



RCAR

Research Council for Automobile Repairs

Newsletter

Research Council for Automobile Repairs

www.rcar.org

February 2001

News From The Centres

MPI - Canada

MPI have continued with their research into Structural Adhesives and Full Frame Repairs. Both these topics were reported at the last RCAR Conference and are of widespread interest.

Structural Adhesives

Plans are in place for a second crash test using structural adhesives. Last year's post crash analysis identified a number of causes for joint failures in the unibody section. The adhesive film used in last year's testing contributed to a number of difficulties in the replacement process.

The manufacturer has reformulated the adhesive so it can be applied from a cartridge medium. The cartridge dispenser is intended to overcome problems with bond line thickness and to make for easier installation of the structural parts. Crash tests are scheduled for early summer in time for the RCAR 2001 Conference presentation



Full Frame Repairs - 1999 and 2000 General Motors.

In 1999 General Motors introduced a redesigned frame on its 1500 and 2500 series light duty trucks and on its sport utility vehicles. The repair industry reports that the new design is not as repairable as the previous model. The majority of complaints relate to the front section.

The frame is made of three different sections: a mild steel hydro-formed front section joined to open channel, high-strength, low-alloy steel centre and rear sections. Reports of repair difficulties relate mainly to the front hydro-formed section.



MPI research technicians are looking at the reparability of the front frame section. Our objective is to determine how the hydro-formed rails react to current straightening techniques and establish repair and sectioning recommendations. The study is ongoing and will be completed in early Spring of this year.

Special points of interest:

- News from 9 RCAR Centres.
- The Benefits of Laminated Sideglazings in Automobiles
- News Sources, Book Review, and Forthcoming Events.
- "CRASH" Newsletter attached.

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News From The Centres

IIHS - USA

The Institute has issued three status reports in recent months, the main themes of which have been reviews of truck safety, the effectiveness of State laws, and occupant survival in side impacts.

The issue of truck safety is linked to driver fatigue which contributes to 15% of fatal and injury producing crashes. Proposals to mandate longer off-duty time for truckers, require electronic records to enforce rules and increase the hours truckers can drive at a stretch, are receiving a mixed reception. The Institute supports the first two proposals but not the third as research has shown that crash risk increases considerably after 8 to 10 driving hours. Note tacographs are currently used in a number of countries to record driver miles. Electronic recorders provide more comprehensive information and will be introduced into the EU in 2002. Other topics cover advanced driver simulators; a review of the changing face of pedestrian crashes; and a discussion on who invented the three point safety belt (of interest mainly to US and Swedish citizens).

The effectiveness of State traffic safety laws is a fascinating and influential review of State laws using the Institute's well tried Good, Acceptable, Marginal and Poor matrix together with States singled out for Best Laws (California, District of Columbia and Maryland) and Worst Laws (Montana, South Carolina and South Dakota). The key fact that one third of traffic safety laws are rated Poor is a worrying finding deserving State attention.

Lastly the January issue "Could you survive.....?" covers side impacts employing the Institute's crash laboratory to carry out side impacts using a pick-up into the side of a Volvo S80 and car-into-pole tests using a BMW X5 and Volvo S80. These tests show that people can survive serious side impact crashes in the real world because airbags prevent heads from striking rigid objects.

IIHS provide some real world examples of fatalities where side airbags were not fitted, together with data from FARS (1991) and NASS/CDS (1995-99) on passenger vehicle occupant deaths in side impact crashes. The Institute maintains that the current Federal test barrier for side impact testing is too low. They are working with Transport Canada to develop a new test barrier and side impact dummies (SIDS).

(IIHS is at www.hwysafety.org)

CESVI - Argentina

CESVI Argentina report on progress in three key areas. The Systems Department has been transferred into new facilities which comprise a 75 square metre "intelligent" building in which US\$400,000 has been invested. Part of the new building is shown below.



