Welcome to the National Academies, TRB 92nd Annual Meeting
"Deploying Transportation Research - Doing Things Smarter, Better, Faster"

The National Academies Transportation Research Board (TRB) EMS Transport Safety ANB10(5) *January 2013 Subcommittee Meeting*

Thursday January 17th 8-12.30
at Keck Center Room 101

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Transportation Research Board 92nd Annual Meeting,
National Academies Washington, DC, January 17th, 2013
"Deploying Transportation Research - Doing Things Smarter, Better, Faster"

Emergency Medical Services Transport Safety Subcommittee ANB 10 (5)
2013 January Meeting:

ANB10(5) – EMS Transport Safety and Technical Science, Guidelines and Standards

Nadine Levick, MD MPH
Chair Emergency Medical Services Subcommittee ANB10 (5), TRB
CEO, Research Director, EMS Safety Foundation
Eileen Frazer RN
Co-Chair ANB10(5) TRB
Executive Director of Commission on Accreditation of Medical Transport Systems (CAMTS)

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This years TRB theme - "Deploying Transportation Research - Doing Things Smarter, Better, Faster"

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What is ANB 10 (5)?

- Emergency Medical Services Safety Subcommittee, ANB 10 (5)
  - Subcommittee of the Transportation Safety Management Committee ANB 10, of the Transportation Research Board of the National Academies

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EMS Safety Subcommittee ANB10(5)

- Subcommittee supported by Transportation Safety Management ANB10
- Established July 2007
- First Subcommittee meeting – Jan 2008
- Chair, Nadine Levick MD, MPH
- Co-Chair, Eileen Frazer, RN
- Scope – Medical Transport Safety

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Subcommittee structure

- Chair
- Co-Chair
- Secretary
- Technical Project Manager
- Liaisons

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Multidisciplinary research

- Encompassing all aspects of transportation
- The expertise that EMS needs to address its transportation safety challenges includes:
  - Systems design
  - Transport systems safety
  - Human factors
  - Vehicles
  - Vehicle operations
  - Air medical transport safety
  - Impaired operators
  - Road design and egress and access
  - Highway and operational hazards

Fragmentation

- There are now numerous and variably sound or technically sophisticated events occurring sporadically on ambulance safety – none under a transportation umbrella

ANB10 (5) TRB EMS Subcommittee Mission

- '*Bridging the gap between what we do and what is known - Enhancing ambulance transport safety through shared knowledge of technical data*'.

Integration

ANB10(5) is an independent platform for:

- Bringing fragmented information together
- Uniting diverse disciplines
- Focus on technically robust information

Technical Science, Standards and Guidelines

Fleet and Vehicle Standards

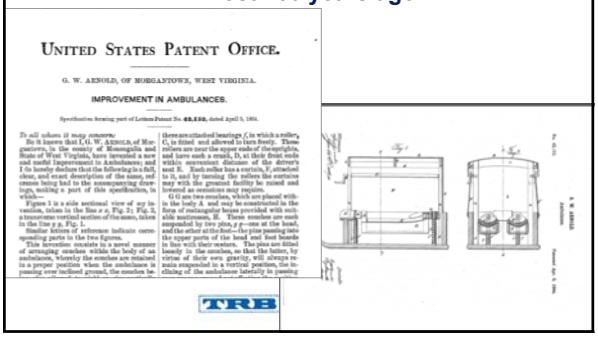
- Fleet
  - FMCSA/Exemptions
  - ANSI/ASSE Z.15
  - ISO 39001 – December 2012
- Vehicle
  - AMD
  - KKK
  - NFPA
  - ASTM
  - FMVSS
  - SAE
  - International - CEN/ASA

Letter to Abe Lincoln – 1864 re: safety of ambulance design

TRB TRAN

1864 Ambulance Design Patent and diagrams

Almost 150 years ago



UNITED STATES PATENT OFFICE.

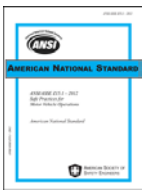
G. W. ARNOLD, OF MORGANTOWN, WEST VIRGINIA.

