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1-30-2010

TD2 Required Documentation:

TD2-1-1 Current Component and System Status

1) Critical fuel systems components received:
2) Critical powertrain components received:
    a. All critical power train components received, assembled, and installed.

WIKISPEED Fig. 1 TD2-1-1a Power train components (Honda R18A).

3) Critical emissions components received:
    a. Exhaust header integrated catalytic converter:

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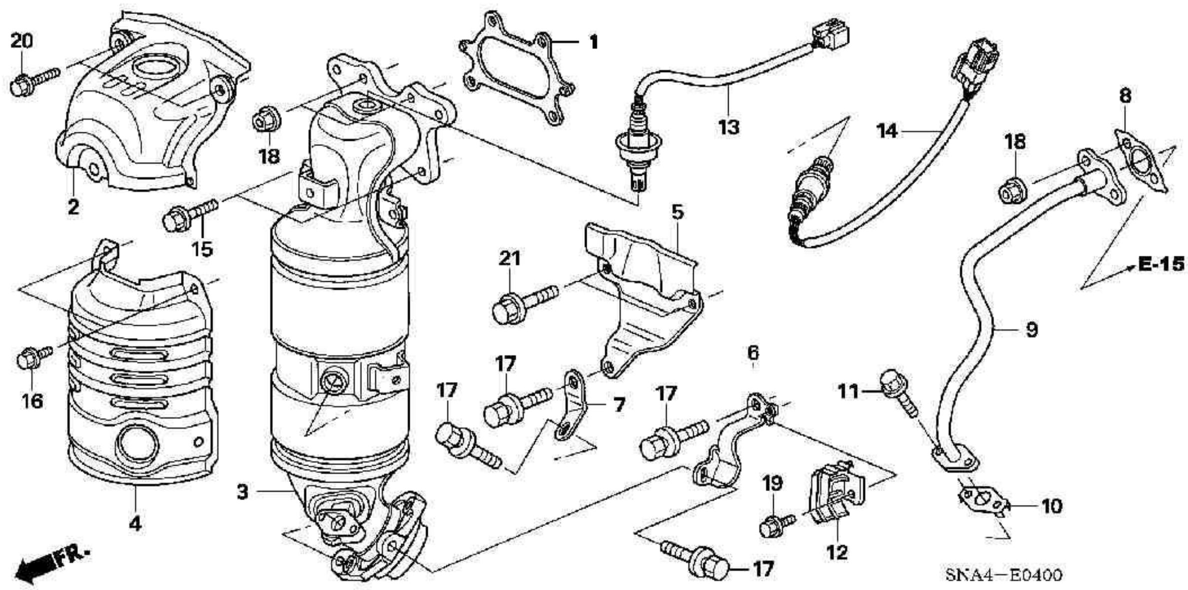

WIKISPEED Fig. 2 TD2-1-1b Exhaust header integrated catalytic converter.

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WIKISPEED Fig. 3 TD2-1-1c Exhaust header integrated catalytic converter, shown attached to R18A engine, cutaway view. Note double block elements and immediate access to hottest gas for rapid element heating and exceptional cold start emissions control.

4) Critical body materials received:
   a. Windshield:
      Our OEM DOT approved glass windshield is in house in the case our glazing materials waiver is not accepted. Update, January 29th our glazing waiver has been accepted. We will be ordering and forming our polycarbonate windshield immediately.
   b. Formed panels:
      Our formed panels are NOT in house. Foamlix will be CNC wire cutting and milling 3 4'x8' foam blocks to form our drop on aeroshell and a 4th block as our drop in interior, which we will then laminate (and insulate and carpet in the case of the interior). Foamlinx assures us an industry leading rapid prototyping turn-around time and we believe the exterior and interior formed panels will be in house and attached during February, allowing the month of March for aerodynamically valid road testing.
5) Evidence that chassis is fully complete:
   a. Please see attached video and photos below:

WIKISPEED Fig. 4 TD2-1-1d Complete structural frame and assemblies. Note complete chassis formed from stock aluminum extrusions for minimal manufacturing cost in start-up scenario. Note all extrusions can be milled on single CNC router table simultaneously with only 2 set ups. Note bolt-in roll bars are not attached, however mounting locations have already been drilled.

TD2-1-2 Proof of a running vehicle

Please see attached video.

TD2-1-4 Ground Clearance

WIKISPEED Fig. 5 TD2-1-4 Vehicle at ride height, showing ground clearance at 4". Ground clearance is fully adjustable and the suspension geometry is adjustable to accommodate from 2" ground clearance to 8" with less than .25" inches track scrub during 1g to 4g vertical loads.

TD2-1-5 Emissions Control Status

Please see exhaust header integrated catalytic converter and downpipe integrated catalytic converter photos above in section TD2-1-1. We have included manufacturer gas analysis data below and will replace with actual certified emissions test center data. Our engine and chassis is running, our wheels turning, but our vehicle is not on-road drivable to an emissions test center. We will have emissions testing data from an emissions test center included with the 3rd technical deliverable. This intent was accepted as of the first technical deliverable; excerpt from first technical deliverable:

"TD1-3-12f 0 Certified test data from emissions testing:

Our engine in our chassis is running but our chassis is not drivable to an emissions test center. We will have emissions testing data from an emissions test center included with the 3rd Technical deliverable. We have included the manufacturer provided emissions test data for the engine, below. We do anticipate similar performance as we have not modified the engine or the emissions equipment in any significant way.

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Product Environmental Performance Information

Note: Information is provided only for major, high-volume-selling models that were either newly released or fully remodeled in FY2007.
W http://world.honda.com/environment/2007report

Automobiles Environmental Performance of New or Remodeled Automobiles Sold in Japan in FY2007 (Major Models)

