

SCV Equivalent Static Analysis

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AP1000 Layout & Structures

Introduction

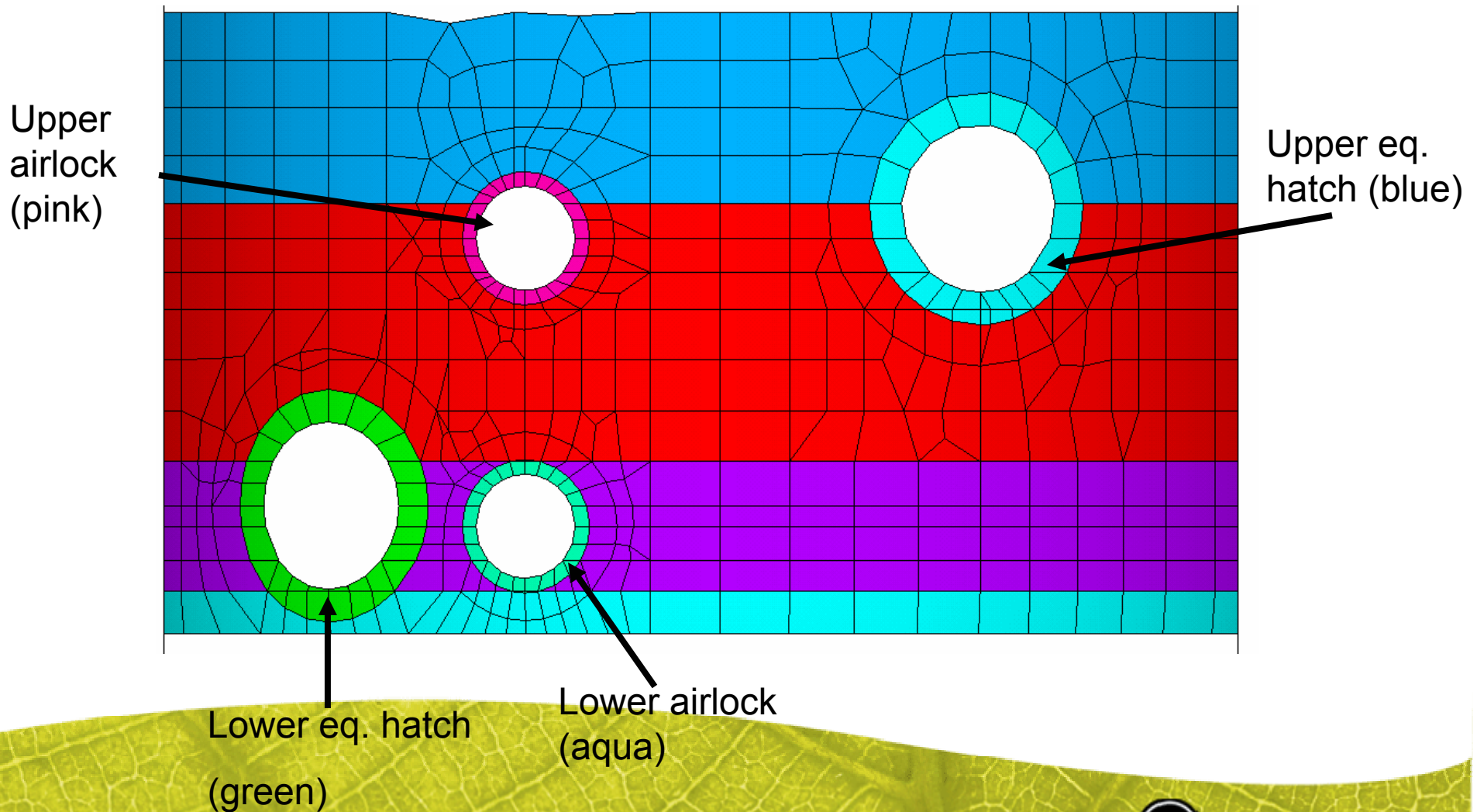
- Purpose

- To summarize the analytical basis for RAI-TR03-016
- Comparisons of equivalent static results against those from the time history made on the same steel containment vessel model