IMPROVEMENT IN AMBULANCES.

TRB

Safe Practices for Motor Vehicle Operations ASSE/ANSI Z15.1 2012

https://www.asse.org/cartpage.php?link=Z15_1_2012&utm_source=ASSE+Members&utm_campaign=b4472c203c-Z15_5_12_125_11_2012&utm_medium=email



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SAE equipment restraint

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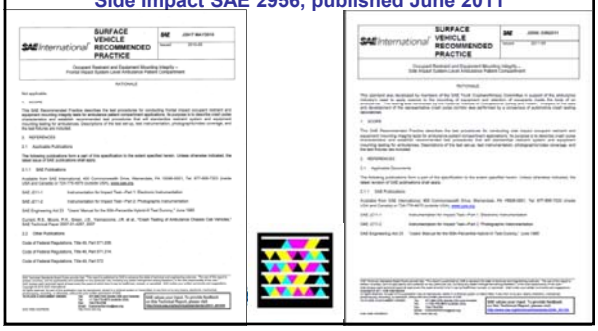
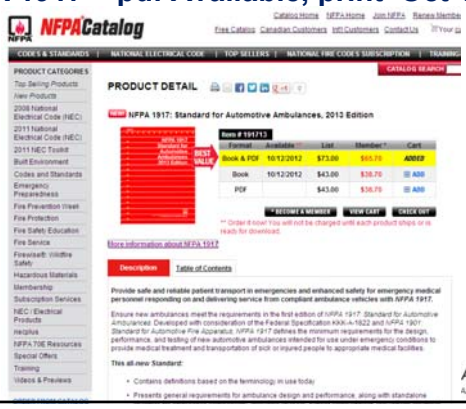
SAE Ambulance Equipment mounting testing standards

Frontal Impact SAE 2917, published May 2010
Side Impact SAE 2956, published June 2011



NFPA 1917 – pdf Available, print Oct 12



NFPACatalog

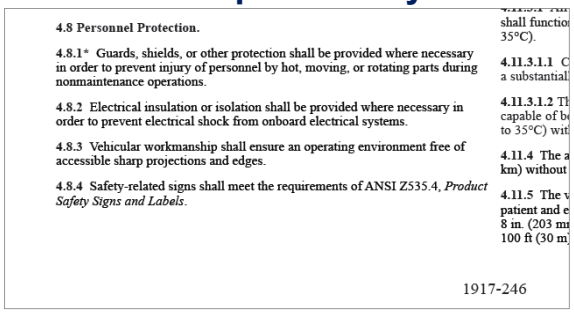
PRODUCT DETAIL

NFPA 1917: Standard for Automotive Ambulances, 2013 Edition

ARD
ADEMIES

Free 2013 NFPA 1917 Access

NFPA 1917 and Occupant safety….. ?



4.8 Personnel Protection.

4.8.1* Guards, shields, or other protection shall be provided where necessary in order to prevent injury of personnel by hot, moving, or rotating parts during nonmaintenance operations.

4.8.2 Electrical insulation or isolation shall be provided where necessary in order to prevent electrical shock from onboard electrical systems.

4.8.3 Vehicular workmanship shall ensure an operating environment free of accessible sharp projections and edges.

4.8.4 Safety-related signs shall meet the requirements of ANSI Z535.4, *Product Safety Signs and Labels*.

1917-246

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The big picture issues

- Neither NPFA nor KKK/AMD is a SAFETY standard – they do not use any injury outcome data - meeting NFPA/KKK requirements DOES NOT predicate safety for occupants
- The manufacturers understandably want to have one standard to design to
- "Certified testing labs" have nothing to do with injury criteria or the safety of occupants. These are NOT automotive safety testing centers, they have no injury outcomes that they test to - but are static metallurgy testing labs
- It is important that any standard does not conflict with existing technical safety science and does not obstruct scientifically proven safety developments

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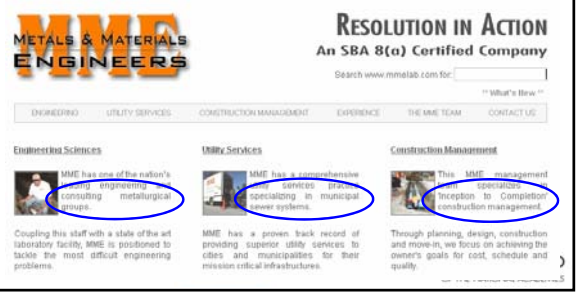
Yes a "nationally recognized testing lab" – BUT - NOT an automotive/occupant safety crash test lab!!



