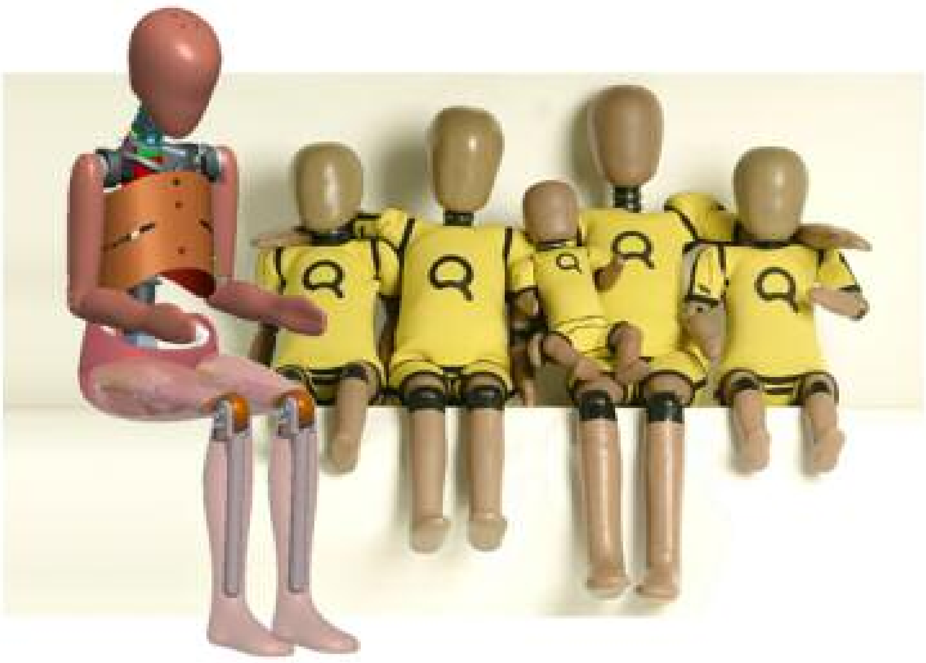
Enabling Protection for Older Children

SEVENTH FRAMEWORK PROGRAMME
THEME 7
Transport (including AERONAUTICS)

EPOCh 218744



EPOCh Final publishable summary report

by M Hynd, M McGrath

PROJECT FINAL REPORT

Grant Agreement number: 218744

Project acronym: EPOCH

Project title: Enabling Protection for Older Children

Funding Scheme: FP7

Period covered: from 01/01/2009 to 31/12/2011

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1 Executive summary

The implementation of Directive 2003/20/EC, dated 8 April 2003 (which amends Directive 91/671/EEC) means that children up to 150 cm in height must use a child restraint appropriate to their size when travelling in cars or goods vehicles fitted with seat belts. The affect of this legislation has led to children remaining in child restraint systems (CRSs) until they are older (up to 12 years old, depending on their height). The Directive states that the CRSs used must comply with UNECE Reg.44 (.03 series or later). The concept of the EPOCh project was to drive the improvement of safety for older children travelling in vehicles by extending the development of the protocols, test procedures and measurement tools necessary, in view of this new legislation, to carry out impact tests for restraint systems designed to protect older and larger children in vehicle collisions.

The project reviewed the available research and information relating to injuries received by older children in car accidents and carried out a small analysis of new UK data relating specifically to children between the age of 6 and 12 years. The focus was on determining the key injury mechanisms to identify the type of measurement capabilities needed by a dummy representing children of this size and in particular, where these older children are being injured and how.

Biomechanical and functional requirements were developed to form the basis for the dummy design and were brought together in a comprehensive specification. The recommendations for the dummy specification, based on the scientific research were disseminated to stakeholders. The feedback from the stakeholders favoured the development of a 10.5yr old dummy "Q10". This feedback was taken into consideration and the specifications were modified to reflect the revised plan for dummy size. The Anthropometric data of CANDAT (Child Anthropometry Database), which have been the basis of all Q dummy family members, were used for this task. Biofidelity, instrumentation, functional, handling and preliminary calibration requirements were developed. In addition, a means to show compliance with the biofidelity requirements was detailed and evaluation test matrices were defined. The most recent knowledge and techniques were brought together and reviewed for the investigation into injury risk curve development. This was followed by the development of a set of injury risk curves that could be used in association with the new Q10 dummy.

A prototype dummy was produced to the agreed specification and evaluated in certification type testing, including component and full body level evaluations to assess the dummy compliance with the defined requirements. Evaluation continued in a sled based environment to assess the dummy prototype's appropriateness for use in both Regulatory and consumer style testing.