A new partner insurance company has joined CESVI Argentina. This is El Comercio, a member of the US Bristol Group, created by the fusion of a number of Argentinean insurers that had been acquired by the US Group. The decision to join CESVI Argentina was heavily influenced by the presentation of key data illustrating the success in reducing insurance claims costs in Argentina.

Finally, at the end of October, a new version (3.1) of Cesvicom was introduced. This version has a new timetables concept (baremos), new photographic processor and new statistical data. This system works with Cesvi Rep Systems (parts). The 3.1 version has all the previous cars together with year 2000 models on the database, a near 90% coverage of the Argentinean market.

(CESVI Argentina is at www.cesvi.com.ar)

News From The Centres

Thatcham - UK

In the last few months Thatcham has issued a number of Methods Manuals to UK Repairers and Insurance Engineers. These publications have covered the Toyota Corolla, BMW E46, Rover 45 and Renault ES. Ten other newsletters and training publications have also been issued.

Work on the creation of the new research workshops and technology centre are well advanced and are scheduled for completion in March. The official opening of the new facility will be in the Summer of 2001.

As RCAR Members will be aware, Michael Smith steps down as Chief Executive shortly. He will be succeeded on 1 March by Peter Roberts (51). Peter has wide industrial experience and his last appointment was as Business Development Director for Partco Plc, a leading UK automotive parts distributor. Another recent management appointment is that of Paul Maddon as head of Communications and Marketing, a new post created at Thatcham.

(Thatcham is at www.thatcham.org)

ICBC - Canada

ICBC has started RCAR crash testing and has developed a facility to conduct 15 km/hr crash testing. The facility has been developed through improvements to an already existing low-speed crash test facility in British Columbia. The development included construction of an offset barrier face and other modifications to conform to the RCAR 15 km/hr testing standards. The first vehicle tested at this facility was a new Honda Insight. The primary purpose was to determine if the hybrid-electric power train in these new types of vehicles present any problems or issues for insurers and repair facilities when the vehicles are involved in low-speed collisions. ICBC has also purchase a Toyota Prius for additional tests.

The results of the Honda test were quite interesting. As expected the hybrid-electric power train did not sustain any damage in the test, although it still requires repair shops to develop some specialised knowledge before repairing the car: items such as shutting off the high voltage systems and identifying high voltage power lines. The aluminium body construction, however, did not fare as well in the test. The most notable problem was deployment of the air bags and seat belt pre-tensioners in this crash. This deployment added thousands of dollars to the repair costs and would have exposed the occupants to unnecessary risk in the crash. John Gane notes that "we hope to be able to work with Honda to have the airbag sensors re-tuned to eliminate these low-speed airbag deployments in the Insight".

(ICBC is at www.icbc.com)



Centro Zaragoza - Spain

RCAR Members will have received copies of Centro Zaragoza's latest magazine for October/December 2000 (in Spanish). Topics covered included a review of car benches and pullers covering Celette, Car-o-Liner, Sevenne. Paint mixing and colouring was featured showing the way in which shades or tints of colour were created from prime colours. The system of certification of parts, together with a listing of the parts, model, applicability, reference and pricing was also shown.

Moving from bodywork, two important topics on tyres and ABS braking were included. An interesting article on vehicle theft outlined the Zaragoza database and provided some real world theft data for the years 1994-1997 showing a rise over the four years from c.100,000 vehicles stolen to 140,000. The police recovery rate however remained fairly constant at c.70%.

In two articles on vehicle occupant safety the efficiency of seat belts was covered as was the efficiency of airbags in a frontal impact crash, the need for both being illustrated with a film sequence carried out by RCAR Centre AZT. Concluding features covered analysis of equipment tools and products, step-by-step repair of plastic bumpers, a look at the future, and an article on the introduction of the Euro.