AMD ambulance '*safety testing*' ? – Is NOT consistent with accepted automotive safety and occupant protection practice…

NFPA 1917- Key issues identified

- Key that meaningful safety data drive the process
- Need for ambulance safety, injury and fatality mechanism outcomes data be used
- Integration and collaboration with technical automotive occupant protection and crashworthiness expertise is paramount

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NASEMSO MRAVD

Presentation Handout

http://www.objectivesafety.net/2012NASEMSOHO.pdf

National Association of State EMS Officials

MODEL RULES FOR AMBULANCE VEHICLE DESIGN (MRAVD)
PROJECT TEAM MEETING
September 24, 2012, Boise - Idaho

Standards, Science, Reality and Where are We Headed?

Nadine Levick, MD MPH
Research Director, EMS Safety Foundation
CEO, Objective Safety, New York, USA
Chair, TRB, EMS Subcommittee, National Academies

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NASEMSO

Model Rules for Ambulance Vehicle Design (MRAVD) initiative

http://www.nasemso.org/Projects/AgencyAndVehicleLicensure/AmbulanceVehicleDesignProject.asp

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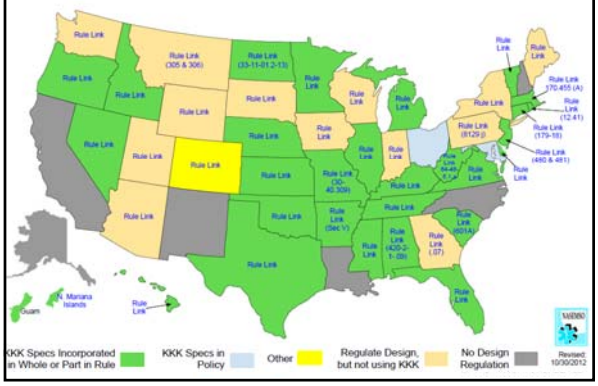
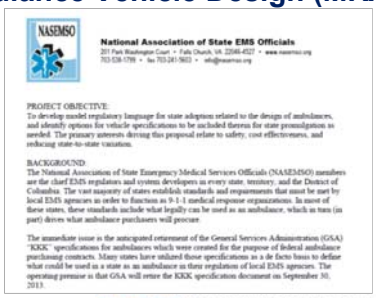
Incorporation of GSA KKK Specifications



August 1, 2012

NASEMSO - Model Rules for Ambulance Vehicle Design (MRAVD)



National Association of State EMS Officials

PROJECT OBJECTIVE:
To develop model regulatory language for state adoption related to the design of ambulances, and identify options for vehicle specifications to be included therein for state promulgation as needed. The primary interests driving this proposal relate to safety, cost-effectiveness, and reducing state-to-state variation.

BACKGROUND
The National Association of State Emergency Medical Services Officials (NASEMSO) members are the chief EMS regulators and system developers in every state, territory, and the District of Columbia. The vast majority of states establish standards and requirements that must be met by local EMS agencies in order to function as 9-1-1 medical response organizations. In most of these states, these standards include what legally can be used as an ambulance, which in turn (in part) drives what ambulance purchasers will procure.

The immediate issue is the anticipated retirement of the General Services Administration (GSA) "KKK" specifications for ambulances which were created for the purpose of federal ambulance purchasing contracts. Many states have utilized those specifications as a de facto basis to define what could be used in a state as an ambulance in their regulation of local EMS agencies. The operating premise is that GSA will retire the KKK specification document on September 30, 2013.

