

# **International Association of Chiefs of Police**

## **Digital Video Systems Minimum Performance Specifications Document**

Version 14 – 11/21/2008



**In-Car Video Camera Systems  
Performance Specifications:  
Digital Video Systems Module**

The seal of the International Association of Chiefs of Police is centered in the background. It features a circular emblem with a laurel wreath border. Inside the wreath is a shield with a scale of justice and a sword. The text "INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE" is written around the top inner edge of the wreath, and "SINCE 1893" is at the bottom.

SINCE 1893

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## Welcome

For a number of years, the IACP has recognized the value of mobile video recorders for the protection of officers, their agencies, and the public they serve. As new digital technology rapidly began to replace existing analog systems, the IACP was concerned with the quality and reliability of the technology. To ensure the continued success of in-car camera programs, in 2005 the IACP Cutting Edge of Technology Project was tasked with establishing minimum performance specifications for digital in-car video systems.

The objective of this initiative was two-fold: 1) As law enforcement leadership recognized that those managing in-car video systems had little in terms of impartial information with which to evaluate, purchase, and manage systems, it became imperative that a document was needed to provide objective guidance and outline optimum system parameters that would promote officer safety and quality video for evidentiary purposes; and 2) It was necessary for manufacturers and system providers to better understand the overall needs of their law enforcement customers in the design and marketing of these digital in-car systems.

Through a grant from the U.S. Department of Justice, National Institute of Justice (NIJ) Office of Science and Technology, the IACP established a Digital Video Systems (DVS) Advisory Panel in March 2005 that included voluntary participation from law enforcement practitioners, video system manufacturers, and the scientific and technical community. Six task groups were formed to address specific components of the technical specifications document: quality measurement, data security, operational measurements, officer safety, interoperability, and testing and certification.

Over the next three years, the DVS Advisory Panel participants conducted field tests at various locales using multiple police agencies and vehicles in an effort to:

- Identify a standard “theater of operations” defined by the field-of-view of an in-car camera during a routine traffic stop. In doing so, the Panel sought to determine the relative sizes of critical objects (e.g. license plates, weapons) within the field-of-view.
- Examine the effects of operating conditions (e.g. inclement and extreme weather and light level) on the ability of standard systems to resolve critical objects.
- Measure the quality of video recordings produced by in-car systems as compared to known test criteria to develop parameters for performance of the in-car systems.

Following multiple field measurements, lengthy collaborative discussions, and a series of Advisory Panel meetings between 2005 and 2008, this document is the culmination of a great deal of effort and dedication from all parties involved in this initiative. Yet as with seemingly any technological innovations, digital in-car camera systems technology is certain to evolve. Thus, the IACP intends for this to be a living document, monitoring industry advancements and technology as it matures and advances.

## **Special Acknowledgements**

The reader will find a complete list of participating agencies and IACP staff within Appendices F and G, but the International Association of Chiefs of Police wishes to first recognize a number of notable individuals and organizations for their dedication and tireless efforts towards the completion of this technical document:

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## Foreword

Over a period of three years, a panel of law enforcement representatives, scientists, and equipment manufacturers worked together in an unprecedented effort to develop a set of minimum performance benchmarks for digital in-car video systems. This open letter to all the participants in this project is to thank you – and commend you – for the spirit of cooperation, collegiality, and dedication to common goals that made this a true collaboration.

We all recognized the value of video technology for enhancing officer safety, fighting crime, and strengthening public support of the police.

Now it is up to all of us – equipment manufacturers, scientists, and police officers – to carry the message of this document forward to our customers and colleagues. It is our collective responsibility to make sure the technology in use by law enforcement is capable of providing high quality evidence to protect both the public and the police.

Industry representatives should use this opportunity to forge new relationships with each other. Use your renewed commitment to high quality video technology to identify to your customers the products that will best support police officers and the citizens they serve.

Law enforcement officials must use the power of peer-to-peer communication to inform colleagues of the critical importance of the quality of the images. In recent years, numerous court cases have depended on video from mobile recorders to help defend officers against charges of misconduct or, sadly, to speak for officers who are unable to speak for themselves.

The scientific community must help us find objective methods of measuring image quality, push the boundaries of current technology, and identify emerging technologies. Sharing this knowledge will benefit all stakeholders.

We want to sincerely thank all who have participated in this project, but remind you that the work is not yet complete. Some formidable challenges still lie ahead, and we will continue to count on your dedicated support of the goals of this project as these minimum standards, specifications and accompanying documents adjust to technological and scientific advances as we move into the future of digital media and its adopted use in public safety..

**Chief Mike Burridge (ret)**

L3-Communications Mobile-Vision

“Digital Video Standards for Public Safety” Executive Committee Co-Chair

<b><u>TABLE OF CONTENTS</u></b>	<b><u>PAGE</u></b>
<b>Welcome Letter</b>	<b>iii</b>
<b>Special Acknowledgements</b>	<b>iv</b>
<b>Foreword</b>	<b>v</b>
<b>Section 1 – General Information</b>	
1.1    Scope	1
1.2    Purpose	1
1.3    Application	1
1.4    Definitions	1
1.5    Acronyms	8
1.6    Units of Measure	9
<b>Section 2 – Applicable Standards</b>	
2.1    Industry Standards	10
2.2    White Paper Requirement	10
<b>Section 3 – Officer/Occupant Safety</b>	
3.1    Requirements for Any and All Physical Equipment Installed in Motor Vehicles for the Purpose of Collecting Digital Multimedia Evidence (DME)	11
3.2    Items Carried by the Officer	13
3.3    Record Indicators	14
<b>Section 4 – General Mobile Video System Specifications</b>	
4.1    Mobile Video Systems Components	15
4.2    Vehicular Recording Front-facing Primary Camera System	15
4.3    Vehicular System Electric Conditions	18
<b>Section 5 – Security Features</b>	
5.1    Restricted Access to Programming Functions	19
5.2    Erasure Prevention	19
5.3    Vehicle Recording System Integrity	19
5.4    Consistency	19
5.5    DME Verification	19
5.6    Transfer of Digital Assets	20
5.7    Vehicle Recording System Security	23
<b>Section 6 – Digital Asset Recording</b>	
6.1    Video Systems Measurements	25
<b>Section 7 – Interoperability</b>	
7.1    Active or Archival Storage Server	29
7.2    Active Storage and Archival Storage Interoperable Exchange	30

<b><u>APPENDICES</u></b>	<b><u>PAGE</u></b>
Appendix A Recommended Policies and Best Practices	31
Appendix B Federal Motor Vehicle Safety Standards 201, “Occupant Protection in Interior Impact”	38
Appendix C Federal Motor Vehicle Safety Standards 205, “Glazing Materials”	71
Appendix D Interoperability Chart	75
Appendix E Acknowledgements: DVS Executive Committee	76
Appendix F Acknowledgements: Participating Agencies/Organizations	77
Appendix G Acknowledgements: IACP Staff	79

## **Section 1 – General Information**

### **1.1 Scope**

The scope of this document is limited to vehicular video and audio recording systems used by law enforcement agencies for recording events occurring in and around the vehicle.

### **1.2 Purpose**

The purpose of this document is to establish minimum performance specifications for digital recording systems to enhance 1) officer safety, and 2) the effectiveness of audio/video evidence by identifying the scientifically measured, minimum performance levels appropriate for use by law enforcement. To achieve this mission, the performance of digital systems must be objectively measured and the level of performance necessary and appropriate to meet the needs of law enforcement must be identified.

The requirement to comply with these specifications applies to any mobile digital video equipment delivered to a law enforcement agency 18 months following the published date of the specifications. Said equipment must meet the minimum performance specifications and show proof of certification and compliance, as determined by the International Association of Chiefs of Police (IACP).

### **1.3 Application**

This document applies to vehicle-mounted digital video recording systems that record at least one camera. This document also applies to vehicle-mounted digital video and audio recording systems that record at least one camera and at least one microphone.

The minimum electrical hazard and performance requirements outlined within this specifications document are based on limited international harmonized requirements that may not be all inclusive for the local country, i.e. normative body. Additional consideration should be given when evaluating products to such electrical hazard and performance requirements outlined within this specifications document as it relates to the local authorities having jurisdiction outside of the United States.

### **1.4 Definitions**

“Will, Shall, Must;” denote mandatory key safety items that are crucial for officer safety and “shall” not be deviated from.

“Recommended, Should, May;” state preferred practices that agencies “may” deviate from.



- 1.4.1 **Acceptance Test:** This refers to any procedure used when a new product is received, or a product is returned from maintenance, to verify that a product or software is performing according to the manufacturer's specifications for a specific use. Common examples include but are not limited to: the use of diagnostic software to test a new computer before it is used to process evidence, and the processing of a set of known standards to verify that the known standards can be processed within an acceptable range of results.
- 1.4.2 **Accuracy:** Refers to how close the actual value obtained is to the range of acceptable values. For example, is the color balance close enough to the optimal color balance to be considered an accurate photographic reproduction? Also refers to the margin of error in measuring a value.
- 1.4.3 **Active Storage:** A storage location or device (i.e. server) which Digital Multimedia Evidence (DME) is transferred to from the in-vehicle recorder using any method. Active Storage shall provide ready access to recently recorded DME which has not been moved to Archival Storage due to elapsed time from the original recording creation date. Access to DME in Active Storage may or may not require administrator interaction based on departmental policy.
- 1.4.4 **Administrative Review:** A procedure used to check for consistency with agency/laboratory policy and for editorial practice.
- 1.4.5 **Ambient Interference:** The conducted and/or radiated electromagnetic interference and/or mechanical motion interference, at a specific test location and time, which might be detrimental to the proper recording system or device performance.
- 1.4.6 **Amperage:** A measurement of electrical current
- 1.4.7 **Archival Image:** Any image placed on media that is suitable for long-term storage.
- 1.4.8 **Archival Storage:** A storage location or device to which DME is moved after a designated amount of time. Access to DME contained within Archival Storage may be limited and may require administrator authorization to review or move back to Active Storage.
- 1.4.9 **Archive:** Offline storage of DME intended for long-term storage and retrieval.
- 1.4.10 **Archive Copy:** A copy of data placed on media suitable for long-term storage and retrieval.
- 1.4.11 **Archive Image:** 1) any image placed on media that is suitable for long-term storage. 2) a bit stream duplicate of the DME placed on media that is suitable for long-term storage and retrieval.

- 1.4.12 **Archiving:** Long-term storage of data.
- 1.4.13 **Authentication:** 1) a security measure designed to protect a communications system against acceptance of a fraudulent transmission or simulation by establishing the validity of a transmission, message, or originator. 2) a means of identifying individuals and verifying their eligibility to receive specific categories of information. 3) evidence by proper signature or seal that a document is genuine and official. 4) in evasion and recovery operations, the process whereby the identity of an evader is confirmed. 5) a means of proving the origin of the evidence and that it has not subsequently been altered (or, where alteration has occurred, that such alterations are properly identified). 6) the process of determining whether a recording or image is original, continuous, and free from unexplained alterations.
- 1.4.14 **Authenticity:** The quality or condition of being authentic, trustworthy, or genuine.
- 1.4.15 **Bundled:** Accessories or software that are included in the purchase of the main item such a computer or a major software application.
- 1.4.16 **Capture:** The process of producing the DME from a natural event.
- 1.4.17 **Capture Device:** A device used to record DME and associated metadata.
- 1.4.18 **CD/DVD (compact disc/digital versatile disc):** Optical disc formats designed to function as digital storage media.
- 1.4.19 **Chamfer:** To cut off the edge or corner of, bevel.
- 1.4.20 **Chain of Custody:** The chronological documentation of the movement, control, locations and possession of evidence.
- 1.4.21 **Codec:** A device/program capable of encoding and/or decoding digital data. Codecs encode a stream or signal for transmission, storage or encryption and decode it for viewing and listening.
- 1.4.22 **Compression:** The process of condensing the size of a video file (measured in bits per second for a stream, or bytes for a file/clip).
- 1.4.23 **Consistency:** The degree of uniformity, standardization, and freedom from contradiction among the video/data or parts of a system or component.
- 1.4.24 **Copy:** An accurate reproduction of information.

- 1.4.25 **Corruption:** A process wherein data in memory or on disk is unintentionally changed, with its meaning thereby altered or obliterated.
- 1.4.26 **DAT:** Digital Audio Tape
- 1.4.27 **Data Extraction:** The identification and recovery of information contained within a recording, which may not be immediately apparent through visual/aural inspection.
- 1.4.28 **Data File:** A set of binary information representing DME.
- 1.4.29 **Data Integrity:** The accuracy of data and its conformity to its expected value, especially after being transmitted or processed.
- 1.4.30 **Date Stamping:** A software feature that automatically inserts the current date into the data file.
- 1.4.31 **Digital Image:** A photographic image that is represented by discrete numerical values organized in a two-dimensional array or video stream. Each discrete block of the array is called a pixel.
- 1.4.32 **Digital Multimedia Evidence (DME):** Data representing audio essence, video essence, metadata, and any other information attached to a digital file.
- 1.4.33 **Digital Recording:** The storage of information in a binary-encoded (digital) format. Digital recording converts information (text, graphics, sound, or pictures) to strings of 1s and 0s that can be physically represented on a storage medium.
- 1.4.34 **Display:** A visual readout device.
- 1.4.35 **Download:** The process of receiving data from another digital source.
- 1.4.36 **Duplicate:** An acceptably accurate and complete reproduction of all data objects independent of the physical media.
- 1.4.37 **Encryption:** The process of coding data so that a specific code or key is required to restore the original data.
- 1.4.38 **Export:** To move information from one system or program to another. Files that consist only of text can be exported in ASCII (plain text format). For files with graphics however, the receiving system or program must offer some support for the exported file's format in order for the data to be displayed.
- 1.4.39 **Format Conversion:** To transfer DME material from one media type to another and/or from one recording method to another.

- 1.4.40 **Hash:** A mathematical formula that generates a unique number used to verify the data's integrity.
- 1.4.41 **Image Authentication:** The scientific examination process used to verify that the information content of the analyzed material is an accurate rendition of the original data by some defined criteria. These criteria usually involve the interpretability of the data, and not simple format changes that do not alter the meaning or content of the data.  
Examples include: Determining the degradation of a transmitted image; Determining whether a video is an original recording or an edited version; Evaluating the degree of information loss in an image saved using lossy compression; determining whether an image contains feature-based modifications such as the addition or the removal of elements in the image (e.g. adding bruises to a face).
- 1.4.42 **Image Transmission:** The act of moving images from one location to another.
- 1.4.43 **Import:** To bring information from one system or program into another. The system or program receiving the data must somehow support the internal format or structure of the data.
- 1.4.44 **Integrity:** 1) the completeness of the digital multimedia evidence throughout its lifecycle. 2) The degree to which a system or component prevents unauthorized access to, or modification of, digital video and or data associated with such video.
- 1.4.45 **Intermediate Storage:** Any media or device on which data is temporarily stored for transfer to permanent or archival storage.
- 1.4.46 **Internal Circuit Test:** A test function (whether manually or automatically initiated) that verifies that all device internal signal processing circuitry is working correctly.
- 1.4.47 **Locked File:** A file on which one or more of the usual types of manipulative operations cannot be performed – typically, one that cannot be altered by additions or deletions.
- 1.4.48 **Log File:** A record of actions, events, and related data.
- 1.4.49 **Logical Copy:** An accurate reproduction of information contained within a logical volume.
- 1.4.50 **Mass Storage:** Any device for the storage of large amounts of data.

- 1.4.51 **Metadata:** Data frequently embedded within a file that describes information about or related to the file or directory in which it is embedded. This may include but is not limited to the locations where the content is stored, dates and times, application specific information, and permissions.
- 1.4.52 **Multimedia Evidence:** Analog or digital media, including, but not limited to, film, tape, magnetic and optical media, and/or the information contained therein.
- 1.4.53 **Native File Format:** The original form of a file. This usually refers to a file format that is associated with, and unique to, a specific software application program.
- 1.4.54 **Network Topology:** Graphical representation of a network.
- 1.4.55 **Nominal Value:** The numerical value of a device characteristic as specified by the manufacturer.
- 1.4.56 **Non-Removable Recording Media:** Any data storage that is housed within another device and cannot be removed from that device without disassembly of the device.
- 1.4.57 **Physical Copy:** An accurate reproduction of information contained on the physical device.
- 1.4.58 **Physical Image:** A bit stream duplicate of data contained on the physical device.
- 1.4.59 **Pinch Points:** Points at which it is possible to be caught between moving parts, or between moving and stationary parts of a piece of equipment.
- 1.4.60 **Pixel:** A picture element.
- 1.4.61 **Power Density:** Power density per unit area or energy density flux per unit area.
- 1.4.62 **Primary Image:** Refers to the first instance in which an image is recorded onto any media that is a separate, identifiable object. Examples include a digital image recorded on a flash card or a digital image downloaded from the Internet.
- 1.4.63 **Processed Image:** Any image that has undergone enhancement, restoration or other operation.
- 1.4.64 **Proprietary:** A quality of a technique, technology, or other in which it is owned and controlled by a company or other party, and is thereby only usable or adaptable as allowed by that party.
- 1.4.65 **Proxy:** A compressed copy of the original DME. A proxy can be transmitted faster than the original data.

