

Work progress regarding Self-Protection

- **Compatibility :**
 - Capacity of 2 vehicles to distribute in a balanced way the energy (proportionally to its mass) of an impact to offer to their occupants the same chances of survival as equal as possible, without degrading the level of protection offered.
 - It is characterized by 2 indicators:
 - **Self-protection:** number of injured people (slightly injured, seriously injured or fatal) observed in the considered car model (internal injuries)
 - **Partner-protection:** number of injured people (slightly injured, seriously injured or fatal) observed in the impacted vehicle by the considered car model (external injuries)
 - Classify vehicles involved in accidents according to their Self-Protection

- SR=Severity Rate indicator (fatalities + serious injuries) internal (frontal protection):

$$SR(\textit{protection}) = \frac{(\textit{Fatalities} + \textit{Severe_injuries})_{\textit{int}}}{(\textit{Fatalities} + \textit{Severe_inj} + \textit{Slight_inj} + \textit{Not_inj})_{\textit{int}}}$$

- MR=Mortality Rate indicator (fatalities) internal (frontal protection):

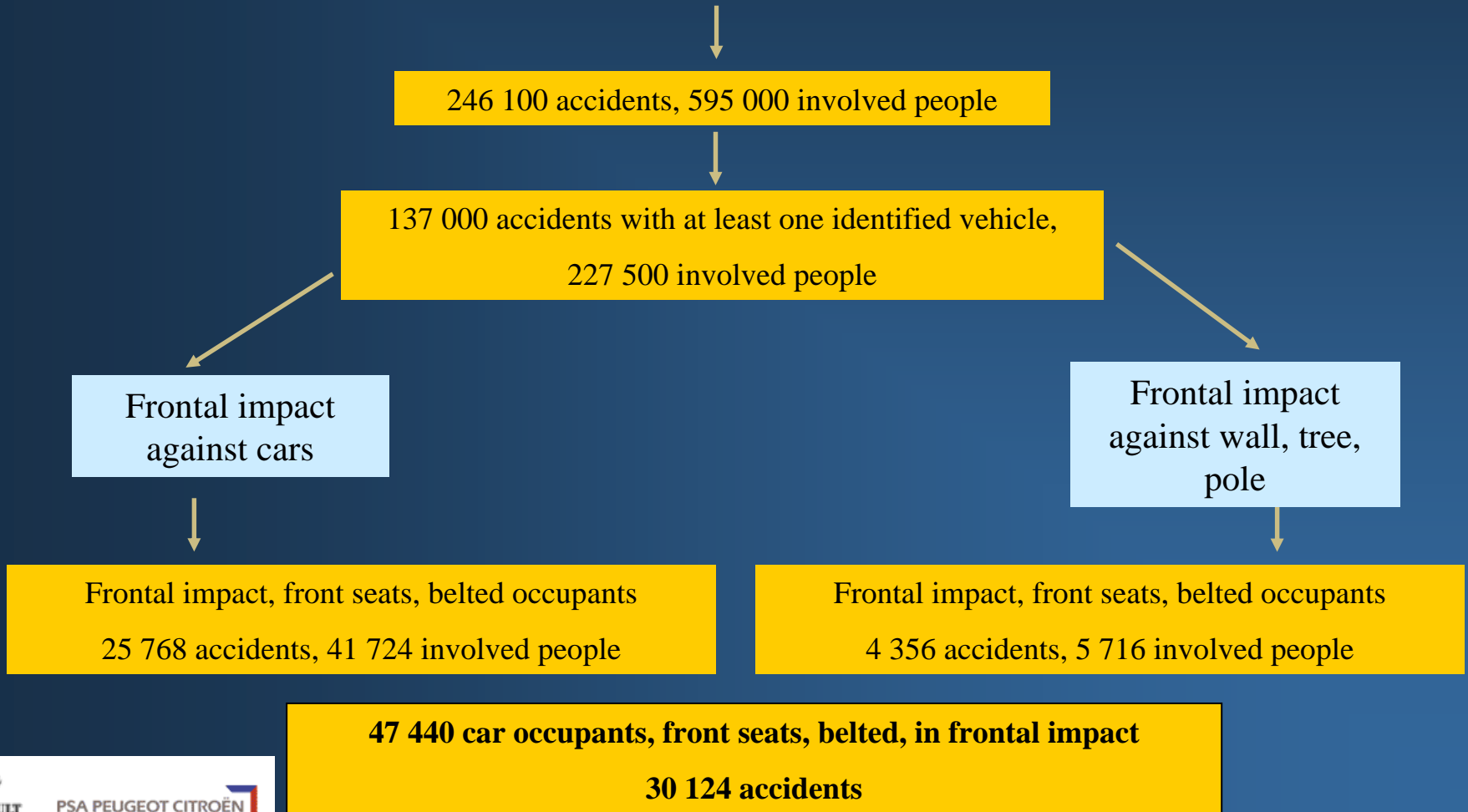
$$MR(\textit{protection}) = \frac{(\textit{Fatalities})_{\textit{int}}}{(\textit{Fatalities} + \textit{Severe_inj} + \textit{Slight_inj} + \textit{Not_inj})_{\textit{int}}}$$