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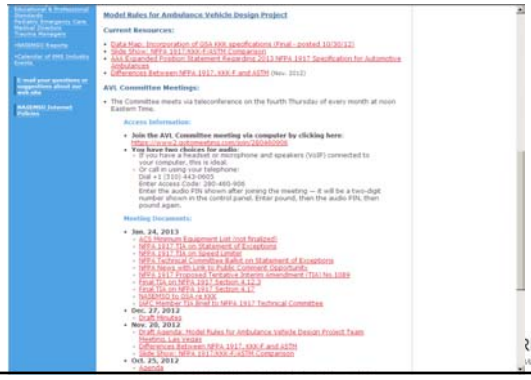
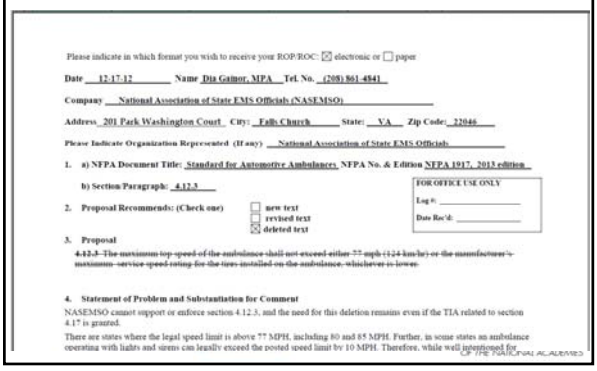
NASEMSO – MRAVD 2012-13

http://www.nasemso.org/Projects/AgencyAndVehicleLicensure/index.asp



http://www.nasemso.org/Projects/AgencyAndVehicleLicensure/documents/TIA-on-4-12-3-FINAL.pdf



Please indicate in which format you wish to receive your ROP/ROC: ☒ electronic or ☐ paper

Date 12-17-12 Name Dia Gainor, MPA Tel No. (208) 861-4841

Company National Association of State EMS Officials (NASEMSO)

Address 201 Park Washington Court City: Falls Church State: VA Zip Code: 22046

Please Indicate Organization Represented (If any) National Association of State EMS Officials

1. a) NFPA Document Title: Standard for Automotive Ambulances NFPA No. & Edition NFPA 1917, 2013 edition
   b) Section/Paragraph: 4.12.3

2. Proposal Recommends: (Check one) ☐ new text ☐ revised text ☒ deleted text

FOR OFFICE USE ONLY
Log #:
Date Rec'd:

3. Proposal
~~4.12.3 The maximum top speed of the ambulance shall not exceed either 77 mph (124 km/hr) or the manufacturer's maximum service speed rating for the tires installed on the ambulance, whichever is lower.~~

4. Statement of Problem and Substantiation for Comment
NASEMSO cannot support or enforce section 4.12.3, and the need for this deletion remains even if the TIA related to section 4.17 is granted.
There are states where the legal speed limit is above 77 MPH, including 80 and 85 MPH. Further, in some states an ambulance operating with lights and sirens can legally exceed the posted speed limit by 10 MPH. Therefore, while well intentioned for

OF THE NATIONAL ACADEMIES

http://www.nasemso.org/Projects/AgencyAndVehicleLicensure/documents/Updated-TIA-4-17-FINAL.pdf

4.17 Statement of Exceptions. The entity responsible for final assembly of the ambulance shall deliver with the ambulance either a certification that the ambulance ~~fully~~ complies with ~~all~~ minimum requirements of this standard, ~~or, alternatively,~~ When exceptions to this standard are required by the purchaser a Statement of Exceptions based on any exceptions to this standard that are required to meet the specifications of the purchaser shall be listed and attached to owners' manual. ~~specifically describing each aspect of the completed ambulance that is not fully compliant with the requirements of this standard at the time of delivery.~~

4.17.1 The Statement of Exceptions shall contain, for each exception at the time of delivery ~~noncompliant aspect of the ambulance or missing required item, the following information:~~