Equivalent Static Analysis Methodology

- Developed by Chicago Bridge & Iron
 - Global acceleration applied as single mode deflection
 - Local accelerations applied at each major penetration
 - 3 separate analyses (combining global and local for X, Y, Z) combined by 100-40-40

Critical Sections for Comparison



Global Acceleration Profile

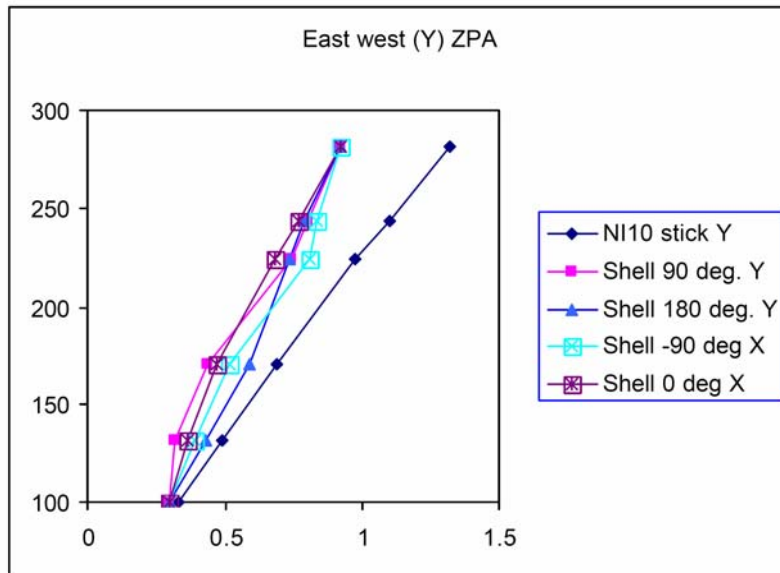


Figure 6 - 5 East West Acceleration (ZPA)

Table 5.7 – Equivalent Global Static Acceleration, ZPA(g)
Steel Containment Vessel (Reference 2, Table 7)

Elevation (ft)	Equivalent Global Static Acceleration, ZPA(g)					
	N-S Direction		E-W Direction		Vertical Direction	
	Mass center	Edge	Mass center	Edge	Mass center	Edge
281.90	1.48		1.56		1.25	
273.83	1.43		1.50		1.02	
265.83	1.38		1.43		0.85	
255.02	1.31		1.34		0.73	
244.21	1.23	1.28	1.26	1.30	0.68	0.71
224.00	1.09	1.13	1.11	1.17	0.66	0.68
200.00	0.90	0.94	0.94	0.98	0.61	0.63
169.93	0.69	0.71	0.72	0.75	0.53	0.55
162.00	0.63	0.65	0.67	0.68	0.51	0.53
141.50	0.49	0.50	0.54	0.54	0.45	0.47
131.68	0.43	0.44	0.47	0.48	0.41	0.44
112.50	0.40	0.41	0.37	0.38	0.35	0.40
104.12	0.38	0.40	0.38	0.40	0.32	0.38
100.00	0.38	0.40	0.39	0.41	0.31	0.34

