GM	WORLDWIDE ENGINEERING STANDARDS	Analytical Procedure	GMW16224

Inside and Outside Rear View Mirrors, Certification Field of Vision, ECE R46.02 or UN R 46.04

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

This standard describes how to validate/certify the vision rays and lines describing the geometric field of vision of rear view mirrors. These vision rays and lines assist in demonstrating compliance with European standard, Economic Commission for Europe (ECE): ECE R46.02 or UN R 46.04, for Inside Rear View Mirror (ISRVM) and Outside Rear View Mirror (OSRVM).

1.1 Purpose. The purpose of this analysis is to demonstrate that the vehicle meets the requirements of European standard, ECE R46.02 or UN R 46.04, for ISRVM and OSRVM. The Mirror Certification function allows UniGraphics (UG) users to perform analysis on driver's side and passenger's side OSRVM and ISRVM. This function will generate vision rays and lines describing the geometric field of vision of rear view mirrors, along with reporting out the numerical results and summarizing the input data.

1.2 Applicability. This standard complies with European standard, ECE R46.02 or UN R 46.04, for Inside and Outside Rear View Mirrors.

1.3 Remarks. While in the past a physical witness test was used to demonstrate that the vehicle's mirrors meet these requirements, this analytical procedure is the standard certification method currently conducted at GM. The certification analysis is done within UG through the function Mirror Certification in the general packaging menu.

Note: Reference GMW16157 for additional requirements which support ISRVM and OSRVM certification.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ECE R46.02 SAE J1100 UN R 46.04

2.2 GM Standards/Specifications.

GMW16157

2.3 Additional References.

- Annex 1 to the Consolidated Resolution on the Construction of Vehicles (RE.3) (document ECE/TRANS/WP.29/78/Rev.2).
- GM Data Creation Standard.
- GM Global Best Practice OSRVM-9 Minimum Glass Size Requirements (The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.)
- GM Global Best Practice OSRVM-11 Obscuration of the Mirror Glass Reflective Surface Criteria (The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.)
- GM Global Best Practice ISRVM-32 Inside Rearview Mirror Certification Requirements (The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.)
- GM Global Design infoBOOK located at http://gmna.gm.com/external/infobook/

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- Mirror Certification User Guide (4.1.2).
- Seating Arrangement Drawings.
- Suspension Heights and Wheel Travel Document.

3 Resources

3.1 Facilities. Not applicable.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment. UG workstation with Vehicle Assembly Structure (VAS) access.

3.3 Test Vehicle/Test Piece. See 4.3.1.1 for revision and variant rules.

3.4 Test Time. Not applicable.

3.5 Test Required Information. See Appendix A.

3.6 Personnel/Skills. Personnel capable of performing analyses within the Mirror Certification function with UG.

4 Procedure

4.1 Preparation. Certification Model is built up with parts from the VAS. (See 4.3.1).

4.1.1 Review the detailed information in the GM Global Design infoBOOK, at website:

- http://gmna.gm.com/external/infobook/

4.1.2 Review the Mirror Certification User Guide. This is part of the UG software package. Look under the menu: **GPDL 5-B**; select **Documentation**, and then **GPDL 5-B.3 Application Information**. Scroll down to **MMR Mirror Certification**, and then select **Users Guide**.

4.1.3 Review the GM Global OSRVM Best Practices OSRVM-9 and OSRVM-11. The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.

4.1.4 Review the GM Global ISRVM Best Practice ISRVM-32. The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.

4.2 Conditions. Not applicable.

4.2.1 Environmental Conditions.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.2.3. Coordinates. The Mirror Certification function is built on the assumption that the data is in vehicle position and follows GM data creation standards. In particular that X direction is established such that X increases from the front to the rear of the vehicle (length). The Z component increases from the ground upward (height), and that the Y component starts at the centerline of the vehicle and increases heading outboard to the right (cross-car). The standard GM coordinate system should be used, i.e., Cartesian right-oriented X, Y, Z-system with axes according to Figure 1.

