

# CCMTA Best Practice For Regulating Excessively-Raised Vehicles

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Approved by the CCMTA board of directors in December 2010

**National Best Practice Document for Regulating**  
**Excessively Raised Vehicles**  
**DRAFT**

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## Executive Summary

A growing concern exists regarding the increasing number of raised<sup>1</sup> vehicles operating on-highway with mixed traffic. This issue was demonstrated in a presentation delivered to the Canadian Council of Motor Transport Administrators (CCMTA) Standing Committee on Drivers and Vehicles (D&V) at the 2009 CCMTA Annual Meeting in Regina, SK, by Daniel Filiatrault from the jurisdiction of British Columbia. The presentation highlighted the fact that modifications that result in an excessive increase in the ride height of raised vehicles have a negative impact on safe vehicle operation, including the degradation of braking performance, compromised fuel system integrity, create a mismatch in the geometric alignment of energy-absorbing structures, increase roll-over propensity, and change handling characteristics by altering the designed integration of original tires and steering, braking and suspension systems.

Subsequently, a recommendation was presented by D&V to the CCMTA Board, to assemble a working group to develop a best practices document for the management of excessively raised vehicles. This recommendation was approved and a group, originally chaired by Mr. Filiatrault, began its work in September 2009.

Since that time, a workplan was developed and numerous conference calls have occurred involving this working group, and of a smaller technical subcommittee, culminating in the preparation of this document. The team reviewed a significant amount of background material, including:

- the Model Legislation for Excessively Raised Vehicles, prepared for the American Association of Motor Vehicle Administrators (AAMVA) in 2007,
- the Memorandum of Understanding on Vehicle Compatibility (developed in 2006 representing a voluntary commitment by vehicle manufacturers for the Canadian market, to design and produce vehicles, by January 1, 2009, with energy absorbing structures that fit within a specified height range).

Guiding Principles were established, in that the group intended to create a document which was:

1. Reasonable
2. Simple to understand
3. Appropriately targeted
4. Technically supported
5. Practical to enforce

The unanimous view of the group was that it is critical to preserve the integrity of the energy absorption mechanisms built into vehicles, to provide the safest outcome in the event of a crash. At the same time, it is recognized that there needs to be some level of flexibility built in for the practical management of raised vehicles – there are legitimate needs to raise vehicles in some circumstances (i.e. postal vehicles, military vehicles, service vehicles used by public and private utilities, vehicles specifically designed primarily for off-road use<sup>2</sup>).

The group concluded that it would develop two pieces of work to be contained within this Best Practice document: a Canadian version of the AAMVA Model Legislation representing a

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<sup>1</sup> Vehicles become raised through the installation of aftermarket body/suspension lift kits and/or oversize replacement tires.  
2 T-05-072\_Compatibility MOU-Nov18.doc

comprehensive model for the management of excessively raised vehicles, and a simple single measurement/management protocol for determining acceptable altered ride height limits for raised vehicles.

An important part of the process included the invitation for input from the two primary vehicle manufacturer's associations - the Canadian Vehicle Manufacturers' Association (CVMA) and the Association of International Automobile Manufacturers of Canada (AIAMC). Additionally, feedback was sought from the Specialty Equipment Market Association (SEMA) regarding the most often selected lift kits.

Letters were sent to the CVMA, AIAMC and SEMA by the CCMTA in July 2010. The letters to the manufacturer's associations contained measurements of heights from the ground to the chassis and energy absorbing structures, for a number of representative 2010 model year light trucks. The reason for sending this information was to provide the manufacturers with an outline of vehicle-specific measurements which would be considered in the development of the Best Practices document. It gave the industry an opportunity to provide additional information for models of trucks which may have been higher than the numbers provided, to ensure that any guidelines developed would consider the full range of measurements for all light trucks in the Canadian market during 2010 model year.

As of October 21, 2010 no response has been received from any of the manufacturers of light trucks in the Canadian market. Since there were no comments or concerns expressed by the industry, the members of the Excessively Raised Vehicle Working Group interpreted this as confirmation that the measurements provided to the industry adequately characterized the heights of all 2010 model year light trucks in the Canadian market.

Additionally, no response has been received from SEMA. However, any responses will be incorporated into this document at a later date.

In summary, the single measurement/management protocol states that light trucks manufactured before September 1, 2009 are to comply with maximum recommended frame heights in model legislation developed by AAMVA in 2007. Light trucks manufactured on and after September 1, 2009 to conform with Section 2.0 of the Memorandum of Understanding on Vehicle Compatibility (MOU) and maximum recommended primary structure heights ranging between 24 and 28 inches developed by the CCMTA in addition to the installation of an approved aftermarket secondary energy-absorbing structure that conforms with Section 2.0 of the MOU.

## Introduction

The CCMTA is an organization established by the provincial, territorial and federal governments to act as a national coordinating body in all matters dealing with the administration, regulation and control of motor vehicle transportation and highway safety.

CCMTA comprises senior officials from federal, provincial and territorial departments. As of July 1993, private organizations and other government departments and agencies have had the opportunity to become associate members of CCMTA.

The CCMTA Board of Directors, responsible for providing overall guidance and specific direction of the organization, reports to the Council of Deputy Ministers. Reporting to the CCMTA Board are three permanent standing committees, which are Drivers and Vehicles, Compliance and Regulatory Affairs, and Road Safety Research and Policies. Under each of these committees are specific working groups and project groups established to address individual projects.

The ***Excessively Raised Vehicle Working Group***, was approved by the CCMTA Board in May 2009 and reports to the Standing Committee on Drivers and Vehicles. This project group had the objective of working with Canadian jurisdictions and a number of stakeholders to develop a national best practice guide for jurisdictions for regulating excessively-raised vehicles.

Excessively raised vehicles can generally be classified as light trucks that have been equipped with after-market products (usually body and suspension lift kits and/or oversize replacement tires) that increase the ride height. In many cases, these modifications compromise the vehicle's original design safety features.

The group has produced a set of guidelines with the objective to allow individual Canadian jurisdictions to either refine existing statutes or introduce new standards for regulating the excessive ride height of light trucks equipped with these after-market products.

The guiding principle throughout this work was public safety which is consistent with the CCMTA's mission to provide a leadership role and a national forum for the development of public policy and programs for road safety.

## Definitions

Section 4. Definitions. As used in this Act, the following words and phrases have the following meanings:

(a) “Bumper” means the horizontal assembly made of metal, composites, rubber or plastic that is fastened to the front and rear of a vehicle and extends as a shield away from and across the full width of the vehicle body;

(b) “Bumper height” means the vertical distance between the ground and the lowest point at the bottom of an original equipment manufacturer (OEM) bumper manufactured entirely of metal, measured when the vehicle is unladen on a flat surface with the tires at the proper tire inflation pressure. Bumper height shall be measured with the vehicle on a level surface, from the ground to the bottom of the frame, at the most forward or rearward points of the frame rail, if any of the following conditions exist: the bumper is absent; a section of the bumper is composed of rubber or plastic material; the original bumper has been modified, or; the vehicle has been equipped with an aftermarket bumper, in place of the OEM bumper;

(c) “Excessively raised vehicle” means a raised motor vehicle, as defined in *sub-Section (n)* of this *Section*, to which modifications have been made that could degrade braking performance, compromise fuel system integrity, create a mismatch in the geometric alignment between energy-absorbing structures of the raised motor vehicle and unmodified light duty motor vehicle and passenger vehicles, increase roll-over propensity, and change handling characteristics by altering the designed integration of the original tires, and the steering, braking and suspension systems, to an extent determined by reference to the standards contained in the proposed framework for regulating excessively raised vehicles.

(d) “Frame” means the main longitudinal structural members of the chassis of the vehicle or, for vehicles with unitized body construction, the lowest main longitudinal structural members of the body of the vehicle;

(e) “Frame height” means the vertical distance between the ground and the bottom of the frame at the most forward or rearward points of the longitudinal frame rail with the vehicle unladen on a flat surface (with less than 5 degrees of slope relative to the horizontal plane) with the tires at the proper inflation pressure (maximum recommended by the manufacturer), and full fuel tank(s). The measurement of vehicles with unitized body/frame construction shall be taken at the lowest point of the front jacking location as manufactured;

(f) “Gross vehicle weight rating” (GVWR) means the value specified by the manufacturer as the maximum loaded weight of the motor vehicle as it appears on the manufacturer’s certificate of origin and/or on the federal motor vehicle safety certification label;

(g) “Light Truck” means a truck with a GVWR of less than 4,536 kg (10,000 pounds).

(h) “Loaded static tire diameter” means the maximum overall diameter when measured horizontally at the wheel hub and adjacent to the outboard sidewall of a tire/wheel assembly with the vehicle unladen on a level surface and the tires at the proper tire inflation pressure;

(i) "Multipurpose passenger vehicle" means a motor vehicle, except a trailer, designed to carry 10 or fewer persons which is constructed either on a truck chassis or with special features for occasional off-road operation;

(j) "Oversize replacement tire/wheel assembly" means tires or wheels that have a larger overall diameter than the original tires and wheels or optional tires or wheels recommended by the original equipment manufacturer;

(k) "Passenger car" means a motor vehicle, except a multipurpose passenger vehicle, motorcycle, or truck designed for carrying 10 or fewer persons;

(l) "Primary frontal energy-absorbing structure height" means the distance between the ground and bottom of the frame at the forward most point;

(m) "Public highway" means any state or other highway, limited access highway, road, street, avenue, alley, driveway, parkway or place, under the control of the state or province or any political subdivision of the state or province, dedicated, appropriated or open to public travel or other use.

(n) "Raised motor vehicle" means a multipurpose passenger vehicle, passenger car, or truck as these types of motor vehicles are defined in this *Section*, with a GVWR of less than 4,536 kg (10,000 pounds) in which the original equipment has been modified, augmented or replaced by the installation of aftermarket parts or materials, including lift kits and oversize replacement tires, that increase its ride height, including the original height of its bumpers, frame, loaded static tire diameter and lighting equipment;

(o) "Ride Height" means the measured distance between the ground and a fixed reference point on the vehicle;

(p) "Secondary energy-absorbing structure" Means a structure connected to the primary structure, or frame, whose lower edge is no higher than the bottom of the CMVSS 215/U.S. part 581 bumper zone and has been designed to prevent or reduce structural over-ride of another vehicle in the event of a frontal crash.

(q) "Truck" means a motor vehicle, designed primarily for the transportation of property or special purpose equipment.

## Description of aftermarket modifications that increase original ride height

Vehicles are raised by private owners and conversion companies to enable them to operate under extreme off road conditions. Larger tires and suspension lift provide clearance to drive through muddy, rocky and uneven terrain that may not be passable for most stock trucks. Often these trucks have their on road safety performance compromised as they are modified for off road use.

### Suspension Lift Kt

- Suspension lift kits essentially raise the body and frame of vehicles higher above the axles.
- The vehicle chassis is typically raised by installing spacer blocks on axles or by lengthening spring shackles.
- Various methods are used to address tire fitment issues in order to accommodate the installation of oversize replacement tires.
- Original steering and suspension components may be replaced with aftermarket components on the front of raised vehicles.



Figure 1 - Suspension Lift Kit Components Installed

- Single or multiple spacers are inserted to raise the body upward and away from the frame



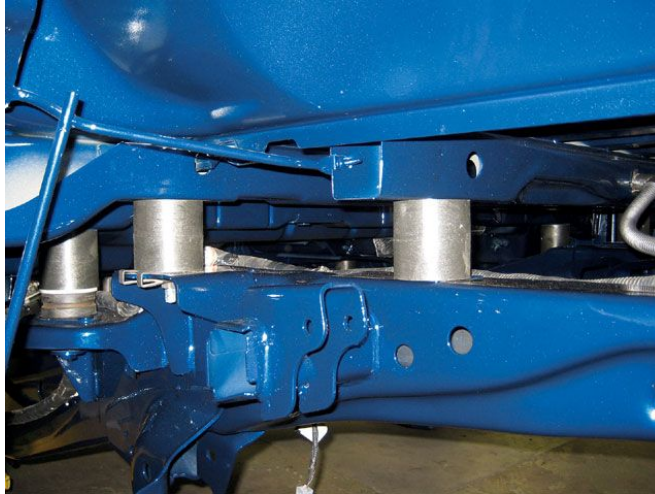


Figure 2 - Body Lift - Actual

### Oversize Replacement Tires

- With few exceptions, the maximum diameter of original and optional tires on light trucks is approximately 33 inches.
  - The diameter (measured distance from the ground to the top) of oversize replacement tires can be 16 inches or more than original tires.
  - Federal law stipulates that new vehicles be equipped with compliance label and tire placard, which are generally affixed to the left door.
  - A vehicle's original and OEM-recommended optional tire sizes are listed on the tire placard.
  - Warning labels are intended to raise the awareness of vehicle owners about the importance of installing the same size and construction of replacement tires as original or optional tires.
  - The same consistent warning directed at vehicle owners is uniformly issued by (a) vehicle manufacturers, (b) tire manufacturers, and (c) manufacturers of aftermarket suspension lift kits.
  - Tire-fender clearance problems often result from the installation of oversize replacement tires, without considering size and proximity of fenders, inner fender wells and suspension components.


 <b>TIRE AND LOADING INFORMATION</b>			
SEATING CAPACITY		TOTAL 5	FRONT 2 REAR 3
The combined weight of occupants and cargo should never exceed XXX kg or XXX lbs.*			
TIRE	SIZE	COLD TIRE PRESSURE	<b>SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION</b>
FRONT	P195/70R14	200 kPa, 29 psi	
REAR	P195/70R14	200 kPa, 29 psi	
SPARE	T125/70D15	420 kPa, 60 psi	

Figure 3 - Sample of Required Tire Placard (ref CMVSS 110 - TSD)

**INFORMATION – TIRE AND LOADING / PNEUS ET CHARGEMENT**

SEATING CAPACITY / NOMBRE DE PLACES – TOTAL **5** FRONT/AVANT **2** REAR/ARRIÈRE **3**

THE COMBINED WEIGHT OF OCCUPANTS AND CARGO SHOULD NEVER EXCEED 1158 kg / 2554 lbs.  
 LE POIDS TOTAL DES OCCUPANTS ET DU CHARGEMENT NE DOIT JAMAIS DÉPASSER 1158 kg / 2554 lb.

TIRE / PNEU	FRONT / AVANT	REAR / ARRIÈRE	SPARE/PNEU DE SECOURS
ORIGINAL TIRE SIZE DIMENSIONS DU PNEU D'ORIGINE	LT235/80R17E	LT235/80R17E	LT235/80R17E
COLD TIRE INFLATION PRESSURE PRESSION DE GONFLAGE À FROID	485 kPa / 70 psi	450 kPa / 65 psi	485 kPa / 70 psi


SEE OWNER'S MANUAL / CONSULTEZ LE GUIDE DE L'AUTOMOBILISTE  **AG193167**

Figure 4 - Sample Tire Placard - Actual

**SUPPLEMENTAL TIRE PRESSURE INFORMATION**  
**FOR LIGHT LOAD AND MAX LOAD CONDITIONS**

LOAD LIGHT: 2 OCCUPANTS (150 lbs. EACH) PLUS 200 lbs. CARGO  
 DEFINITION MAX: AS DEFINED ON DRIVERS SIDE B – PILLAR PLACARD

INFLATION PRESSURE	FRONT	REAR
MAX LOAD (COLD)	485 kPa, 70 psi	450 kPa, 65 psi
LIGHT LOAD (COLD)	450 kPa, 65 psi	280 kPa, 40 psi
TIRE SIZE	LT235/80R17E	LT235/80R17E

SEE OWNERS MANUAL FOR ADDITIONAL INFORMATION  **AG193167**

Figure 5 - Sample Supplemental Tire Pressure Information Label - Actual



Figure 6 - Illustration of Sidewall Markings on a Tire Used in Raised Vehicle Applications

## **Safety implications of excessively raised vehicles**

An excessively raised vehicle may no longer comply with OEM specifications or the Canadian Motor Vehicle Safety Standards (CMVSS) regulating braking, fuel system integrity, lighting, electronic stability control, and energy management in a collision affecting the modified vehicle's ability to provide effective crash avoidance and occupant protection.

