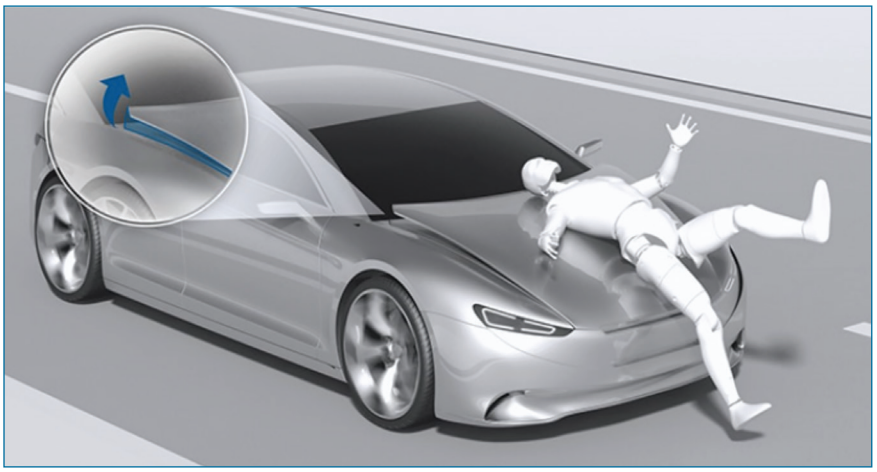
TECHNICAL REPORT

I-CAR NEW ZEALAND

PEDESTRIAN SAFETY TECHNOLOGY -

USING PYROTECHNICS TO REDUCE PEDESTRIAN INJURIES AND FATALITIES



For a number of years now, vehicle -makers have been developing & implementing technologies and systems that are designed to reduce the severity of injuries (and limit fatalities), to pedestrians when they invariably come into contact with moving vehicles.

We could rightly ask, why is so much time and energy (& associated cost) spent on pedestrian safety, when we most often think of collision events as being associated with contact between moving vehicles and / or stationary objects? Anecdotally speaking, in our part of the world, statistics would suggest that “vehicle V pedestrian” occurrences are relatively low - in fact “walking” is shown to be the 2nd safest mode of transport in New Zealand (only bettered if travelling by bus).

In many other parts of the developed world, these statistics are reversed (in some low-income countries, statistics confirm that pedestrians account for up to 45% of road fatalities).

There a number of circumstances and conditions that create these horrific figures, such as geographical locations and distractions (especially by technologies such as texting etc.), but without doubt, this is exacerbated by the high ratios of cars-to- pedestrians in virtually all of the world’s cities and towns.

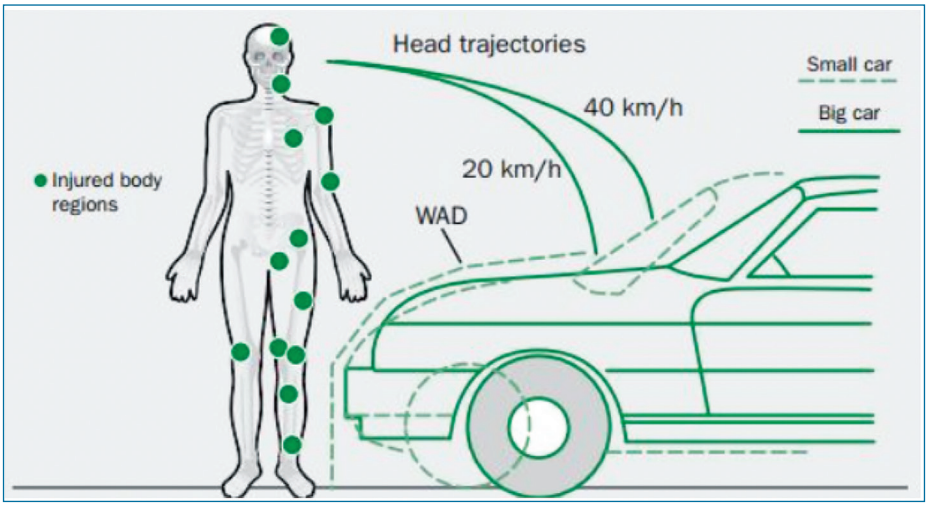
With these facts and figures identified, countries and their governments are motivated to reduce these statistics to the benefit of all (to the writer’s way of thinking, this raises a myriad of questions about the suitability of infrastructure and roading etc. – but that’s a discussion for another day !!).