- New french injury definition (year 2005)
 - Severely injured = injured people hospitalized more than 24 hours.
 - Slightly injured = injured people hospitalized less than 24 hours.
- Filter:
 - Frontal impact against cars or against fixed obstacles (wall, tree,...)
 - A least 1 slightly injured people involved in the accident
 - Minimum of 30 involved people for the same car model
 - Front occupant belted
 - 4 vehicle samples:
 - Vehicle not tested at the Euro NCAP
 - Vehicle tested A, B or C class according to their Euro NCAP frontal note
 - Vehicle tested D class according to their Euro NCAP frontal note
 - Vehicle tested E class according to their Euro NCAP frontal note

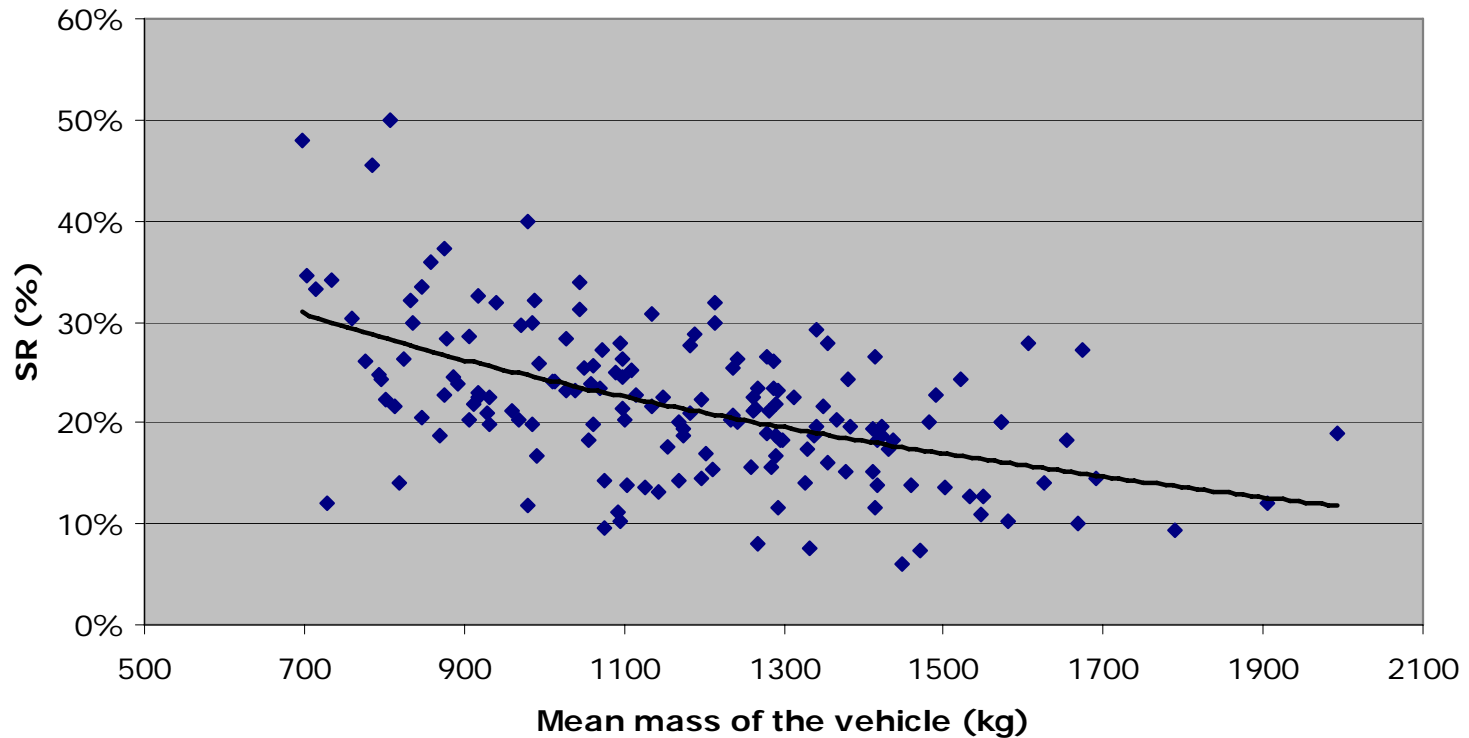
➤ Frontal class: how are they classified ?