### Energy management structures and crash compatibility of vehicles

In a head-on collision, the front bumper (and primary energy absorbing structure) of an excessively-raised vehicle may not engage with the bumper or primary energy absorbing structure of the vehicle with which it is colliding, causing its bumper to ride over top of the other vehicle's bumper. In such a situation, the higher bumper comes in contact with body panels and engine components which are less capable in absorbing crash energy. Intrusion of the higher vehicle over the lower will then be excessive, causing severe damage relative to the speed of impact. In severe cases, the bumper of the higher vehicle may intrude into the occupant compartment of the lower vehicle, causing severe injury and/or fatalities. The mismatch in ride height between the front bumper of an excessively raised vehicle and rocker panel of a smaller vehicle could also prevent the deployment of a side air bag and increase the severity of injuries in side impact collisions. These serious injuries and/or loss of life could be prevented if proper alignment of the vehicles' energy absorbing structures is maintained during a crash.

In the event of a rear-end collision, a similar situation may result. Either the lower vehicle, failing to stop, may ride under the rear bumper of the higher vehicle, or the higher vehicle, failing to stop, will override the rear of the lower vehicle. In both cases, significant damage, injury and fatalities may occur as a result of poor or non-existent engagement (also called "compatibility") between the energy absorbing structures of the two vehicles involved in the crash.

## Braking

The installation of a lift-kit and oversize tires raises the vehicle's center of gravity relative to the stock configuration which can adversely affect the vehicle's weight transfer characteristics during braking. As shown in Figure 7 the greater height of  $CG_2$  relative to  $CG_1$  increases angle  $\alpha_2$  relative to  $\alpha_1$ .

Most trucks have 60-70% of their weight on the front axle in a stationary, unladen condition. During braking, while traveling in the forward direction, the proportion of the vehicle's weight on the front axle increases. For a given rate of deceleration, a raised vehicle having an angle  $\alpha_2$  which is significantly greater than that of the stock vehicle ( $\alpha_1$ ) will experience greater rear-to-front weight transfer than the stock vehicle.

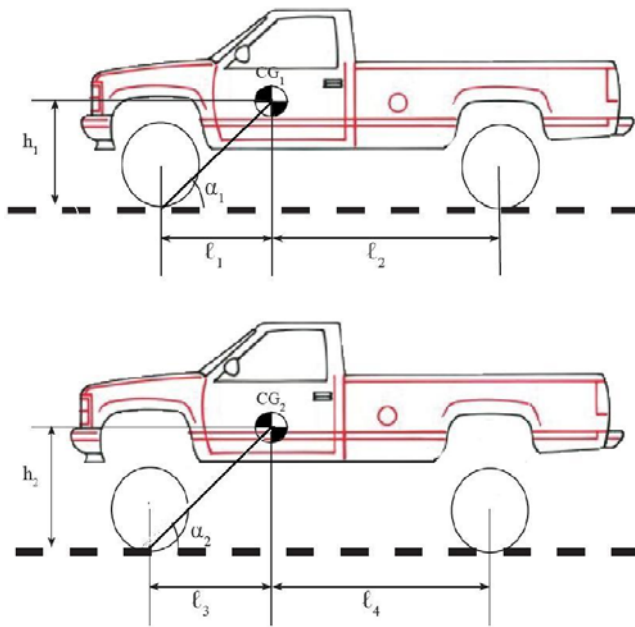


Figure 7 – Vehicle height affects weight shift during braking

During extreme braking, weight on the rear axle of the raised vehicle may decrease to the point at which the rear tires lose traction. This will be exacerbated if the brake proportioning valve has not been adjusted to compensate by reducing brake application pressure to the rear brakes. This will probably result in excessive braking force being applied to the rear axle brakes, causing the rear tires to prematurely lock and skid. A skidding rear axle will likely experience a loss of directional control and make the vehicle liable to spinning out. It is also possible that the vehicle could roll, as it yaws into a sideways attitude, relative to its direction of travel down the road, during a skid. Such a condition is very dangerous, since if the vehicle rolls over completely at a relatively high speed, significant damage to the vehicle, property which comes in contact with the vehicle, occupant/bystander injuries and possibly fatalities are likely to result. Oversize replacement tires could also lead to loss of control on slippery surfaces by interfering with the ability of an antilock braking system or electronic stability control system to determine when tires are near the limit of adhesion.



## Stopping distance

The installation of a tire with a larger diameter requires increased braking torque in proportion with the increased diameter of the tire to maintain the same braking force (applied to the axle). An increase in tire diameter beyond the size recommended by the vehicle manufacturer may result in stopping distance increasing by an unsafe amount.

If the vehicle owner insists on excessively large diameter tires, brakes may have to be upgraded to maintain the required performance. This requirement will generally apply to the front brakes on a vehicle which has also been raised, for reasons given in the previous section on braking.

To increase braking force, brake rotor diameter must be increased, which will necessitate the installation of a modified caliper mounting to clear the outside diameter of the rotor. Larger friction pads should also be installed (in proportion with the increased weight of the vehicle) to maintain comparable brake life.

Most jurisdictions have regulations which govern minimum brake performance. To ensure that the vehicle is equipped with properly-sized brakes, the vehicle should be tested following installation of the lift kit and oversize tires. In many provinces brake performance should be adequate to bring the vehicle to a stop from approximately 30 kilometers per hour (18.6 miles per hour) within a distance of about 9 metres (29.5 feet) from the point of application of the brakes.

## Vehicle Handling

Undesirable contact between an oversize replacement tire and fender could affect steering or impinge a rolling tire/wheel assembly and lead to a loss of control. In some cases, a tire could be damaged to the point that it loses air, resulting in failure and loss of control.

The installation of upgraded springs, sway bars and other suspension components can significantly affect efforts that were taken by an original equipment manufacturer to fully integrate subsystems. Not surprisingly, such alterations may unexpectedly cause an excessively raised vehicle to handle far differently from its stock condition, especially at high speeds, resulting in unexpected oversteer, excessive body lean in turns, increased steering sensitivity and poor brake/engine performance which could contribute to loss of control and a crash.

To minimize the likelihood of unforeseen handling issues, it is recommended that lift kits and recommended tire sizes be employed from recognized lift kit suppliers, especially on vehicles in which the height is to be significantly raised.

## Stability and Rollover

In order for a raised vehicle to exhibit the same static roll-over resistance<sup>3</sup> as its factory unmodified condition, its track width must increase by the same percentage as the vertical distance between the ground and the vehicle's center of gravity (CG). For example, depending on its year, make and model a raised half-ton 4x4 truck lifted six inches may have its track increased almost 13 inches<sup>4</sup> in order to maintain its original factory condition static rollover resistance. Failure to retain the factory static rollover resistance increases the vehicle's rollover propensity. Likelihood of vehicle rollover during a lateral skid or while operating on a cambered surface increases with elevated CG height, relative to its track.

While track may be increased by installing larger tires (track increases by the same amount as the increased width of one tire), or wheel offset spacers, this may be relatively insignificant compared to the increased height of the vehicle. In addition, a wider vehicle is harder to manoeuvre through tight spaces and park. Also, the maximum width of the vehicle is limited in most jurisdictions, putting a cap on the amount that the impact of CG height on stability may be offset.

## Fuel System Integrity

Modifications to a vehicle's fuel system can bring it out of compliance with the CMVSS 301 Fuel System Integrity.

When a vehicle is excessively raised the fuel tank(s) may be vulnerable to collision damage from a vehicle which under-rides the rear bumper or rear primary energy absorbing structure. Although the frequency of fire-related injuries is low, the injuries caused may be quite severe.

"An analysis of 1991-1998 National Automotive Sampling System (NASS) data shows that about 12,941 occupants per year were exposed to fire in passenger cars and light vehicles (vans, pickup trucks, and multipurpose vehicles with GVWR of 4,536 kg (10,000 lb) or less) that were towed away from the fire. Of those occupants, about 1,062 (8 percent) received moderate or severe burns (AIS 2 and greater)."

National Highway Traffic Safety Administration

[http://www.nhtsa.gov/cars/rules/rulings/301NPRM/Index.html#N\\_4](http://www.nhtsa.gov/cars/rules/rulings/301NPRM/Index.html#N_4)

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<sup>3</sup> 49 CFR Part 575: At-rest roll-over resistance is calculated using Static Stability Factor (SSF) which is calculated as the track width divided by twice the vertical centre of gravity measurement (track width/2(center-of-gravity)). **Please note**, "suspension geometry, component stiffness factors, allowable ride travel, and tire stiffness factors also exert a measurable influence on rollover performance".

<sup>4</sup> Rollover Stability Measurement for 2004 New Car Assessment Program (NCAP) NHTSA September 2004. **Please note**: the example above does not take into account the vehicles unsprung mass (running gear and differentials).

## Steering and Suspension

The installation of oversized tires may require modification of the suspension system in order to provide body-to-tire clearance. Suspension modifications can adversely affect drive-train and driveshaft angles, under/oversteer handling qualities and roll/pitch characteristics, steering response and directional stability<sup>5</sup>.

Steering geometry, can be significantly altered from OEM specifications by raising a vehicle and chassis on its suspension. The steering geometry controls vehicle directional stability and enhances turning capabilities that encourage the vehicle's steering to return to a straight-ahead orientation, following a turn. Modifications made to the vehicle may change the steering geometry to the point that it no longer provides the desired corrective forces, which assure stable directional control, that were provided while the vehicle's suspension was configured within OEM tolerances.

The installation of an incorrectly designed custom pitman arm or linkage assembly may not allow the vehicle to turn within its designed turning radius. This may result in the vehicle requiring more than one driving lane to negotiate a corner. In addition, the tires may contact suspension components, steering arms, fenders or the frame before the intended steering components reach their stops.

The installation of a custom pitman arm assembly or the installation of oversized replacement tires may increase steering effort and result in steering gear sector shaft and bearing failures. The increased loading associated with steering system modifications and the installation of oversized replacement tires may contribute to the premature failure of steering system ball-joints, bushings and kingpins. In a worst-case situation, steering control could be seriously degraded or lost completely by the failure of one or more overloaded components, resulting in a serious crash.

## Lighting

Depending on how high a vehicle is raised, the vehicle's headlamps, tail lamps, signal and brake lamps may be at a height that exceeds the allowable limit for lamp height as required by the CMVSS. This raises a safety issue when the headlamps are not capable of directing light properly for vehicle operator visibility. Headlamp glare to oncoming drivers can also be a safety issue.

## **Overview of testing and research affiliated with excessively raised vehicles**

Association of American Motor Vehicle Administrators (AAMVA). <http://www.aamva.org>

- Effect of Oversize Tires on Stopping Capability and Handling Stability of an Altered-Height Vehicle, December 2003
- Model Legislation for Excessively Raised Vehicles, May 17 2007

National Highway Traffic Safety Administration [www.nhtsa.gov](http://www.nhtsa.gov)

- Initiatives to Address the Mitigation of Vehicle Rollover, June 2003
- Trends in the Static Stability Factor of Passenger Cars, Light Trucks, and Vans, June 2005

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<sup>5</sup> SAE J2492. Considerations for Suspension Modification.

## **Current methods of regulating excessively raised vehicles**

### **1. Maximum frame height**

Frame height is not currently regulated with a maximum height in any Canadian jurisdiction.

### **2. Maximum bumper height**

Some Canadian jurisdictions limit the bumper height of a vehicle

### **3. Maximum ride height**

Some Canadian jurisdictions limit the ride height of a vehicle based on a formula or the total increase in ride height.

### **4. Maximum headlamp height**

Most Canadian jurisdictions limit the height of headlamps.

### **5. Engineering certification**

New Brunswick relies on the advice of professional engineers when a vehicle is suspected of having been modified to an unsafe or mechanically unfit condition. See Appendix C for further details.



## Summary of enforcement practices by jurisdiction (regulation matrix)

JURISDICTION	Maximum suspension height	Maximum head lamp height	Maximum tail lamp height	Maximum front bumper height	Maximum frame height	Maximum tire size or height	Minimum braking performance	Wheel alignment settings	Splash & spray devices	Mud flaps	Maximum body lift	Maximum ride height (formula)	Lift blocks?	Extended shackles?
British Columbia	10cm	137cm	183cm	750mm	No	No	8m @30 km/h	Yes	Yes	No	No	No	No	Yes
Alberta	No	140cm	200cm	No	No	No	10m@30km/h	Yes	No	Yes	No	No	No	No
Saskatchewan	No	140cm	211cm	750mm	No	No	Yes	Yes	Yes	Yes	No	No	No	Yes
Manitoba	Yes	No	No	740cm	No	No	9m@30km/h	No	Yes	Yes	No	Yes	No	No
Ontario	No	No	No	No	No	No	9.15m@32km/h	No	Yes	Yes	No	No	No	No
Quebec	Yes	Yes	Yes	No	No	Yes	6m@30 km/h	No	Yes	Yes	Yes	Yes	Yes	No
New Brunswick <sup>6</sup>	Waiting to receive completed survey													
Nova Scotia <sup>7</sup>	Waiting to receive completed survey													
PEI	Yes	140cm	152cm	No	No	No	9.15m@30km/h	No	Yes	Yes	10cm	10cm	10cm	No
Newfoundland	Waiting to receive completed survey													
Yukon	Waiting to receive completed survey													
NWT	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Nunavut	Waiting to receive completed survey													

<sup>6</sup> A certificate of support from an engineer registered with the New Brunswick Association of Engineers and Geoscientists is required before a raised vehicle can be registered for use in New Brunswick.

<sup>7</sup> Nova Scotia Inspection Station Manual (Section 7) restricts hockey pucks from being utilized as a replacement for body mounts, and does not permit a suspension to be modified to the extent that the alteration could affect the proper steering of the vehicle.

