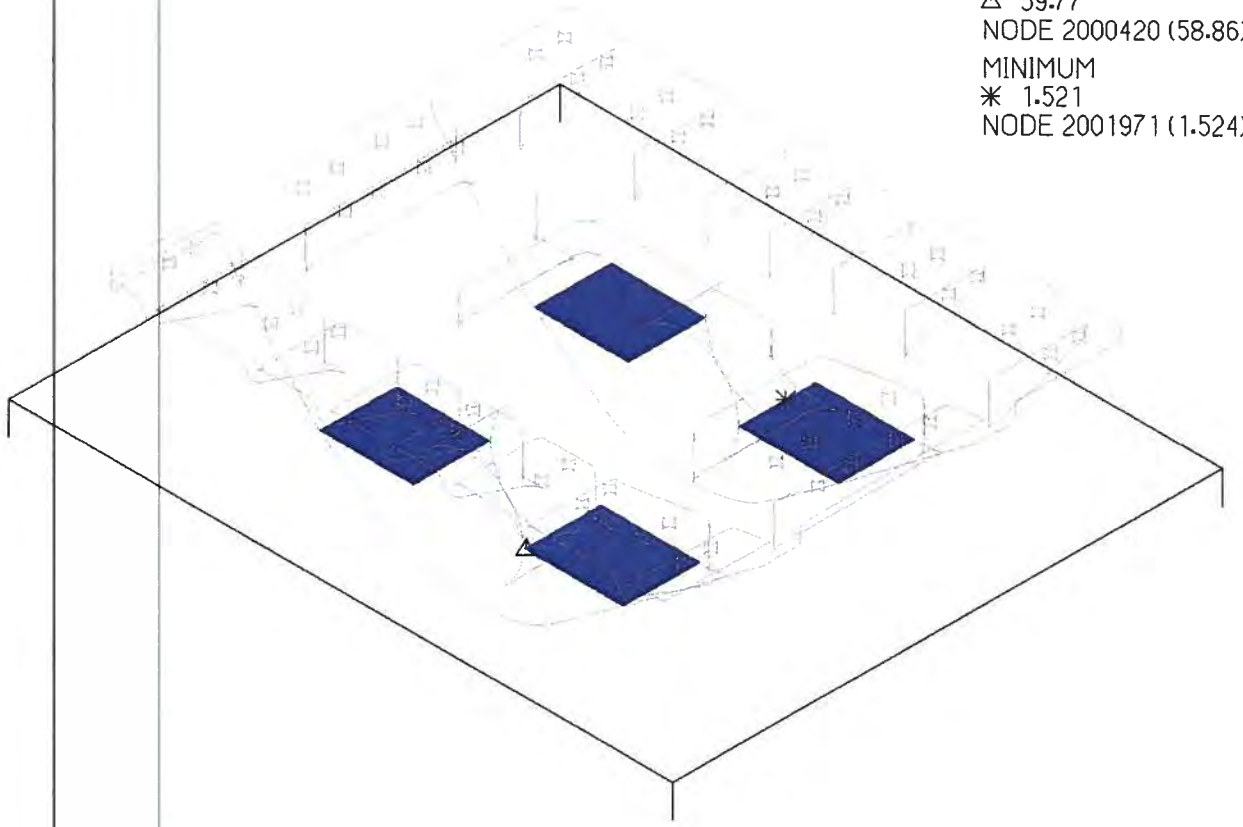

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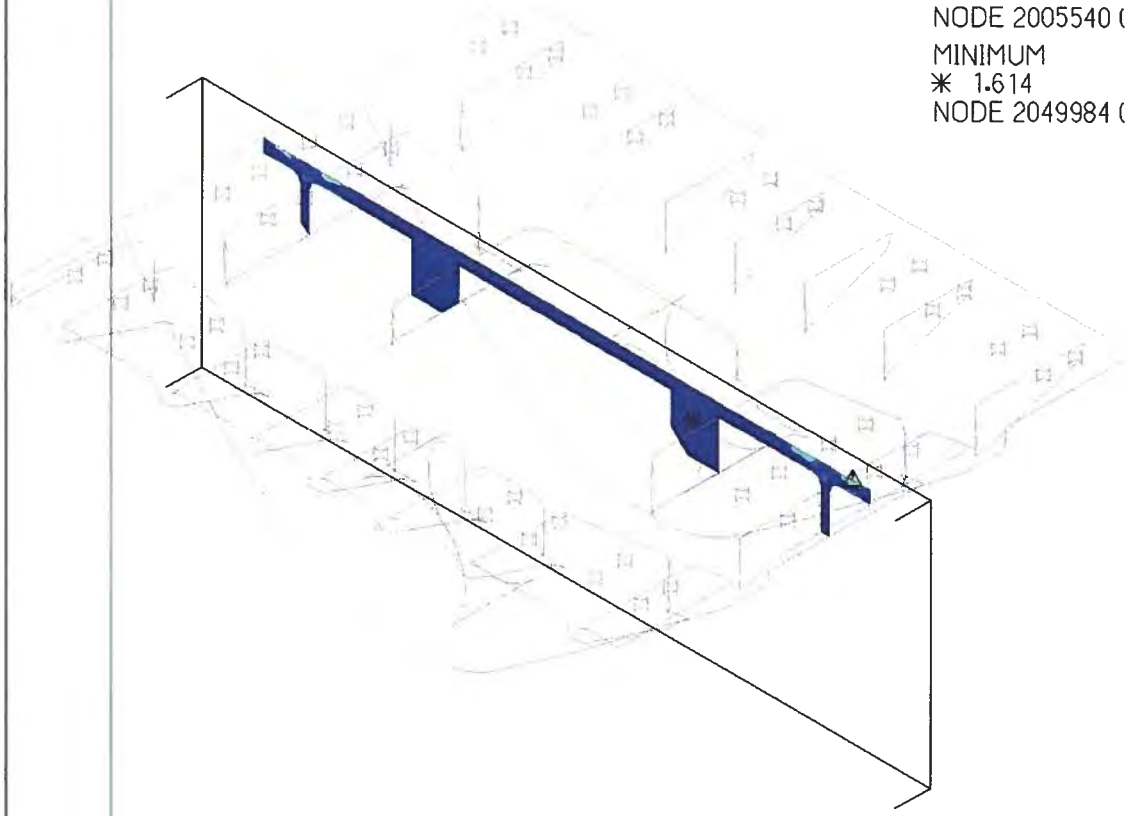
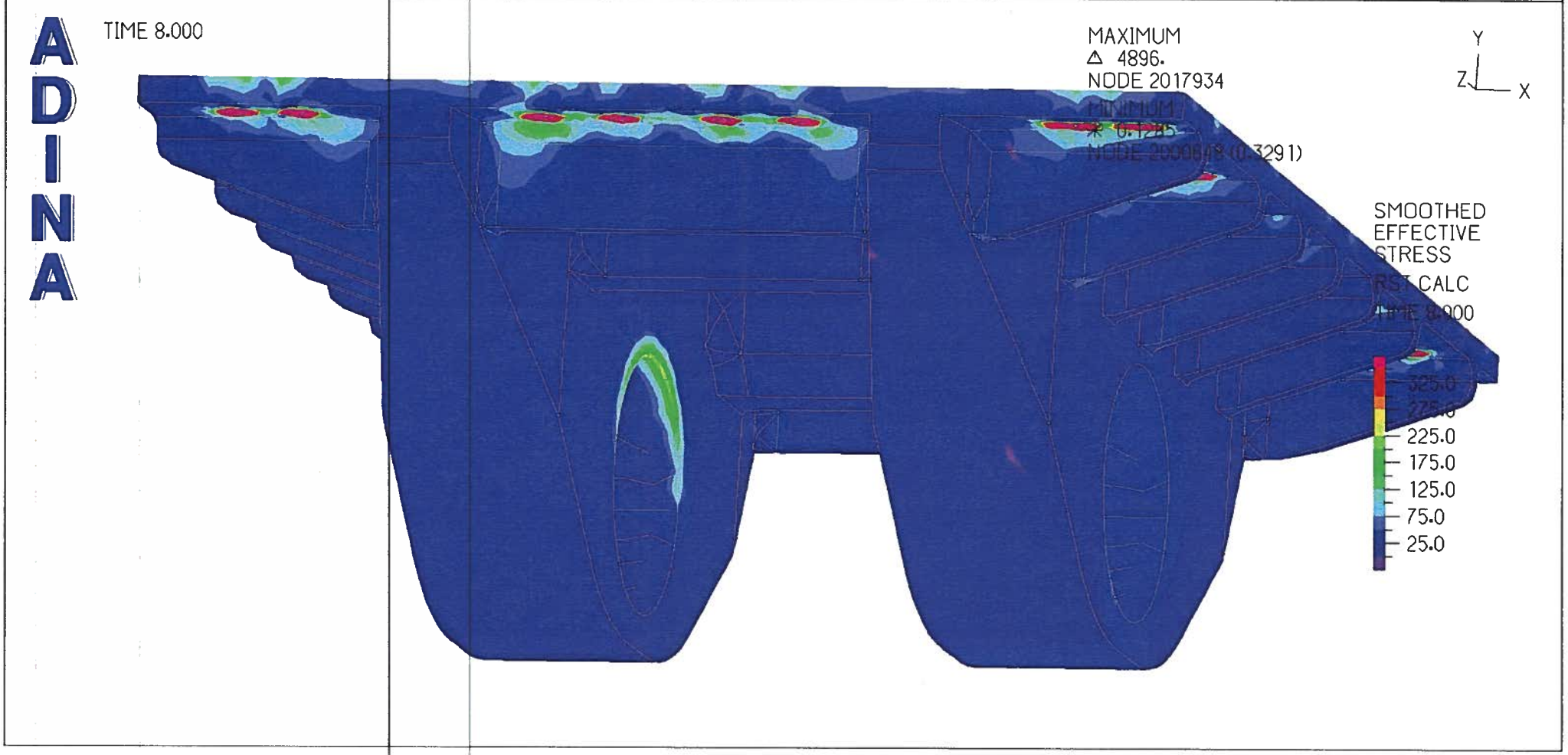
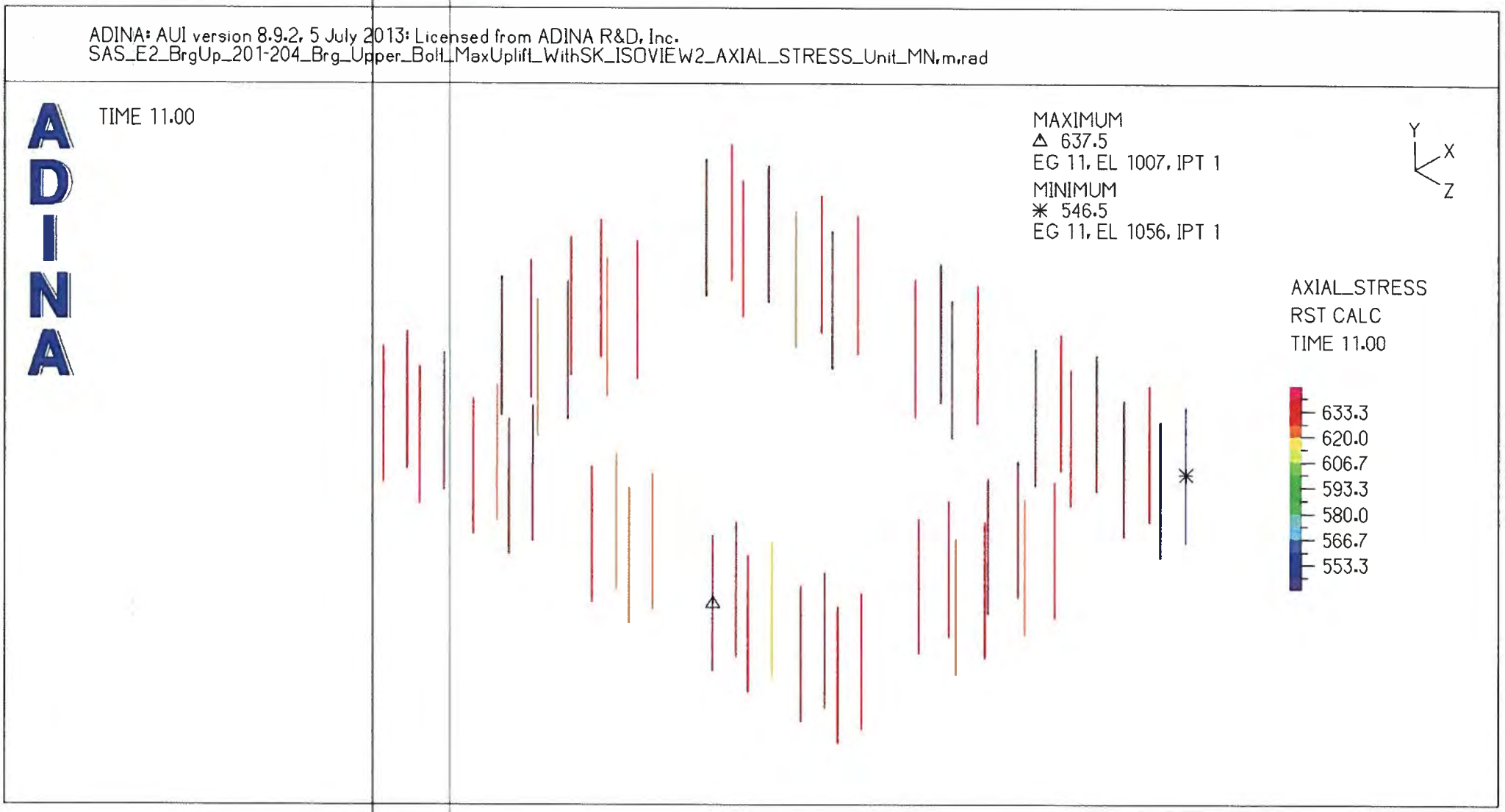
TIME 8.000



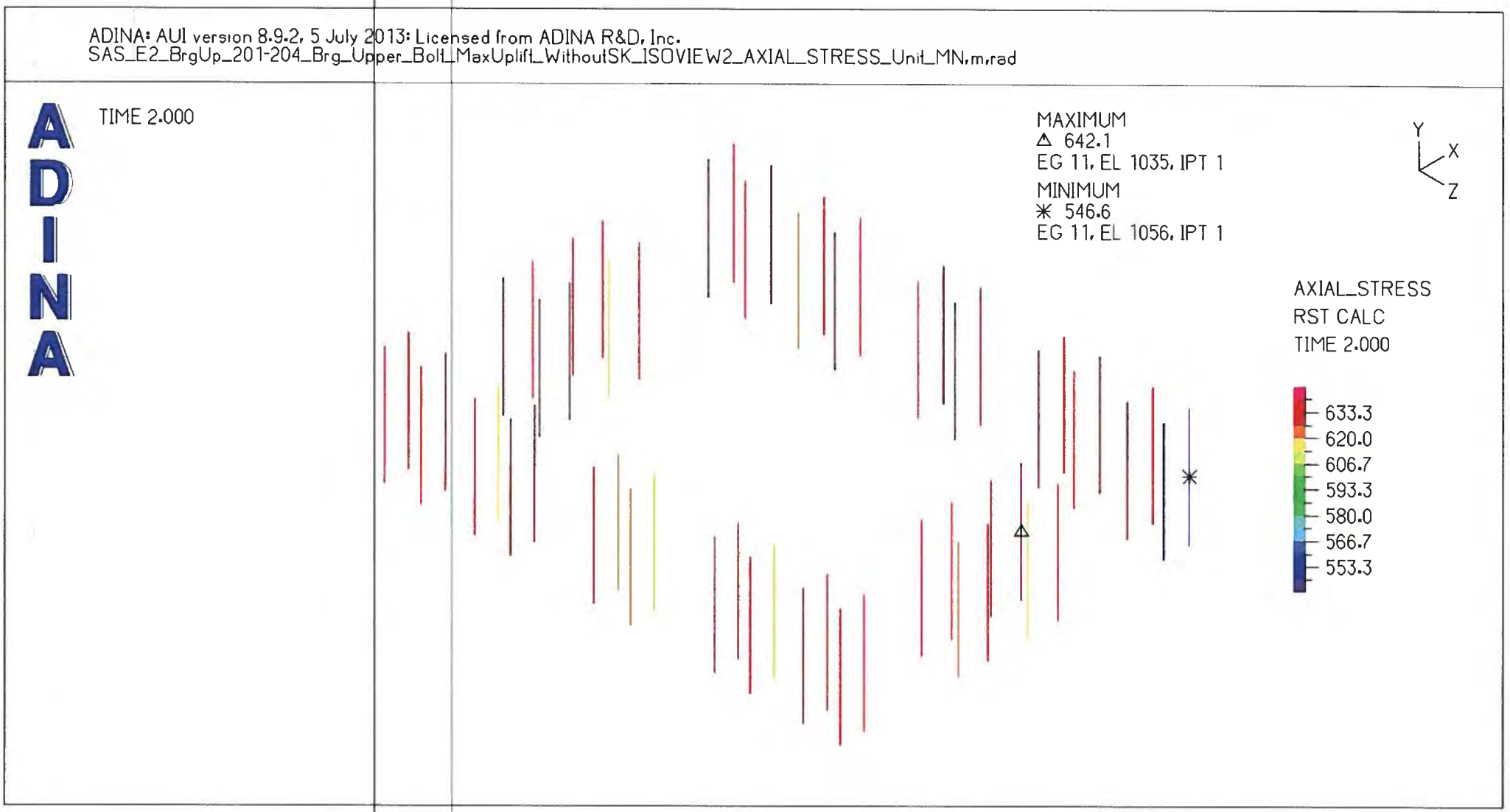
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_BrgUp_201-204_Brg_Upper_MaxLongiShear_WithoutSK_ISO_PosiY_EFFECTIVE_STRESS_Unit_MN,m,rad