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Where:

X: Rearwards in the vehicle, starting from in front of the front bumper

Y: Rightwards in the vehicle, starting from the center of the car

Z: Upwards, starting from below the body

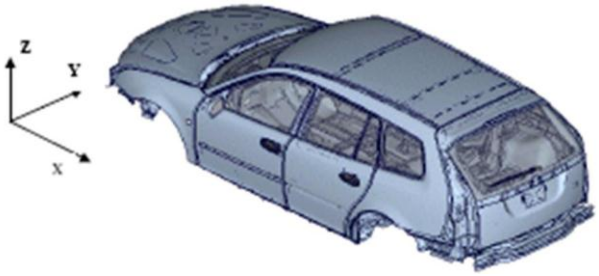

Figure 1: Standard GM Coordinate Directions

4.3 Instructions.

4.3.1 Certification Model. The certification model is built up with parts from the Vehicle Assembly Structure (VAS) system, or Teamcenter Engineering (TcAE). The parts, mirrors, backlight and other needed parts (e.g., side panel outer, etc.,) shall have the revision rule equal to a status representing serial production before loading them into UG. Also be sure that the variant rule is set to the correct product line, body design, market specification and steering wheel position.

Note: The standard can also be used during the development phase of a vehicle project. Then the revision rule should be set to status, which corresponds to the actual development phase.

4.3.1.1 The **hip point** has to be included. It is found in the Seating Arrangement Drawings from the packaging group. Furthermore, the ground line has to be included. This originates from the vehicle loading. The points needed to create this line are found in the Suspension Heights and Wheel Travel Document from the Chassis Subsystem Management Team (SMT).

4.3.1.2 Driver's Side Mirror. The ECE standard specifies that both a **Far Target** Field Of View (FOV) and a **Near Target** FOV are required, as shown in Figure 2.

The **Far Target** FOV uses a distance of 20 m behind the driver's ocular point and a width of 4 m outboard from the driver's side ground wide point.

The OSRVM **ground wide point** is defined as the vehicle's widest outboard point behind the mirror (may be different driver's side versus passenger's side).

In addition to the **Far Target** FOV, a **Near Target** FOV is required, which has a distance of 4 m behind the driver's ocular point and a width of 1 m outboard from the driver's side ground wide point.

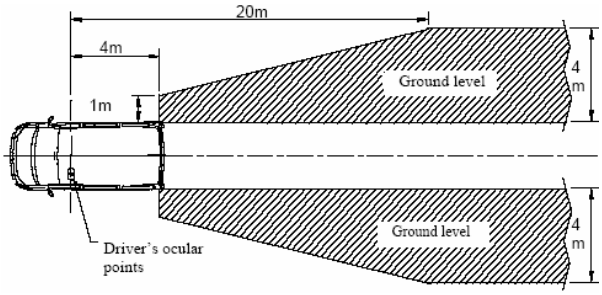

Figure 2: OSRVM Field of Vision

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4.3.1.3 Passenger's Side Mirror. Similar to the driver's side OSRVM, the ECE standard specifies that both a **Far Target** FOV and a **Near Target** FOV are required for the passenger's side OSRVM, as shown in Figure 2.

The **Far Target** FOV uses a distance of 20 m behind the driver's ocular point and a width of 4 m outboard from the driver's side ground wide point.

The OSRVM **ground wide point** is defined as the vehicle's widest outboard point behind the mirror (may be different driver's side versus passenger's side).

In addition to the **Far Target** FOV, a **Near Target** FOV is required, which has a distance of 4 m behind the driver's ocular point and a width of 1 m outboard from the driver's side ground wide point.

4.3.1.4 Inside Mirror. ECE R46.02 and UN R 46.04 state that the field of vision must be such that the driver can see at least a 20 m wide, flat, horizontal portion of the road centered on the vertical longitudinal median plane of the vehicle and extending from 60 m behind the driver's ocular points to the horizon, as shown in Figure 3. The ISRVM ground point is defined as a point at Y = 0 (vehicle's centerline), 60 m behind the hip point along the ground line.

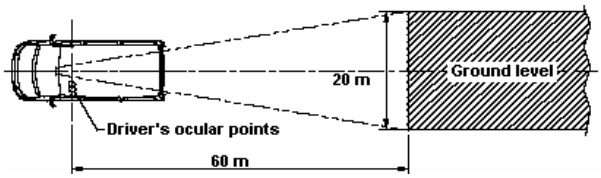

Figure 3: ISRVM Field of Vision

4.3.2 Certification Standard. The certification is done within UG through the function Mirror Certification in the general packaging menu. The Mirror Certification function provides numerical and visual performance of a given mirror design. It is the user that actually certifies the mirror when the results are compared to the established national rear view mirror standards. The Mirror Certification function for OSRVMs is virtually identical for Driver's side and Passenger's side mirrors. Therefore, only the Driver's side Mirror Certification analysis is discussed.