Q10 Dummy

The injury risk curves were developed further to reflect the results from an assessment of the dummy thorax under belt loading and research results from the THORAX project. Pass fail criteria have been proposed, for use with the new dummy under Reg.44 conditions and also some suggested assessment bands for consumer testing.

A study was completed on whole body kinematics through video analysis and 3D motion analysis of the Q10, to provide further understanding of the physical process behind submarining. Submarining is a slouching motion occurring in frontal impacts consisting of a backward pelvis tilt, rounding of the spine, and slipping forward of the pelvis, resulting in poor routing and interaction of the seat-belt with the body, potentially causing injuries to the abdomen.

The project succeeded in achieving and exceeding all the objectives of the initial programme of work.

2 A summary description of project context and objectives

Across most of Europe, the law requires children younger than 3 years to use the child restraint appropriate for their weight in any vehicle (including vans and other goods vehicles). In vehicles where seat belts are fitted, the law now also requires children up to the age of 12 years or up to 150 cm in height to use an appropriate child restraint. Child restraints sold in the EU must conform to UNECE Regulation 44.

The concept of this project was to drive the improvement of safety for older children travelling in vehicles by extending the development of the protocols, test procedures and measurement tools necessary, in view of the recent changes in legislation, to carry out impact tests for restraint systems designed to protect older and larger children in vehicle collisions.

We expect that his will directly impact European and potentially worldwide testing and will specifically target the consumer assessment protocols of NPACS and findings on EPOCh project will feed into Phase 2 of the development of the new Regulation.

To date, the regulations in this field have relied on the P series child dummies as restraint loading devices. The projects of CREST and CHILD have worked on the development of the "Q" series of dummies, which have been recommended in the scientifically based NPACS assessment programme. However up until now, NPACS was unable to provide an assessment for children over the age of 6 years as there was no 10/12 year dummy appropriate for use in the side impact assessment. This has meant that consumers have not been able to make informed decisions on the purchase of CRSs and hence provide the best protection for their older children, and therefore was out of step with the recent changes in legislation. The EPOCh project has changed this.

The Q dummies could, in the future, also replace the P-series dummies in Regulatory testing if the family included a 10/12 year old dummy. The "P" series of dummies are less sophisticated than the "Q" and have not been designed to be biofidelic. Recommendations made in a paper presented on behalf of WG12 and WG18, (de Jager et al, 2005), were:

i. The assessment process should be extended to cover older children.
ii. The "Q" series of dummies should be extended including additional measurement possibilities.
iii. New injury criteria should be investigated.
iv. ECE-R44 focuses on frontal impact, this should be extended to include side impact.

The EPOCh project objectives were:

- To produce a 10/12 year old prototype dummy
- To extended the NPACS testing and rating protocols to include assessments of child restraints for older children
- To make proposals for performance limits that that will allow the assessment of child restraints in ECE Regulation 44 if the Q series dummies replace the P series in the future

The scope of the project was to implement a targeted small-scale co-operative action and consolidate results and findings from previous research efforts on child safety by completing the child dummy series and to develop the NPACS and R44 test procedures further, to accommodate the ability to assess the safety of CRSs for older children. This was expected to actively promote the safety of older children to the consumer by completing the NPACS CRS ratings which was expected also to contribute to the reduction of fatal and seriously injured child occupants in vehicles.

3 A description of the main S&T results/foregrounds

In task 1.1 the latest information relating to the injuries received by older children in car accidents was reviewed. This focussed on the key injury mechanisms and the measurement capabilities needed by a dummy that represents older children. A detailed report was produced and this is available from the EPOCh website (www.epochfp7.org). The review looked at how and where these older children are being injured whilst travelling in vehicles. It established the main priorities for the body areas that need to be protected by restraint systems and fed into the identification of requirements for the dummy.

The approach taken was to review the latest literature and current research relating to older children, which included a review of the previous work of CREST, ChILD, NPACS, EEVC etc. The study found that while many studies of child injury mechanisms include older children in their sample, very few studies describe in detail the types of injuries received by older children specifically. This shortfall of information was addressed, in part, by carrying out a small investigation of the Cooperative Crash Injury Study (CCIS) database, from the UK. The CCIS analysis supported the findings of the literature review. The head was an important body region for front and side impact collisions, the principle mechanism of injury being direct contact with the interior of the vehicle, resulting in skull fracture and/or local brain injury. Non-contact injuries due to inertial loading are rare in older children. Neck injuries were rare in the literature and in the CCIS analysis. However, a dummy must be capable of recording neck forces and moments to ensure that child restraint systems do not develop to permit excessive loads to this body region, in order to achieve benefits elsewhere. Chest injuries were also rare; nevertheless, major organs are found in the chest. A child restraint must be capable of distributing the impact forces over a wide area in a front impact collision and must protect a child from intruding structures in a side impact. A dummy that represents older children must be capable of measuring both chest acceleration and compression, in order to mitigate these risks. The abdomen was an important body region, especially for front impact collisions. The review found that the principle injury mechanism was loading from the adult seat belt at the site of the injured organ. This can result from submarining and/or from misplacement of the belt. A dummy that represents older children must be capable of detecting when submarining is taking place.