(Centro Zaragoza is at www.centro-zaragoza.com)

News From The Centres

KART and JKC - Korea and Japan

Research centres, KART and JKC, held a joint research council at the Jiken Centre (JKC) in Japan over a three day period from 29 November to 1 December 2000. This followed upon the very successful inauguration council held in KART Centre in Korea in October 1999. The main purpose of the council is the improvement of research techniques and presentational ability for the education and training of young engineers. The council was held using English as the presentational language as is the case at other RCAR Meetings. Altogether six engineers from KART and five from JKC presented on research themes as follows:

- **Comparison of Damageability and Reparability on Frontal Low Speed Crash Test on Luxury Cars**

Presented by Mr Young Bum, Chun (KART)

- **Reparability Improvement Proposal to Car Manufacturers**

Presented by Mr Toru Oguma (JKC)

- **Comparison of the Active Suspension**

Presented by Mr Jong Hun, Lim (KART)

- **Study of the CVT**

Presented by Mr Koji Demachi (JKC)

- **Airbags' Impact on Repair Cost**

Presented by Mr Seung Soo, Kang (KART)

- **Training and Education System of JKC**

Presented by Mr Shizuo Ichimasa (JKC)

- **Comparison and Analysis of Waterborne Paint Quality**

Presented by Mr Se Il, Park (KART)

- **Main Function & Characteristics of ARECCOM System**

Presented by Mr Sang Woo, Shim (KART)

- **Investigation of the Paint Film Quality**

Presented by Mr Takeo Hiyoshi (JKC)

- **Research of the Bumper Stay Structures to Minimize the Damage of Side Member**

Presented by Mr Jee Won, Kim (KART)

- **Study of Reparability Using an Adhesive**

Presented by Mr Masaaki Matsushita (JKC)



The council was held in a large meeting room with many seats being set aside for observers. The presentations proved to be very popular and were attended by many JKC employees and also adjusters from the insurance companies. It was excellent experience for the young engineers and all worked very hard in the preparation and presentation of their research topics.

All the KART members stayed at the JKC in lodging rooms in the main building and took their meals at the cafeteria with JKC members. A very successful welcome dinner was held at JKC for the council and this was also attended by many JKC employees. The atmosphere was very friendly and colleagues from Korea and Japan got on well with each other, serving the purpose of the council which was not just about automobile repairs but was to learn about each other's country and develop relationships.

Other events included a demonstration of the crash test in JKC facility. This was arranged 30 degrees angle barrier with 25 km/h using Toyota Hi-lux. There were also visits to two repair shops in Tokyo. KART members were able to observe their facilities and the actual repair works in Japan and were able to discuss with repairers and adjusters. (We are very grateful to Mr Tsuneyuki Wada of JKC for this report.)



News From The Centres

CESVIMAP - SPAIN

CESVIMAP have issued a variety of Repair Manuals in the last four months. These have included Ford Focus, Renault Kangoo, Aprilia Pegaso 650 Motorcycle, Seat Leon and the Nissan Cabstar E Truck. In addition thirteen Technical Data Sheets have been distributed. CESVIMAP have also published the bi-monthly information bulletin of safety "Seguridad Vial". Two recent issues cover the Technical Inspection of Vehicles and the fitting and use of Snow Tyres.

The magazine is published in hard copy and on the web at www.revistacesvimap.com/revista34/secciones_ing134.htm. There is a summary of areas of interest in both English and Spanish, including bodywork, painting, vehicles (Honda CB250), industrial vehicles, motorcycles, road safety workshop news, the environment, claims adjuster advice and travel. Detailed reports on the above subjects are provided in Spanish.

(CESVIMAP is at www.cesvimap.com)

From The Secretary General

Welcome to 2001 and our first Newsletter of the year. One of the reasons for our newsletters is to keep in touch during the year and I am conscious that it is now four months since the RCAR Conference in Buenos Aires. The feedback that I have received confirms my belief that last year's conference was highly successful, with enjoyable and exciting in-country arrangements, and a relevant and balanced technical programme. On behalf of us all, I would like to repeat our thanks to the host centre, CESVI Argentina, and in particular to Fabian Pons, Head of Centre, and his team for all their hard work, kindness and hospitality.

