Research Council for Automobile Repairs

RCAR Newsletter

www.rcar.org.

June 2003

CESVIMAP's 20th Anniversary

CESVIMAP has celebrated the twentieth anniversary of the creation of the Mapfre Centre for Experimentation and Road Safety, CESVIMAP, with an "Open House" day for their employees and their families. More than 300 people came along and everyone enjoyed the day's celebrations, organised by Cesvimap in collaboration with the Mapfre Institute for Road Safety. A wide range of activities was on offer and particularly popular were the games for the younger children, with an emphasis on road safety: a go-cart circuit, workshops, etc, and guided tours of our installations for the adults to show them the research work and activities carried out in the centre.

The day was rounded off with a traditional birthday cake for everyone to mark the twenty years that CESVIMAP has been in existence.

Special points of interest:

- *News from 10 RCAR Centres.*
- *News Sources and Forthcoming Events.*
- *Effects of New Materials*
- *ESV*
- *NCAP Results*

Inside this issue:

RCAR People

KTI—Germany

A very warm welcome to Dipl.-Ing. Klaus-Dieter Moser, who took up his appointment as Head of Centre and Managing Director of KTI in September 2002.

Klaus-Dieter has a wealth of experience in engineering, initially in Bundeswehr (the Federal Armed Forces) where he served as Repair Officer, Engineering Officer, and Training and Project Officer at Unit and Headquarters level. Following a successful Service career, Klaus-Dieter gained experience of the insurance industry and was a motor vehicle expert with Kfz-Sachverständigen GmbH, Wiesbaden. He was responsible for Quality Assurance, Training and Development of technical staff, and for collaboration with EVU (Europeant Association for Accident Reconstruction and Accident Analysis).

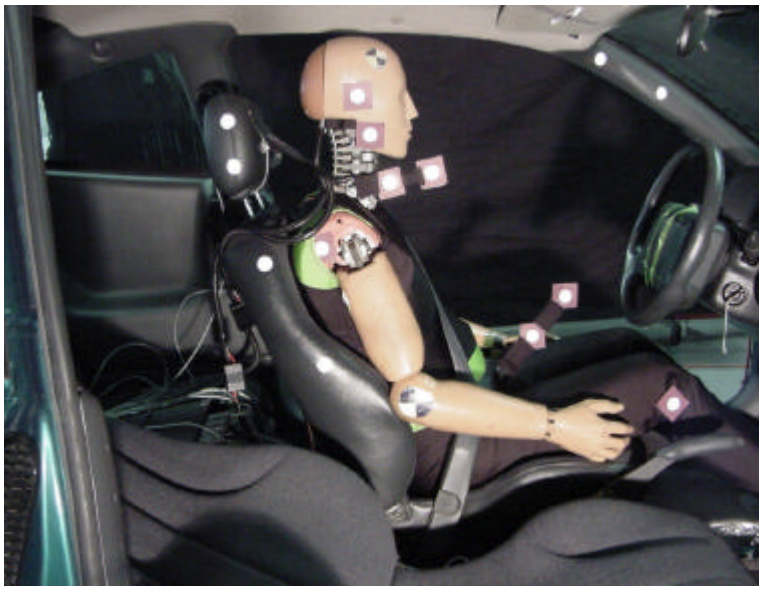
Klaus-Dieter Moser takes up his appointment at a crucial time for KTI and its partners. He is currently managing a programme of changes, which will affect the emphasis of research and training at KTI and also the future location of the research institute. He will be unable to meet fellow RCAR Members in Australia this year but will join the RCAR conference in Berlin in 2004. We wish him success in his new appointment.

(KTI is at www.k-t-i.de)

News From The Centres

ICBC-Canada

No Pain-No Gane



Many Insurance claims for whiplash injuries happen as a result of very low speed rear-impact collisions. Insurers are usually sceptical of whiplash claims when the impact has been so small that there is no damage to the vehicle's rear bumper. In the past it has been difficult to document if a minor bump is likely to result in a whiplash injury.

John Gane reports that ICBC is conducting a series of low speed rear impacts which use a BioRID dummy in an effort to document the likelihood of an injury in minor rear-impact crashes. Twenty vehicles are being tested with a full flat barrier at speeds of 6, 8 and 10 km/hr. Dummy readings are being monitored with special emphasis on the threshold for the "Neck Injury Criteria".

Vehicles have been selected to give a good cross section of the various bumper configurations in common use, including energy-absorbing passenger car bumpers (with various damage thresholds), and rigid mounted bumpers on pick-up trucks and SUVs. Various head restraint designs and adjustment levels are also being used.

Early results indicate that there is a very significant difference in outcome from car to car—even with similar design features. We are also finding some important information about the repair of bumpers following minor damage—for example, how important is it to replace foam energy absorbers when they have received minor damage but still appear serviceable?

(ICBC is at www.icbc.com)

News From The Centres

Thatcham—UK

A number of Methods Manuals and Newsletters have been issued recently including Methods Manuals on Jaguar X Type, Citroen C3 and Nissan Primera. Technical information published includes Extended Service Life for Airbags, Use of New Paint Data after April 2003 for cars, Vauxhall Corsa 2001 and Boron/High Strength Steels. Thatcham have also issued their Panel Area Based Paint Material Cost guide for EPA Compliant Products.

A new Training Programme has been circulated and a great deal of effort made to extend regional training. In March Thatcham expanded its training base to Scotland by linking up with Motherwell College (south of Glasgow). This adds to the current regional network of Birmingham, Norwich, Gateshead, Liverpool, Manchester and Doncaster.

(Thatcham is at www.thatcham.org)

CESVI Argentina

Crash Test is 3 Years Old!

Crash Test TV and Magazine were 3 years old on 24 May 2003 and they celebrated with a full revision including contents, production and design and a new logotype. Crash Test TV is broadcast countrywide through two TV Channels: America Sports (on Wednesdays at 10.30 pm and Saturdays at 12.00 pm) and Multideporte (on Fridays at 9.30 pm), with five repeats a week. In both media the reader/viewer can find, among other things, reports on technical, highway safety, car crash reconstructions, automotive news, safety devices and all the information relative to low and high-speed crash tests.