Model Name			Civic	Stream	Partner	CR-V	Edix	Elysion Prestige	Crossroad	Civic
Type covered			2.0GL	X	EL	ZX	24S	SG	20X	TYPE R
Release date			April 7, 2006	July 14, 2006	July 25, 2006	Oct. 13, 2006	Nov. 30, 2006	Dec. 21, 2006	Feb. 23, 2007	Mar. 30, 2007
Type details			DBA-FD2	DBA-RN6	DBE-GJ4	DBA-RE4	DBA-BE8	DBA-RR5	DBA-RT3	ABA-FD2
Engine (motor) type			K20A	R18A	L15A	K24A	K24A	J35A	R20A	K20A
Engine displacement (cm^3)			1,998	1,799	1,496	2,354	2,354	3,471	1,997	1,998
Drive train	Type of drive train*1		FF	FF	4WD	4WD	FF	FF	FF	FF
	Transmission		Electronically controlled 5-speed automatic	Electronically controlled 5-speed automatic	Electronically controlled 5-speed automatic	Electronically controlled 5-speed automatic	Electronically controlled 5-speed automatic	Electronically controlled 5-speed automatic	Electronically controlled 5-speed automatic	6-speed manual
Vehicle weight (kg)			1,280–1,300	1,350–1,380	1,220	1,530–1,580	1,480; 1,490	1,920–1,980	1,430–1,460	1,250
Emissions	Compliance with 2005 Emissions Standards*2		○	○	○	○	○	○	○	○
	MLIT Low-Emissions Vehicle certification level*3		★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	—
10-15+11 mode	Values reported to MLIT (g/km)	CO	0.40	0.40	0.50	0.40	0.50	0.40	0.40	0.60
		NMHC	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.04
		NOx	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.04
Fuel economy	10-15 mode (km/L)		13.6	14.8	15.4	11.6	12.0	8.5	13.8	11.4
	CO2 emissions (g/km)		170.7	156.9	150.8	200.1	193.5	273.1	168.2	203.7
	Compliance with FY2011 Fuel Economy Standards		○	○	○	○	—	—	○	—
	Attains FY2011 Fuel Economy Standards + 5%		—	○	○	○	—	—	○	—
	Attains FY2011 Fuel Economy Standards + 10%		—	○	○	○	—	—	—	—
	Attains FY2011 Fuel Economy Standards + 20%		—	—	—	—	—	—	—	—
	Equipped with a fuel economy meter*4		—	Standard equipment	Standard equipment	Standard equipment	Standard equipment	—	Standard equipment	—
Compliance with Green Purchasing Law	8 prefectures/cities, including Tokyo		○	○	○	○	○	○	○	—
	7 prefectures/cities in the Kyoto-Osaka-Kobe area		○	○	○	○	○	○	○	—
Compliance with Green Purchasing Law			○	○	○	○	—	—	○	—
Eligibility for Green Tax rebate			—	○	○	○	—	—	—	—
Noise level (MLIT measurement)	Noise near exhaust outlet (dB (A)) / Engine rpm		83/4,500	85/4,725	82/4,125	83/4,350	87/4,275	81/4,650	85/4,650	93/5,000
	Acceleration noise (dB (A))		74	73	75	74	75	75	74	75
	Constant speed passing noise (dB (A)), (km/h)		69 (50)	70 (50)	69 (50)	70 (50)	70 (50)	70 (50)	70 (50)	71 (50)
Compliance with JAMA interior VOC standards (within MHLW guidelines for interior VOC density)			○	○	○	○	○	○	○	○
Air conditioner	Refrigerant HFC 134a consumption (g)		500	500	500	490	500	750	500	—
Reduction in SOCs	Lead*5 (meets JAMA target of 10% of 1996 levels)		○	○	○	○	○	○	○	○
	Mercury*6 (meets JAMA target for elimination after January 2005)		○	○	○	○	○	○	○	○
	Hexavalent chromium (meets JAMA target for elimination after January 2008)		Minute quantities used	Minute quantities used	Minute quantities used	Minute quantities used	Minute quantities used	Minute quantities used	○	Minute quantities used
	Cadmium (meets JAMA target for elimination after January 2007)		○	○	○	○	○	○	○	○
Recycling	Recyclability*7		Over 90% of entire vehicle	Over 90% of entire vehicle	Over 90% of entire vehicle	Over 90% of entire vehicle	Over 90% of entire vehicle	Over 90% of entire vehicle	Over 90% of entire vehicle	Over 90% of entire vehicle

*1 FF—Front engine, front-wheel drive; 4WD—4-wheel drive
*2 Complies with long-term CO2 emission standards for passenger and light-duty vehicles
*3 ★★★: Low-emissions vehicle with emissions 50% lower than 2005 standards
★★★★: Low-emissions vehicle with emissions 75% lower than 2005 standards
*4 Eco Drive support devices, including real-time fuel economy meters, average fuel economy meters and eco lamps
*5 Lead batteries are excluded from the reduction target, as a separate recovery and recycling channel has been established
*6 Mercury used in minute quantities required to ensure traffic safety (in parts such as LCDs for navigation systems, combination meters, high intensity discharge headlights and interior fluorescent lights) is excluded from the reduction target
*7 Based on 1998 JAMA guidelines for defining and calculating new-vehicle recyclability

Note: Fuel economy values obtained under predefined testing conditions. Fuel economy may vary under actual driving conditions (depending on weather, road surface, manner of driving, vehicle maintenance, etc).

WIKISPEED Fig. 8 TD1-3-12f. Above, emissions output from Honda R18A engine. This information will be replaced by emissions testing conducted at a certified emissions test facility after the vehicle is drivable. We do expect similar performance as we have not modified the emissions system in any significant way."

TD2-3-2 Liquid fuel tank

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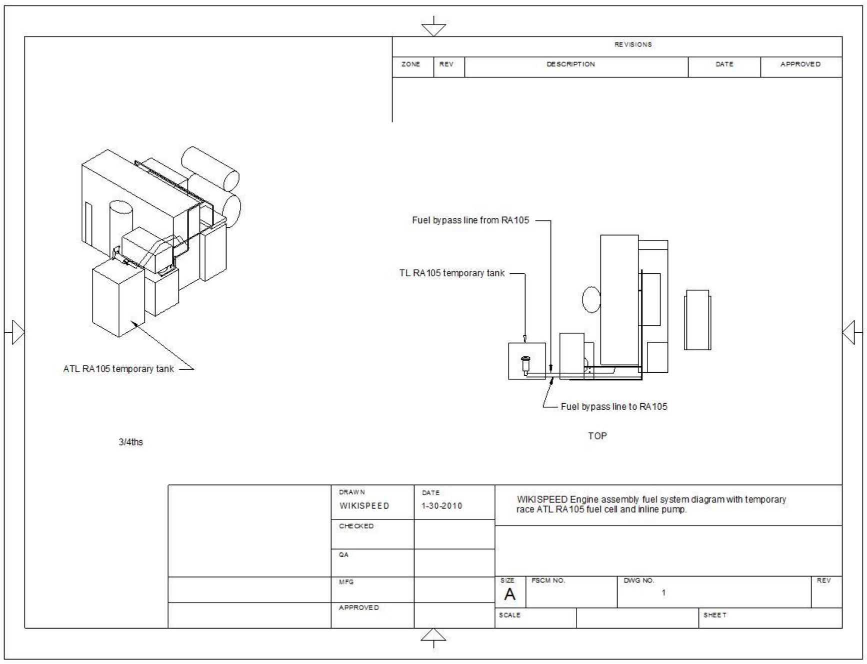
CAD showing location of supplemental competition fuel tank and in-line pump in temporary competition location. We will provide actual photos once the competition removable tank, disconnects and pump are received. Main fuel tank tabs have been further isolated with rubber bushings to reduce stress transfer from frame to fuel tank, to address comments from review of our first technical deliverable (thanks!).



WIKISPEED Fig. 6 TD2-3-2 CAD showing placement of supplemental competition fuel tank and in line pump. Note fuel bypass lines completely bypass permanent fuel tank but allow use of evaporative fuel recovery canister.