- 1.4.66 **Recorded Evidence Reference Lifecycle:** The stages or states in which a recording will exist from the time it is created until it is destroyed.
- 1.4.67 **Reference Lifecycle:** The stages or states that are applicable to the recommendations in this document.
- 1.4.68 **Reliability:** The extent to which information can be depended upon.
- 1.4.69 **Removable Media:** Any portable device that contains data. Storage media that can be removed from the recording device.
- 1.4.70 **Sample Rate:** The number of horizontal lines of video information and the number of samples on each line.
- 1.4.71 **Storage Media:** Any object on which DME is preserved.
- 1.4.72 **Transcoding:** The direct digital-to-digital conversion from one format to another. It involves decoding/decompressing the original data to an intermediate format and re-encoding.
- 1.4.73 **Validation:** The process of performing a set of experiments and/or tests which establishes the efficacy and reliability of a tool, function, or procedure or modification.
- 1.4.74 **Validation Testing:** An evaluation to determine if a tool, technique, or procedure functions correctly as intended for a specific application using a representative sample.
- 1.4.75 **Validity Check:** The process of analyzing data to determine whether it conforms to predetermined completeness and consistency parameters.
- 1.4.76 **Vehicle Video Evidence Capture System Reference Lifecycle:** The stages or states in which the recording equipment in the vehicle (e.g. recorder, camera, etc.) will exist from the time it is first received by the operating agency until it is properly disposed of.
- 1.4.77 **Verification:** The process of confirming the accuracy of any copy of the DME to the original DME.
- 1.4.78 **Working Copy:** An accurate copy or duplicate of the original DME that can be used for subsequent processing and/or analysis.

## 1.5 Acronyms

<b>ABA</b>	American Bar Association
<b>AFSC</b>	United States Air Force Charts
<b>ANSI</b>	American National Standards Institute
<b>ASCLD-LAB</b>	American Society of Crime Lab Directors/Laboratory Accreditation Board
<b>CPSC</b>	Consumer Product Safety Commission
<b>DSS</b>	Digital Spread Spectrum
<b>DVS</b>	Digital Video System
<b>DME</b>	Digital Multimedia Evidence
<b>EDD</b>	Electronic Disruption Device
<b>EIA</b>	Electronics Industry Association
<b>ESSID</b>	Extended Service Set Identification
<b>ETATS</b>	Enforcement Technologies Advisory Technical Subcommittee
<b>FCC</b>	Federal Communications Commission
<b>FMVSS</b>	Federal Motor Vehicle Safety Standards
<b>HF</b>	High Frequency
<b>IACP</b>	International Association of Chiefs of Police
<b>IEC</b>	International Electrotechnical Commission
<b>IEEE</b>	Institute of Electrical and Electronic Engineers
<b>ISO</b>	International Standards Organization
<b>MDT</b>	Mobile Data Terminal
<b>MDVR</b>	Mobile Digital Video Recorder
<b>MVS</b>	Mobile Video System
<b>NFPA Intl</b>	National Fire Protection Association International
<b>NHTSA</b>	National Highway Transportation Safety Administration
<b>NTSC</b>	National Television Standards Committee
<b>RC4</b>	Rivest Cipher 4
<b>RFP</b>	Request for Proposal
<b>SAE</b>	Society of Automotive Engineers
<b>SIA</b>	Security Industry Association
<b>SMPTE</b>	Society of Motion Picture and Television Engineers
<b>SSID</b>	Service Set Identification
<b>SSL</b>	Secure Sockets Layer
<b>UHF</b>	Ultra High Frequency
<b>UL</b>	Underwriters Laboratories Inc.
<b>ULC</b>	Underwriters Laboratories of Canada
<b>VHF</b>	Very High Frequency
<b>VVCS</b>	Vehicle Video Capture System
<b>WMV</b>	Windows Media Format
<b>WORM</b>	Write Once, Read Many

## **1.6 Units of Measure**

Reference the standards to which the measurements apply. In all other cases, Society of Automotive Engineers (SAE) measurement standards will be used.



## **Section 2 – Applicable Standards**

- 2.1** All mobile video systems and related audio equipment must conform to the applicable minimum standards as set by the following:
- a) Electronic Industries Association (EIA)
  - b) Federal Communications Commission rules and regulations (FCC)
  - c) Institute of Electrical and Electronic Engineers (IEEE)
  - d) International Electrotechnical Commission (IEC)
  - e) International Organization for Standardization (ISO)
  - f) National Fire Protection International (NFPA)
  - g) National Highway Traffic Safety Administration (NHTSA)
  - h) Society of Automotive Engineers (SAE)
  - i) Underwriters Laboratories Inc. (UL)
  - j) Underwriters Laboratories of Canada (ULC)
- 2.2** Vendors must be able to provide a White Paper that establishes that it adheres to the minimum performance specifications of this document, and that the technology used is generally accepted in the relevant field.

### **Section 3 – Officer/Occupant Safety**

#### **3.1 Requirements for any and all physical equipment installed in the motor vehicle for the purpose of collecting Digital Multimedia Evidence (DME).**

- 3.1.1 Items installed or located in the interior of the vehicle per the manufacturers' installation instructions and supplied hardware shall remain in place during a reasonably foreseeable crash. This will be determined by a static pull test. The force applied to the item will correspond to 50 times its own weight (50g). This force must be maintained for at least one (1) full second. The test shall be conducted from a minimum of three (3) different angles to simulate frontal, side, and rear collision directions. The item will be allowed to move or pivot on any adjustable mounts or joints as long as it does not move into a location that could increase the likelihood of impact with an occupant or into a hazardous area such as an airbag deployment zone.
- 3.1.1.1 Any items installed in the interior of the vehicle shall meet the requirements stated in Federal Motor Vehicle Safety Standard 201 [October 1, 2002] *Occupant Protection in Interior Impact* (see Appendix B).
- 3.1.1.2 Exposed exterior surfaces, corners, fasteners, and controls that could be contacted by an occupant during a collision shall be of a design that minimizes the potential for injury. Edges and corners shall have a minimum 1/8-inch (3.2mm) radius or chamfer or be padded with an energy absorbing material to minimize the risk of injury. Note: This correlates to Federal Motor Vehicle Safety Standard 201 (5.4) [October 1, 2002] See Appendix B.
- 3.1.1.3 No equipment will be installed in any original vehicle manufacturer's designated airbag deployment zone. Alternatively, this requirement can be met if the airbag corresponding to the airbag deployment zone that is violated is turned off or disabled in accordance with National Highway Traffic Safety Administration (NHTSA) guidelines and vehicle occupants are clearly warned with a readily visible placard or illuminated indicator that the airbag has been disabled.
- 3.1.1.4 Manufacturers shall provide the customer the necessary brackets, mounting hardware, and installation instructions that if followed properly will ensure the vendor's equipment is installed in accordance with all appropriate Federal Motor Vehicle Safety Standards (FMVSS) that are in place at the time of the contract between the vendor and the consumer.
- 3.1.2 All controls and components should be located and designed to minimize driver distraction. The control pad should be designed and organized to minimize officer workload. The record button should be readily identifiable by size, color, location, and/or other design features. The record button should be easily accessible by officers wearing gloves. This can be simulated by the use of UL's articulated probe consisting of a radial tip of one inch as defined in UL 250.

- 3.1.2.1 All cameras should default to autofocus. The manufacturer may provide an autofocus override system for all except the front-facing camera if desired. An autofocus override system for the front-facing camera shall be provided. The override system should be configurable to prevent operation while the vehicle is in motion.
- 3.1.2.2 System components shall be capable of being illuminated for ready identification during periods of darkness. Backlit controls are preferred. The illumination level shall be capable of being controlled over a range from bright to dark. The illumination level shall be set by either a discrete control within the unit itself or by linking to vehicle dash illumination control. The viewing screen light level shall be controlled simultaneously with the controls or independently. The viewing screen shall be capable of being completely dimmed. An operator must have the ability to blackout the system on demand.
- 3.1.3 Installed equipment shall be located to minimize interference with the view of the driver.
  - 3.1.3.1 Installed equipment shall be located to also minimize interference with the view of the front-seat passenger.
  - 3.1.3.2 No item in the system that is installed in the vehicle, other than the camera and (if included) a replacement to the factory-installed rear-view mirror that meets applicable federal standards, shall extend below the AS-1 line. This line has been determined in Federal Motor Vehicle Safety Standard 205 [October 1, 2002] *Glazing Materials* (ANSI/SAE Z26.1) (see Appendix C) to be the minimum vertical sight line necessary for safe vehicle operation. It can commonly be located on the vehicle at the bottom of the factory-installed tint band at the top of the windshield. At one or both sides of the windshield near the “A-pillar” is a printed designation visible from the outside of the vehicle marked “AS-1.” To ensure safe vehicle operation, equipment located in other locations shall not impair the driver’s view to the front, sides, or rear of the vehicle. Alternatively, a manufacturer may elect to perform the SAE tests for vertical visibility that determine the AS-1 line if it wants to extend below this line at locations rearward of the windshield. The minimum height for eye level above the seat cushion will be as determined for an SAE 90% male model.
  - 3.1.3.3 Before being placed into service, equipment installed in the passenger compartment should be checked by drivers and occupants of various sizes and builds in order to ensure that it does not interfere with any speedometer, warning lights, gauges, mirrors, or essential controls, placed in the vehicle by the OEM.
  - 3.1.3.4 Manufacturers shall specify equipment-mounting locations to comply with this specification in their installer’s guide or owner’s manual, or will provide a list of vehicles for which the vendors’ systems will meet this specification.

3.1.4 Installed equipment shall be properly fused to minimize shock and fire hazards.

3.1.4.1 All wiring shall meet industry standards applicable to the wire application. For example, wiring and electronic components contained within the system housing such as the camera body, control panel, and monitor shall comply with the appropriate certification requirements as referenced in NFPA70 and applicable UL Standards. Wiring exterior to these components will meet all applicable Society of Automotive Engineers (SAE) standards for gauge, insulation type, fusing, connectors, etc.

3.1.4.2 All systems shall be properly grounded using the same industry standards as above and if necessary, due to the presence of hazardous voltage or amperage levels, shall be equipped with ground fault interrupters to prevent shock and electrocution hazards. Properly grounded equipment will also provide the most reliable service for the user and minimize many sources of electromagnetic interference.

3.1.4.3 Manufacturers shall provide information in their installer's guides or owner's manuals that specifies the proper wiring, fuses, connectors, and connection points with the vehicle electrical system and grounding points.

3.1.5 Elimination of hazardous pinch points.

3.1.5.1 Care shall be taken in the design to minimize potential injury of officer due to pinching by moveable parts (e.g. doors, brackets, latches).

## **3.2 Items Carried by the Officer**

3.2.1 No parts that can come into contact with human skin shall be allowed to reach a temperature capable of causing a burn injury. Reference UL 60950, "Safety of Information Technology Equipment" as amended December 1, 2000. Items carried on the officer's person or uniform shall not pose an undue risk of injury.

3.2.2 Any system component carried on the officer's person shall meet all Underwriters Laboratories Standards for shock/electrocution and burn prevention. All batteries used in such devices shall meet Underwriters Laboratories Standards for safety.

- 3.2.3 The manufacturer shall provide a warning that components and controls shall not be placed on the officer's person so that it prohibits free access to and removal of a firearm, baton, pepper spray, handcuffs, etc. The following proposed statement should be prominent in the owner's manual:

*“Placement of items on the duty belt can restrict ready access to important equipment.”* The location of the wireless transmitter or any other device provided with this system that is carried on the officer's person should be chosen with great care and consideration. After a location is selected, the officer should test access to and practice drawing primary items such as service firearms and secondary defense devices such as aerosol subject restraint, batons, electronic control devices, etc. Proper operation of handheld radios and other signaling devices should also be tested as should access to handcuffs and other restraining devices.”

- 3.2.4 Any body-worn cords or wires shall be of such construction that they minimize the risk of strangulation or injury from strangulation, cutting off of blood flow or laceration during assault, slipping, falling, or other types of incidents. Body-worn cords shall also be of such construction that they minimize possible injury during a vehicle crash.
- 3.2.5 Any component worn or carried by the officer shall be of smooth construction properly rounded or chamfered to minimize the possibility of injury. The components shall be free of sharp points or edges that could cause injury during a fight, slip, fall, or other type of incident. In addition, all clips and retention devices should be designed to minimize the possibility of pinch points that could cause injury.

### **3.3 Record Indicators**

- 3.3.1 A system shall have an illuminated record indicator readily visible to persons outside the vehicle to the front and passenger side that indicates when the system is actively recording. This indicator light shall be able to be disabled.

## **Section 4 – General Mobile Video System Specifications**

### **4.1 Mobile Video Systems Components**

This document applies to vehicle-mounted digital video recording systems that record at least one camera. This document also applies to vehicle-mounted digital video and audio recording systems that at least one camera and at least one microphone.

- 4.1.1 The DME shall accurately and reliably reproduce the viewable image, the audible sound, and associated metadata.
- 4.1.2 The system shall maintain consistent audio/visual recording quality while subject to interference from the following sources:
  - a) High-powered radio frequency transmissions
  - b) Other radio frequency interference (including UHF, VHF, and HF transmitters)
  - c) Automobile alternator, ignition, and electrical systems
  - d) Fan motors from automobile heaters and air conditioners
  - e) Other patrol vehicle electrical systems to include radios, emergency lights, sirens, mobile data computers, and speed-measuring devices.
  - f) High-voltage power line, traffic signals, neon signs, etc.
- 4.1.3 When in operation, the mobile video system must not generate electromagnetic interference or radiation that interferes with communications or other electronic equipment found within a police vehicle.
- 4.1.4 The Vehicular Recording System shall operate within the range of temperatures from 0 to 120 degrees Fahrenheit or between -17.8 and 48.9 degree Celsius.

### **4.2 Vehicular Recording Front-Facing Primary Camera System**

- 4.2.1 The Vehicular Recording System camera and lens will be equipped with autofocus, automatic exposure, and automatic white balance.
- 4.2.2 The Vehicular Recording System camera shall have a backlight compensation setting.
- 4.2.3 The Vehicular Recording System's Front-Facing Camera shall be capable of being rotated 360 degrees on its mount in a horizontal plane or 180 degrees in either direction from its front-facing position without having to loosen any screws or knobs.

- 4.2.4 The Vehicular Recording System Front-Facing Camera shall provide a minimum field of view of 24 feet in width at a distance of 35 feet (40 degrees) with all optional zoom settings at the full wide angle view.
- 4.2.5 The Vehicular Recording System shall provide both automatic and manual focus capabilities which are user selectable.
- 4.2.6 The camera shall offer a signal-to-noise ratio of at least 46db.
- 4.2.7 The Vehicular Recording System's video monitor shall be a minimum of 3 inches (diagonally measured) and able to display color.
- 4.2.8 The Vehicular Recording System monitor shall be capable of displaying a live picture from the system camera(s) when the system is on (even if recording is not in progress).
- 4.2.9 The Vehicular Recording System shall include a system speaker to provide monitoring of live audio from the wireless microphone as well as recorded sounds during playback mode. The system shall contain a readily accessible control(s) to adjust the volume and enable and disable monitoring of live audio.
- 4.2.10 The Vehicular Recording Device shall operate independently of the monitor. "Operate independently" means that the system shall be able to record without the image or sound being displayed.
- 4.2.11 The Vehicular Recording System Monitor shall have the capability to selectively display: date/time, user identification information, emergency light indication, siren indication, braking indicator and microphone activation indicator. These items shall be captured for each video frame in the metadata and not superimposed onto, added to, or be embedded in the video stored on the recording.
- 4.2.12 The Vehicular Recording System shall be capable of recording audio from a wireless microphone at a range of 1,000 feet, line of sight, under ideal conditions.
- 4.2.13 The Vehicular Recording System wireless microphone shall contain an integrated antenna.
- 4.2.14 The Vehicular Recording System's operator shall have the ability to deactivate audio from the wireless microphone without stopping or disabling the recording of video.
- 4.2.15 The Vehicle Recording wireless microphone shall be able to activate audio and video recording from the remote transmitter.

4.2.16 The Vehicle Recording wireless microphone shall contain a microphone built into the device worn by the user.

4.2.17 The Vehicular Recording wireless microphone shall use FCC-approved frequency bands.

4.2.18 The Vehicular Recording wireless microphone shall be able to be synchronized or paired to a specific receiver in the vehicle without any manual adjustment by the user.

4.2.19 The Vehicular Recording wireless microphone shall contain a rechargeable battery with a minimum battery-life of 15 hours (passive mode) or a talk time of 3.5 hours (active mode).

4.2.20 The Camera or Vehicular Recording System shall provide the following controls:

- a) Power on/off
- b) Play
- c) Record start
- d) Fast Forward
- e) Rewind
- f) Stop
- g) Pause
- h) Zoom in/out
- i) Auto Focus on/off
- j) Backlight Compensation
- k) Manual Focus

4.2.21 The Camera or Vehicular Recording System shall provide the following Indicators:

- a) System Power On
- b) Microphone On
- c) Media inserted and operational with remaining capacity/time available
- d) Recording
- e) Fast Forward
- f) Rewind
- g) Stop
- h) Time Counter
- i) Diagnostic Display showing the results as specified in 5.7.1 through 5.7.1.3



4.2.22 The Vehicular Recorder System's recording functions shall be activated by any of the following methods:

- a) User pushes the "record" button
- b) Activation of the emergency lights and/or sirens
- c) User activates the "record" button on the wireless microphone transmitter

4.2.23 The Vehicular Recording System shall be capable of recording events uninterrupted for a minimum of three and a half (3.5) hours at a minimum image refresh rate of 30 frames per second (fps) per camera.

4.2.24 When pre-event and/or post-event DME capture is provided by the Vehicular Recording System, it shall be possible to enable or disable the pre-event and post-event audio capture capability while continuing to capture the remaining DME items.