While pelvis injuries were relatively rare, the design of a dummy pelvis is important for a realistic interaction with the restraint system in front impact. In addition, measurements in the pelvis could help to determine when submarining is taking place. Direct loading of the pelvis is important in side impact collisions and hence a dummy must be capable of distinguishing the level of protection that a child restraint provides from intruding side structures.

Finally, extremity injuries were found in both front and side impact collisions. The principle mechanism of injury was loading applied (to the extremity) by the vehicle interior, resulting in fracture.

In task 1.2 the project focussed on the development of biomechanical requirements for the dummy. This task brought together all of the dummy requirements in a single report, to produce a comprehensive specification. The appropriate dummy size was

determined and biofidelity requirements were defined. Instrumentation requirements were defined based on task 1.1 results and functional requirements were set. Compliance assessment matrices were developed. This EPOCh consortium report, based on the research from tasks 1.1 and 1.2 recommended the development of a Q12 dummy. This size represented the 50th percentile age and mass of a 150cm tall child, that must currently use a CRS under Directive 2003-20-EC. These research results were disseminated to various stakeholder groups.
The stakeholders expressed a preference for a dummy with 10.5 year old anthropometry to represent an average sized child between the Q6 and the 150cm tall child. Their reasoning was that this would ensure that booster seats would still fit into the rear of current vehicles and the size of dummy would remain as traditionally used in R44 and tie in with the 36 kg limit in the current regulation.

The EPOCh team took on board the overwhelming feedback from the stakeholders and proceeded with the development of the Q10.5 dummy with 10.5 year old anthropometry.

Task 1.3 focussed on the specification of injury criteria and developed thresholds for these criteria, appropriate to the age and size of child. The task brought together the most recent knowledge and techniques on the development of injury risk functions through the scaling of adult data. The task also included a review of the material properties information available for children. Using preferred scaling techniques and the most up to date material properties, methods of calculating injury risk functions for the older child were presented. Scaling was then applied to generate risk curves or injury threshold values for the following parameters:

- Linear head acceleration
- Neck tension, anterior-posterior bending, and shear force
- Chest compression

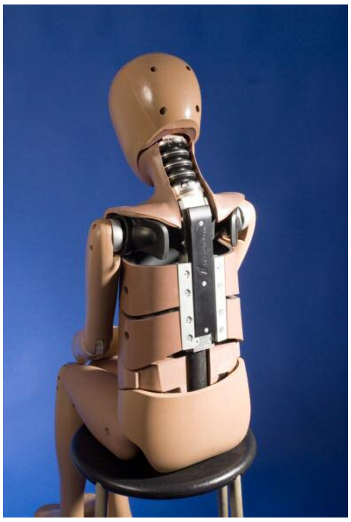
The input data and scaled products were compared against the limited information on child injury tolerance in the literature to check the proposed tolerance values. A report was produced and is available from the EPOCh website. The report also contains recommendations for ways of providing better scaling results, should this task be revisited in future projects.

The work of 1.3 was revisited (1.3a) to take into account some of the decisions made within the THORAX project, particularly the use of “survival analysis” when generating risk curves. Child injury information is certainly not prolific amongst the accident investigation and biomechanics literature. This means that injury risk functions developed for children are usually based upon a small number of data points and therefore have poor robustness (wide confidence intervals). The functions reviewed or derived certainly fall into that category. This means that care must be taken when using those risk functions to set an injury criterion. The level of confidence offered by the data needs to be kept in mind during any process using such a function.
This work has considered frontal test criteria for use with the Q10 dummy. There are only limited biomechanical data on which to base an extension of this work to side impact. Side impact testing is outside the scope of Reg.44 and as such it is not possible to compare P limits to Q response, for the development of equivalent limits. For this reason, the objective of EPOCh was to focus on the development of frontal impact limits for use in Reg.44. However, a similar approach can be taken in future studies, to define limits for side impact testing with the Q10 in newly developed regulations.
The revised injury risk functions have been compared with initial test results with the Q10 dummy under Regulation 44 conditions. Associated with this comparison has been an assessment of the feasibility for CRS manufacturers to meet prospective criteria. This has also been balanced with pragmatic expectations of how well the criteria may relate to current CRS performance and real world accidental injury incidence. As a result of this work proposals have been made as to the criteria which should be used with the Q10 in regulation 44 type conditions.