So, put simply, pedestrian injury and death reduction falls back on the vehicle-maker, with a substantial focus on pedestrian injury mitigation technologies in both the existing and future carpark.

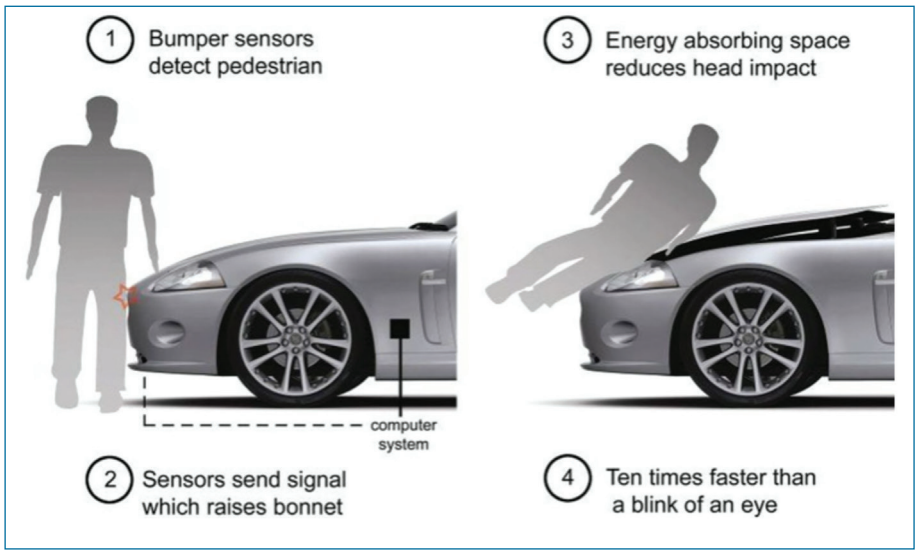
THE SCIENCE OF IDENTIFYING THE “DAMAGE” THAT OCCURS WHEN A PEDESTRIAN COLLIDES WITH A VEHICLE: -

Conventional passenger vehicle design has shown that frontal impact with a pedestrian (by far the most common scenario), will result in direct contact between the front bumper of the vehicle, and the upper leg / thigh area of the

pedestrian. While that typically results in leg & pelvis injuries, of more concern is that the pedestrian will inevitably have their legs "swept out" from underneath them which results in the entire upper body (and head, in particular) making accelerated contact with the bonnet and screen area of (& in most instances), the still-moving vehicle.



Up until recently, (& aside from what a number of European vehicle-makers have already been incorporating into their vehicles), pedestrian protection technologies have been confined to "deformable" parts – the most obvious of these is clearly shown when we open the bonnet of a later-model vehicle and see that the front guards / fenders are mounted to extension brackets that are designed to collapse and absorb energy created by the impact of a person. While these features are helpful, they have limited effectiveness in reducing head injuries (as previously identified). Enter the age of devices that are designed to activate at supersonic speeds and provide "cushioning" to the impacting force (in this instance, the pedestrian). Effectively, SRS or Supplementary Restraint Systems have been adapted to become "Supplementary Cushioning Systems".



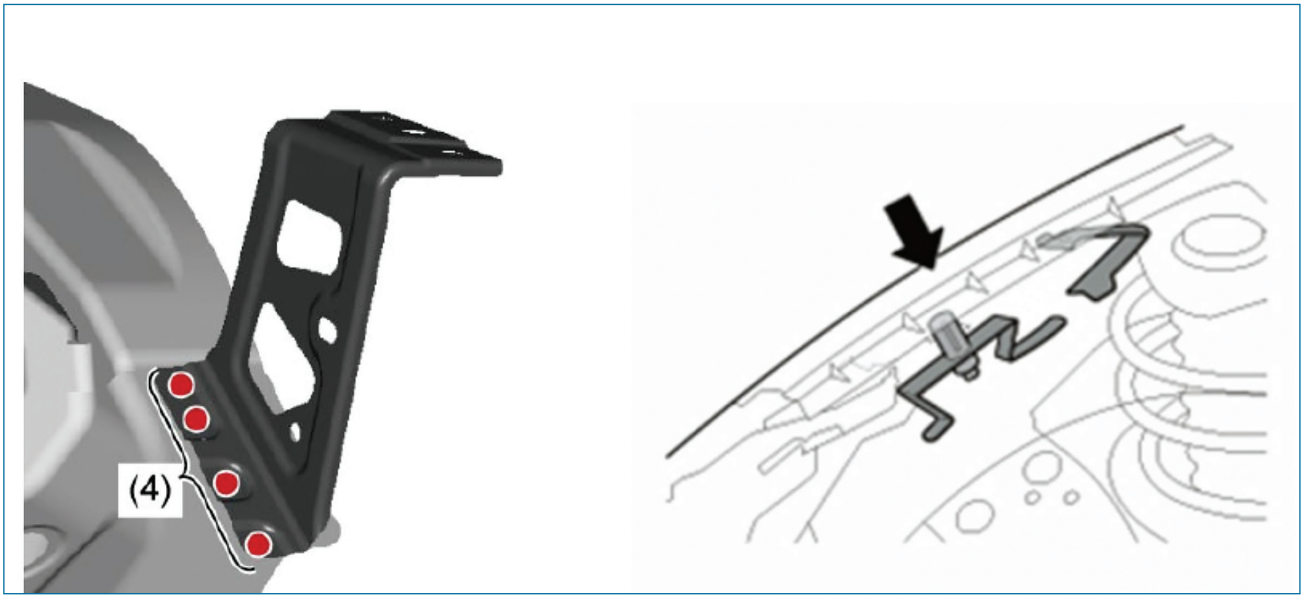
THE TWO DISTINCT IDEOLOGIES THAT HAVE EMERGED AROUND USING PYROTECHNIC DEVICES TO MITIGATE PEDESTRIAN INJURIES ARE: -