For reference, Here are the fuel system schematics of the system without the temporary competition use ATL RA105 fuel cell attached:

TD1-2-4b 0 Vehicle schematics or drawings (front, top/bottom, side) showing the fuel system. The drawings should show the placement of tank, fueling lines, and all other fuel components (filters, pumps, etc.)

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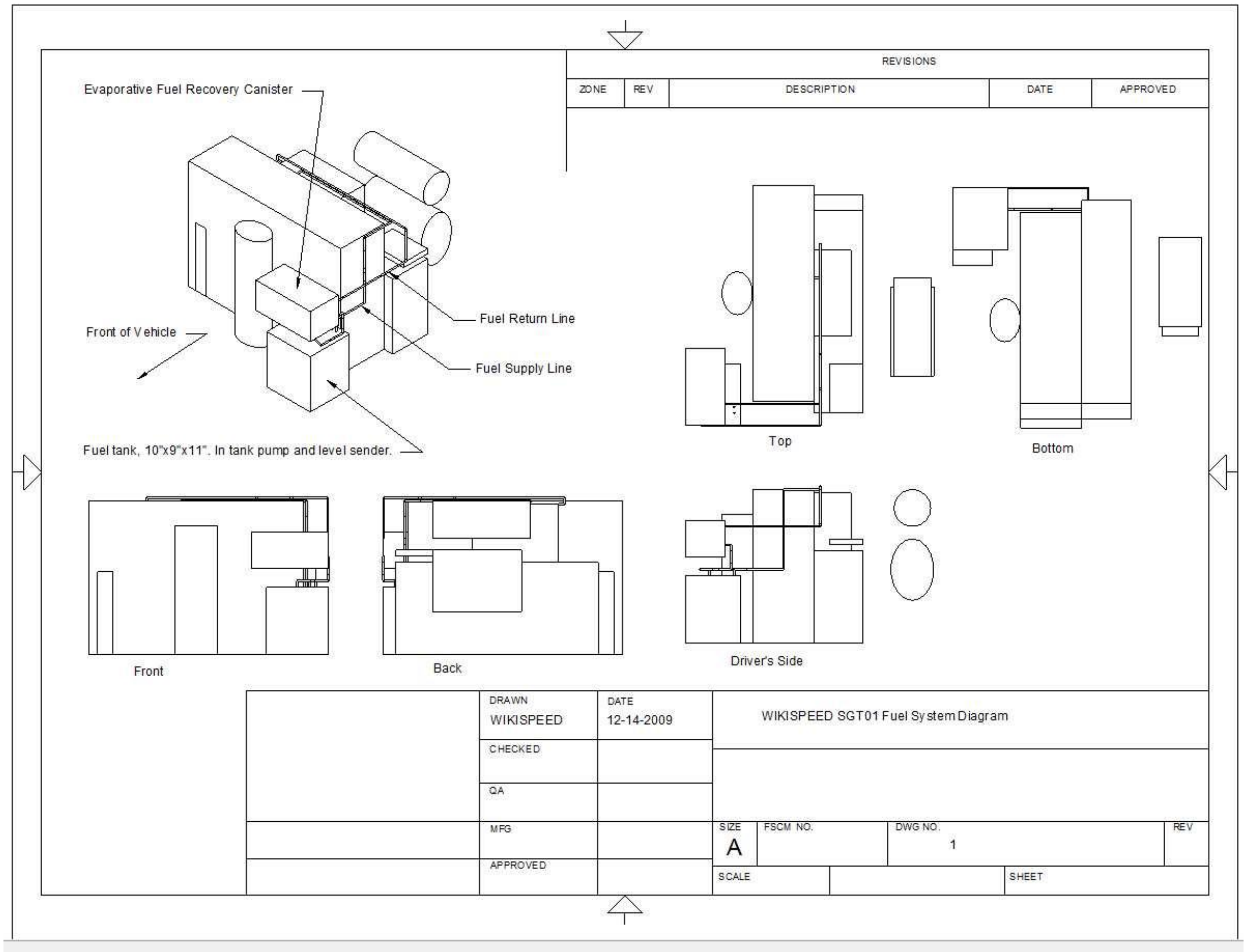

WIKISPEED Fig. 1b TD1-2-4b. Schematic of R18A engine in relation to fuel tank, evaporative fuel recovery canister, fuel lines, and callout for in-tank fuel pump and fuel level sender. 3/4ths view, top view, side view.

TD2-5-5 Detailed description of structure

Still current with the description from the first technical deliverable, however our CAD files now more accurately represent the roll bar hoops witch comprise the roof crush resistance and roof structure.

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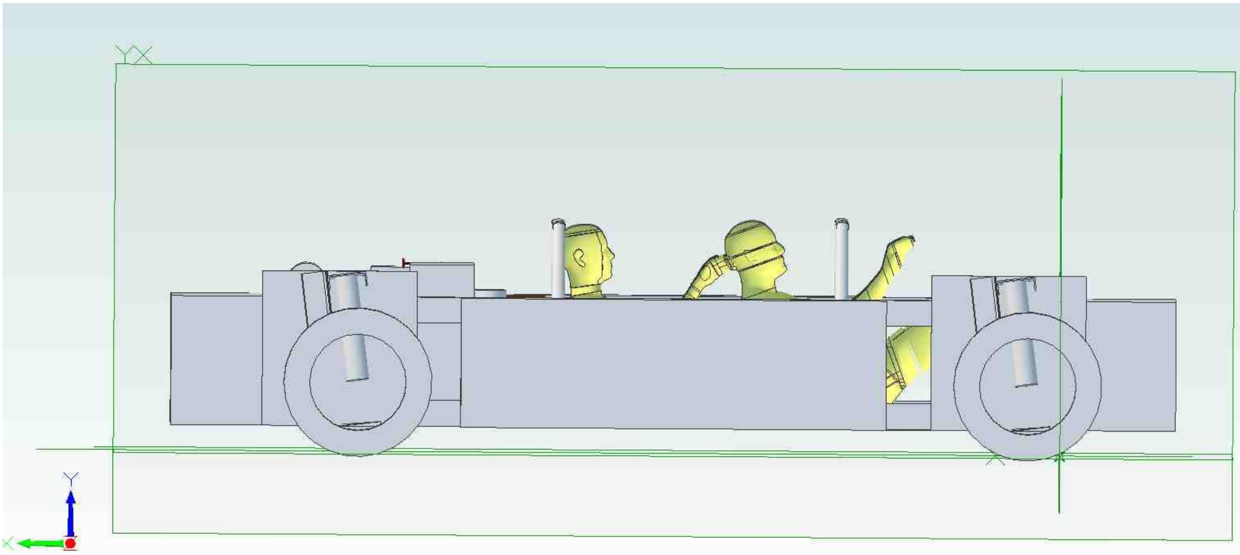

WIKISPEED Fig. 7 TD2-5-5 CAD showing roll bar hoops as described in previous technical deliverable.