4.3.2.1 Basic High Level Sequence.

4.3.2.1.1 Select the Location and the Standard, and then select OK to continue. This will lead to the next dialog: **Mirror Definition.**

4.3.2.1.2 Follow the cue line messages and select all the required objects. It is recommended to use the same prime point location for both **Far Target** and **Near Target** FOV certifications.

Select OK to continue. Next, the **Hip Point** selection dialog will be displayed.

4.3.2.1.3 Select the **Hip Point** (i.e., the **R-Point**) based on the standard, and then select OK to continue. This will lead to the next dialog: **Options**.

4.3.2.1.4 Change the Default Mirror Construction if desired, including adjusting the required Convex Radius. Do not select the **Deviate from Standard** option, unless specifically stated in the detailed steps of Appendix A or Appendix B. Select the restrictions to certify with mirror restrictions. Select OK from the Options dialog. This will lead to the next dialog: **Output Options**.

4.3.2.1.5 Select the optional colors for output, and then enter any user remarks. Select OK to continue the processing.

4.3.2.1.6 The mirror certification output will appear. Save this text to a file. This shall later be included in the simulation report.

4.4 Result Evaluation.

4.4.1 Results Presentation. The results shall be presented as per the following examples in Table 1, Figure 4 and Figure 5, along with Table 2 and Table 3. Figure 6 shows the ISRVM output in the larger context of the analysis model.

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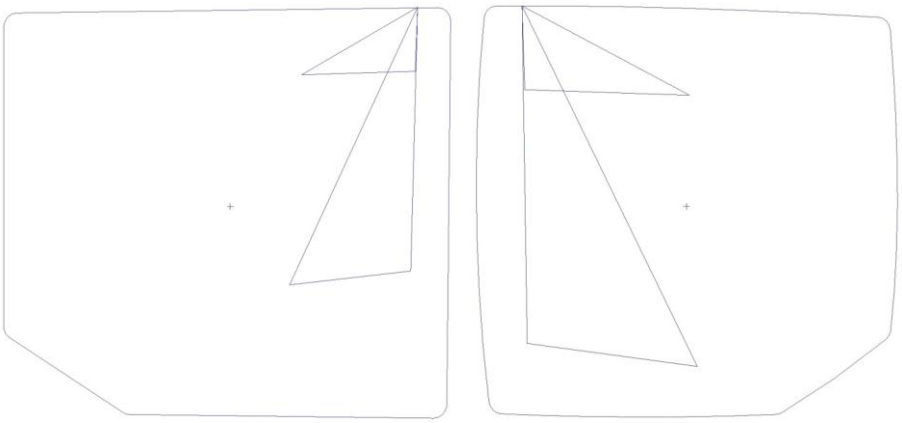
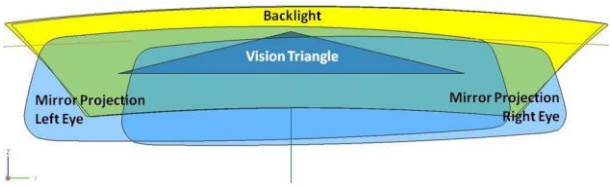
Table 1: Table of Analyzed Models

	Outside Rear View Mirror: Driver's side Left Hand (LH)
	Outside Rear View Mirror: Passenger's side Right Hand (RH)
	Inside Rear View Mirror



Note: Include a picture of vision triangle displayed on the mirror glass for each mirror. (Both driver's side and passenger's side shown.)

Figure 4: OSRVM Output, Vision Triangles



Note: For Inside Rear View Mirrors (ISRVM), the projection on the backlight shall also be included.