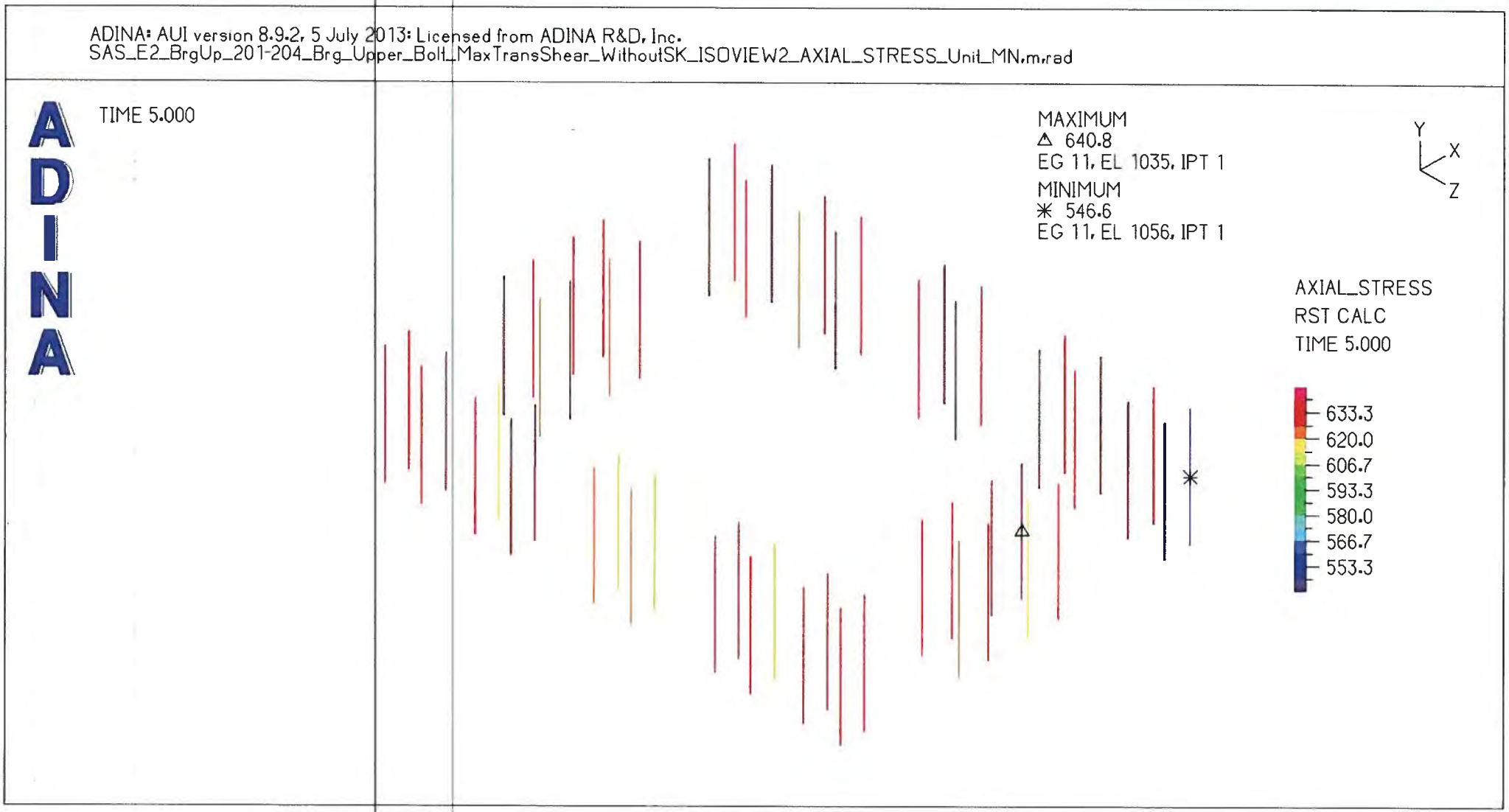
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_BrgUp_201-204_Brg_Upper_Bolt_MaxUplift_WithSK_ISOVIEW2_AXIAL_STRESS_Unit_MN.m.rad



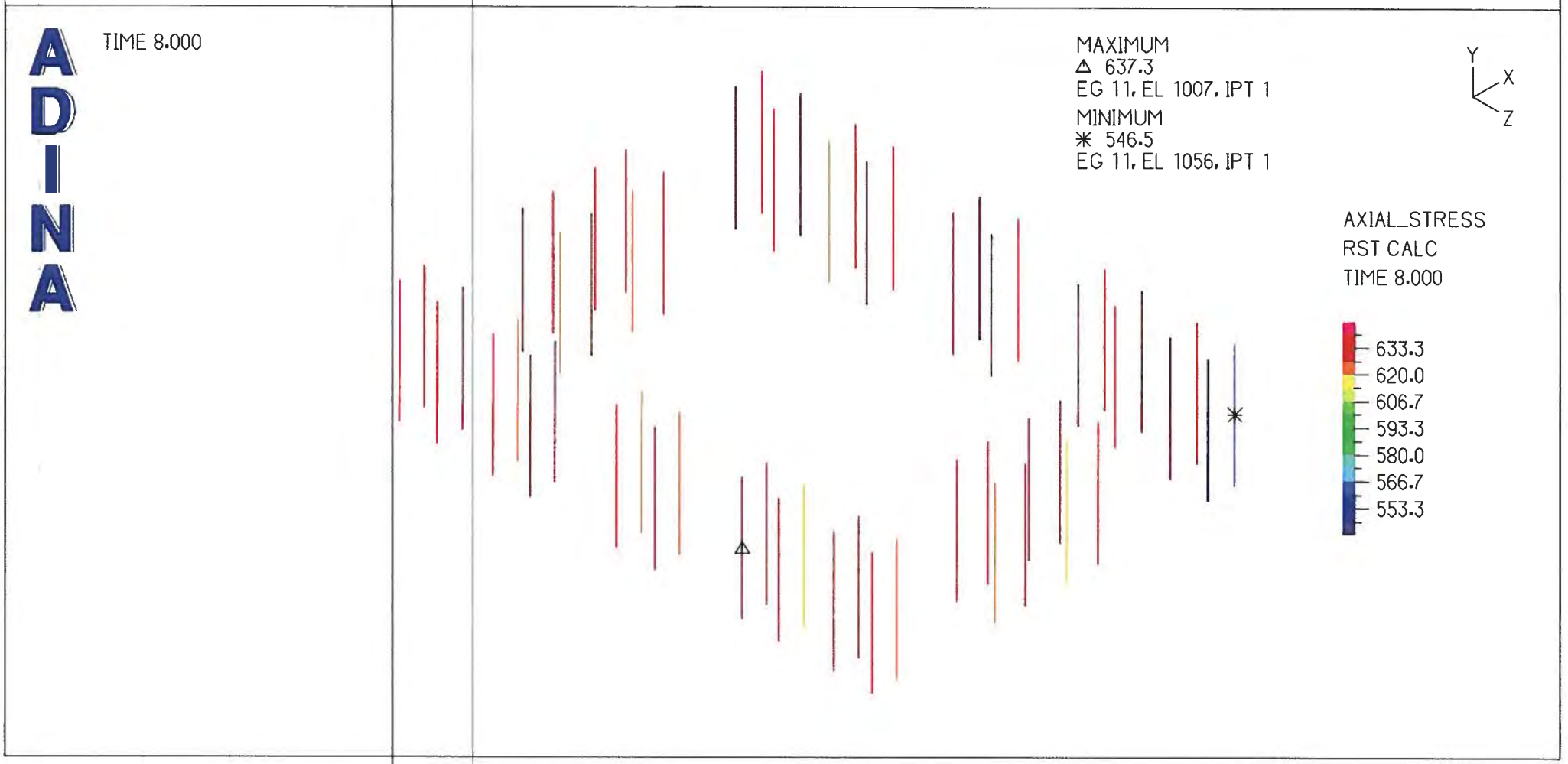
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_BrgUp_201-204_Brg_Upper_Bolt_MaxUplift_WithoutSK_ISOVIEW2_AXIAL_STRESS_Unit_MN,m,rad



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_BrgUp_201-204_Brg_Upper_Bolt_MaxTransShear_WithoutSK_ISOVIEW2_AXIAL_STRESS_Unit_MN.mrrad



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_BrgUp_201-204_Brg_Upper_Bolt_MaxLongiShear_WithoutSK_ISOVIEW2_AXIAL_STRESS_Unit_MN,m,rad

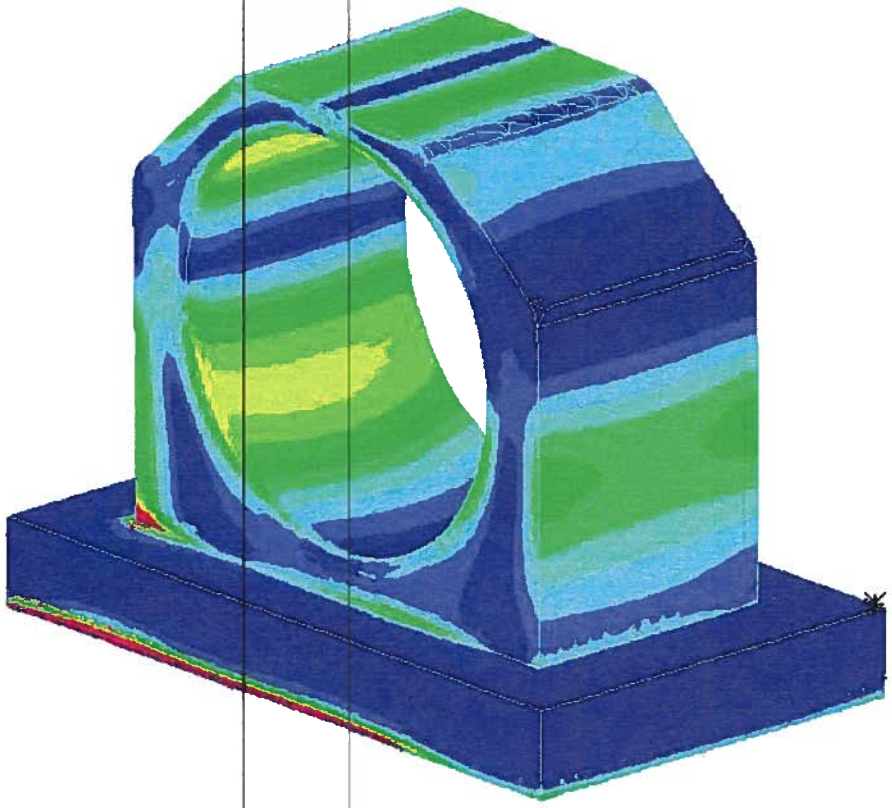


Lower Housing FEM

ADINA: AUI version 8.9.2, 8 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_Brg_LowerHousing_MaxLongiShear_WithoutSK_ISO_PosiY_EFFECTIVE_STRESS_Unit_MN.m.rad

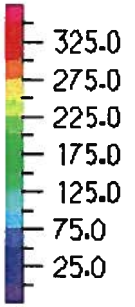
ADINA

TIME 1.000



MAXIMUM
△ 1253.
EG 1, EL 5469, IPT 4 (852.5)
MINIMUM
✳ 0.03885
EG 1, EL 3964, IPT 5 (0.1955)

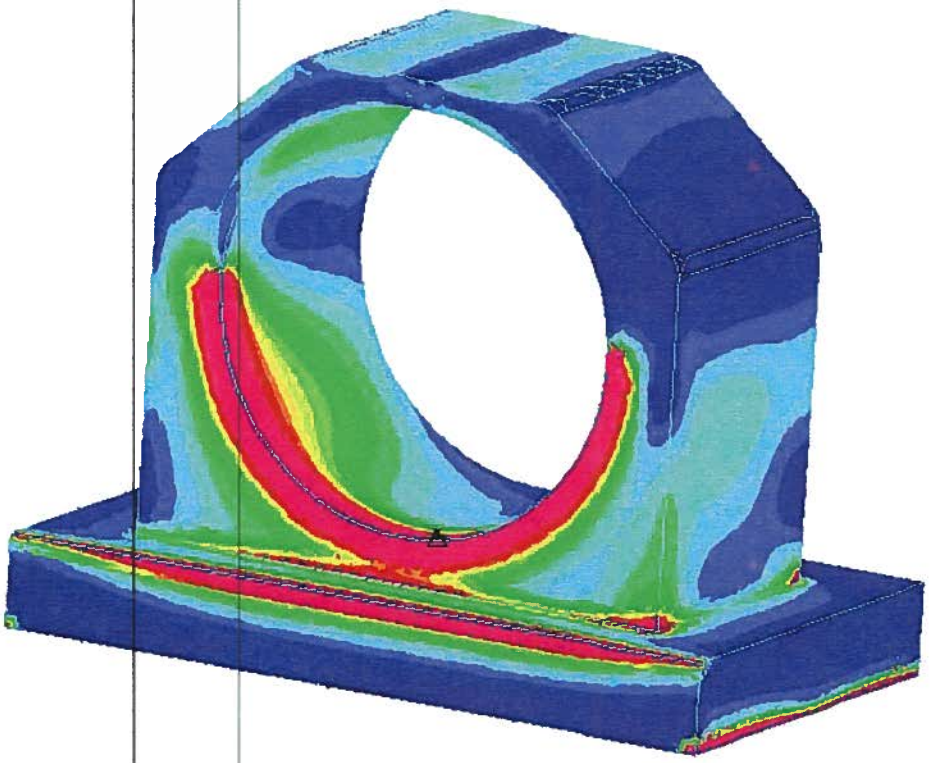
EFFECTIVE STRESS
RST CALC
TIME 1.000



ADINA: AUI version 8.9.2, 8 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_Brg_LowerHousing_MaxTransShear_WithoutSK_ISO_PosiY_EFFECTIVE_STRESS_Unit_MN.mrad

ADINA

TIME 1.000



MAXIMUM
△ 3400.
EG 1, EL 1461, IPT 4 (1790.)
MINIMUM
✳ 0.2727
EG 1, EL 81146, IPT 4 (0.9606)

Y
X Z

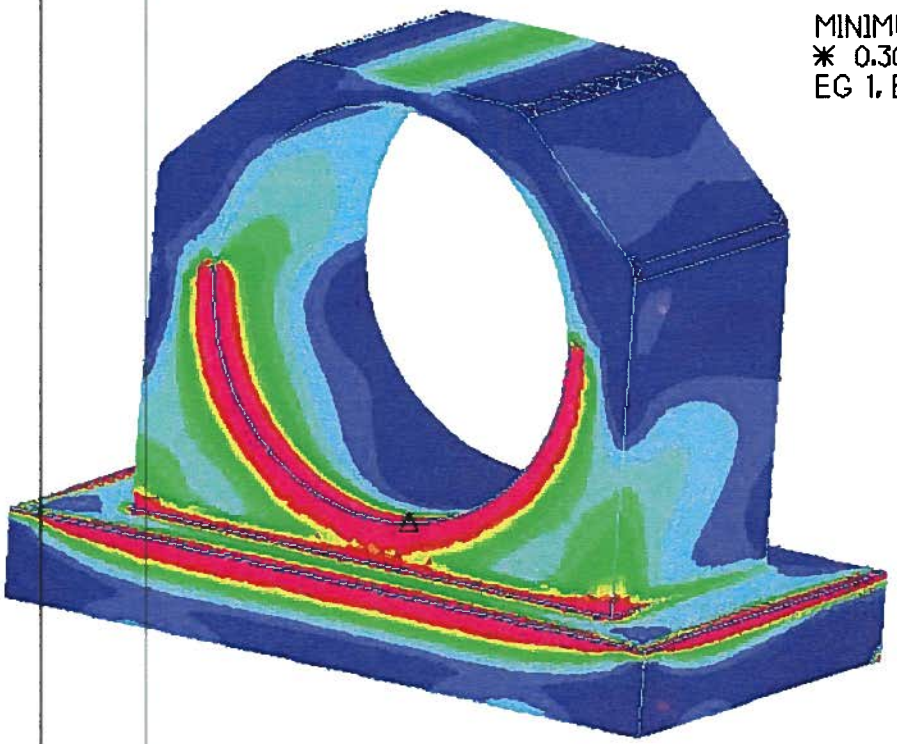
EFFECTIVE
STRESS
RST CALC
TIME 1.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 8 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_Brg_LowerHousing_MaxUpliftWithoutSK_ISO_PosiY_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