~~(1) A~~ a separate listing of the section(s) of the applicable standard for which ~~compliance is lacking~~ an exception has occurred
~~(2) A description of the particular aspect of the ambulance that is not in compliance therewith or required equipment that is missing~~
~~(3) A description of the further changes or modifications to the delivered ambulance that must be completed to achieve full compliance~~
~~(4) Identification of the entity that will be responsible for making the necessary post-delivery changes or modifications or for supplying and installing any missing required equipment to the ambulance to achieve full compliance with this standard~~

4.17.2 Prior to, or at the time of, delivery of the ambulance, the Statement of Exceptions shall be signed by an authorized agent of the entity responsible for final assembly of the

D
IES

The "Statement of Exception" goes to the liability risk to the manufacture should the purchaser desire to modify the vehicle. The risk should be shifted to the purchaser. The TIA has a detailed explanation.

NASEMSO's concern over the speed control was the states should determine a speed limit for ambulances and that some states have an 85 mph speed limit. Additionally, ambulance manufactures could only identify one manufacture of the device. And as noted in the TIA, not all chassis from different manufactures (i.e. Dodge) can accept the device. And members at the meeting agreed that the speed control could be disabled.

To be clear, the state directors are not suggesting that there not be any control of driving speed. They simple prefer to have the option to manage ambulance speed limits themselves, and consider other technology to assist – such as GPS tracking/monitoring, drive cam camera's that monitor speed and video tapes several seconds leading up to an event and immediately afterwards, or other electronic means. One ambulance system operator described using GPS monitoring where managers receive and immediate notice to their smart phones about a speed violation.

Technical Incident Advisory (TIA) path

AVL Committee to meet Jan 24 2013

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National Fire Protection Association

1 Batterymarch Park, Quincy, MA 02169-7471
Phone: 617-770-3000 • Fax: 617-770-0700 • www.nfpa.org

MEMORANDUM

To: NFPA Technical Committee on Ambulances

From: Yvonne Smith, Project Administrator

Date: January 2, 2013

Subject: NFPA 1917 Proposed Tentative Interim Amendment (TIA) No.1089

The attached proposed Tentative Interim Amendment (TIA) is being submitted to you for letter ballot. This proposed TIA was submitted by Dia Gainor and endorsed by Fred Schimmel, Paul Holzapfel and Aarron Reinert.

This proposed TIA will be published for public comment in the January 4, 2012 issue of *NFPA*

NFPA/KKK/ASTM comparisons

- NASEMSO
  - http://www.nasemso.org/Projects/AgencyAndVehicleLicensure/SlideShow_NFPA-KKK-ASTM-Comparison.pps
  - http://www.nasemso.org/Projects/AgencyAndVehicleLicensure/documents/NFPAfinalcondensedcomparisons11-12.pdf

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NFPA/KKK-A-1822/ASTM Comparison

	Requirement	NFPA	KKK-A-1822	ASTM
1)	AMD Testing Requirements	Includes a reference to third party testing laboratories for Generators 3KW or larger. NFPA (TBD) Proposes using some of the AMD Standards, but not 007, 013, 017, 019, 020, 022, or 023. Definitions are included on the last page.	Third party testing of AMD 001 through 025 required for type certification.	ASTM only references AMD 001 through 015 and allows third party or self-certification. (ASTM Current edition published March 2009)
2)	Cot Orientation	One patient located on the primary cot so positioned that care can be given from a selected seating position. No orientation of patient head position specified.	Primary cot is to be loaded so that it positions the patient's head forward in the ambulance.	Configuration A - All litters shall be loaded to position the patient's head forward in the vehicle. Configuration B – Requires accommodation for (2) patients - (1) primary and (1) secondary or (1) Primary and (3) secondary patients seated on the squad bench
3)	Payload Requirements	Purchaser sets minimum usable payload or refer to 5.1.1 for GVWR requirements	Type II – 1500 lbs Type I or III – 1750 lbs Type I or III AD – 2250 lbs	Type II - 1700 lbs Type I or III – 1750 lbs SRW Modular – 1500 lbs Note: March 2009 latest update