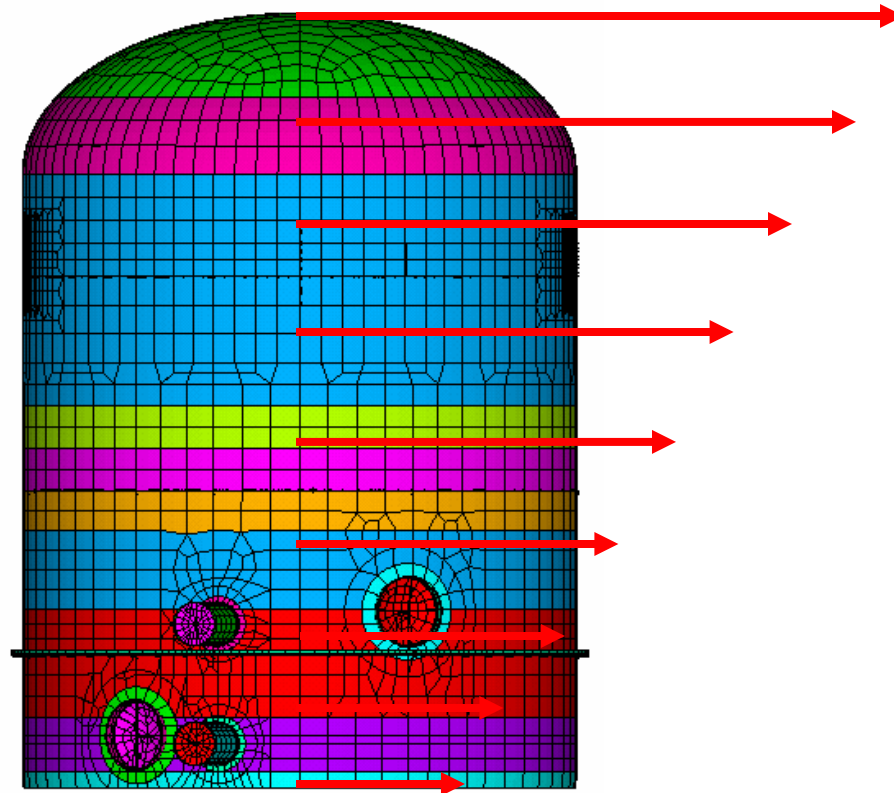
Local Accelerations

- Developed in APP-MV50-S2C-009

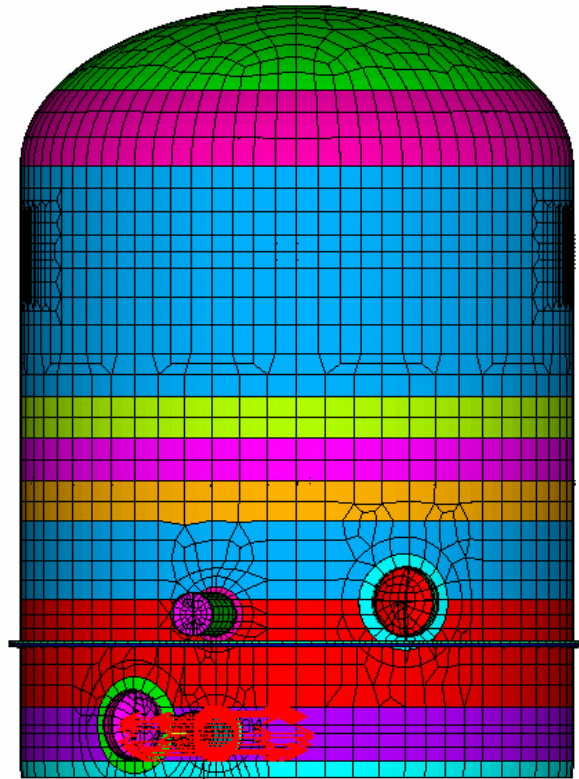
Table 6- 8 Equivalent static accelerations to account for local shell flexibility

	Radial acceleration (g)	Rotational acceleration about horizontal axis (radians/sec ²)	Rotational acceleration about vertical axis (radians/sec ²)
Upper equipment hatch	0.21	0.54	0.45
Upper airlock	0.27	2.54	1.46
Lower e equipment hatch	0.12	0.44	0.39
Lower airlock	0.20	1.49	1.87

