

FMVSS Test Summary and Estimated Costs

(Prepared May 16, 2009)

This document summarizes the new vehicle FMVSS tests and estimates the cost to perform the tests. The cost of these services varies at each test center so this is only meant to be a rough guide line. Cost estimates do not include the following; test vehicles, interior bucks, engineering support for interpretation of results and oversight of tests, transport of vehicles to test facilities, government witnesses, logistics support and travel expenses for employees to oversee the tests.

Test Procedure #	Title	Test Type	Test Cost	Comments
101	Controls and Displays	Visual inspection	\$5,000	
102	Transmission Shift lever Sequence	Visual inspection	\$5,000	
103-13	Windshield Defrost and Defogging Systems	Climactic chamber test	\$40,000	
104-08	Windshield Wiping and Washer Systems	Climactic chamber test and physical tests	\$35,000	
105-03	Hydraulic Brake Systems	Visual inspection and Dynamic testing	\$35,000	Assumes the use of brake lines that are certified by the manufacturer
106-10	Brake Hoses	Visual inspection	\$5,000	Assumes the use of brake lines that are certified by the manufacturer
108-13	Lamps, reflective Devices, Etc	Visual inspection	\$5,000	Assumes the use of donor parts that are fully certified
109-09	Pneumatic Tires	Visual inspection	\$5,000	Assumes the use of tires that are certified by the manufacturer
110P/T-03	Tire Selection and Rims	Visual inspection	\$5,000	Assumes the use of tires and rims that are certified

				by the manufacturer
111V	Rear View Mirrors	Visual inspection	\$5,000	
113	Hood Latch Systems	Visual inspection	\$5,000	
114-02	Theft Prevention and Rollaway Prevention	Visual inspection and Physical tests	\$12,000	
116-04	Hydraulic Brake Fluids	White paper Documentation	\$1,000	Assumes the use of brake fluid certified by the manufacturer
118-06	Power Operated Window Systems	Visual inspection and Physical tests	\$12,000	
124-06	Accelerator Control Systems	Visual inspection and Physical tests	\$10,000	
125-1/2	Warning Devices	Visual inspection and Physical tests	\$10,000	
135-01	Light Vehicle Braking Systems	Visual inspection and Dynamic tests	\$14,000	
138-03	Tire Pressure Monitoring Systems	Visual inspection and Dynamic tests	\$10,000	
139-01/2/3	Pneumatic radial Tires for Light Vehicles	Visual inspection	\$5,000	Assumes the use of tires that are certified by the manufacturer
201-2	Occupant Protection in Interior Impact	Visual inspection and Dynamic tests	\$30,000	
201P	Occupant Protection in Interior Impact – Upper interior Head impact Protection	Visual inspection and Dynamic tests	\$30,000	
202-08/aS	Head Restraints	Visual inspection and Physical tests	\$10,000	
203-02	Impact protection for Driver from Steering Control System	Visual inspection and Physical tests	\$15,000	



204-08	Steering Control Rearward Displacement	Visual inspection and Physical tests	\$15,000	
205	Glazing Materials	Visual inspection	\$5,000	Assumes glass is manufactures to AS1 & 2 standards
206-6/7	Door Locks and Door Retention Components	Visual inspection and Physical tests	\$15,000	
206I	Door Locks and Door Retention Components	Visual inspection and Physical tests	\$15,000	
206S	Door Locks and Door Retention Components	Visual inspection and Physical tests	\$15,000	
207-09 parts 1&2	Seating Systems	Visual inspection and Physical tests	\$30,000	
208-13, sections 1 thru 14	Occupant Crash Protection	Visual inspection and Dynamic tests	\$200,000	These are the crash tests. Includes crash protection, windshield mounting, zone intrusion & fuel system integrity - Frontal
208-14, sections 1 thru 15	Occupant Crash Protection	Visual inspection and Dynamic tests	\$200,000	These are the crash tests. Airbag and seatbelt adjustment requirements
208S-01, Parts 1 thru 6	Occupant Crash Protection	Visual inspection and Dynamic tests	\$200,000	These are the crash tests – Occupant Crash Protection Sled Tests
209-08	Seat Belt Assemblies	Visual inspection and Physical tests	\$15,000	
210-09	Seat Belt Assembly Anchorages	Visual inspection and Physical tests	\$35,000	

212/219/301F	Windshield Mounting	Visual inspection and Physical tests	\$5,000	Performed as part of frontal barrier tests
213-8a thru 9c	Child Restraint Systems	Visual inspection and Physical tests	\$15,000	
214P	Rigid Pole Side impact	Visual inspection and Dynamic tests	\$50,000	This is a nasty crash test – side curtain airbags are virtually required to pass it.
214-S05	Side impact protection Static	Visual inspection and Physical tests	\$50,000	Basically the door bar test
216-05	Roof Crush Resistance	Visual inspection and Physical tests	\$40,000	
216A	Roof Crush Resistance	Visual inspection and Physical tests	\$40,000	
219	Windshield Zone intrusion Standard regulations	Visual inspection and Physical tests	\$5,000	Performed as part of frontal barrier tests
225-01	Child Seat Anchorages	Visual inspection and Physical tests	\$10,000	
301-F-04	Fuel System Integrity	Visual inspection and Physical tests	\$5,000	Performed as part of frontal fixed barrier tests
301-L-04	Fuel System Integrity	Visual inspection and Physical tests	\$5,000	Performed as part of lateral moving barrier tests
301-R-02	Fuel System Integrity	Visual inspection and Physical tests	\$5,000	Performed as part of rear moving barrier tests
302	Flammability of Interior Materials	Visual inspection	\$5,000	Assumes materials are certified by manufacturer
305-01	Electric Vehicles	Visual inspection and Physical tests	TBD	Battery Spill tests



