



Service Bulletin

WARRANTY ADMINISTRATION

Subject: Wheel Alignment Specifications, Requirements and Recommendations for GM Vehicles

Models: 2014 and Prior GM Passenger Cars and Light Duty Trucks

This bulletin is being revised to add the 2014 model year and update the Labor Operations. Please discard Corporate Bulletin Number 05-03-07-009E (Section 03 – Suspension).

Purpose

The purpose of this bulletin is to provide retail, wholesale and fleet personnel with General Motors' warranty service requirements and recommendations for customer concerns related to wheel alignment. For your convenience, this bulletin updates and centralizes all of GM's Standard Wheel Alignment Service Procedures, Policy Guidelines and bulletins on wheel alignment warranty service.

Important: PLEASE FAMILIARIZE YOURSELF WITH THESE UPDATES BEFORE PERFORMING YOUR NEXT GM WHEEL ALIGNMENT SERVICE.

The following five (5) key steps are a summary of this bulletin and are REQUIRED in completing a successful wheel alignment service.

1. **Verify the vehicle is in an Original Equipment condition** for curb weight, tires, wheels, suspension and steering configurations. Vehicles modified in any of these areas are not covered for wheel alignment warranty.
2. **Review the customer concern relative to "Normal Operation"** definitions.
3. Verify that the **vehicle is within the "Mileage Policy"** range.
4. **Document wheel alignment warranty claims** appropriately for labor operations 8070012 and 8070032.

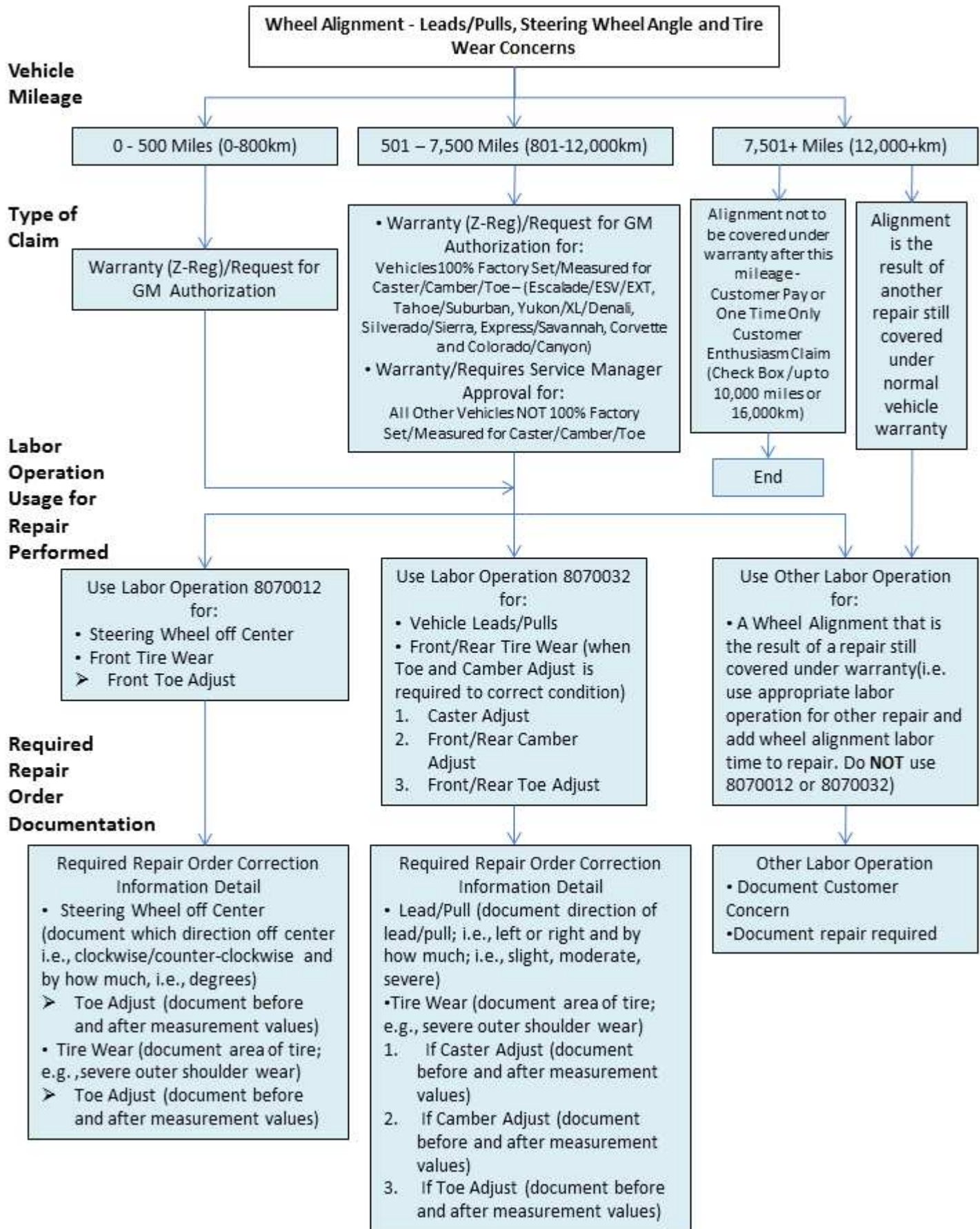
The following information must be documented or attached to the repair order (R.O.):