Differences Between NFPA 1917 (8/29/12), KKK-F and ASTM

Subject Topic	NFPA Section	NFPA Description	KKK-F Code	KKK-F Description	ASTM Code	ASTM Description
REFERENCED DOCUMENTS: Significant differences between referenced items used by NFPA - KKK - ASTM						
Chapter 2 – Referenced Documents						
Applicable Documents and References Cited	Chapter 2	Slight differences between KKK or ASTM referenced materials. Includes NFPA, ASTM, SAE, AMECA, ANSI / UL, Title 49 and Title 29 references.	2.1	KKK has been used as the basis for comparison of this item Includes NFPA, ASTM, SAE, AMECA, NTEA/AMD, ANSI / UL, Title 49 and Title 29 references.	2.5	Similar to KKK with exceptions Missing 29CFR1910.1030 Blood-borne Pathogens regulation. Missing 29CFR1910.7 Definition and requirements for a nationally recognized testing laboratory.
Manufacturer Self-Certification	4.7	Allows for many of the tests to be performed by the manufacturer provided that appropriate equipment, training, and a program for the calibration of all equipment is established.	4.3.3 4.3.5	N/A Requires third party testing by a nationally recognized independent testing facility certified to OSHA or ISO17025 standards	7.1	Quality Assurance Program & Self certification requirements documented.
Third Party and AMD Testing Requirements	N/A	Includes a reference to third party testing laboratories (4.4). Third party testing required for generator 3KW or larger [9.9.6.2]. NFPA has adapted some of the AMD test standards, excluding 007, 013, 017, 019, 020, 022, or 023. Definitions of excluded standards are included on final page	2.2	Third party testing of AMD 001 through 025 required for type certification.	2.6	ASTM only references AMD 001 through 015 and allows third party or self-certification. (ASTM Current edition published March 2009).
Chapter 3 - Definitions						
Cot Orientation	3.3.3	One patient located on the primary cot so positioned that the primary patient can be given emergency care during transit. No orientation of patient head position specified.	3.1.5	Primary cot is to be loaded so that it positions the patient's head forward in the ambulance.	6.1.5	Configuration A - All litters shall be loaded to position the patient's head forward in the vehicle. Configuration B – Requires accommodation for (2) patients - (1) primary and (1) secondary or (1) Primary and (3) secondary patients seated on the squad bench.

But should the comparison be between CEN and KKK/NFPA/ASTM??

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NFPA 1917

- Whilst safety is clearly a paramount goal for all in EMS
- A design standard is not the same as a safety standard
- NFPA is design standard not a safety standard

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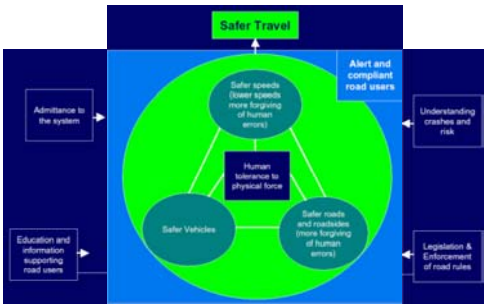
Safe Systems Approach



Source: Road Safety Branch, Infrastructure and Surface Transport Policy, Department of Infrastructure, Transport, Regional Development and Local Government, Australia.

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Occupant Systems Safety

- Occupant Safety in EMS is driven by both operational and biomechanical systems.
- Systems Safety integrating these two issues is key
- There is interaction of occupants with the system, with each other and with available seating options and vehicle interior, equipment and operational tasks.

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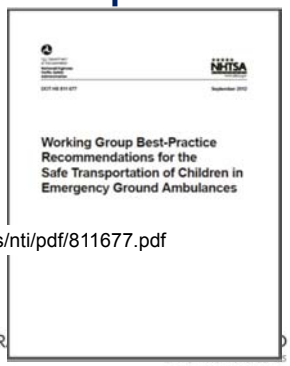
September 2012 Maryn/NHTSA report



http://www.nhtsa.gov/staticfiles/nti/pdf/811677.pdf

The meat in the sandwich

Maryn/NHTSA

- GOOD – there is focus on this with some good practice recommendations
- Bad – this has been done without input from technical expertise/literature
- *Ugly – some of the recommendations <u>are in conflict</u> with what the technical experts have determined is safe practice*