In task 2.1 a concept that complies with the requirements defined in the Design Brief (Task 1.2) was developed. A dummy selection report was produced and the work was presented to stakeholders as part of the dissemination activities in work package 5. The resulting Q10.5 dummy was designed to be a member of the Q-dummy family, and therefore Q-dummy concepts were adopted where possible. In addition, lessons learned from the lateral impact development of the Q3s and Q6s, in America, were taken onboard. Some concepts used in WorldSID 50th and 5th were considered, to optimise the combination of frontal and lateral performance in one dummy, especially in the pelvis area. Trade-off studies have been performed to facilitate the selection of the best solutions for the Q10.5 dummy.

The detailed design of the dummy, dedicated equipment and manufacturing tools was completed in task 2.2. The design detailing consisted of all the elements required to ensure that the manufacturing process would produce the dummy consistently. The production of two prototype dummies was achieved within the proposed timescales.

The Q10 head design is along the same lines as the Q6 head, the mass is tuned in such a way to prevent the occurrence of ringing, with airbag contact. The head design facilitates the use of a 6 channel accelerometer and angular rate sensor array and the application of a 6-channel high capacity upper neck load cell. The Q10 neck design is based on the Q3s neck design to simultaneously comply with flexion and extension as well as lateral performance requirements. The design includes a 6-channel high capacity load cell between the neck and the thoracic spine.



Q10 Dummy

Special attention has been given to the Q10 shoulder shape and position of the clavicle bone representation. The clavicle has a hinge at the shoulder joint side and the shoulder thoracic spine attachment is equipped with a steel wire to help prevent the shoulders sinking downwards under the weight of the arms. This allows the use of softer materials to allow more flexibility under forward inertia loading and better lateral impact compliance.

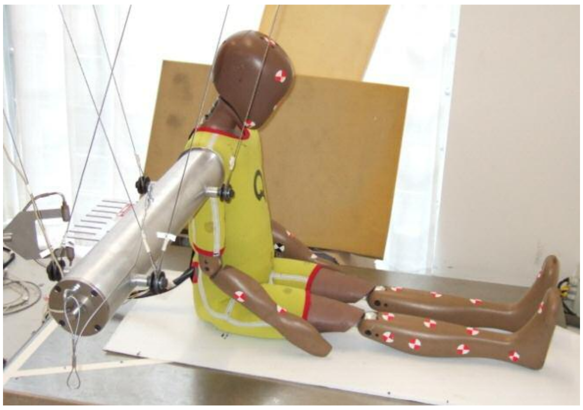
The Q10 thorax incorporates lessons learned in the Q3s development. The ribcage has a metal insert to improve the durability and the handling has been improved by making the rib cage attachment screws easily accessible from the back of the dummy. Rib cage displacement is measured with an upper and lower IR-TRACC, both of which can be mounted either for use in frontal or lateral impact. The abdomen is designed to fill the gap between the thoracic ribcage, the pelvis and the lumbar spine and extends downwards into the area between the ilium bones. The abdomen aims to prevent ribcage to pelvis contact and provide a human like interaction with the adult belt.

The Q10 pelvis is based on the WorldSID 5th percentile arrangement, aiming for a closer representation of the human ilium bone and pubic symphysis lay out than the smaller Q dummies. The design facilitates the use of load cells between the ilium bones and the sacrum block, which may provide extra information relating to lap belt ilium bone engagement.

The pelvis flesh is shaped to reduce the possibility of the lap belt being trapped in the cavities between pelvis and the legs.

The complete Q10 dummy assembly embodies several improvements over the other Q dummies to allow easier dummy handling. The dummy has been designed to contain 69 instrumentation channels, six will be tilt sensor channels meant for positioning only. For every part and assembly of the dummy, 3-D CAD models have been generated and detailed 2-D drawings produced.

In Task 2.3, the Q10 dummy was extensively evaluated and certification procedures were developed. The dummy dimensions are in compliance with the anthropometric requirements, although the mass of several parts of the Q10 will be fine tuned in the final design. This is the case for the upper and lower arm as well as the pelvis and lower leg.
The dummy was assessed in head drop, neck pendulum and full body wire pendulum tests, its biofidelity was assessed by its performance under frontal and lateral testing. For frontal loading conditions it can be stated that the dummy correlates well with biomechanical targets specified in the Q10 design brief. It is recommended to increase the impact stiffness of the head to perform closer to the middle of the corridor. For the neck it is recommended to modify the mould such that its stiffness increase in flexion, occurs earlier (now at 45 degrees, for ideal conditions, it should be between 30 to 35 degrees).