# Proposed framework for regulating excessively raised vehicles (consolidated version)

## Characteristics and Maximum Tolerances and Dimensions for Raised Motor Vehicles.

- (a) With respect to body lift,
- (i) a body that has been elevated more than 76mm (3 inches) above the frame,
  - or (ii) a body with unitized body construction that has been elevated above the frame, regardless of the amount of elevation;
  - or (iii) a body that has been elevated by the use of multiple spacers, regardless of the amount of elevation;
  - or (iv) aftermarket materials and fasteners that are not equivalent or greater in quality than original equipment (i.e. diameter, strength, grade of bolt);
  - or (v) alterations that interfere or displace the safety features of the energy-absorbing steering column; affect the operation of the transmission, clutch, or accelerator controls; or mitigate the effectiveness of occupant restraint systems.
- (b) With respect to the brake system,
- (i) brake lines do not display a DOT marking symbol (49 C.F.R. 571.106) or which are not contained in the Handbook of Automotive Safety Devices published by the Automotive Manufacturers Equipment Compliance Agency;
  - or (ii) brake lines do not accommodate the full extension of the suspension without binding or being stretched;
  - or (iii) brake lines and hoses that are not protected from excessive heat and vibration, chafing and undue wear, stress or unintentional disconnection during operation of the vehicle;
  - or (iv) loss of brake fluid;
  - or (v) minimum stopping distance requirement cannot be achieved in jurisdictions that conduct dynamic braking tests with the aid of a portable decelerometer or performance-based brake testing equipment.
- (c) With respect to the bumper,
- (i) absence of the front or rear bumper with the exception of when a recognized vehicle manufacturer did not supply and install a rear bumper as original equipment;
  - or (ii) bumpers that are not oriented or fastened in the original mounted position;
  - or (iii) aftermarket bumpers that do not provide equivalent or superior protection as the original bumper;
  - or (iv) bumpers with sharp or unwarranted protruding edges,
- (d) With respect to bumper height,
- (i) if the original bumper is not composed entirely of steel and the vehicle frame exceeds the frame heights denoted in *Section (1)(e)(i)* of this regulation.
  - or (ii) when the FRONT bumper height of vehicles manufactured through September 30, 2009 is greater than 559 mm (22 inches) for passenger cars; 610 mm (24 inches) for vehicles with a gross vehicle weight rating 2,041 kg (4,500 pounds) or less; 686 mm (27 inches) for vehicles with a gross vehicle weight rating between 2,042 kg (4,501 pounds) and 3,402 kg (7,500 pounds); 711 mm (28 inches) for vehicles with a gross vehicle weight rating between 3,403 kg (7,501 pounds) and 4,536kg (10,000 pounds);

- or (iii) when the REAR bumper height of vehicles is greater than 559 mm (22 inches) for passenger cars; 660 mm (26 inches) for vehicles with a gross vehicle weight rating less than 2,041 kg (4,500 pounds); 737 mm (29 inches) for vehicles with a gross vehicle weight rating between 2,042 kg (4,501 pounds) and 3,402 kg (7,500 pounds); 762 mm (30 inches) for vehicles with a gross vehicle weight rating between 3,403 kg (7,501 pounds) and 4,536kg (10,000 pounds);
- or (iv) when the height of the primary frontal energy-absorbing structure of vehicles manufactured after October 1, 2009 exceeds 457 mm (18 inches) from the ground or the lower edge of a secondary energy-absorbing structure is greater than 406 mm (16 inches) from the ground.

(e) With respect to frame height,

- (i) shall not exceed:
  - 559 mm (22 inches) for passenger cars;
  - or (ii) 610 mm (24 inches) for vehicles with a gross vehicle weight rating of less than 2,041 kg (4,500 pounds);
  - or (ii) 660 mm (26 inches) for vehicles with a gross vehicle weight rating between 2,042 kg (4,501 pounds) and 3,402 kg (7,500 pounds);
  - or (iii) 711 mm (28 inches) for vehicles with a gross vehicle weight rating between 3,403 kg (7,501 pounds) and less than 4,536 kg (10,000 pounds);
- or (ii) if a raised vehicle manufactured after October 1, 2009 does not comply with Option 1 or Option 2 of the Vehicle Compatibility Commitment for enhancing the geometric alignment of front energy-absorbing structures of light trucks with passenger cars.<sup>8</sup>

(f) With respect to the fuel system,

- (i) loss of flammable liquid;
- or (ii) fuel filler hose is loose, damaged or excessively extended or retracted;
- or (iii) fuel tank from aftermarket modifications or a change in original location makes it more exposed and susceptible to being punctured in a crash;
- or (iv) the fuel tank/s is loose or not equipped with fasteners, mounts or straps that are equivalent or greater in strength as original equipment (i.e. diameter, strength or grade of material).

(g) With respect to lighting equipment,

- (i) maximum height of headlamps exceeds 1,370 mm (54 inches) when measured from the ground to the center of the lamp;
- or (ii) alignment of headlamps do not conform to the specifications of the Registrar;
- or (iii) maximum height of tail lamps is more than 1,830 mm (72 inches) when measured from the ground to the center of the lamp.

(h) With respect to tire/wheel assembly,

- (i) absence of tire information placard installed by the original equipment manufacturer;
- or (ii) mud flaps do not extend across the full width of oversize replacement tire/wheel assembly;

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<sup>8</sup> OPTION 1: The light truck's primary frontal energy-absorbing structure (frame rails) shall overlap at least 50 percent of the 49 C.F.R. Part 581 zone AND at least 50 percent of the light truck's primary frontal energy-absorbing structure shall overlap the 49 C.F.R. Part 581 zone if the primary frontal energy-absorbing structure of the light truck is greater than 8 inches tall, engagement with the entire 49 C.F.R. Part 581 zone is required, OR OPTION 2: there must be a secondary energy-absorbing structure, connected to the primary structure, whose lower edge shall be no higher than the bottom of the 49 C.F.R. Part 581 zone.

- or (iii) aftermarket fender flares do not extend beyond the full width of oversize replacement tire/wheel assembly;
- or (iv) loaded static tire diameter of an oversize replacement tire/wheel assembly exceeds 889 mm (35 inches) when measured horizontally at the wheel hub;

(i) With respect to the steering system,

- (i) steering wheel is smaller in diameter than the steering wheel installed by original equipment manufacturer;
- or (ii) caster, camber, toe-in and toe-out settings do not conform to original specifications or those recommended by the aftermarket lift kit manufacturer;
- or (iii) steering components bind, interfere, or come into contact with any part of the vehicle (except a steering stop) when the steering wheel is turned full right or full left;
- or (iv) the complete “full” engagement of threads cannot be observed on bolts that are used to fasten or connect steering components.

(j) With respect to the suspension system,

- (i) aftermarket spring shackles are longer than 102 mm (4 inches);,
- or (ii) lift blocks were installed on the front axle;
- or (iii) height of aftermarket spacer blocks on the rear axle exceed 152 mm (6 inches);
- or (iv) rear spacer block on rear axle is comprised of multiple spacers and not a single component;
- or (v) original suspension was reconfigured, dismantled or permanently disconnected or removed and replaced with aftermarket components that are not equivalent or exceed the strength of original equipment;
- or (vi) original leaf springs were repositioned from below the axle to above the axle;
- or (vii) shock absorbers are leaking oil or could be damaged by being extended to its limit during full extension of the suspension travel;
- or (viii) bump stops were removed or mounted at a different location than originally intended;
- or (ix) a warning label is not attached on the left door jamb or visible within the occupant compartment to inform drivers that the original suspension has been modified and may change the handling characteristics of the raised vehicle;
- or (x) warning label does not contain the following statement: “**WARNING** – The suspension of this vehicle has been modified. As a result, this vehicle may handle differently than that of a factory-equipped vehicle. As with any vehicle, Extreme Care must be used to prevent loss of control or roll-over during sharp turns or abrupt manoeuvres. Always wear seat belts, and drive safely, recognizing that reduced speeds and specialized driving techniques may be required. Failure to drive this vehicle safely may result in serious injury or death. Do not drive this vehicle unless you are familiar with its unique handling characteristics and confident of your ability to maintain control under all driving conditions. Some modifications (and combination of modifications) are not recommended”;
- or (xi) suspension travel is restricted or binds;
- or (xii) suspension components contact other vehicle components;
- or (xiii) aftermarket materials and fasteners are not equivalent or greater in quality than original equipment (i.e. diameter, strength, grade of bolt);
- or (xiv) the complete “full” engagement of threads cannot be observed on bolts that are used to fasten or connect suspension components.

# Single Measurement Protocol for Regulating the Ride Height of Excessively Raised Vehicles

Where a jurisdiction is considering regulating raised vehicles through one simple variable, it is recommended that jurisdictions use frame height as the single measurement protocol for determining acceptable altered ride height limits for raised vehicles. This approach supports recent industry efforts to improve the alignment of energy management structures in the light-duty fleet and will indirectly assist in the regulation of lighting heights, braking performance and roll-over propensity on raised vehicles. The proposal also includes breaking down the management of vehicles by date of manufacture, to align with the Memorandum of Understanding on Vehicle Compatibility.

**Vehicles manufactured before September 1, 2009** to comply with maximum recommended frame heights (measured at the most forward and rearward accessible points on the longitudinal frame rail) as stipulated in model legislation developed by AAMVA in 2007.

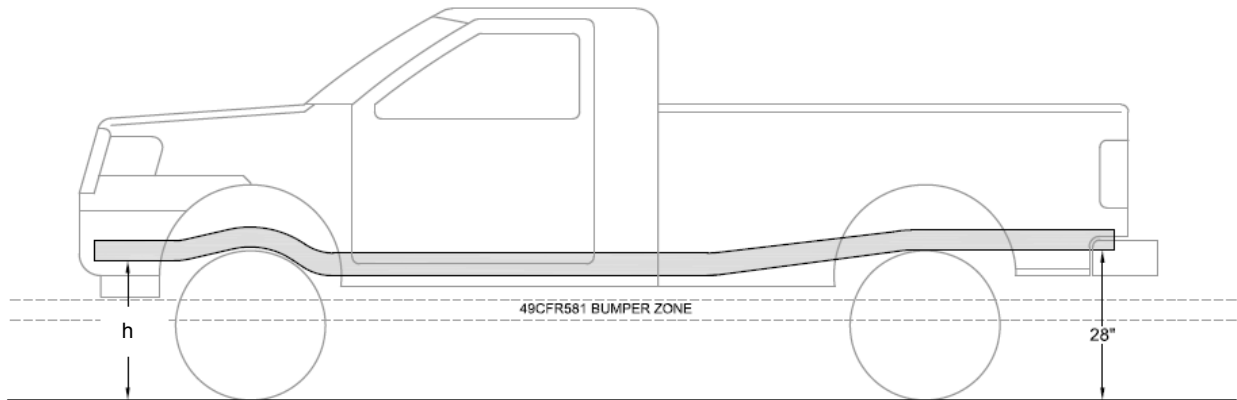


Figure 8 – Acceptable range of frame heights on vehicles manufactured before September 1, 2009  
“h” is the maximum frame height based on the truck’s GVWR

**Vehicles manufactured on and after September 1, 2009** that have subsequently had their ride height increased will conform to maximum recommended frame heights developed by the CCMTA found in part (e) of section “Proposed framework for regulating excessively raised vehicles” and supplemented by the installation of an approved aftermarket secondary energy-absorbing structure that conforms with Section 2.0 of the MOU.

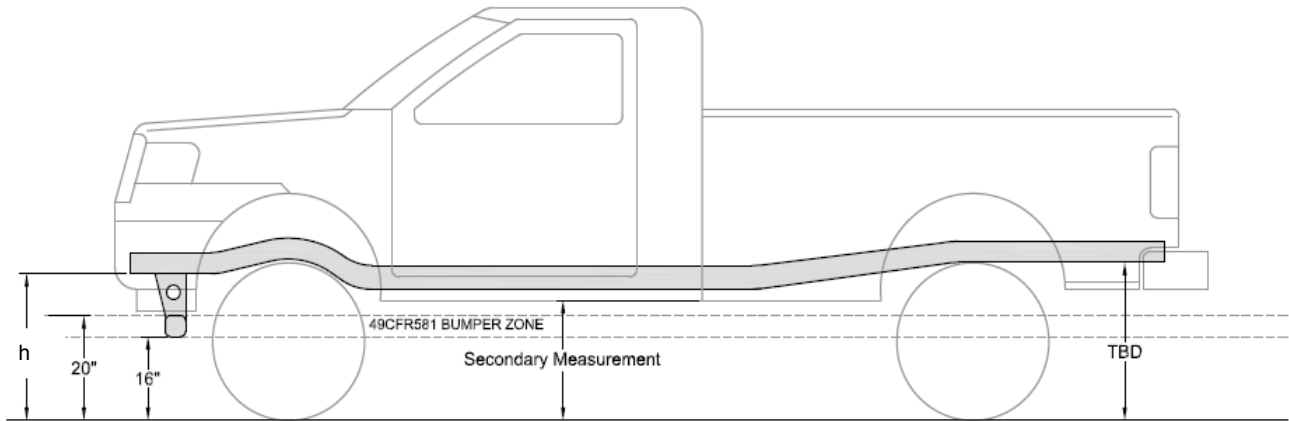


Figure 9 – Acceptable range of heights on vehicles manufactured on or after September 1, 2009  
 “h” is the maximum frame height based on the truck’s GVWR

## Future Considerations

There are opportunities to further improve the safety of raised vehicles beyond what the proposed framework and single measurement protocol address. The seven points below provide a brief overview of future considerations that were discussed by the committee, but that require additional research and consultation to implement.

1) Beginning with 2010MY trucks, any modifications made to increase the height of the chassis from the OEM height requires **retention or extension of the secondary energy-absorbing structure** which will engage the “CMVSS 215/U.S. Part 581” zone, as stipulated in the MOU

2) Beginning with 2010MY trucks, any modifications made to increase the height of the chassis from the OEM height is **limited to 25 inches vertical distance maximum between the road and the bottom of the longitudinal frame rail at mid-wheel base** (based upon 16” stock + 6” lift kit and change of tires from LT265/70R17 with OD=30.6”, to a maximum of OD=35”, (based upon measurements for 2010 Dodge Ram 2500) → total lift approx 8.2” max with 6” kit and 35” tires

3) Beginning with 2010MY trucks, any modifications made to increase the height of the chassis from the OEM height requires that the **vertical distance between the road and the bottom of the frame at the most forward point of the longitudinal frame rail be limited to 28 inches maximum** (based upon 19<sup>3</sup>/<sub>4</sub>” maximum stock chassis height + 6” lift kit & tires changed from LT265/70R17 (OD=30.6”), to a maximum of OD=35”, (based upon measurements for 2010 Dodge Ram 2500) → total lift approx 8.2” max with 6” kit and 35” tires

(note: consider P275/60R20 with OD=33” is stock tire of greatest diameter based upon our field survey)

4) Beginning with 2010MY, trucks with any modifications made to increase chassis height above that of the OEM requires that the **vertical distance between the road and the bottom of the frame at the most rearward point of the longitudinal frame rail be:**

**(i) limited to 28 inches maximum** (note that **28.625”** is stock measurement for 2010 Dodge Ram 2500), or

(ii) **limited to 37 inches, only if a secondary energy-absorbing structure is installed on the rear longitudinal frame rails**, at the rear-most possible location, which will engage with the “CMVSS 215/U.S. Part 581” zone, as stipulated in the MOU for the front energy-absorbing structure (@OD=35” will require a 21” tall secondary energy-absorbing structure on the rear longitudinal frame rails at the rear-most possible location)

5) Beginning with 2015MY, all light-duty trucks must be equipped with a **secondary energy-absorbing structure installed on the rear longitudinal frame rails**, at the rear-most possible location, which will engage with the “CMVSS 215/U.S. Part 581” zone, as stipulated in the MOU for the front energy-absorbing structure

6) Beginning January 1, 2020 all light duty trucks, must be equipped with a **front secondary energy-absorbing structure** which will engage with the “CMVSS 215/U.S. Part 581” zone, as stipulated in the MOU

7) Beginning January 1, 2025 all light duty trucks, must be equipped with a **secondary energy-absorbing structure on the rear longitudinal frame rails**, at the rear-most possible location, which will engage with the “CMVSS 215/U.S. Part 581” zone, as stipulated in the MOU for the front energy-absorbing structure

## Conclusions

Altering vehicles in any way that renders them non-compliant with the MVSR or results in significant deviation from the manufacturer’s design and recommended set-up parameters for safe operation is of concern to all Canadian jurisdictions. Light trucks are being raised without testing to confirm that they remain compliant with national and provincial safety standards. Operators of these vehicles are often unaware of the impact these modifications have had on the many safety systems installed throughout modern vehicles. As vehicles advance, the safety features such as collision compatibility structures, electronic stability control and ABS may become significantly less effective.

Canadian jurisdictions can help to limit the impact that raised vehicles have on the safety of their roadways by implementing a policy that is consistent with other Canadian jurisdictions, regulating the extent to which on-road vehicles may have their heights modified. The single measurement protocol allows jurisdictions to regulate raised vehicles by controlling the height of the vehicle at the front of its frame. This is the most effective point for regulating excessively raised vehicles and provided a single point for enforcement to measure to ensure compliance. The section titled “Proposed framework for regulating excessively raised vehicles” provides a comprehensive list of recommendations for further addressing issues associated with excessively raised vehicles.