### **4.3 Vehicular System Electric Conditions**

4.3.1 The Vehicular Recording System shall be protected from damage due to input of voltage, reverse polarity, and electrical transients that may be encountered.

4.3.2 The Vehicular Recording System shall operate on a filtered power source, regulated, and short-circuit protected. The voltage supplied to the system shall meet the manufacturer's specifications and shall not vary with fluctuations of the system's electrical system voltage of between 9 and 18 volts.

4.3.3 Loss of operating power or disconnection from the vehicle battery shall not result in the system requiring programming. Sudden loss of power shall not cause loss of any DME previously written to DME storage.

## **Section 5 – Security Features**

### **5.1 Restricted Access to Programming Functions**

The Vehicular Recording System shall have the capability to restrict access to the programming functions, including but not limited to time/date features.

### **5.2 Erasure Prevention**

The Vehicular Recording System shall have the capability of preventing the user from erasing, altering, and/or recording over previously recorded information from either inside the vehicle or at the recording device controls.

### **5.3 Vehicular Recording System Integrity**

User interfaces shall prevent the input of invalid data that exceeds the system's expected ranges.

### **5.4 Consistency**

#### **5.4.1 Time Consistency**

5.4.1.1 The Vehicular Recording Video Capture System shall provide a mechanism to capture the time and date of DME creation.

5.4.1.2 Time stamping of DME elements (video, audio, metadata) shall be consistent within all system components.

5.4.1.3 All elements of the Digital Multimedia Evidence (DME) shall remain accurate with respect to the recording as it was captured.

5.4.1.4 The Vehicle Recorder, Active Storage, and Archival Storage Systems clocks shall be capable of being synchronized to an external time reference.

5.4.1.5 The Vehicular Recording System's recorder clocks shall be capable of remaining synchronized with each other within 33 milliseconds when connected to an external time reference. The DME Audit Log and DME metadata shall indicate when time synchronization to the external time reference was not available.

### **5.5 DME Verification**

5.5.1 The DME, or removable media containing the DME, shall indicate either the ID number(s) of the operator(s)/officer(s) assigned when the DME was captured or the vehicle ID in which the DME was recorded.

5.5.2 All electronic transfer of the DME shall have an automated verification mechanism. Information consisting of a minimum 128 bit hash value shall be attached to the DME when first recorded. The automated mechanism shall not introduce any visible or audible artifacts into the DME.

## **5.6 Transfer of Digital Assets**

5.6.1 Physical Digital Asset Transfer Using Removable Media:

5.6.1.1 An integrity check shall be used to validate that the DME on the Active Storage is an exact duplicate of any data on the removable storage media prior to the clearing of the data on the removable storage media.

5.6.1.2 The DME Audit Log shall contain the following items when the DME on a removable media device (e.g. spinning optical, flash, digital tape, or removable magnetic) is transferred to Active Storage:

- a) Name or ID (badge number or employee number) of officer or person submitting digital asset for transfer;
- b) A verification check per section 5.5.2 shall be performed and logged to validate that the DME transferred to the Active Storage is an exact duplicate prior to any clearing of data on the removable storage media;
- c) Active Storage retention period for the DME

5.6.2 Wireless Data Transfer:

An integrity check shall be used to validate that the DME on the Active Storage is an exact duplicate to any data on the recorder prior to the information being deleted from the recorder

5.6.2.1 Wireless Transfer Network Topology:

A wireless network used to transfer the DME from the recorder to Active Storage shall, at a minimum, use 128-bit encryption to create a secure connection for the DME to be transferred. Manufacturers, at their customers' discretion, may provide other security technologies that surpass 128-bit encryption.

IEEE standards-based wireless networking equipment shall support the following security standards:

- a) Customized network name;
- b) Disabled SSID/ESSID (Network Name) broadcast; and
- c) 128-bit RC4 link encryption

Additional security standards which exceed those set by the standards listed above may be applied to the wireless link as defined by the customer or the manufacturer.

If non-IEEE standards-based wireless networking equipment is used, it should be configured to at least meet the equivalent minimums defined in 5.6.2.1.

#### 5.6.2.2 DME Audit Log on the Active Storage

The DME Audit Log shall contain the following items when wireless DME transfer from the recorder to Active Storage is used:

- a) An indication that a successful wireless connection with the recorder was completed;
- b) Time/date of transfer;
- c) Active Storage retention period for the DME;
- d) A verification check per section 5.5.2 shall be performed and logged to validate that the DME transferred to the server is an exact duplicate prior to any clearing of data on the recorder storage medium.

#### 5.6.3 Wired Data Transfer:

An integrity check shall be used to validate that the original DME transferred to the Active Storage is an exact duplicate to any DME on the recorder prior to the information being deleted from the recorder.

##### 5.6.3.1 Wired Transfer Network Topology

A private network (i.e. separate from any other networks) used to transfer the DME from the recorder to Active Storage shall be considered secure since it is limited in its scope and is restricted from being accessed by any device except for the recorder and the Active Storage server.

A public network (i.e. where the data must cross over another non-private network) used to transfer the DME from the recorder to Active Storage or between Active Storage and Archival Storage shall, at a minimum, use 128-bit encryption to create a secure connection for the DME to be transferred. Manufacturers, at their customers' discretion, may provide other security technologies that surpass 128-bit encryption.

#### 5.6.3.2 DME Audit Log Items on the Active Storage

The DME Audit Log shall contain the following items when a wired DME transfer from the recorder to Active Storage is used:

- a) An indication that a successful wired connection with the recorder was completed;
- b) Time/date of transfer
- c) Active Storage retention period for the DME
- d) A verification check per section 5.5.2 shall be performed and logged to validate that the DME copied to the server is an exact duplicate prior to any clearing of data on the removable storage medium.

#### 5.6.4 Transfer from Active Storage to Archival Storage

The DME Audit Log shall contain the following items when the DME is transferred from Active Storage to Archival Storage:

- a) The identity of the user initiating the transfer (if the process is not automated);
- b) Time/date of the transfer;
- c) Archival Storage retention for the DME – It is anticipated that the Archival Storage retention period will be recomputed and not necessarily related to the previous Active Storage retention period associated with the DME;
- d) A verification check per section 5.5.2 shall be performed and logged to validate that the DME transferred from Active Storage to Archival Storage is an exact duplicate prior to the clearing of Active Storage.

#### 5.6.5 Retrieval of DME from Archival Storage back to Active Storage

The DME Audit Log shall contain the following items when the DME is transferred from Archival Storage to Active Storage:

- a) The identity of the user initiating the transfer (if the process is not automated);
- b) Time/date of the transfer;
- c) A verification check per section 5.5.2 shall be performed to validate that the DME transferred back to Active Storage is an exact duplicate should the DME stored in Archival Storage be removed;
- d) An Active Storage retention period for the DME – It is anticipated that the Active Storage retention period will be recomputed and is not necessarily related to the previous Archival Storage retention period associated with the DME. The DME shall be returned to the Archival Storage after expiration of the Active Storage retention period.

5.6.5.1 The Active and Archival Storage systems shall provide a mechanism for backing-up the DME.

5.6.5.2 The Active and Archival Storage systems should utilize fault tolerant storage or similar technology.

5.6.6 Removal of DME from both Active Storage and Archival Storage

5.6.6.1 The DME Audit Log shall contain the following items when any portion of the DME is permanently removed from both Active Storage and Archival Storage:

- a) The user identity initiating the removal (if the process is not automated);
- b) Time/date of the removal;
- c) An indication of what components of the DME were removed.

5.6.6.2 In systems that may support the creation of a lower bit-rate instance of the DME, the DME Audit Log shall also contain an indication that a lower bit-rate instance of the removed DME components has been created.

## **5.7 Vehicular Recorder System Security**

The following items shall be included to protect the Vehicular Recording System and its removable media:

5.7.1 Equipment Diagnostics

5.7.1.1 When powered, the recorder shall perform a self-test to ensure complete functionality. If the recorder does not pass the self-test, it shall immediately notify the user.

5.7.1.2 The recorder shall be able to monitor itself while in operation. Should a component of the recorder fail while in operation, the recorder shall immediately notify the user.

5.7.1.3 The recorder shall provide the following minimum media diagnostics:

- a) Indicate the amount of storage space remaining on the media; and
- b) Send a notification to the user (audible/visual) that storage is reaching its maximum capacity.

### 5.7.2 Equipment Enclosure

5.7.2.1 The recording device shall be physically mounted in the vehicle, following the manufacturer's recommendations, to prevent removal without tools and deter theft of the device.

### 5.7.3 Removable Media Security

5.7.3.1 The recording media shall be secured using a security mechanism that prevents unauthorized removal of the storage media from the recorder.

5.7.3.2 The recording device shall indicate when media is inserted into the recorder.

5.7.3.3 If non-removable recording media is being used, it shall be housed inside the recorder to prevent tampering with and/or destruction of the media.

5.7.3.4 The manufacturer shall provide guidelines on the media life-cycle.

5.7.3.5 Removable media shall contain the following items and markings:

- a) Tamper detection process;
- b) Damage protection; and
- c) The media must be marked on the exterior with an identifying number (or markings) that identifies each media and makes that media unique.

## **Section 6 – Digital Asset Recording**

### **6.1 Video Systems Measurements**

These tests apply to video obtained under section 7.1.1. from the primary camera.

#### **6.1.1 Dynamic Range Measurement**

The purpose of this test is to determine the degree to which the system under test will be able to record both light and dark contents in the scenes.

6.1.1.1 Record several seconds of video of a step tablet, illuminated in a sensitometer, with a brightness range of 10,000 to 1.

6.1.1.2 Light should be nominally 2,800 to 3,200 degrees Kelvin.

6.1.1.3 Capture a number of frames as per the process provided by the system vendor and open them in a software program such as Adobe Photoshop.

6.1.1.4 Using a sampling tool with at least 5x5 pixels, measure the red, green, and blue values of each of the steps.

6.1.1.5 Using the data for the sensitometer, plot the brightness values for each step as a function of its log (base 10) exposure value (corrected for color temperature).

6.1.1.6 Determine the point on the log exposure axis at which the response curve is flat due to saturation. This is the saturation point.

6.1.1.7 Determine the point on the response where the signal due to both light and noise is equal to twice the noise level alone. This is the threshold point.

6.1.1.8 Subtract the threshold point value from the saturation point value. This is the dynamic range in terms of log exposure.

6.1.1.9 The system should have a range of 2.0 log exposure or more.

#### **6.1.2 Static Resolution**

The purpose of this test is to determine if the system is able to capture images of small items of importance in the typical scenes it is likely to encounter in practice.

6.1.2.1 Working at an incident light level in the range from 500 lux to 2,000 lux, record several frames of video of a high-contrast, bar-type resolution test target.

6.1.2.2 Capture selected video frames and examine them to determine that the bars are clear enough to be counted correctly.



6.1.2.3 The target should have bars that are nominally horizontal, vertical, and at 45 degrees.

6.1.2.4 The system should be capable of resolving bars that represent one-half of a line pair per inch (both lines of equal width, one black and one white) at a frame width of 24 ft. This requirement will increase to one line pair per inch one year after this initial specification goes into effect.

6.1.2.5 Equivalent geometry can be used.

### 6.1.3 Aspect Ratio

The purpose of this test is to determine if the system presents images to the user that have the correct aspect ratio (width to height) so that measurements can be made.

6.1.3.1 Record several frames of a test target with a circle and a square.

6.1.3.2 Capture several frames and measure the height and the width of the test target elements to assure that they have their claimed aspect ratio to within 2% of 1 to 1.

### 6.1.4 Color Fidelity

The purpose of this test is to determine the degree to which the system under test can capture colors accurately so that color can be reliably used in analyses of the recorded video.

6.1.4.1 Record several frames of video of a Macbeth Corporation Color Checker™. The light should be at 5,000 to 6,000 Kelvin and between 300 and 400 lux incident light.

6.1.4.2 The target has well rendered primaries (red, green, blue, cyan, magenta, and yellow) and six shades of gray.

6.1.4.3 Determine the CIE/Lab dimensions for each patch in the test target.

6.1.4.4 Open the frames in image editing software such as Adobe Photoshop and measure the CIE/Lab parameters for each patch using a sampling tool with a view of at least 5x5 pixels.

6.1.4.5 Subtract the measured values from the respective patch values for all 12 patches.

6.1.4.6 Square the individual differences and sum them.

6.1.4.7 Divide by 36 (the number of values). This is the mean squared error. The mean squared error for the system under test should be less than 204.

#### 6.1.5 Dynamic Modulation

The purpose of this test is to determine the ability of the system under test to reproduce moving portions of the scene as a function of item size, velocity, and scene brightness. It invokes the system's shutter function, compression function, and image capture process.

6.1.5.1 Record a test target moving at known velocities ranging from the equivalent of up to 45 miles per hour at a frame width of 24 feet and distance of 35 feet, or optical equivalent.

6.1.5.2 The test target should move across the video frame and it should cover at least 40% of the frame height.

6.1.5.3 The test target should have two series of white and black bars that are the equivalent of two and four inches wide each.

6.1.5.4 The test target will be illuminated at two levels: between 1,800 lux and 2,200 lux incident and between 9,000 and 10,000 lux incident.

6.1.5.5 Capture frames and open them in an editing software package such as Adobe Photoshop.

6.1.5.6 Render the images as grayscale images.

6.1.5.7 Measure the brightness levels of the dark and light bars using a sampling tool with a window of at least 5x5 pixels.

6.1.5.8 Subtract the dark bar values from the light bar values to determine the modulation.

6.1.5.9 Normalize the modulation for each velocity by dividing it by the modulation of the stationary test target.

6.1.5.10 Plot the relative modulation as a function of the velocity of the target.

6.1.5.11 The relative modulation should be at least 50% at 15 miles per hour equivalent at both light levels.

6.1.5.12 There shall be no dropped frames. The test shall capture the expected number of frames as specified by the manufacturer and as determined by target motion used in section 6.1.5.1. Each captured frame shall show the target progressing through the frame the expected number of pixels as determined by the target motion used in section 6.1.5.1.

#### 6.1.6 Rolling Shutter Distortion

The purpose of this test is to provide an indication of the angle between a moving vertical line and the representation of that line that is caused by the process the camera uses to sample the real image formed by the camera lens.

6.1.6.1 The angle between the bars recorded in the dynamic modulation test and true vertical will be measured at each light level.

6.1.6.2 This is a measure that a forensic video analyst can use to correct any measurements that might be made. There will be no basic requirement in this specification.

#### 6.1.7 Microphone

The purpose of this test is to determine whether the transmitter can communicate intelligibly with the in-car mounted system over the required distance.

##### 6.1.7.1 Procedure

6.1.7.2 Set out 500, 750, and 1,000 foot markers along an open pathway.

6.1.7.3 With the transmitter positioned to prevent any object from impeding the transmission path to the in-car receiver, play recorded audio (at normal roadside speaking volumes) to the microphone at each of the distances, starting at the 1,000 ft. mark.

6.1.7.4 Record the transmitted signal at the in-car system.

6.1.7.5 Compare the system recording to the original for clarity.

6.1.7.6 The recoded sound message must be intelligible.

## **Section 7 – Interoperability**

### **7.1 Active or Archival Storage Server (see Appendix D)**

The Active Storage Server or the Archival Storage Server shall provide two interoperability formats to export the DME.

#### 7.1.1 Decompressed DME Export

7.1.1.1 The DME (images, sounds, metadata, and DME Audit Log) shall be capable of being exported in decompressed industry-standard file formats that are viewable and playable without the need for proprietary codecs, players, or viewers available from only the system manufacturer.

7.1.1.2 The decompression mechanism shall provide an accurate representation of the images, sounds, and metadata as recorded.

7.1.1.3 The decompressed images and sounds shall minimally comply with section 6.0

7.1.1.4 A DME verification check shall be performed to confirm the automatic verification mechanism of Section 5.5.2 prior to exporting the decompressed DME.

7.1.1.5 A verification report shall be included with the Decompressed DME Export stating the results of a DME verification check in section 7.1.1.4.

7.1.1.6 The DME Audit Log on the Active Storage

The DME Audit Log shall contain the following items when the Decompressed DME Export is performed:

- a) Identification of the person performing the export;
- b) Identification of the person receiving the export;
- c) Time and date of the export;
- d) A verification check per section 5.5.2 shall be performed and logged to validate the DME immediately prior to the decompressed DME export;
- e) A hash or other verification shall be computed for the exported decompressed DME using an industry-standard method, without the need for proprietary codecs, players, or viewers available from only the system manufacturer, and shall be provided with the exported decompressed DME.

### 7.1.2 Compressed DME Export

7.1.2.1 The DME (images, sounds, metadata, and DME Audit Log) shall be capable of being exported in industry-standard file formats that are viewable and playable without the need for proprietary codecs, players, or viewers available from only the system manufacturer.

7.1.2.2 A DME verification check shall be performed to confirm the automatic verification mechanism of Section 5.5. prior to exporting the compressed DME.

7.1.2.3 A verification report shall be included with the Compressed DME Export stating the results of a DME verification check in Section 7.1.2.2.

### 7.1.2.4 The DME Audit Log on the Active Storage

The DME Audit Log shall contain the following items when the compressed DME export is performed:

- a) Identification of the person performing the export;
- b) Identification of the person receiving the export;
- c) Time and date of the export;
- d) A verification check per section 5.5.2 shall be performed and logged to validate the DME immediately prior to the compressed DME export;
- e) A hash or other verification shall be computed for the exported compressed DME using an industry-standard method, without the need for proprietary codecs, players, or viewers available from only the system manufacturer, and shall be provided with the exported compressed DME.

