

Elaboration of Automobile Safety
Standards: shock wave
emanating from the United States
at the end of the 1960s or how
European economic actors
entered the game

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Main issues

- To study an attempt of global solution to a problem common to all industrialised countries (ESVs as an answer to road safety problems at the beginning of the 1970s)
- Governmental guidelines: the DOT played the main role (political aspect: President Johnson, 1966)
- The solutions must be found by private actors (focus only put on car makers, and not on oil producers or infrastructures financed by public institutions)
- Threat of regulation if efforts made by car makers are insufficient

Five parts in this presentation

- I – Introduction
- II – Origins and context of experimental safety vehicles (ESVs)
- III – The project of ESV
- IV – Criticisms of this project
- V – Conclusion

I - Introduction

- High – and still rising - number of killed and injured people on roads in all industrialised countries at the beginning of the 1970s
- From that point on these figures are considered as unacceptable: consensus of economic actors and wish to take measures
- The number of victims occupants of the car rose the most steeply: improvements in vehicle safety focussed mainly on the people in the cars
- Intrusion of public authorities on a field ruled until that point by car makers
- Car makers had a diverse approach of vehicle safety (for some it was a hard core of research, for others it was mainly neglected)

Evolution of Car Accidents in France from 1960 to 1974

•	Years	Population (thousands)	Nb of accidents	Killed	Injured	Car nb (thous.)
•	1960	45 465	141 309	8 295	185 031	6 800
•	1961	45 904	163 139	9 337	214 298	7 617
•	1962	46 422	172 400	10 112	229 770	8 409
•	1963	47 573	179 060	10 227	243 919	9 280
•	1964	48 059	192 999	11 105	264 075	10 090
•	1965	48 652	210 754	12 150	290 256	10 815
•	1966	48 954	209 909	12 158	290 109	11 636
•	1967	49 374	215 740	13 585	301 256	12 405
•	1968	49 723	220 201	14 274	312 313	13 040
•	1969	50 105	220 618	14 664	311 273	13 710
•	1970	50 324	228 000	15 050	322 200	14 370
•	1971	51 012	249 817	16 213	353 386	15 020
•	1972	52 000	274 491	16 621	388 139	15 975
•	1973	52 346	270 618	15 636	374 661	16 800
•	1974	52 675	260 187	13 521	353 059	17 390

- Rise of accidents, killed and injured people on roads in correlation to the rise of the population and the number of cars.
- Nearly half the victims of road accidents at that time were car drivers and passengers, but the number of pedestrian victims rose by 70 %. That of two-wheeled drivers rose more slowly, by 18 %. But car drivers and passengers rose the most steeply, by 240 %.
- 1972 was a turning point in road safety public policy in France. Interestingly similar turning points occurred at the same period in all industrialised countries.