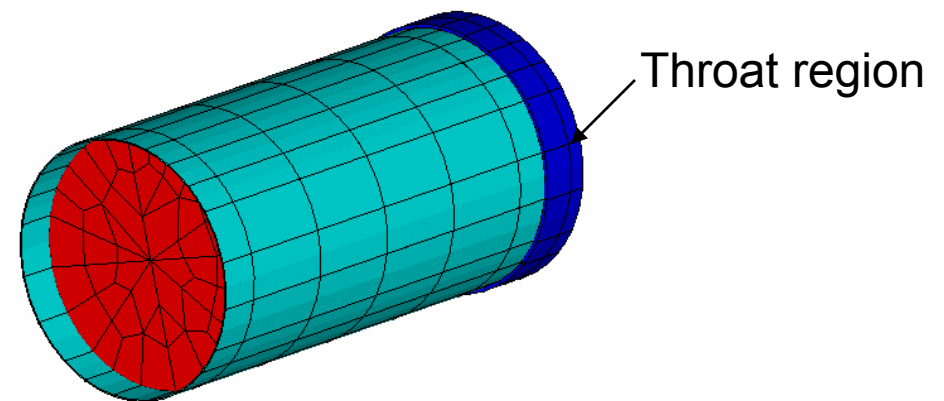
Global Acceleration Loading



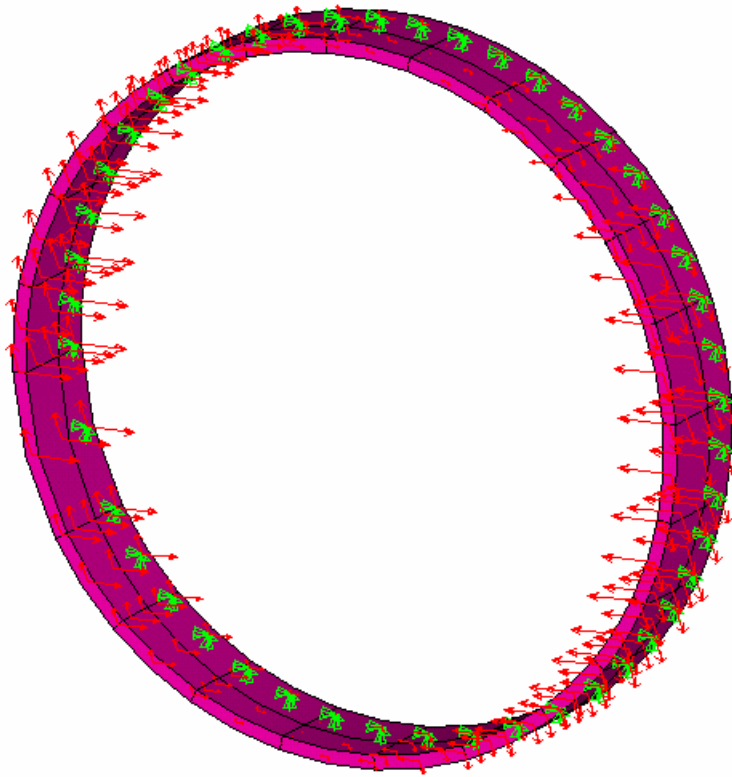
Local Accelerations (cont.)



Each penetration has a separate local acceleration load step

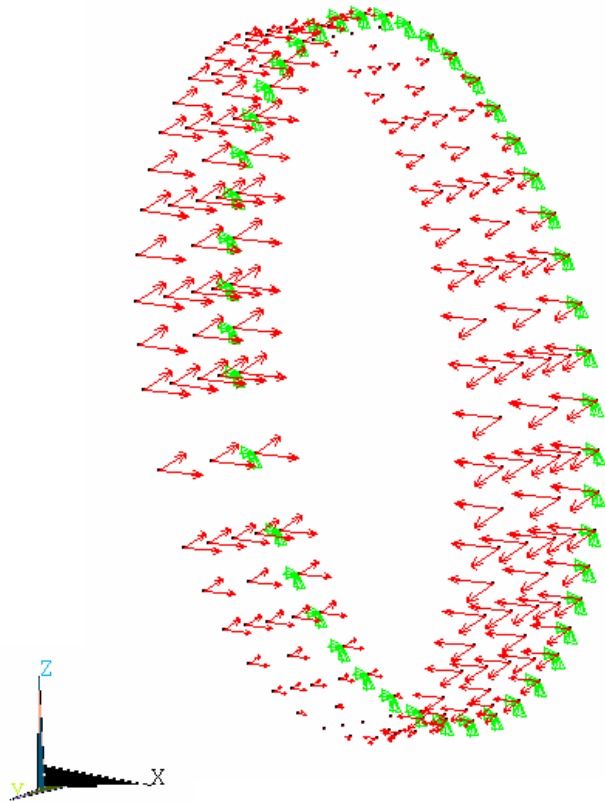


Local Accelerations (cont.)



