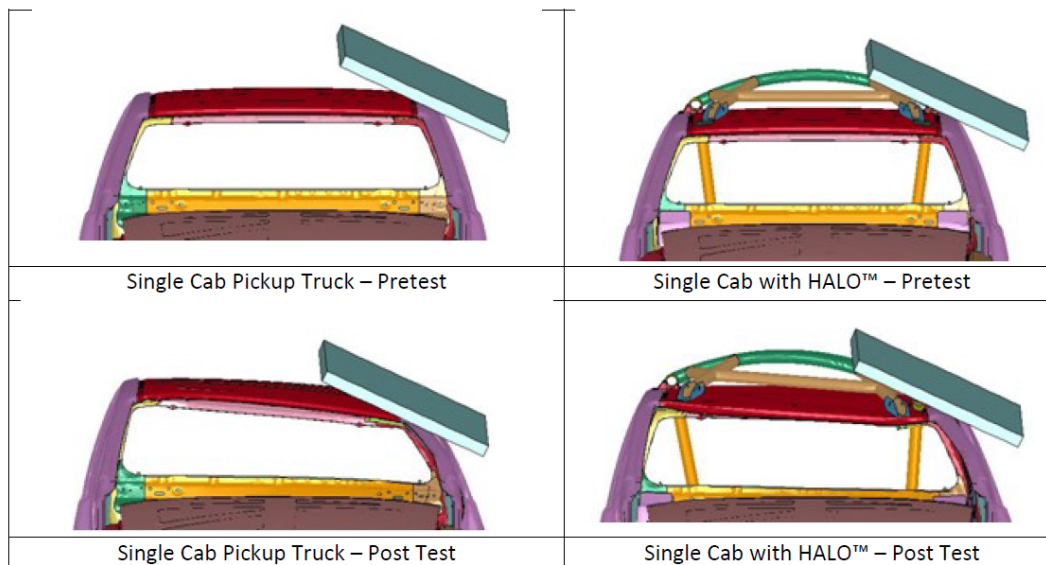


## HALO™ Rollover Occupant Protection System – SWR Analysis Report

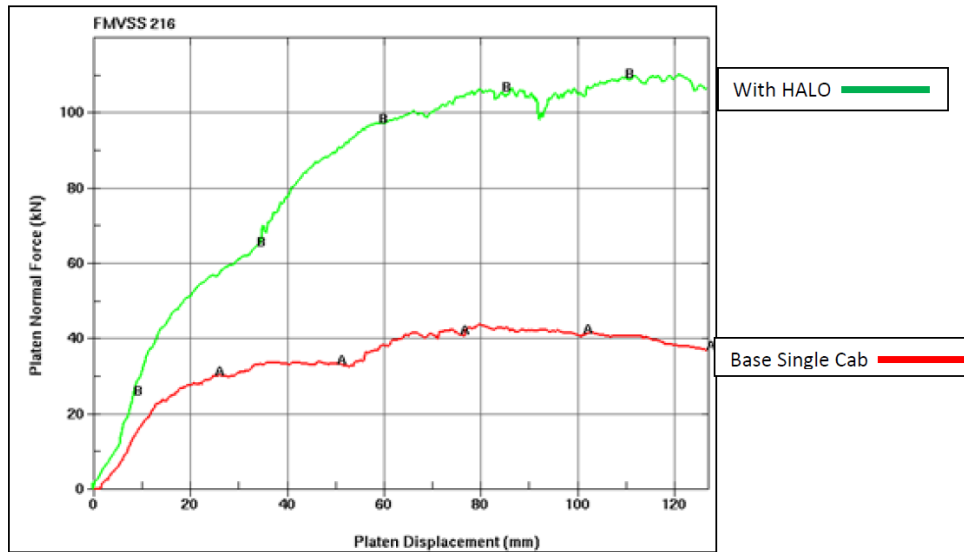
Please find the following information regarding the design and performance of the HALO™ Rollover Occupant Protection System. In response to a request for information, Safety Engineering International performed an FMVSS 216 type loading test on a single cab pickup truck model and the same model with the HALO ROPS equipped.

The FMVSS 216 Static Roof Strength test prescribes that a platen of specific size be placed at a specific angle relative to the vehicle body. The vehicle body is then secured to a base structure to stabilize it from shifting under the platen forces. The platen is then moved into the vehicle to a total displacement of 5" (127mm). The force required to achieve this displacement is measured to get the peak load value. This value is then divided by the weight to give the Strength to Weight Ratio (SWR) of a given vehicle.