TIME 1.000



MAXIMUM
△ 2822.
EG 1, EL 1461, IPT 4 (1488.)
MINIMUM
✳ 0.3098
EG 1, EL 3226, IPT 5 (0.4826)

Y
X Z

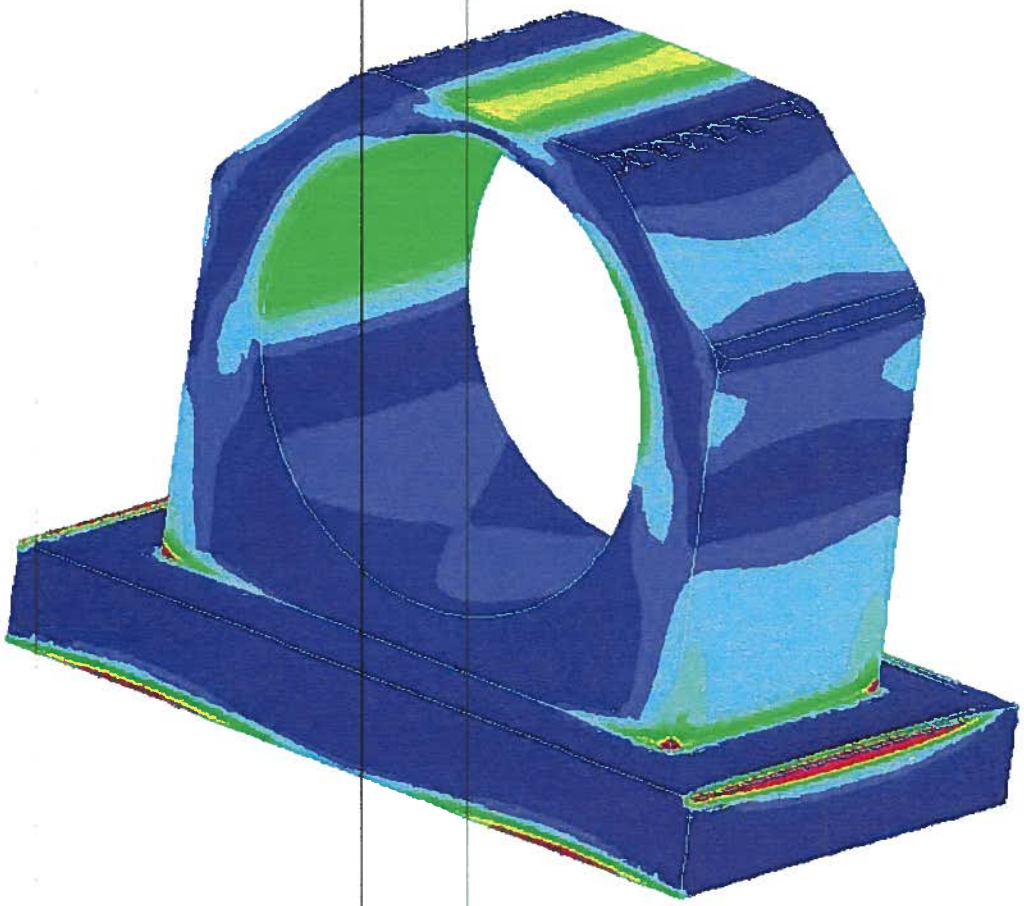
EFFECTIVE STRESS
RST CALC
TIME 1.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

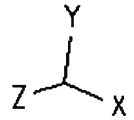
ADINA: AUI version 8.9.2, 8 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_Brg_LowerHousing_MaxUpliftWithSK_ISO_PosiY_EFFECTIVE_STRESS_UniLMN.mrad

ADINA

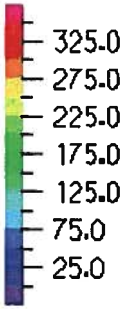
TIME 1.000



MAXIMUM
△ 641.2
EG 1, EL 33562, IPT 3 (439.8)
MINIMUM
✳ 0.1068
EG 1, EL 84457, IPT 5 (0.09808)



EFFECTIVE STRESS
RST CALC
TIME 1.000

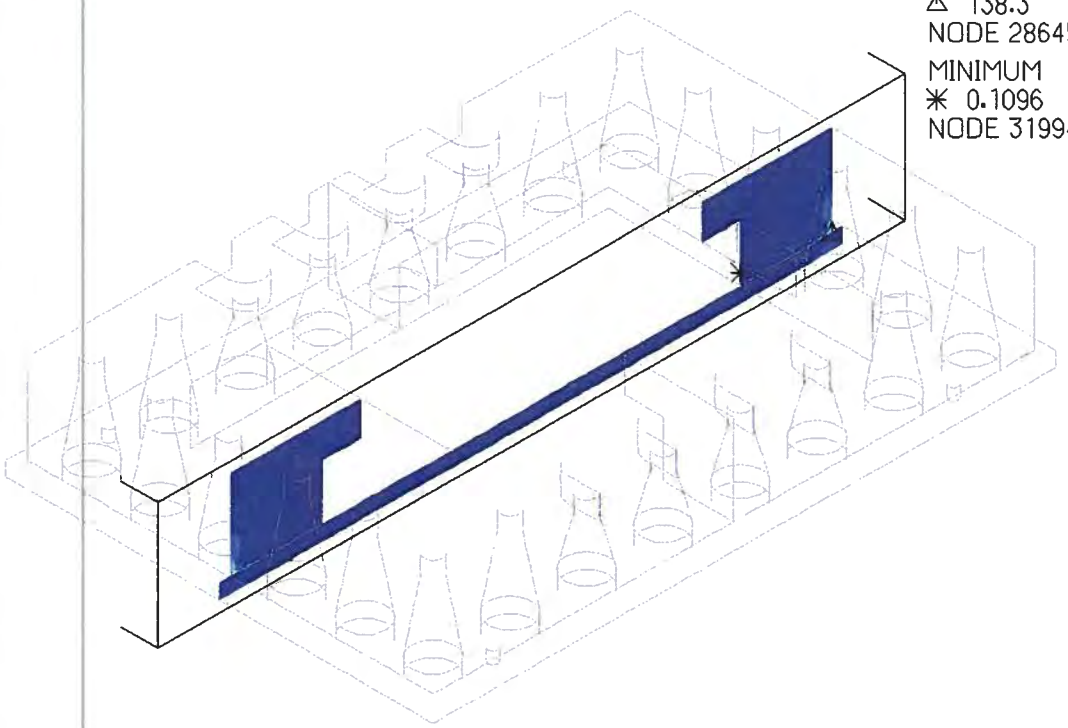


Hold Down Assembly FEM

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithSK_ISOVIEW2_ZPlane_1_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

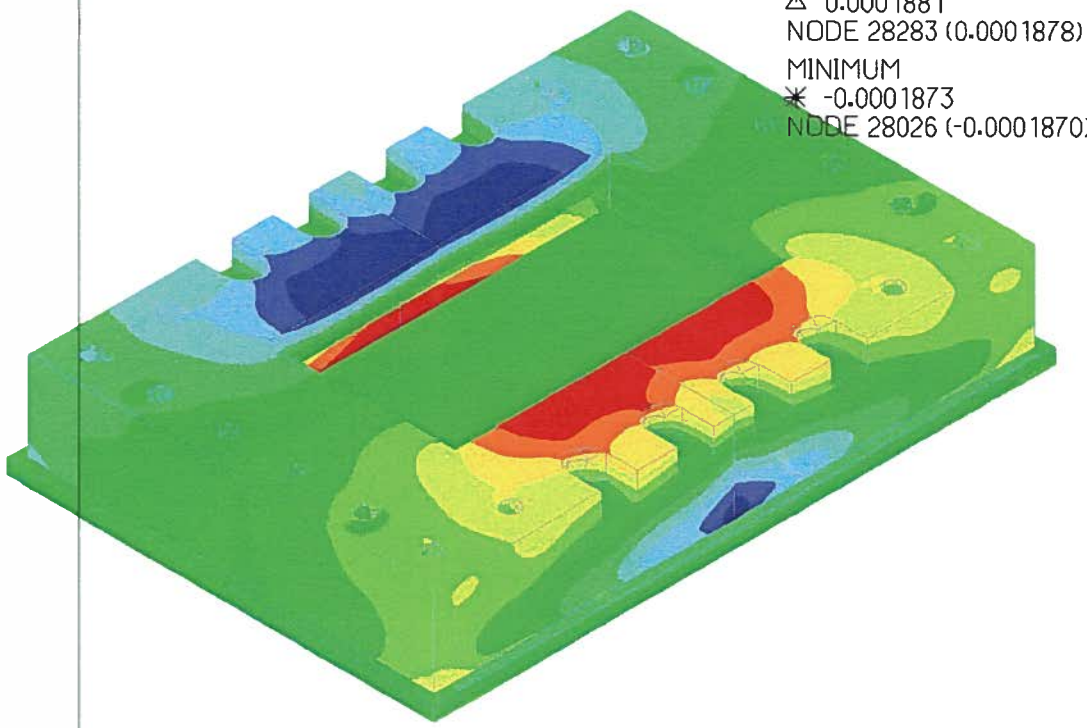
TIME 7.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithSK_ISOVIEW2_Z-DISPLACEMENT_Unit_MN.m.rad

ADINA

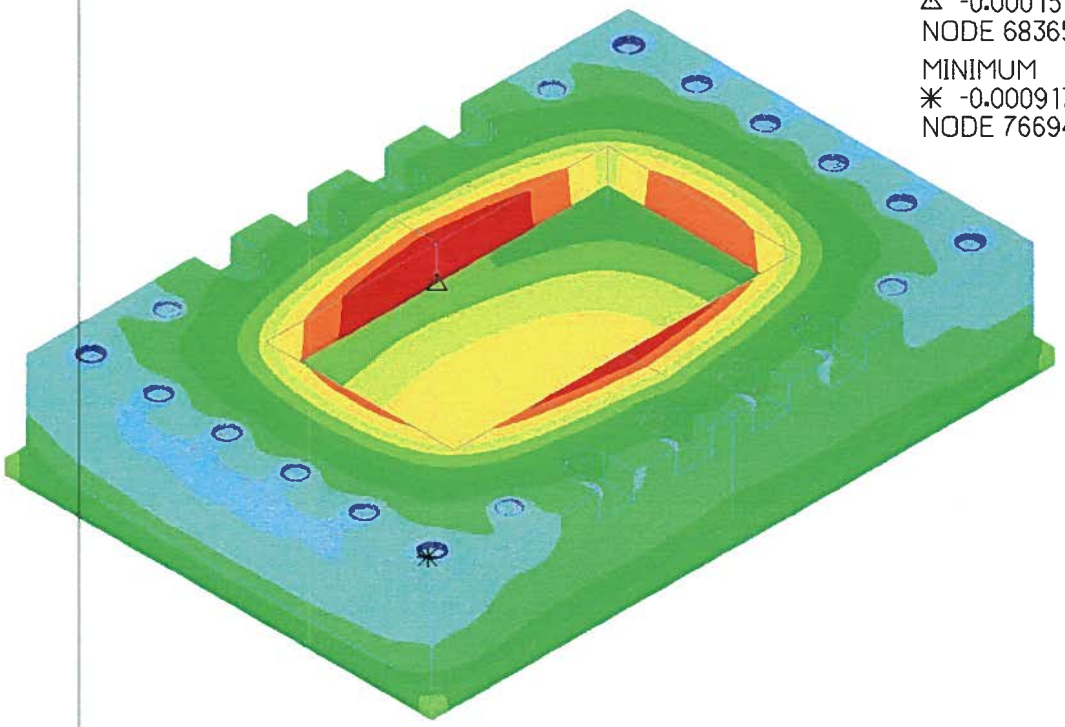
TIME 7.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithSK_ISOVIEW2_Y-DISPLACEMENT_Unit_MN,m,rad

ADINA

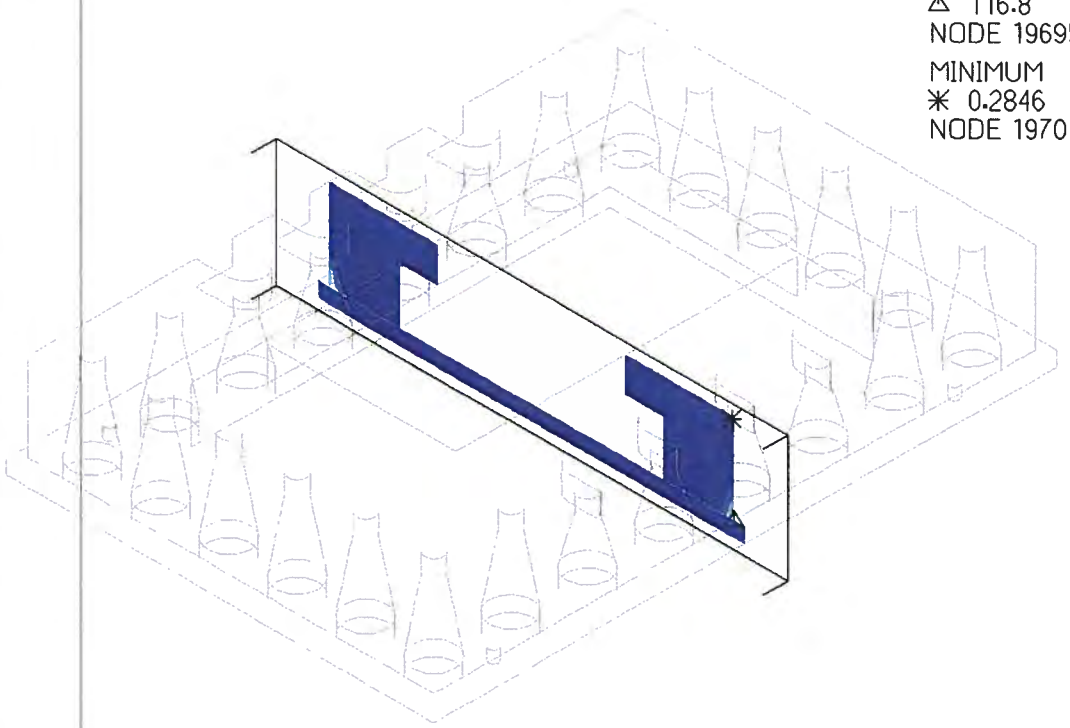
TIME 7.000



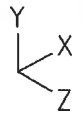
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithSK_ISOVIEW2_XPlane_1_EFFECTIVE_STRESS_Unit_MN.m.rad

ADINA

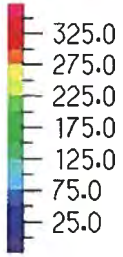
TIME 7.000



MAXIMUM
△ 116.8
NODE 19695
MINIMUM
✳ 0.2846
NODE 19701 (3.729)