Equivalent forces are applied to the ring section at the throat of each penetration

Local Accelerations (cont.)



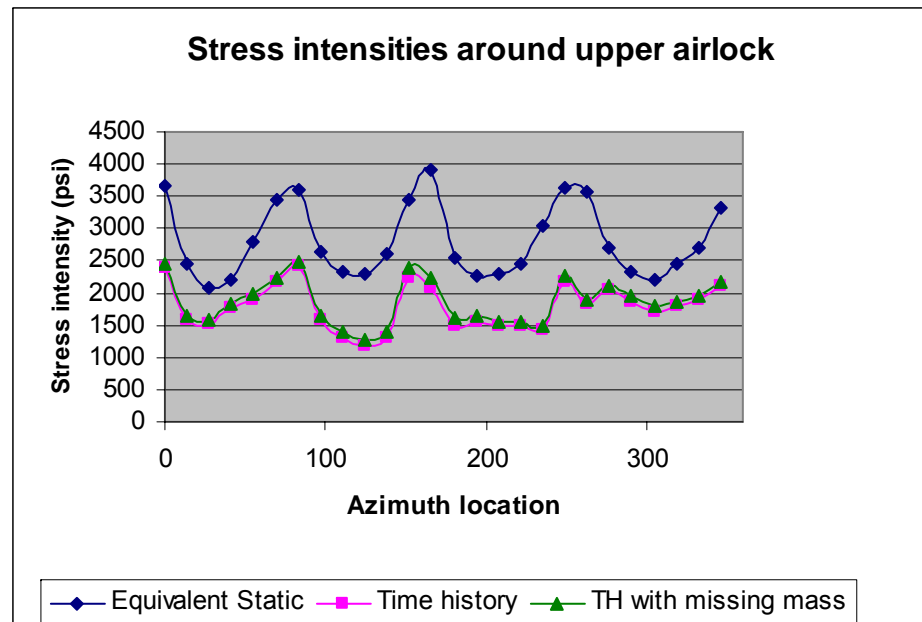
Local rotational
acceleration about
vertical axis

Each load scaled by
rotation angle from
axis – moment of
inertia is higher at
extremes

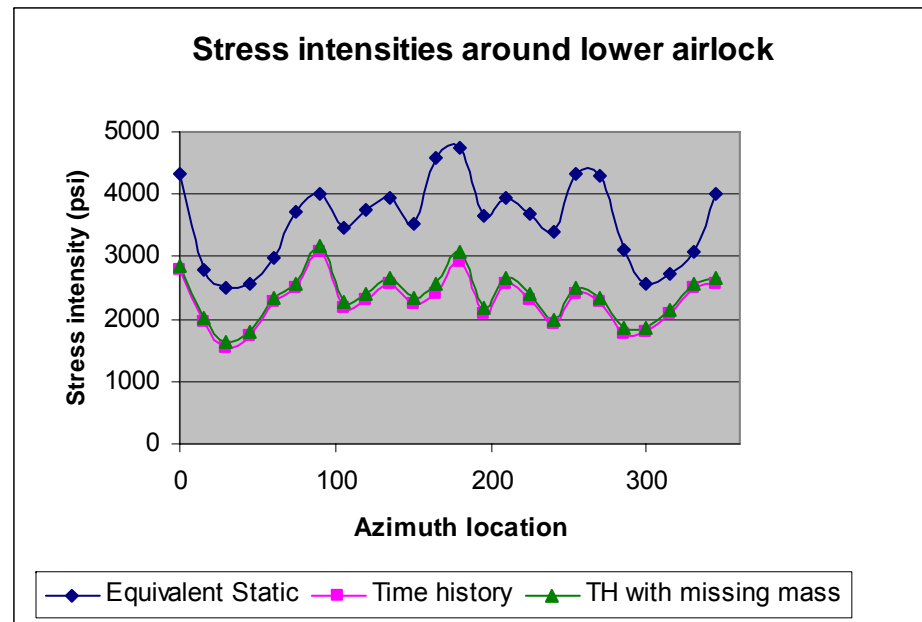
Load Combinations

- Global accelerations are combined with local for each direction X, Y, Z
- As penetrations are located near the 90° azimuth
 - Radial load is combined directly with global Y
 - Horizontal load is combined with global Z
 - Vertical load is combined with global X