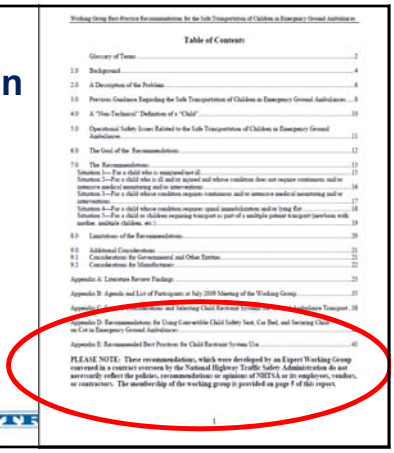
This NHTSA/Maryn document has some useful information BUT also complications and hazards!!

Sept 2012 - NHTSA's clear disclaimer

DISCLAIMER

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade names, manufacturers' names, or specific products are mentioned, it is because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

And again



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PLEASE NOTE: These recommendations, which were developed by an Expert Working Group convened in a contract overseen by the National Highway Traffic Safety Administration do not necessarily reflect the policies, recommendations or opinions of NHTSA or its employees, vendors, or contractors. The membership of the working group is provided on page 5 of this report.

Kids deserve

a proper technical guideline with core input from appropriate auto safety and occupant protection technical engineering expertise

http://www.objectivesafety.net/EMSSFCommentNHTSA2010-0089.pdf

Maryn Scenarios

Working Group Best-Practice Recommendations for the Safe Transportation of Children in Emergency Ground Ambulances

7.0 The Recommendations

The recommendations for the safe transportation of children via emergency ground ambulances from the scene of a traffic crash or medical emergency are presented as follows to address five situations:

Situation 1	For a child who is uninjured/not ill
Situation 2	For a child who is ill and/or injured and whose condition *does not require* continuous and/or intensive medical monitoring and/or interventions
Situation 3	For a child whose condition *requires* continuous and/or intensive medical monitoring and/or interventions
Situation 4	For a child whose condition *requires* spinal immobilization and/or lying flat
Situation 5	For a child or children who *require* transport as part of a multiple patient transport (newborn with mother, multiple children, etc.)

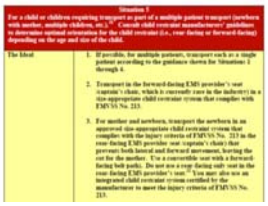
Key Issues

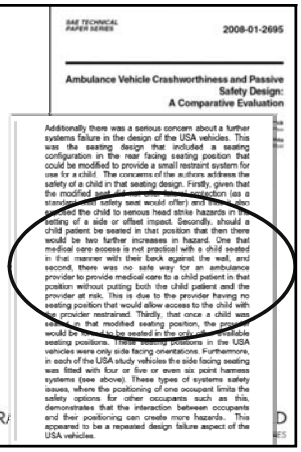
To quote Robert S. Salzar, PhD, Principal Scientist Center for Applied Biomechanics University of Virginia:

- "First, the restraint systems for any vehicle are only as strong as the weakest part
- AND current practices do not always mean best practices"

(Remember Galen and "laudable pus")

Maryn report make recommendations in conflict with peer reviewed technical engineering data





SAE TECHNICAL PAPER SERIES 2008-01-2695

Ambulance Vehicle Crashworthiness and Passive Safety Design: A Comparative Evaluation