## 7.2 Active Storage and Archival Storage Interoperable Exchange

The Active Storage shall be interoperable with non-manufacturer specific Archival Storage systems.

## **Appendix A – Recommended Policies and Best Practices**

1.1 All mobile video systems should be of industrial/commercial grade and in full production. No prototype models will be considered for testing.

1.2 Requirements:

1.2.1 The mobile video system (in-car camera) should have a proven, reliable record in actual vehicular use under a variety of conditions. This record should be evidenced by either manufacturers' testing results, or filed testing results by other law enforcement agencies.

1.2.2 The vendor must have experience in manufacturing and supporting such systems to include provisions for parts and service as needed.

1.2.3 The vendor should provide business and financial history upon request.

1.2.3.1 Vendors that do not manufacture the components comprising the system should be authorized by the original component manufacturer to resell such components. A copy of a factory-authorized dealer certificate should be provided.

1.2.3.2 All components of the system must comply with Federal Communications Commission (FCC) standards.

1.2.3.3 To document vendors' experience in the manufacturing, sales, and support of mobile video systems, the vendor should provide a list of several agencies to which mobile video systems were sold. Letters of reference for verification should also be included.

1.2.4 Sample and Demonstration:

Prior to award, the agency reserves the right to require any bidder to provide complete video systems of the exact configuration offered for the purposes of evaluation to determine compliance with the specifications requirements.

1.2.4.1 Any mobile video system may be field and laboratory-tested by state or independent laboratories to verify its acceptable level of performance and conformity to specifications.

### **1.3 Warranty Section**

1.3.1 All camera, recorder, environmental control components, wireless microphones, and transmitters, receiver, monitor, and control circuit components should be warranted to ensure that they are fit for their intended purposes for a minimum of one year.

1.3.2 All defective equipment should be repaired or replaced within the contracted terms of the warranty. Law enforcement agencies should take into consideration the down time of a vehicle placed out of service due to equipment failure.

1.3.3 For warranty purposes, the warranty time begins with the initial installation of the said equipment in the vehicle.

#### **1.4 Vehicle Recording System Integrity**

1.4.1 If the unit does not have a discrete login capability, the officer assigned to the vehicle should log into the recorder prior to the use of the recorder. This login may be through a user identification and authentication mechanism provided by the recorder or by standing in front of the camera and recording the officer's image and voice.

1.4.2 Before each shift, the officer should visually verify that the equipment has not been tampered with or been damaged.

1.4.3 The IACP Model Policy requires that the officer conduct an operational readiness test of the system prior to the beginning of a tour of duty. If the system is malfunctioning, the officer should notify a supervisor and communications. The supervisor should make the determination as to when and how the system is repaired or in some cases whether to keep the unit in service.

#### **1.5 Active and Archival Storage Systems**

1.5.1 The Active and Archival Storage system should be located in a secured building (e.g. police station) in a room with restricted access (e.g. server room).

1.5.2 The Active and Archival Storage system should be backed up at an off-site location.

1.5.3 When the media is being transferred to another medium during the back-up, the file should also be stored separately from the main server.

1.5.4 Access and authentication to the Active and Archival Storage system should be governed by the agency's policies and procedures and should include additional levels of user authentication prior to granting access.

1.5.5 Electronic notification should be provided for each DME intended to be removed from Active and Archival Storage at a time prior to removal based on operating agency policy according to the retention period for the DME.

#### **1.6 Removable Media Security**

1.6.1 Physical Tamper Detection

1.6.1.1 The operator of the recorder should perform a physical “check” of the removable media to ensure no tampering has occurred and that physical tamper-detection devices are in place.

1.6.2 Key Management – Keys should be managed via agency policies and procedures such as:

- a) Identification of individual with key to media;
- b) Identification of individual with a “master” key; and
- c) Identification of individual that can replicate keys.

## **1.7 Back Office Equipment Security**

Any space used by the agency to house or access the Active Storage, Archival Storage, and associated equipment housed in the agency’s back office should include:

- a) Equipment housed in secured facility with limited employee access;
- b) Secured system access;
- c) System captures standard “audit” information when user logs into the system;
- d) System captures number of times user attempts to log into the system;
- e) System user accounts become inoperable if more than three unsuccessful login attempts have been made.

1.7.1 System “passwords” governed by agency policy requirements:

a) Passwords to user accounts should be changed on a regular basis per departmental policy, though the IACP recommends that the user account passwords to the digital video system be changed every 30 days for enhanced security.

b) Force “character” requirements for passwords (e.g. numeric, alpha, caps, etc.)

1.7.2 Operational Policy Considerations:

These are questions that should be considered when setting operational policy related to the use of the recorder, recorded material, or archive. These considerations are items that support the recommendations in these specifications but are beyond the scope of the minimum recommendations.

## **1.8 Operational Digital Asset Transfer Policy**



1.8.1 The agency should have a documented transfer policy with procedures establishing:

- a) How the transfer of the DME from the vehicle takes place;
- b) Available storage capacity remaining limit at which point the DME should be transferred from the vehicle recorder.
- c) How equipment or removable media keys should be managed via policies and procedures, such as:
  - i) Identification of individual with key to media;
  - ii) Identification of individual with a “master” key.
  - iii) Identification of individuals who can replicate keys.
- d) Who is allowed to initiate the transfer or handle any removable media;
- e) How to maintain a manual audit trail;
- f) Recommend audit trail metrics for instances when the physical (manual) transfer of the DME from the recorder to Active Storage uses a removable media device (e.g. spinning optical, flash, digital tape, removable magnetic);
- g) A system for establishing the identification (badge number or employee number) of the officer or person submitting the DME for transfer. (It is recommended that when a major incident occurs, authorized personnel respond to the scene and take custody of the DME);
- h) Media identification numbering system (if tracked by the department);
- i) The capture of the time/date of the transfer;
- j) The capture of the size of the DME transferred;
- k) The capture of the number of “copies” made to other media (e.g. tape, spinning, optical media, other server storage location);
- l) Acceptable retention periods for DME;
- m) How integrity checks are to be performed as a means to validate that the DME transferred to the active storage as an exact duplicate prior to any clearing of DME on the removable storage media;
- n) Indicate successful transfer of the DME capture; and
- o) Dictate how metadata are specifically coordinated and managed, to include where and how a user may or may not be permitted access.

1.8.2 Archival Policies – How long the DME needs to be archived should be mandated by the agency in accordance with local and state laws. It is an operational and departmental policy that needs to be established.

1.8.3 Verification of location of capture of the DME – Proof of where the DME was captured through verification by the officer in the stated location.

1.8.4 Electronic check of the DME Audit Log on the media.

## 1.9 Manufacturers' Considerations

Although not part of the minimum recommendations, these are additional areas that should be considered when specifying a Vehicle Video Recording System.

### 1.9.1 Storage Solution

- What are the methods of DME retention offered by the manufacturer?
- Does the manufacturer provide a storage solution that facilitates the removal of the DME from the vehicle?
- Types of storage solutions:
  - i. Hard drive;
  - ii. Digital cassette;
  - iii. Optical media;
  - iv. Flash media.
- Transfer Methods:
  - i. Automatic;
  - ii. Manual;
  - iii. Wireless;
  - iv. Wired.
- Ease of removal of the storage solution.
- Does the manufacturer provide a method to electronically identify when the media is removed from the vehicle recorder and the individual logged into the system at the time the media was removed?
- Does the manufacturer's solution provide a method to configure an alert indicating when the maximum storage capacity in the vehicle equipment is being approached?
- Does the manufacturer's Active and Archival Storage system provide protection against failure of the storage solution?
- Does the manufacturer's vehicular equipment contain mechanisms to minimize the damage to the DME in case of vehicle crash, fire, and/or physical abuse?
- Does the manufacturer's equipment contain tamper detection mechanisms?

- Does the manufacturer's equipment contain tamper resistance mechanisms?
- What is the cost-effectiveness of the storage solution?
- What is the shelf-life of the storage solution? For a class 1 felony, can the digital asset be kept available for a minimum of 25 years and up to 75 years?
- Does the manufacturer's storage solution indicate when the recorder or removable media is operated outside of the manufacturer's specified temperature range? This indication may be used to determine when to recertify the equipment or replace the storage solution.
- Does the recorder include functionality to track the estimated remaining lifetime of the removable media?
- Does the manufacturer provide a method to electronically identify removable media?

#### 1.9.2 Chain of Custody

- Does the manufacturer provide physical security for the vehicle equipment?
- Are there mechanisms to prove that the DME is original?
- Does the manufacturer include a CPU or Hardware ID of the vehicle recorder in the DME Audit Log?
- Is there an ability to indicate where and when the DME was captured?
- Does the equipment provide electronic validation of location and time synchronization between recorders through the use of GPS equipment?
- Is the time and date on the recorders synchronized to the back office equipment?
- Does the manufacturer provide evidence that the system components are synchronized in time?
- Can the manufacturer provide a recording stream that is not alterable?

- Does the manufacturer provide the capability of assigning individuals authorization to access the media?
- Does the manufacturer provide the capability of protecting the DME on removable media so that it cannot be accessed by unauthorized equipment?
- Does the manufacturer provide synchronization between the record streams and the telemetry streams from one or more mobile systems for playback?
- Does the manufacturer provide a method for the user of the vehicle recorder to log in and authenticate?

### 1.9.3 Electronic Transfer

- Does the manufacturer provide other security methods?
- Cryptography methods other than 128-bit encryption may be used to create a private network connection for the DME transfer. Does the manufacturer provide technical documentation to support admissibility hearings if an encryption method other than 128-bit encryption is used?
- Other forms of high security tunnels (e.g. VPN, IKE, PKI, DES, 3 DES, IPSec, AES, TKIP) are commercially available and provide security beyond what is provided by 128-bit encryption. At their customers' discretion, manufacturers may provide a higher level of data confidentiality for the transfer of DME. Does the manufacturer provide technical documentation to support admissibility hearings that ensures that the link is secure and that the data transfer across the link meets the integrity requirements laid out in these specifications?
- Manufacturers, at their customers' discretion, may also provide encryption of the DME using commercially available or proprietary methods prior to transfer to active storage using one. Does the manufacturer provide technical documentation to support admissibility hearings to ensure that the DME, once decrypted on the other side of the transfer, is an exact duplicate of the original and meets the integrity requirements laid out in these specifications.

**Appendix B – Federal Motor Vehicle Safety Standards 201,**  
**“Occupant Protection in Interior Impact”**

§571.201 Standard No. 201; Occupant protection in interior impact.

S1. Purpose and scope. This standard specifies requirements to afford impact protection for occupants.

S2. Application. This standard applies to passenger cars and to multipurpose passenger vehicles, trucks, and buses with a GVWR of 4,536 kilograms or less, except that the requirements of S6 do not apply to buses with a GVWR of more than 3,860 kilograms.

S3. Definitions.

A-pillar means any pillar that is entirely forward of a transverse vertical plane passing through the seating reference point of the driver's seat.

Ambulance means a motor vehicle designed exclusively for the purpose of emergency medical care, as evidenced by the presence of a passenger compartment to accommodate emergency medical personnel, one or more patients on litters or cots, and equipment and supplies for emergency care at a location or during transport.

B-pillar means the forward most pillars on each side of the vehicle that is, in whole or in part, rearward of a transverse vertical plane passing through the seating reference point of the driver's seat, unless:

- (1) There is only one pillar rearward of that plane and it is also a rearmost pillar; or
- (2) There is a door frame rearward of the A-pillar and forward of any other pillar or rearmost pillar.

Brace means a fixed diagonal structural member in an open body vehicle that is used to brace the roll-bar and that connects the roll-bar to the main body of the vehicle structure.

Convertible means a vehicle whose A-pillars are not joined with the B-pillars (or rearmost pillars) by a fixed, rigid structural member.

Convertible roof frame means the frame of a convertible roof. Convertible roof linkage mechanism means any anchorage, fastener, or device necessary to deploy a convertible roof frame.

Convertible roof linkage mechanism means any anchorage, fastener, or device necessary to deploy a convertible roof frame.

Daylight opening means, for openings on the side of the vehicle, other than a door opening, the locus of all points where a horizontal line, perpendicular to the vehicle longitudinal centerline, is tangent to the periphery of the opening. For openings on the front and rear of the vehicle, other than a door opening, daylight opening means the locus of all points where a horizontal line, parallel to the vehicle longitudinal centerline, is tangent to the periphery of the opening. If the horizontal line is tangent to the periphery at more than one point at any location, the most inboard point is used to determine the daylight opening.

Door frame means the rearmost perimeter structure, including trim but excluding glass, of the forward door and the forward most perimeter structure, including trim but excluding glass, of the rear door of a pair of adjacent side doors that:

- (1) Have opposing hinges;
- (2) Latch together without engaging or contacting an intervening pillar;
- (3) Are forward of any pillar other than the A-pillar on the same side of the vehicle; and
- (4) Are rearward of the A-pillar.

Door opening means, for door openings on the side of the vehicle, the locus of all points where a horizontal line, perpendicular to the vehicle longitudinal centerline, is tangent to the periphery of the side door opening. For door openings on the back end of the vehicle, door opening means the locus of all points where a horizontal line, parallel to the vehicle longitudinal centerline, is tangent to the periphery of the back door opening. If the horizontal line is tangent to the periphery at more than one point at any location, the most inboard point is the door opening.

Dynamically deployed upper interior head protection system means a protective device or devices which are integrated into a vehicle and which, when activated by an impact, provide, through means requiring no action from occupants, protection against head impacts with upper interior structures and components of the vehicle in crashes.

Forehead impact zone means the part of the free motion headform surface area that is determined in accordance with the procedure set forth in S8.10.

Free motion headform means a test device which conforms to the specifications of part 572, subpart L of this chapter.

Interior rear quarter panel means a vehicle interior component located between the rear edge of the side door frame, the front edge of the rearmost seat back, and the daylight opening.

Mid-sagittal plane of a dummy means a longitudinal vertical plane passing through the seating reference point of a designated seating position.

Other door frame means the rearmost perimeter structure, including trim but excluding glass, of the forward door and the forward most perimeter structure, including trim but excluding glass, of the rear door of a pair of adjacent side doors that:

- (1) Have opposing hinges;
- (2) Latch together without engaging or contacting an intervening pillar; and
- (3) Are rearward of the B-pillar.

Other pillar means any pillar which is not an A-pillar, a B-pillar, or a rearmost pillar.

Pillar means any structure, excluding glazing and the vertical portion of door window frames, but including accompanying moldings, attached components such as safety belt anchorages and coat hooks, which:

- (1) Supports either a roof or any other structure (such as a roll-bar) that is above the driver's head, or
- (2) Is located along the side edge of a window.

Roll-bar means a fixed overhead structural member, including its vertical support structure, that extends from the left to the right side of the passenger compartment of any open body vehicles and convertibles. It does not include a header.

Seat belt anchorage means any component involved in transferring seat belt loads to the vehicle structure, including, but not limited to, the attachment hardware, but excluding webbing or straps, seat frames, seat pedestals, and the vehicle structure itself, whose failure causes separation of the belt from the vehicle structure.

Seat belt mounting structure means:

- (a) A vehicle body or frame component, including trim, that incorporates an upper seat belt anchorage conforming to the requirements of S4.2.1 and S4.3.2 of 49 CFR 571.210, that is located rearward of the rearmost outboard designated seating position, and that extends above a horizontal plane 660 mm above the seating reference point (SgRP) of that seating position; and
- (b) A vehicle body or frame component, including trim, that incorporates an upper seat belt anchorage conforming to the requirements of S4.2.1 and S4.3.2 of 49 CFR 571.210, that is located forward of the rearmost outboard designated seating position, and that extends above a horizontal plane 460 mm above the SgRP of that seating position located rearward of the anchorage.
- (c) The seat belt mounting structure is not a pillar, roll bar, brace or stiffener, side rail, seat, interior rear quarter panel, or part of the roof.

Sliding door track means a track structure along the upper edge of a side door opening that secures the door in the closed position and guides the door when moving to and from the open position.

Stiffener means a fixed overhead structural member that connects one roll-bar to another roll-bar or to a header of any open body vehicle or convertible.

Upper roof means the area of the vehicle interior that is determined in accordance with the procedure set forth in S8.15.

Windshield trim means molding of any material between the windshield glazing and the exterior roof surface, including material that covers a part of either the windshield glazing or exterior roof surface.

#### S4 Requirements

S4.1 Except as provided in S4.2, each vehicle shall comply with either:

- (a) The requirements specified in S5, or,
- (b) The requirements specified in S5 and S6.

S4.2 Vehicles manufactured on or after September 1, 1998 shall comply with the requirements of S5 and S6.

S5 Requirements for instrument panels, seat backs, interior compartment doors, sun visors, and armrests. Each vehicle shall comply with the requirements specified in S5.1 through S5.5.2.

S5.1 Instrument panels. Except as provided in S5.1.1, when that area of the instrument panel that is within the head impact area is impacted in accordance with S5.1.2 by a 6.8 kilogram, 165 mm diameter head form at—

- (a) A relative velocity of 24 kilometers per hour for all vehicles except those specified in paragraph (b) of this section,
- (b) A relative velocity of 19 kilometers per hour for vehicles that meet the occupant crash protection requirements of S5.1 of 49 CFR [571.208](#) by means of inflatable restraint systems and meet the requirements of S4.1.5.1(a)(3) by means of a Type 2 seat belt assembly at the right front designated seating position, the deceleration of the head form shall not exceed 80 g continuously for more than 3 milliseconds.