1. Airbag module(s) mounted in or around the bonnet area which inflate on impact and protect the pedestrian.

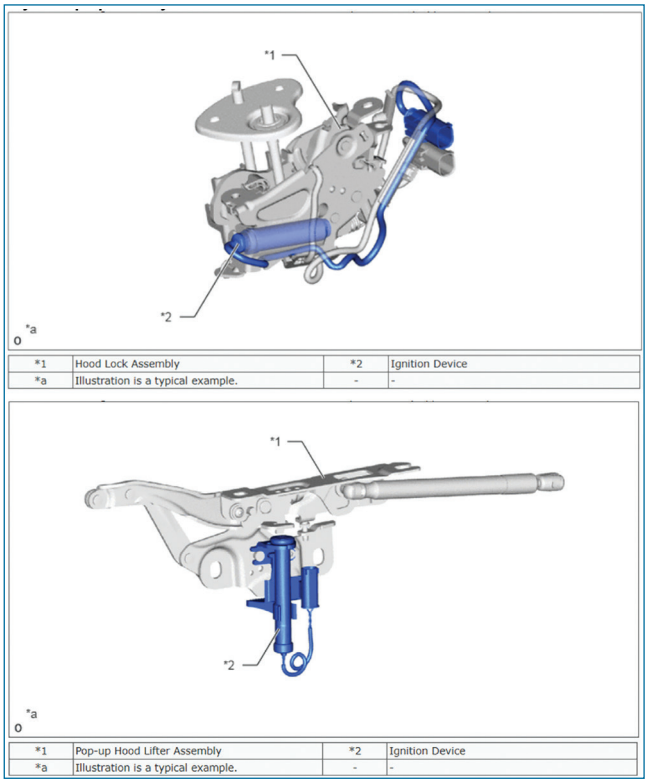
2. Electronically controlled triggers strategically located at the bonnet hinge (& in some instances the latch area), that activate on impact to “lift” the bonnet and increase the distance between it and the hard parts directly underneath – creating a space and deflection angle the assists in the protection of the pedestrian.

In both instances, the deployment of the appropriate SRS devices is controlled by sensor arrays in the front bumper. Like many other ADAS systems, the autobody technician / refinisher needs to be aware that any damage and subsequent repairs to front bumper facias may compromise the correct operation of these systems in a future impact …

DEFORMATION BRACKETS & MOUNTS

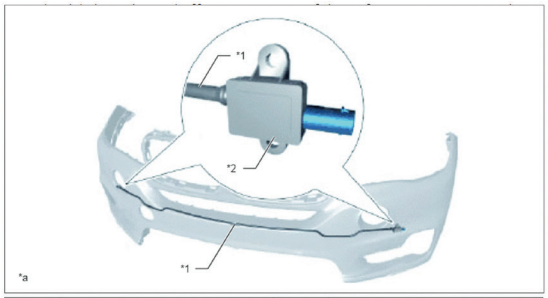


TOYOTA POP UP HOOD SYSTEM :-

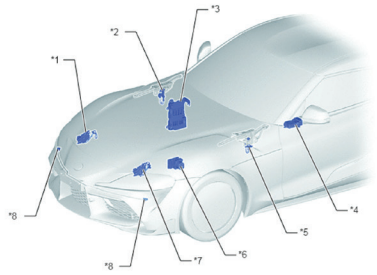


*1	Hood Lock Assembly	*2	Ignition Device
*a	Illustration is a typical example.	-	-