TD2-5-7 Detailed description of plan to meet FMVSS Crashworthiness Requirements

Please see screen shots from side impact FEA on the vehicles frame. As discussed in the first technical deliverable we have verified the frame is as able to take the full load of the FMVSS impacts, in this case the lateral deformable barrier side impact test, which then allows us to attach crush structures front, side, and rear to reduce the amplitude of the crash pulse. By validating the frame we are able to first mitigate passenger compartment intrusion. Also please see the frame with static vertical loading simulating the roll hoops pressing down on the frame during the roof crush test. Note in the side and roof scenarios there is no permanent deformation of the frame and no passenger compartment intrusion.

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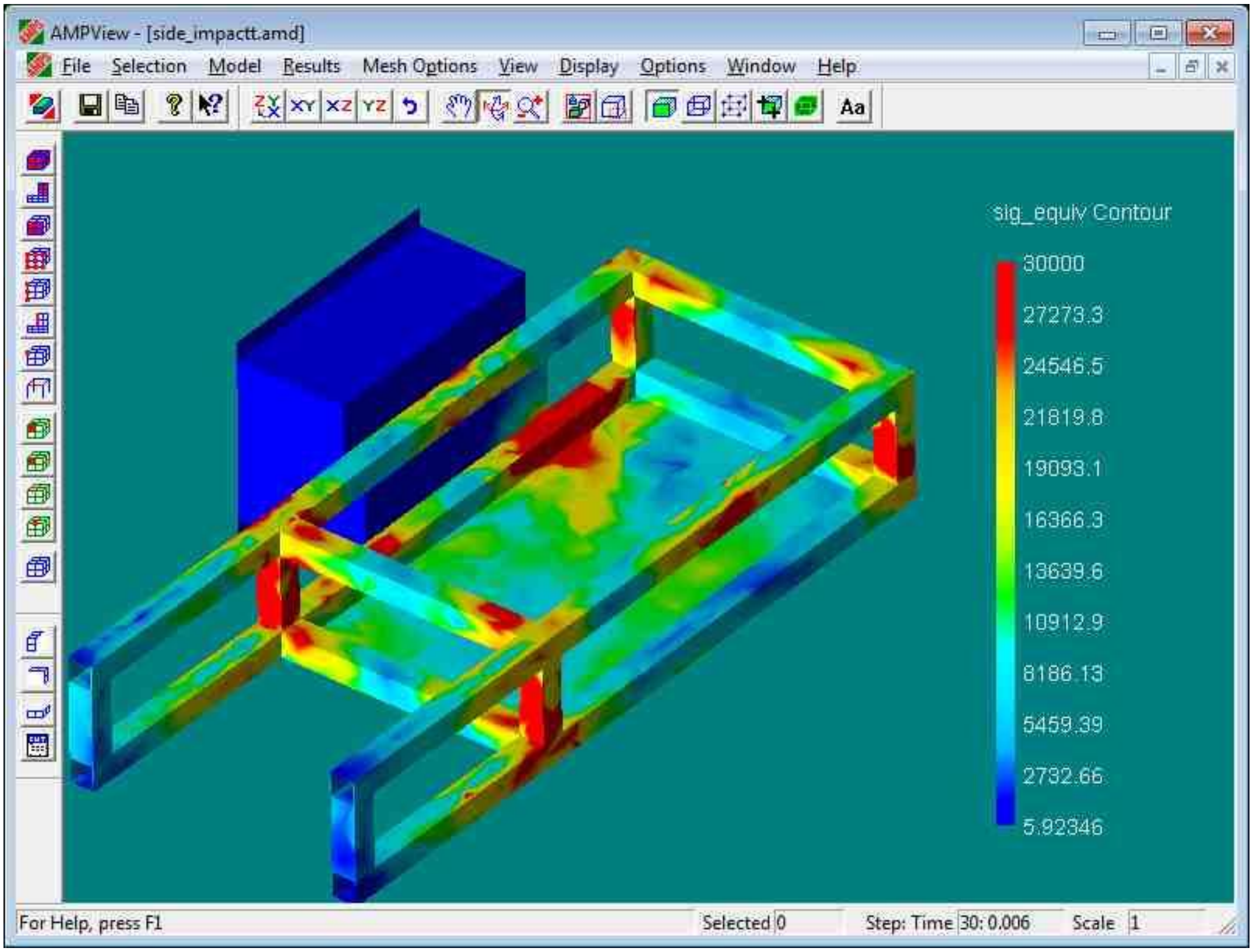
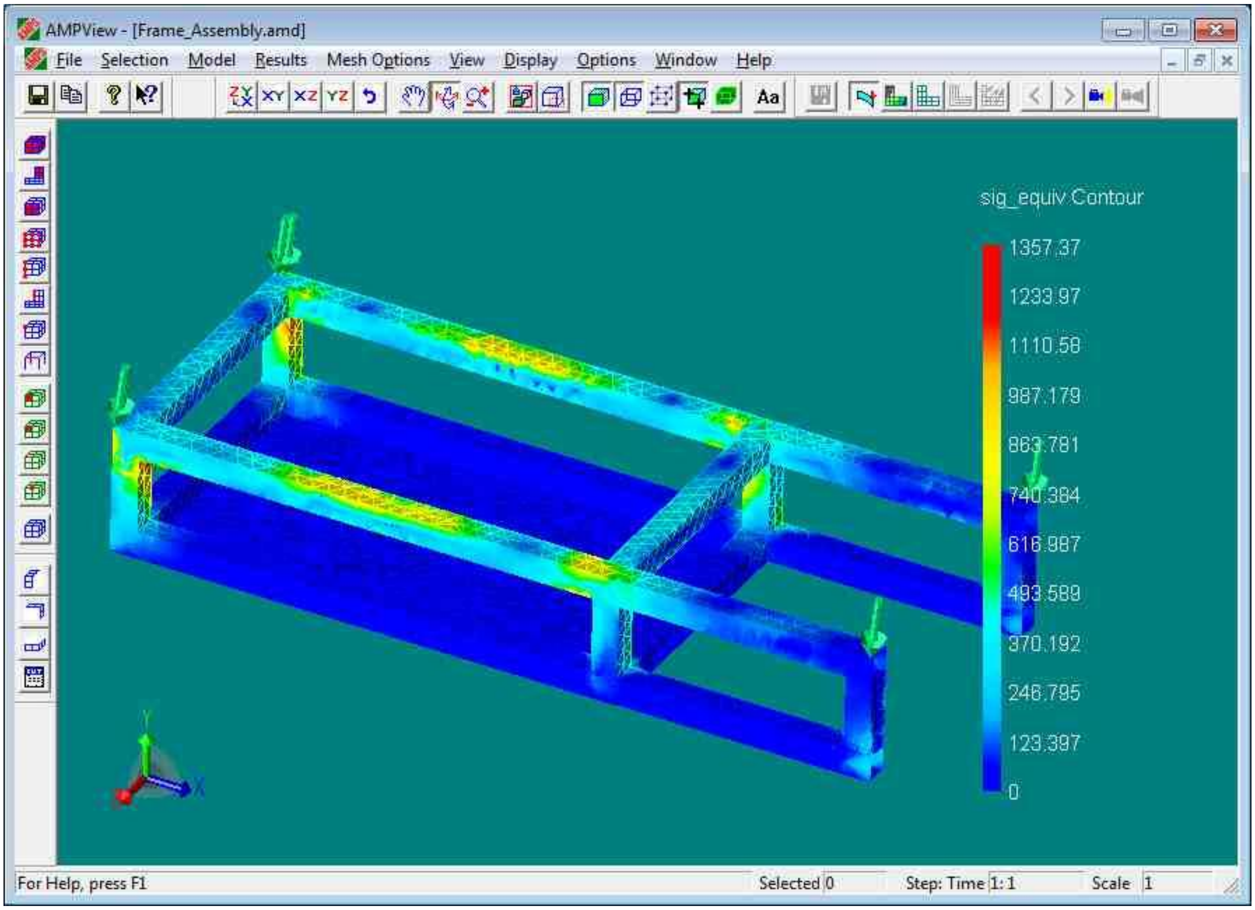