- Customer concern in detail.
 - What corrected the customer concern?
 - If a wheel alignment is performed:
 - Consult SI for proper specifications.
 - Document the "Before" AND "After" wheel alignment measurements/settings.
 - Completed "Wheel Alignment Repair Order Questionnaire" (form attached to this bulletin)
5. **Use the proper wheel alignment equipment** (preferred with print-out capability), process and the appropriate calibration maintenance schedules.

Important: If it is determined that a wheel alignment is necessary under warranty, use the proper labor code for the repair. 8070012 for Steering Wheel Angle and/or Front Toe set or 8070032 for Wheel Alignment Check/Adjust includes Caster, Camber and Toe set (Wheel alignment labor time for other component repairs is to be charged to the component that causes a wheel alignment operation).

The following flowchart is to help summarize the information detailed in this bulletin and should be used whenever a wheel alignment is performed.

Customer Concern – Leads/Pulls, Steering Wheel Angle and Tire Wear



Verify Original Equipment Condition of the Vehicle

- Verify that Original Equipment Tires and Wheels or Official GM Accessory Tires and Wheels are on the vehicle.
- Verify that aftermarket suspension “Lift” or “Lowering” Kits or other suspension alterations have NOT been done to the vehicle.
- Check for accidental damage to the vehicle; for example, severe pothole or curb impacts, collision damage that may have affected the wheel alignment of the vehicle; e.g., engine cradles, suspension control arms, axles, wheels, wheel covers, tires may show evidence of damage/impact.
- Check to be sure vehicle has seen “Normal Use” rather than abuse; e.g., very aggressive driving may show up by looking at the tires and condition of the vehicle.
- Check for other additional equipment items that may significantly affect vehicle mass such as large tool boxes, campers, snow plow packages (without the snowplow RPO), etc., especially in trucks and cutaway/incomplete vehicles. Significant additional mass can affect trim height and wheel alignment of the vehicle and may necessitate a customer pay wheel alignment when placed semi-permanently in the vehicle (Upfitter instructions are to realign the vehicle after placement of these types of items. (This typically applies to trucks and incomplete vehicles that can be upfit with equipment such as the above.)

Customer Concerns, “Normal Operation” Conditions and “Mileage Policy”

Possible Concerns

The following are typical conditions that may require wheel alignment warranty service:

1. **Lead/Pull:** defined as "at a constant highway speed on a typical straight road, the amount of effort required at the steering wheel to maintain the vehicle's straight heading."

Important: Please evaluate for the condition with hands-on the steering wheel. Follow the “Vehicle Leads/Pulls” diagnostic tree located in SI to determine the cause of a lead/pull concern. Lead/Pull concerns can be due to road crown or road slope, tires, wheel alignment or even in rare circumstances a steering gear issue. Lead/pull concerns due to road crown are considered “Normal Operation” and are NOT a warrantable condition -- the customer should be advised that this is “Normal Operation.”

Important: Some customers may comment on a “Lead/Pull” when they hold the steering wheel in a level condition. If so, this is more likely a “steering wheel angle” concern because the customer is “steering” the vehicle to obtain a “level” steering wheel.

2. **Steering wheel angle to the left or right** (counter-clockwise or clockwise, respectively): Defined as the steering wheel angle (clocking) deviation from “level” while maintaining a straight heading on a typical straight road.
3. **Irregular or Premature tire wear:** Slight to very slight “feathering” or “edge” wear on the shoulders of tires is NOT considered unusual and should even out with a tire rotation; if the customer is concerned about a “feathering” condition of the tires, the customer could be advised to rotate the tires earlier than the next scheduled mileage/maintenance interval (but no later than the next interval). Be sure to understand the customer's driving habits as this will also heavily influence the tire wear performance; tire wear from aggressive or abusive driving habits is NOT a warrantable condition.