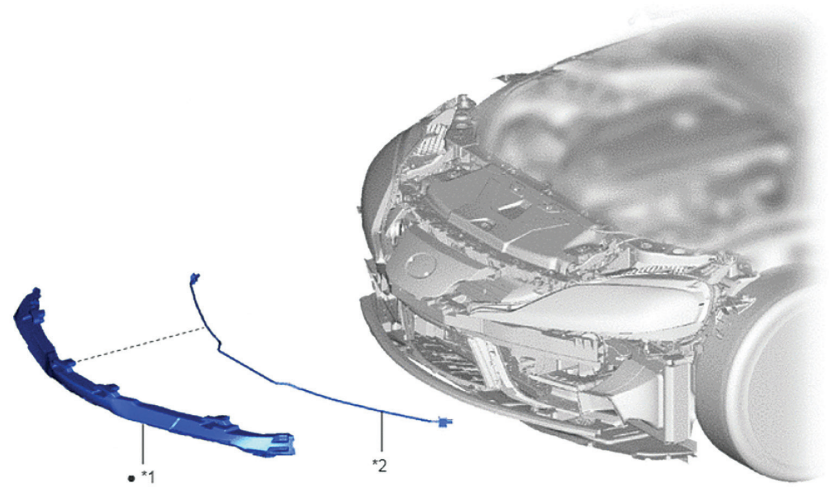
*1	Pop-up Hood Lifter Assembly	*2	Ignition Device
*a	Illustration is a typical example.	-	-



*1	Pedestrian Detection Chamber Assembly	*2	Pedestrian Detection Sensor
*a	Illustration is a representative example.	-	-