News from the Centres features 9 of our 24 centres. There is variety in the progress reported and all RCAR continents are represented. I applaud the meeting in Japan of the young engineers of JKC and KART. As Tsuneyuki Wada reported, it was not just about automobile repairs but also to learn about each other's country and to develop relationships. Meanwhile in the USA we see IIHS conducting a very serious and influential review of the effectiveness of State traffic safety laws – not something that could be done in all countries. We also see two centres investing in improvements to research facilities, namely ICBC, with a major upgrading of their crash rig for conducting the RCAR Standard low-speed test, and CESVI Argentina in the creation of an "intelligent building" at Pilar.

RCAR Activities: Two groups within the RCAR community are working on important issues: Full Frame Repairs and Head and Neck Injury (Whiplash). Both are at an early stage and will report at the October conference in Korea. However initially our North American colleagues are handling the first issue of Full Frame Repairs. The aim is to prepare an RCAR Standard or design guide for repair. The second issue on Whiplash is focussing on Dynamic Standards for testing seatbacks and head restraints. There are both European and US proposals for rules for dynamic testing and, in the case of the USA, for static evaluation as well. The USA is more pressing and National Highway Traffic Safety Administration (NHSTA) issued their proposed rule for comment by early March. IIHS, AZT and Thatcham, who are working in conjunction with GDV, the German Insurance safety group, are developing the RCAR Dynamic Standard jointly. A meeting was held in Munich in December 2000 with the next planned at Thatcham in April 2001. Some progress has been made and early indications are that the Dynamic Standard will be based on sled testing using a number of vehicle crash pulses. In the meantime I shall provide comments to NHSTA on behalf of RCAR.

Vehicle Security: I have just been involved in judging car and truck security in the UK, an annual event sponsored by the British Vehicle Leasing and Rental Association (BVLRA). I was extremely impressed with the efforts of vehicle manufacturers in incorporating security features into their cars and vans for the British market: GM Astra, Ford Mondeo and BMW 5 Series won their class in the Car Section, with Ford Transit winning the Van Section. However I was disappointed that no trucks had sufficient security to be considered for an award. Is this a global problem? The point was made even more graphically when I attended a demonstration at Thatcham where a US\$120,000 tractor unit was broken into and driven away. The thief (in this case a security engineer) took less than one minute and used only a ruler and a paper clip. An interesting distinction in the UK is that there is a classification system for cars that rewards for good security and penalises for bad, whereas no such classification system exists for trucks. I am sure the situation exists elsewhere and it would be of interest to explore ways of motivating vehicle manufacturers on a more global basis.

Pedestrian Safety: I enclose the February Newsletter of the European Transport Safety Councils, "CRASH", which is a special issue on pedestrian safety. This is a very pressing issue in Europe and I am grateful to M. Jeanne Breen, Executive Director, ETSC, and Editor of "CRASH" for providing copies for RCAR Members. It reviews the technical arguments, provides a historical perspective and also some of the political background and argument. For details of the work of ETSC see www.etsc.be.

Currently I am handing over as Chief Executive of Thatcham to my successor, Peter Roberts. I shall be at the SAE 2001 with Peter and Ken Roberts and very much hope to see North American RCAR colleagues in Detroit.

With very best wishes,

Michael Smith

The Benefits of Laminated Sideglazings in Automobiles

Introduction

An increasing number of vehicles, mainly in Europe, are fitted with laminated sideglazings in place of tempered glass which has been used for the past 60 years. It is estimated that there are now 200,000 cars on the road fitted with laminated sideglazings and market forecasts show that in future these glazings could even become a standard feature. Laminated sideglazings are fitted as standard or as an option in some Audi, BMW, Peugeot, Mercedes and Volvo vehicles.