Additionally there was a serious concern about a further systems failure in the design of the USA vehicles. This was the seating design that included a seating configuration in the rear facing seating position that could be modified to provide a small restraint system for use by a child. The concerns of the authors address the safety of a child in that seating design. Firstly, given that the modified seat [illegible] protection (as a standard child safety seat would offer) and [illegible] also exposed the child to serious head strike hazards in the [illegible] seating of a side or offset impact. Secondly, should a child patient be seated in that position that then there would be two further increases in hazard. One that medical care access is not practical with a child seated in that manner with their back against the wall, and second, there was no safe way for an ambulance provider to provide medical care to a child patient in that position without putting both the child patient and the provider at risk. This is due to the provider having no seating position that would allow access to the child with [illegible] provider restrained. Thirdly, that once a child was [illegible] in that modified seating position, the [illegible] would be [illegible] to be seated in the only [illegible] available seating positions. These seating positions in the USA vehicles were only side facing orientations. Furthermore, in each of the USA study vehicles the side facing seating was fitted with four or five or even six point harness systems (see above). These types of systems safety issues, where the positioning of one occupant limits the safety options for other occupants such as this, demonstrates that the interaction between occupants and their positioning can create more hazards. This appeared to be a repeated design failure aspect of the USA vehicles.

Known hazards!

- Securing a child to the rear facing Captains Chair – exposes that child to increased hazard as projectiles from within the ambulance vehicle have been demonstrated to be a hazard in that seating position in a sudden deceleration or crash.
- Additionally suboptimally restrained other occupants have been shown in full vehicle studies to strike this region of the interior of the ambulance

Demonstrated hazards!!

- **AVOID EVER**
  putting any children in the front passenger seat
  OR
  the rear facing Captains chair –

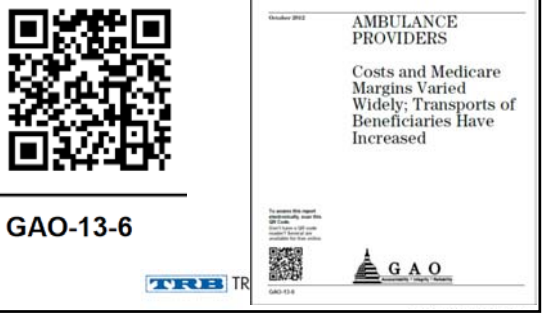
  evidence shows this is hazardous for both the child and others

Current technical Science suggests

- DO secure the child patient to the stretcher, if they fit and it is medically appropriate in a child car seat or in an immobilization device if they require critical care or immobilization
- Based on peer reviewed engineering data - *if the stretcher is occupied and there are multiple occupants* the squad bench is the optimal position to consider. Re: the squad bench seating positions -
  - A child car seat SHOULD be in the middle seating position
  - A seated child should AVOID the middle seating position
- As in all situations – DRIVE CAUTIOUSLY

GAO-13-6

http://www.gao.gov/assets/650/649018.pdf

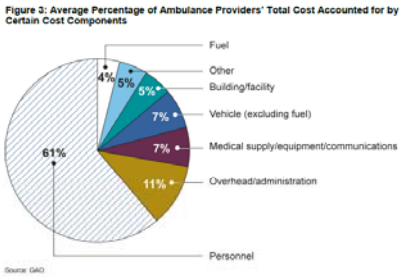


GAO-13-6

GAO findings

- Transports for all Medicare fee-for-service beneficiaries grew 33% 2004 to 2010
- Transports nationwide grew most in super-rural areas (41%) relative to urban & rural areas
- 59% increase in basic life support (BLS) nonemergency transports
- BLS nonemergency transports in super-rural areas grew the most—by 82%

Cost components



Research Problem Statements

Developed 3 small and 2 larger project outlines

1. Data definitions of:
   - i. ambulance
   - ii. emergency response
   - iii. ambulance crash
2. Essential/Optional Ambulance Equipment

   What does each state require? Expert panel to identify -:
   - i. essential equipment
   - ii. optional equipment
   - iii. equipment specific to regional needs
3. Fleet mix, by state

Research Problem Statements

2 larger project outlines

4. Effectiveness and cost effectiveness of EMS monitoring feedback devices

5. Determination of State based emergency vehicle data capture and analysis: police, fire and EMS

Forthcoming 2013 Plans:

- White paper focusing on Technical Science underpinning guidelines and standards
- Minitopic seminars
- Preparation for Safety Systems Strategies & Solutions Summit 2014
- Enhance social media foot print

New Business

- New projects
- Task Force?

Any questions or comments?