score in frontal testing	frontal class
not tested	not tested
[0 ; 1.5]	A
[1.51 ; 4.5]	B
[4.51 ; 8.5]	C
[8.51 ; 12.5]	D
[12.51 ; 16]	E

- French National data base: ONISR (BAAC: Bulletin d'Analyse d'Accident Corporel de la Circulation), for years 2005 to 2007



**BAAC 2005-2007. Car occupants, belted, front seats, frontal impact against another car (n= 38 154). Severity Rate according to the mean mass of the vehicle.
162 car models. At least 30 occupants per models**

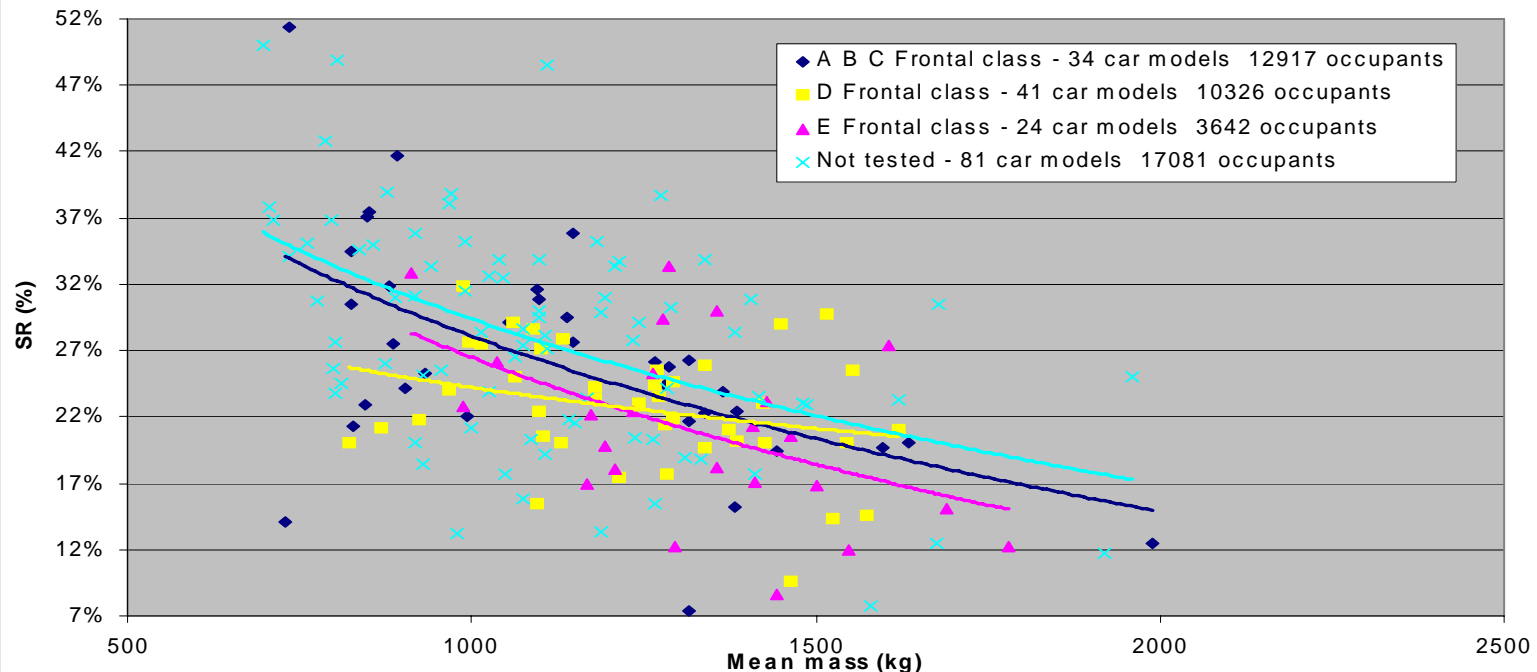


Homogenization of the Severity Rate for D class vehicles

On the other hand simple translation of the curve for E class vehicles regarding the others: gain of 5 %

We could conclude that D class vehicles have a better global compromise between Severity Rate and Mass.