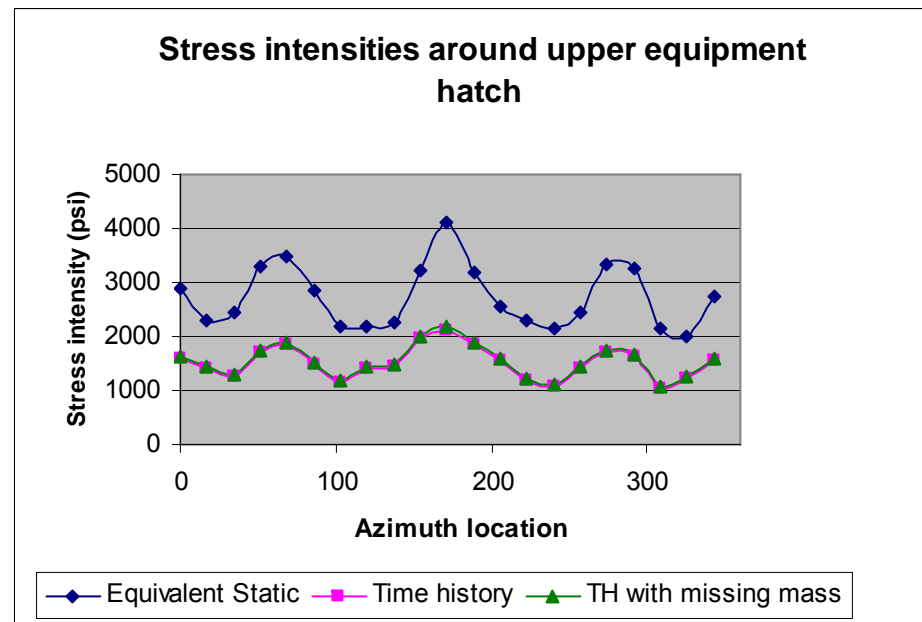
Comparison of Stress Intensity



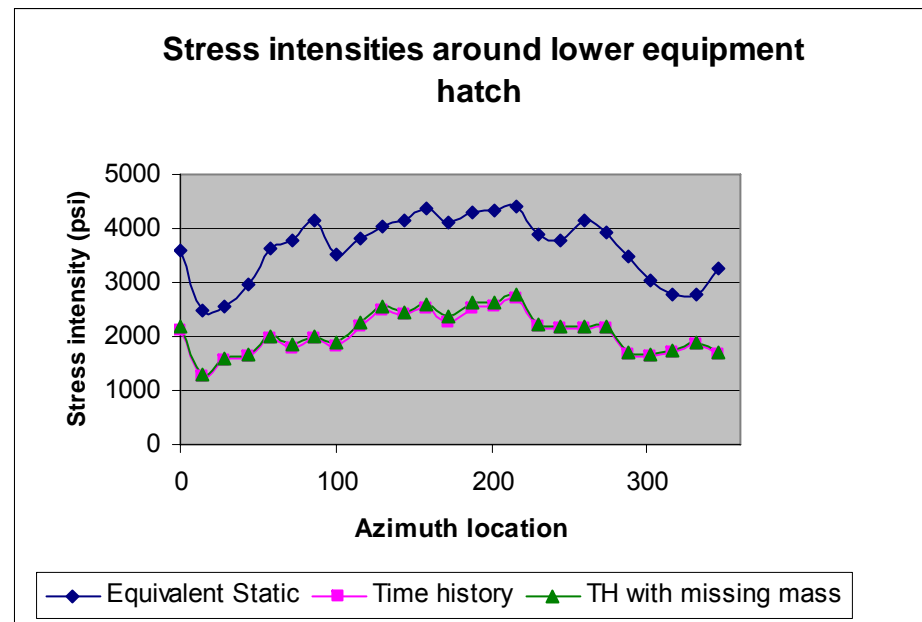
Comparison of Stress Intensity



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Questions