## **Appendices**

- A. Maximum recommended frame heights (MVMA)**
- B. Model legislation for excessively raised vehicles (AAMVA)**
- C. Engineering certification (New Brunswick)**
- D. Technical bulletin (Quebec)**
- E. Memorandum of Understanding (MOU) on vehicle compatibility**
- F. Voluntary U.S. commitment**



# APPENDIX A

## Maximum Recommended Frame Heights

	<b>California Vehicle Code</b> (Section 24008.5) <sup>1</sup>	<b>Motor Vehicle Manufacturers Association</b> (1988)	<b>AAMVA Model Legislation</b> (2007)	<b>Michigan High Rise Vehicle Law</b> (1992)
Maximum frame height (definition)	"Frame height" means the vertical distance between the ground and the <u>lowest point on the frame</u> midway between the front axle and the second axle on the vehicle."	"Frame height means the vertical distance between the ground and the <u>lowest point on the frame</u> midway between the front axle and second axle on the vehicle.	"Frame height" means the vertical distance between the ground and the <u>bottom of the frame at the most forward or rearward points</u> of the longitudinal frame rail."	"Frame height is measured to the <u>bottom of the frame at a point midway</u> between the front and rear axles."
Passenger car	23 inches	22 inches	22 inches	N/A
Light truck less than 4,500 pounds	27 inches	24 inches	24 inches	24 inches
Light truck 4,501 - 7,500 pounds	30 inches	26 inches	26 inches	24 inches
Light truck 7,501-10,000 pounds	31 inches	28 inches	28 inches	26 inches

<sup>1</sup> [http://www.dmv.ca.gov/pubs/vctop/d12/vc24008\\_5.htm](http://www.dmv.ca.gov/pubs/vctop/d12/vc24008_5.htm)

## **APPENDIX B**

# **Model Legislation for Excessively Raised Vehicles**

**May 2007**

## **Excessively Raised Motor Vehicle Safety Act**

Section 1. Short Title. This Act may be cited as the Excessively Raised Motor Vehicle Safety Act.

Section 2. Statement of Intent and Purpose. The purpose of this Act is to prohibit the operation on any public highway of a motor vehicle that has been altered to excessively increase the original height of its frame or bumper, or that has been equipped with oversized replacement tires to a degree that creates safety hazards to the occupants of such vehicle and to other motor vehicles using the public highway. The Act further directs the [title of chief motor vehicle official] not to issue or renew a motor vehicle registration that authorizes the highway operation of an unsafe, excessively raised vehicle, as defined in the Act.

Section 3. Statement of Findings. [This *Section* to be completed by jurisdictions that require legislation to include a factual statement of findings, concerning the basis and the need for the creation of new legal rights, remedies or obligations contained in the Act].

Section 4. Definitions. As used in this Act, the following words and phrases have the following meanings:

(a) "Bumper" means the horizontal assembly made of aluminum, metal, rubber or plastic that is fastened to the front and rear of a vehicle and extends as a shield away from and across the full width of the vehicle body;

(b) "Bumper height" means the vertical distance between the ground and the lowest point at the bottom of an original bumper manufactured entirely of metal measured when the vehicle is unladen on a flat surface with the tires at the proper tire inflation pressure. If the bumper is absent, or if a section of the bumper is composed of rubber or plastic material, or if the original bumper has been modified, or if the vehicle has been equipped with an aftermarket bumper then the bumper height shall be measured with the vehicle on a level surface from the ground to the bottom of the frame at the most forward or rearward points of the frame rail;

(c) "Excessively raised vehicle" means a raised motor vehicle, as defined in *sub-Section (m)* of this *Section*, to which modifications have been made that could degrade braking performance, compromise fuel system integrity, create a mismatch in the geometric alignment of energy-absorbing structures between excessively raised vehicles and multi-purpose vehicles and passenger vehicles, increase roll-over propensity, and change handling characteristics by altering the designed integration of the original tires, and the steering, braking and suspension systems, to an extent determined by reference to the standards contained in *Section 8* of this Act, and as may be further specified in regulations adopted pursuant to the authority granted by *Section 7* of this Act.

(d) "Frame" means the main longitudinal structural members of the chassis of the vehicle or, for vehicles with unitized body construction, the lowest main longitudinal structural members of the body of the vehicle;

(e) “Frame height” means the vertical distance between the ground and the bottom of the frame at the most forward or rearward points of the longitudinal frame rail with the vehicle unladen on a level surface with the tires at the proper inflation pressure. The measurement on vehicles with unitized body/frame construction shall be taken at the lowest point of the front jacking location as manufactured;

(f) “Gross vehicle weight rating” means the value specified by the manufacturer as the maximum loaded weight of the motor vehicle as it appears on the manufacturer’s certificate of origin and/or on the federal motor vehicle safety certification label;

(g) “Loaded static tire diameter” means the maximum overall diameter when measured horizontally at the wheel hub and adjacent to the outboard sidewall of a tire/wheel assembly with the vehicle unladen on a level surface and the tires at the proper tire inflation pressure;

(h) “Multipurpose passenger vehicle” means a motor vehicle with motive power, except a trailer, designed to carry 10 or fewer persons which is constructed either on a truck chassis or with special features for occasional off-road operation;

(i) “Oversize replacement tire/wheel assembly” means tires or wheels that differ in overall diameter, width and height of original tires and wheels or optional tires or wheels recommended by the original equipment manufacturer;

(j) “Passenger car” means a motor vehicle with motive power, except a multipurpose passenger vehicle, motorcycle, or trailer designed for carrying 10 or fewer persons;

(k) “Primary frontal energy-absorbing structure height” means the distance between the ground and bottom of the frame;

(l) “Public highway” means any state or other highway, limited access highway, road, street, avenue, alley, driveway, parkway or place, under the control of the state or province or any political subdivision of the state or province, dedicated, appropriated or open to public travel or other use.<sup>1</sup>

(m) “Raised motor vehicle” means a multipurpose passenger vehicle, passenger car, truck as these types of motor vehicles are defined in this *Section*,<sup>2</sup> with a gross vehicle weight rating (GVWR) of less than 11, 500 pounds (5,216 kg) in which the original equipment has been modified, augmented or replaced by the installation of aftermarket parts or materials, including lift kits and oversize replacement tires, that increase its ride height, including the original height of its bumpers, frame, loaded static tire diameter and lighting equipment;

(n) “Ride Height” means the measured distance between the ground and a fixed reference point on the vehicle;

(o) “Truck” means a motor vehicle with motive power, except a trailer, designed primarily for the transportation of property or special purpose equipment.

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<sup>1</sup> A jurisdiction may wish to reference its existing definition of highway or public highway as contained in its motor vehicle code.

<sup>2</sup> These definitions are identical to those found in Title 49, Section 571.3 of the U.S. Code of Federal Regulations, which apply to the Federal Motor Vehicle Safety Standards (FMVSS).

Section 5. Operation prohibited. No person shall operate an excessively raised vehicle on any public highway of this state.

Section 6. Registration not permitted. The [title of chief motor vehicle official] shall not issue or renew a registration that authorizes the operation of a motor vehicle on a public highway if such motor vehicle is known to be an excessively raised vehicle.

Section 7. Inspection standards. The [title of chief motor vehicle official] is authorized to adopt regulations to implement any of the provisions of this Act, including regulations that contain inspections standards, guidelines and criteria, to determine if, during the course of performing any administrative safety inspection, authorized by [reference to statute that establishes inspection program] or any inspection performed by a law enforcement officer, as authorized by [reference to statute that authorizes roadside or other inspections by law enforcement personnel] the motor vehicle is an excessively raised vehicle, or otherwise fails to comply with any provision of [reference to statutory sections or part of State's motor vehicle code that contains standards for required equipment and condition for highway use and operation].

Section 8. Excessively Raised Vehicles, Description and Measurements. A motor vehicle is deemed to be an excessively raised vehicle for the purpose of this Act if it meets the definition contained in *Section 4* of this Act, and is observed to have any of the characteristics, or to exceed any of the tolerances or dimensions described in regulations adopted pursuant to the authority granted in *Section 7* of this Act. The regulations address the vehicle characteristics of body lift, brake system, bumpers, bumper height, frame height, fuel system, lighting equipment, tire/wheel assembly, steering system, and suspension system.<sup>3</sup>

- (a) With respect to body lift;
- (b) With respect to the brake system;
- (c) With respect to bumpers;
- (d) With respect to bumper height;
- (e) With respect to frame height;
- (f) With respect to the fuel system;
- (g) With respect to lighting equipment;
- (h) With respect to tire/wheel assembly;
- (i) With respect to the steering system;
- (j) With respect to the suspension system.

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<sup>3</sup> A model regulation is attached to the model law, which contains the standards for these vehicle characteristics.

Section 9. Penalties for Violation. Any person who operates an excessively raised vehicle on a public highway in violation of this act notwithstanding that the vehicle is currently registered by [type in jurisdiction] shall be guilty of [category of offense] and shall be fined in an amount not to exceed \$\_\_\_\_. Any person who commits a second or subsequent violation of this act shall be guilty of [category of offense] and shall be fined not more than \$\_\_\_\_, or imprisoned not more than \_\_\_\_ days, or both. In any case where the [name of motor vehicle agency] receives a report of a conviction under this *Section*, the [name of chief motor vehicle official] may require that the motor vehicle involved be presented for an official inspection. If the motor vehicle is not presented within the time required, or if it fails inspection, the registration shall be suspended, and no new registration shall be issued until such time as the owner demonstrates that the motor vehicle is in compliance with the standards of this Act.

Section 10. Warning of Violation. In any case in which a law enforcement officer has reason to believe that a motor vehicle operated on a public highway is an excessively raised vehicle, in apparent violation of *Section 9* of this Act, but circumstances do not permit an inspection to be performed with sufficient detail or accuracy to make a determination of compliance or noncompliance with the standards adopted pursuant to *Section 7 and 8* of this Act, such law enforcement officer may issue a written warning to the operator of such motor vehicle. The warning shall be in such form and contain such information as shall be prescribed by the [name of chief motor vehicle official], and shall contain a notice to the operator that the motor vehicle is required to be presented for an official inspection by the [name of motor vehicle agency]. If such motor vehicle is not presented for inspection within the time required by the notice, or if such motor vehicle fails such inspection, the registration shall be suspended, and no new registration shall be issued until such time as the owner demonstrates that the motor vehicle is in compliance with the standards of this Act.

Section 11. Right to Bring Civil Action. Any person who claims to have suffered bodily injury or to have sustained property damage in an amount in excess of \$\_\_\_\_ as a result of any collision on any public highway with an excessively raised vehicle may bring a civil action in the [name of trial court of primary jurisdiction] for the [name of county or other geographical area] where such person resides against the operator or the owner, or both, of such excessively raised vehicle to recover actual damages, statutory damages of not more than \$\_\_\_\_, court costs, and reasonable attorney's fees. If the owner is not the operator of the excessively raised vehicle, the liability imposed by the provisions of this *Section* shall be joint and several. It shall not be an affirmative defense to any action brought under this *Section* that the collision was caused by the negligence of the plaintiff, but such negligence, if determined to exist by the trier-of-fact, shall be considered to reduce the amount of actual damages, court costs and attorney's fees that the plaintiff is entitled to recover."

Section 12. Effective Date.

## Regulation Concerning Excessively Raised Motor Vehicles

The following is adopted as an official regulation of [name of agency or department] by [title of chief motor vehicle official].

### Section 1. Characteristics and Maximum Tolerances and Dimensions for Raised Motor Vehicles.

(a) With respect to body lift,

- (i) a body that has been elevated more than 3 inches (76mm) above the frame,
- or (ii) a body with unitized body construction that has been elevated above the frame, regardless of the amount of elevation;
- or (iii) a body that has been elevated by the use of multiple spacers, regardless of the amount of elevation;
- or (iv) aftermarket materials and fasteners that are not equivalent or greater in quality than original equipment (i.e. diameter, strength, grade of bolt);
- or (v) alterations that interfere or displace the safety features of the energy-absorbing steering column; affect the operation of the transmission, clutch, or accelerator controls; or mitigate the effectiveness of occupant restraint systems.

(b) With respect to the brake system,

- (i) brake lines do not display a DOT marking symbol (49 C.F.R. 571.106) or which are not contained in the Handbook of Automotive Safety Devices published by the Automotive Manufacturers Equipment Compliance Agency;
- or (ii) brake lines do not accommodate the full extension of the suspension without binding or being stretched;
- or (iii) brake lines and hoses that are not protected from excessive heat and vibration, chafing and undue wear, stress or unintentional disconnection during operation of the vehicle;
- or (iv) loss of brake fluid;
- or (v) minimum stopping distance requirement cannot be achieved in jurisdictions that conduct dynamic braking tests with the aid of a portable decelerometer or performance-based brake testing equipment.

(c) With respect to the bumper,

- (i) absence of the front or rear bumper with the exception of when a recognized vehicle manufacturer did not supply and install a rear bumper as original equipment;
- or (ii) bumpers that are not oriented or fastened in the original mounted position;
- or (iii) aftermarket bumpers that do not provide equivalent or superior protection as the original bumper;
- or (iv) bumpers with sharp or unwarranted protruding edges,

(d) With respect to bumper height,<sup>4</sup>

- (i) if the original bumper is not composed entirely of steel and the vehicle frame exceeds the frame heights denoted in *Section (1)(e)(i)* of this regulation.
- or (ii) when the FRONT bumper height of vehicles manufactured through September 30, 2009 is greater than 22 inches (559 mm) for passenger cars; 24 inches (610 mm) for vehicles with a gross vehicle weight rating 4,500 pounds (2,041 kg) or less; 27 inches (686 mm) for vehicles with a gross vehicle weight rating between 4,501 pounds (2,042 kg) and 7,500 pounds (3,402 kg); 28 inches (711 mm) for vehicles with a gross vehicle weight rating between 7,501 pounds (3,403 kg) and 11,500 pounds (5,216 kg);
- or (iii) when the REAR bumper height of vehicles is greater than 22 inches (559 mm) for passenger cars; 26 inches (660 mm) for vehicles with a gross vehicle weight rating less than 4,500 pounds (2,041 kg); 29 inches (737 mm) for vehicles with a gross vehicle weight rating between 4,501 pounds (2,042 kg) and 7,500 pounds (3,402 kg); 30 inches (762 mm) for vehicles with a gross vehicle weight rating between 7,501 pounds (3,403 kg) and 11,500 pounds (5,216 kg);,
- or (iv) when the height of the primary frontal energy-absorbing structure of vehicles manufactured after October 1, 2009 exceeds 18 inches (457 mm) from the ground or the lower edge of a secondary energy-absorbing structure is greater than 16 inches (406 mm) from the ground.

(e) With respect to frame height,<sup>5</sup>

- (i) shall not exceed:
  - 22 inches (559 mm) for passenger cars;
  - or (ii) 24 inches (610 mm) for vehicles with a gross vehicle weight rating of less than 4,500 pounds (2,041 kg);
  - or (ii) 26 inches (660 mm) for vehicles with a gross vehicle weight rating between 4,501 pounds (2,042 kg) and 7,500 pounds (3,402 kg);
  - or (iii) 28 inches (711 mm) for vehicles with a gross vehicle weight rating between 7,501 pounds (3,403 kg) and less than 10,000 pounds (4,536 kg);
  - or (iv) 29 inches (737 mm) for vehicles with a gross vehicle weight rating between 10,001 pounds (4,537 kg) and less than 11,500 pounds (5,216 kg).
- or (ii) if a raised vehicle manufactured after October 1, 2009 does not comply with Option 1 or Option 2 of the Vehicle Compatibility Commitment for enhancing the geometric alignment of front energy-absorbing structures of light trucks with passenger cars.<sup>6</sup>

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4 "Bumper height" means the vertical distance between the ground and the lowest point at the bottom of an original bumper manufactured entirely of steel measured when the vehicle is unladen on a flat surface with the tires at the proper tire inflation pressure. If the bumper is absent, or if a section of the bumper is composed of rubber or plastic material, or if the original bumper has been modified, or if the vehicle has been equipped with an aftermarket bumper then the bumper height shall be measured with the vehicle on a level surface from the ground to the bottom of the frame at the most forward or rearward points of the frame rail.