Important: Slight or mild feathering, cupping, edge or heel/toe wear of tire tread shoulders is “normal” and can show up very early in a tire/vehicle service mileage; in fact, some new tires can show evidence of feathering from the factory. These issues do NOT affect the overall performance and tread life of the tire. Dealer personnel should always check the customer's maintenance records to ensure that tire inflation pressure is being maintained to placard and that the tires are being rotated (modified-X pattern) at the proper mileage intervals. Wheel alignments are NOT to be performed for the types of “Normal” Tire Feathering shown in Figures 1-4 below.

Figure 1: Full Tread View – “NORMAL” Tire “Feathering” Wear on the Shoulder/Adjacent/Center Ribs



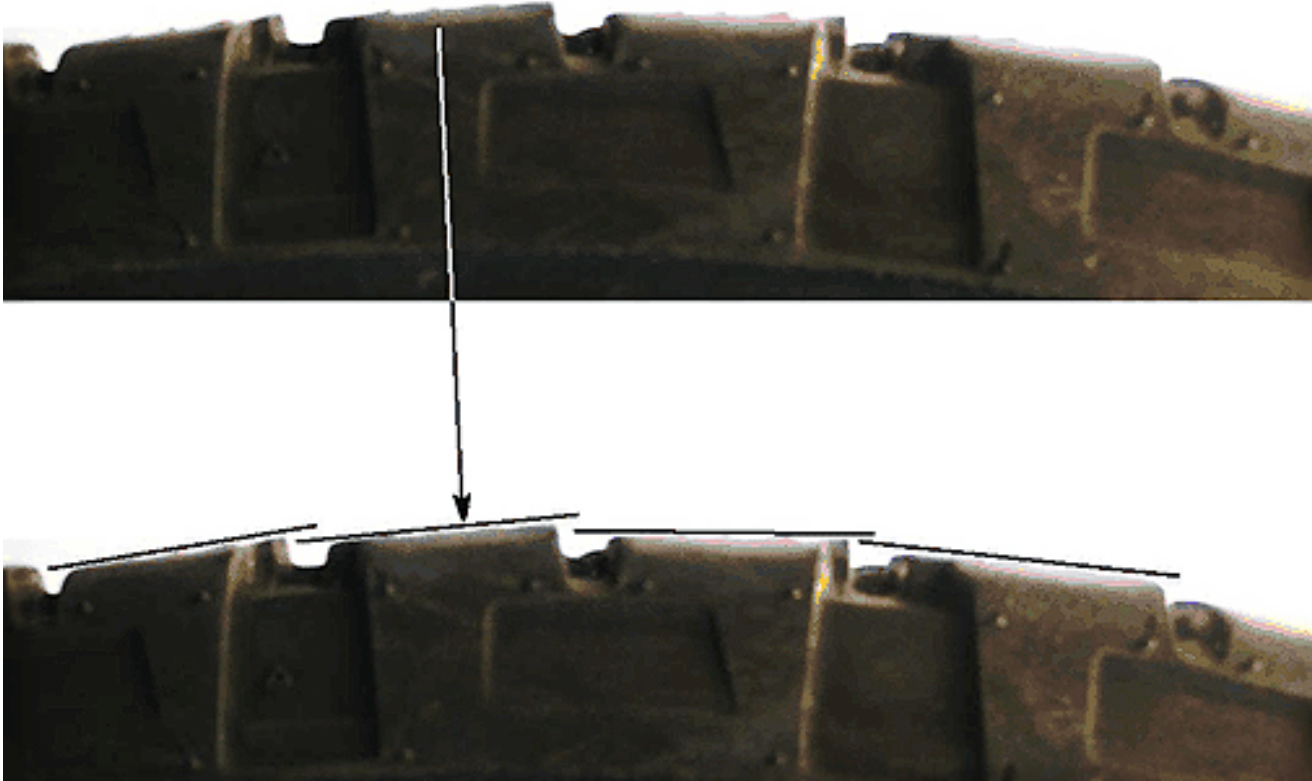
Figure 2: Tire Shoulder View Example 1 - "NORMAL" Tire "Feathering" Wear on the Shoulder



Figure 3: Tire Shoulder View Example 2 - "NORMAL" Tire "Feathering" Wear



Figure 4: Detail Side View of Tire Shoulder Area - "NORMAL" Tire "Feathering" Wear



Important: When a wheel alignment is deemed necessary for tire wear, be sure to document on the repair order, in as much detail as possible, the severity and type of tire wear (e.g., severe center wear or severe inside or outside shoulder wear) and the position of the tire on the vehicle (RF, LF, LR, RR). Please note the customer's concern with the wear such as, noise, appearance, wear life, etc. A field product report with pictures of the tire wear condition is recommended. Refer to the latest version of Corporate Bulletin Numbers 02-00-89-002 (Canada, 10-00-89-006) and 07-00-89-036.