Q10 dummy in shoulder impact pendulum test setup

For lateral impacts the dummy showed a response which was initially too stiff and at later stages too soft relative to side impact biofidelity corridors. Identical trends were found for shoulders, thorax and pelvis meaning that the total load distribution over the dummy was such that none of the regions were overexposed with distributed side impact loading. It was recommended to reconsider the clearance between the hip joint hardware and the sacrum block to allow more freedom for the iliac wing to deform in side impact conditions.
Sensitivity studies were very positive, showing obvious trends to variations in impact speeds, impact direction and alignments. Repeated tests showed generally small variations in response of less than 2.5%. Only the T1- acceleration in the lateral shoulder impact test and the pubic symphysis load in the lateral pelvis impact tests show larger variations: 3.2% and 4.6% respectively. All the coefficients of variation are well within the required 5%. It is concluded that the Q10 dummy can be used as a repeatable tool.
The durability of the dummy meets requirements as specified. Separate reports, D3.1 and D3.2, describe the durability shown in sled tests according to UNECE Reg.44 and NPACS in detail.
The certification procedures outlined in D2.3 should be followed to ensure compatible dummy performance data. It recommends regular interval dummy certification testing for each dummy.

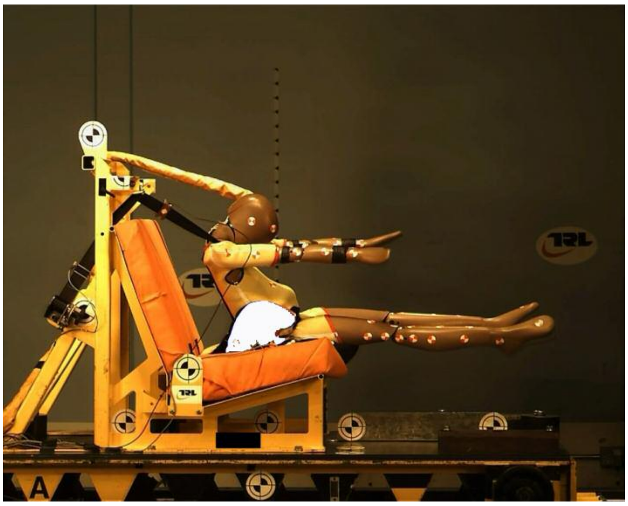
Task 2.4 was an ongoing study, which reported at the end of the project. It looked specifically at the mechanism of the submarining of older children, involved in impacts. The approach was to look at the whole body kinematics of submarining and, where possible, how this is affected by restraint design. The motion of the new 10.5 yr old crash test dummy was assessed, in the sled testing, with various booster systems, to investigate, and subsequently identify, key factors that influence submarining in the older child.

Submarining was defined, during the study, as the downward and forward motion of the pelvis in relation to the lap-belt, whereby the seat-belt's correct alignment and interaction with the body is compromised.

Currently under European regulation, child restraint systems (CRSs) are tested to ensure they meet a certain level of protection. Abdominal injuries are assessed using a clay insert in the current dummy's abdominal cavity (not available on Q dummies) and through the analysis of the impact test videos. This procedure, however, does not provide a definite way of determining the presence of submarining.

The aim of the work under Task 2.4, as stated above, was to provide a better understanding of the dummy motion through video analysis and motion tracking. Where clear cases of submarining and non-submarining were identified, these were investigated further to see if there were clear differences in the measured data from the dummy sensors.

The motion of the new Q10 was assessed, in the sled testing, with various booster systems, to investigate whether there were key factors of restraint design that influence submarining in the older child. The sled tests were recorded, mostly using conventional high speed cameras positioned on the side and above the sled and in some instances, also using infrared cameras.



Example of Submarining

The results revealed that distinct patterns of the torso-leg complex trajectory can be recognised in tests where suspected submarining took place. In tests with submarining the maximal horizontal displacement of the lower limbs is greater than in the non-submarining ones. Also, the vertical downward displacement of the thighs is delayed. This pattern was observed both for booster seats and booster cushions. The dynamic data from the built-in sensors in the lumbar spine, pelvis and torso, also showed distinct patterns in tests where submarining occurred. In booster seats the above mentioned dynamic data had a clear and repeatable pattern; chest displacement showed the most pronounced difference in both the timing and magnitude between submarining and non-submarining tests. In booster cushions, the patterns were less recognisable. This is because booster cushions, unlike booster seats, do not manage the movement of the dummy in a controllable way. The results suggest that lower limb kinematics as well as torso, lumbar spine, and pelvis dynamic measurements could be used in the future for the detection of submarining in booster seats.