Growing Up Safely: 2nd Stage

Following the 2002 success, the second stage of Growing Up Safely will start mid-June 2003. This is the Highway Safety Education Programme for school students that CESVI Argentina and MAPFRE Argentina organise with the purpose of inculcating the "drivers of the future" with adequate driving habits and behaviour in order to attain better levels of safety. Like the first stage in 2002, this second stage will include 40 private schools in the Buenos Aires City area and other cities nearby. Also this year some provincial schools will be included. The students from the first levels receive a specific annual training during their first 12 school years according to their maturity. Last year the topic of the programme was "My place in traffic" (for 5 and 6 year olds) and this year it will be "Going through my neighbourhood" for 6 and 7 year olds. When the reach the age of 17 all of these young people will be licensed to drive having acquired all the good habits needed to drive safely and defensively in the Argentinean road system. This programme is supported by several large companies including General Motors, Michelin, McDonalds and Osram among others, who are joining CESVI Argentina and MAPFRE to ensure a safer future for our children.

(Details are at www.creciendoseguros.com.ar)

CESVICOM 3.1 in Uruguay, Paraguay and El Salvador

The Damage Valuation System, CESVICOM 3.1, created by CESVI Argentina, is spreading throughout Latin America. After its success in Paraguay over the last three years, it has now arrived in Uruguay and El Salvador. Both countries needed a useful management tool for the local insurance market and now, with installation of CESVICOM 3.1, they are satisfied with the benefits and results they have achieved. CESVICOM 3.1 has been installed in two of the most important companies in El Salvador, and has also been installed in a large group of bodyshops and valuation companies.

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

News From The Centres

Centro Zaragoza—Spain

The April/June issue of Centro Zaragoza Magazine covers a number of interesting topics. Motorcycle Jigs are reviewed and the equipment studied was VULVO, Techno Spyder 2000, Cialvier, MotoJig, and Bike Bench. Repair Software is outlined in respect of damage estimation. Paint preparation, with a focus on anti-corrosion protection, is also covered, and the fundamentals of adhesives are outlined. In the Mechanical area the principals of shock absorbers are highlighted and lubricants are covered. There is also an article on the tuning of vehicles. Two cars are reviewed: the Toyota Prius and the Lexus RS-300. There is a wealth of equipment analysis and a listing of recent Centro Zaragoza projects and videos. There is also a very topical article on Intelligent Transport Systems (ITS).

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

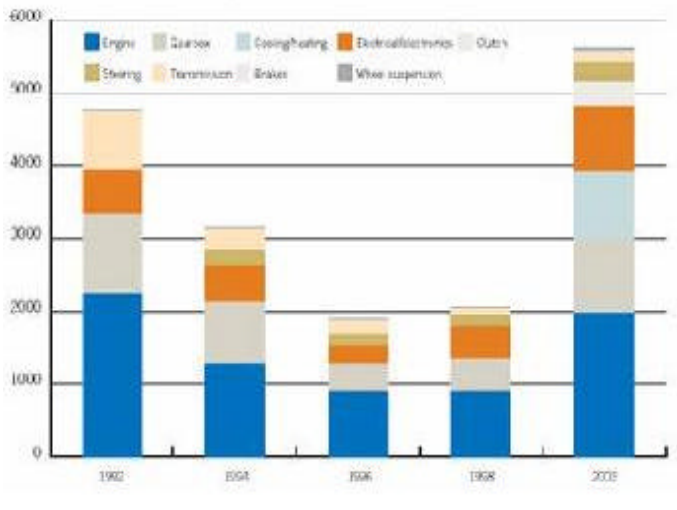
Länsförsäkringar—Sweden

Toyota Yaris and Volvo S60 have the lowest customer costs at a model level. Lexus is the brand with the least number of damages. Citroen as a brand shows a marked improvement. Audi S4, Ford Windstar and Land Rover Discovery are the most expensive for the customer.

In 2002 a total of 5,619 machine damage accidents were reported to Länsförsäkringar. This is an increase of 34% compared to 2001. The main reason for the increase is that the number of new cars sold has been greater in recent years. This means that the stock of cars is being transformed. The new cars replace the old ones which do not have a valid machine damage insurance any longer because of their age or mileage. For certain car brands the increase can be derived from the deficiencies in the design or production processes.

The undertakings of the car manufacturers and general agents as regards goodwill and warranties also change over a period of time. The quality of cars is, in general, at about the same level as earlier. It is also apparent that different brands prioritise differently as regards the will to keep customers economically indemnified when a fault occurs on a car. The largest differences between the different brands are in the damage frequency area.

The investigation also shows that slightly more than one third of the damages are engine damages, which is a reduction of almost 15% compared with the previous investigation. After this comes the damage to gearboxes (18%), cooling and heating systems (16%), electrical damage (16%), clutch (6%), steering (4%) and transmission (2%). Damage to brakes and wheel suspensions are quite unusual in this investigation. The big difference compared to the previous investigations is a reduction in the percentage of engine damage. This depends mainly on the fact that the technology in cars is being developed and that electrical/electronic equipment and the new group cooling/heating systems answer today for a large part of the damages. The average repair cost for machine damage in 2002 was approximately SEK9,000 after the Excess had been deducted (SEK3,000-5,000 depending on mileage group).



Engine damage accounts for the largest part (35%) of all machine damages in 2002. Gearbox faults account for 18%, electrical faults for 16%, faults in cooling/heating systems 16%, clutch 6%, steering 4%, transmission 2%, wheel suspension 1%, and brakes 1%.

The distribution among the various design parts is more even in this year's investigation. As regards quantities, all parts show in principal an increase in damages. The single largest increase is in cooling/heating systems. These systems are reported separately for the first time in this investigation.