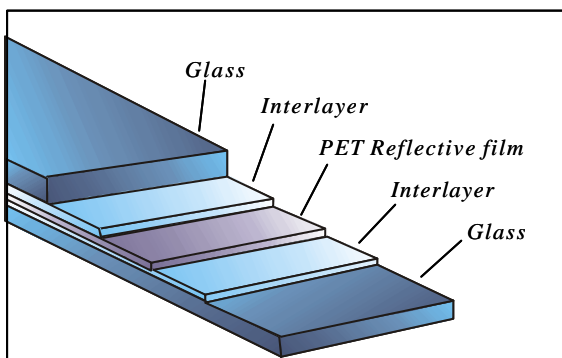


Ray Cross

Industry Team Chairman

(see Industry Development Activities below)

Laminated Sideglazings



Typical Laminated Sideglazings Construction

A standard laminated windscreen consists of 2 plies of glass strongly bonded together by use of a 0.76 mm thick PVB interlayer, but for sideglazings the glass needs to be strong enough to resist breakage due to the shocks created by slamming doors. This can be achieved by a heat strengthening or semi-tempering process that has to maintain good optics and perfect glass shape in the case of thin glass.

The first commercial vehicle offering all-round laminated glass was in a segment E1 vehicle in 1994. Then the glazing consisted of two pieces of 2.6 mm heat strengthened glass laminated with 0.76 mm PVB. Today the products are typically 2 x 2.1 mm + PVB or 5 mm total thickness and the expectation is that a total thickness of 4.4 mm will be available in the near future. The availability of this thinner configuration could revolutionise the entire market for automotive glazing as it would fit most existing doors designed for 4 mm toughened glass. Such a glass configuration would allow the car manufacturer to offer all the benefits of laminated sideglazing without a weight penalty. Other interlayer materials will become available which will give greater benefits in some applications, eg providing heat reflecting properties to the glass. These products will cost more.

Benefits of Laminated Sideglazing

The benefits are in 3 main categories: Safety, Security and Comfort.

Safety: A US Congress Directive to the Department of Transport's National Highways Traffic Safety Administration (DOT/NHTSA) has asked for an investigation into the means of reducing the 9,000 fatalities per annum from ejection from vehicles in the USA. Specifically the investigation has been looking at rollovers where almost 60% of fatalities occur in 10% of accidents where the occupants are completely or partially ejected from the vehicle. NHTSA predicts that using some form of new glazing, laminated is the preferred form, could save between 500 and 1,300 lives per annum. It is estimated that a similar number of lives could be saved in Europe. Because the glass is less likely to be penetrated by objects from outside the vehicle in a crash, there will be some safety benefits from this aspect.

Security: In countries where the "smash and grab" crime phenomenon is increasingly important, laminated sideglazings offer an answer to the problem. It will resist this type of quick attack; the glass will break but thieves will be surprised as the glass remains integral and they cannot penetrate through the window. Rather than taking another chance and making a lot of noise in attempting to break through the glass, thieves may leave and look for an easier target. Depending on the type of attack, the glass will resist at least 10 times longer than tempered glass. In the UK the Home Office has now officially recommended to car manufacturers that they fit the glass as a way of reducing car crime in the future.

Laminated sideglazings will also give an improvement in personal security where the high resistance to penetration will help to prevent attacks on the vehicle, its contents and its occupants whilst the occupants are present in the vehicle. Road rage and car jacking incidents should be reduced or possibly become non-existent. Consumers interviewed about laminated sideglazings in recent research indicated that they would feel more secure and protected by this type of glazing.

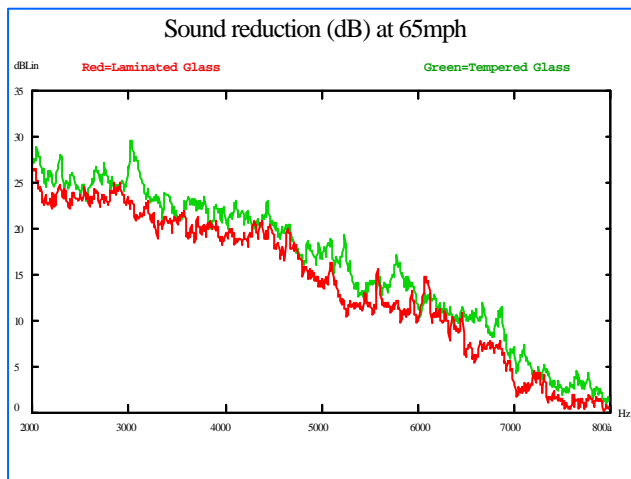


Benefits of Laminated Sideglazings in Automobiles (continued)