WIKISPEED Fig. 7 TD2-5-7a Side impact FEA of frame. Note minimal deformation and no intrusion. By placing a crush structure similar to the frontal offset deformable barrier onto the sides of the vehicle we are able to reduce side impact deceleration to below 8g’s during the FMVSS 20MPH side impact.



WIKISPEED Fig. 8 TD2-5-7B Roof crush test load applied to frame. Note minimal deformation and no intrusion. By distributing the roll hoop pressure through even 2x2" foot pads per hoop end we achieve results similar to uniform frame top loading. We see no visible frame deflection at 1.5 times the vehicle weight as specified by the roof crush test, and in fact do not exceed the material yield strength even with a 10g roof load.

For reverence, the visuals from TD1-4-8 have been included below.

"TD1-4-8c 0 Calculations, simulation results, or Finite Element Analysis report regarding structural integrity and crashworthiness.

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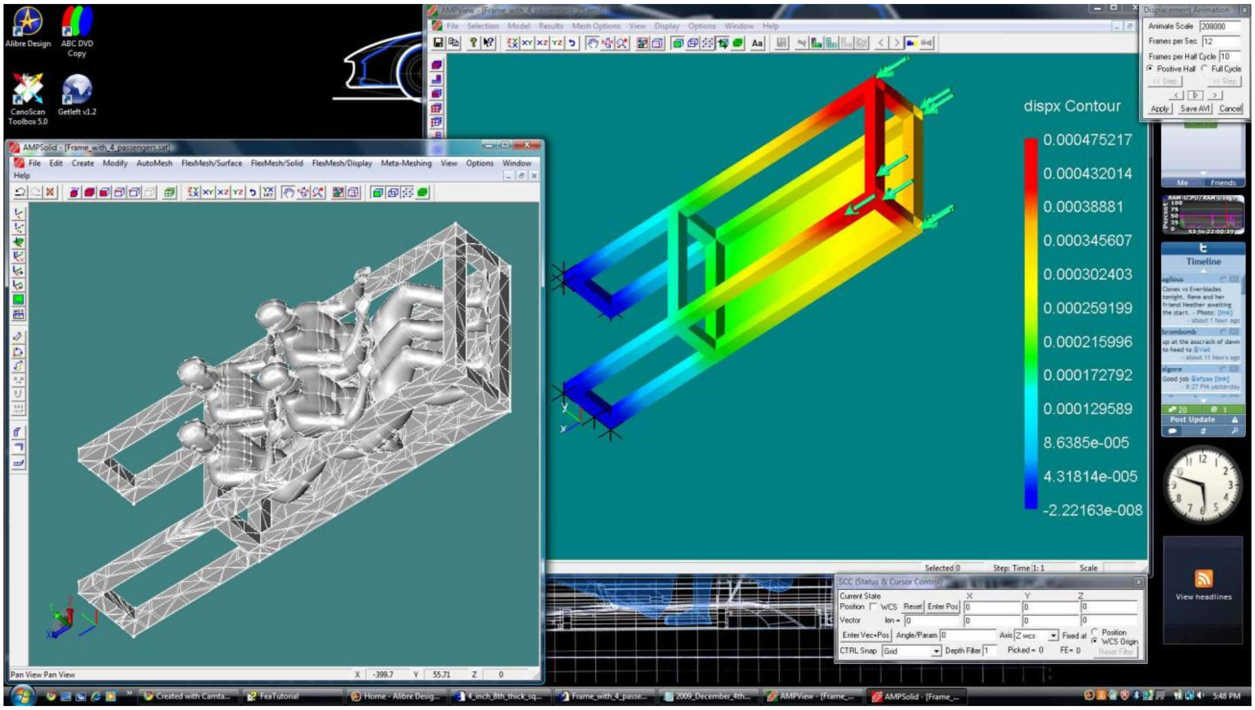

WIKISPEED Fig. 12 TD1-4-8c. Initial FEA meshing and colored portrayal of failure path in frontal load.