(Länsförsäkringar is at www.lansforsakringar.se)

News From The Centres

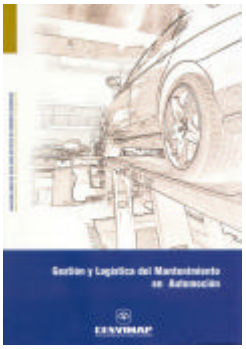
CESVIMAP—Spain

2002 Golden Firefighter Prize

The CESVIMAP video "Salvage Operation on Vehicles with Airbag" has been awarded two prizes in the latest Golden Firefighter Awards, a prestigious international competition established in 1987. The prizes received were "Best Training Video" and the special jury prize for "Best Video in Competition". The central argument being "When the airbag doesn't go off...what should be done to act correctly and with minimum risk?", the CESVIMAP video takes us through the procedure that the rescue team should follow in order to help crash victims, according to the different airbags in place.

New CESVIMAP Books

"Maintenance Manual for Automobile Repair Shops" and *"The Management and Logistics of Maintenance in Automobiles"* are the two new titles that CESVIMAP has just published. The first, aimed at repair workshops, is a practical manual from which a maintenance plan can be drawn up for the workshop's main equipment and installations, including the operations and checks which should be carried out. *"The Management and Logistics of Maintenance in Automobiles"* is a text book for students undergoing professional training; in other words, those who wish to join the workforce without a university degree. This book describes the physical layout of the workshop and the equipment and installations needed. It analyses productive capacity, the distribution of work load, and the organisational and economic side of the repair shop.



(Cesvimap is at: www.cesvimap.com)

State Farm—USA

In its fifth year of data collection, the Partners for Child Passenger Safety (PCPS) research team works simultaneously in each phase of the research-to-action-cycle with a continued focus on saving children from injury and death in motor vehicle crashes. The team has gone beyond identification and in-depth study of crashes involving children to development and implementation of interventions. Monitoring trends over time is a vital next step to evaluate the success of these efforts.

The field of child occupant protection has experienced a recent infusion of new technology, laws and targeted educational campaigns fuelled, in part, by PCPS research findings. Further, thee are approximately 4 million births in the United States each year. Each day, new parents learn about child passenger safety (CPS) issues for the first time.

PCPS' continued surveillance of children in automobile crashes serves as a unique national resource that helps set the agenda for improving the protection of children. Real-world current data provide a snapshot of how our nation's children fare in motor vehicle crashes, and in-depth engineering studies by the research team identify how their protection can be improved.

Recognizing the importance of continued monitoring, State Farm Insurance Companies and The Children's Hospital of Philadelphia have renewed their commitment to child passenger safety by extending PCPS to at least 2005.

The Interim Report 2003 for Child Passenger Safety Programme is at www.statefarm.com/kidsafety/reports.htm

(State Farm is at: www.statefarm.com)

News From The Centres

IIHS—USA

The Institute produced a Special Issue Status Report in April focussing on Vehicle Compatibility in Crashes. Two safety concerns are raised when a car, pick-up or SUV crashes into a car (referred to as the Crash Partner Car). One is the risk for the people in the crash partner car and whether the design characteristics of the striking SUV or pick-up increase the risks for people in the crash partner car. The second concern is the risk for people in the striking SUV, car or pick-up. The report includes graphs of fatalities per million registered miles in cars, SUVs and pick-ups during 1990-91 and 2000-01 plotted on a base of vehicle weight. A series of graphs showing Crash Partner risks and Crash Partner risks by Crash Configuration, the latter for 2000-01, but comparing front-to-front crashes and front-to-side crashes. Car occupants are about twice as likely to be killed in a side impact if the other vehicle is a SUV than if it is a car of about the same weight. In the short term ,the Institute concludes, the best way to address this is by adding Side Airbags with Head Protection.

The report published on 11 June took up the issue of Child Safety in relation to the attachment of child restraints. A Federal rule, known as Lower Anchors and Tethers for Children (LATCH), is supposed to be simplifying the process of installing infant and child restraints. An Institute team tested 6 different restraints in 10 vehicles and concluded that installation generally is easier and less complex with LATCH systems compared with the old way of routing safety belts through restraints to attach them to cars. However it is still not easy and LATCH does not always make it a simple click-in. The Status Report also outlined a study of child fatalities, using FARS data and looked at ways to improve child restraints to save more lives in crashes. It concludes with the assertion that cars that perform well in tests also protect people in real crashes. The Swedish National Road Administration and Monash University Study is cited in support as is a study by the Institute in three states: Florida, Ohio and Pennsylvania.

The 16 June Status Report concentrates on the question of truckers' driving hours, rest and monitoring systems. The Institute questions new rules released in April 2003 by the Federal Motor Carrier Safety Administration (FMCSA) for enforcement beginning January 2004. The highway safety concern is that whilst commercial truckers will have drivers' mandatory rest periods lengthened by two hours, those drivers will be able to stay on the road for an extra hour at a stretch. Added to this, the lack of monitoring drivers' hours adds to the Institute's disappointment in the long awaited legislation. The point is made that the USA is falling further behind the EU where the latter is moving on to digital tachographs. As a conclusion to the issue an Institute survey shows that three out of four Ford drivers say they like to be reminded to buckle up.

In a News Release on 8 May 2003 the Institute announced an increase of 8 new Board Members. These new members will serve a three year term and increase the Board from 28 to 36 for 2003. "We expanded the Board to allow more of our member companies to participate in the Institute's work" says Institute President, Brian O'Neill. "These new members are a great addition to our outstanding Board of Directors."

(IIHS is at www.highwaysafety.org)

Folksam—Sweden

Folksam have provided details of research carried out in conjunction with Swedish National Road Administration and Monash University. Authors are Claes Tingvall, Maria Krafft, Anders Kullgren, and Anders Lie. An abstract from the paper, published in 2003, entitled "The Effectiveness of ESP (Electronic Stability Programme) in Reducing Real Life Accidents" is below.

"ESP (Electronic Stability Programme) has recently been introduced on the market to reduce the number and severity of loss-of-control accidents. It has been expected that this reduction would mainly be addressed to accidents on roads with low friction. It is, however, complicated to evaluate the effectiveness with more conventional methods.