S5.1.1 The requirements of S5.1 do not apply to:

- (a) Console assemblies;
- (b) Areas less than 125 mm inboard from the juncture of the instrument panel attachment to the body side inner structure;
- (c) Areas closer to the windshield juncture than those statically contactable by the head form with the windshield in place;
- (d) Areas outboard of any point of tangency on the instrument panel of a 165 mm diameter head form tangent to and inboard of a vertical longitudinal plane tangent to the inboard edge of the steering wheel; or
- (e) Areas below any point at which a vertical line is tangent to the rearmost surface of the panel.

S5.1.2 Demonstration procedures. Tests shall be performed as described in Society of Automotive Engineers Recommended Practice J921, "Instrument Panel Laboratory Impact Test Procedure," June 1965, using the specified instrumentation or instrumentation that meets the performance requirements specified in Society of Automotive Engineers Recommended Practice J977, "Instrumentation for Laboratory Impact Tests," November 1966, except that:

- (a) The origin of the line tangent to the instrument panel surface shall be a point on a transverse horizontal line through a point 125 mm horizontally forward of the seating reference point of the front outboard passenger designated seating position, displaced vertically an amount equal to the rise which results from a 125 mm forward adjustment of the seat or 19 mm; and
- (b) Direction of impact shall be either:
  - (b)(1) In a vertical plane parallel to the vehicle longitudinal axis; or
  - (b)(2) In a plane normal to the surface at the point of contact.

S5.2 Seat Backs. Except as provided in S5.2.1, when that area of the seat back that is within the head impact area is impacted in accordance with S5.2.2 by a 6.8 kilogram, 165 mm diameter head form at a relative velocity of 24 kilometers per hour, the deceleration of the head form shall not exceed 80g continuously for more than 3 milliseconds.

S5.2.1 The requirements of S5.2 do not apply to seats installed in school buses which comply with the requirements of Standard No. 222, School Bus Passenger Seating and Occupant Protection (49 CFR [571.222](#)) or to rearmost side-facing, back-to-back, folding auxiliary jump, and temporary seats.

S5.2.2 Demonstration procedures. Tests shall be performed as described in Society of Automotive Engineers Recommended Practice J921, "Instrument Panel Laboratory Impact Test Procedure," June 1965, using the specified instrumentation or instrumentation that meets the performance requirements specified in Society of Automotive Engineers Recommended Practice J977, "Instrumentation for Laboratory Impact Tests," November 1966, except that:

(a) The origin of the line tangent to the uppermost seat back frame component shall be a point on a transverse horizontal line through the seating reference point of the right rear designated seating position, with adjustable forward seats in their rearmost design driving position and reclinable forward seat backs in their nominal design driving position;

(b) Direction of impact shall be either:

(b)(1) In a vertical plane parallel to the vehicle longitudinal axis; or

(b)(2) In a plane normal to the surface at the point of contact.

(c) For seats without head restraints installed, tests shall be performed for each individual split or bucket seat back at points within 100 mm left and right of its centerline, and for each bench seat back between points 100 mm outboard of the centerline of each outboard designated seating position;

(d) For seats having head restraints installed, each test shall be conducted with the head restraints in place at its lowest adjusted position, at a point on the head restraint centerline; and

(e) For a seat that is installed in more than one body style, tests conducted at the fore and aft extremes identified by application of subparagraph (a) shall be deemed to have demonstrated all intermediate conditions.

S5.3 Interior compartment doors. Each interior compartment door assembly located in an instrument panel, console assembly, seat back, or side panel adjacent to a designated seating position shall remain closed when tested in accordance with either S5.3.1(a) and S5.3.1(b) or S5.3.1(a) and S5.3.1(c). Additionally, any interior compartment door located in an instrument panel or seat back shall remain closed when the instrument panel or seat back is tested in accordance with S5.1 and S5.2. All interior compartment door assemblies with a locking device must be tested with the locking device in an unlocked position.

S5.3.1 Demonstration procedures.

(a) Subject the interior compartment door latch system to an inertia load of 10g in a horizontal transverse direction and an inertia load of 10g in a vertical direction in accordance with the procedure described in section 5 of SAE Recommended Practice J839b, "Passenger Car Side Door Latch Systems," May 1965, or an approved equivalent.

(b) Impact the vehicle perpendicularly into a fixed collision barrier at a forward longitudinal velocity of 48 kilometers per hour.

(c) Subject the interior compartment door latch system to a horizontal inertia load of 30g in a longitudinal direction in accordance with the procedure described in section 5 of SAE Recommended Practice J839b, "Passenger Car Side Door Latch Systems," May 1965, or an approved equivalent.

#### S5.4 Sun visors.

S5.4.1 A sun visor that is constructed of or covered with energy-absorbing material shall be provided for each front outboard designated seating position.

S5.4.2 Each sun visor mounting shall present no rigid material edge radius of less than 3.2 mm that is statically contactable by a spherical 165 mm diameter head form.

#### S5.5 Armrests.

S5.5.1 General. Each installed armrest shall conform to at least one of the following:

(a) It shall be constructed with energy-absorbing material and shall deflect or collapse laterally at least 50 mm without permitting contact with any underlying rigid material.

(b) It shall be constructed with energy-absorbing material that deflects or collapses to within 32 mm of a rigid test panel surface without permitting contact with any rigid material. Any rigid material between 13 and 32 mm from the panel surface shall have a minimum vertical height of not less than 25 mm.

(c) Along not less than 50 continuous mm of its length, the armrest shall, when measured vertically in side elevation, provide at least 50 mm of coverage within the pelvic impact area.

S5.5.2 Folding armrests. Each armrest that folds into the seat back or between two seat backs shall either:

(a) Meet the requirements of S5.5.1; or

(b) Be constructed of or covered with energy-absorbing material.

#### S6 Requirements for upper interior components.

S6.1 Vehicles manufactured on or after September 1, 1998, and before September 1, 2002. Except as provided in S6.3 and S6.1.4, for vehicles manufactured on or after September 1, 1998 and before September 1, 2002, a percentage of the manufacturer's production, as specified in S6.1.1, S6.1.2, or S6.1.3 shall conform, at the manufacturer's option, to either S6.1(a) or S6.1(b). For vehicles manufactured by final stage manufacturers on or after September 1, 1998 and before September 1, 2006, a percentage of the manufacturer's production as specified in S6.1.4 shall, except as provided in S6.3, conform, to either S6.1(a) or S6.1(b). The manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle.

(a) When tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 when impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any target that cannot be located using the procedures of S10.

(b) When equipped with a dynamically deployed upper interior head protection system and tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 as follows:

(b)(1) Targets that are not located over any point inside the area measured along the contour of the vehicle surface within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any targets that can not be located by using the procedures of S10.

(b)(2) Targets that are over any point inside the area measured along the contour of the vehicle interior within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, when the dynamically deployed upper interior head protection system is not deployed, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 19 km/h (12 mph) with the system undeployed. The requirements do not apply to any target that can not be located using the procedures of S10.

(b)(3) Each vehicle shall, when equipped with a dummy test device specified in part 572, subpart M, and tested as specified in S8.16 through S8.28, comply with the requirements specified in S7 when crashed into a fixed, rigid pole of 254 mm in diameter, at any velocity between 24 kilometers per hour (15 mph) and 29 kilometers per hour (18 mph).

#### S6.1.1 Phase-in Schedule #1

S6.1.1.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 1999. Subject to S6.1.5(a), for vehicles manufactured by a manufacturer on or after September 1, 1998 and before September 1, 1999, the amount of vehicles complying with S7 shall be not less than 10 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1996 and before September 1, 1999, or

(b) The manufacturer's production on or after September 1, 1998 and before September 1, 1999.

S6.1.1.2 Vehicles manufactured on or after September 1, 1999 and before September 1, 2000. Subject to S6.1.5(b), for vehicles manufactured by a manufacturer on or after September 1, 1999 and before September 1, 2000, the amount of vehicles complying with S7 shall be not less than 25 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1997 and before September 1, 2000, or

(b) The manufacturer's production on or after September 1, 1999 and before September 1, 2000.

S6.1.1.3 Vehicles manufactured on or after September 1, 2000 and before September 1, 2001. Subject to S6.1.5(c), for vehicles manufactured by a manufacturer on or after September 1, 2000 and before September 1, 2001, the amount of vehicles complying with S7 shall be not less than 40 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1998 and before September 1, 2001, or

(b) The manufacturer's production on or after September 1, 2000 and before September 1, 2001.

S6.1.1.4 Vehicles manufactured on or after September 1, 2001 and before September 1, 2002. Subject to S6.1.5(d), for vehicles manufactured by a manufacturer on or after September 1, 2001 and before September 1, 2002, the amount of vehicles complying with S7 shall be not less than 70 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1999 and before September 1, 2002, or

(b) The manufacturer's production on or after September 1, 2001 and before September 1, 2002.

S6.1.2 Phase-in Schedule #2

S6.1.2.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 1999. Subject to S6.1.5(a), for vehicles manufactured by a manufacturer on or after September 1, 1998 and before September 1, 1999, the amount of vehicles complying with S7 shall be not less than seven percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1996 and before September 1, 1999, or

(b) The manufacturer's production on or after September 1, 1998 and before September 1, 1999.

S6.1.2.2 Vehicles manufactured on or after September 1, 1999 and before September 1, 2000. Subject to S6.1.5(b), for vehicles manufactured by a manufacturer on or after September 1, 1999 and before September 1, 2000, the amount of vehicles complying with S7 shall be not less than 31 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1997 and before September 1, 2000, or

(b) The manufacturer's production on or after September 1, 1999 and before September 1, 2000.

S6.1.2.3 Vehicles manufactured on or after September 1, 2000 and before September 1, 2001. Subject to S6.1.5(c), for vehicles manufactured by a manufacturer on or after September 1, 2000 and before September 1, 2001, the amount of vehicles complying with S7 shall be not less than 40 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1998 and before September 1, 2001, or

(b) The manufacturer's production on or after September 1, 2000 and before September 1, 2001.

S6.1.2.4 Vehicles manufactured on or after September 1, 2001 and before September 1, 2002. Subject to S6.1.5(d), for vehicles manufactured by a manufacturer on or after September 1, 2001 and before September 1, 2002, the amount of vehicles complying with S7 shall be not less than 70 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1999 and before September 1, 2002, or

(b) The manufacturer's production on or after September 1, 2001 and before September 1, 2002.

S6.1.3 Phase-in Schedule #3

S6.1.3.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 1999 are not required to comply with the requirements specified in S7.

S6.1.3.2 Vehicles manufactured on or after September 1, 1999 shall comply with the requirements specified in S7.

S6.1.4 Phase-in Schedule #4. A final stage manufacturer or alterer may, at its option, comply with the requirements set forth in S6.1.4.1 and S6.1.4.2.

S6.1.4.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 2009 are not required to comply with the requirements specified in S7.

S6.1.4.2 Vehicles manufactured on or after September 1, 2009 shall comply with the requirements specified in S7.

S6.1.5 Calculation of complying vehicles.

(a) For the purposes of complying with S6.1.1.1 or S6.1.2.1, a manufacturer may count a vehicle if it is manufactured on or after May 8, 1997, but before September 1, 1999.

(b) For the purposes of complying with S6.1.1.2 or S6.1.2.2, a manufacturer may count a vehicle if it:

(b)(1) Is manufactured on or after May 8, 1997, but before September 1, 2000, and

(b)(2) Is not counted toward compliance with S6.1.1.1 or S6.1.2.1, as appropriate.

(c) For the purposes of complying with S6.1.1.3 or S6.1.2.3, a manufacturer may count a vehicle if it:

(c)(1) Is manufactured on or after May 8, 1997, but before September 1, 2001, and

(c)(2) Is not counted toward compliance with S6.1.1.1, S6.1.1.2, S6.1.2.1, or S6.1.2.2, as appropriate.

(d) For the purposes of complying with S6.1.1.4 or S6.1.2.4, a manufacturer may count a vehicle if it:

(d)(1) Is manufactured on or after May 8, 1997, but before September 1, 2002, and

(d)(2) Is not counted toward compliance with S6.1.1.1, S6.1.1.2, S6.1.1.3, S6.1.2.1, S6.1.2.2, or S6.1.2.3, as appropriate.

S6.1.6 Vehicles produced by more than one manufacturer.

S6.1.6.1 For the purpose of calculating average annual production of vehicles for each manufacturer and the number of vehicles manufactured by each manufacturer under S6.1.1 through S6.1.4, a vehicle produced by more than one manufacturer shall be attributed to a single manufacturer as follows, subject to S6.1.6.2.

(a) A vehicle which is imported shall be attributed to the importer.

(b) A vehicle manufactured in the United States by more than one manufacturer, one of which also markets the vehicle, shall be attributed to the manufacturer which markets the vehicle.

S6.1.6.2 A vehicle produced by more than one manufacturer must be attributed to any one of the vehicle's manufacturers specified by an express written contract, reported to the National Highway Traffic Safety Administration under 49 CFR Part 585, between the manufacturer so specified and the manufacturer to which the vehicle would otherwise be attributed under S6.1.6.1.

S6.2 Vehicles manufactured on or after September 1, 2002 and vehicles built in two or more stages manufactured after September 1, 2006. Except as provided in S6.1.4 and S6.3, vehicles manufactured on or after September 1, 2002 shall, when tested under the conditions of S8, conform, at the manufacturer's option, to either S6.2(a) or S6.2(b). Vehicles manufactured by final stage manufacturers on or after September 1, 2006 shall, except as provided in S6.3, when tested under the conditions of S8, conform, at the manufacturer's option, to either S6.2(a) or S6.2(b). The manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle.

(a) When tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 when impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any target that cannot be located using the procedures of S10.

(b) When equipped with a dynamically deployed upper interior head protection system and tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 as follows:

(b)(1) Targets that are not located over any point inside the area measured along the contour of the vehicle surface within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any targets that cannot be located by using the procedures of S10.



(b)(2) Targets that are over any point inside the area measured along the contour of the vehicle interior within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, when the dynamically deployed upper interior head protection system is not deployed, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 19 km/h (12 mph) with the system undeployed. The requirements do not apply to any target that cannot be located using the procedures of S10.

(b)(3) Except as provided in S6.2(b)(4), each vehicle shall, when equipped with a dummy test device specified in 49 CFR part 572, subpart M, and tested as specified in S8.16 through S8.28, comply with the requirements specified in S7 when crashed into a fixed, rigid pole of 254 mm in diameter, at any velocity between 24 kilometers per hour (15 mph) and 29 kilometers per hour (18 mph).

(b)(4) Vehicles certified as complying with the vehicle-to-pole requirements of S9 of [49 CFR 571.214](#), Side Impact Protection, need not comply with the pole test requirements specified in S6.2(b)(3) of this section.

S6.3 A vehicle need not meet the requirements of S6.1 through S6.2 for:

(a) Any target located on a convertible roof frame or a convertible roof linkage mechanism.

(b) Any target located rearward of a vertical plane 600 mm behind the seating reference point of the rearmost designated seating position. For altered vehicles and vehicles built in two or more stages, including ambulances and motor homes, any target located rearward of a vertical plane 300 mm behind the seating reference point of the driver's designated seating position (tests for altered vehicles and vehicles built in two or more stages do not include, within the time period for measuring HIC(d), any free motion headform contact with components rearward of this plane). If an altered vehicle partition positioned between the seating reference point of the driver's designated seating position and a vertical plane 300 mm behind the seating reference point of the driver's designated seating position, any target located rearward of the vertical partition is excluded.

(c) Any target in a vehicle manufactured in two or more stages that is delivered to a final stage manufacturer without an occupant compartment. Note: Motor homes, ambulances, and other vehicles manufactured using chassis cab, a cut-away van, or any other incomplete vehicle delivered to a final stage manufacturer with a furnished front compartment are not excluded under this S6.3(c).

(d) Any target in a walk-in van-type vehicles.

(e) Any target located on the seat belt mounting structures, door frames and other door frames before December 1, 2005.

S7 Performance Criterion. The HIC(d) shall not exceed 1000 when calculated in accordance with the following formula:

$$HIC = \left[ \frac{1}{(t_2 - t_1)^4} \int_{t_1}^{t_2} a dt \right]^{2.5} (t_2 - t_1)$$

Where the term a is the resultant head acceleration expressed as a multiple of g (the acceleration of gravity), and  $t^1$  and  $t^2$  are any two points in time during the impact which are separated by not more than a 36 millisecond time interval.

(a) For the free motion headform;  $HIC(d) = 0.75446 (\text{free motion headform HIC}) + 166.4$ .

(b) For the part 572, subpart M, anthropomorphic test dummy;  $HIC(d) = HIC$ .

S8 Target location and test conditions. The vehicle shall be tested and the targets specified in S10 located under the following conditions.

S8.1 Vehicle test attitude.

(a) The vehicle is supported off its suspension at an attitude determined in accordance with S8.1(b).

(b) Directly above each wheel opening, determine the vertical distance between a level surface and a standard reference point on the test vehicle's body under the conditions of S8.1(b)(1) through S8.1(b)(3).

(b)(1) The vehicle is loaded to its unloaded vehicle weight, plus its rated cargo and luggage capacity or 136 kg, whichever is less, secured in the luggage area. The load placed in the cargo area is centered over the longitudinal centerline of the vehicle.

(b)(2) The vehicle is filled to 100 percent of all fluid capacities.

(b)(3) All tires are inflated to the manufacturer's specifications listed on the vehicle's tire placard.

S8.2 Windows and Sunroofs.

(a) Movable vehicle windows are placed in the fully open position.