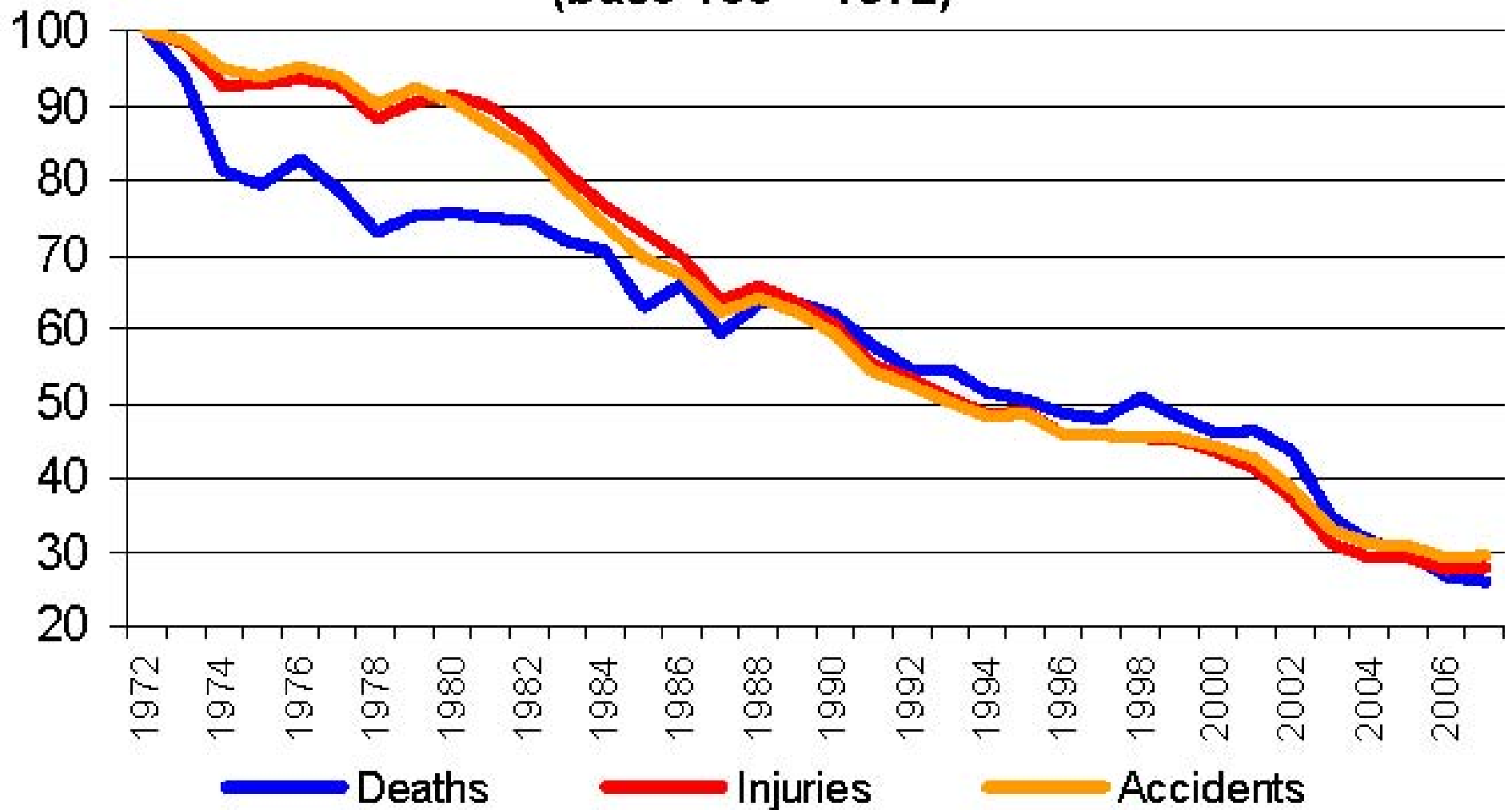
Road Safety Chronology (Mercedes-Benz)

- 1931 : oscillating axle with a double articulation
- 1931 : front independent suspension
- 1933 : rear independent suspension
- 1937 : shock-absorbers
- 1938 : transmission with four gear ratios entirely synchronised
- **1939: safety elements on an experimental car called Mercedes 11 (strong side protection, extremely rigid floor, steering column in three parts)**
- **1949 : safety lockers (which can not be open during impacts)**

- 1949: torsion bars in the suspension system on the front axle
- 1949: standard ventilation system without draughts combined with the heating
- **1951: study of the first safety body in the world (safety-cell, deformable front and rear parts, shock-absorbers, side protection). Patent in January.**
- 1952: steering shock-absorber
- 1954: steering with ball screws
- 1954: oscillating front axle with a unique articulation
- 1954: power brakes
- 1957: power steering

- 1959: first crash tests
- **1959: first mass-produced vehicles with safety-cell**
- 1961: V-brake (continuous efficiency of braking) with servo-wave
- 1961: standard fixation system for safety belts
- **1963: braking system with a double circuit**
- 1965: safety item for children on rear doors
- 1966: Mercedes Benz used the new terms « passive safety » and « active safety »
- 1967: folding steering column
- 1967: systematic elimination of dangerous elements inside the car
- 1968: safety head-rest
- **1970: Anti-Blocking System (ABS)**
- **1971: presentation of the first safety experimental vehicle (ESV)**

Comparative evolution in the number of accidents and victims over 30 days (base 100 = 1972)



II – Origins and context of experimental safety vehicles

- Impulse given by Americans: First ESV made by Ford in 1956, Ralph Nader *Unsafe at any Speed* in 1965 and vehicle safety governmental regulations in 1966
- Similar regulations might be adopted in other countries
- Car makers make, or intensify, research on vehicle safety (levelling)