In this study, data from accidents occurring in Sweden during 2000 to 2002 were used to evaluate the effectiveness of ESP. To control for exposure, induced exposure methods were used, where ESP-sensitive to ESP-insensitive accidents and road conditions were matched in relation to cars equipped with and without ESP. Cars of similar or in some cases identical make and model were used to isolate the role of ESP.

News From The Centres

The study shows that there are positive effects of ESP in circumstances where the road has low friction. The overall effectiveness was 22.1 +/- 21%, while for accidents on wet roads, the effectiveness was 31.5 +/- 23.4%. ESP was found to be effective for three different types of cars, small front wheel drive, and large front wheel and large rear wheel drive cars

(Folksam Auto is at: www.folksamauto.com)

18th ESV—Nagoya, Japan

The 18th ESV was held 19-22 May 2003 in Nagoya, Japan. The conference was divided into fourteen Technical Sessions as follows: Vehicle Rollover Stability and Rollover Crash Protection; Compatibility in Frontal/side Collisions; NCAP Related to Existing Test Procedures; Real World Data Acquisition; Injury Risk Assessment and Functional Capacity Metrics; Advanced Technology #1: Passive Restraint Systems; Biomechanics #1: Injury Criteria and Dummy Development; Advanced Technology #2: Driver-Vehicle Safety/Driver Performance; Developments in Side Impact Protection; Improved Safety for Vulnerable Road Users; Advanced Intelligent Technologies—ITS; Child Restraint Systems; Biomechanics #2: Injury Criteria and Dummy Development; Safety of Heavy Trucks, Buses and Truck Tyres and Developments in Frontal Impact Protection.

(The Secretary General thanks Yasuaki Kada of JKC and Brian O'Neill of IIHS for details of the conference.)

The proceedings are available at: **www-nrd.nhtsa.dot.gov/departments/nrd-01/esv/18th/esv18th.htm**.

Euro NCAP Results

Test Results from Euro NCAP released 26 June 2003

	Occupant	Pedestrian Protection
Executive Cars		
Saab 9-5	5 Stars	Not tested to new protocol
Family Cars		
Toyota Avensis	5 Stars	1 Star
Honda Accord	4 Stars	2 Stars
Vauxhall/Opel Signum	4 Stars	1 Star
Small Family Cars		
Peugeot 307CC	4 Stars	2 Stars
Superminis		
Citroën C3 Pluriel	4 Stars	2 Stars
Nissan Micra	4 Stars	2 Stars
Renault Twingo	3 Stars	2 Stars
Large 4x4s		
BMX X5	5 Stars	1 Star
Volvo XC90	5 Stars	2 Stars
KIA Sorento	4 Stars	1 Star
Large MPVs		
Peugeot 807	5 Stars	1 Star
Renault Espace	5 Stars	2 Stars
Hyundai Trajet	3 Stars	1 Star
KIA Sedona/Carnival	2 Stars	1 Star
Small MPVs		
Ford Fusion	4 Stars	2 Stars
VW Touran	4 Stars	3 Stars
Roadsters		
MG TF	4 Stars	3 Stars

Ford Fusion

Volvo XC90

Related Sites: www.nrma.com.au
www.osa.go.jp
www.nhtsa.gov/cars/testing/ncap
www.highwaysafety.org

Effects of New Materials, Joining Technologies and Car Body Concepts on Crash Repair Methods

By Michael Weiland, Allianz Centre for Technology

Abstract: Repair methods must meet increasing demands with regard to the crash safety of road vehicles – especially passenger cars. Accident repair work must not affect a vehicle's deformation behaviour or crash safety. Nor may repair methods influence repair costs in the event of subsequent damage (second crash). In a series of tests conducted at the end of 1999, the Allianz Centre for Technology clearly demonstrated that these demands can be fully met by expert repair work which complies with manufacturers' specifications. The call for lighter vehicles along with higher torsional rigidity and crash safety makes the application of new materials, joining methods and car-body concepts virtually inevitable. As a result, deviations from hitherto common repair practices are already occurring. This trend will continue and considerably influence vehicle repair methods. Moreover, it must still be possible in the future to carry out accident repairs in such a way that they do not affect body stiffness, deformation behaviour, crash safety or repair costs in the event of a second crash. The steel industry and vehicle manufacturers should therefore give some thought to technical and visually equivalent repair solutions as early as the development phase. Otherwise, new vehicle concepts will not gain acceptance in the market, because they would result in considerably higher insurance premiums – something which motorists would not tolerate.

Keywords: Repair and crash behaviour, high-tensile steel, tailored blanks, tailored tubes, alternative joining methods.

1 Introduction

Repair methods must meet increasing demands with regard to the crash safety of road vehicles – especially passenger cars. Accident repair work must not affect a vehicle's deformation behaviour or crash safety. Nor may repair methods influence repair costs in the event of subsequent damage (second crash). In a series of tests conducted at the end of 1999, the Allianz Centre for Technology clearly demonstrated that these demands can be fully met by expert repair work which complies with manufacturers' specifications.

Because to the use of new materials and joining techniques, deviations from formerly standard repair practice can occur with regard to the repair of modern vehicles. Nevertheless, even here it is possible to meet the aforementioned demands in full. However, this presupposes that vehicle manufacturers offer appropriate repair solutions and ensure that repair instructions are available to every repair workshop and that the workshops, in turn, comply with these manufacturer and model-specific specifications.

The following explanations and repair examples are intended to sensitise steel producers, vehicle manufacturers and all institutions and skilled workers involved in crash repairs to the consequences of new technologies.

2. Use of high-tensile panels, tailored blanks and tailored tubes

The call for lighter vehicles along with higher torsional rigidity and crash safety makes the application of new materials, joining methods and car-body concepts virtually inevitable. With the help of these innovations, greater component stiffness and higher energy absorption can be achieved despite reduced wall thicknesses.

Thanks to the use of so-called tailored blanks, further progress can be made in terms of weight and energy absorption. In this method, two or more sheets are welded into plates by means of mash welding or laser welding. Various sheet thickness as well as various steel types can be used. This makes it possible to do without additional reinforcements at highly stressed sites by employing thicker or stronger sheets. Furthermore, gradually increasing resistance moment from the bumper to the bulkhead can be achieved by using plates that incrementally increase in thickness along their length.

