



Static Offsets for Steer Angle Correction

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.

1.1 Purpose. The purpose of this procedure is to detail the steps necessary for steer-angle correction of ball joint fore/aft and lateral loads. The major emphasis is to ensure that total static offsets are added prior to steer angle correction.

1.1.1 Add static offsets.

1.1.2 Perform steer angle correction.

1.2 Applicability. This procedure is written specifically regarding the steer angle correction of front ball joint fore/aft and lateral loads. However, this procedure applies to any Road Load Data Acquisition (RLDA) measurement in a rotating coordinate system that is going to be corrected to a fixed coordinate system.

1.3 Remarks. This procedure documents the justification for the order of the processing steps, and provides the generic steps for performing the processing.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

3 Resources

3.1 Facilities.

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. Mathematical Manipulation Software.

3.3 Test Vehicle/Test Piece. Not applicable.

3.4 Test Time. Dependent on size of data set, typically 1 h to 4 h.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Test technician familiar with test facilities and equipment.

4 Procedure

4.1 Preparation. A typical example of RLDA data measured in a rotating coordinate system is the front ball joint fore/aft and lateral loads. During RLDA data collection, the load channels are balanced in the vehicle static condition (the vehicle sitting static on a level surface in neutral). Therefore, the ball joint channels are referenced from the static condition. Also, the ball joint channels are in the rotating coordinate system with the knuckle of

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the vehicle. For lab test simulations that do not have the steer degree of freedom or for analysis, the ball joint loads are transformed or corrected to the fixed vehicle coordinate system using the steer angle of the wheel.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

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.

4.3 Instructions. The calculations in Appendix A, "Justification for Adding Static Offsets before Steer Angle Correction", show the justification for performing the processing in the following order.

4.3.1 Add Static Offsets. The proper procedure for doing this coordinate system correction is to add the total static offsets to the ball joint channels so that these channels are now referenced from bench (or 0 load = 0 output). This step can be done using mathematical manipulation software, such as the Channel Math tool in RPCpro.

4.3.2 Perform Steer Angle Correction Function.

4.3.2.1 Caution on Steer Angle Measurement and Calibration. It is worth noting that, due to the Ackerman Steering Geometry (see Figure 1), the steering angle left versus right will NOT be identical. Either separate left and right steer angles should be recoded, or separate calibrations between, for example, steering rack displacement and angle must be obtained.

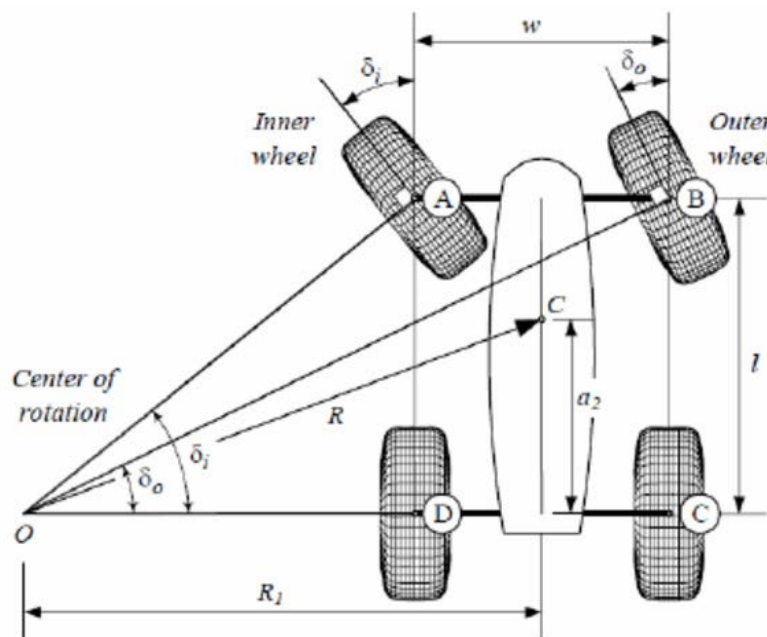


Figure 1: Effect of Ackerman Angle

4.3.2.2 The coordinate transformation or steer angle correction may now be performed. Similar mathematical manipulation software may be used as in the previous step, as long as trigonometric functions are available. The equations to use are seen in Figure 2.

- $X_{veh} = x_{Loc} \cos \theta + y_{Loc} \sin \theta$
- $Y_{veh} = -x_{Loc} \sin \theta + y_{Loc} \cos \theta$

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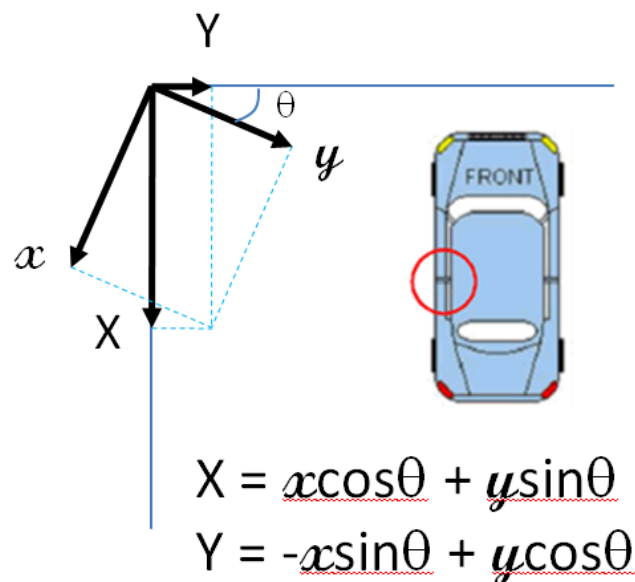


Figure 2: Steer Angle Correction Function

Note: Be very cautious if NOT using the coordinate system shown in Figure 2.

An example of available software is to use the Channel Transformation tool in RPCpro. An example setup for this is shown in Appendix B, Figure B1.

4.3.3 Check the corrected data at several points during the time history. Select a point in time, and verify that the output is correct using the input data and simple trigonometry.

Note: This procedure yields a result which is steer angle corrected loads in a fixed coordinate system, including both static and dynamic portions of the load. This same procedure **must** be used to determine the dynamic only portion of the load (e.g., for full vehicle simulation development), with the additional step of subtracting the static offsets from the corrected data.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Not applicable.

5.3 Test Documentation. All data is to be archived per local process in RPC3 file format.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary.

MTS: MTS Systems Corporation.

Remote Parameter Control (RPC). Software marketed by MTS Systems Corporation for use in developing drive files for laboratory tests.

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