Figure 5: ISRVM Output, Rear View Mirror Projection on Backlight

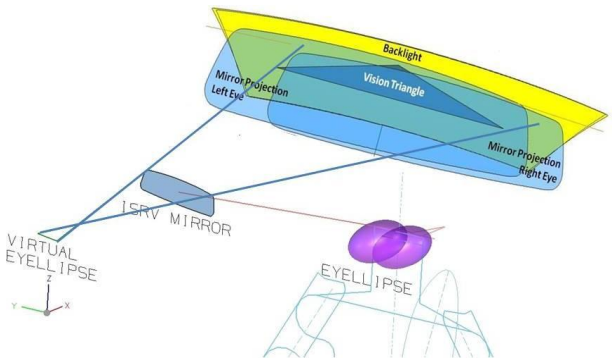


Figure 6: ISRVM Output, with Full Analysis Model

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Table 2: Mirror Certification Driver Outside – Summary Results Note 1, Note 2

```
Standard                                  = Europe
Designation                               = 71/127/EEC - ECE R46.02

Standard Distance                         = 10000.0000

Modified Distance                         =  4000.0000

Standard Width                            =  2500.0000

Modified Width                            =  1000.0000

Mirror Rotation Angle LS                  =     3.1316

Mirror Rotation Angle PV                  =     0.5599

Head Turn Angle PV                        =     0.0000

Maximum Ambinocular Angle PV              =    16.5761

Ambinocular Angle @ Ground PV             =    11.6700

Outboard Deviation                        =    23.3956

Inboard Deviation                         =    28.6355

System Messages:

Value(s) from standard have been overridden by user values

Ambinocular Angle @ Ground PV value may be affected by Mirror-Target
Restrictions.

User Notes
```

Note 1: This example is for the Driver's side Outside Rear View Mirror (OSRVM). Results for the passenger's side OSRVM will be similar. Results for the ISRVM will differ somewhat.
Note 2: For final validation certifications, the **Complete Results** report for each mirror analysis must be generated, which is more detailed than this Summary Analysis report, as shown in Table 3.
Key: LS = Left Side View, PV = Plan View.

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Table 3: Mirror Certification Driver Outside - Complete (Detailed) Results

```
Standard                                = Europe
Designation                             = 71/127/EEC - ECE R46.02

Mirror Model                            = 25951434LHEUNEAR
Units                                   = Metric
Date @ Time                             = 18/Sep/2008 @ 10:11:23
Location                                = Driver Side Outside

Mirror Sheet Name                       = ASPHERIC GLASS
Mirror Curvature                        =  1400.0000
Optional Bezel                          = Not Used

Mirror Pivot Point                      = XC =  2542.7530   X =  2542.7530
                                          YC =  -905.6422   Y =  -905.6422
                                          ZC =  1236.5692   Z =  1236.5692

Prime Point on Mirror                   = XC =  2540.5040   X =  2540.5040
                                          YC =  -873.6169   Y =  -873.6169
                                          ZC =  1301.7146   Z =  1301.7146

Inboard Ground Point                    = XC =  7142.0000   X =  7142.0000
                                          YC =  -921.1950   Y =  -921.1950
                                          ZC =   150.0446   Z =   150.0446

Outboard Ground Point                   = XC =  7142.0000   X =  7142.0000
                                          YC = -1921.1950   Y = -1921.1950
                                          ZC =   150.0446   Z =   150.0446

Hip Point (SgRp)                        = XC =  3142.0000   X =  3142.0000
                                          YC =  -370.0000   Y =  -370.0000
                                          ZC =   701.0000   Z =   701.0000

Standard Distance                       = 10000.0000
Modified Distance                       =  4000.0000

Standard Width                          =  2500.0000
Modified Width                          =  1000.0000

Optional Vehicle Loading                = Not Used

General Output Color                    = DEFAULT
Left Eye Output Color                   = DEFAULT
Right Eye Output Color                  = DEFAULT

Mirror Rotation Angle LS                =     3.1316
Mirror Rotation Angle PV                =     0.5599

Head Turn Angle PV                      =     0.0000
Maximum Ambinocular Angle PV            =    16.5761
Ambinocular Angle @ Ground PV           =    11.6700

Vision Restriction                      =     3.8639%

Reference Plane                         = XC =  3142.0000   X =  3142.0000

Angle of View PV                        =    41.0379
Road Viewing Distance                   =  2664.4675
Target Width                            =  1448.6664

Outboard Deviation                      =    23.3956
Inboard Deviation                       =    28.6355


System Messages:  Value(s) from standard have been overridden by user values
Ambinocular Angle @ Ground PV value may be affected by Mirror-Target Restrictions.

User Notes
```


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