Use of so-called tailored tubes manufactured by the high internal pressure forming method creates further possibilities for the use of more cost-effective, high-strength lightweight components with extremely complicated shapes. These are hollow bodies that are formed by high internal pressures and in some cases additionally by hydraulically exerted axial forces. The shaping usually has a positive effect on the hardness, tensile strength and fatigue strength of the component. Although such components have been used for some time, for example in exhaust systems, they are now increasingly being employed in highly stressed body parts.

Effects of New Materials, Joining Technologies and Car Body Concepts on Crash Repair Methods (Continued)

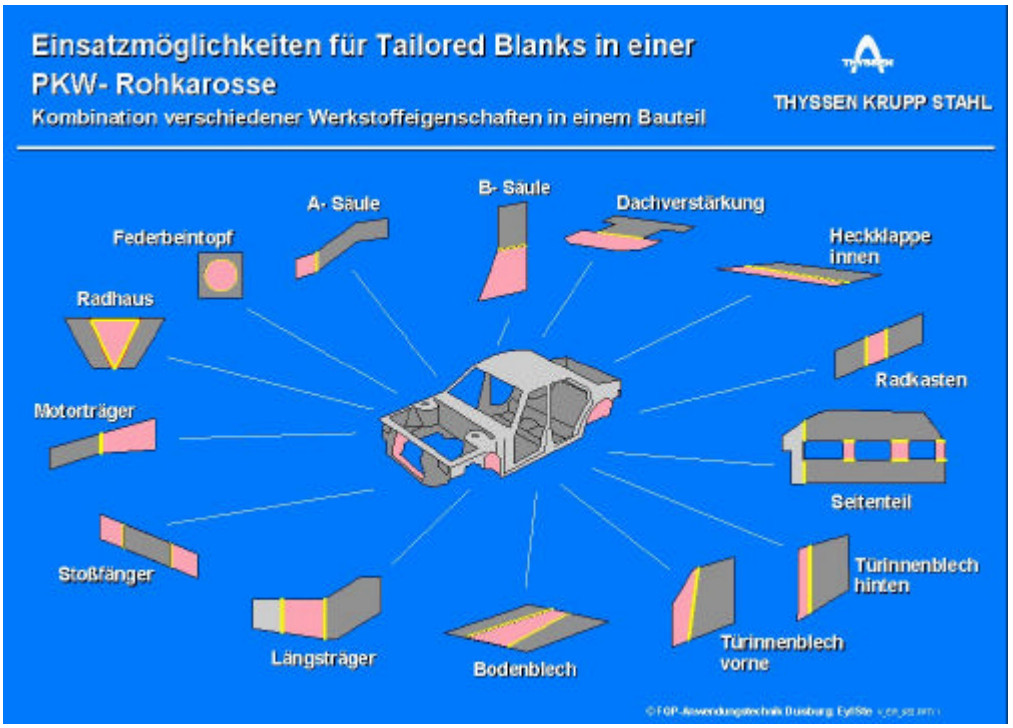


Fig. 1

Possible uses of tailored blanks in a car body
Combination of various material properties in one component

Legend:-	Radhaus	*Wheel well*	Seitenteil	*Side panel*
	Federbeintopf	*Spring strut well*	Türenblech hinten	*Rear door panel*
	A-Säule	*A-column*	Türenblech vorne	*Front door panel*
	B-Säule	*B-column*	Bodenblech	*Floor panel*
	Dachverstärkung	*Roof reinforcement*	Längsträger	*Main chassis member*
	Heckklappe innen	*Inside trunk lid*	Stossfänger	*Bumper*
	Radkasten	*Wheel arch*	Motorträger	*Engine mount*

3. Repair and Crash Behaviour

The aim in every car repair is to restore the vehicle's:

- Road and operational safety
- Operational strength
- Body stiffness
- Deformation behaviour
- Corrosion protection.

Restoration of the original deformation behaviour is particularly gaining importance. Repair methods must also take into account increasing demands with regard to crash safety. Thus, the reshaping of structural parts without subsequent removal of the substantially (sharp-edged) deformed area is rejected. If such sharp-edged deformations are repaired, substantial changes to the deformation behaviour must be expected. With high-strength steels the possibility of reshaping is severely limited in any case. In such cases the reshaping of even minor deformations can affect the yield strength and tensile strength of the material. Before any body repair work is carried out, it must therefore be considered very carefully whether reshaping is still permissible owing to possibility of structural deformation. In order to minimize effects on the deformation behaviour, which has been precisely calculated by the manufacturer and matched to the occupant protection systems, it is essential where marked deformations occur in the structural area – and this begins right at the tip of the main chassis member –that the part in question be replaced or a component replacement approved by the manufacturer be carried out. Expert repair complying with the manufacturer's specifications ensures that the deformation behaviour and crash safety are maintained in the event of further crash damage. This has been demonstrated by experiments at the Allianz Centre for Technology (AZT) and at the Institute of Automotive Engineering (KTI).

Resistance spot welding (RSW) remains the joining technique most commonly used in repairs. Moderately high-tensile thin sheet steel is also readily amenable to resistance spot welding. However, the welding parameters may vary considerably depending on the nature and thickness of the material to be joined. Likewise, moderately high tensile and especially high-tensile steels require substantially greater electrode tip forces, which cannot always be achieved with handheld resistance spot welding equipment. It is therefore essential to observe the repair guidelines or instructions of the manufacturer and to

Effects of New Materials, Joining Technologies and Car Body Concepts on Crash Repair Methods (Continued)

perform welding tests on such sheets in order to achieve approximately the same strength after repair welding as in the original condition. When repairing tailored blanks it is not possible to produce an equivalent joint in the area of the laser beam or mash weld. It is therefore mandatory to observe the manufacturer's model-specific specifications, which describe appropriate cutting lines or zones as well as the joining method to be used.