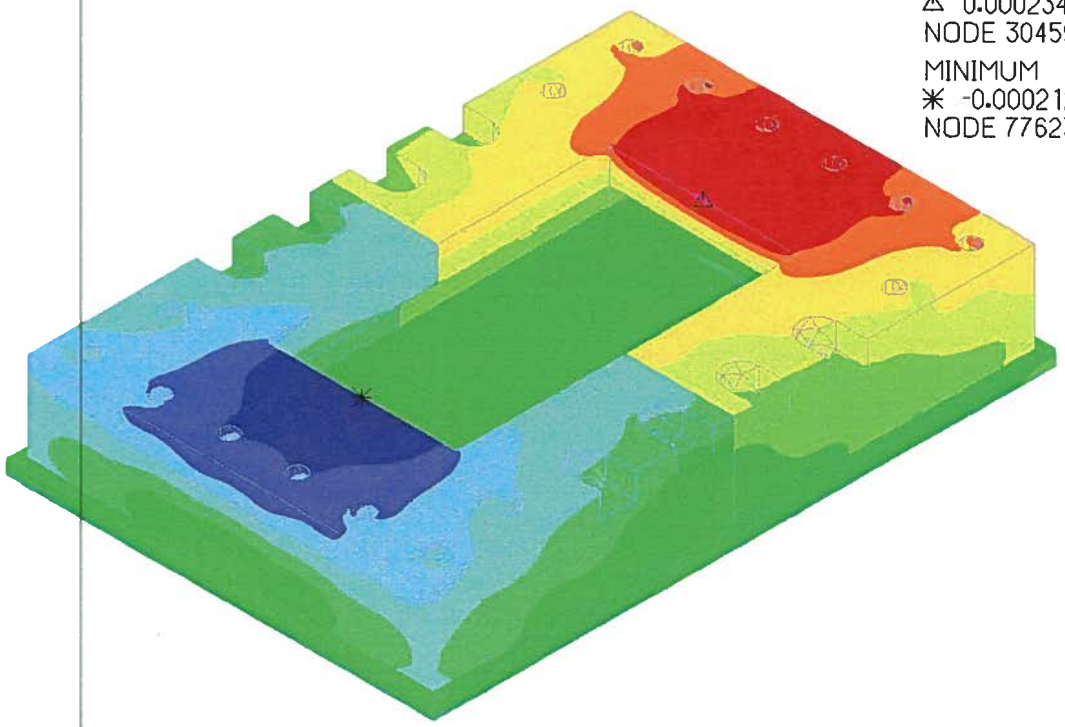
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 7.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithSK_ISOVIEW2_X-DISPLACEMENT_Unit_MN,m,rad

ADINA

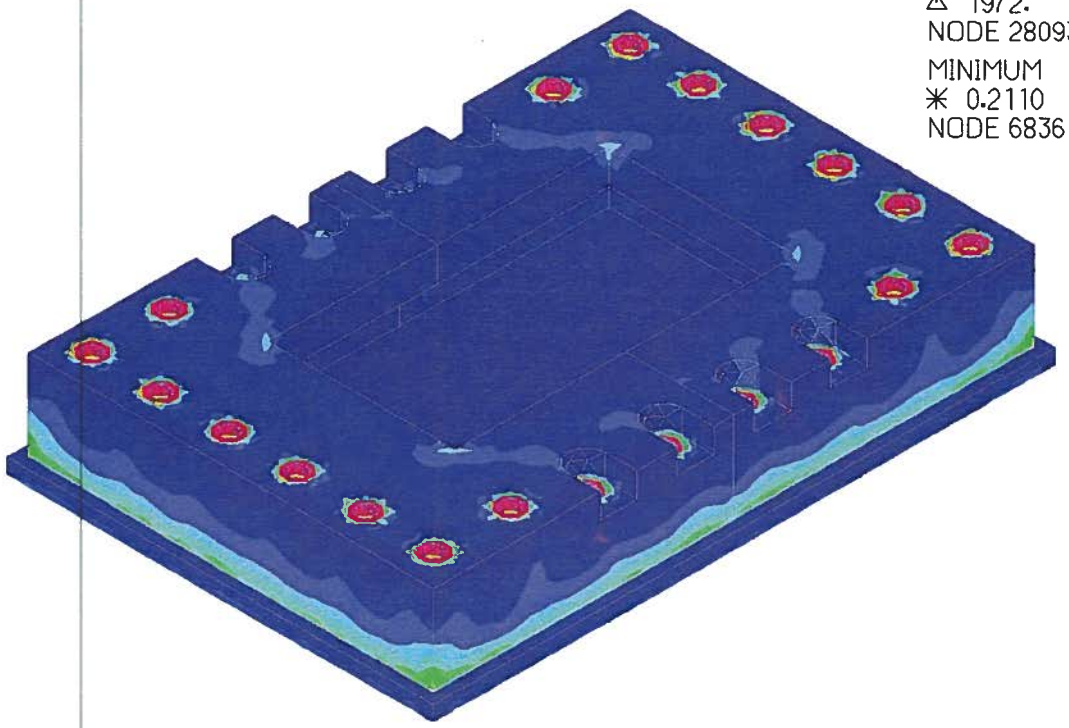
TIME 7.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithSK_ISOVIEW2_EFFECTIVE_STRESS_Unit_MN.m.rad

ADINA

TIME 7.000



MAXIMUM
△ 1972.
NODE 28093
MINIMUM
✳ 0.2110
NODE 68361 (3.843)

Y
X
Z

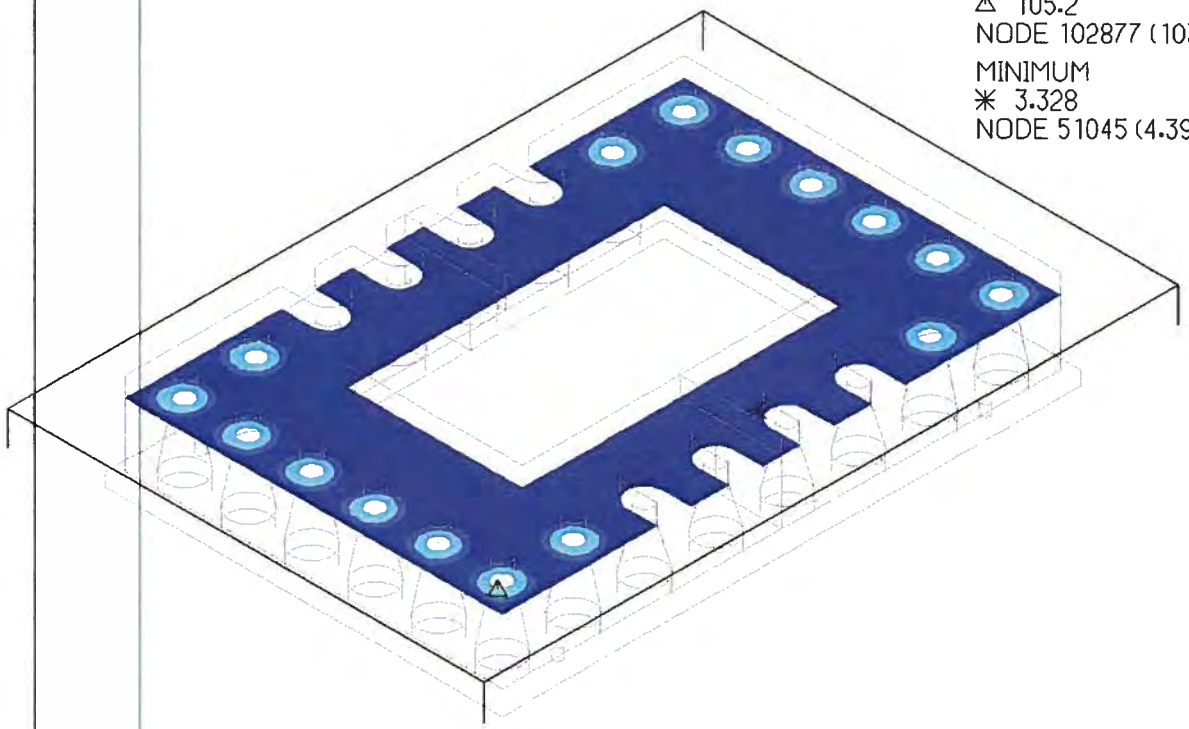
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 7.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithSK_ISOVIEW2_ YPlane_2_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

TIME 7.000



MAXIMUM
△ 105.2
NODE 102877 (103.6)
MINIMUM
✳ 3.328
NODE 51045 (4.392)

Y
X
Z

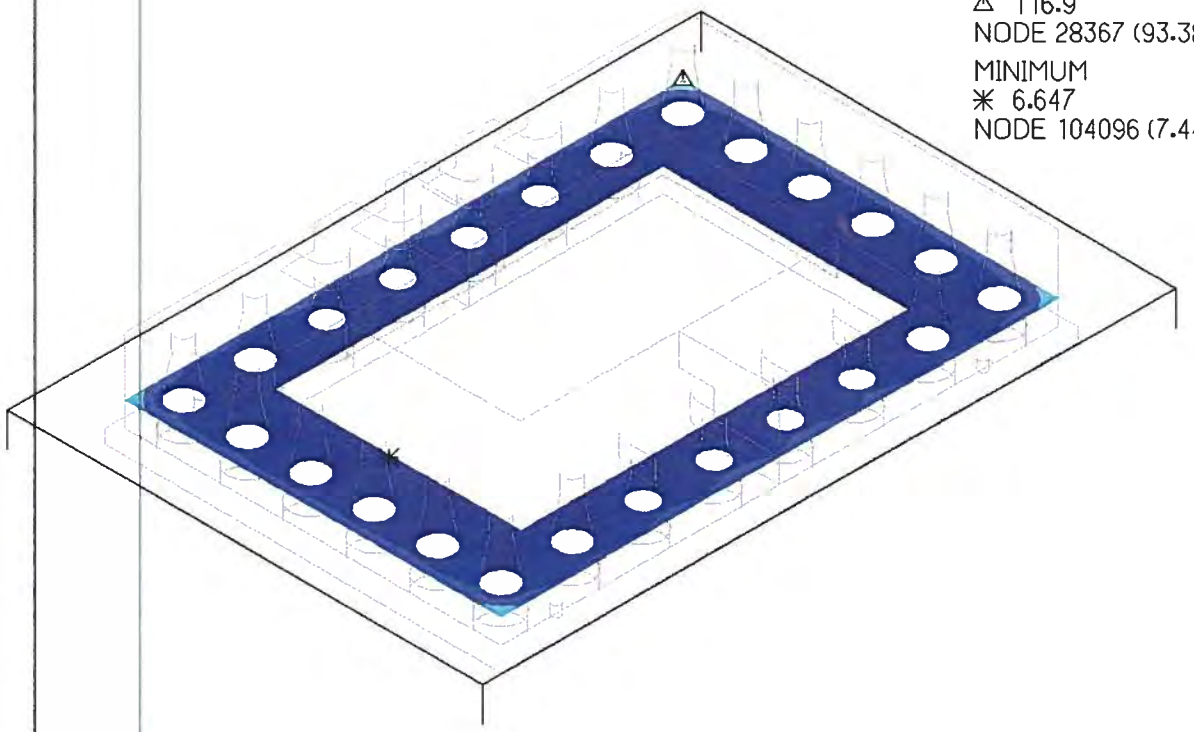
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 7.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithSK_ISOVIEW2_ YPlane_1_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

TIME 7.000



MAXIMUM
△ 116.9
NODE 28367 (93.38)
MINIMUM
✳ 6.647
NODE 104096 (7.440)

Y
X
Z

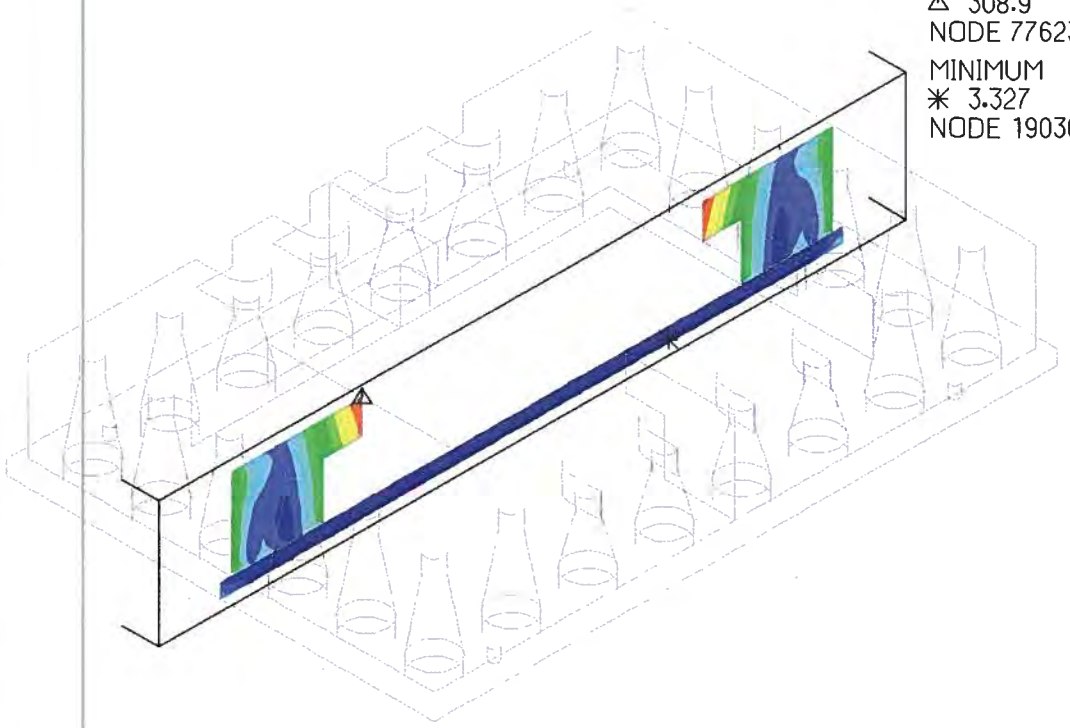
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 7.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithoutSK_ISOVIEW2_ZPlane_1_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

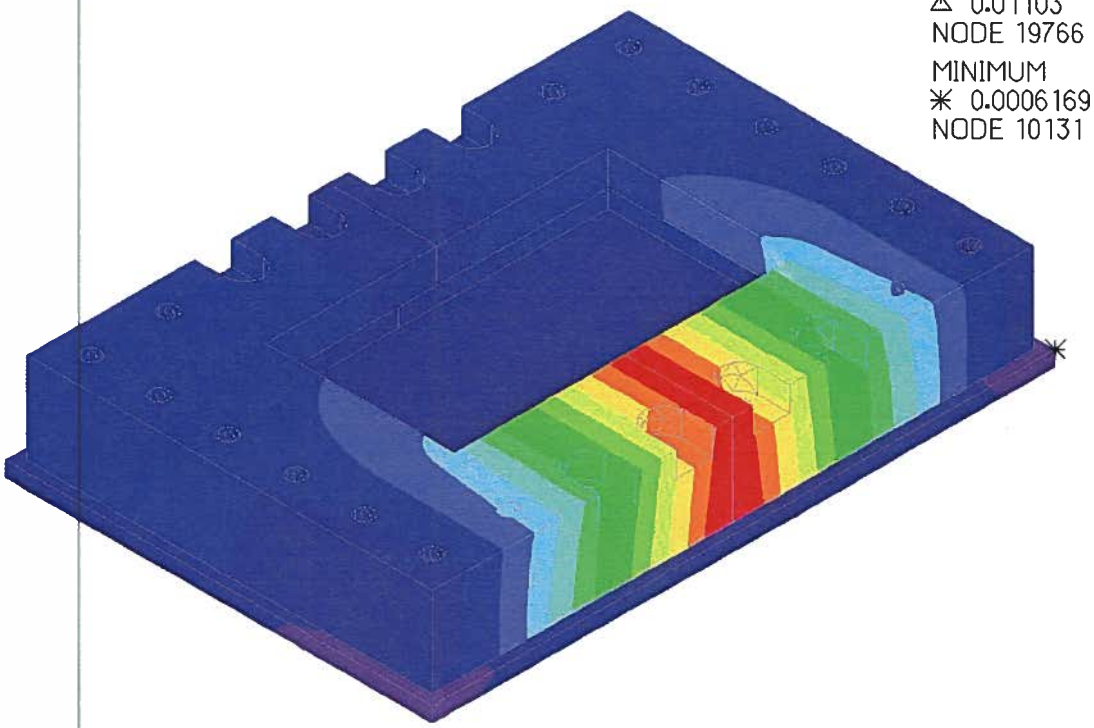
TIME 1.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithoutSK_ISOVIEW2_Z-DISPLACEMENT_Unit_MN.m.rad