Comfort: There are benefits in areas of UV protection and acoustics with the standard laminated product, and with the addition of a special PET layer, which is placed between the two pieces of glass, improved solar control can be obtained. UV protection will reduce skin irritation, which is important in the Japanese markets, and increase the life of materials and upholstery used in the interior of the vehicle.

Laminated glass offers a significant damping effect in terms of sound transmission, especially in those frequencies associated with traffic noise. This is due to the interlayer being a soft polymeric product. A car so equipped can give occupants a feeling of quiet and comfort whilst still allowing them to hear outside sounds like the important acoustic signals from emergency vehicles.

The graph below illustrates the benefits of laminated glass installed in a typical segment E2 car (red curve) as compared to tempered glass of the same total thickness of 5 mm (green curve). The data correspond to a real test drive in the car at a speed of 65 mph (104 km/h), sound recorded with binaural head in the front passenger seat. Demand for air conditioning has increased dramatically in the USA and Europe. Laminated sideglazings offer car companies the possibility to add still another feature to increase the occupant comfort. This is done by combining laminated glass and infra-red reflective (IRR) metallic coatings which reflect heat whilst maintaining visibility by being transparent to visible light. This coating can be applied either on the glass surface or on a thin PET carrier film, but in either case it will be protected from scratches by the interlayer used to make laminated glass.

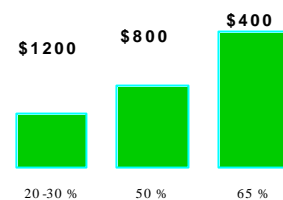


with this type of IRR coating, showing that it significantly reduces the temperature in parked cars and that allows the air conditioning unit to bring the temperature much faster to a comfortable level upon start-up. The product will also increase significantly the comfort of the passengers when driving in sunny conditions. Work is also underway to develop products for IR reflection that could eliminate the need for metallic coatings. Improvements to the comfort of car drivers can lead to improvements in the safety of the driver.

Market Situation

Recent market surveys in USA, Europe and the UK have shown that most consumers want laminated sideglazings fitted on their next vehicle and are prepared to pay more for such glazing products. The research, carried out by Solutia, a major interlayer supplier, was designed to determine what the consumer interest level would be for the product at a range of different option prices. These numbers are based on interviews with consumers expressing the intention to buy a D or E class car within the next 18 months.

For buyers of \$20,000+ vehicles...



As you can see here, interest is high at the \$400 price level with 65% of those surveyed indicating they would include the product on their next vehicle. At \$800 interest is still quite high at 50%. Even at the high end of our price scale - \$1,200 - interest in adding the option to their next vehicle was expressed by 20-30% of those surveyed.

Industry Development Activities

As with any new product, certain issues and challenges need to be addressed. Therefore an industry forum/team has been formed. The team comprises glass manufacturers Glaverbel (Asahi), Pilkington and Saint Gobain, and material suppliers 3M, Du Pont, HT Troplast, Huntsman Polymers, Sekisui and Solutia. The team will be led by myself as the independent chairman of the forum. The above companies produce 75% of the world's automotive glazings and nearly 100% of the interlayers used in laminated glass.

The team has commissioned accident research studies in the UK and Europe and in undertaking a research programme with the Emergency Services. In early 2001 when the studies are complete an education programme will be carried out with the emergency services globally, car manufacturers in Europe, USA and Japan, and with the automotive decision makers such as trade journalists, automotive associations, insurance companies and with RCAR. As part of this education programme it is expected that a presentation will be made to the 2001 RCAR global meeting.