The vehicle model used for the simulation does not have glass incorporated or doors incorporated, but does have coupling of the A and B post incorporated at the striker level. The cab was supported under the rocker panel and at locations under the frame rails in both simulations. The platen then applied loads to the base vehicle roof structure or with HALO equipped as applicable. The platen was displaced 5" in both cases. Screen shots of the simulations of the initial and final positions for both the base vehicle and HALO equipped vehicle simulations are shown below.



In the graph below, the letter B (green line) shows the force in kilos (kN) for the HALO equipped vehicle with the peak at about 110kN at almost 5" (120mm). The letter A (red line) shows the base vehicle with a peak of about 42kN at a little more than 3" (80mm) of displacement.



With this information, and the curb weight of the vehicle, we can calculate the SWR of each of the vehicles tested. Using a weight of 4032 lbs (1828kg), the base single cab has a SWR of 2.34, while the HALO equipped vehicle has a SWR of 6.13. This indicates that a vehicle with a HALO equipped has an increased SWR of slightly better than a factor of 2.

Vehicle Weight		Lbs/Kg
Single Cab		4032/1829
	Base Vehicle	HALO Equipped
Force lbs withstood	9441	24728
Resultant SWR	2.34	6.13

From these simulations as well as over 30 real world incidents in the last decade with HALO's equipped on both single and double cab vehicles, we are confident that SWR will be increased to more than 4x and perhaps even better than 6x, as was the case in this simulation.

If you should require additional information, please don't hesitate to contact me.

Sincerely,

Susie Bozzini – President  
Safety Engineering International

**A) Steel Properties of Material Used for H19 Nissan HALO Fabrication:**

Structure	HALO Top Component
Material	2 In. Structural Steel Tube
ASTM	A513
Ultimate Tensile Strength	910 MPa
Yield Tensile Strength	511 MPa
Hardness Brinell	137-185

Structure	Internal Reinforcement Plates
Material	5mm Steel Plate
ASTM	A36
Ultimate Tensile Strength	469 MPa
Yield Tensile Strength	359 MPa
Hardness Brinell	119-159

Structure	Internal Reinforcement Plates
Material	3mm Steel Plate
ASTM	A36
Ultimate Tensile Strength	469 MPa
Yield Tensile Strength	359 MPa
Hardness Brinell	119-159

Structure	Internal Reinforcement Plates
Material	2mm Steel Plate
ASTM	Ramor 500
Ultimate Tensile Strength	1350 MPa
Yield Tensile Strength	1250 MPa
Hardness Brinell	490-460

**B) Technical Sheet for Toyota Hilux HALO ROPS H16AKIT:**



NAME	HALO™
MODEL:	H16AKIT
COMPABILITY:	TOYOTA HILUX DUAL CAB 2018 - 2023
DESIGN AND DEVELOPMENT	SAFETY ENGINEERING INTERNATIONAL
PRODUCT DESCRIPTION:	ROLLOVER OCCUPANT PROTECTION SYSTEM
PRODUCT USE:	VEHICLE SAFETY EQUIPMENT FOR THE INTERNAL PROTECTION OF OCCUPANTS IN CASE OF A ROLLOVER.
PLACE OF MANUFACTURING:	MEXICO
PATENT AND COPYRIGHT:	USA #7717492 / MX #03-2016-120912494800-001
DIMESIONS (CM):	134.4 X 122.1 X 18.8
WEIGHT (KG)	41
COLOR:	BLACK
MAIN COMPONENTS:	EXTERNAL TUBE PROTECTION SYSTEM, INTERNAL REINFORCEMENT PLATE SYSTEM AND FAIRING
MAIN MATERIALS:	STRUCTURAL STEEL ASTM A36, HARDOX 450, RAMOR 500, STEEL TUBE A513 AND PLEXIGLASS
USEFUL LIFESPAN:	REINFORCEMENT PLATES: 10 YEARS / TUBE SYSTEM: 5 YEARS
TECHNICAL REQUIREMENTS:	PERFORATION OF B PILLARS (INTERNAL AND EXTERNAL), PERFORATION OF ROOF RAIL, CERTIFIED INSTALLER TECHNICIAN
INSTALATION METHOD:	RIVETS, NUTS, BOLTS AND GASKETS