ADINA

TIME 1.000



MAXIMUM
△ 0.01103
NODE 19766
MINIMUM
✳ 0.0006169
NODE 10131

Y
X
Z

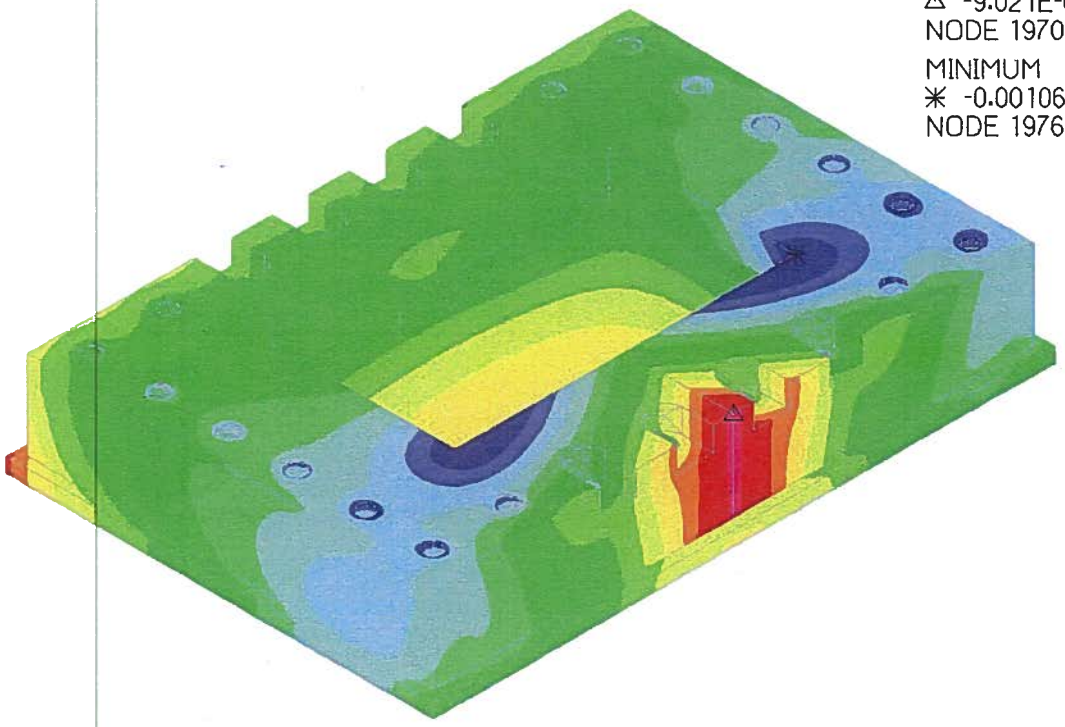
Z-DISPLACEMENT
TIME 1.000

0.01050
0.00900
0.00750
0.00600
0.00450
0.00300
0.00150

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithoutSK_ISOVIEW2_Y-DISPLACEMENT_Unit_MN,m,rad

ADINA

TIME 1.000



MAXIMUM
△ -9.021E-05
NODE 19701
MINIMUM
✳ -0.001061
NODE 19765

Y
X
Z

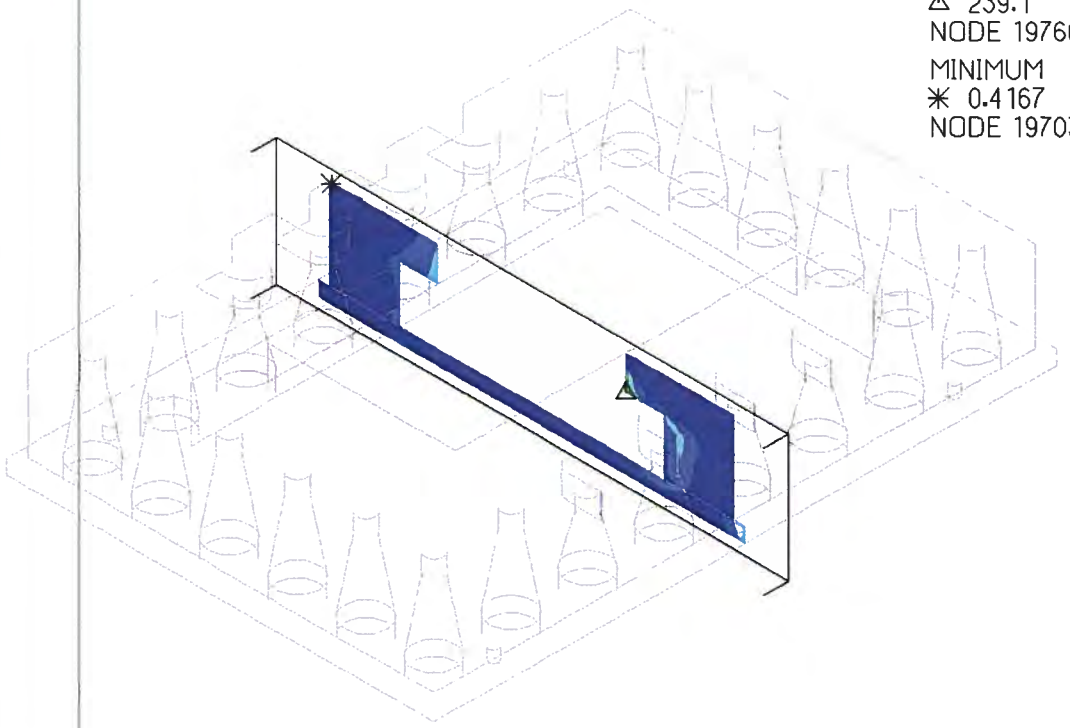
Y-DISPLACEMENT
TIME 1.000

-0.000200
-0.000333
-0.000467
-0.000600
-0.000733
-0.000867
-0.001000

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithoutSK_ISOVIEW2_XPlane_1_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

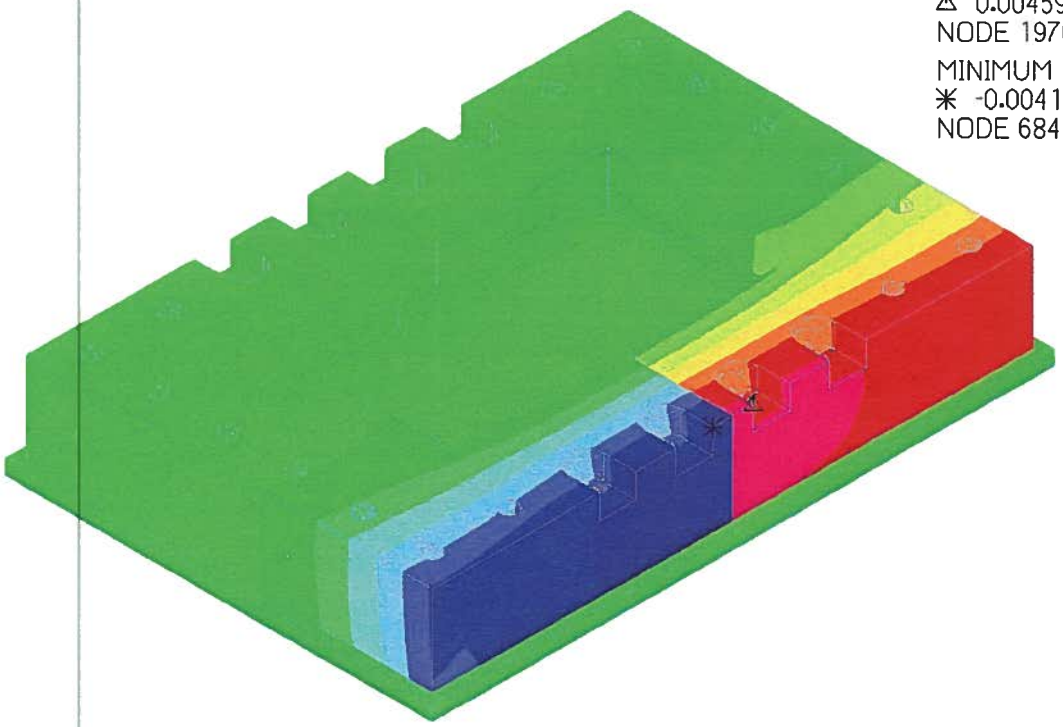
TIME 1.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithoutSK_ISOVIEW2_X-DISPLACEMENT_Unit_MN,m,rad

ADINA

TIME 1.000



MAXIMUM
△ 0.004599
NODE 19702
MINIMUM
✳ -0.004102
NODE 68415

Y
X
Z

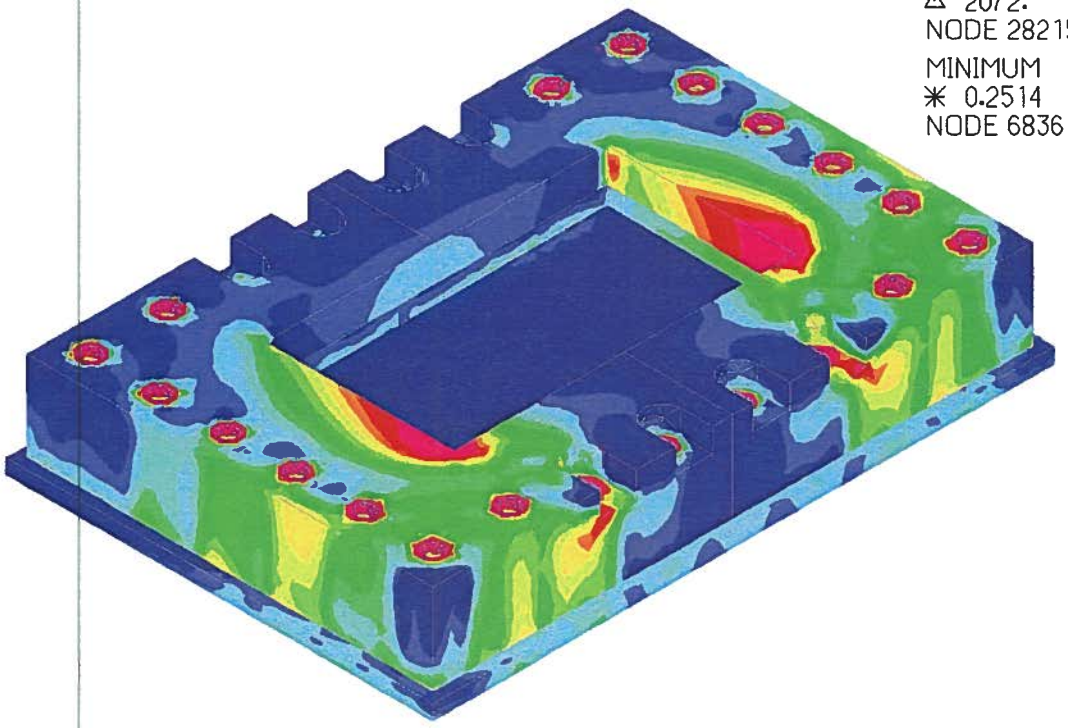
X-DISPLACEMENT
TIME 1.000

0.003600
0.002400
0.001200
0.000000
-0.001200
-0.002400
-0.003600

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithoutSK_ISOVIEW2_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

TIME 1.000



MAXIMUM
△ 2072.
NODE 28215
MINIMUM
✳ 0.2514
NODE 68361 (2.052)

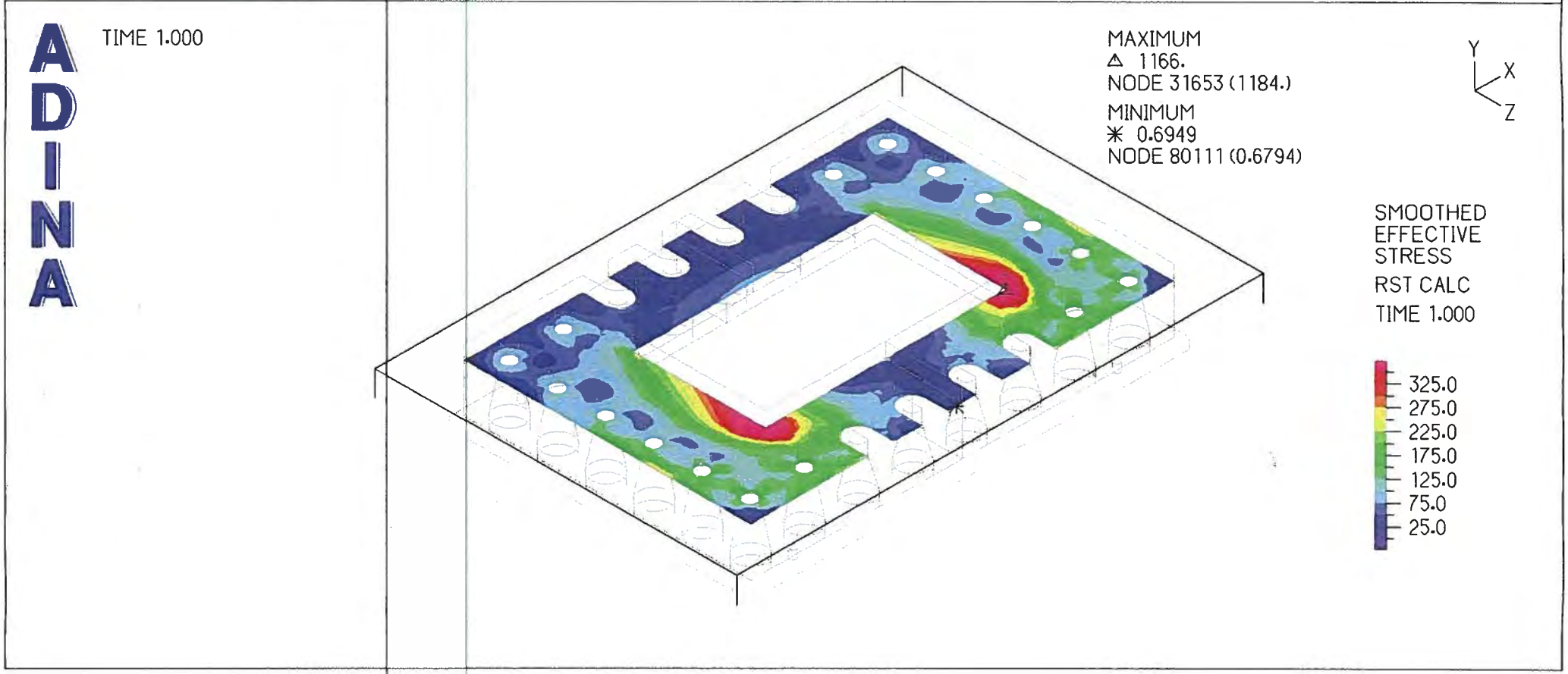
Y
X
Z

SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 1.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

B2

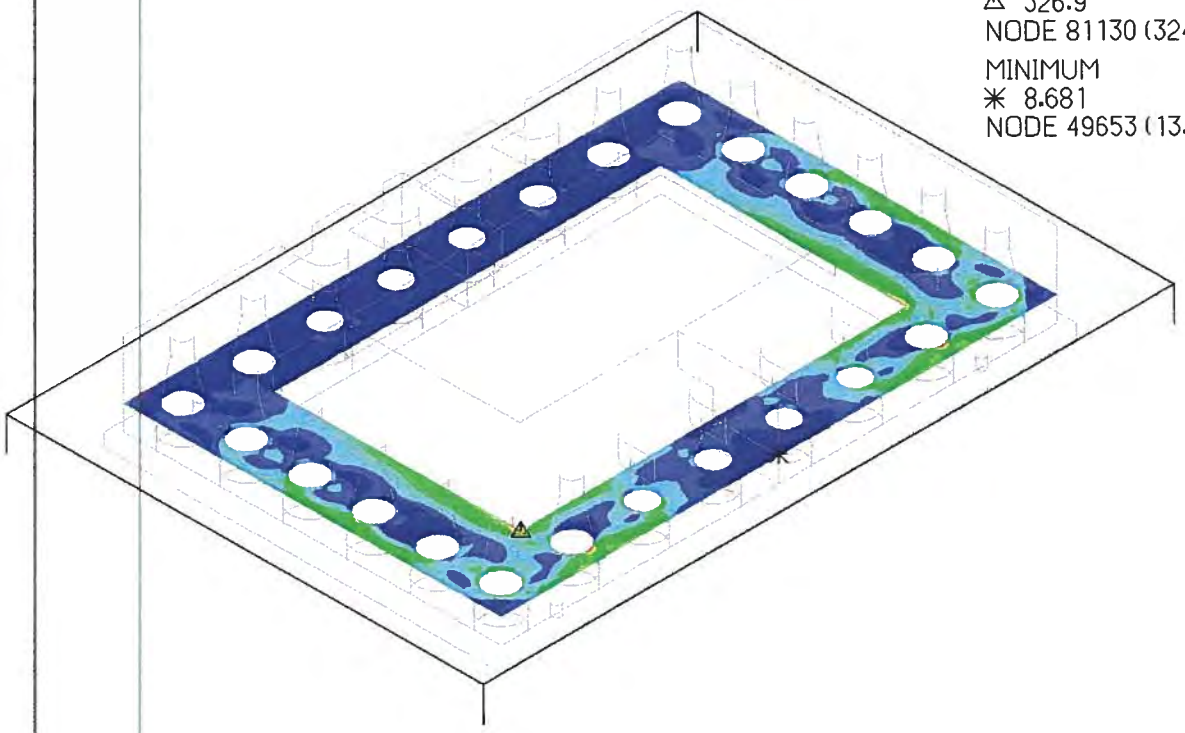
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithoutSK_ISOVIEW2_ YPlane_2_EFFECTIVE_STRESS_Unit_MN.m.rad



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxUplift_WithoutSK_ISOVIEW2_ YPlane_1_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

TIME 1.000



MAXIMUM
△ 326.9
NODE 81130 (324.5)
MINIMUM
✳ 8.681
NODE 49653 (13.42)