American Safety Prescriptions (NHTSA)

- 23 prescriptions
- Apply on ESV prototypes to improve knowledge on vehicle safety as well as on mass-produced vehicles
- Two test series are foreseen:
 - 1) low speed impact (8 km/hr) against a solid obstacle without any serious damages on the car: favoured in particular the development of bumpers;
 - 2) 80 km/hr impact against a solid obstacle without any serious injuries for passengers: it requires the combination of restraint systems for passengers and a safety-cell.

Main Points of these Prescriptions

- 1) Safety belts: fasten system, resistance, easy access to vehicle driving systems for the fastened driver
- 2) Good visibility
- 3) Double circuit for brakes with indicators
- 4) Protection of damages for occupants (inside the car)
- 5) Protection in case of rear impact (head-rest)
- 6) Seat securely anchored to the structure of the vehicle
- 7) Safety lockers
- 8) limitation of fire risk after collision (non-inflammable stuffing, protection of petrol tanks, and so on)

III – The project of Experimental Safety Vehicle (ESV)

- Project implemented in the United States in 1970: writing of specifications
- At the core of efforts for improving passive safety
- Aim: to elaborate a vehicle based on safety items from scratch, but also presenting a nice design and reasonable production costs, and which could meet with a success in the market
- Extended to European countries and Japan (on a voluntary basis) in the NATO framework. Agreements were signed between ministers of Transport and the US *Department of Transportation*. The ESV project is based on a public/private partnership according to modalities different from one country to another. It requires huge public and private investments.

Members of the Project

- Public actors: ministries of Transport, units working on vehicle safety (laboratories, research institutes) like the Japanese Automobile Research Institute, the ONSER, and so on.
- Private actors: automotive firms and firms outside the field
- 1) Germany: Daimler-Benz, Volkswagen, Opel, BMW;
- 2) United States: Fairchild Hiller Corporation specialised in military projects and aeronautics; AMF Incorporated which is a leading producer of leisure time and industrial products like bowling and undersea equipments, Harley-Davidson motorcycles, and so on; General Motors, Ford Motor Company;
- 3) Japan: Toyota, Nissan, Honda;
- 4) Italy: Fiat, Alfa Romeo;
- 5) France: Peugeot/Renault Association, Citroën.

The objectives of the project

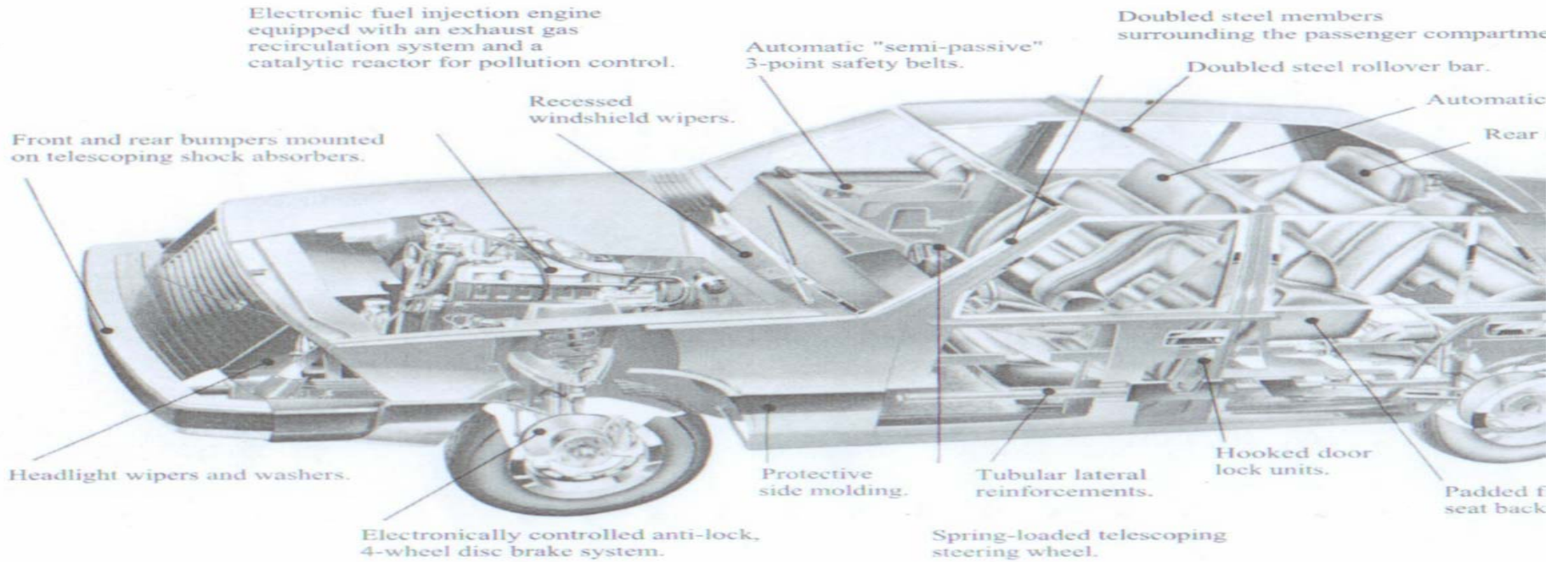
- To stimulate the development of a technology focussed on safety
- To establish a good co-operation between car engineers around the world while sharing new technologies as soon as they appear: new modalities for a very competitive industry
- To incorporate rapidly safety items of ESV in mass-produced vehicles