4 Joining Methods

Improved material properties can only benefit the structure as a whole if the material properties can be transferred to the adjoining structure through the use of suitable joining methods. The joining methods used in the automotive industry today can be divided into three categories:

Joining with heat:	**Joining without heat:**	**Combined joining methods:**
- Laser beam welding	- Punch riveting	- Spot weld bonding
- Resistance welding	- Clinching	- Mechanical joining and bonding
- Inert gas welding	- Lock seams	- Bolts and bonding
- Brazing/gas metal arc soldering/laser soldering	- Bonding	
	- Bolted connections	

Basically, these joining methods can be divided into those that rely on heat and those that do not. Joining techniques that do not use heat and combined methods have gained increasing importance in recent years. This is particularly true of materials whose properties could be altered by the influx of heat as well as metallically coated and/or organically coated materials whose coating must not be damaged. In addition, these joining techniques are also important for hybrid constructions that utilise

5 Repair examples

The following sections presents examples of problems that may occur during the repair of passenger cars. It should be stressed here that for modern vehicles it is of paramount importance to follow the manufacturer and model-specific repair specifications.

5.1 Example of replacement of a main chassis member

Depending on the scope of damage, the separating cut can be freely selected (Fig. 2a). Only in the area of the original mash welds should the cut not be made. The section of the main chassis member is properly positioned and butt joined by inert gas welding. When the cover plate (Fig. 2b) is welded in place, the spot welds must be placed parallel to each other and the specified spacing (here, for example, 45 mm) must be stringently observed.

Fig 2a

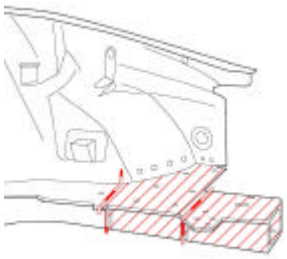
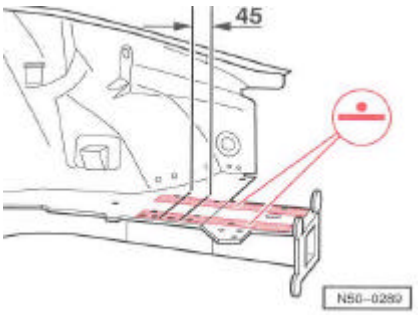


Fig 2b



5.2 Resistance spot welding of high-tensile sheets

Although moderately high tensile sheets are basically characterized by adequate to good resistance spot weldability, for thicker-gage sheets and three-ply sheet joints significant problems can occur in a workshop setting. The example (Fig. 3) shows a welded connection of the inside hinge column (1.0 mm - ZSTE 300 BH), the A-column reinforcement (1.5 mm-ZSTE 300 BH) and the outside A-column (2.0mm-ZSTE 300 Z). Here repair tests conducted by the manufacturer have produced unsatisfactory welding results, even with modern high-power spot welding guns. It was found that the welding current needed to be set in accordance with the number of sheets to be joined and that the available power of the systems and/or the electrode tip pressure was insufficient.

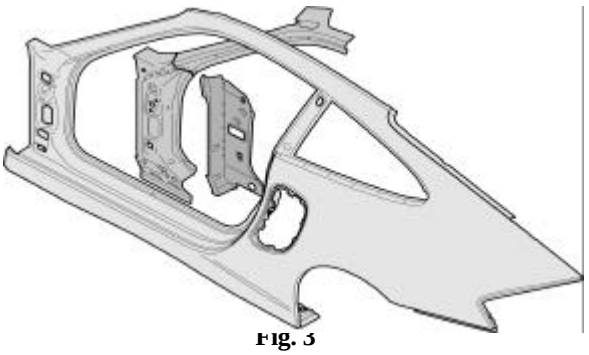


Fig. 3

Effects of New Materials, Joining Technologies and Car Body Concepts on Crash Repair Methods (Continued)

This example underscores the fact that it is now essential to first carry out suitable test welds on available old components using a roll-off test procedure and to stringently observe the manufacturer's repair instructions.

5.3 Joining methods that deviation from production methods

The following section describes the replacement of a roof panel that was continuously laser-beam welded to the side roof frame. Since this joining technique cannot be duplicated for repairs, the damaged roof panel is cut out in such a way that an approximately 20 mm flange is left along the weld. In this zone the new roof panel overlaps the residual flange and is joined by resistance spot welding and two inert gas beads (not visible in the photograph). In addition, four steel rivets (4 x 8 mm) are used at four precisely defined locations marked by the arrows (Fig. 4).

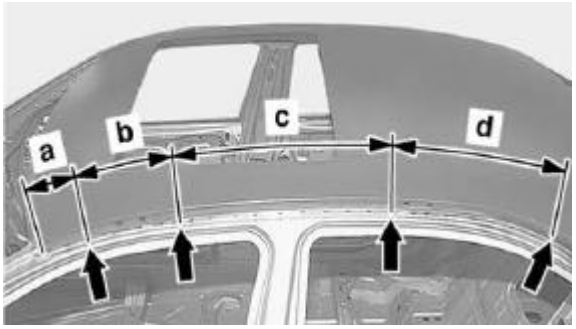


Fig. 4

5.4 Tailored Tubes

An example of the use of tailored tubes is the A-column/cross member construction of a modern convertible (Fig. 5a). The construction consists of five high-tensile steel tailored tube sections (Fig. 5b). By achieving adapted cross-sectional profiles and avoiding welds, the component behaviour is significantly improved. The high roof stiffness required for the safety of a convertible has been increased by more than 70 percent compared to conventional sheet-shell construction—without any increase in weight. In addition, the number of individual parts has been reduced by 44 percent. Repair methods for such tailored tube components are practically on-existent.