Y
X
Z

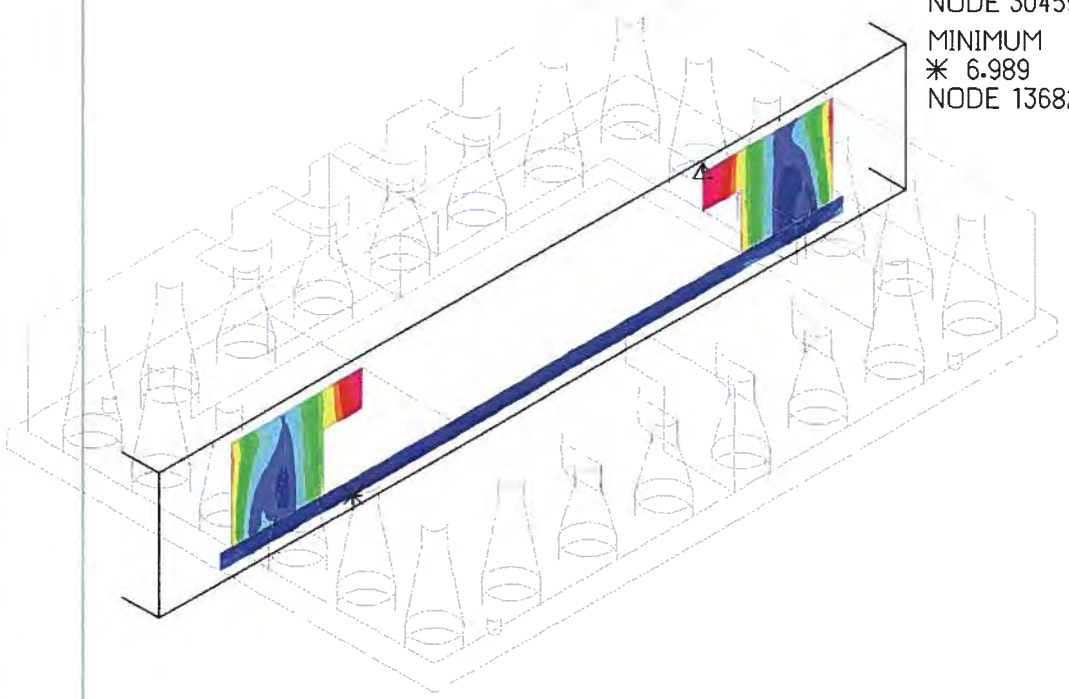
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 1.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxTransShear_WithoutSK_ISOVIEW2_ZPlane_1_EFFECTIVE_STRESS_Unit_MN.m.rad

ADINA

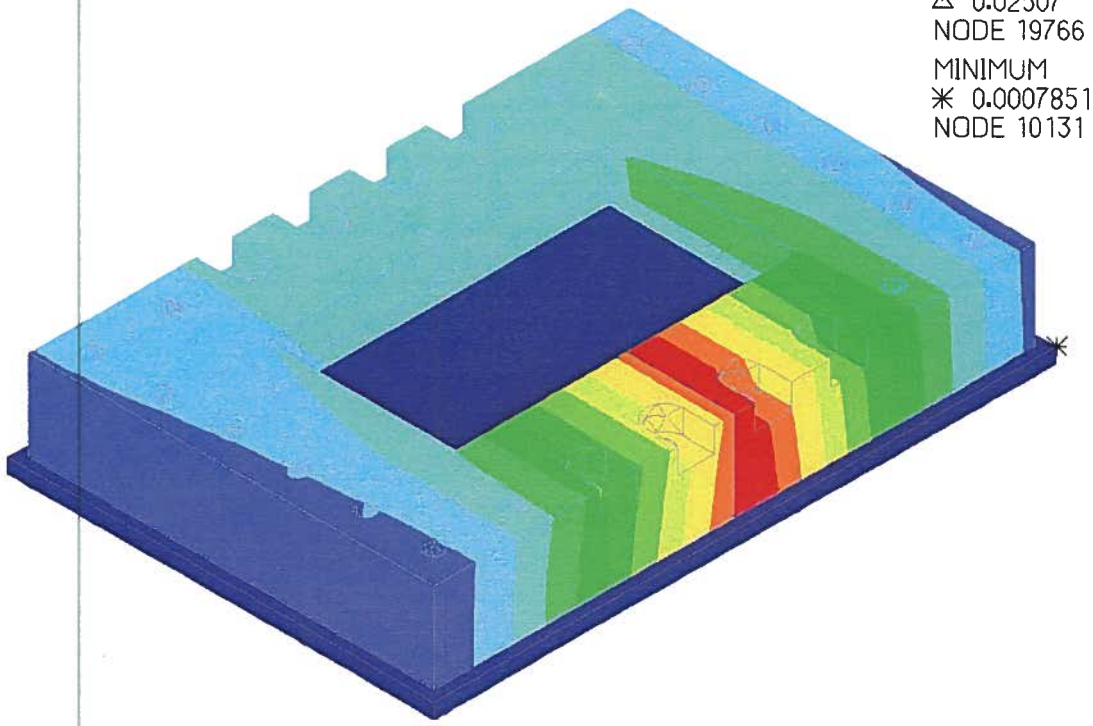
TIME 3.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxTransShear_WithoutSK_ISOVIEW2_Z-DISPLACEMENT_Unit_MN,m,rad

ADINA

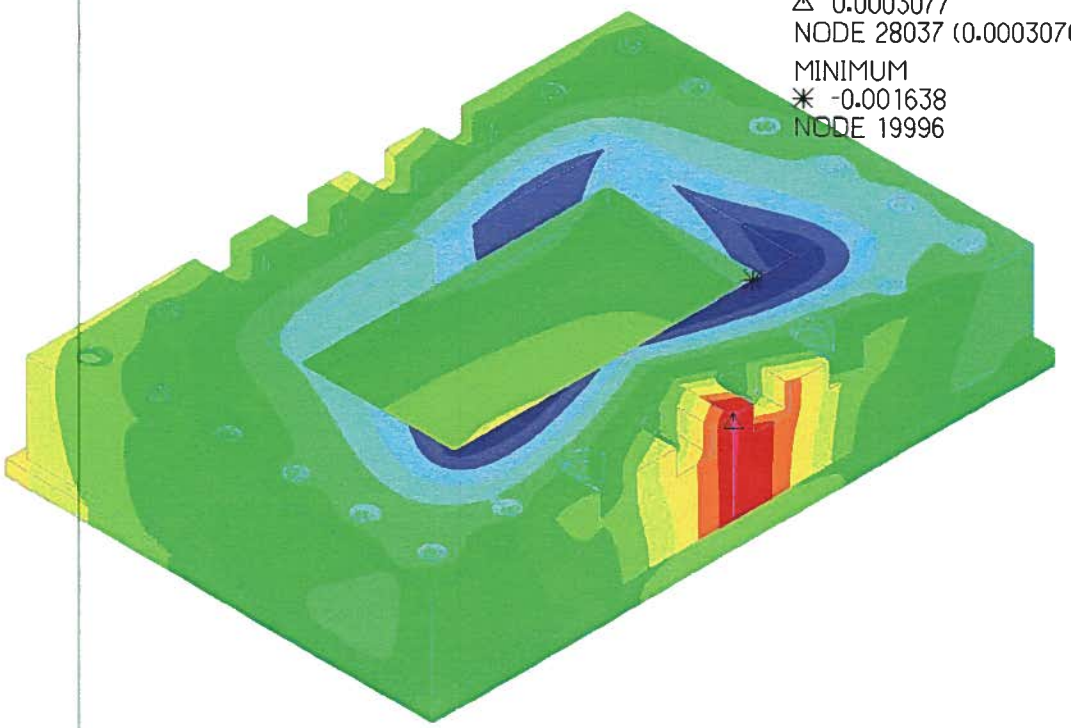
TIME 3.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxTransShear_WithoutSK_ISOVIEW2_Y-DISPLACEMENT_Unit_MN,m,rad

ADINA

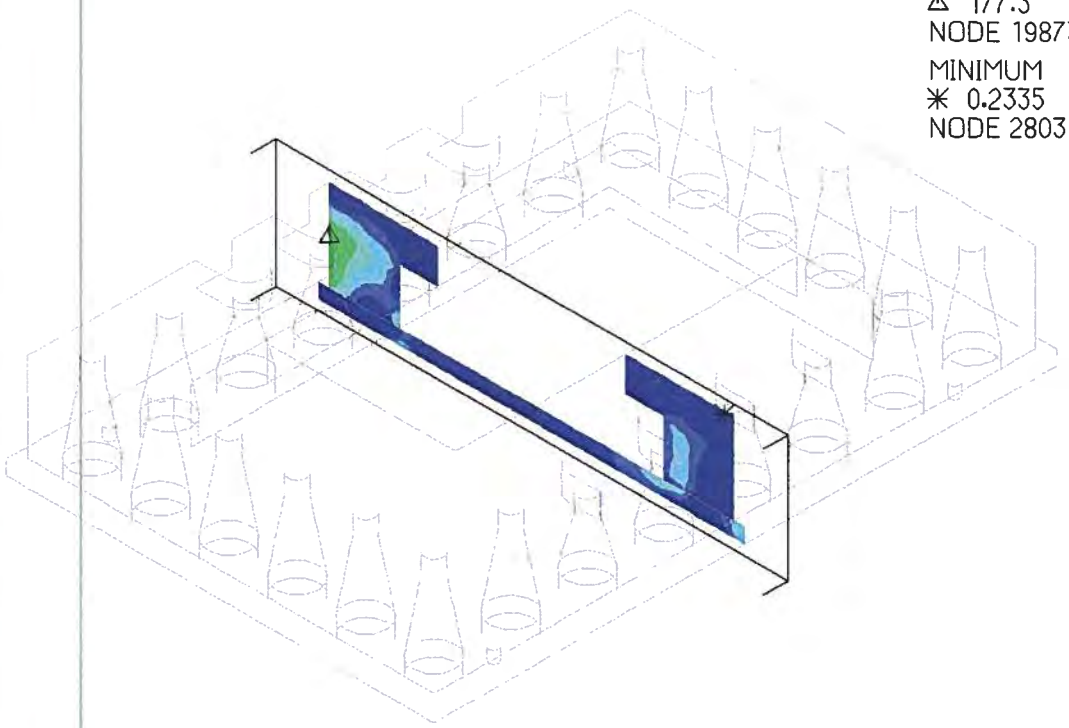
TIME 3.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxTransShear_WithoutSK_ISOVIEW2_XPlane_1_EFFECTIVE_STRESS_Unit_MN.m.rad

ADINA

TIME 3.000



MAXIMUM
△ 177.3
NODE 19873
MINIMUM
✳ 0.2335
NODE 28031 (2.459)

Y
X
Z

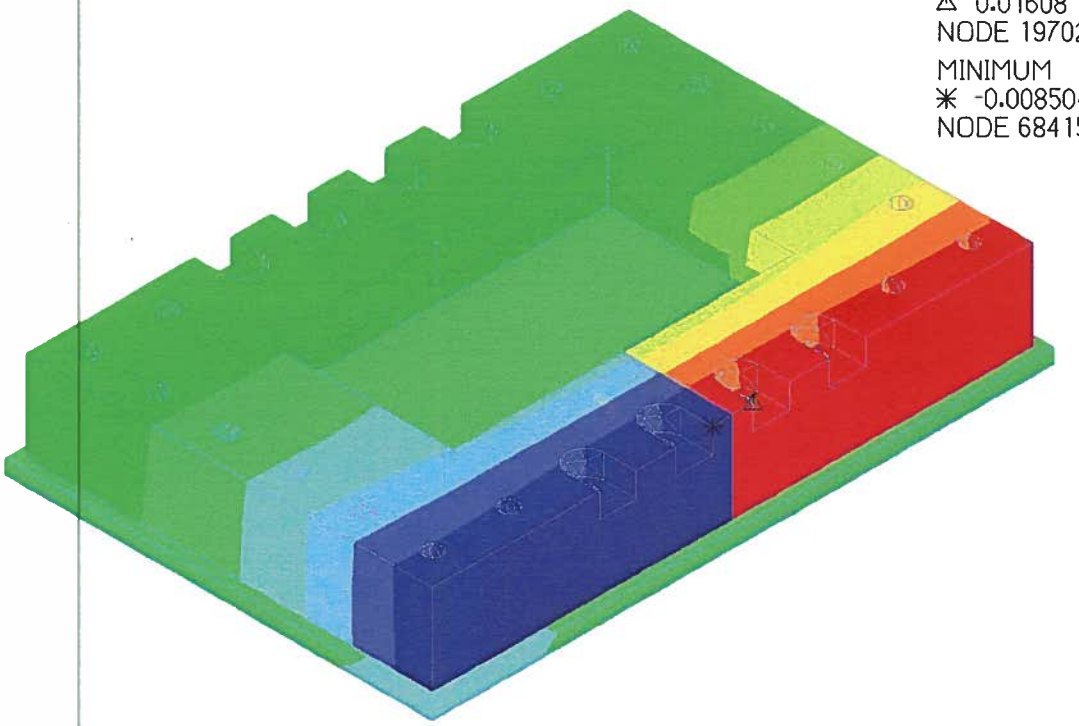
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 3.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxTransShear_WithoutSK_ISOVIEW2_X-DISPLACEMENT_Unit_MN,m,rad

ADINA

TIME 3.000



MAXIMUM
△ 0.01608
NODE 19702
MINIMUM
✳ -0.008504
NODE 68415

Y
X
Z

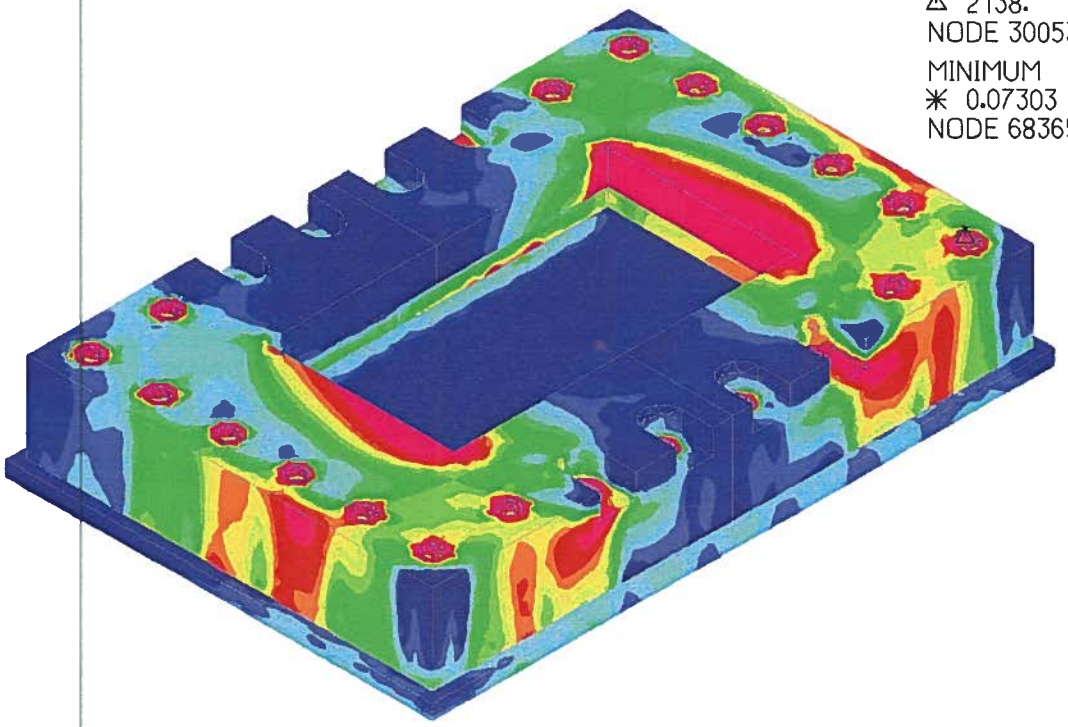
X-DISPLACEMENT
TIME 3.000

0.01440
0.01080
0.00720
0.00360
0.00000
-0.00360
-0.00720

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxTransShear_WithoutSK_ISOVIEW2_EFFECTIVE_STRESS_Unit_MN.m.rad

ADINA

TIME 3.000



MAXIMUM
△ 2138.
NODE 30053
MINIMUM
✳ 0.07303
NODE 68365 (1.030)