4. **Other repairs** that affect wheel alignment; e.g., certain component replacement such as suspension control arm replacement, engine cradle adjustment/replace, steering gear replacement, steering tie rod replace, suspension strut/shock, steering knuckle, etc. may require a wheel alignment.

Important: If other components or repairs are identified as affecting the wheel alignment, policy calls for the wheel alignment labor time to be charged to the replaced/repaired component's labor operation time rather than the wheel alignment labor operations.

Important: Vibration type customer concerns are generally NOT due to wheel alignment except in the rare cases; e.g., extreme diagonal wear across the tread. In general, wheel alignments are NOT to be performed as an investigation/correction for vibration concerns.

“Normal Operation” Conditions

Vehicle Lead/Pull Due to Road Crown or Slope:

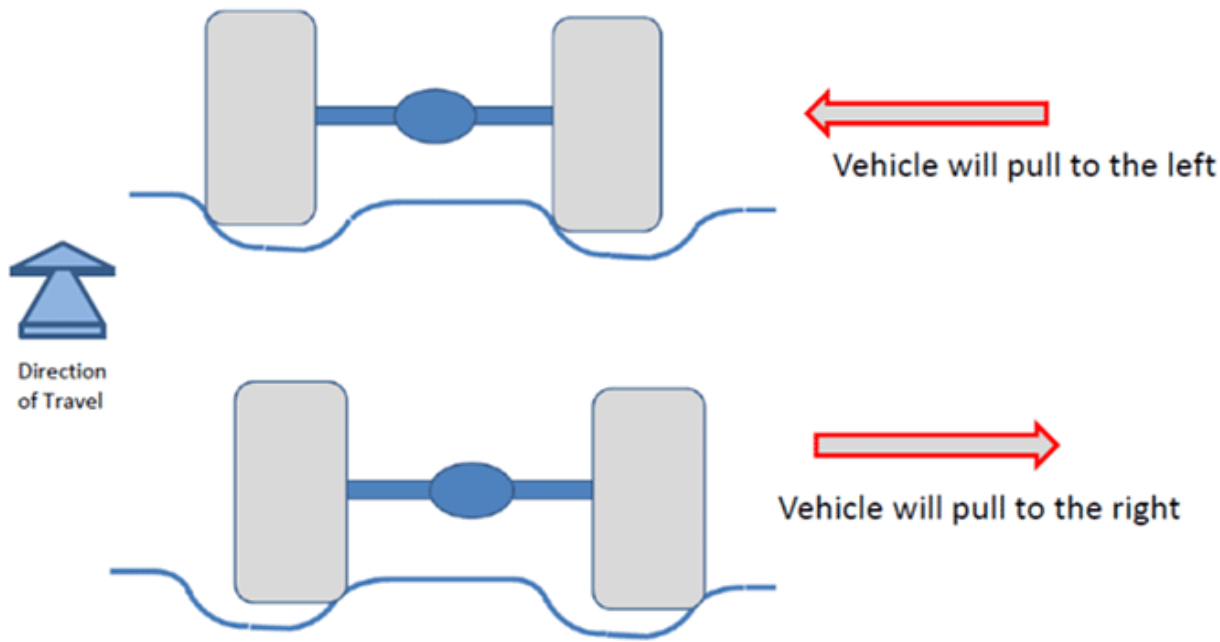
As part of “Normal Operation,” vehicles will follow side-to-side or left to right road crown or slope. Be sure to verify from the customer the types of roads they are driving as they may not recognize the influence of road crown on vehicle lead/pull and steering wheel angle. If a vehicle requires significant steering effort to prevent it from “climbing” the road crown there may be an issue to be looked into further.

Important: A wheel alignment will generally NOT correct vehicles that follow the road crown since this is within “Normal Operation.”

Trough Wander/Tramlining:

Some customers may comment about their vehicle having a tendency to pull left or right depending on road conditions. Typical descriptions may refer to the vehicle not tracking properly or that the car wanders. Additional comments may include that the car follows grooves or inconsistencies in the road to the extent that the vehicle must be steered or directed with additional force to overcome these roadway characteristics.