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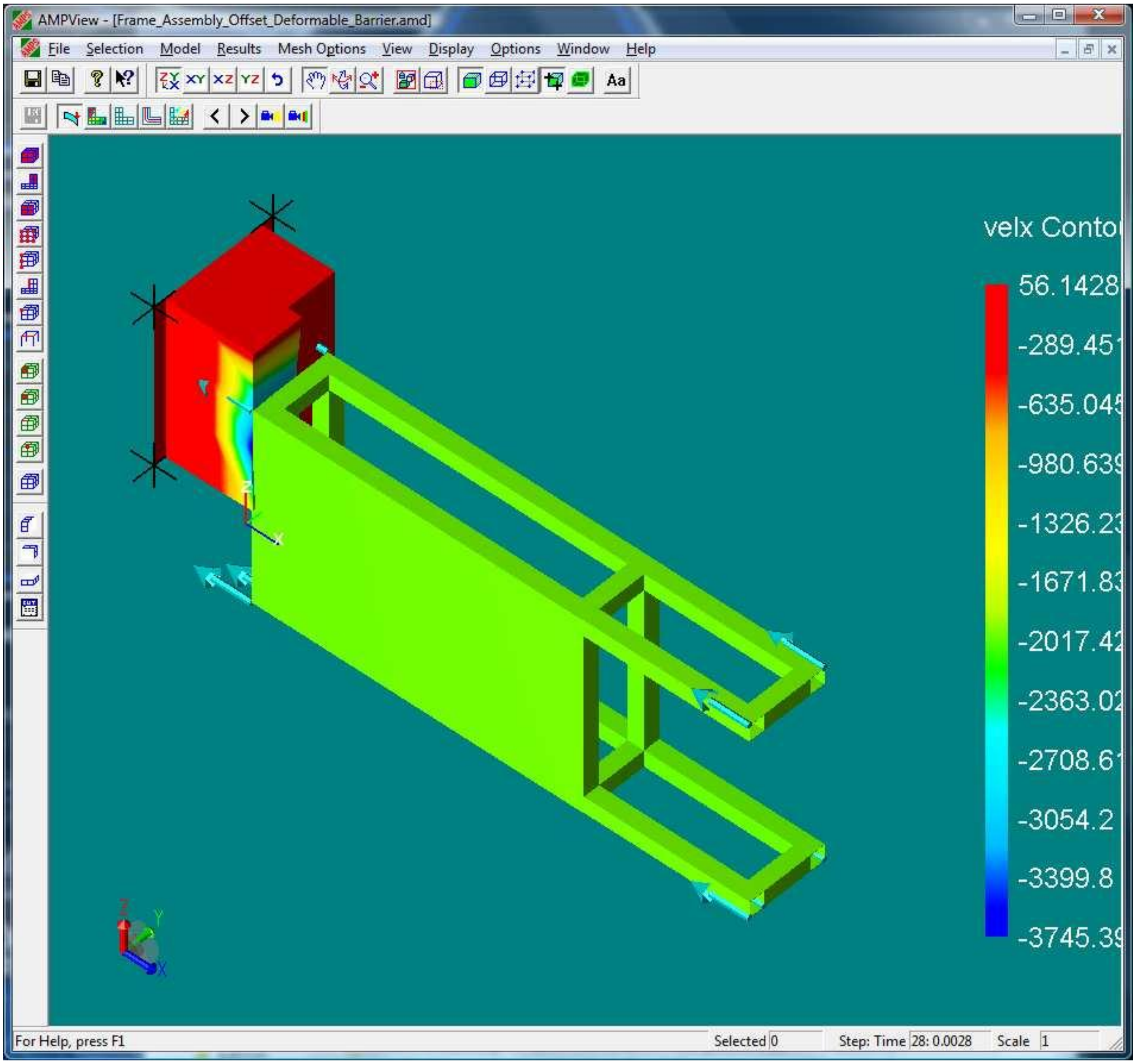

WIKISPEED Fig. 12b TD1-4-8c. Offset Frontal Deformable Barrier Impact simulation with naked frame.

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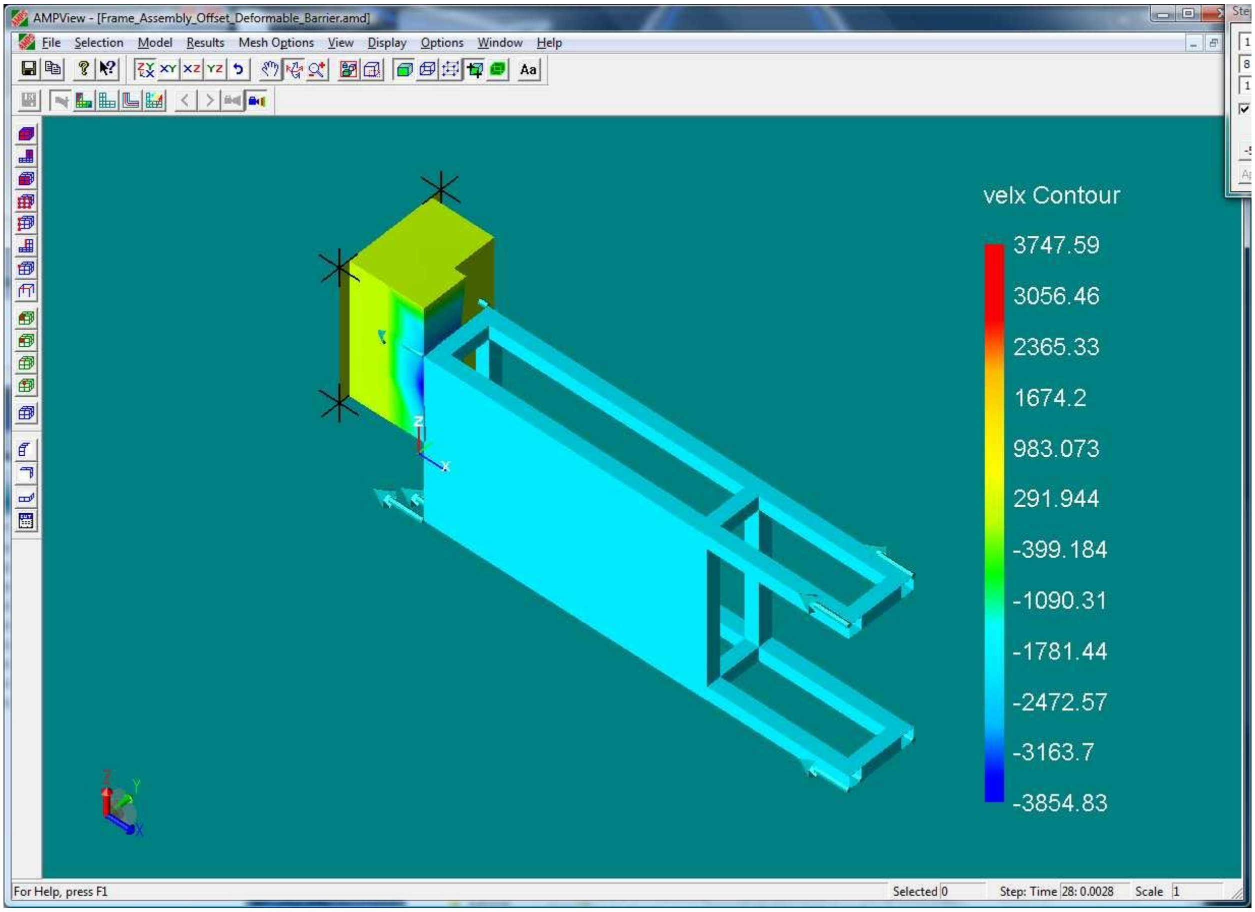

WIKISPEED Fig. 12c TD1-4-8c. Offset Frontal Deformable Barrier Impact simulation with naked frame.