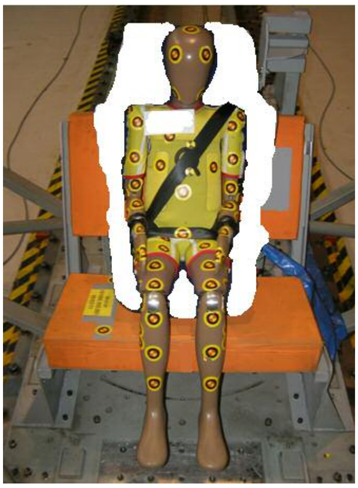
In tasks 3.1 and 3.2 the aspects of the Q10 dummy specification and validation relating specifically to the NPACS consumer testing programme and the UNECE Reg.44 respectively, were covered. Elements of these two tasks ran very much in parallel with each other. Test matrices for the practical assessment phase were defined and reported from the Work Package 1 design brief.

Task 3.1 related to the published NPACS protocols, which has three assessment categories; front impact, side impact and usability. This task focused on the dynamic assessment categories; front impact and side impact. One prototype Q10 was assessed in 51 NPACS front impact tests, conducted by IDIADA. The second Q10 prototype was assessed by TRL in 64 NPACS side impact dynamic tests.

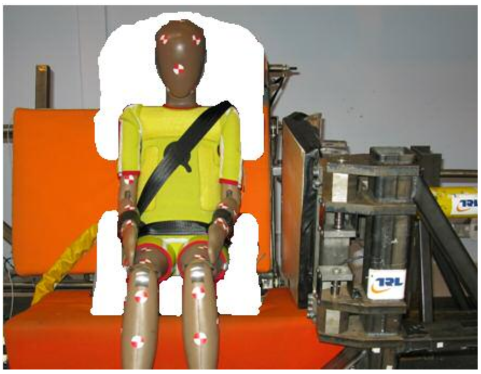
The study concluded that the Q10 is sensitive enough to show differences in dummy readings when the installation of the dummy is altered, in both front and side impact. It is also sensitive enough to detect and show specific patterns for different child restraint designs, in both front and side impact. The Q10 is durable enough to be used in the NPACS side impact tests. The Q10 suffered some failures of parts in the NPACS front impact testing. However design improvements of these parts (specified during the project) will be incorporated into the final version of the Q10. This should help to prevent the future failure of these parts. An expansion to the published NPACS scoring system has been proposed, to achieve an assessment and rating system, applicable to the Q10.

For the UNECE Reg.44 programme, two prototype Q10 dummies were assessed. One prototype Q10 was assessed by Dorel, in 65 Reg.44 front impact tests and the other was assessed by TRL in 50 Reg.44 dynamic tests.
It was concluded that the Q10 is durable in the Reg.44 front impact tests. The Q10 measures loading as expected related to its kinematic behaviour. The component testing in Task 2.3 showed that the Q10 is capable of producing repeatable results and this was borne out further in the results of the sled testing. The dummy can differentiate between different child restraint designs of the same type.
Comparison with the P10 showed that the kinematics of the Q10 is significantly different. The sophisticated thorax and shoulder design of the Q10 allows it to interact with the adult belt and achieves a more realistic restraint, unlike the P dummy, which slides out of the belt. This resulted in a difference in measured loading between the two dummies. Revised limits have been proposed for the Q10, when used in Reg.44 testing.