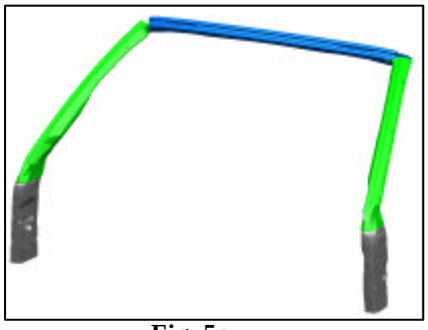
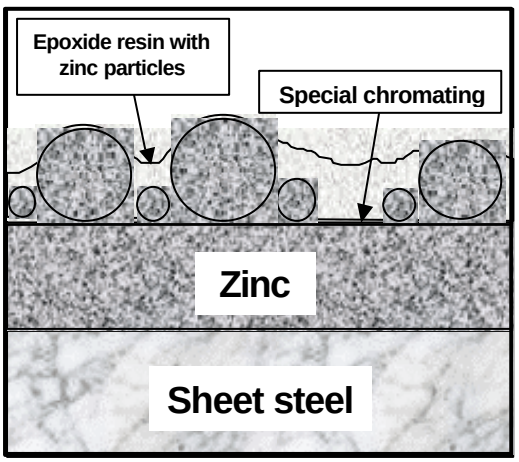


Fig. 5a

Fig. 5b

5.5 Coated body components



Coatings on metallic surfaces also influence repair methods. With the aim of further improving corrosion protection, steel manufacturers offer, in addition to the well-known galvanizing of body panels, active surface treatment concepts, for example additional organic coatings on galvanized body panels.

During repair welding the added layers may require special attention. The welding parameters, eg the welding current and pressure of the resistance spot welding gun, need to be adapted. Here the preparation of test welds is more important than ever – even for experienced welders.

Fig. 6 Schematic cross-section

Effects of New Materials, Joining Technologies and Car Body Concepts on Crash Repair Methods (Continued)

5.6 Foam-filled body sections / hollow bodies

Foam-filled body sections also have an influence on repair methods. Many manufacturers have adopted the foam-filling technique in order to improve acoustic and crash behaviour. Special repair methods are required for foam-filled sections (separating methods, connecting methods). Specifically, manufacturers supply special replacement foam blocks for repair purposes.

5.7 Arc soldering

Arc soldering is already used in various areas of car construction. Arc soldering methods can be divided into metal inert gas and tungsten inert gas methods. These are almost identical to metal inert gas welding and tungsten plasma welding with wire filler material. The filler materials used are brazing and high-temperature solders whose melting ranges are below that of the base materials.

Usually arc soldering is used on thin galvanized sheets (bodies), since the low melting temperature of the solder helps to achieve low zinc burning as well as low heat exposure of the components. Arc soldering is not yet used as a repair method. Here it is of utmost important to observe the model-specific instructions of the manufacturer regarding the joining method (welding, brazing or the like) to be used for repairs.

In the future arc soldering will also be unavoidable in automotive repair work. To this end, it is essential that workshops be fitted with the proper equipment and that staff receive the requisite training.

Fig. 7

5.8 Repairs using alternative combined joining methods

The following presents an example of a hybrid section repair on the rocker panel of a car of hybrid construction (Fig. 8).

The work sequence is as follows:

- The damaged component section is cut out along specified cutting lines (components with body saw, punch rivets with a press-out tool, bonded flanges with a flat chisel).
- The new part is trimmed, the duplicator is assembled using the old part, adapted and drilled.
- The adapted parts are removed and the bonding flange is cleaned and prepared for bonding (SACO-ROC, primer).
- Cement is applied to the flange.
- The parts are joined, fixed with clamping grippers and riveted in steps.

Note. Grinding and cutting tools must never be used alternately on aluminium and steel because of the danger of corrosion. Strict separation is necessary.

Fig. 8

Effects of New Materials, Joining Technologies and Car Body Concepts on Crash Repair Methods (Continued)

6 Conclusion

The future of automotive construction lies essentially in further reduction of the vehicle weight.

Today the steel industry is able to reconcile to a large degree opposing material properties – the yield strength and elongation after fracture – with the help of new alloy concepts and temperature-controlled production processes.

The use of moderately high-tensile and high-tensile steels in automobile construction has enormous potential for weight reduction and improvement of crash behaviour. If, in addition, new adaptations of previous constructions, tailored blanks and new joining techniques are used, an ideal compromise of all component properties can be achieved. This will ultimately be attained not least of all through the production of tailored blanks, which unite disparate requirements for materials, surface coatings and material thicknesses in one component.

Conventional resistance spot welding remains the joining method most commonly used in the modern production of vehicle bodies. Moderately high-tensile thin steel sheets are characterized by good spot welding properties. Provided that the basic welding parameters are properly selected, such as increasing the electrode tip force and adapting the dwelling time, hybrid connections can readily be realized between various soft and moderately high-tensile material qualities. However, it should be noted that the property profile of modern moderately high-tensile thin sheet steel is sometimes significantly altered by heat exposure. For this reason, joining methods that do not rely on heat as well as the combination of spot welding and bonding methods are gaining importance.

Moderately high-tensile steels also exhibit good properties with regard to inert gas welding. However, structural changes due to heat exposure are more likely to occur with inert gas welding of these materials than with resistance spot welding.

To an ever increasing extent tailored tubes are also being used in vehicle structures. These must meet high demands in terms of quality, service life and reliability in conjunction with relatively high process loads and associated demands. The production volumes of modern tailored tube systems for sophisticated automotive lightweight components show that the construction of suitable metal-forming tools is already feasible and that these components are already finding use in various high-quality vehicle bodies.

In comparison to point connecting elements, bonded joints provide a large-surface force-transmitting area between the joined elements. Bonding is particularly suitable for lightweight constructions in the automotive industry thanks to optimum utilization of materials. Bonded joints therefore make it possible to design light yet stiff and crash-safe vehicle bodies and mounted components.

Metal-forming joining methods such as clinching and punch riveting are being increasingly used in sheet metal working. Thus aluminum sheets as well as pre-coated and high-tensile steel sheets are being increasingly used in the production of components and structures from rolled semi-finished products and joined by punch riveting, etc.

It is therefore of paramount importance to sensitize bodywork repair and garage staff to the notion that, before carrying out bodywork repairs on a new vehicle generation, the question of which joining technique was used in production and which joining technique should be used for the repair must be considered. Where there is any doubt, the manufacturer should be consulted.