5 "Frame height" means the vertical distance between the ground and the bottom of the frame at the most forward or rearward points of the longitudinal frame rail with the vehicle unladen on a level surface with the tires at the proper inflation pressure. The measurement on vehicles with unitized body/frame construction shall be taken at the lowest point of the front jacking location as manufactured.

6 OPTION 1: The light truck's primary frontal energy-absorbing structure (frame rails) shall overlap at least 50 percent of the 49 C.F.R. Part 581 zone AND at least 50 percent of the light truck's primary frontal energy-absorbing structure shall overlap the 49 C.F.R. Part 581 zone if the primary frontal energy-absorbing structure of the light truck is greater than 8 inches tall, engagement with the entire 49 C.F.R. Part 581 zone is required, OR OPTION 2: there must be a secondary energy-absorbing structure, connected to the primary structure, whose lower edge shall be no higher than the bottom of the 49 C.F.R. Part 581 zone.



(f) With respect to the fuel system,

- (i) loss of flammable liquid;
- or (ii) fuel filler hose is loose, damaged or excessively extended or retracted;
- or (iii) fuel tank from aftermarket modifications or a change in original location makes it more exposed and susceptible to being punctured in a crash;
- or (iv) the fuel tank/s is loose or not equipped with fasteners, mounts or straps that are equivalent or greater in strength as original equipment (i.e. diameter, strength or grade of material).

(g) With respect to lighting equipment,

- (i) maximum height of headlamps exceeds 54 inches (1,370 mm) when measured from the ground to the center of the lamp;
- or (ii) alignment of headlamps do not conform to the specifications of the Registrar;
- or (iii) maximum height of tail lamps is more than 72 inches (1,830 mm) when measured from the ground to the center of the lamp.

(h) With respect to tire/wheel assembly,

- (i) absence of tire information placard installed by the original equipment manufacturer;
- or (ii) mud flaps do not extend across the full width of oversize replacement tire/wheel assembly;
- or (iii) aftermarket fender flares do not extend beyond the full width of oversize replacement tire/wheel assembly;
- or (iv) loaded static tire diameter of an oversize replacement tire/wheel assembly exceeds 34 inches (864 mm) when measured horizontally at the wheel hub.

(i) With respect to the steering system,

- (i) steering wheel is smaller in diameter than the steering wheel installed by original equipment manufacturer;
- or (ii) caster, camber, toe-in and toe-out settings do not conform to original specifications or those recommended by the aftermarket lift kit manufacturer;
- or (iii) steering components bind, interfere, or come into contact with any part of the vehicle (except a steering stop) when the steering wheel is turned full right or full left;
- or (iv) the complete “full” engagement of threads cannot be observed on bolts that are used to fasten or connect steering components.

(j) With respect to the suspension system,

- (i) aftermarket spring shackles are longer than four inches (102 mm);,
- or (ii) lift blocks were installed on the front axle;
- or (iii) height of aftermarket spacer blocks on the rear axle exceed 6 inches (152 mm);
- or (iv) rear spacer block on rear axle is comprised of multiple spacers and not a single component;

- or (v) original suspension was reconfigured, dismantled or permanently disconnected or removed and replaced with aftermarket components that are not equivalent or exceed the strength of original equipment;
- or (vi) original leaf springs were repositioned from below the axle to above the axle;
- or (vii) shock absorbers are leaking oil or could be damaged by the full extension of the suspension travel;
- or (viii) bump stops were removed or mounted at a different location than originally intended;
- or (ix) a warning label is not attached on the left door jamb or visible within the occupant compartment to inform drivers that the original suspension has been modified and may change the handling characteristics of the raised vehicle;
- or (x) warning label does not contain the following statement: **“WARNING** – The suspension of this vehicle has been modified. As a result, this vehicle may handle differently than that of a factory-equipped vehicle. As with any vehicle, Extreme Care must be used to prevent loss of control or roll-over during sharp turns or abrupt maneuvers. Always wear seat belts, and drive safely, recognizing that reduced speeds and specialized driving techniques may be required. Failure to drive this vehicle safely may result in serious injury or death. Do not drive this vehicle unless you are familiar with its unique handling characteristics and confident of your ability to maintain control under all driving conditions. Some modifications (and combination of modifications) are not recommended”;
- or (xi) suspension travel is restricted or binds;
- or (xii) suspension components contact other vehicle components;
- or (xiii) aftermarket materials and fasteners are not equivalent or greater in quality than original equipment (i.e. diameter, strength, grade of bolt);
- or (xiv) the complete “full” engagement of threads cannot be observed on bolts that are used to fasten or connect suspension components.

Section 2. Effective Date Provision.

## **APPENDIX C - ENGINEERING CERTIFICATION (NB)**

In New Brunswick, when a vehicle is suspected to have been modified to an unsafe or mechanically unfit condition the Registrar of Motor Vehicles relies on the advice of Professional Engineers. The authority for the Registrar to do this is under section 25(1)(b) of the New Brunswick Motor Vehicle Act, which states, the Registrar shall refuse registration or any transfer of registration upon any of the following grounds: that the vehicle is mechanically unfit or unsafe to be operated or moved upon the highways.

The process unfolds such that when a peace officer suspects that a vehicle is unsafe or mechanically unfit he or she may issue an order to the owner of the vehicle to have it inspected and certified by a Professional Engineer. The registration of the vehicle is changed to 'hold' status which means that the registration cannot be renewed or transferred until the vehicle is examined and subsequently deemed safe.

The Professional Engineer is required to provide a letter to the Registrar of Motor Vehicles itemizing in detail all aspects of the modifications together with his or her certification of the road worthiness and mechanical safety of the vehicle. The registered owner would also maintain a copy of this letter with the vehicle for presentation to enforcement personnel upon request. The Professional Engineer's examination must attest to whether the vehicle is mechanically fit and road worthy. Included in this certification must be the height of the bottom of the driver side door, as it existed when the examination was made as a form of protection for the engineer against further modifications.

# APPENDIX D – TECHNICAL BULLETIN (QUEBEC)

**SUBJECT: ALTERED-HEIGHT VEHICLE STANDARDS**

**TO: "LIGHT VEHICLES" MECHANICAL INSPECTION AGENTS**

## **1. APPLICATION**

This policy provides guidelines for evaluating and approving alterations to light-duty trucks or multipurpose passenger vehicles. Alterations include increased riding height by raising the body with spacers and/or lifting the suspension by replacing or modifying certain original parts and, in some cases, installing oversize tires.

## **2. DEFINITIONS**

### **Mechanical lift**

Raising of the vehicle following modifications or addition of one or more components to the frame, suspension and body other than the tires/wheels.

### **Original equipment**

Any equipment or component initially installed by the manufacturer as standard or optional equipment.

### **Original height**

Height of reference of the vehicle measured for each model according to the highest suspensions and largest diameter tires available as original equipment. This height must be measured from the lowest point at the center of the door on the driver's side.

## **3. GENERAL REQUIREMENTS**

A vehicle that has been modified should still be able to perform safely on the road. Whether they have been modified or not, frame components and systems (braking, suspension, steering, etc.) must continue to be as efficient as they were originally.

What is more, altered vehicles must meet other requirements, including:

- Tires must never come into contact with a part of the frame or body, taking into account the maximum extent of suspension and steering movements.
- The maximum difference in height added between the rear and front of the vehicle will be 50 mm.
- Increasing the front and rear tread by 100 mm at the most is permitted; however, it is prohibited to use spacers to that end.

- It is prohibited to use spacers between the axle and springs other than the spacers provided for this purpose by the manufacturer.
- No steering system component may be bent, heated, cut or welded.
- Brake hoses must be replaced by longer ones where required.
- Spring shackles cannot be longer than those installed by the manufacturer.
- Rim size must comply with tire manufacturer recommendations.
- Where required, steering components must be replaced in accordance with suspension lift to allow for free movement of all components.
- Tire tread must be covered, as provided by regulation.
- Fender profile can be remolded without sharp angles or dangerous overhang. Flexible materials used to cap sharp edges are unacceptable.
- Installing more than two shock absorbers per wheel is prohibited.

#### 4. LIFT MEASUREMENT AND CONTROL

When altered-height vehicles are being inspected, the height of the bottom of the door shall be measured and compared with the maximum height ( $h_3$ ) provided in the appended table. This value ( $h_3$ ) includes a total lift tolerance to account for certain variations that are impossible to control.

Where the height of the bottom of the door exceeds the  $h_3$  value, the vehicle will not pass inspection.

If the height of the bottom of the door is lower than the computed value but the mechanical lift is greater than the computed value (ML), then the vehicle will not pass inspection.

Control must be done when the vehicle is not loaded, that is, the maximum height ( $h_3$ ) will be measured without driver or load other than the fuel or other liquids required to operate the vehicle.

#### STANDARDS FOR ALTERED-HEIGHT VEHICLES

MANUFACTURER	MODEL	YEAR	W	FT	RT	H1	ML	H3
DODGE	Raider	87-89	92.5	54.0	54.0	21.0	0.9	22.6
	Ramcharger	74-93	106.0	63.3	63.3	21.0	3.0	26.5
	Reg. Pickup 8'D 150	74-93	131.0	65.7	63.9	22.0	3.9	28.9
	Reg. Pickup 6'D 150	74-93	115.0	65.7	63.9	21.0	3.4	27.1
	Reg. Pickup 8'D 150	94-99	134.0	65.7	63.9	22.0	3.9	28.9
	Reg. Pickup 6'D 150	94-99	118.0	65.7	63.9	21.0	3.4	27.1
	Mini P/up Ram 50 short	83-93	105.0	55.0	55.0	19.0	2.6	23.7
	Mini P/up Ram 50 long	83-93	116.0	55.0	55.0	19.0	2.9	24.2
	P/up Dakota short	87-96	112.0	59.0	59.0	19.0	3.0	24.4
	P/up Dakota long	87-96	124.0	59.0	59.0	19.0	3.3	24.9
	P/up Dakota short	97-99	11.20	59.0	59.0	17.0	3.0	22.4
	P/up Dakota long	97-99	124.0	59.0	59.0	17.0	3.3	22.9
		Bronco II	84-90	94.0	56.9	56.9	20.0	2.4

MANUFACTURER	MODEL	YEAR	W	FT	RT	H1	ML	H3
FORD	Pickup Ranger short	83-99	108.0	56.5	55.1	20.0	2.7	24.9
	Pickup Ranger long	83-99	114.0	56.5	55.1	20.0	2.9	25.2
	Pickup Ranger Sup. Cab	85-99	125.0	56.5	55.1	20.0	3.2	25.7
	Bronco	78-96	105.0	65.1	64.4	21.0	3.1	26.5
	Pickup F-150 8'	78-99	133.0	65.1	64.4	21.0	3.9	28.0
	Pickup F-150 6'	78-99	117.0	65.1	64.4	21.0	3.4	27.2
	Pickup F-150 Super Cab	78-99	139.0	65.1	64.4	21.0	4.6	29.2
	Pickup F-250 8'	80-99	133.0	66.7	64.2	23.0	4.0	30.1
	Pickup F-250 Super Cab	80-99	155.0	66.7	64.2	23.0	4.6	31.3
	Pickup F-350 8'	80-99	133.0	65.0	65.0	24.0	3.9	31.1
	Pickup F-350 Super Cab	80-99	155.0	65.0	65.0	24.0	4.6	32.2
GM	Geo Tracker (4 doors)	97-99	97.0	52.0	52.0	20.0	2.3	24.0
	Geo Tracker (2 doors)	89-99	86.0	52.0	52.0	20.0	2.0	23.7
	S-10 Mini-Blazer 2 d.	83-99	100.5	55.0	54.6	19.0	2.5	21.5
	S-10 Mini-Blazer 4 d.	91-99	107.0	55.0	54.6	17.0	2.7	21.7
	S-10 Mini-Pickup short	83-99	108.3	55.0	55.4	17.0	2.7	21.9
	S-10 Mini-Pickup long	83-99	117.9	55.0	55.4	17.0	3.0	22.3
	S-10 Mini P/up X/Cab	83-99	122.0	55.0	55.0	17.0	3.1	22.5
	Reg. Blazer	73-86	106.5	66.1	63.0	21.0	3.1	26.6
GM	Reg. Pickup 8'	73-87	131.5	66.8	63.7	22.0	3.9	29.0
	Reg. Pickup 8'	88-99	131.5	64.0	64.0	20.0	3.8	26.9
	Reg. Pickup 6'	73-87	117.5	66.8	63.7	21.0	3.5	27.3
	Reg. Pickup 6'	88-99	117.5	64.0	64.0	20.0	3.4	26.2
	Reg. Pickup X/Cab	73-99	155.0	64.0	64.0	20.0	4.5	28.1
	Suburban	73-91	129.0	66.0	66.0	22.0	3.9	29.0
	Suburban	92-99	131.5	66.0	66.0	22.0	3.9	29.0
ISUZU	Trooper 2 doors	83-88	94.0	54.0	54.0	19.0	2.3	23.1
	Trooper II 2 doors	83-88	104.0	54.0	54.0	19.0	2.6	23.5
	Trooper II 4 doors	83-91	104.0	54.0	54.0	19.0	2.6	23.5
	Trooper 4 doors	92-99	108.7	54.0	54.0	19.0	2.8	23.7
	Pickup short	83-88	104.0	53.0	53.0	19.0	2.5	23.5
	Pickup short	89-94	105.0	53.0	53.0	19.0	2.5	23.5
	Pickup long	83-88	117.0	53.0	53.0	19.0	2.8	24.0
	Pickup long	89-94	119.0	53.0	53.0	19.0	2.8	24.0
	Pickup (extended cab)	88-89	117.0	53.0	53.0	19.0	2.8	24.0
JEEP	CJ-7	82-86	93.4	55.8	55.1	26.0	2.4	30.2
	Wrangler	89-95	93.4	58.2	58.2	26.0	2.5	30.4
	Reg. Cherokee	69-83	108.7	59.4	57.8	20.0	2.9	25.2
	Grand Cherokee	93-99	106.0	58.0	58.0	20.0	2.9	25.2
	Reg. Wagoneer	69-91	108.7	59.4	57.8	20.0	2.9	25.2
	Cherokee short	84-99	101.4	57.0	57.0	21.0	2.6	25.7
	Wagoneer short	84-91	101.4	57.0	57.0	21.0	2.6	25.7
	Reg. Pickup J-10	69-86	130.7	63.3	63.8	21.0	3.8	27.8
	Reg. Pickup J-20	69-86	130.7	64.0	65.4	21.0	3.8	27.9
	Pickup Commanche LB	86-92	119.9	58.0	58.2	21.0	3.2	26.7
	Pickup Commanche SB	87-92	113.0	58.0	58.2	21.0	3.0	26.5
	Scrambler	81-85	103.0	56.0	56.0	26.0	2.6	30.7
	YJ	89-99	93.4	58.0	58.0	26.0	2.5	30.4
MITSUBISHI	Montero 2 doors	83-89	92.0	54.0	54.0	20.0	2.3	24.0
	Montero 4 doors	89-91	106.0	55.0	55.0	20.0	2.7	24.7
	Montero 4 doors	92-95	107.3	55.0	55.0	20.0	2.7	24.7
	Pickup short	83-95	105.0	55.0	55.0	19.0	2.6	23.7
	Pickup long	83-95	116.0	55.0	55.0	19.0	2.9	24.2