VOLVO Experimental Safety Car





VOLVO Experimental Safety Car



Volvo Experimental Safety Car Specifications

Length 205.7"	Track, front 58.3"
Width 71.7"	Track, rear 57.7"
Height 55.9"	Weight 3200 lbs.
Wheelbase 106.4"	

IV – The criticisms of the project

- Intrusion of politics
- Efforts on vehicle safety only (and not on infrastructures, drivers' education, and so on)
- Accidentological basis of research in vehicle safety still insufficient. Wish of a work done in common at the Community level
- Focus made on passive safety meanwhile European car makers worked mainly after WWII on active safety: to discharge drivers from driving tasks, limit tiredness, limit driving mistakes, reduce the impact of bad driving conditions and so on.

- Unfavourable cost/benefit ratio (transport safety becomes an object of calculus)

Costs: the VDA calculated that the only safety equipments will cost 3,000 DM per vehicle. For 2 millions of buyers, it will represent 6 billions DM. During the ten years necessary to renew entirely the mass of vehicles circulating, these efforts will be permanent: 60 billions DM.

Benefit: 130,000 DM (NHTSA estimation) x 9169 killed people in Germany in 1971 + 7, 000 DM (NHTSA estimation) x 331 000 injured people = 3,5 billion DM en 1971 Heavy technical implications from the test at 80 km/hr: 300-400 additional kilograms, bigger dimensions, more expensive vehicles from 30 to 50%. The choice of the speed impact was very much criticised by car makers in Europe where the standard of 50 km/hr was chosen. Risks related to these technical limitations: to limit safety items to rich customers and put aside the European car;

- Resolution of complicated technical problems (vehicle parts must provide a good resistance as well as good transformation quality) made more tricky on light and small vehicles

- Technological choices reoriented to follow US innovations (airbags; telescopic bumpers; head-rests) even if considered as too complicated, expensive, heavy, big, and so on
- No clear approach on the ESV objectives: are they useful prototypes for obtaining further knowledge on vehicle safety or should they be rapidly destined to be mass-produced?
- They are accompanied by some unexpected steps backward on safety: while following the ESV specifications, the height of the Fiat 132 was risen (to improve crashworthiness). As a consequence, the car lost in surface of windows, and hence visibility.

Conclusion

- Public authorities entered the game on vehicle safety: guidelines, threat of legislation. Legislation was effectively rapidly introduced, but concerned already mass-produced safety items and the use of vehicles (speed limitations) and not vehicle specifications
- Government standard setting coming from the US: interesting for a country where private interests are now predominant in the process of standard setting
- Transfer of model from the US: Research reoriented to correspond to US specifications
- Creation of the European Committee for experimental vehicles (CEVE) whose ambitions are more modest and whose technological implications are more adapted to the particularities of European vehicles