Automotive manufacturers and the steel industry should therefore give careful thought to technically and visually equivalent repair solutions as early as the development phase for new vehicles. Otherwise, new vehicle concepts will not gain acceptance in the marketplace, because they would result in dramatically higher insurance premiums - something motorists would not accept.

(The Author wishes to thank the following for their assistance: DVS [Deutscher Verband für Schweißen und verwandte Vertahren] and the DVS-working-group, ThysssenKrupp Stahl, BMW, Volkswagen, DaimlerChrysler and Porsche.)

From The Secretary General

Our June 2003 Newsletter brings news from 10 of our 24 Centres covering a range of topics including research projects and management changes. There is also news of ESV, held in Nagoya in May, of the latest Euro NCAP results released 26 June, and of course a longer technical article. I am delighted to include a paper on “Effects of New Materials, Joining Technologies and Car Body Concepts on Crash Repair Methods” written by Michael Weiland of AZT. Michael was head of the DVS working group, which developed the report. It is of course particularly relevant at this time when a number of centres are researching repair methods for new materials and the subject is to be discussed again at the forthcoming RCAR Conference in Sydney.

In May I travelled to Germany to visit KTI, welcome the new management team and to brief them on RCAR. I was extremely well received by Klaus-Dieter Moser, the new head of Centre (see Page 2 of this Newsletter). In addition to discussing RCAR

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The RCAR Network

Of the 24 RCAR Centres in 17 countries, 21 have web sites. Addresses are to be found on www.rcar.org. However, for convenience, web sites are also listed below.

AZT	www.allianz-azt.de
Centro Zaragoza	www.centro-zaragoza.com
CESTAR	www.cestar.it
Cesvimap	www.cesvimap.com
Cesvi Argentina	www.cesvi.com.ar
Cesvi Brasil	www.cesvibrasil.br
Cesvi Colombia	www.cesvicolombia.com
Cesvi Mexico	www.cesvimexico.com.mx
Folksam Auto	www.folksamauto.com
IBC/VIC	www.vicc.com
ICBC	www.icbc.com
IIHS	www.highwaysafety.org
JKC	www.jikencenter.co.jp
KART	www.kidi.co.kr
KTI	www.k-t-i.de
Lansforsakringar	www.lansforsakringar.se
MPI	www.mpi.mb.ca
NRMA/IAG	www.nrma.com.au
State Farm	www.statefarm.com
Tech-Cor	www.tech-cor.com
Thatcham	www.thatcham.org

Dates For Your Diary

Annual RCAR Conference 2003 is to be held in Sydney, Australia, 21-27 September 2003, and will be hosted by Insurance Australia Group (IAG).

47th Annual Conference of the Association for the Advancement of Automotive Medicine (AAAM)
Lisbon, Portugal, 22-24 September 2003
Details: http://www.carcrash.org

47th STAPP Car Crash Conference is to be held at San Diego, California. 27-29 October 2003.
Details: http://www.stapp.org.

NACE 2003 is to be held in Orlando, Florida.
4-7 December 2003.
Details: http://www.naceexpo.com

SAE 2004 World Congress is to be held in Detroit, Michigan, 8-11 March 2004.
Details: http://www.sae.org

4th International Symposium on Safety of Commercial Vehicles will be held 20-21 October 2004.
Details: angelika.hech@dekra.com

From The Secretary General (continued)

matters I spent time in the research workshop and was greatly impressed by the quality and depth of work being undertaken. One example was the welding of aluminium. KTI run courses for international delegates and one delegate I met was from Florida, USA. KTI face a number of challenges to meet the aims of their partners, not the least of which is to relocate to a more central position in Germany but at the same time expand this regional training, a challenge Thatcham is addressing with their regional training in the UK at present (see Thatcham Page 3). I wish Klaus-Dieter every success.

Whilst in Germany I also visited AZT and discussed initial planning for the 2004 RCAR meeting with Dieter Anselm and Hartmuth Wolff. Our conference next year is to be held in Berlin and is scheduled for 5-11 September to fit in with AutoMechanika the following week, 14-19 September. I also had an opportunity to see AZT's modified Crash Rig and to discuss a number of RCAR projects.

I can report strong support for RCAR in Germany and I thank my hosts at both centres for their kindness during my visit.

Returning to the subject of the Annual Conference in Sydney, at present I am putting together the Technical Programme which, as in the past, is both interesting and comprehensive. Apart from presentations from Centres there are three key discussion sessions on Head and Neck Injury, New Materials (to focus on New Steels) and Crash Testing. Early indications are that Robert McDonald is putting together a very interesting social programme. I shall also be presenting the results of the Conference Review and take this opportunity to thank all those Centres who responded to my questionnaire on the format of our annual conference.

I look forward to seeing RCAR Members in Sydney in September.

With best wishes, Michael Smith

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.

Automotive Online.	http://www.automotive-online.com
Automotive.com	http://www.automotive.com
AM-online	http://www.am-online.com
Associated Press.	http://www.ap.org
AutomotiveNewsWire.	http://www.brgtownsend.com
Bloomberg.	http://www.bloomberg.com
CeBIT	http://www.cebit.de
Cisco Systems	http://www.cisco.com
CMGI	http://www.cmgi.com
CNN.	http://cnn.com
Far East Newsletter.	http://www.feer.com
Financial Times.	http://www.ft.com
Fleet NewsNet.	http://www.automotive.co.uk
JUST-AUTO	http://just-auto.com
MSN.	http://www.msn.com
New York Times.	http://www.nytimes.com
Newspage.	http://www.newspage.com
ODETTE	http://www.odette.org
PRNewswire	http://www.prnewswire.com
REUTERS.	http://www.reuters.com
Roadtransport.	http://www.roadtransport.net
Silicon.	http://www.silicon.com
Slate.	http://www.slate.com
Wired.	http://www.wired.com
Wall Street Journal.	http://www.interactive.wsj.com
Yahoo!	http://uk.yahoo.com
ZD.	http://cgi.zdnet.com