(b) For testing, any window on the opposite side of the longitudinal centerline of the vehicle from the target to be impacted may be removed.

(c) For testing, movable sunroofs are placed in the fully open position.

S8.3 Convertible tops. The top, if any, of convertibles and open-body type vehicles is in the closed passenger compartment configuration.

S8.4 Doors.

(a) Except as provided in S8.4(b) or S8.4(c), doors, including any rear hatchback or tailgate, are fully closed and latched but not locked.

(b) During testing, any side door on the opposite side of the longitudinal centerline of the vehicle from the target to be impacted may be open or removed.

(c) During testing, any rear hatchback or tailgate may be open or removed for testing any target except targets on the rear header, rearmost pillars, or the rearmost other side rail on either side of the vehicle.

S8.5 Sun visors. Each sun visor shall be placed in any position where one side of the visor is in contact with the vehicle interior surface (windshield, side rail, front header, roof, etc.).

S8.6 Steering wheel and seats.

(a) During targeting, the steering wheel and seats may be placed in any position intended for use while the vehicle is in motion.

(b) During testing, the steering wheel and seats may be removed from the vehicle.

S8.7 Seat belt anchorages. If a target is on a seat belt anchorage, and if the seat belt anchorage is adjustable, tests are conducted with the anchorage adjusted to a point midway between the two extreme adjustment positions. If the anchorage has distinct adjustment positions, none of which is midway between the two extreme positions, tests are conducted with the anchorage adjusted to the nearest position above the midpoint of the two extreme positions.

S8.8 Temperature and humidity.

(a) The ambient temperature is between 19 °C and 26 °C, at any relative humidity between 10 percent and 70 percent.

(b) Tests are not conducted unless the headform specified in S8.9 is exposed to the conditions specified in S8.8(a) for a period not less than four hours.

S8.9 Headform. The headform used for testing conforms to the specifications of part 572, subpart L of this chapter.

S8.10 Forehead impact zone. The forehead impact zone of the headform is determined according to the procedure specified in (a) through (f).

(a) Position the headform so that the baseplate of the skull is horizontal. The midsagittal plane of the headform is designated as Plane S.

(b) From the center of the threaded hole on top of the headform, draw a 69 mm line forward toward the forehead, coincident with Plane S, along the contour of the outer skin of the headform. The front end of the line is designated as Point P. From Point P, draw a 100 mm line forward toward the forehead, coincident with Plane S, along the contour of the outer skin of the headform. The front end of the line is designated as Point O.

(c) Draw a 125 mm line which is coincident with a horizontal plane along the contour of the outer skin of the forehead from left to right through Point O so that the line is bisected at Point O. The end of the line on the left side of the headform is designated as Point a and the end on the right as Point b.

(d) Draw another 125 mm line which is coincident with a vertical plane along the contour of the outer skin of the forehead through Point P so that the line is bisected at Point P. The end of the line on the left side of the headform is designated as Point c and the end on the right as Point d.

(e) Draw a line from Point a to Point c along the contour of the outer skin of the headform using a flexible steel tape. Using the same method, draw a line from Point b to Point d.

(f) The forehead impact zone is the surface area on the FMH forehead bounded by lines a-O-b and c-P-d, and a-c and b-d.

S8.11 Target circle. The area of the vehicle to be impacted by the headform is marked with a solid circle 12.7 mm in diameter, centered on the targets specified in S10, using any transferable opaque coloring medium.

S8.12 Location of head center of gravity.

(a) Location of head center of gravity for front outboard designated seating positions (CG-F). For determination of head center of gravity, all directions are in reference to the seat orientation.

(a)(1) Location of rearmost CG-F (CG-F2). For front outboard designated seating positions, the head center of gravity with the seat in its rearmost normal design driving or riding position (CG-F2) is located 160 mm rearward and 660 mm upward from the seating reference point.

(a)(2) Location of forward most CG-F (CG-F1). For front outboard designated seating positions, the head center of gravity with the seat in its forward most adjustment position (CG-F1) is located horizontally forward of CG-F2 by the distance equal to the fore-aft distance of the seat track.

(b) Location of head center of gravity for rear outboard designated seating positions (CG-R). For rear outboard designated seating positions, the head center of gravity (CG-R) is located 160 mm rearward, relative to the seat orientation, and 660 mm upward from the seating reference point.

### S8.13 Impact configuration.

S8.13.1 The headform is launched from any location inside the vehicle which meets the conditions of S8.13.4. At the time of launch, the midsagittal plane of the headform is vertical and the headform is upright.

S8.13.2 The headform travels freely through the air, along a velocity vector that is perpendicular to the headform's skull cap plate, not less than 25 mm before making any contact with the vehicle.

S8.13.3 At the time of initial contact between the headform and the vehicle interior surface, some portion of the forehead impact zone of the headform must contact some portion of the target circle.

S8.13.4 Approach Angles. The headform launching angle is as specified in Table 1. For components for which Table 1 specifies a range of angles, the headform launching angle is within the limits determined using the procedures specified in S8.13.4.1 and S8.13.4.2, and within the range specified in Table I, using the orthogonal reference system specified in S9.

#### S8.13.4.1 Horizontal Approach Angles for Headform Impacts.

##### (a) Left A-Pillar Horizontal Approach Angles.

(a)(1) Locate a line formed by the shortest horizontal distance between CG-F1 for the left seat and the right A-pillar. The maximum horizontal approach angle for the left A-pillar equals 360 degrees minus the angle formed by that line and the X-axis of the vehicle, measured counterclockwise.

(a)(2) Locate a line formed by the shortest horizontal distance between CG-F2 for the left seat and the left A-pillar. The minimum horizontal approach angle for the left A-pillar impact equals the angle formed by that line and the X-axis of the vehicle, measured counterclockwise.

##### (b) Right A-Pillar Horizontal Approach Angles.

(b)(1) Locate a line formed by the shortest horizontal distance between CG-F1 for the right seat and the left A-pillar. The minimum horizontal approach angle for the right A-pillar equals 360 degrees minus the angle formed by that line and the X-axis of the vehicle, measured counterclockwise.

(b)(2) Locate a line formed by the shortest horizontal distance between CG-F2 for the right seat and the right A-pillar. The maximum horizontal approach angle for the right A-pillar impact equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise.

(c) Left B-Pillar Horizontal Approach Angles.

(c)(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the left seat and the left B-pillar. The maximum horizontal approach angle for the left B-pillar equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 270 degrees, whichever is greater.

(c)(2) Locate a line formed by the shortest horizontal distance between CG-R for the left seat and the left B-pillar. The minimum horizontal approach angle for the left B-pillar equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise.

(d) Right B-Pillar Horizontal Approach Angles.

(d)(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the right seat and the right B-pillar. The minimum horizontal approach angle for the right B-pillar equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 90 degrees, whichever is less.

(d)(2) Locate a line formed by the shortest horizontal distance between CG-R for the right seat and the right B-pillar. The maximum horizontal approach angle for the right B-pillar equals the angle between that line and the X-axis of the vehicle measured counterclockwise.

(e) Left door frame horizontal approach angles.

(e)(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the left seat and the left door frame. The maximum horizontal approach angle for the left door frame equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 270 degrees, whichever is greater.

(e)(2) Locate a line formed by the shortest horizontal distance between CG-R for the left seat and the left door frame. The minimum horizontal approach angle for the left door frame equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise.

(f) Right door frame horizontal approach angles.

(f)(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the right seat and the right door frame. The minimum horizontal approach angle for the right door frame equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 90 degrees, whichever is less.

(f)(2) Locate a line formed by the shortest horizontal distance between CG-R for the right seat and the right door frame. The maximum horizontal approach angle for the right door frame equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise

(g) Left seat belt mounting structure horizontal approach angles.

(g)(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the left seat and the left seat belt mounting structure. If the seat belt mounting structure is below a horizontal plane passing through CG-F2 for the left seat, locate the point 200 mm directly below CG-F2 and locate a line formed by the shortest horizontal distance between that point and the left seat belt mounting structure. The maximum horizontal approach angle for the left seat belt mounting structure equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 270 degrees, whichever is greater.

(g)(2) Locate a line formed by the shortest horizontal distance between CG-R for the left seat and the left seat belt mounting structure. If the seat belt mounting structure is below a horizontal plane passing through CG-R for the left seat, locate the point 200 mm directly below CG-R and locate a line formed by the shortest horizontal distance between that point and the left seat belt mounting structure. The minimum horizontal approach angle for the left seat belt mounting structure equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise. If the CG-R does not exist, or is forward of the seat belt mounting structure, the maximum horizontal approach angle is 270 degrees.

(h) Right seat belt mounting structure horizontal approach angles.

(h)(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the right seat and the right seat belt mounting structure. If the seat belt mounting structure is below a horizontal plane passing through CG-F2 for the right seat, locate the point 200 mm directly below that CG-F2 and locate a line formed by the shortest horizontal distance between that point and the right seat belt mounting structure. The minimum horizontal approach angle for the right seat belt mounting structure equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 90 degrees, whichever is less.

(h)(2) Locate a line formed by the shortest horizontal distance between CG-R for the right seat and the right seat belt mounting structure. If the seat belt mounting structure is below a horizontal plane passing through CG-R, locate the point 200 mm directly below CG-R and locate a line formed by the shortest horizontal distance between that point and the right seat belt mounting structure. The maximum horizontal approach angle for the right seat belt mounting structure equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise. If the CG-R does not exist, or is forward of the seat belt mounting structure, the maximum horizontal approach angle is 90 degrees.

#### S8.13.4.2 Vertical Approach Angles.

(a) Position the forehead impact zone in contact with the selected target at the prescribed horizontal approach angle. If a range of horizontal approach angles is prescribed, position the forehead impact zone in contact with the selected target at any horizontal approach angle within the range which may be used for testing.

(b) Keeping the forehead impact zone in contact with the target, rotate the FMH upward until the lip, chin or other part of the FMH contacts the component or other portion of the vehicle interior.

(b)(1) Except as provided in S8.13.4.2(b)(2), keeping the forehead impact zone in contact with the target, rotate the FMH downward by 5 degrees for each target to determine the maximum vertical angle.

(b)(2) For all pillars, except A-pillars, and all door frames and seat belt mounting structures, keeping the forehead impact zone in contact with the target, rotate the FMH downward by 10 degrees for each target to determine the maximum vertical angle.

#### S8.14 Multiple impacts.

(a) A vehicle being tested may be impacted multiple times, subject to the limitations in S8.14(b), (c), (d) and (e).

(b) As measured as provided in S8.14(d), impacts within 300 mm of each other may not occur less than 30 minutes apart.

(c) As measured as provided in S8.14(d), no impact may occur within 150 mm of any other impact.

(d) For S8.14(b) and S8.14(c), the distance between impacts is the distance between the center of the target circle specified in S8.11 for each impact, measured along the vehicle interior.



(e) No impact may occur within the “exclusion zone” of any pillar target specified in S10.1 through S10.4, door frame target specified in S10.14 and S10.15, upper roof target specified in S10.9, or seat belt mounting structure target specified in S10.16. The “exclusion zone” is determined according to the procedure in S8.14(f) through S8.14(k).

(f) Locate the point, Point X, at the center of the target circle specified in S8.11 for the tested target.

(g) Determine two spheres centered on Point X. Radii of these spheres are 150 mm and 200 mm, respectively.

(h) Locate a horizontal plane passing through Point X. Determine the intersection points, if they exist, of the small sphere surface, the horizontal plane, and the vehicle interior surface. Relative to Point X, the point on the left is Point L and the point on the right is Point R.

(i) Locate a vertical plane, Plane Z, passing through Point X and coincident (within  $\pm 5^\circ$ ) with the horizontal approach angle used or intended for use in testing the target centered on Point X.

(j) If either Point L or Point R does not exist, extend Line LX and/or Line RX, as appropriate, perpendicular to Plane Z beyond Point X by 150 mm. The end of the line is designated as Point L or Point R, as appropriate.

(k) Locate a vertical plane, Plane ZL, passing through Point L and parallel to Plane Z. Locate another vertical plane, Plane ZR, passing through Point R and parallel to Plane Z. The “exclusion zone” is the vehicle interior surface area between Plane ZL and Plane ZR below the upper boundary of the smaller sphere and above the lower boundary of the larger sphere. Points on the intersection of the vehicle interior surface and the large sphere below the target, the small sphere above the target, Plane ZL and Plane ZR are not included in the “exclusion zone.”

S8.15 Upper Roof. The upper roof of a vehicle is determined according to the procedure specified in S8.15 (a) through (h).

(a) Locate the transverse vertical plane A at the forward most point where it contacts the interior roof (including trim) at the vehicle centerline.

(b) Locate the transverse vertical plane B at the rearmost point where it contacts the interior roof (including trim) at the vehicle centerline.

(c) Measure the horizontal distance (D1) between Plane A and Plane B.

(d) Locate the vertical longitudinal plane C at the leftmost point at which a vertical transverse plane, located 300 mm rearward of the A-pillar reference point described in S10.1(a), contacts the interior roof (including trim).

(e) Locate the vertical longitudinal plane D at the rightmost point at which a vertical transverse plane, located 300 mm rearward of the A-pillar reference point described in S10.1(a), contacts the interior roof (including trim).

(f) Measure the horizontal distance (D2) between Plane C and Plane D.

(g) Locate a point (Point M) on the interior roof surface, midway between Plane A and Plane B along the vehicle longitudinal centerline.

(h) The upper roof zone is the area of the vehicle upper interior surface bounded by the four planes described in S8.15(h)(1) and S8.15(h)(2):

(h)(1) A transverse vertical plane E located at a distance of (.35 D1) forward of Point M and a transverse vertical plane F located at a distance of (.35 D1) rearward of Point M, measured horizontally.

(h)(2) A longitudinal vertical plane G located at a distance of (.35 D2) to the left of Point M and a longitudinal vertical plane H located at a distance of (.35 D2) to the right of Point M, measured horizontally.

S8.16 Test weight—vehicle to pole test. Each vehicle shall be loaded to its unloaded vehicle weight, plus 136 kilograms (300 pounds) or its rated cargo and luggage capacity (whichever is less), secured in the luggage or load-carrying area, plus the weight of the necessary anthropomorphic test dummy. Any added test equipment shall be located away from impact areas in secure places in the vehicle.

S8.17 Vehicle test attitude—vehicle to pole test. Determine the distance between a level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its "as delivered" condition. The "as delivered" condition is the vehicle as received at the test site, filled to 100 percent of all fluid capacities and with all tires inflated to the manufacturer's specifications listed on the vehicle's tire placard. Determine the distance between the same level surface and the same standard reference points in the vehicle's "fully loaded condition." The "fully loaded condition" is the test vehicle loaded in accordance with S8.16. The load placed in the cargo area shall be centered over the longitudinal centerline of the vehicle. The pretest vehicle attitude shall be the same as either the "as delivered" or "fully loaded" attitude or is between the "as delivered" attitude and the "fully loaded" attitude. If the test configuration requires that the vehicle be elevated off the ground, the pretest vehicle attitude must be maintained.

S8.18 Adjustable seats—vehicle to pole test. Initially, adjustable seats shall be adjusted as specified in S8.3.1 of Standard 214 ([49 CFR 571.214](#)).

S8.19 Adjustable seat back placement—vehicle to pole test. Initially, position adjustable seat backs in the manner specified in S8.3.1 of Standard 214 ([49 CFR 571.214](#)).

S8.20 Adjustable steering wheels—vehicle to pole test. Adjustable steering controls shall be adjusted so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions.

S8.21 Windows and sunroof—vehicle to pole test. Movable windows and vents shall be placed in the fully open position. Any sunroof shall be placed in the fully closed position.

S8.22 Convertible tops—vehicle to pole test. The top, if any, of convertibles and open-body type vehicles shall be in the closed passenger compartment configuration.

S8.23 Doors—vehicle to pole test. Doors, including any rear hatchback or tailgate, shall be fully closed and latched but not locked.

S8.24 Impact reference line—vehicle to pole test. On the striking side of the vehicle, place an impact reference line at the intersection of the vehicle exterior and a transverse vertical plane passing through the center of gravity of the head of the dummy seated in accordance with S8.28, in the front outboard designated seating position.

S8.25 Rigid Pole—vehicle to pole test. The rigid pole is a vertical metal structure beginning no more than 102 millimeters (4 inches) above the lowest point of the tires on the striking side of the test vehicle when the vehicle is loaded as specified in S8.16 and extending above the highest point of the roof of the test vehicle. The pole is 254 mm  $\pm$ 3 mm (10 inches) in diameter and set off from any mounting surface, such as a barrier or other structure, so that the test vehicle will not contact such a mount or support at any time within 100 milliseconds of the initiation of vehicle to pole contact.

S8.26 Impact configuration—vehicle to pole test. The rigid pole shall be stationary. The test vehicle shall be propelled sideways so that its line of forward motion forms an angle of 90 degrees ( $\pm$ 3 degrees) with the vehicle's longitudinal center line. The impact reference line shall be aligned with the center line of the rigid pole so that, when the vehicle-to-pole contact occurs, the center line of the pole contacts the vehicle area bounded by two transverse vertical planes 38 mm (1.5 inches) forward and aft of the impact reference line.

S8.27 Anthropomorphic test dummy—vehicle to pole test.

S8.27.1 The anthropomorphic test dummy used for evaluation of a vehicle's head impact protection shall conform to the requirements of subpart M of part 572 of this chapter (49 CFR part 572, subpart M). In a test in which the test vehicle is striking its left side, the dummy is to be configured and instrumented to strike on its left side, in accordance with subpart M of part 572. In a test in which the test vehicle is striking its right side, the dummy is to be configured and instrumented to strike its right side, in accordance with subpart M of part 572.