MANUFACTURER	MODEL	YEAR	W	FT	RT	H1	ML	H3
NISSAN	Pickup long & King Cab	78-86	110.8	52.9	53.1	22.0	2.7	26.8
	Pathfinder	87-99	104.0	55.0	55.0	21.0	2.6	25.7
	X long box	87-99	116.0	57.0	57.0	21.0	3.0	26.4
	X short box	87-99	104.0	57.0	57.0	21.0	2.7	25.9
	Pickup short	78-86	101.4	52.9	53.1	22.0	2.4	26.4
SUZUKI	Samurai	85-92	79.9	51.2	51.6	19.5	1.9	22.9
	Sidekick 2 doors	89-98	86.6	54.5	55.1	16.3	2.2	20.1
	Sidekick 4 doors	91-98	97.6	54.5	55.1	16.5	2.5	20.5
	Vitara (2 doors)	1999	86.6	54.5	55.1	16.5	2.2	20.0
	Vitara (4 doors)	1999	97.6	54.5	55.1	16.5	2.5	20.5
TOYOTA	Landcruiser 2 doors	72-87	90.9	56.3	56.0	20.0	2.3	24.2
	Landcruiser 4 doors	81-89	107.5	58.5	57.9	20.0	2.8	25.1
	Landcruiser 4 doors	94-99	117.5	58.5	57.9	20.0	3.0	25.5
	Pickup short 4-Runner	85-99	103.0	56.3	55.0	23.0	2.6	27.7
	Pickup short	79-99	102.0	56.3	55.0	23.0	2.6	27.6
TOYOTA	Pickup long	85-99	112.2	56.3	55.0	23.0	2.9	28.1
	Pickup long SR-5	79-86	110.3	56.3	55.1	23.0	2.8	28.0
	Pickup T100	95-99	103.0	61.8	64.0	23.0	2.5	28.0
	Pickup T100	93-99	121.8	61.8	64.0	23.0	3.5	29.0

**LEGEND:**      **W:**      **Wheelbase**                              **H1:**      **Original Manufactured Height**  
                     **FT:**      **Front tread**                                      **ML:**      **Mechanical Lift**  
                     **RT:**      **Rear Tread**    **H3:**      **Total Authorized Height**

**NOTE:** Measurements are in inches.

### Lift Limits for Four Wheel Drive Vehicles

Alterations targeted are in connection with **total lift**, which is equal to the sum of the **mechanical lift** of the frame, suspension and body, with the **tire lift** obtained from oversize tires.

The original height specific to each model will vary depending on the highest suspension and greatest diameter tire available **as standard or optional equipment from the manufacturer**. It is measured from the ground to the bottom center of the front door.

Two formulas are used for calculating lifts. These are:

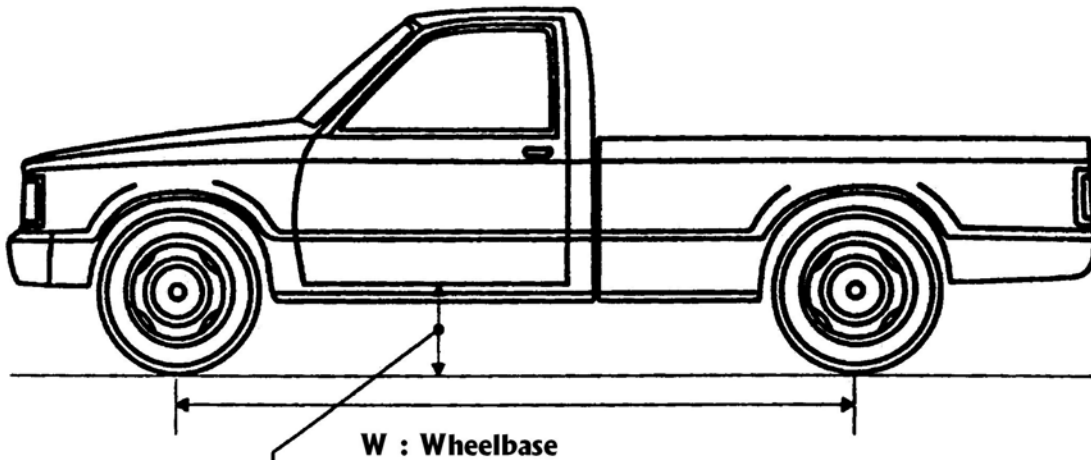
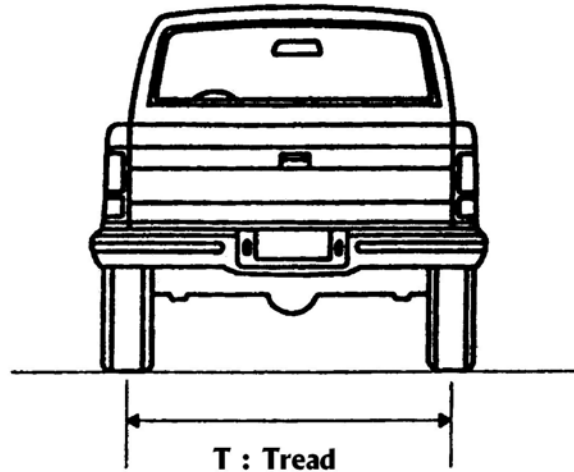
$$\text{Total lift (inches)} = \frac{\text{tread (inches)} \times \text{wheelbase (inches)}}{1222}$$

$$\text{Mechanical lift (inches)} = \text{total lift (inches)} \times 0.55$$

The vehicle with a total lift that exceeds the computed value will not pass inspection. Moreover, if the total lift is below the computed value but the mechanical lift is greater than the computed value, then the vehicle will not pass inspection either.

### **WARNING**

Using oversize tires reduces vehicle-stopping capacity. The distance required to stop the vehicle will increase and braking system components risk overheating. Altering a vehicle's height also reduces its stability and increases rollover risk. Exaggerated modifications can seriously threaten the safety of passengers and other road users.



**H3 : Total height permitted**  
Height measured from the lowest point  
at the center of the door on the driver's side



## **APPENDIX E**

### **MEMORANDUM OF UNDERSTANDING (MoU) ON VEHICLE COMPATIBILITY**

## **Appendix E Memorandum of Understanding (MOU) on Vehicle Compatibility**

The purpose of this MOU between Transport Canada and «COMPANY» is to set out the general terms and conditions with regard to marketing in Canada, vehicles designed in accordance with the performance criteria contained in Attachment A, as amended from time to time.

Attachment A defines the vehicle performance criteria for enhancing crash compatibility as well as the anticipated timing by which «COMPANY» commits to implement these criteria for vehicles it markets in Canada.

This non-regulatory program, while considered acceptable to both parties concerned, does not preclude the Government of Canada from introducing vehicle compatibility regulations under the authority of the *Canada Motor Vehicle Safety Act*. The Government's regulatory process will provide the opportunity for input, comment, lead time and fair notice prior to the introduction of such a regulation.

### **Principles:**

The parties to this MOU recognize and acknowledge:

- The integrated nature of the motor vehicle manufacturing industry and the commitment of Transport Canada and the motor vehicle manufacturing industry to work towards North American and ultimately world-wide harmonization of standards relating to vehicle-to-vehicle crash compatibility, and
- The value of enhancing vehicle-to-vehicle- crash compatibility..

### **Agreement:**

In recognition of these principles, both parties understand and mutually agree that:

- Concurrent with the signing of this MOU, «COMPANY» will begin marketing vehicles in Canada that have been designed in accordance with the performance and implementation criteria contained in Attachment A with the exception of those vehicles exempted by that Attachment.
- By September 1, 2009, all of «COMPANY's» new passenger cars and light duty trucks produced for sale in Canada, will be designed in accordance with the performance and implementation criteria set out in Attachment A with the exception of those vehicles exempted by that Attachment.
- Beginning November 1, after the signing of the MOU, and on each November 1<sup>st</sup> thereafter, through to and including November 1, 2009, for the applicable model year

vehicles, «COMPANY» shall provide to Transport Canada, a list identifying which new vehicle designs are in accordance with the front-to-front and/or front-to-side performance criteria set out in Attachment A. This information may be publicly disclosed by Transport Canada on its web site in a mutually-agreeable format.

- Upon receipt of a written request, «COMPANY» shall provide to Transport Canada, confirmatory data and/or engineering analyses demonstrating that vehicle designs are in accordance with the front-to-front and/or front-to-side performance criteria set out in Attachment A. This information may be submitted on a confidential basis and, subject to Canadian law, will be kept confidential by Transport Canada.

**Termination:**

This MOU shall remain in effect until both parties mutually agree that such an understanding is no longer desirable. Notwithstanding the preceding, in the event of changes to any Canadian or U.S. regulatory requirements, which «COMPANY» determines make fulfillment of its obligations, as set out in this MOU, impracticable, «COMPANY» reserves the right to terminate this MOU with 90 days advance written notice to Transport Canada. Said notification shall include supporting documentation for this decision. The Minister or his duly authorized representative will notify all other participating vehicle manufacturers listed in Attachment B in the event that this MOU has been terminated.

_____ Name and Title	_____ Name and Title
_____ Signature «COMPANY»	_____ Signature Transport Canada
_____ Date:	_____ Date:

# **ATTACHMENT A**

## **INTRODUCTION**

Motor vehicle safety is a shared responsibility of manufacturers, consumers, and governments. Individual vehicle manufacturers have made changes in their vehicles over the years to enhance crash compatibility. Yet individual efforts are only the beginning. Even greater safety benefits can be achieved if industry works together. Moreover, improving compatibility is an ongoing effort. As the research in vehicle-to-vehicle crash compatibility progresses, there may be a need to reassess or refine aspects of the performance criteria contained herein.

## **1.0 FRONT-TO-SIDE CRASHES**

### **1.1 PERFORMANCE CRITERIA & IMPLEMENTATION**

#### ***Enhancing Self-Protection***

*Participating manufacturers will begin designing new passenger cars and light trucks, with GVWRs less than 3856 kg (8500 pounds) in accordance with one of the following two head-protection alternatives:*

*Option 1: HIC<sub>36</sub> performance of 1000 or less for a SID/H3 crash dummy in the driver's seating position in an FMVSS 201 pole impact test<sup>1</sup>, OR*

*Option 2: HIC<sub>15</sub> performance of 779 or less (with no direct head contact with the barrier) for a SID-IIs crash dummy in the driver's seating position in the IIHS MDB side impact crash test<sup>2</sup>.*

*Until September 1, 2009, vehicles may be designed to meet either Option 1 or Option 2. Starting September 1, 2009, these vehicles will be designed in accordance with Option 2.*

***Applicability:*** *These performance criteria do not apply to vehicles that a manufacturer determines, due to basic practicability and functionality issues, cannot meet the performance criteria (e.g., very low sales volume vehicles, convertibles, very low height sports cars, and vehicles with removable doors), or would have to be excluded from the marketplace if compliance were required. For excluded vehicles, the manufacturer shall provide to Transport Canada, upon request, an explanation for the exclusion.*

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<sup>1</sup> Sections S8.16 through S8.28 of Federal Motor Vehicle Safety Standard No. 201, "Occupant Protection in Interior Impact" (October 2002).

<sup>2</sup> See [http://www.hwysafety.org/vehicle\\_ratings/test\\_protocol\\_side.pdf](http://www.hwysafety.org/vehicle_ratings/test_protocol_side.pdf)

## **2.0 FRONT-TO-FRONT CRASHES**

### **2.1 PERFORMANCE CRITERIA & IMPLEMENTATION**

#### ***Enhancing Geometric Alignment of Front Energy-absorbing Structures***

*Participating manufacturers will begin designing light trucks in accordance with one of the following two geometric alignment alternatives, with the light truck at unloaded vehicle weight (as defined in subsection 2(1) of the Motor Vehicle Safety Regulations but without accessories that are ordinarily removed from the vehicle when they are not in use):*

*OPTION 1: The light truck's primary frontal energy-absorbing structure shall overlap at least 50 percent of the Canada Motor Vehicle Safety Standard (CMVSS) 215/U.S. part 581 zone AND at least 50 percent of the light truck's primary frontal energy-absorbing structure shall overlap the CMVSS 215/U.S. part 581 zone (if the primary frontal energy-absorbing structure of the light truck is greater than 20.3 cm's (8 inches) tall, engagement with the entire CMVSS 215/U.S. part 581 zone is required)<sup>3</sup>,  
OR*

*OPTION 2: If a light truck does not meet the criteria of Option 1, there must be a secondary energy-absorbing structure, connected to the primary structure, whose lower edge shall be no higher than the bottom of the CMVSS 215/U.S. part 581 bumper zone. This secondary structure shall be designed to reduce structural over-ride of a passenger car during a frontal crash.*

*If a light truck has crash compatibility devices that deploy in high-severity frontal crashes with another vehicle, all measurements shall be made with these devices in their deployed state.*

*Not later than September 1, 2009, all of <<Company>>'s light truck production marketed for sale in Canada will be designed in accordance with Option 1 or Option 2.*

***Applicability:*** *All light truck vehicles with GVWRs up to 4536 kg (10,000 pounds), except, low production volume vehicles, vehicles over 3856 kg (8,500 pounds) GVWR with functional criteria which preclude them from meeting the performance criteria, (e.g., postal vehicles, military vehicles, service vehicles used by public and private utilities, vehicles specifically designed primarily for off-road use, and incomplete vehicles), and other vehicles that a manufacturer determines cannot meet the performance criteria without severely compromising their practicality or functionality.*

<sup>3</sup> See attachment for the geometric alignment assessment procedure to be followed.

**ATTACHMENT B**

**PARTICIPATING VEHICLE MANUFACTURERS**

**BMW CANADA INC.**

**DAIMLERCHRYSLER CANADA INC.**

**FORD MOTOR COMPANY OF CANADA, LIMITED  
INCLUDING JAGUAR CANADA AND LAND ROVER CANADA, DIVISIONS OF FORD  
MOTOR COMPANY OF CANADA, LIMITED**

**GENERAL MOTORS OF CANADA LIMITED**

**HONDA CANADA INC.**

**HYUNDAI AUTO CANADA**

**KIA MOTORS CANADA INC.**

**MAZDA CANADA INC.**

**MERCEDES-BENZ CANADA INC.**

**MITSUBISHI MOTOR SALES OF CANADA INC.**

**NISSAN CANADA INC.**

**PORSCHE CARS CANADA LTD.**

**SUBARU CANADA INC.**

**SUZUKI CANADA INC.**

**TOYOTA CANADA INC.**

**VOLKSWAGEN CANADA INC.**

**VOLVO CARS OF CANADA LTD.**

## ATTACHMENT C

### FRONT-TO-FRONT CRASHES; MEASUREMENT PROCEDURE

The conformance to Options 1 and 2 may be evaluated using engineering judgment, engineering drawings with production tolerances or, physical measurements.

The following procedure shall be used to define the upper and lower heights of the Primary Energy Absorbing structure (PEAS).

All measurements will be made with the vehicle on a flat, level horizontal surface and at its unloaded weight (as defined in subsection 2(1) of the Motor Vehicle Safety Regulations but without accessories that are ordinarily removed from the vehicle when they are not in use). The tires will be inflated to the pressure recommended by the manufacturer of the vehicle and any systems likely to affect the vehicle structure height (such as air suspensions, etc) will be in the cruising configuration for the vehicle traveling at 56 km/h (35 mph) on a level horizontal road surface.

If the vehicle has crash compatibility devices that deploy in the event of high severity frontal crashes with another vehicle, all measurements shall be made with these devices in their deployed stage.