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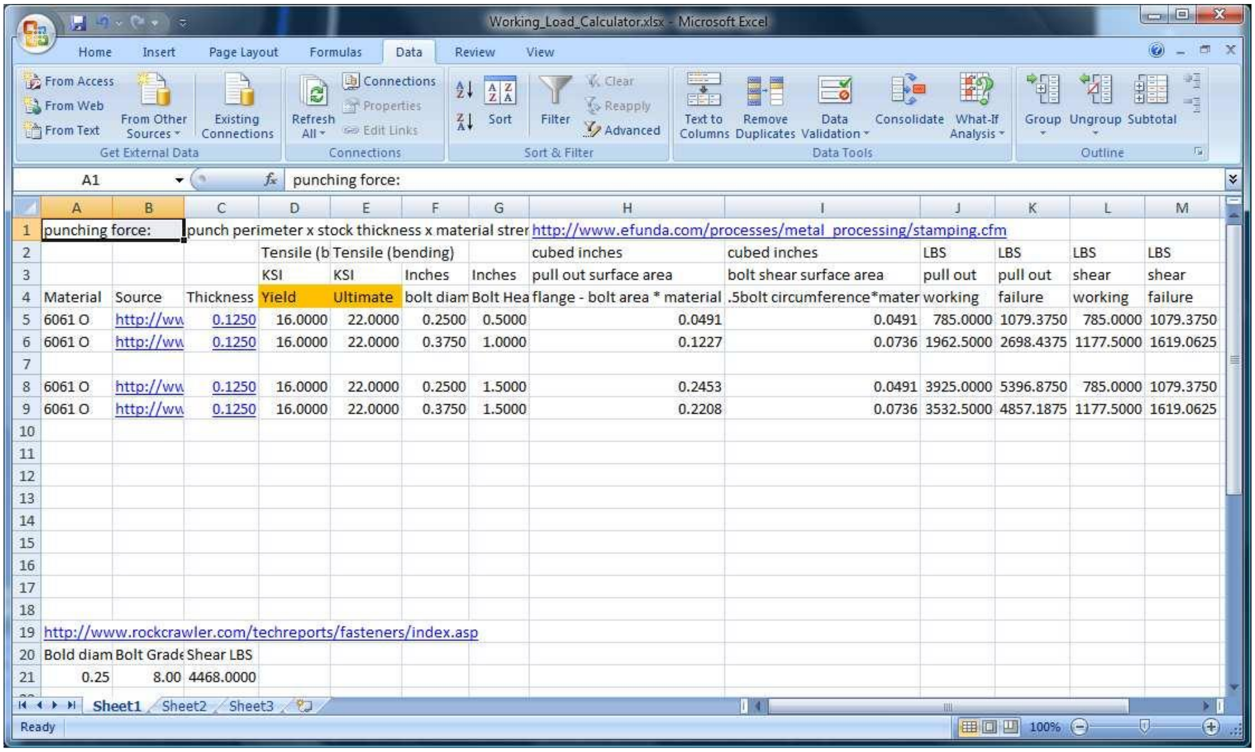


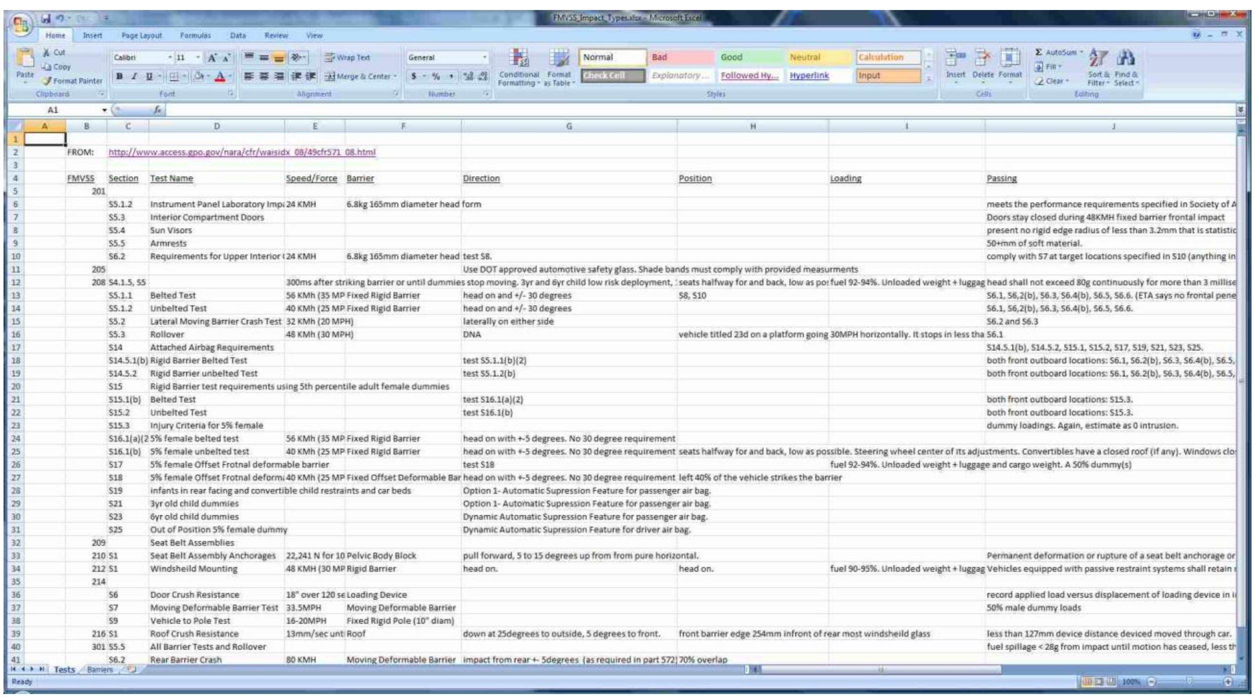
Working_Load_Calculator.xlsx - Microsoft Excel

A1: punching force:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	punching force:		punch perimeter x stock thickness x material strer					http://www.efunda.com/processes/metal_processing/stamping.cfm					
2				Tensile (b	Tensile (bending)			cubed inches	cubed inches	LBS	LBS	LBS	LBS
3				KSI	KSI	Inches	Inches	pull out surface area	bolt shear surface area	pull out	pull out	shear	shear
4	Material	Source	Thickness	Yield	Ultimate	bolt diam	Bolt Hea	flange - bolt area * material	.5bolt circumference*mater	working	failure	working	failure
5	6061 O	http://ww	0.1250	16.0000	22.0000	0.2500	0.5000	0.0491	0.0491	785.0000	1079.3750	785.0000	1079.3750
6	6061 O	http://ww	0.1250	16.0000	22.0000	0.3750	1.0000	0.1227	0.0736	1962.5000	2698.4375	1177.5000	1619.0625
7													
8	6061 O	http://ww	0.1250	16.0000	22.0000	0.2500	1.5000	0.2453	0.0491	3925.0000	5396.8750	785.0000	1079.3750
9	6061 O	http://ww	0.1250	16.0000	22.0000	0.3750	1.5000	0.2208	0.0736	3532.5000	4857.1875	1177.5000	1619.0625
19	http://www.rockcrawler.com/techreports/fasteners/index.asp												
20	Bold diam	Bolt Grade	Shear LBS										
21	0.25	8.00	4468.0000										

Sheet1 / Sheet2 / Sheet3

WIKISPEED Fig. 12d TD1-4-8c. Basic bolt pull out scenario calculations.