Trough Wander / Tramlining



What is Tramlining?

"Tramlining" is an industry term used to describe a vehicle's tendency to follow the longitudinal ruts and/or grooves present in the road. (Also called "trough wander"). The name comes from the feeling on a tram or trolley as the vehicle follows along the tracks. Any vehicle can exhibit tramlining due to uneven pavement or severe rutting in the roads surface. All vehicles tramline to some degree, however vehicles equipped with low aspect ratio, wide tires tend to be more sensitive to this condition (e.g. Corvette, Camaro, CTS-V).

Vehicles experiencing this condition can feel "pulled" in both directions depending on the positions of the tires in the trough (ruts).

If a similarly equipped vehicle experiences the same condition as the customer's car, the customer's car is most likely experiencing tramlining, which is a normal characteristic of a car with low aspect ratio, wide tires.

Important: It should be noted that adjusting alignment settings will NOT improve this condition.

Mileage Policy

The following mileage policy applies for 8070032 and 8070012 labor operations:

Note: Wheel Alignment is NOT covered under the New Vehicle Limited Warranty for Express and Savana Cutaway vehicles as these vehicles require Upfitters to set the wheel alignment after completing the vehicles.

- **0-800 km (0-500 mi):** 8070012/8070032 claims ONLY allowed with Call Center Authorization. Due to the tie down during shipping, the vehicle's suspension requires some time to reach normal operating position. For this reason, new vehicles are generally NOT to be aligned until they have accumulated at least 800 km (500 mi). A field product report should accompany any claim within this mileage range.
- **801-12,000 km (501-7,500 mi):**
 - If a vehicle came from the factory with incorrect alignment settings, any resulting off-angle steering wheel, lead/pull characteristics or the rare occurrence of excessive tire wear would be apparent early in the life of the vehicle. The following policy applies:
 - **Vehicles 100% Factory Set/Measured for Caster/Camber/Toe** – Escalade/ESV/EXT, Tahoe/Suburban, Yukon/XL/Denali, Silverado/Sierra, Express/Savana, Corvette and Colorado/Canyon:
8070012/8070032 Claims: Call Center Authorization Required
- **All Vehicles NOT 100% Factory Set/Measured for Caster/Camber/Toe as noted above:**
8070012/8070032 Claims: Dealer Service Manager Authorization Required
- **12,001 km and beyond (7,501 miles and beyond):** During this period, customers are responsible for the wheel alignment expense or dealers may provide on a case-by case basis a one-time customer enthusiasm claim up to 16,000 km (10,000 mi). In the event that a defective component required the use of the subject labor operations, the identified defective component labor operation will include the appropriate labor time for a wheel alignment as an add condition to the component repair.

Important: Only one wheel alignment labor operation claim (8070012 or 8070032) may be used per VIN.

Warranty Documentation Requirements

When a wheel alignment service has been deemed necessary, the following items will need to be clearly documented on/with the repair order:

- Customer concern in detail.
 - What corrected the customer concern?
 - If a wheel alignment is performed:
 - Consult SI for proper specifications.
 - Document the “Before” AND “After” wheel alignment measurements/settings.
 - Completed “Wheel Alignment Repair Order Questionnaire” (form attached to this bulletin)
1. Document the customer concern in as much detail as possible on the repair order and in the warranty administration system. Preferred examples:
 - Steering wheel is off angle in the counterclockwise direction by approximately x degrees or clocking position.
 - Vehicle lead/pulls to the right at approximately x-y mph. Vehicle will climb the road crown. Severe, Moderate or Slight.
 - RF and LF tires are wearing on the outside shoulders with severe feathering.

Important: In the event of a lead/pull or steering wheel angle concern, please note the direction of lead/pull (left or right) or direction of steering wheel angle (clockwise or counterclockwise) on the repair order and within the warranty claim verbatim.

Important: In the event of a tire wear concern, please note the position on the vehicle and where the wear is occurring on the tire; i.e., the RF tire is wearing on the inside shoulder.
 2. Document the technician’s findings on cause and correction of the issue. Examples:
 - Reset LF toe from 0.45 degrees to 0.10 degrees and RF toe from -0.25 degrees to 0.10 degrees to correct the steering wheel angle from 5 degrees counterclockwise to 0 degrees.
 - Reset LF camber from 0.25 degrees to -0.05 degrees to correct the cross-camber condition of +0.30 degrees to 0.00 degrees on the vehicle.
 - Front Sum toe was found to be 0.50 degrees, reset to 0.20 degrees.
 3. Print-out the “Before” and “After” wheel alignment measurements/settings and attach them to the Repair Order or if print-out capability is not available, measurements may also be clearly and legibly handwritten into the Wheel Alignment Repair Order Questionnaire attached to this bulletin.
 4. Attach the Wheel Alignment Repair Order Questionnaire below along with the print-out of “Before” and “After” wheel alignment measurements to the Repair Order and retain for use by GM.