The height of the vehicle's primary energy absorbing structure (PEAS) mentioned in **Option 1** shall be measured at the forward-most point where a vertical plane intersects a complete section<sup>4</sup> of the vehicle's primary energy absorbing structure<sup>5</sup>. The heights of the top and of the bottom of the primary structure are determined as the heights of the upper side and of the lower side respectively of the smallest vertical rectangle enclosing the outer surfaces of the cross-section of the primary energy absorbing structure. For this measurement, all components that are not designed for crash energy dissipation will be excluded from the measurement<sup>6</sup>.

The measurement of the height of vehicle's secondary energy absorbing structure mentioned in **Option 2** shall be determined as the height of the horizontal plane that is tangential to the lowest point of the secondary energy absorbing structure.

<sup>4</sup> Typically, this will be a closed section.

<sup>5</sup> "Primary Energy Absorbing Structure" is defined as structure that manages energy in high severity crashes.

<sup>6</sup> For structures that employ unique configurations, the test report shall include assumptions that influenced determination of PEAS height.

**Option 1, Typical**

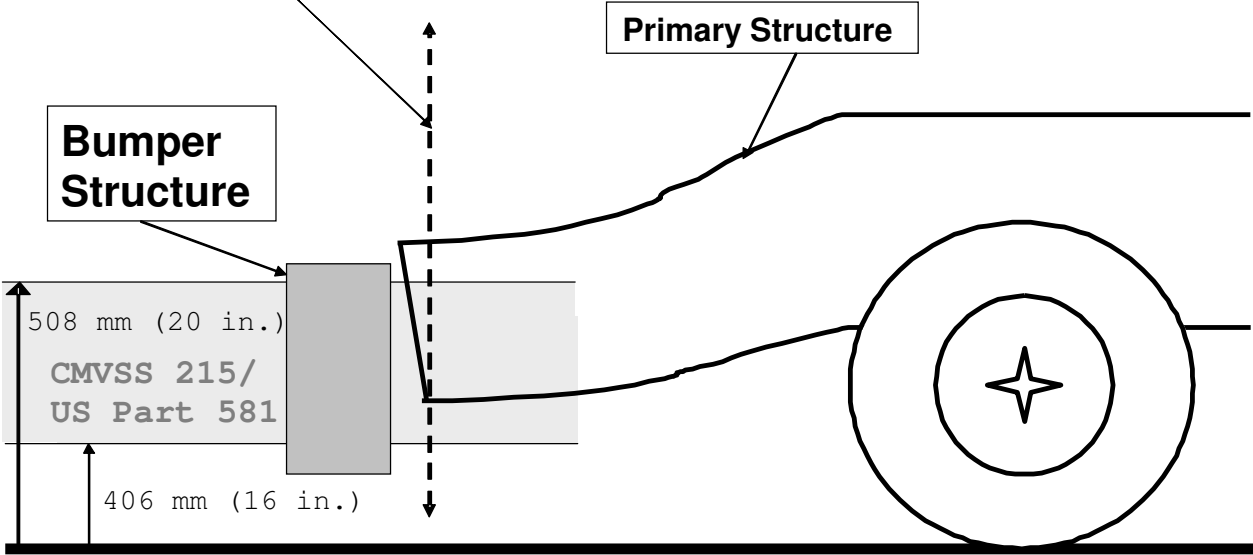
**OPT-1 Measurement plane location  
(Beginning at a complete  
section in the vertical plane)**

**Primary Structure**

**Bumper  
Structure**

508 mm (20 in.)  
CMVSS 215/  
US Part 581

406 mm (16 in.)





# **APPENDIX F**

## **VOLUNTARY U.S. COMMITMENT**

# APPENDIX F

## VOLUNTARY U.S. COMMITMENT



May 10, 2006

The Honorable Jacqueline Glassman  
Acting Administrator  
National Highway Traffic Safety  
Administration  
400 Seventh Street, S.W.  
Suite 5220  
Washington, DC 20590

Dear Ms. Glassman:

On December 2, 2003, we were pleased to forward to NHTSA a voluntary commitment to begin designing vehicles according to the performance criteria contained in the report, "ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY: A Set of Commitments for Progress by Automobile Manufacturers." The vehicle manufacturers making this commitment represented almost all light vehicle sales in the United States. These companies are BMW Group, DaimlerChrysler Corporation, Ford Motor Company, General Motors, American Honda, Hyundai Motor America, Isuzu Motors America, Kia Motors America, Mitsubishi Motors, Nissan, Subaru, Suzuki, Toyota, and Volkswagen. The Insurance Institute for Highway Safety facilitated the development of this plan, with the sponsorship of the Alliance of Automobile Manufacturers.

The December 2003 commitment established performance criteria to further enhance occupant self-protection in front-to-side crashes, principally through enhanced head impact protection. It also included design criteria to enhance partner protection in vehicles involved in front-to-front crashes, primarily through geometric matching of front structural components of cars and light trucks. Furthermore, it defined research programs to investigate future test procedures and performance criteria. These voluntary criteria for crash compatibility, combined with an industry commitment to begin to design new vehicles in accordance with those new criteria, represent a model for responsible industry action to bring significant safety improvements into the new vehicle fleet faster than typically achieved through regulation.

Since December 2003, the industry has made substantial progress in implementing this commitment. The commitment required 100 percent of each participating manufacturer's applicable vehicles to be designed to the criteria by September 2009, and each participating manufacturer

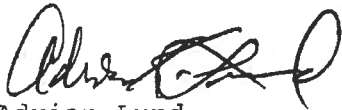
May 10, 2006

began implementing the performance criteria immediately upon the industry's agreement. Consequently, by production year 2005, approximately 62 percent of applicable vehicles were designed in accordance with the front-to-front criteria and 33 percent of applicable vehicles were designed in accordance with the front-to-side criteria.

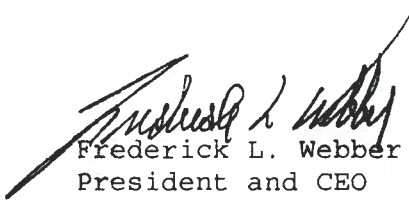
In November 2005, participating manufacturers and the Insurance Institute for Highway Safety added new test procedures and performance criteria for supplemental structures added to light trucks to engage passenger cars' primary energy-absorbing structures in frontal crashes. The research plan for further improving front-to-front compatibility also was refined to contemporaneously investigate potential dynamic geometric, stiffness, and other relevant front-end performance characteristics that would enhance partner protection without sacrificing self-protection in frontal crashes. This research plan was approved at a meeting between the Insurance Institute for Highway Safety and participating manufacturers on March 22, 2006.

Enclosed is the updated version of the December 2003 compatibility commitment, as well as a December 2005 progress report on its implementation. These documents demonstrate the continuing strong commitment of participating auto manufacturers to further improve, on a voluntary basis, the safety performance of their new vehicles.

Sincerely,

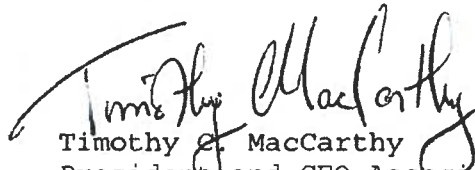


Adrian Lund  
President  
Insurance Institute for Highway Safety



Frederick L. Webber  
President and CEO

Alliance of Automobile Manufacturers



Timothy J. MacCarthy  
President and CEO Association of International  
Automobile Manufacturers

Enclosures

# ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS

## INTRODUCTION

Motor vehicle safety is a shared responsibility of manufacturers, consumers, and governments. Individual vehicle manufacturers have made changes in their vehicles over the years to enhance crash compatibility. Yet individual efforts are only the beginning. Even greater safety benefits can be achieved if industry works together. Moreover, improving compatibility is an ongoing effort. As the research in this commitment progresses, there may be a need to reassess or refine aspects of the performance criteria contained herein. Consistent with our dedication to advancing motor vehicle safety and in the spirit of the philosophy of shared responsibility, the vehicle manufacturers listed below make the following voluntary commitment for enhancing vehicle-to-vehicle crash compatibility.

## 1.0 FRONT-TO-SIDE CRASHES

### **1.1 PERFORMANCE CRITERIA & IMPLEMENTATION SCHEDULE**

#### ***Phases 1 & 2: Enhancing Self-Protection***

*Participating manufacturers will begin designing their vehicles in accordance with one of the following two head protection alternatives:*

*OPTION 1: HIC<sub>36</sub> performance of 1000 or less for a SID/H3 crash dummy in the driver's seating position in an FMVSS 201 pole impact test<sup>1</sup>, OR*

*OPTION 2: HIC<sub>15</sub> performance of 779 or less (with no direct head contact with the barrier) for a SID-II's crash dummy in the driver's seating position in the IIHS MDB side impact crash test<sup>2</sup>.*

***Phase 1:*** *Not later than September 1, 2007, at least 50 percent of each participating manufacturer's new passenger car and light truck (GVWR up to 8,500 pounds) production intended for sale in the United States will be designed in accordance with either head protection Option 1 or Option 2.*

***Phase 2:*** *Not later than September 1, 2009, 100 percent of each participating manufacturer's new passenger car and light truck (GVWR up to 8,500 pounds) production intended for sale in the United States will be designed in accordance with the IIHS MDB recommended practice of HIC<sub>15</sub> performance of 779 or less (with no direct head contact with the barrier) for a SID-II's crash dummy in the driver's seating position.*

<sup>1</sup> Sections S8.16 through S8.28 of Federal Motor Vehicle Safety Standard No. 201. "Occupant Protection in Interior Impact." (October 2002).

<sup>2</sup> [http://www.highwaysafety.org/presentations/sice\\_files/IIHSSideImpactProtocolStat.pdf](http://www.highwaysafety.org/presentations/sice_files/IIHSSideImpactProtocolStat.pdf) (February 2003, as amended)

# ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY

## COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS

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***Applicability:** These performance criteria do not apply to vehicles that a manufacturer determines, due to basic practicability and functionality issues, cannot meet the performance criteria, and would have to be eliminated from the marketplace if compliance were required.*

### **1.2 RESEARCH PLAN**

#### ***Phase 3: Additional Injury Criteria, Seating Positions, and Test Dummies***

*Investigation of Additional Injury Criteria, Seating Positions, and Test Dummies – perform crash tests and other related research over the next year using the IIHS side impact test to assess the safety benefits of adding performance criteria for other body regions, with specific attention to the thoracic and abdominal regions. This research also will assess the potential safety benefits of performance criteria for a rear-seat test dummy, as well as compare the performance of the SID IIs and WorldSID test dummies.*

#### ***Phase 4: Enhanced Structural Interaction in Front-to -Side Crashes***

*Investigation of Performance Criteria for Enhanced Structural Interaction – investigate the opportunities to further enhance structural interaction between vehicles in front-to-side crashes, with a particular emphasis on striking vehicles meeting the front-to-front compatibility performance criteria. This work will include an assessment of the IIHS side impact barrier in light of the front-to -front compatibility performance criteria. Phase 4 research will start within one year, and build upon the results of Phase 3 research.*

# ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY

## COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS

### 2.0 FRONT-TO-FRONT CRASHES

#### 2.1 PERFORMANCE CRITERIA & IMPLEMENTATION SCHEDULE

##### *Phase 1: Enhancing Geometric Alignment of Front Energy-absorbing Structures*

*Participating manufacturers will begin designing light trucks in accordance with one of the following two geometric alignment alternatives, with the light truck at unloaded vehicle weight (as defined in 49 CFR 571.3)<sup>3</sup>:*

*OPTION 1: The light truck's primary frontal energy-absorbing structure shall overlap at least 50 percent of the Part 581 zone AND at least 50 percent of the light truck's primary frontal energy-absorbing structure shall overlap the Part 581 zone (if the primary frontal energy-absorbing structure of the light truck is greater than 8 inches tall, engagement with the entire Part 581 zone is required), OR,*

*OPTION 2: If a light truck does not meet the criteria of Option 1, there must be a secondary energy-absorbing structure, connected to the primary structure, whose lower edge shall be no higher than the bottom of the Part 581 bumper zone. This secondary structure shall be designed to reduce structural over-ride of a passenger car during a frontal crash.*

#### **ADDENDUM – Nov. 15, 2005**

*This secondary structure shall withstand a load of at least 100 KNewtons exerted by a loading device as described in the attached Appendix B, before this loading device travels 400 mm as measured from a vertical plane at the forward-most point of the significant structure of the vehicle.*

*If a light truck has crash compatibility devices that deploy in high-severity frontal crashes with another vehicle, all measurements shall be made with these devices in their deployed state.*

*Not later than September 1, 2009, 100 percent of each participating manufacturer's new light truck production intended for sale in the United States will be designed in accordance with either geometric alignment Option 1 or Option 2.*

***Applicability:*** *All light truck vehicles with GVWRs up to 10,000 pounds, except, low production volume vehicles, vehicles over 8,500 pounds GVWR with functional criteria which preclude them from meeting the performance criteria, (e.g., postal vehicles, military*

<sup>3</sup> See Attachment for the geometric alignment assessment procedure to be followed.

# ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY

## COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS

*vehicles, service vehicles used by public and private utilities, vehicles specifically designed primarily for off-road use, and incomplete vehicles), and other vehicles that a manufacturer determines cannot meet the performance criteria without severely compromising their practicality or functionality.*

### 2.2 RESEARCH PLAN

#### ***Phase 2: Force Matching of Front Energy-absorbing Structures***

*Dynamic Test Protocol for Enhanced Structural Interaction – to be assessed over the next year.*

#### **ADDENDUM – Nov. 15, 2005**

*Research conducted since 2003 was summarized in: Barbat, S., "Status of Enhanced Front-to-Front Vehicle Compatibility Technical Working Group Research and Commitment," 19<sup>th</sup> International Technical Conference on the Enhanced Safety of Vehicles, Paper Number 05-463, Washington, D.C., 2005.*

#### ***Phases 3: Stiffness Matching of Front Energy-absorbing Structures***

*Investigation of Front-end Stiffness Performance – Investigate potential test over the next two years to determine appropriate front-end stiffness characteristics and criteria that would strike an appropriate balance between small vehicle passenger compartment strength and large vehicle energy absorption characteristics.*

#### **ADDENDUM – Nov. 15, 2005**

*Based on the findings of research conducted to date, further research will investigate potential test procedures and performance metrics to assess potential dynamic front-end geometric, stiffness, and any other relevant performance characteristics that would enhance partner protection without any significant degradation in self-protection.*

*Research in 2006 is to proceed along three parallel paths:*

- 1. Continued research to evaluate the possibility of using measurements from a test barrier instrumented with a large number of load cells to measure crash forces generated by vehicles in field-representative crashes;*
- 2. Development of a moving, deformable barrier as a surrogate for a 'fleet representative' passenger car that may be used to establish performance criteria for light trucks in crashes with passenger cars; and*
- 3. Development of computer modeling (finite element simulations) to assess light truck-to-passenger car crash performance in a range of different crash conditions.*

# ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS

## **3.0 INFORMATION DISSEMINATION**

### **3.1 PRODUCT INFORMATION:**

*Beginning December 4, 2003, and on each September 1<sup>st</sup> thereafter, through September 1, 2009 (i. e., December 4, 2003; September 1, 2004; September 1, 2005; September 4, 2006; September 3, 2007; September 1, 2008; and September 1, 2009), participating manufacturers will publicly disclose at least annually, the vehicle nameplates [models] for the upcoming model year that have been engineered according to the front-to-front and front-to-side performance criteria.*

### **3.2 CONFIRMATORY DATA:**

*Beginning December 4, 2003, and on each September 1<sup>st</sup> thereafter, through September 1, 2009 (i.e., December 4, 2003; September 1, 2004; September 1, 2005; September 5, 2006; September 3, 2007; September 1, 2008; and September 1, 2009), participating manufacturers shall voluntarily provide to NHTSA confirmatory information or engineering analyses demonstrating that vehicles identified under "Product Information" above have been designed in accordance with the front-to-front and front-to-side performance criteria, respectively. The process of confirming that vehicles have been designed in accordance with the performance criteria is consistent with the process used by manufacturers to self-certify compliance with Federal Motor Vehicle Safety Standards.*

### **3.3 IMPLEMENTATION PROGRESS:**

*Beginning November 1, 2004, and on each November 1<sup>st</sup> thereafter, through November 1, 2010 (i. e., November 1, 2004; November 1, 2005; November 1, 2006; November 1, 2007; November 3, 2008; November 2, 2009; and November 1, 2010) participating manufacturers will publicly disclose annually the percentages of the manufacturer's total production for the preceding 12-month period ending August 31<sup>st</sup> that were engineered in accordance with the front-to-front and front-to-side performance criteria, respectively.*

## **4.0 SUSTAINABILITY**

*Participating manufacturers will transfer these performance criteria to an appropriate internationally recognized voluntary standards organization when appropriate to ensure the sustainability of these criteria.*



**ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY  
COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS**

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**PARTICIPATING VEHICLE MANUFACTURERS**

**BMW GROUP**

**DAIMLERCHRYSLER CORPORATION**

**FORD MOTOR COMPANY**

**GENERAL MOTORS**

**HONDA**

**HYUNDAI MOTOR**

**ISUZU MOTORS**

**KIA MOTORS**

**MAZDA**

**MITSUBISHI MOTORS**

**NISSAN**

**SUBARU**

**SUZUKI**

**TOYOTA**

**VOLKSWAGEN GROUP**

# ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS

## ATTACHMENT A

### FRONT-TO-FRONT CRASHES: PHASE-1 MEASUREMENT PROCEDURE

The conformance to Phase 1, Options 1 and 2, may be evaluated using engineering judgment, engineering drawings with production tolerances, or physical measurements.