UNECE Reg.44 testing bench



NPACS Front Impact Test bench

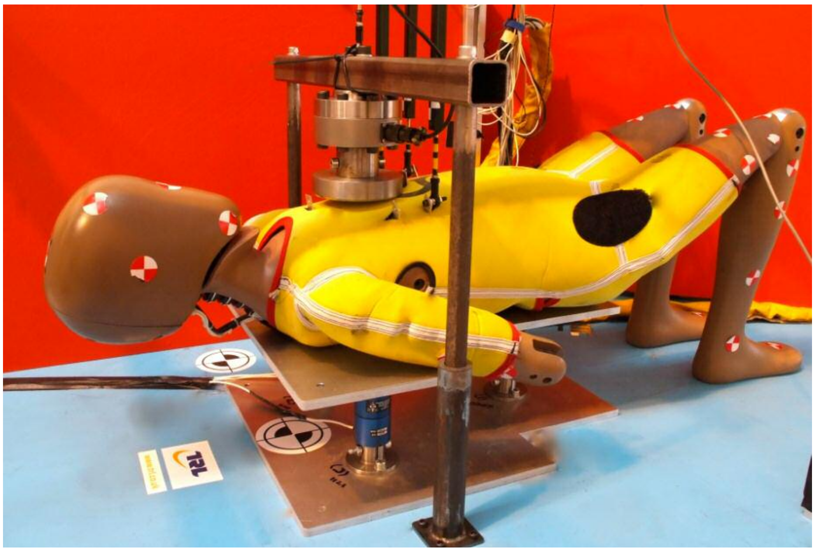


NPACS Side Impact Test bench

Two additional deliverables were added to Amendment V of Description of work, D3.1a and D3.2a.
Task 3.1a was added to investigate further the behaviour of the Q10 under NPACS test conditions. During the physical assessment of the Q10 under Task 3.1, described above, it was noted that the Q10 was incurring regular damage during NPACS frontal testing. The objective of 3.1a was to compare the dynamic behaviour of the Q10 in a NPACS front impact test on an acceleration sled to that carried out on a deceleration sled rig. The results were analysed to determine whether the same loading levels measured by the dummy, on the acceleration sled were reproducible on the deceleration sled. An extra 10 tests were conducted; 2 on each of the 5 child restraints assessed as part of the sensitivity to seat design phase of Task 3.1.
The outcome of D3.1a showed that, although the magnitude of the sled pulses were very similar, the loading to the dummy was phased slightly differently in the two systems. This meant that the maximum loadings to the dummy happened when it was in a

different position within its overall travel in one sled system, compared to the other. This effect was more pronounced with the booster cushion tests. The test results showed that generally the Q10 was able to measure reproducible results across the two test laboratories. The Q10 only measured consistently different measurements when tested on the booster cushion where the dummy was not as well restrained.

The additional Task 3.2a, added in Amendment V, was to assess the Q10 thorax and the relevance of existing biofidelity curves. This was undertaken in parallel with the development of the injury risk functions work (D1.3a). A programme of experimental work was undertaken to investigate the thoracic biofidelity in more detail. In particular the regional thoracic stiffness under diagonal belt loading was compared with adult dummy requirements. The thorax stiffness in response to belt or hub loading was also investigated. From the results it seems that the Q10 response shows similar trends to the responses obtained previously with adult PMHS and in this regard demonstrates good biofidelity.



Q10 Table Top Thoracic Testing

The objectives of Task 3.3 were to assess the impact that the new Q10 dummy may have. The aim was to give a high level assessment of the implications, if the dummy is implemented into Regulatory and Consumer testing (New Programme for the Assessment of Child-Restraint Systems (NPACS), European Testing Consortium and Euro NCAP). This included performing a brief cost benefit analysis to discuss the potential for benefits from injury reductions and the benefits to society.
The total annual cost of European casualties aged 9-11 was calculated using the European cost per European casualty multiplied by the estimated total number of European casualties.
The total additional annual costs to the child restraint industry for using the Q10 as a test tool in Reg.44 were identified and discussed. The potential annual benefits from using the Q10 in Reg.44 were estimated.
Assumptions were made to scale the costs of one manufacturer to represent all European child restraint manufacturers. It was also assumed that 100% correct usage and no child restraint misuse was present. This however produces a very optimistic view of the benefits. A similar process was conducted for the costs and benefits of using the Q10 in consumer testing.
In summary, the potential benefits of using the Q10 dummy in Reg.44 and consumer testing were found to be far larger than the costs. Therefore, in terms of benefits and costs, it is recommended that the Q10 should be used in Regulation and consumer testing. Although in order to achieve these benefits, the issues of non-use and mis-use of CRSs need to be addressed.

4 The potential impact

The dissemination and exploitation activities of EPOCh were designed so that the progress and results of the EPOCh project reached a wide audience, with the potential to have an immediate impact on child safety, by influencing test procedures and regulation. The targeted audiences have included manufacturing industry, road safety bodies, child safety bodies, consumer organisations, regulatory bodies and governments. An EPOCh dissemination plan, detailing the different routes to dissemination and exploitation, was developed and this was subsequently revised in collaboration with the fp7 COVER consortium.

The activities of work package 1, detailing the biomechanical requirements and design brief for the dummy were presented to international stakeholders; the project held a dissemination forum in June 2009, where these results were disseminated to representatives from other European Projects and research groups, including NPACS, EEVC WG12-18, CASPER and COVER. Subsequently, presentations were given at an informal GRSP meeting, where the results were disseminated to industry, consumer groups and governments from Europe, America and Japan. In addition, the work was presented to the EEVC WG12. The feedback from these groups was taken into consideration when making the final decision on the dummy size. The final dummy design brief was then presented at the Protection of Children in Cars conference in Munich, in December 2009.

A website was developed (www.epochfp7.org) during the course of the project. It contains information about the scope of the project and provides access to published technical reports and presentations. In addition to this, it provides links to other international websites relevant to protecting children in vehicles.

The objectives of this work package are achieved with collaboration, through the coordination activities of COVER. Exchanges of information were made across the biomechanical based projects, EPOCh, THORAX and CASPER that ran concurrently. These projects were running complementary research activities and optimise their outcomes and implementation of results from each of the individual initiatives through collaboration within COVER.