Y
X
Z

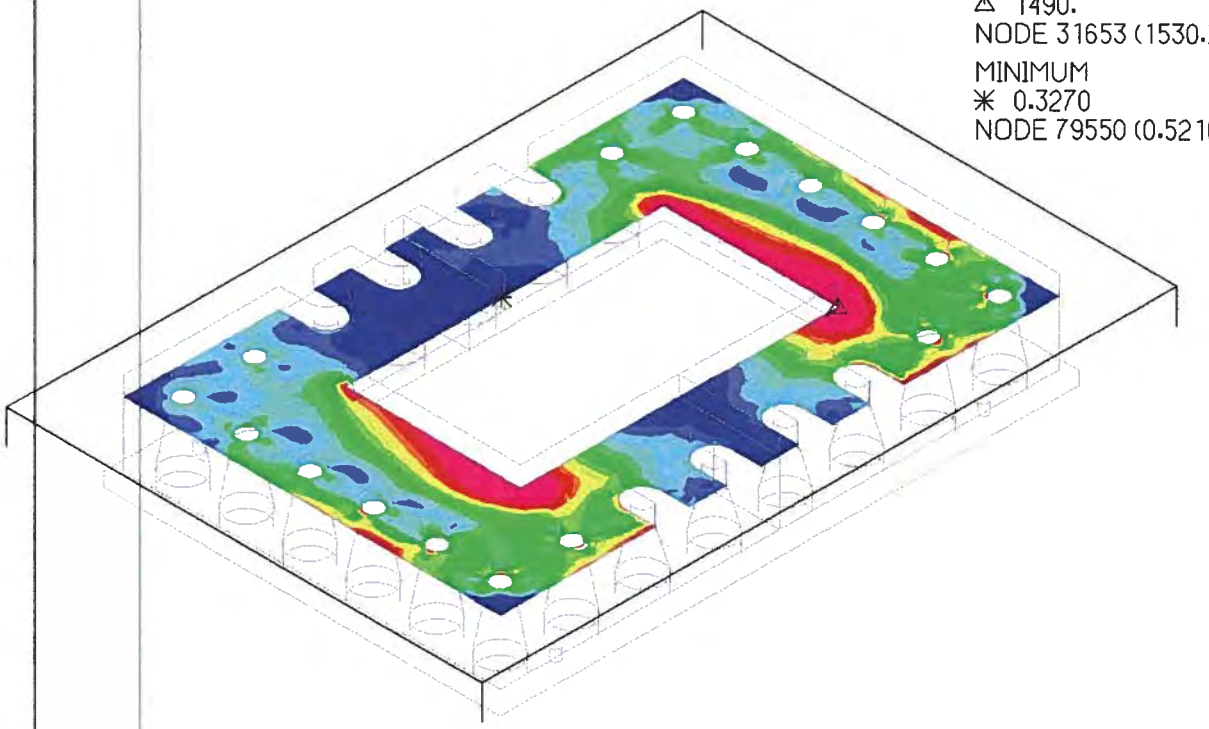
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 3.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxTransShear_WithoutSK_ISOVIEW2_ YPlane_2_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

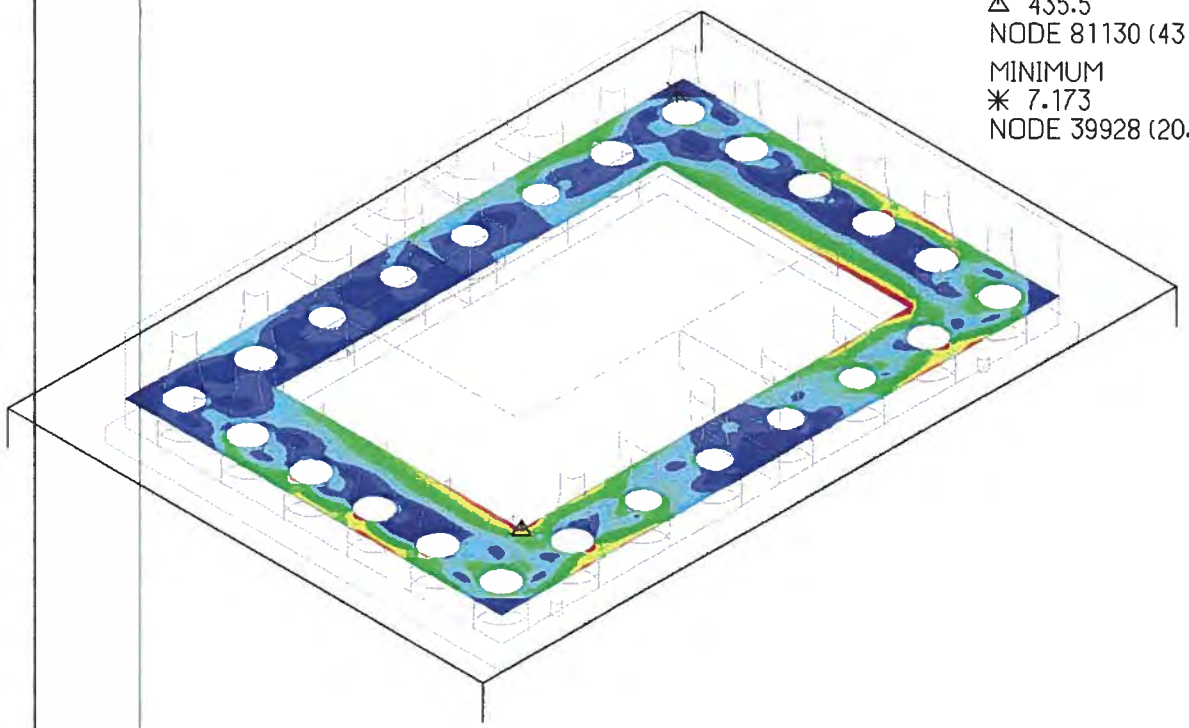
TIME 3.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxTransShear_WithoutSK_ISOVIEW2_ YPlane_1_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

TIME 3.000



MAXIMUM
△ 435.5
NODE 81130 (431.7)
MINIMUM
✳ 7.173
NODE 39928 (20.37)

Y
X
Z

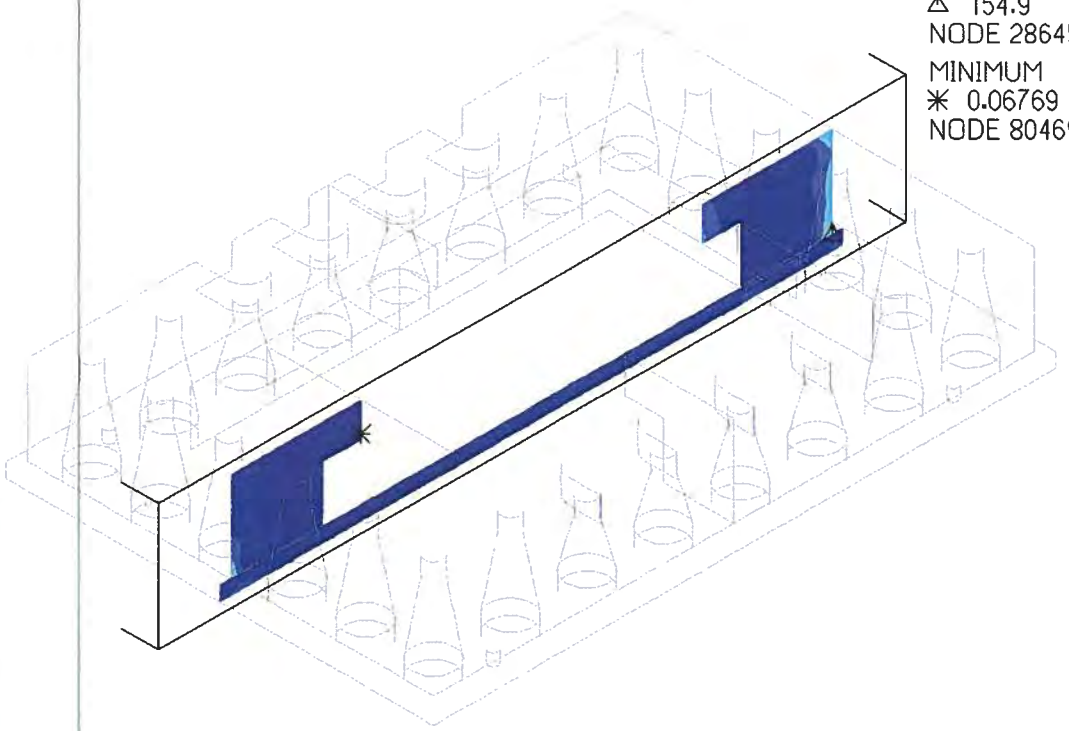
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 3.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxLongiShear_WithoutSK_ISOVIEW2_ZPlane_1_EFFECTIVE_STRESS_Unit_MN.m.rad

ADINA

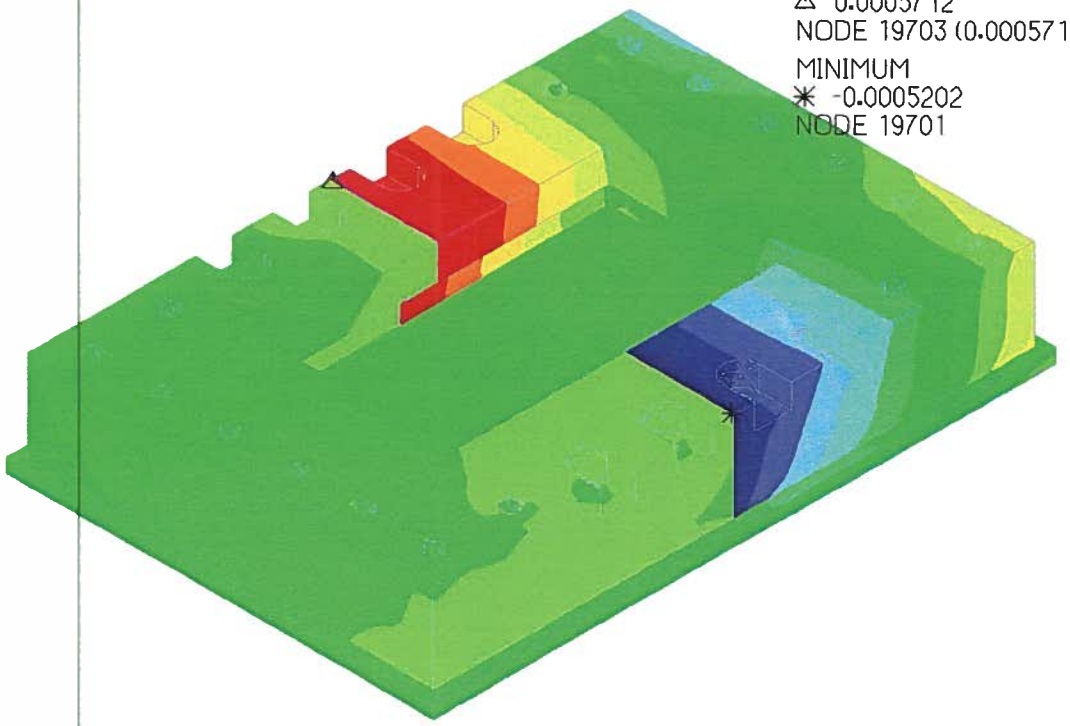
TIME 5.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxLongiShear_WithoutSK_ISOVIEW2_Z-DISPLACEMENT_Unit_MN,m,rad

ADINA

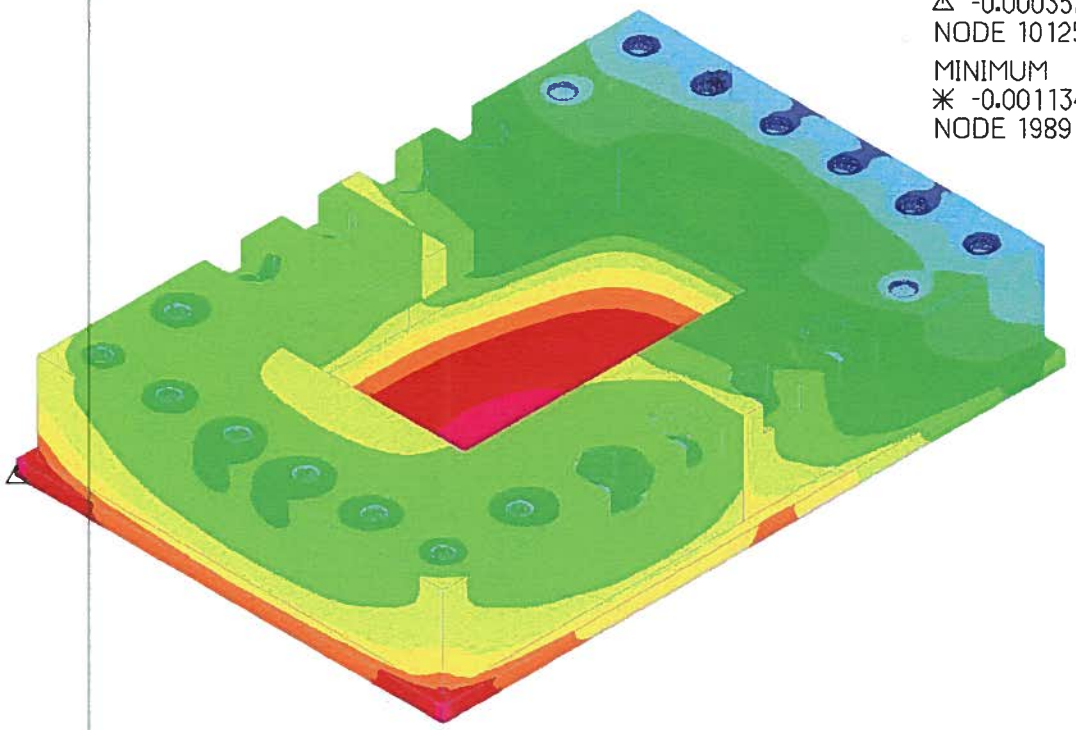
TIME 5.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxLongiShear_WithoutSK_ISOVIEW2_Y-DISPLACEMENT_Unit_MN,m,rad

ADINA

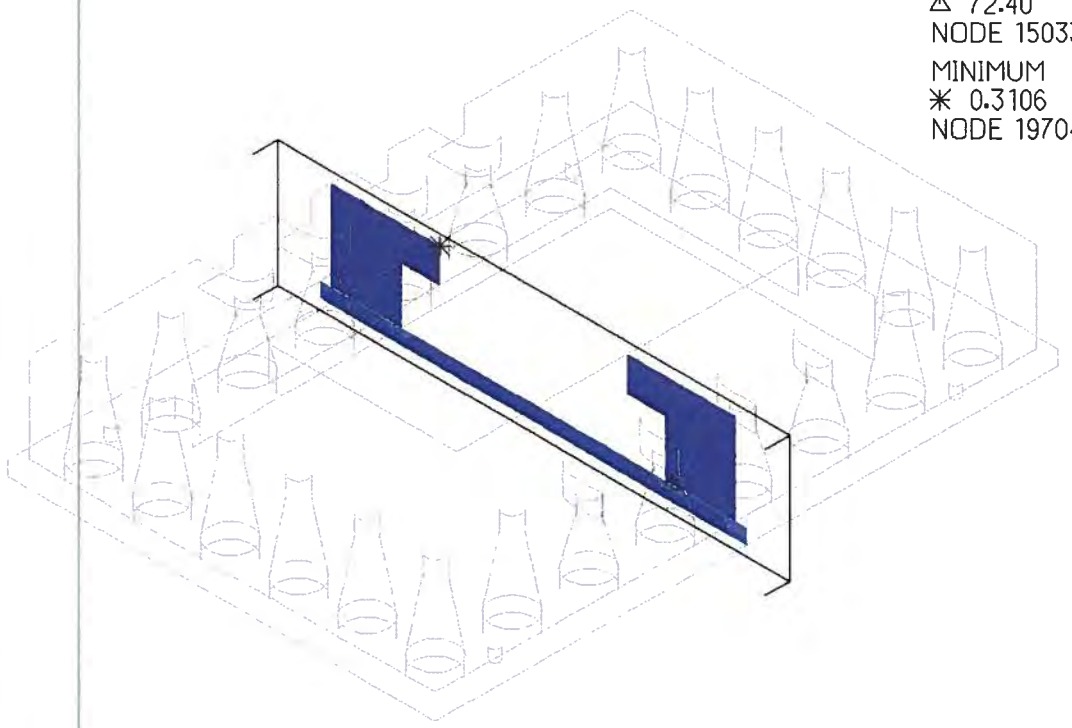
TIME 5.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxLongiShear_WithoutSK_ISOVIEW2_XPlane_1_EFFECTIVE_STRESS_Unit_MN.m.rad