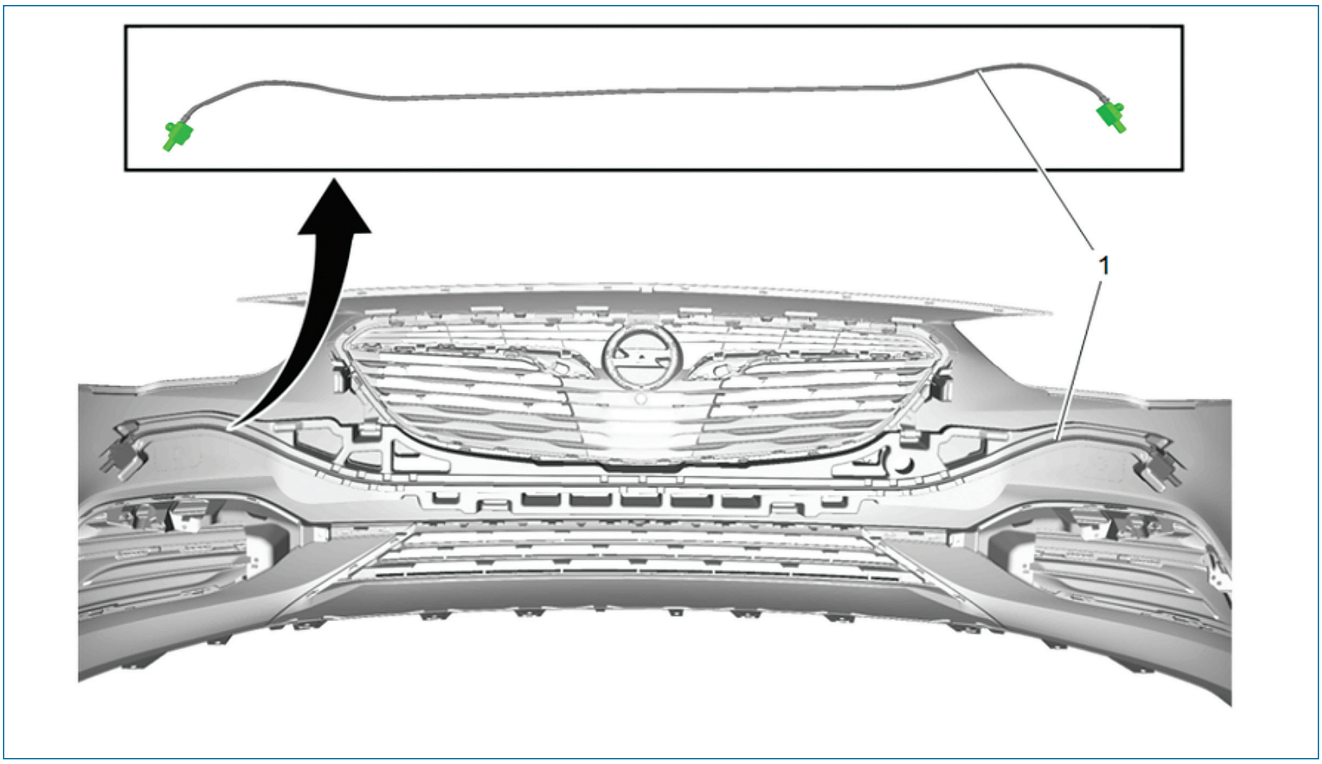


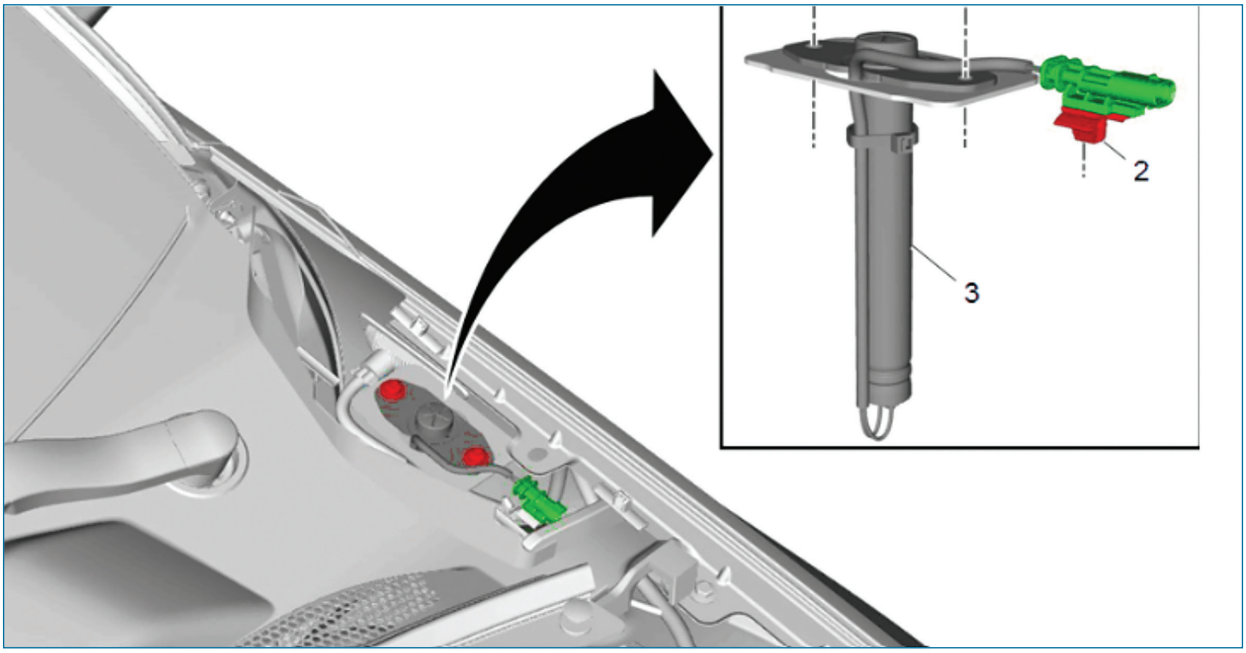
*1	Hood Lock Assembly RH · Pop-up Hood Lifter	*2	Pop-up Hood Lifter Assembly RH
*3	Main Body ECU (Multiplex Network Body ECU)	*4	Airbag ECU Assembly
*5	Pop-up Hood Lifter Assembly LH	*6	Brake Actuator Assembly
*7	Hood Lock Assembly LH · Pop-up Hood Lifter	*8	Pedestrian Detection Chamber Assembly · Pedestrian Detection Sensor



*1	FRONT BUMPER ENERGY ABSORBER	*2	PEDESTRIAN DETECTION CHAMBER ASSEMBLY
•	Non-reusable part	-	-

GM HOLDEN PEDESTRIAN IMPACT DETECTION SYSTEM (PIDS)





RANGE ROVER "BONNET AIRBAGS"

These articles have been written by Martyn Lane : I-CAR Instructor, Weld Test Administrator and Technical Specialist to the auto body industry