BAAC 2005-2007. 43 966 car occupants, front seats, belted, frontal impact. 180 car models with at least 30 car occupants involved.
Severity Rate (SR) according to the mean mass of the car and its frontal score class.



➤ Reports

- Constant gain regarding the Severity Rate between the not tested vehicles and the A, B or C class vehicles: about 2 to 3 %
- A decrease in the slope in the right side of D and E class with a gain of about 10 % on the Severity Rate for the worst vehicles with regard to vehicles A, B or C class
- A tendency to homogenize the Severity Rate on vehicles
- Potential gains of 15 % for the worst D and E class compare to the best D and E class

➤ Method:

- Estimation of the number of expected victims if all the vehicles had an identical Severity Rate.
- Choose a group of vehicles whose Severity Rate will be the target to be reached by the other vehicles.
- Calculation of the expected number of victims (N_1), with this Severity Rate of reference.
- The difference between the number of victims N observed, and N_1 represents the potential benefit for fatalities and severe injuries.

- Reference category:
 - Vehicle with a mean mass > 1500 kg.

47 440 front passengers, belted, frontal impact
30 124 accidents



Class of mean of vehicle mass	n	Mean within the class	SR	MR
< 800 kg	2793	740 kg	35.3%	4.6%
800 - 949 kg	12325	863 kg	30.2%	3.2%
950 - 1149 kg	16322	1050 kg	28.1%	2.5%
1150 - 1349 kg	9227	1261 kg	23.3%	1.9%
1350 - 1499 kg	4325	1408 kg	22.3%	1.6%
1500 kg and over	2415	1705 kg	17.2%	1.3%

Reference vehicles



➤ 3 different estimations

- A : determine the new number of victims for the models whose SR is > 17.2%, under the hypothesis that their SR = 17.2%.

(Done vehicle by vehicle, whatever the mass of the vehicle).

The total of the new number of victims is compared to the actual number and the % of avoided victims is given.

Car model	Not injured	Fatally injured	Severely injured	Slightly injured	Total	Initial SR	Target SR	victims expected if SR = 17.2%
...
x1	61	0	10	33	104	9,6%	9,6%	10
x2	20	0	10	41	71	14,1%	14,1%	10
x3	322	19	150	284	775	21,8%	17,2%	133,8
x4	626	44	496	794	1960	27,6%	17,2%	338,5
x5	156	46	261	348	811	37,9%	17,2%	140,1
...
Total					N			N1

- B : Determine the new number of victims
 - B1 : The mean mass of the vehicle is taken into account

Class of mean of vehicle mass	Initial SR	Target SR	n	B1 : victims if SR=17.2%
< 800 kg	35.3%	17.2%	2793	$n1 = 2793 * 17.2\%$
800 - 949 kg	30.2%	17.2%	12325	n2
950 - 1149 kg	28.1%	17.2%	16322	n3
1150 - 1349 kg	23.3%	17.2%	9227	n4
1350 - 1499 kg	22.3%	17.2%	4325	n5
1500 kg and over	17.2%	17.2%	2415	n0

- B : Determine the new number of victims
 - B2 : The mean mass of the vehicle and accident typologies are taken into account