The dummy hardware was presented in Sept 2010, in Cologne, at the Kind und Jugend Trade Fair. In December 2010, a workshop was given alongside the POCC conference, by the EPOCh and CASPER projects. The coordination of this Workshop was facilitated within COVER. The results from EPOCh Work package 1 were disseminated into this workshop. A paper summarising the biomechanical performance against design requirements was also presented at POCC 2010 conference.

All published reports, papers and presentations can be downloaded, along with Workshop presentations, from the EPOCh website www.epochfp7.org.

In 2011, before the end of the project, five papers under each of the main areas of work were proposed for POCC 2011 conference. Two papers were accepted, a paper on Task 2.4 work on submarining and an overview paper incorporating the remaining four areas:

Q10 biofidelity – Dummy validation in certification type testing

Assessment of the Q10 dummy as a tool for use in UNECE Reg.44 Type Approval testing

Assessment of the Q10 dummy as a tool for use in NPACS testing

Development of Injury Risk Curves for the Q10 dummy

As an aside, all five topics will be more fully presented at the COVER workshop in 2012, thereby maximising the dissemination of the work undertaken on the EPOCh project.

Once EC Approval has been received all publishable deliverable reports will be uploaded to the EPOCh website.

A press release was made highlighting dissemination activities at POCC 2011 and COVER workshop 2012. A final press release will be made summarising EPOCh project.

A free downloadable PDF on the EPOCh expansion to procedures will be available on the EPOCh website.

An assessment was carried out as part of the EPOCh project to gauge the impact that the new Q10 dummy may have. The aim was to give a high level assessment of the implications if the dummy is implemented into Regulatory and Consumer testing (New Programme for the Assessment of Child-Restraint Systems (NPACS), European Testing Consortium and Euro NCAP). This included performing a cost benefit analysis to discuss the potential benefits from accident reductions and the benefits to society. The findings are outlined below.

- The total annual cost of European casualties aged 9-11 was calculated using the European cost per European casualty multiplied by the estimated total number of European casualties. The annual European total cost of casualties, for children aged 9-11 was estimated to be €1,269,600,250.
- The total annual costs to the child restraint industry for using the Q10 as a test tool in Reg.44 were estimated to be €591,450. The potential annual benefits from using the Q10 in Reg.44 were estimated to be €9,037,007.
- A similar process was conducted for the costs and benefits of using the Q10 in consumer testing. The total annual costs to the child restraint industry for using the Q10 in consumer testing were estimated to be €2,243,000. The potential annual benefits from using the Q10 in consumer testing were estimated to be €11,378,602.
- Assumptions were made to scale the costs of one manufacturer to represent all European child restraint manufacturers. It was also assumed that 100% correct usage and no child restraint misuse is present. This could mean that the benefits are actually reduced in both instances.

In summary, the potential benefits of using the Q10 dummy in Reg.44 and consumer testing were found to be far larger than the costs. This however is a very optimistic evaluation, as it assumes both 100% restraint child restraint use and 100% correct use of child restraint systems.

5 Web address and contact details

The results are published on the epoch website and are freely available on www.epochfp7.org .

The work described in this report was carried out by the EPOCh consortium. The EPOCh consortium management committee would like to acknowledge the European Commission for supporting this work. We would like to thank the teams within our organisations for their continued commitment and flexible approach, which was essential to achieve delivery of this project.

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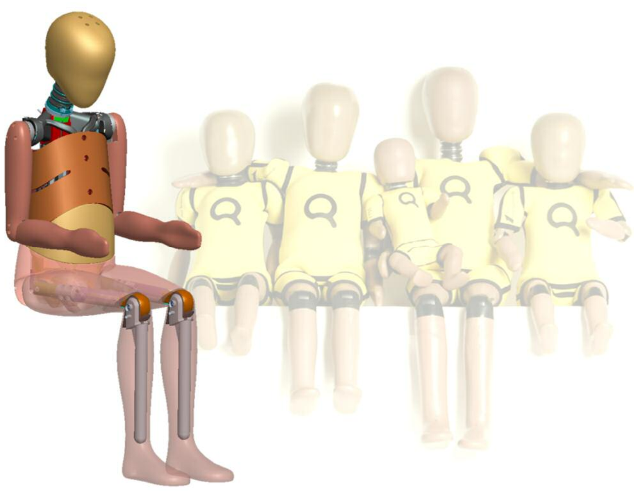

[3] [3] In Jan 2011 FTSS Europe BV was declared bankrupt. EU FP7 research activities were transferred to Humanetics Europe GmbH.