S8.27.2 The part 572, subpart M, test dummy specified is clothed in form fitting cotton stretch garments with short sleeves and midcalf length pants. Each foot of the test dummy is equipped with a size 11EEE shoe, which meets the configuration size, sole, and heel thickness specifications of MIL-S-13192 (1976) and weighs  $0.57 \pm 0.09$  kilograms (1.25  $\pm$  0.2 pounds).

S8.27.3 Limb joints shall be set at between 1 and 2 g's. Leg joints are adjusted with the torso in the supine position.

S8.27.4 The stabilized temperature of the test dummy at the time of the side impact test shall be at any temperature between 20.6 °C and 22.2 °C.

S8.27.5 The acceleration data from the accelerometers installed inside the skull cavity of the test dummy are processed according to the practices set forth in SAE Recommended Practice J211, March 1995, "Instrumentation for Impact Tests," Class 1000.

S8.28 Positioning procedure for the Part 572 Subpart M test dummy— vehicle to pole test. The part 572, subpart M, test dummy is initially positioned in the front outboard seating position on the struck side of the vehicle in accordance with the provisions of S12.1 of Standard 214 ([49 CFR 571.214](#)), and the vehicle seat is positioned as specified in S8.3.1 of that standard. The position of the dummy is then measured as follows. Locate the horizontal plane passing through the dummy head center of gravity. Identify the rearmost point on the dummy head in that plane. Construct a line in the plane that contains the rearward point of the front door daylight opening and is perpendicular to the longitudinal vehicle centerline. Measure the longitudinal distance between the rearmost point on the dummy head and this line. If this distance is less than 50 mm (2 inches) or the point is not forward of the line, then the seat and/or dummy positions is adjusted as follows. First, the seat back angle is adjusted, a maximum of 5 degrees, until a 50 mm (2 inches) distance is achieved. If this is not sufficient to produce the 50 mm (2 inches) distance, the seat is moved forward until the 50 mm (2 inches) distance is achieved or until the knees of the dummy contact the dashboard or knee bolster, whichever comes first. If the required distance cannot be achieved through movement of the seat, the seat back angle is adjusted even further forward until the 50 mm (2 inches) distance is obtained or until the seat back is in its fully upright locking position.

S9. Orthogonal Reference System. The approach angles specified in S8.13.4 are determined using the reference system specified in S9.1 through S9.4.

S9.1 An orthogonal reference system consisting of a longitudinal X axis and a transverse Y axis in the same horizontal plane and a vertical Z axis through the intersection of X and Y is used to define the horizontal direction of approach of the headform. The X-Z plane is the vertical longitudinal zero plane and is parallel to the longitudinal centerline of the vehicle. The X-Y plane is the horizontal zero plane parallel to the ground. The Y-Z plane is the vertical transverse zero plane that is perpendicular to the X-Y and X-Z planes. The X coordinate is negative forward of the Y-Z plane and positive to the rear. The Y coordinate is negative to the left of the X-Z plane and positive to the right. The Z coordinate is negative below the X-Y plane and positive above it. (See Figure 1.)

S9.2 The origin of the reference system is the center of gravity of the headform at the time immediately prior to launch for each test.

S9.3 The horizontal approach angle is the angle between the X axis and the headform impact velocity vector projected onto the horizontal zero plane, measured in the horizontal zero plane in the counter-clockwise direction. A 0 degree horizontal vector and a 360 degree horizontal vector point in the positive X direction; a 90 degree horizontal vector points in the positive Y direction; a 180 degree horizontal vector points in the negative X direction; and a 270 horizontal degree vector points in the negative Y direction. (See Figure 2.)

S9.4 The vertical approach angle is the angle between the horizontal plane and the velocity vector, measured in the midsagittal plane of the headform. A 0 degree vertical vector in Table I coincides with the horizontal plane and a vertical vector of greater than 0 degrees in Table I makes an upward angle of the same number of degrees with that plane.

S10 Target Locations.

(a) The target locations specified in S10.1 through S10.16 are located on both sides of the vehicle and, except as specified in S10(b), are determined using the procedures specified in those paragraphs.

(b) Except as specified in S10(c), if there is no combination of horizontal and vertical angles specified in S8.13.4 at which the forehead impact zone of the free motion headform can contact one of the targets located using the procedures in S10.1 through S10.16, the center of that target is moved to any location within a sphere with a radius of 25 mm, centered on the center of the original target, which the forehead impact zone can contact at one or more combination of angles.

(c) If there is no point within the sphere specified in S10(b) which the forehead impact zone of the free motion headform can contact at one or more combination of horizontal and vertical angles specified in S8.13.4, the radius of the sphere is increased by 25 mm increments until the sphere contains at least one point that can be contacted at one or more combination of angles.

### S10.1 A-pillar targets.

(a) A-pillar reference point and target AP1. On the vehicle exterior, locate a transverse vertical plane (Plane 1) which contacts the rearmost point of the windshield trim. The intersection of Plane 1 and the vehicle exterior surface is Line 1. Measuring along the vehicle exterior surface, locate a point (Point 1) on Line 1 that is 125 mm inboard of the intersection of Line 1 and a vertical plane tangent to the vehicle at the outboard most point on Line 1 with the vehicle side door open. Measuring along the vehicle exterior surface in a longitudinal vertical plane (Plane 2) passing through Point 1, locate a point (Point 2) 50 mm rearward of Point 1. Locate the A-pillar reference point (Point APR) at the intersection of the interior roof surface and a line that is perpendicular to the vehicle exterior surface at Point 2. Target AP1 is located at point APR.

(b) Target AP2. Locate the horizontal plane (Plane 3) which intersects point APR. Locate the horizontal plane (Plane 4) which is 88 mm below Plane 3. Target AP2 is the point in Plane 4 and on the A-pillar which is closest to CG-F2 for the nearest seating position.

(c) Target AP3. Locate the horizontal plane (Plane 5) containing the highest point at the intersection of the dashboard and the A-pillar. Locate a horizontal plane (Plane 6) half-way between Plane 3 and Plane 5. Target AP3 is the point on Plane 6 and the A-pillar which is closest to CG-F1 for the nearest seating position.

### S10.2 B-pillar targets.

(a) B-pillar reference point and target BP1. Locate the point (Point 3) on the vehicle interior at the intersection of the horizontal plane passing through the highest point of the forward most door opening and the centerline of the width of the B-pillar, as viewed laterally. Locate a transverse vertical plane (Plane 7) which passes through Point 3. Locate the point (Point 4) at the intersection of the interior roof surface, Plane 7, and the plane, described in S8.15(h), defining the nearest edge of the upper roof. The B-pillar reference point (Point BPR) is the point located at the middle of the line from Point 3 to Point 4 in Plane 7, measured along the vehicle interior surface. Target BP1 is located at Point BPR.

(b) Target BP2. If a seat belt anchorage is located on the B-pillar, Target BP2 is located at any point on the anchorage.

(c) Target BP3. Target BP3 is located in accordance with this paragraph. Locate a horizontal plane (Plane 8) which intersects Point BPR. Locate a horizontal plane (Plane 9) which passes through the lowest point of the daylight opening forward of the pillar. Locate a horizontal plane (Plane 10) half-way between Plane 8 and Plane 9. Target BP3 is the point located in Plane 10 and on the interior surface of the B-pillar, which is closest to CG-F(2) for the nearest seating position.

(d) Target BP4. Locate a horizontal plane (Plane 11) half-way between Plane 9 and Plane 10. Target BP4 is the point located in Plane 11 and on the interior surface of the B-pillar which is closest to CG-R for the nearest seating position.

### S10.3 Other pillar targets.

(a) Target OP1.

(a)(1) Except as provided in S10.3(a)(2), target OP1 is located in accordance with this paragraph. Locate the point (Point 5), on the vehicle interior, at the intersection of the horizontal plane through the highest point of the highest adjacent door opening or daylight opening (if no adjacent door opening) and the centerline of the width of the other pillar, as viewed laterally. Locate a transverse vertical plane (Plane 12) passing through Point 5. Locate the point (Point 6) at the intersection of the interior roof surface, Plane 12 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. The other pillar reference point (Point OPR) is the point located at the middle of the line between Point 5 and Point 6 in Plane 12, measured along the vehicle interior surface. Target OP1 is located at Point OPR.

(a)(2) If a seat belt anchorage is located on the pillar, Target OP1 is any point on the anchorage.

(b) Target OP2. Locate the horizontal plane (Plane 13) intersecting Point OPR. Locate a horizontal plane (Plane 14) passing through the lowest point of the daylight opening forward of the pillar. Locate a horizontal plane (Plane 15) half-way between Plane 13 and Plane 14. Target OP2 is the point located on the interior surface of the pillar at the intersection of Plane 15 and the centerline of the width of the pillar, as viewed laterally.

### S10.4 Rearmost pillar targets

(a) Rearmost pillar reference point and target RP1. Locate the point (Point 7) at the corner of the upper roof nearest to the pillar. The distance between Point M, as described in S8.15(g), and Point 7, as measured along the vehicle interior surface, is D. Extend the line from Point M to Point 7 along the vehicle interior surface in the same vertical plane by  $(3 \cdot D / 7)$  beyond Point 7 or until the edge of a daylight opening, whichever comes first, to locate Point 8. The rearmost pillar reference point (Point RPR) is at the midpoint of the line between Point 7 and Point 8, measured along the vehicle interior. Target RP1 is located at Point RPR.

(b) Target RP2.

(b)(1) Except as provided in S10.4(b)(2), target RP2 is located in accordance with this paragraph. Locate the horizontal plane (Plane 16) through Point RPR. Locate the horizontal plane (Plane 17) 150 mm below Plane 16. Target RP2 is located in Plane 17 and on the pillar at the location closest to CG-R for the nearest designated seating position.

(b)(2) If a seat belt anchorage is located on the pillar, Target RP2 is any point on the anchorage.

#### S10.5 Front header targets.

(a) Target FH1. Locate the contour line (Line 2) on the vehicle interior trim which passes through the APR and is parallel to the contour line (Line 3) at the upper edge of the windshield on the vehicle interior. Locate the point (Point 9) on Line 2 that is 125 mm inboard of the APR, measured along that line. Locate a longitudinal vertical plane (Plane 18) that passes through Point 9. Target FH1 is located at the intersection of Plane 18 and the upper vehicle interior, halfway between a transverse vertical plane (Plane 19) through Point 9 and a transverse vertical plane (Plane 20) through the intersection of Plane 18 and Line 3.

(b) Target FH2.

(b)(1) Except as provided in S10.5(b)(2), target FH2 is located in accordance with this paragraph. Locate a point (Point 10) 275 mm inboard of Point APR, along Line 2. Locate a longitudinal vertical plane (Plane 21) that passes through Point 10. Target FH2 is located at the intersection of Plane 21 and the upper vehicle interior, halfway between a transverse vertical plane (Plane 22) through Point 10 and a transverse vertical plane (Plane 23) through the intersection of Plane 21 and Line 3.

(b)(2) If a sun roof opening is located forward of the front edge of the upper roof and intersects the mid-sagittal plane of a dummy seated in either front outboard seating position, target FH2 is the nearest point that is forward of a transverse vertical plane (Plane 24) through CG-F(2) and on the intersection of the mid-sagittal plane and the interior sunroof opening.

#### S10.6 Targets on the side rail between the A-pillar and the B-pillar or rearmost pillar in vehicles with only two pillars on each side of the vehicle.

(a) Target SR1. Locate a transverse vertical plane (Plane 25) 150 mm rearward of Point APR. Locate the point (Point 11) at the intersection of Plane 25 and the upper edge of the forward most door opening. Locate the point (Point 12) at the intersection of the interior roof surface, Plane 25 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR1 is located at the middle of the line between Point 11 and Point 12 in Plane 25, measured along the vehicle interior.

(b) Target SR2. Locate a transverse vertical plane (Plane 26) 300 mm rearward of the APR or 300 mm forward of the BPR (or the RPR in vehicles with no B-pillar). Locate the point (Point 13) at the intersection of Plane 26 and the upper edge of the forward most door opening. Locate the point (Point 14) at the intersection of the interior roof surface, Plane 26 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR2 is located at the middle of the line between Point 13 and Point 14 in Plane 26, measured along the vehicle interior.



S10.7 Other side rail target (target SR3).

(a) Except as provided in S10.7(b), target SR3 is located in accordance with this paragraph. Locate a transverse vertical plane (Plane 27) 150 mm rearward of either Point BPR or Point OPR. Locate the point (Point 15) as provided in either S10.7(a)(1) or S10.7(a)(2), as appropriate. Locate the point (Point 16) at the intersection of the interior roof surface, Plane 27 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR3 is located at the middle of the line between Point 15 and Point 16 in Plane 27, measured along the vehicle interior surface.

(a)(1) If Plane 27 intersects a door or daylight opening, the Point 15 is located at the intersection of Plane 27 and the upper edge of the door opening or daylight opening.

(a)(2) If Plane 27 does not intersect a door or daylight opening, the Point 15 is located on the vehicle interior at the intersection of Plane 27 and the horizontal plane through the highest point of the door or daylight opening nearest Plane 27. If the adjacent door(s) or daylight opening(s) are equidistant to Plane 27, Point 15 is located on the vehicle interior at the intersection of Plane 27 and either horizontal plane through the highest point of each door or daylight opening.

(b) Except as provided in S10.7(c), if a grab handle is located on the side rail, target SR3 is located at any point on the anchorage of the grab-handle. Folding grab-handles are in their stowed position for testing.

(c) If a seat belt anchorage is located on the side rail, target SR3 is located at any point on the anchorage.

S10.8 Rear header target (target RH). Locate the point (Point 17) at the intersection of the surface of the upper vehicle interior, the mid-sagittal plane (Plane 28) of the outboard rearmost dummy and the plane, described in S8.15(h), defining the rear edge of the upper roof. Locate the point (Point 18) as provided in S10.8(a) or S10.8(b), as appropriate. Except as provided in S10.8(c), Target RH is located at the mid-point of the line that is between Point 17 and Point 18 and is in Plane 28, as measured along the surface of the vehicle interior.

(a) If Plane 28 intersects a rear door opening or daylight opening, then Point 18 is located at the intersection of Plane 28 and the upper edge of the door opening or the daylight opening (if no door opening).

(b) If Plane 28 does not intersect a rear door opening or daylight opening, then Point 18 is located on the vehicle interior at the intersection of Plane 28 and a horizontal plane through the highest point of the door or daylight opening nearest to Plane 28. If the adjacent door(s) or daylight opening(s) are equidistant to Plane 28, Point 18 is located on the vehicle interior at the intersection of Plane 28 and either horizontal plane through the highest point of each door or daylight opening.

(c) If Target RH is more than 112 mm from Point 18 on the line that is between Point 17 and Point 18 and is in Plane 28, as measured along the surface of the vehicle interior, then Target RH is the point on that line which is 112 mm from Point 18.

S10.9 Upper roof target (target UR). Target UR is any point on the upper roof.

S10.10 Sliding door track target (target SD). Locate the transverse vertical plane (Plane 29) passing through the middle of the widest opening of the sliding door, measured horizontally and parallel to the vehicle longitudinal centerline. Locate the point (Point 19) at the intersection of the surface of the upper vehicle interior, Plane 29 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Locate the point (Point 20) at the intersection of Plane 29 and the upper edge of the sliding door opening. Target SD is located at the middle of the line between Point 19 and Point 20 in Plane 29, measured along the vehicle interior.

S10.11 Roll-bar targets.

(a) Target RB1. Locate a longitudinal vertical plane (Plane 30) at the mid-sagittal plane of a dummy seated in any outboard designated seating position. Target RB1 is located on the roll-bar and in Plane 30 at the location closest to either CG-F2 or CG-R, as appropriate, for the same dummy.

(b) Target RB2. If a seat belt anchorage is located on the roll-bar, Target RB2 is any point on the anchorage.

S10.12 Stiffener targets.

(a) Target ST1. Locate a transverse vertical plane (Plane 31) containing either CG-F2 or CG-R, as appropriate, for any outboard designated seating position. Target ST1 is located on the stiffener and in Plane 31 at the location closest to either CG-F2 or CG-R, as appropriate.

(b) Target ST2. If a seat belt anchorage is located on the stiffener, Target ST2 is any point on the anchorage.

S10.13 Brace target (target BT) Target BT is any point on the width of the brace as viewed laterally from inside the passenger compartment.

S10.14 Door frame targets.

(a) Target DF 1. Locate the point (Point 21) on the vehicle interior at the intersection of the horizontal plane passing through the highest point of the forward door opening and a transverse vertical plane (Plane 32) tangent to the rearmost edge of the forward door, as viewed laterally with the adjacent door open. Locate the point (Point 22) at the intersection of the interior roof surface, Plane 32, and the plane, described in S8.15(h), defining the nearest edge of the upper roof. The door frame reference point (Point DFR) is the point located at the middle of the line from Point 21 to Point 22 in Plane 32, measured along the vehicle interior surface. Target DF1 is located at Point DFR.

(b) Target DF2. If a seat belt anchorage is located on the door frame, Target DF2 is located at any point on the anchorage.

(c) Target DF3. Locate a horizontal plane (Plane 33) which intersects Point DFR. Locate a horizontal plane (Plane 34) that passes through the lowest point of the adjacent daylight opening forward of the door frame. Locate a horizontal plane (Plane 35) half-way between Plane 33 and Plane 34. Target DF3 is the point located in Plane 35 and on the interior surface of the door frame, which is closest to CG-F2 for the nearest seating position.