Wheel Alignment Equipment and Process

Wheel alignments must be performed with a quality machine that will give accurate results when performing checks. "External Reference" (image-based camera technology) is preferred. Please refer to the latest version of Corporate Bulletin Number 05-00-89-029: General Motors Dealership Critical Equipment Requirements and Recommendations.

Requirements:

- Computerized four wheel alignment system.
- Computer capable of printing before and after alignment reports.
- Computer capable of time and date stamp printout.
- Racking system must have jacking capability.
- Racking system must be capable of level to 1.6 mm (1/16 in).
- Appropriate wheel stops and safety certification.
- Built-in turn plates and slip plates.
- Wheel clamps capable of attaching to 20" or larger wheels
- Racking capable of accepting any GM passenger car or light duty truck.
- Operator properly trained and ASE-certified (U.S. only) in wheel alignment.

Recommendations:

Racking should have front and rear jacking capability.

Equipment Maintenance and Calibration:

Alignment machines must be regularly calibrated in order to give correct information. Most manufacturers recommend the following:

- Alignment machines with "internal reference" sensors should be checked (and calibrated, if necessary) every six months.

- Alignment machines with "external reference" (image-based camera technology) should be checked (and calibrated, if necessary) once a year.
- Racks must be kept level to within 1.6 mm (1/16 in).
- If any instrument that is part of the alignment machine is dropped or damaged in some way, check the calibration immediately.

Check with the manufacturer of your specific equipment for their recommended service/calibration schedule.

Wheel Alignment Process

When performing wheel alignment measurement and/or adjustment, the following steps should be taken:

Preliminary Steps:

1. Verify that the vehicle has a full tank of fuel (compensate as necessary).
2. Inspect the wheels and the tires for damage.
3. Inspect the tires for the proper inflation and irregular tire wear.
4. Inspect the wheel bearings for excessive play.
5. Inspect all suspension and steering parts for looseness, wear, or damage.
6. Inspect the steering wheel for excessive drag or poor return due to stiff or rusted linkage or suspension components.
7. Inspect the vehicle trim height.
8. Compensate for frame angle on targeted vehicles (refer to Wheel Alignment Specifications in SI).

Satisfactory vehicle operation may occur over a wide range of alignment angles. However, if the wheel alignment angles are not within the range of specifications, adjust the wheel alignment to the specifications. Refer to Wheel Alignment Specifications in SI. Give consideration to excess loads, such as tool boxes, sample cases, etc. Follow the wheel alignment equipment manufacturer's instructions.

Measure/Adjust:

Important: Prior to making any adjustments to wheel alignment on a vehicle, technicians must verify that the wheel alignment specifications loaded into their wheel alignment machine are up-to-date by comparing these to the wheel alignment specifications for the appropriate model and model year in SI. Using incorrect and/or outdated specifications may result in unnecessary adjustments, irregular and/or premature tire wear and repeat customer concerns.

Important: When performing adjustments to vehicles requiring a 4-wheel alignment, set the rear wheel alignment angles first in order to obtain proper front wheel alignment angles.

Perform the following steps in order to measure the front and rear alignment angles:

1. Install the alignment equipment according to the manufacturer's instructions.
2. Jounce the front and the rear bumpers 3 times prior to checking the wheel alignment.
3. Measure the alignment angles and record the readings.

If necessary, adjust the wheel alignment to vehicle specification and record the before and after measurements. Refer to Wheel Alignment Specifications in SI.

Important: Technicians must refer to SI for the correct wheel alignment specifications. SI is the only source of GM wheel alignment specifications that is kept up-to-date throughout the year.

Test drive the vehicle to ensure a proper repair.

Understanding the Effects of Wheel Alignment on a Vehicle vs. Customer Complaints (Quick Reference Section)

Note: Refer to SI for complete alignment specifications.

- Prior to any measurement on the alignment machine, you must confirm the current specifications and tolerances as listed in GM's Service Information System. Do not assume that numbers in the alignment machine are correct, as it may not have been recently updated.
- Always use the correct specifications for that vehicle based on confirmed vehicle option content.
- It is important to always include as much information as possible in the RO – including the confirmed customer complaint and the complete before and after alignment measurements on the vehicle.