ADINA

TIME 5.000



MAXIMUM
△ 72.40
NODE 15033 (71.05)
MINIMUM
✳ 0.3106
NODE 19704

Y
X
Z

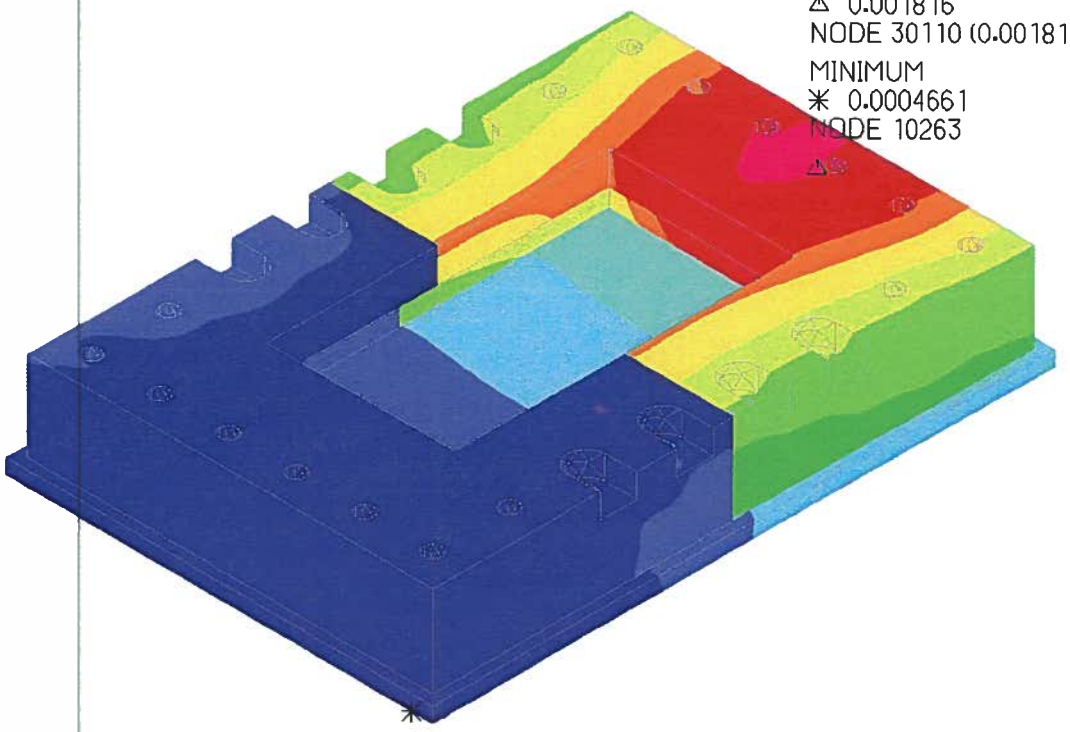
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 5.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxLongiShear_WithoutSK_ISOVIEW2_X-DISPLACEMENT_Unit_MN,m,rad

ADINA

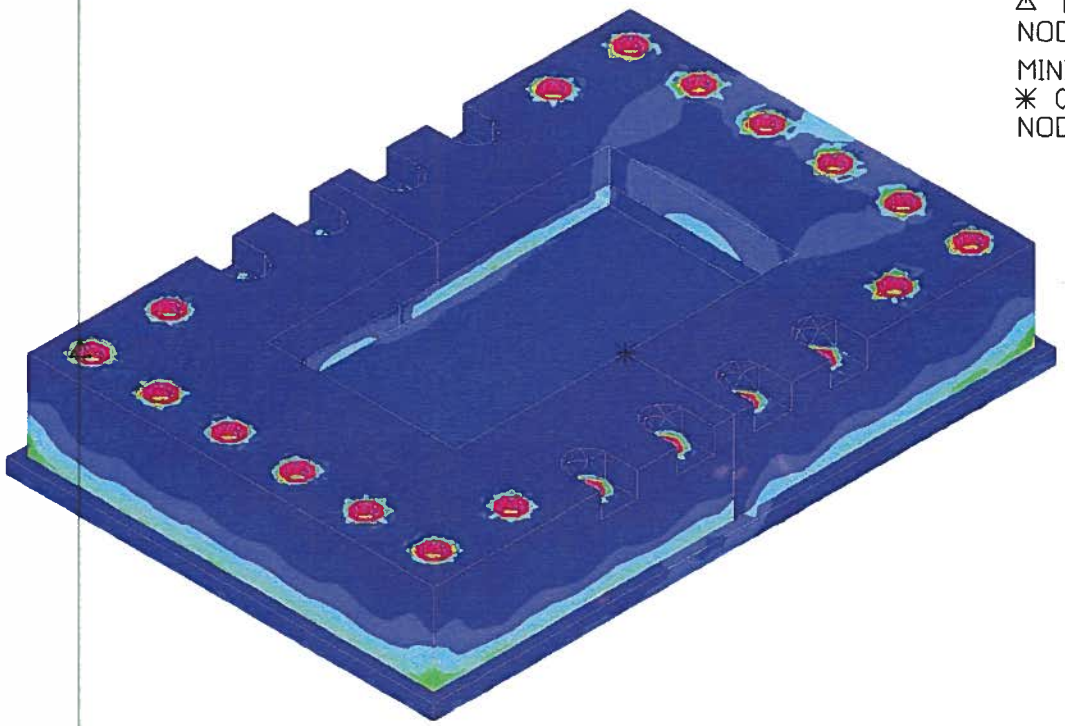
TIME 5.000



ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxLongiShear_WithoutSK_ISOVIEW2_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

TIME 5.000



MAXIMUM
△ 1964.
NODE 76899
MINIMUM
✳ 0.08335
NODE 68363

Y
X
Z

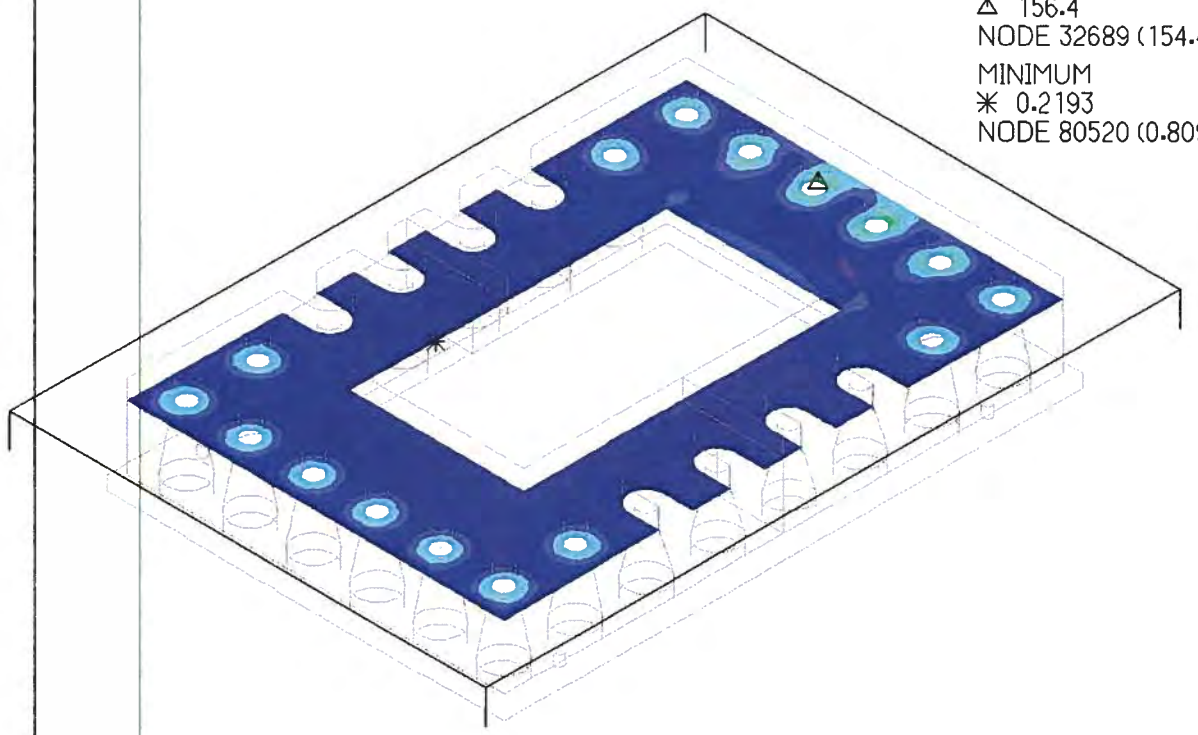
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 5.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxLongiShear_WithoutSK_ISOVIEW2_ YPlane_2_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

TIME 5.000



MAXIMUM
△ 156.4
NODE 32689 (154.4)
MINIMUM
✳ 0.2193
NODE 80520 (0.8094)

Y
X
Z

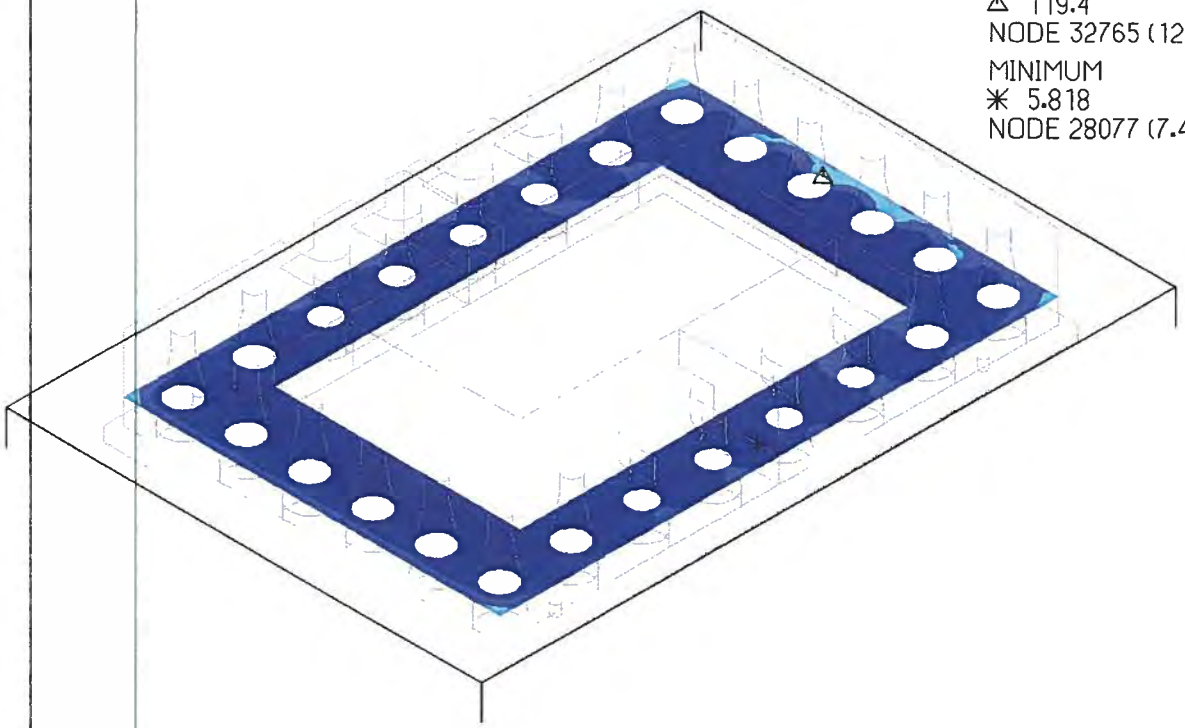
SMOOTHED
EFFECTIVE
STRESS
RST CALC
TIME 5.000

325.0
275.0
225.0
175.0
125.0
75.0
25.0

ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_HoldDown_MaxLongiShear_WithoutSK_ISOVIEW2_ YPlane_1_EFFECTIVE_STRESS_Unit_MN,m,rad

ADINA

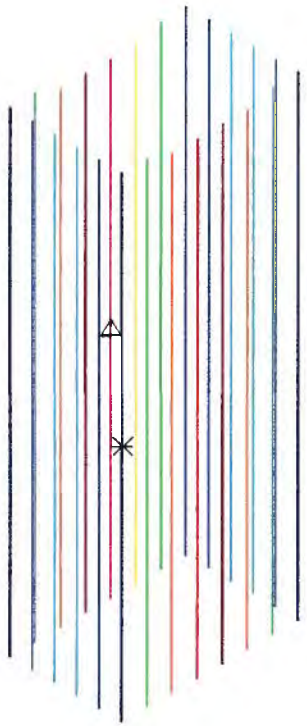
TIME 5.000



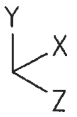
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_Bolt_MaxUplift_WithSK_ISOVIEW2_AXIAL_STRESS_Unit_MN,m,rad_fpu=965MPa

ADINA

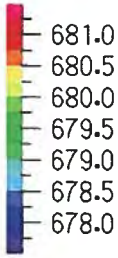
TIME 7.000



MAXIMUM
△ 681.3
EG 1003, EL 1022, IPT 1
MINIMUM
✳ 677.8
EG 1003, EL 1007, IPT 1



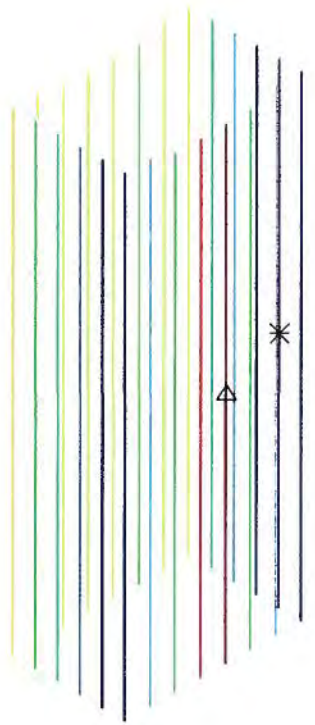
AXIAL_STRESS
RST CALC
TIME 7.000



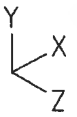
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_Bolt_MaxUplift_WithoutSK_ISOVIEW2_AXIAL_STRESS_Unit_MN,m,rad_fpu=965MPa

ADINA

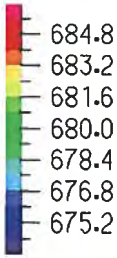
TIME 1.000



MAXIMUM
△ 685.5
EG 1003, EL 1018, IPT 1
MINIMUM
✳ 674.2
EG 1003, EL 1002, IPT 1



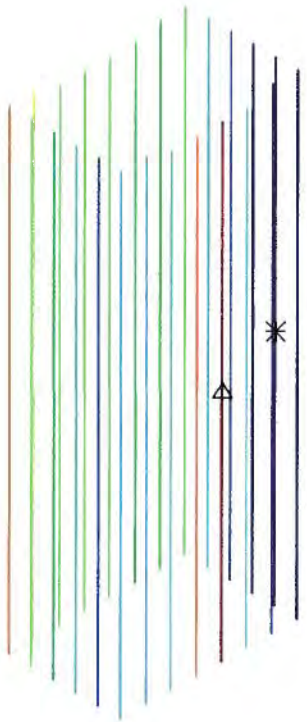
AXIAL_STRESS
RST CALC
TIME 1.000



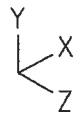
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_Bolt_MaxTransShear_WithoutSK_ISOVIEW2_AXIAL_STRESS_Unit_MN,m,rad_fpu=965MPa

ADINA

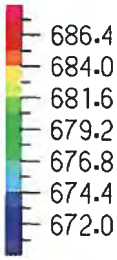
TIME 3.000



MAXIMUM
△ 687.5
EG 1003, EL 1018, IPT 1
MINIMUM
✳ 670.5
EG 1003, EL 1002, IPT 1



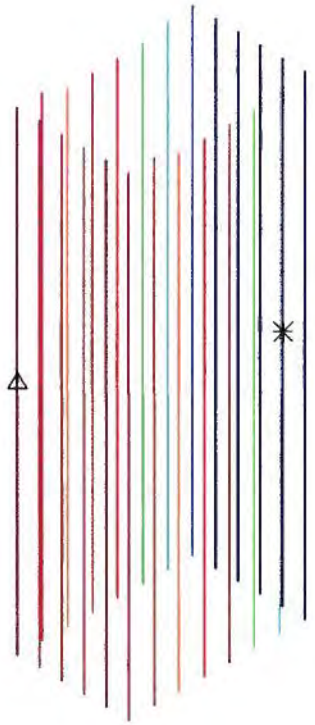
AXIAL_STRESS
RST CALC
TIME 3.000



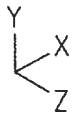
ADINA: AUI version 8.9.2, 5 July 2013: Licensed from ADINA R&D, Inc.
SAS_E2_B4_111-114_Brg_Bolt_MaxLongiShear_WithoutSK_ISOVIEW2_AXIAL_STRESS_Unit_MN,m,rad_fpu=965MPa

ADINA

TIME 5.000



MAXIMUM
△ 678.6
EG 1003, EL 1012, IPT 1
MINIMUM
✳ 671.6
EG 1003, EL 1002, IPT 1



AXIAL_STRESS
RST CALC
TIME 5.000