(d) Target DF4. Locate a horizontal plane (Plane 36) half-way between Plane 34 and Plane 35. Target DF4 is the point located in Plane 36 and on the interior surface of the door frame that is closest to CG-R for the nearest seating position.

S10.15 Other door frame targets.

(a) Target OD1.

(a)(1) Except as provided in S10.15(a)(2), target OD1 is located in accordance with this paragraph. Locate the point (Point 23) on the vehicle interior, at the intersection of the horizontal plane through the highest point of the highest adjacent door opening or daylight opening (if there is no adjacent door opening) and the center line of the width of the other door frame, as viewed laterally with the doors in the closed position. Locate a transverse vertical plane (Plane 37) passing through Point 23. Locate the point (Point 24) at the intersection of the interior roof surface, Plane 37 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. The other door frame reference point (Point ODR) is the point located at the middle of the line between Point 23 and Point 24 in Plane 37, measured along the vehicle interior surface. Target OD1 is located at Point ODR.

(a)(2) If a seat belt anchorage is located on the door frame, Target OD1 is any point on the anchorage.

(b) Target OD2. Locate the horizontal plane (Plane 38) intersecting Point ODR. Locate a horizontal plane (Plane 39) passing through the lowest point of the daylight opening forward of the door frame. Locate a horizontal plane (Plane 40) half-way between Plane 38 and Plane 39. Target OD2 is the point located on the interior surface of the door frame at the intersection of Plane 40 and the center line of the width of the door frames, as viewed laterally, with the doors in the closed position.

S10.16 Seat belt mounting structure targets.

(a) Target SB1. Target SB1 is located at any point on the seat belt anchorage mounted on the seat belt mounting structure.

(b) Target SB2. Locate a horizontal plane (Plane 41), containing either CG-F2 or CG-R, as appropriate, for any outboard designated seating position whose seating reference point, SgRP, is forward of and closest to, the vertical center line of the width of the seat belt mounting structure as viewed laterally. Target SB2 is located on the seat belt mounting structure and in Plane 41 at the location closest to either CG-F2 or CG-R, as appropriate.

(c) Target SB3. Locate a horizontal plane (Plane 42), containing CG-R for any outboard designated seating position rearward of the forward most designated seating position or positions whose seating reference point, SgRP, is rearward of and closest to, the vertical center line of the width of the seat belt mounting structure, as viewed laterally. Locate a horizontal plane (Plane 43) 200 mm below Plane 42. Target SB3 is located on the seat belt mounting structure and in Plane 43 at the location closest to CG-R, as appropriate.

Figures and Table to §571.201

[FIGURE 1 - ORTHOGONAL REFERENCE SYSTEM](#)

[FIGURE 2 - VERTICAL AND HORIZONTAL APPROACH ANGLE PLANE](#)

TABLE 1.—APPROACH ANGLE LIMITS  
[In degrees]

Target component	Horizontal angle	Vertical
Front Header	180	0-50
Rear Header	0 or 360	0-50
Left Side Rail	270	0-50
Right Side Rail	90	0-50
Left Sliding Door Track	270	0-50

Right Sliding Door Track	90	0-50
Left A-Pillar	195-255	-5-50
Right A-Pillar	105-165	-5-50
Left B-Pillar	195-345	-10-50
Right B-Pillar	15-165	-10-50
Left Door Frame	195-345	-10-50
Right Door Frame	15-165	-10-50
Other Left Pillars	270	-10-50
Other Right Pillars	90	-10-50
Other Left Door Frame	270	-10-50
Other Right Door Frame	90	-10-50
Left Rearmost Pillar	270-345	-10-50
Right Rearmost Pillar	15-90	-10-50
Upper Roof	Any	0-50
Overhead Rollbar	0 or 180	0-50
Brace or Stiffener	90 or 270	0-50
Left Seat Belt Mounting Structure	195-345	-10-50
Right Seat Belt Mounting Structure.	15-165	-10-50
Seat Belt Anchorages	Any	0-50

[36 FR 22902, Dec. 2, 1971, as amended at 44 FR 68475, Nov. 29, 1979; 47 FR 52451, Nov. 22, 1982; 56 FR 26039, June 6, 1991; 60 FR 43050 and 43055, Aug. 18, 1995; 62 FR 16725, Apr. 8, 1997; 62 FR 16725, Apr. 8, 1997; 63 FR 28, Jan. 2, 1998; 63 FR 41464, Aug. 4, 1998; 63 FR 45965, Aug. 28, 1998; 64 FR 7140, Feb. 12, 1999; 64 FR 69671, Dec. 14, 1999; 67 FR 79439, Dec. 27, 2002; 68 FR 51711, Aug. 28, 2003; 69 FR 9226, Feb. 27, 2004; 69 FR 70914, Dec. 8, 2004; 70 FR 51669, Aug. 31, 2005; 71 FR 51133, Aug. 29, 2006; 72 FR 50906, Sept. 5, 2007; 72 FR 51956, Sept. 11, 2007]

**Appendix C – Federal Motor Vehicle Safety Standards 205,**  
**“Glazing Materials”**

S1. Scope. This standard specifies requirements for glazing materials for use in motor vehicles and motor vehicle equipment.

S2. Purpose. The purpose of this standard is to reduce injuries resulting from impact to glazing surfaces, to ensure a necessary degree of transparency in motor vehicle windows for driver visibility, and to minimize the possibility of occupants being thrown through the vehicle windows in collisions.

S3. Application and Incorporation by Reference.

S3.1 Application.

(a) This standard applies to passenger cars, multipurpose passenger vehicles, trucks, buses, motorcycles, slide-in campers, pickup covers designed to carry persons while in motion and low speed vehicles, and to glazing materials for use in those vehicles.

(b) For glazing materials manufactured before September 1, 2006, and for motor vehicles, slide-in campers and pickup covers designed to carry persons while in motion, manufactured before November 1, 2006, the manufacturer may, at its option, comply with 49 CFR 571.205(a) of this section.

S3.2 Incorporation by Reference.

(a) “American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways-Safety Standard” ANSI/SAE Z26.1-1996, Approved by American National Standards Institute August 11, 1997 (ANSI/SAE Z26.1-1996) is incorporated by reference in Section 5.1 and is hereby made part of this Standard. The Director of the Federal Register approved the material incorporated by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51 (see §571.5 of this part). A copy of ANSI/SAE Z26.1-1996 may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0007. A copy of ANSI/SAE Z26.1-1996 may be inspected at NHTSA's technical reference library, 400 Seventh Street, SW., Room 5109, Washington, DC or at the Office of the Federal Register, 900 North Capitol Street, NW., Suite 700, Washington, DC.

(b) The Society of Automotive Engineers (SAE) Recommended Practice J673, revised April 1993, "Automotive Safety Glasses" (SAE J673, rev. April 93) is incorporated by reference in Section S5.1, and is hereby made part of this Standard. The Director of the Federal Register approved the material incorporated by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51 (see Sec. 571.5 of this part). A copy of SAE J673, rev. April 93 may be obtained from SAE at the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096. A copy of SAE J673, rev. April 93 may be inspected at NHTSA's technical reference library, 400 Seventh Street, SW., Room 5109, Washington, DC, or at the Office of the Federal Register, 900 North Capitol Street, NW., Suite 700, Washington, DC.

(c) The Society of Automotive Engineers (SAE) Recommended Practice J100, revised June 1995, "Class 'A' Vehicle Glazing Shade Bands" (SAE J100, rev. June 95) is incorporated by reference in Section S5.3, and is hereby made part of this Standard. The Director of the Federal Register approved the material incorporated by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51 (see Sec. 571.5 of this part). A copy of SAE J100, rev. June 95 may be obtained from SAE at the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096. A copy of SAE J100, rev. 95 may be inspected at NHTSA's technical reference library, 400 Seventh Street, SW., Room 5109, Washington, DC, or at the Office of the Federal Register, 900 North Capitol Street, NW., Suite 700, Washington, DC.

#### S4. Definitions.

Bullet resistant shield means a shield or barrier that is installed completely inside a motor vehicle behind and separate from glazing materials that independently comply with the requirements of this standard.

Camper means a structure designed to be mounted in the cargo area of a truck, or attached to an incomplete vehicle with motive power, for the purpose of providing shelter for persons.

Glass-plastic glazing material means a laminate of one or more layers of glass and one or more layers of plastic in which a plastic surface of the glazing faces inward when the glazing is installed in a vehicle.

Pickup cover means a camper having a roof and sides but without a floor, designed to be mounted on and removable from the cargo area of a truck by the user.

Prime glazing manufacturer means a manufacturer that fabricates, laminates, or tempers glazing materials.

Slide-in camper means a camper having a roof, floor, and sides, designed to be mounted on and removable from the cargo area of a truck by the user.

#### S5. Requirements.

S5.1 Glazing materials for use in motor vehicles must conform to ANSI/SAE Z26.1-1996 unless this standard provides otherwise.

S5.1.1 Multipurpose passenger vehicles. Except as otherwise specifically provided by this standard, glazing for use in multipurpose passenger vehicles shall conform to the requirements for glazing for use in trucks as specified in ANSI/SAE Z26.1-1996.

S5.1.2 Aftermarket replacement glazing. Glazing intended for aftermarket replacement is required to meet the requirements of this standard or the requirements of 49 CFR 571.205(a) applicable to the glazing being replaced.

S5.1.3 Location of arrow within "AS" markings. In ANSI/SAE Z26.1-1996 (August 11, 1997) Section 7. "Marking of Safety Glazing Materials," on page 33, in the right column, in the first complete sentence, the example markings "AS↓1", "AS↓14" and "AS↑2" are corrected to read "A↓S1", "A↓S14" and "A↑S2". Note that the arrow indicating the portion of the material that complies with Test 2 is placed with its base adjacent to a horizontal line.

S5.2 Each of the test specimens described in ANSI/SAE Z26.1-1996 Section 5.7 (fracture test) must meet the fracture test requirements of that section when tested in accordance with the test procedures set forth in that section.

S5.3 Shade bands. Shade band areas for windshields shall comply with the requirements of either S5.3.1 or S5.3.2.

S5.3.1 Shade bands for windshields shall comply with SAE J100 JUNE 1995.

S5.3.2 Except as provided in S5.3.2.1, the lower boundary of shade bands for windshields shall be a plane inclined upwards from the X axis of the vehicle at 7 degrees, passing through point V<sub>1</sub>, and parallel to the Y axis. The coordinate system and point V<sub>1</sub> shall be as specified in Annexes 18 and 19 of European Commission for Europe (ECE) Regulation No. 43 Revision 2 – Amendment 1.

S5.3.2.1 In the area 300 mm wide centered on the intersection of the windshield surface and longitudinal vertical median plane of the vehicle, the lower boundary of shade bands for windshields shall be a plane inclined upwards from the X axis of the vehicle at 3 degrees, passing through point V<sub>1</sub>, and parallel to the Y axis.

S5.4 Low speed vehicles. Windshields of low speed vehicles must meet the ANSI/SAE Z26.1-1996 specifications for either AS-1 or AS-4 glazing.

S5.5 Item 4A Glazing. Item 4A glazing may be used in all areas in which Item 4 safety glazing may be used, and also for side windows rearward of the "C" pillar. I.e., Item 4A glazing may be used under Item 4A paragraph (b) of ANSI/SAE Z26.1-1996 only in side windows rearward of the "C" pillar.



S6. Certification and marking.

S6.1 A prime glazing material manufacturer must certify, in accordance with 49 U.S.C. 30115, each piece of glazing material to which this standard applies that is designed--

- (a) As a component of any specific motor vehicle or camper; or
- (b) To be cut into components for use in motor vehicles or items of motor vehicle equipment.

S6.2 A prime glazing manufacturer certifies its glazing by adding to the marks required by section 7 of ANSI/SAE Z26.1-1996, in letters and numerals of the same size, the symbol "DOT" and a manufacturer's code mark that NHTSA assigns to the manufacturer. NHTSA will assign a code mark to a manufacturer after the manufacturer submits a written request to the Office of Vehicle Safety Compliance, National Highway Traffic Safety Administration, 400 Seventh Street, SW., Washington, DC 20590. The request must include the company name, address, and a statement from the manufacturer certifying its status as a prime glazing manufacturer as defined in S4.

S6.3 A manufacturer or distributor who cuts a section of glazing material to which this standard applies, for use in a motor vehicle or camper, must--

- (a) Mark that material in accordance with section 7 of ANSI/SAE Z26.1-1996; and
- (b) Certify that its product complies with this standard in accordance with 49 U.S.C. 30115.

[37 FR 12239, June 21, 1972, as amended at 37 FR 13097, July 1, 1972; 37 FR 24036, Nov. 11, 1972; 37 FR 24826, Nov. 22, 1972; 42 FR 61466, Dec. 5, 1977; 45 FR 47151, July 14, 1980; 46 FR 43690, Aug. 31, 1981; 48 FR 52065, Nov. 16, 1983; 49 FR 6734, Feb. 23, 1984; 56 FR 12674, Mar. 27, 1991; 56 FR 18531, Apr. 23, 1991; 56 FR 49149, Sept. 27, 1991; 57 FR 1654, Jan. 15, 1992; 57 FR 13656, Apr. 17, 1992; 57 FR 30164, July 8, 1992; 57 FR 58150, Dec. 9, 1992; 60 FR 13646, Mar. 14, 1995; 61 FR 41743, Aug. 12, 1996; 67 FR 79439, Dec. 27, 2002; 68 FR 43971, July 25, 2003; 68 FR 55545, Sept. 26, 2003; 69 FR 51191, Aug. 18, 2004; 70 FR 39965, July 12, 2005; 71 FR 64474, Nov. 2, 2006]

**Appendix D – DVS Interoperability Chart**

<p><b>Type 1a</b></p>	<p><b>Type 1 b</b></p>	<p><b>Type 2</b></p>
<p><b>6.2.a</b></p>	<p><b>6.2.b</b></p>	<p><b>6.2.c</b></p>
<p><b>7.1.1</b></p>	<p><b>7.1.2</b></p>	<p><b>Vendor Option to Provide Proprietary Viewer</b></p>

**Appendix E – Acknowledgements: “Digital Video Systems for  
Public Safety: Developing Minimum Performance Specifications”  
Executive Committee**

Advisory Panel Executive Committee Co-Chairs:

**Captain Thomas Didone**

Montgomery (MD) County Department of Police  
Law Enforcement Executive Co-Chair

**Mike Burridge**

L-3 Communications, Display Systems  
Industry Executive Co-Chair

Executive Committee Task Group Chairs:

**Herbert L. Blitzer**

Executive Director, Institute for Forensic Imaging  
Quality Measurement Task Group Chair

**D. Miles Brissette**

Tarrant County (TX) Criminal District Attorney’s Office  
Testing and Certification Task Group Chair

**Raymond Cooke**

Principal Architect, IBM Global Services Technology  
Interoperability Task Group Chair

**Gregory A. Dertz**

Distinguished Member of the Technical Staff, Motorola, Inc.  
Data Security Task Group Chair

**Sergeant Scott Galbreath**

Delaware State Police  
Operational Measurements Task Group Chair

**Lieutenant Ronald Castleberry and Captain James D. Wells, Jr.**

Florida Highway Patrol  
Officer Safety Task Group Chairs

**Appendix F – Acknowledgements: Participating  
Agencies/Organizations**

A4S Security, Inc  
C Media Solutions Corporation  
Cherry Road GT  
City of White Plains, New York –Department of Public Safety  
Coban Research and Technologies, Inc.  
Control Concepts, Inc.  
CruiseCam International  
Custody Video  
Data 911  
Decatur Electronics, Inc.  
Dedicated Micros  
Delaware State Police  
Digital Ally, Inc  
DriveCam Video Systems  
EDO Corporation  
Enforcement Technologies International, LLC  
Everett, WA Police Department  
Farmington, NM Police Department  
Federal Bureau of Investigation Academy/TDU  
Fleet Safety Equipment  
Florida Highway Patrol  
Forensic Video Solutions, LLC  
FSCAM/ Fleet Safety  
Gasser Consulting  
IBM Global Services  
ICOP Digital, Inc.  
Insight Video Net Corporation  
Institute for Forensic Imaging  
Integrian, Inc.  
International Police Technologies, Inc.  
JFK Forensics  
Kustom Signals, Inc.  
L-3 Communications Mobile Vision, Inc.  
L-3 Display Systems  
Los Angeles County Sheriff's Department  
Los Angeles Police Department  
McCoy's Law Line, Inc.  
Montgomery County, MD Department of Police  
MPH Industries  
Mobile Police Solutions  
Motorola Inc.  
National Institute of Justice

National Institute of Standards and Technology  
National Law Enforcement and Corrections Technology Center- West (NLECTC)  
National Transportation Safety Board  
New Albany, OH Police Department  
New York Police Department  
NL Technology  
Noblis, Inc.  
Northland Security Products-MobileEye  
NTIA  
On Patrol Video International  
Panasonic AVC Networks Company  
Panasonic Computer Solutions Company  
Prince Georges County, MD Police Department  
Raytheon JPS Communications  
Security Industry Association  
Sony Electronics  
Stalker Radar and Video, Applied Concepts, Inc.  
Tarrant County, TX Criminal District Attorney's Office  
The Ashcroft Group, LLC  
TranTech, Inc.  
Toronto, ON Police Service  
Underwriters Laboratories, Inc.  
United States Park Police  
ViewPointe Solutions, LLC  
Verint  
Washington State Patrol  
WatchGuard Video

## **Appendix G– IACP Staff Acknowledgements**

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