FMVSS_Impact_Types.xlsx - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J
1										
2		FROM:	http://www.access.gpo.gov/nara/cfr/waisidx_08/49cfr571_08.html							
3										
4		FMVSS	Section	Test Name	Speed/Force	Barrier	Direction	Position	Loading	Passing
5		201								
6			S5.1.2	Instrument Panel Laboratory Imp:	24 KMH	6.8kg 165mm diameter head form				meets the performance requirements specified in Society of A
7			S5.3	Interior Compartment Doors						Doors stay closed during 48KMH fixed barrier frontal impact
8			S5.4	Sun Visors						present no rigid edge radius of less than 3.2mm that is statistic
9			S5.5	Armrests						50+mm of soft material.
10			S6.2	Requirements for Upper Interior (	24 KMH	6.8kg 165mm diameter head	test S8.			comply with S7 at target locations specified in S10 (anything in
11		205					Use DOT approved automotive safety glass. Shade bands must comply with provided measurments			
12		208	S4.1.5, S5		300ms after striking barrier or until dummies stop moving. 3yr and 6yr child low risk deployment, :			seats halfway for and back, low as po:	fuel 92-94%. Unloaded weight + luggag	head shall not exceed 80g continuously for more than 3 millise
13			S5.1.1	Belted Test	56 KMh (35 MP	Fixed Rigid Barrier	head on and +/- 30 degrees	S8, S10		S6.1, S6,2(b), S6.3, S6.4(b), S6.5, S6.6. (ETA says no frontal pene
14			S5.1.2	Unbelted Test	40 KMh (25 MP	Fixed Rigid Barrier	head on and +/- 30 degrees			S6.1, S6,2(b), S6.3, S6.4(b), S6.5, S6.6.
15			S5.2	Lateral Moving Barrier Crash Test	32 KMh (20 MPH)		laterally on either side			S6.2 and S6.3
16			S5.3	Rollover	48 KMh (30 MPH)		DNA	vehicle titled 23d on a platform going 30MPH horizontally. It stops in less tha		S6.1
17			S14	Attached Airbag Requirements						S14.5.1(b), S14.5.2, S15.1, S15.2, S17, S19, S21, S23, S25.
18			S14.5.1(b)	Rigid Barrier Belted Test			test S5.1.1(b)(2)			both front outboard locations: S6.1, S6.2(b), S6.3, S6.4(b), S6.5,
19			S14.5.2	Rigid Barrier unbelted Test			test S5.1.2(b)			both front outboard locations: S6.1, S6.2(b), S6.3, S6.4(b), S6.5,
20			S15	Rigid Barrier test requirements using 5th percentile adult female dummies						
21			S15.1(b)	Belted Test			test S16.1(a)(2)			both front outboard locations: S15.3.
22			S15.2	Unbelted Test			test S16.1(b)			both front outboard locations: S15.3.
23			S15.3	Injury Criteria for 5% female						dummy loadings. Again, estimate as 0 intrusion.
24			S16.1(a)(2	5% female belted test	56 KMh (35 MP	Fixed Rigid Barrier	head on with +-5 degrees. No 30 degree requirement			
25			S16.1(b)	5% female unbelted test	40 KMh (25 MP	Fixed Rigid Barrier	head on with +-5 degrees. No 30 degree requirement	seats halfway for and back, low as possible. Steering wheel center of its adjustments. Convertibles have a closed roof (if any). Windows clo		
26			S17	5% female Offset Frotnal deformable barrier			test S18		fuel 92-94%. Unloaded weight + luggage and cargo weight. A 50% dummy(s)	
27			S18	5% female Offset Frotnal deform:	40 KMh (25 MP	Fixed Offset Deformable Bar	head on with +-5 degrees. No 30 degree requirement	left 40% of the vehicle strikes the barrier		
28			S19	infants in rear facing and convertible child restraints and car beds			Option 1- Automatic Supression Feature for passenger air bag.			
29			S21	3yr old child dummies			Option 1- Automatic Supression Feature for passenger air bag.			
30			S23	6yr old child dummies			Dynamic Automatic Supression Feature for passenger air bag.			
31			S25	Out of Position 5% female dummy			Dynamic Automatic Supression Feature for driver air bag.			
32		209		Seat Belt Assemblies						
33		210	S1	Seat Belt Assembly Anchorages	22,241 N for 10	Pelvic Body Block	pull forward, 5 to 15 degrees up from from pure horizontal.			Permanent deformation or rupture of a seat belt anchorage or
34		212	S1	Windsheild Mounting	48 KMH (30 MP	Rigid Barrier	head on.	head on.	fuel 90-95%. Unloaded weight + luggag	Vehicles equipped with passive restraint systems shall retain
35		214								
36			S6	Door Crush Resistance	18" over 120 se	Loading Device				record applied load versus displacement of loading device in i
37			S7	Moving Deformable Barrier Test	33.5MPH	Moving Deformable Barrier				50% male dummy loads
38			S9	Vehicle to Pole Test	16-20MPH	Fixed Rigid Pole (10" diam)				
39		216	S1	Roof Crush Resistance	13mm/sec unti	Roof	down at 25degrees to outside, 5 degrees to front.	front barrier edge 254mm infront of rear most windsheild glass		less than 127mm device distance deviced moved through car.
40		301	S5.5	All Barrier Tests and Rollover						fuel spillage < 28g from impact until motion has ceased, less th
41			S6.2	Rear Barrier Crash	80 KMH	Moving Deformable Barrier	impact from rear +- 5degrees (as required in part 572)	70% overlap		

Tests / Barriers

WIKISPEED Fig. 12d TD1-4-8c. FEA ToDo list, each crash scenario, orientation, load, barrier type, success criteria, etc.

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Preliminary FEA shows frame alone would survive Offset frontal barrier without intrusion into the passenger compartment during an impact at 57 Kph (35 Mph). By attaching a crush structure similar to the deformable barrier used in the offset test (but with omni-directional core material versus the directionally biased honeycomb structure of the spec barrier), the SGT01 frame is able to survive a fixed barrier collision at 57 Kph without intrusion into the passenger compartment. By virtue of the step-in frame design being door-less, the FMVSS language excuses us from the side impact (lateral barrier and pole) tests along with the door crush resistance test. Next up, then, is the rear impact test, then rollover test. It is taking us roughly 24 hours to model a crash scenario, and at that rate we intend to have iterations on all impact scenarios by January 15th (including side impact, required or not), at which time we will order our crush structures based on FEA input.

Two risks: 1) our AMPS FEA engine, while extremely powerful, has not yet been certified validated with real world crash results (like, say, LS Dyna). While AMPS gives us extremely helpful information we have to accept it as merely an indication, and will still perform destructive testing prior to road going vehicle sale. To this end we have secured access to a drop tower for destructive testing.

2) Our in-team FEA skill is sufficient to model the frame, barriers, and components of significant mass, but is not yet sufficient to model air bag deployments or linked geometries like a human dummy thigh and knee. Prior to production we will have to invest in about $100,000 of FEA team engineering support to produce valid, safe airbag deployments in order for us to spec airbags for fabrication. We will campaign in the X prize with significant structure to hold airbags and ballast to mimic live airbags."