Steering Wheel Angle Complaints:

A true steering wheel angle complaint can be diagnosed as a vehicle that goes straight down the road without extra steering input, but the steering wheel angle is clocked to one side or the other. Make sure to always note which direction the steering wheel is clocked on the Repair Order ("Left/CCW" or "Right/CW").

If a steering wheel angle complaint has been verified, it should be noted that front and rear toes are the only alignment values that affect the angle of the steering wheel.

Vehicle Pull Complaints:

Prior to any adjusts, the vehicle must be driven to confirm the customer complaint. Use this drive to verify that the vehicle does have a pull and it is not a steering wheel angle issue. Try and use same stretch of road for all drives so that you understand the different characteristics of that specific road.

A true vehicle pull only complaint will have the vehicle pull to one side or the other regardless of steering wheel angle. It may require more than normal effort to keep the vehicle going straight.

Important: It is possible for customers to confuse a steering wheel off angle issue as a vehicle pull, as they may be trying to hold the wheel centered (level) on a straight road which would be adding a slight steering input to the wheels. If this is the case, please note this on the Repair Order, including the direction the vehicle is pulling.

Please note the following on what can cause a vehicle pull:

- Tires
- Alignment settings

Tires: If a pull complaint has been verified but all the alignment settings all are within specifications, the issue may be in the tires. Certain tire differences left to right may cause a vehicle pull. Swapping the front tires left to right and re-evaluating is a simple way to verify a tire issue.

Important: Always ensure tire pressures are set to correct specifications before and after evaluating a vehicle.

Important: Always note if tires are directional and not able to be permanently swapped side to side.

Alignment Information

Alignment Settings:	Positive Value	Negative Value
Front Cross Camber (LH minus RH)	Pulls Left	Pulls Right
Front Cross Caster (LH minus RH)	Pulls Right	Pulls Left
Front and Rear Toe	Does Not Cause Vehicle Pulls	Does Not Cause Vehicle Pulls

Important: Front or rear toe values being out of specifications do not cause a true vehicle pull. If only front or rear toe values are out of specification on a confirmed vehicle pull issue, something else is causing the pull.

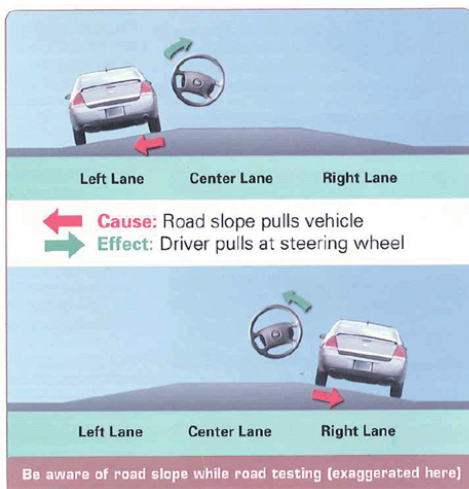
Important: If Cross Camber and Cross Caster are within GM specifications listed in the Service Information System, it generally means they are not the reason for a vehicle pull complaint.

Note: Although not normally an adjustable setting on many vehicles, you should always verify the caster repair procedure in GM's Service Information System.

Road Slope:

It is important to always note road slope during a drive, high angles can cause a vehicle to drift one way or the other. As flat of road as possible should be used for evaluations.