401-01	Interior Trunk Release	Visual inspection and Physical tests	\$6,000	
537-01	Automotive Fuel Economy reports	White Paper Documentation	\$1,000	
581-01	Bumper Standards	Visual inspection and Physical tests	\$30,000	Formerly 215 – aka pendulum tests
-	Noise pass by test	Dynamic Tests	\$15,000	
		Total Estimated →	\$1,341,000	

In addition to the above expenditures, most start up auto manufactures will have at least one full time engineer on staff supervising the FMVSS testing who also helps to prepare for the tests, create documentation and interpret test results. FMVSS consultants are retained to provide guidance and interpretations of the standards. FMVSS consultants typically work on a retainer / hourly rate basis unless the service is rolled into a larger engineering support program. It is estimated that the total cost of the FMVSS consultant for the life of the program to be approximately \$250,000.

Companies that have achieved the most success use experienced design engineers who have been thru the FMVSS process very early in the program. By designing the vehicle to meet FMVSS requirements from the beginning, the risk of failure and retesting can be minimized saving significant amounts of money. We have been involved with several new vehicle programs and have experienced engineers on staff to help customers design chassis, body and interior systems. Typically, the vehicle packaging and integration phase takes one to two years with several engineers using tools such as Alias for digital modeling and Catia for engineering. During this phase, most of the major FMVSS tests can also be simulated there-by ensuring the successful passage of the required testing. In our experience, it is this phase of the program that determines the success or failure of most new vehicle programs. Issues not resolved at this point typically require significant costs to re-engineer, re-tool, re-manufacture and re-test. The cost for this phase can range from \$500,000 to \$2M depending on how well the vehicle specification documentation is prepared and the level of the design completeness.

Airbags are now virtually required to pass the FMVSS testing requirements. TRW is has entered into agreement with ATG to provide specific engineering support and technical data for TRW proprietary front and side curtain airbag systems. With ATG engineering the necessary airbag systems into the vehicle at the packaging stage, costs are kept to a minimum. TRW will provide custom made prototypes for the prototype and test vehicles. Once the airbag system is engineered into the vehicle, we use TRW’s facilities to perform airbag component testing using HYGE and bungee sleds as well as their linear impactors and test stands. These tests provide a level of certainty that once passed; the vehicle should perform well in the actual barrier tests. These tests are not required but are inexpensive compared to the cost of a barrier retest. Cost



of this phase is approximately \$400,000 if performed in conjunction with the packaging and integration phase of the program.

EPA and CAFÉ testing is wholly separate from the FMVSS process. ATG does not get too involved with this phase as it is very specialized. We can refer you to several qualified EPA test facilities upon request. Plan for EPA testing to take up to 2 years and cost several million dollars. This does not include the investment that is required to develop the power train before testing.

ATG can work with you in all areas of the vehicle development, engineering, pre-production manufacture and testing. To create digital models (interior and exterior) from design sketches takes up to 6 months for 2 men and will cost approx \$190K. The data will be suitable for advanced rendering and provides the foundation for the first engineering phase. Engineering support during packaging phase and body engineering typically requires 3 engineers in Catia V5 with some support staff for approximately one year to develop the vehicle where a running mule car can be manufactured. The cost for this level of support from ATG is approximately \$400K to \$1M. During this phase scale models and full size foam models are typically cut to verify the designs and for use in fund raising. A typical scale hard model that is painted cost approximately \$25K but is worth its weight in gold when it comes to fundraising. The manufacture of the first running mule car typically cost \$1M to \$1.5M. All of the above costs give no consideration to the power train except to package it. This assumes there is separate and dedicated team on the power train development. For the mule car it is anticipated that a donor power train with a custom electrical system (non-EPA compliant) will be used to allow for initial testing and marketing activities.

The U.S. FMVSS process is a self certification process. Simply put NHTSA provides the rule book (FMVSS Safety Standards) and the burden is on the manufacturer to provide complete documentation showing compliance and to perform tests as needed to back up the documentation. NHTSA will typically require a few tests but it is now possible to simulate nearly all the physical tests. The problems arise when a vehicle buyer is injured in one of the vehicles and the attorneys look to place blame on the manufacturer. They will pour through certification documentation and find any area where a test may not have been performed or a shortcut taken. Look out if they find one.

We hope you find this overview helpful. If you have questions or comments please feel free to contact me directly.

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