To summarise, laminated side glazings offer the consumer significant benefits in terms of safety, security and comfort and the glass industry and its suppliers are taking a responsible attitude in ensuring that any remaining issues regarding the use of the product are addressed.

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News, News...

It is not the intention to provide the latest automotive or insurance industry news in this Newsletter. However there are some excellent sources available on the Web and members may find the following sites useful.

www.ap.org
www.ft.com
www.smmmt.co.uk
www.individual.com
www.automotive-online.co.uk
www.newspage.com
www.bloomberg.com
www.automotive.com
www.feer.com
www.jrm-software.co.uk
www.sillicon.com
www.koreaheadline.com
www.nytimes.com
www.slate.com
www.wired.com
cgi.zdnet.com
www.msnbc.com
www.cnn.com
www.interactive.wsj.com

Dates For Your Diary

SAE 2001 World Congress is to be held in Detroit, Michigan, 5-8 March 2001.
Details: <http://www.sae.org>

International Congress on Whiplash Associated Disorders is to be held in Berne, Switzerland, 8-10 March 2001.
Details: <http://www.wad2001.ch>

17th International Technical Conference on the Enhanced Safety of Vehicles (ESV) is to be held in Amsterdam, Netherlands, 4-7 June 2001.
Details: <http://www.esv2001.com>

45th Annual Conference of the Association for the Advancement of Automotive Medicine (AAAM) is to be held in San Antonio, Texas, 23-26 September 2001.
Details: <http://www.carcrash.org/annual.html>

Annual RCAR Conference 2001 is to be held in Seoul, Korea, 7-12 October 2001, and will be hosted by KART.

NACE 2001 will be held in Las Vegas, from 29 November to 2 December 2001.
Details: <http://www.naceexpo.com>

45th STAPP Car Crash Conference is to be held in San Antonio, Texas, 15-17 November 2001. Details: <http://www.stapp.org>

Book Review

The Passenger Car Body

Author: Dr.-Ing. Dieter Anselm

Publisher: Vogel Verlag und Druck GmbH

Price: 169 DM

It is refreshing to review a comprehensive automotive reference work set out in such a logical fashion. The work will hold particular interest for those involved in the automobile industry, whether they be vehicle manufacturers, researchers, repairers or field engineers (assessors/experts).

The contents of the book are organised in a progressive manner and cover the following main areas:

- Design of Automotive Bodies.
- Deformation of Vehicle Bodies.
- Vehicle Body Repair Characteristics.
- Crash Repair Test.
- Accident Event and Statistics.
- Crash Characteristics of Different Car Body Designs.

Dr Dieter Anselm, the author, has unique experience in putting together such a reference work in that in his 28 years at Allianz Centre for Technology (AZT) he has served as Head of Engineering and more recently as Head of Centre. During the last 30 years there has been a great deal of development in the automotive industry and the developmental theme is well chronicled in this work. ***The Passenger Car Body*** is the result of extensive research, networking and analysis of the literature. As such it is meticulously researched with over 460 references, circa 40 of which were published from work carried out directly by Allianz Centre for Technology.

Unifying themes running through the work are the development of safety and economic design, ie design to reduce damage and to speed and simplify subsequent repair. The treatment of the subject is detailed and holistic in that the linkage between development, manufacture and real world use is well made. Examples abound and the work is enhanced by the results of good networking with manufacturing colleagues.

As head of a very busy research centre we can believe the author when he says that "there is no doubt that family life suffered....." in the writing of this book. We celebrate Dr Anselm's diligence and thank him for providing the industry with such a comprehensive and relevant reference work.

Available from: Vogel Verlag und Druck GmbH
D-Würzburg, Germany.
ISBN 3-8023-1866-8/316pp/English Edition 2000

Co-distributor: Society of Automotive Engineers Inc (SAE)
400 Commonwealth Drive, Warrendale, PA, USA.
ISBN 0-7680-0708-9 Order No.R-307

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