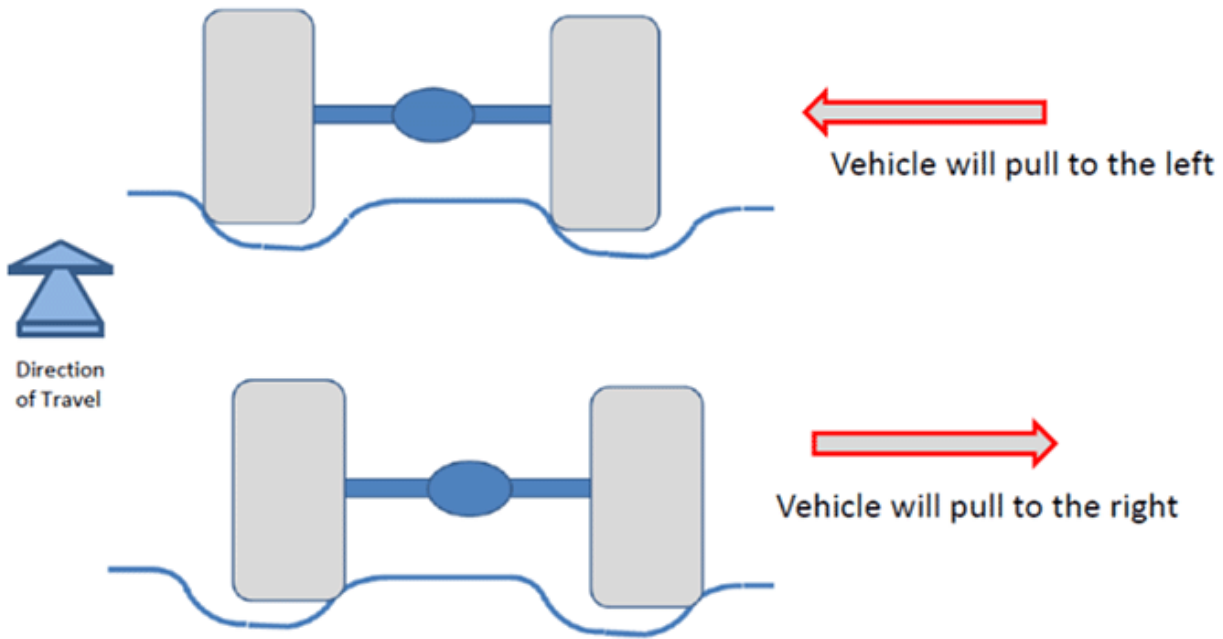
Effect of Road Slope



Trough Wander / Tramlining

Troughs or grooves in the road can pull a vehicle to either side depending on where in the groove the tire is. The tires will always want to pull the vehicle up the wall of the trough.

Trough Wander / Tramlining



Wheel Alignment Repair Order Questionnaire

Note: Please fill in the blanks. Additional help can be found in the "Vehicle Lead/Pull Diagnostics" located in SI under Suspension – General Diagnosis.

Serviceing Dealer:

Phone Number:

VIN _____

Technician Name:

Date:

Model:

Year:

Odometer:

TAC Case # if applicable:

Vehicle Concern Information

Customer Concern:

Tire Wear ___ Steering Wheel Off-Angle ___

Lead/Pull ___ Other _____

Was the customer concern duplicated? Yes ___ No ___

Is the tire pressure within +/- 3 psi of the tire placard? Yes ___ No ___

Technician Name:

Date:

Model:

Year:

Odometer:

TAC Case # if applicable:

Vehicle Concern Information

Customer Concern:

Tire Wear ___ Steering Wheel Off-Angle ___

Lead/Pull ___ Other _____

Was the customer concern duplicated? Yes ___ No ___

Is the tire pressure within +/- 3 psi of the tire placard? Yes ___ No ___

If No, record the tire pressures (psi):

LF ___ RF ___ LR ___ RR ___

Tire Wear (If Applicable)

Please check all boxes that apply:

Left Front Tire:

Even Wear ___ Inside Shoulder ___

Center ___ Outside Shoulder ___ Cupping/Feathering ___

Right Front Tire:

Even Wear ___ Inside Shoulder ___

Center ___ Outside Shoulder ___ Cupping/Feathering ___

Left Rear Tire:

Even Wear ___ Inside Shoulder ___

Center ___ Outside Shoulder ___ Cupping/Feathering ___

Right Rear Tire:

Even Wear ___ Inside Shoulder ___

Center ___ Outside Shoulder ___ Cupping/Feathering ___

Steering Wheel Off-Angle (If Applicable)

Which way was the steering wheel off angle?

Lead/Pull (If Applicable)

Which way does the vehicle lead or pull? Right ___ Left ___

Record Alignment Measurements or Print and Attach Before and After Printouts

	Left Front		Right Front		Left Rear		Right Rear	
	Before	After	Before	After	Before	After	Before	After
Toe:								
Camber:								
Caster:					XXXXX	XXXXX	XXXXX	XXXXX
Z/D-Height								

Frame Angle Measurement (Express / Savana Only) _____

What corrected the customer concern and was the repair verified?

Please Explain: _____

GM bulletins are intended for use by professional technicians, NOT a "do-it-yourselfer". They are written to inform these technicians of conditions that may occur on some vehicles, or to provide information that could assist in the proper service of a vehicle. Properly trained technicians have the equipment, tools, safety instructions, and know-how to do a job properly and safely. If a condition is described, DO NOT assume that the bulletin applies to your vehicle, or that your vehicle will have that condition. See your GM dealer for information on whether your vehicle may benefit from the information.



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