The following procedure shall be used to define the upper and lower heights of the Primary Energy Absorbing structure (PEAS).

All measurements will be made with the vehicle on a flat, level horizontal surface and at its unloaded weight (49 CFR Part 571.3). The tires will be inflated to the pressure recommended by the manufacturer of the vehicle and any systems likely to affect the vehicle structure height (such as air suspensions, etc) will be in the cruising configuration for the vehicle traveling at 35 mph on a level horizontal road surface.

If the vehicle has crash compatibility devices that deploy in the event of high severity frontal crashes with another vehicle, all measurements shall be made with these devices in their deployed stage.

The height of the vehicle's PEAS mentioned in **Option 1** shall be measured at the forward-most point where a vertical plane intersects a complete section<sup>4</sup> of the vehicle's PEAS<sup>5</sup>. The heights of the top and of the bottom of the primary structure are determined as the heights of the upper side and of the lower side respectively of the smallest vertical rectangle enclosing the outer surfaces of the cross-section of the PEAS. For this measurement, all components that are not designed for crash energy dissipation will be excluded from the measurement<sup>6</sup>.

The measurement of the height of vehicle's secondary energy absorbing structure mentioned in **Option 2** shall be determined as the height of the horizontal plane that is tangential to the lowest point of the secondary energy absorbing structure.

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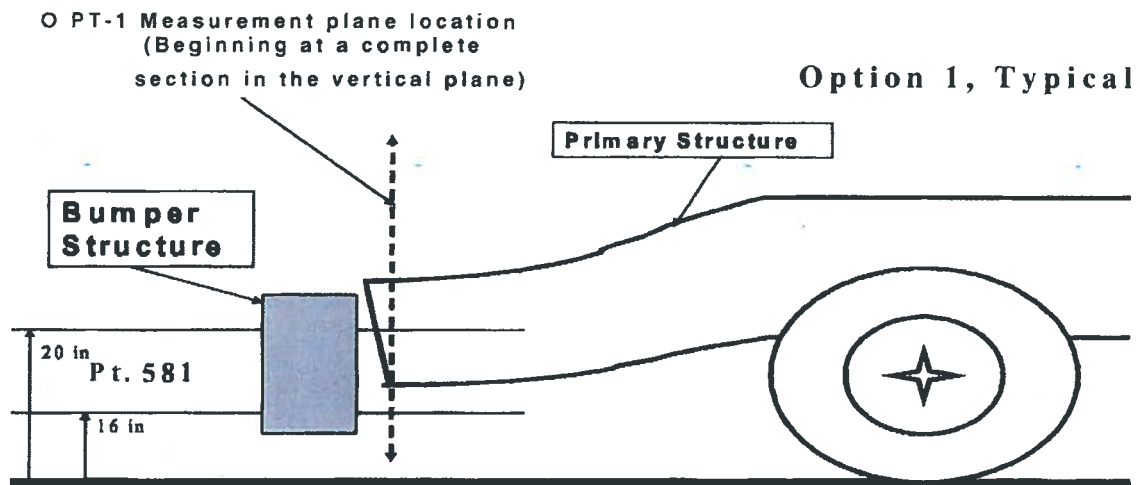
<sup>4</sup> Typically, this is a closed section.

<sup>5</sup> "Primary Energy Absorbing Structure" is defined as the structure that manages energy in high severity crashes.

<sup>6</sup> For structures that employ unique configurations, the test report shall include assumptions that influenced determination of PEAS height.

# ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY

## COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS



# ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS

## Appendix B - Test Procedure and Performance Criteria for SEAS

The conformance to these requirements may be assessed by either of the two procedures below.

### *Procedure B1: Quasi-static Force Application for Evaluating Secondary Structure*

#### 1 Definitions

##### 1.1 Secondary Energy Absorbing Structure – SEAS

#### 2 Requirements

2.1 *SEAS Location.* The SEAS must be a continuous structure connected to the primary energy absorbing structure of the vehicle.

2.2 *SEAS Strength.* The SEAS must resist the force level specified in S2.2.1 without exceeding the total force application device travel distance specified in S2.2.1.

2.2.1 A minimum force of 100 kN must be generated in a maximum horizontal travel of the force application device of 400 mm as measured from the forward-most point of the significant structure of the vehicle. The forward-most point of the significant structure of the vehicle is defined at 3.3.6.

3 *SEAS Test Procedures.* The procedures for evaluating the SEAS to the criteria of S2 are specified in S3.1 through S4.0.

3.1 *Force Application Device.* The force application device employed in S3.4 of this section consists of a rectangular solid made of rigid steel. The steel solid is 125 mm in height, 25 mm in thickness. For the measurements, the top edge of the solid shall be placed so that its first contact is only with the SEAS. The width of the solid must be at least the horizontal (y-direction) dimension of the SEAS. The face of the block is used at the contact surface for application of the forces specified in S2.2.1. Each edge of the contact surface has a radius of curvature of 5 mm plus or minus 1 mm.

3.1.1 The solid rectangle of S3.1 shall be rigidly attached to a device capable of applying quasi-static load as specified in S3.4.

3.1.2 Instrumentation with a minimum accuracy of 5 percent plus or minus 5 percent shall be used for measuring the load and will be placed in the force application device so that it measures the actual load being transmitted into the vehicle SEAS.

3.1.3 Travel of the force application shall be measured in a horizontal direction from the point of foremost significant structure on the vehicle, this 'foremost point of significant structure' as defined at 3.3.6.

3.2 *Vehicle Preparation.* The vehicle should be prepared such that it is secured in a stationary position.

3.2.1 The vehicle must be secured on a rigid, horizontal fixture ( $\pm 0.250^\circ$ ) so that it is adequately restrained at the vehicle underbody and also at the sides to prevent rearward movement of the whole vehicle during the test. Good engineering judgment will be required to provide maximum support, for the maximum area possible.

3.2.2 A sufficient number of horizontal and vertical tie-downs shall be used to prevent movement under load. The vehicle may be secured to the loading fixture using wire rope, turnbuckles, strap plates, etc.

3.2.3 An unyielding vertical face shall support the vehicle rear bumper to prevent rearward movement.

3.3 *Positioning the Force Application Device.* Before applying any force to the guard, locate the force application device such that:

3.3.1 The center point of the contact surface of the force application device is aligned with the SEAS at the vehicle horizontal centerline.

3.3.2 The force application device top edge shall be no higher than 455 mm

3.3.3 The force application device must be vertically positioned so as to insure that the first point of

## ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS

contact during the test is with the SEAS.

- 3.3.4 If necessary to achieve the condition achieved in S3.3.3, any structure in front of the SEAS should be removed before force application.
- 3.3.5 The longitudinal axis of the force application device passes through the horizontal centerline of the vehicle and is perpendicular to the vertical axis of the vehicle.
- 3.3.6 *Forward-most point of Significant Structure:* The forward-most point of significant structure on the vehicle is defined as the forward most point of the vehicle structure that participates in the management of the forces generated in high severity frontal crashes.
- 3.3.7 *Alignment:* The front face of the force application device is aligned with the horizontal plane passing through the foremost point of significant structure on the vehicle.
- 3.4 *Force Application:* After the force application device has been positioned according to S3.3 of this section, apply the load per the force application procedures described in S3.4.1 through S3.4.2
- 3.4.1 *Rate of Travel:* Apply force continuously such that the force application device travel rate does not exceed 12.5 mm per second until the minimum force in S2.1.1 has been exceeded or until the force application device has traveled the total distance in S2.1.2 from the position in S3.3, whichever occurs first.
- 3.4.2 *Direction of Travel:* During each force application, the force application device is guided so as to travel only horizontally in a direction perpendicular to the surface of the device during the entire test. The location of the longitudinal axis of the force application device remains constant at all times during the application of force.

### ***Procedure B2: Dynamic Force Application for Evaluating Secondary Structure***

#### ***4.0 Alternate Procedure***

- 4.1 As an alternative, this measurement may be made with a 'loading attachment' to a fixed barrier. The vehicle will move into this attachment at the minimum velocity that will result in at least 400mm of horizontal travel by the forward-most point of the significant structure of the vehicle. The movement of the vehicle shall be horizontally in a direction perpendicular to the plane of the loading attachment.
- 4.2 This attachment shall be designed to perform as the force application device described in S3 for the quasi-static test procedure and will have the same dimensions and instrumentations.
- 4.3 The test shall be performed by removing as necessary any structure in front of the SEAS (e.g. bumpers, fascias etc) so as to insure that the first point of contact of the loading attachment is with the designated SEAS on the vehicle.

**ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY  
COMMITMENT FOR CONTINUED PROGRESS BY LEADING AUTOMAKERS**

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**ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY**  
**A SET OF COMMITMENTS FOR PROGRESS BY AUTOMOBILE MANUFACTURERS**

**PROGRESS REPORT**  
**DECEMBER 2005**

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**INTRODUCTION**

*Within two years of launching a voluntary vehicle crash compatibility commitment (December 2003), approximately 33% of 2005 model year vehicles are meeting the stringent performance criteria established for front-to-side crashes and 62% of 2005 model year vehicles are meeting the stringent performance criteria established for front-to-front crashes. This report documents automakers' progress and on-going research.*

In December 2003, 15 major auto manufacturers committed to a plan developed by an international group of safety experts for enhancing the crash compatibility of passenger cars and light trucks. The plan established new performance criteria for further enhancing occupant protection in front and side crashes between cars and light trucks. It also defined research programs to investigate future test procedures and performance criteria. The Insurance Institute for Highway Safety (IIHS) facilitated the development of this plan with the sponsorship of the Alliance of Automobile Manufacturers.

By September 2009, 100% of a participating manufacturer's applicable vehicles will be designed to these criteria. However, the 15 auto manufacturers began implementing the front-to-front and front-to-side performance criteria immediately upon industry's agreement. Manufacturers' progress in implementing this commitment is described below.

Approximate Percentage of Production Designed in Accordance w/Performance Criteria		
Crash Mode	Production Year 2004	Production Year 2005
Front-to-Front Criteria	54%	62%
Front-to-Side Criteria	24%	33%

**FRONT-TO-FRONT COMPATIBILITY**

The commitment established criteria to further reduce the potential for vehicle override and underride in serious front-to-front crashes between cars and light trucks by requiring sufficient overlap between the primary energy-absorbing (PEAS) structures of the two vehicle types. This may be achieved by 'geometric matching' or alignment of these structures or by providing additional structure in light trucks (called secondary energy absorbing structures (SEAS)) for this purpose. In November 2005, new test procedures were added by safety experts to measure the performance of the SEAS. While geometric matching is being implemented, automakers continue to explore additional ways to address how vehicles interact in collisions and what the parameters are that contribute to the safety of vehicle occupants in crashes. The research conducted since December 2003

**ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY**  
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includes barrier and vehicle-to-vehicle crash tests and computer modeling. The aim of this research is to better understand how vehicles interact in vehicle-to-vehicle crashes, the injury causation mechanisms associated with such crashes and how crash partner occupant protection might be enhanced in smaller vehicles without degrading the protection for the occupants of larger vehicles.

One research approach is examining the use of a dynamic rigid barrier crash test (load cell wall or 'LCW' test) to measure the 'height of force' of light trucks in an effort to determine whether or not a relationship exists for vehicle crash compatibility. So far these studies have not shown a relationship to exist. NHTSA, based on its research, reached a similar conclusion independent of this initiative. The new information on the limits of the LCW test spurred auto manufacturers to expand research using all available technology such as statistical analysis of crash data, vehicle-to-vehicle tests, computer modeling, etc., to find solutions.

Research in 2006 is to proceed along three parallel paths:

1. Continued research to evaluate the possibility of using measurements from a test barrier instrumented with a large number of load cells to measure crash forces generated by vehicles in field-representative crashes;
2. Development of a moving, deformable barrier as a surrogate for a 'fleet representative' passenger car that may be used to establish performance criteria for light trucks in crashes with passenger cars; and
3. Development of computer modeling (finite element simulations) to assess light truck-to-passenger car crash performance in a range of different crash conditions.

**FRONT-TO-SIDE COMPATIBILITY**

This commitment established performance criteria that will further enhance head protection for people riding in passenger vehicles that are struck in the side. Manufacturers have two test options: They can design vehicles according to the federal government's (NHTSA) optional side-into-pole test, or the test the Insurance Institute for Highway Safety (IIHS) conducts for consumer information, using a moving deformable barrier with front-end geometry to simulate an SUV or pickup. Use of the NHTSA pole test option will sunset in 2009, and all manufacturers will then have to use the IIHS test. In its testing to date, the IIHS is seeing very promising results when vehicles are equipped with head protecting side air bags.



**ENHANCING VEHICLE-TO-VEHICLE CRASH COMPATIBILITY**  
**A SET OF COMMITMENTS FOR PROGRESS BY AUTOMOBILE MANUFACTURERS**

**PROGRESS REPORT**  
**DECEMBER 2005**

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**PARTICIPATING MANUFACTURERS**

BMW GROUP	DAIMLERCHRYSLER CORP.	FORD MOTOR COMPANY
GENERAL MOTORS	HONDA	HYUNDAI MOTOR
ISUZU MOTORS	KIA MOTORS	MAZDA
MITSUBISHI MOTORS	NISSAN	SUBARU
SUZUKI	TOYOTA	VOLKSWAGEN GROUP

***References for more information:***

1. <http://www.autoalliance.org/safety/vsi.php?PHPSESSID=0fe35d0bf6f79d152c581d1f328e30eb>
2. **Barbat, S.**, *"Status of Enhanced Front-to-Front Vehicle Compatibility Technical Working Group Research and Commitment," 19<sup>th</sup> International Technical Conference on the Enhanced Safety of Vehicles, Paper Number 05-463, Washington, D.C., 2005.*