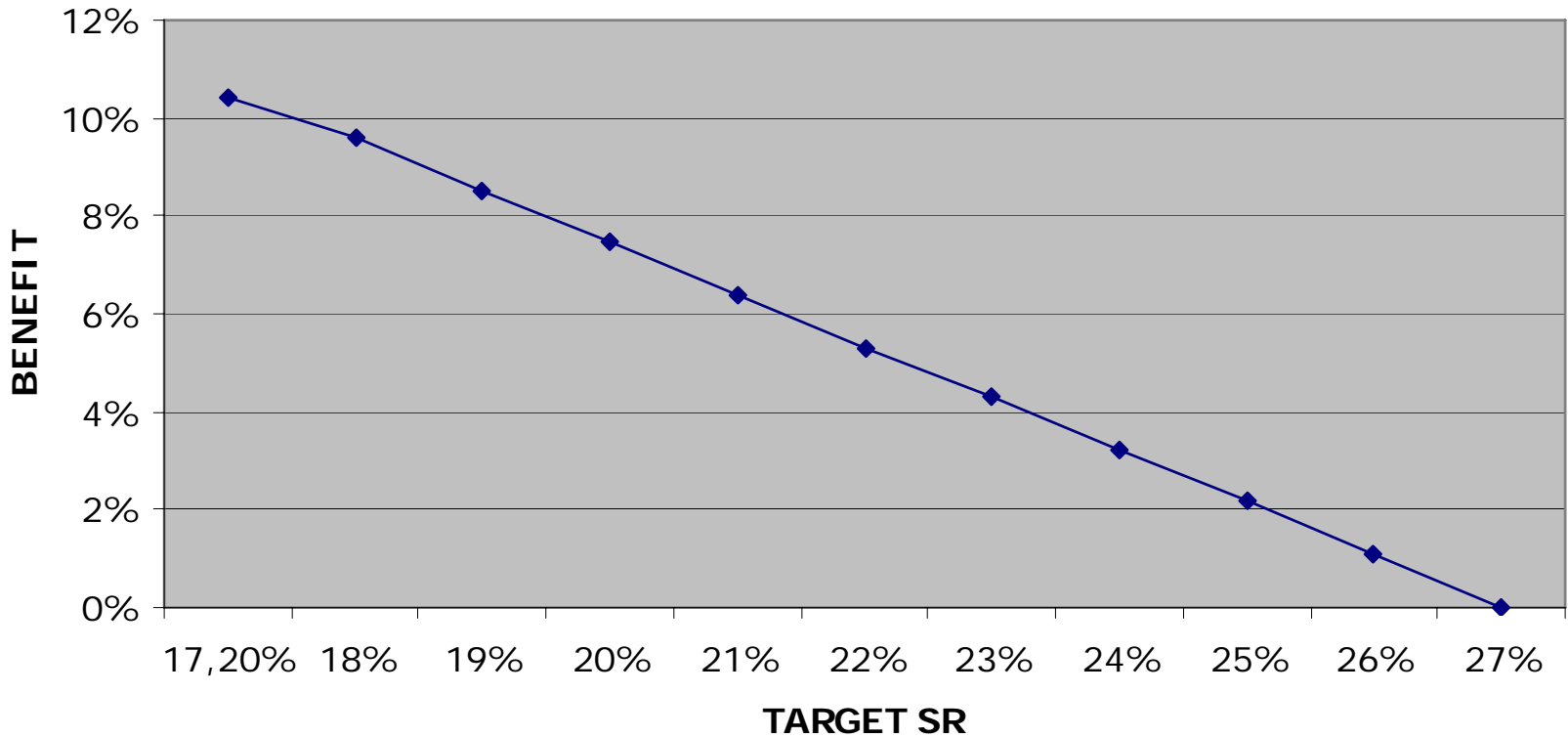
class of mean of vehicle mass	SR for single vehicle accident	SR for VL vs. VL	% of single vehicle accident	% of VL vs. VL	n	B2 : victims if taking into account typologies
< 800 kg	57.8%	31.3%	15%	85%	2793	$m1 = 2793 * (15% * 60% + 85% * 13,9%)$
800 - 949 kg	56.2%	26.4%	12.7%	87.3%	12325	m2
950 - 1149 kg	56.9%	23.5%	13.6%	86.4%	16322	m3
1150 - 1349 kg	54.7%	19.9%	9.9%	90.1%	9227	m4
1350 - 1499 kg	56.8%	18.6%	9.7%	90.3%	4325	m5
1500 kg and over	60%	13.9%	7.2%	92.8%	2415	m0

➤ Result (method A, B1 and B2)

➤ France 2007 all impacts: 2 464 fatalities and 16 486 severe injuries in cars

	Frontal			All impacts		
	Victims reduction on pertinent accident (car occupant, front seats, belted ,frontal impact. car vs. car or car againt rigid obstacle)			Victims reduction extrapolated to the whole set of car occupants		
	Method			Method		
	A	B1	B2	A	B1	B2
Reduction in fatalities (MR)	53%	47%	29%	10.5%	9%	6%
Reduction in fatalities and severe injuries (SR)	37%	36%	28%	10.6%	10%	8%

**BENEFIT OF THE HARMONISATION OF FRONTAL PROTECTION
 ACCORDING TO THE VALUE OF THE TARGET SEVERITY RATE (SR).
 Reduction of the the number of fatal and severely injured car
 passenger. SETRA 2005 2006 2007.**



- For France year 2007
 - Reduction in fatalities will represent: 148 victims
 - Reduction in fatalities and severe injuries will represent: 1516 victims
- Future work:
 - Include partner protection part
 - Relation between accidentology and PDB crash test