

The Development History Of The Howard Precision Steer Wheel Control System

The Design Objective

Advancing the state of the art in heavy vehicle directional stability to greatly reduce driving fatigue and related catastrophic heavy vehicle highway accidents.

Design Assumptions and Problems That Needed to be Overcome

It was considered that over the many years the very creative heavy vehicle design community had made amazing technical contributions in the function and reliability of heavy over-the-road vehicles. It was also considered that the same creative talent had achieved virtually all that could be achieved to improve the heavy vehicle drivability with variations in the geometry of the steer wheels. For example, to achieve steering wheel returnability after turning a corner, the spindles (king pins) were slanted aft at the top to achieve a turning-lift effect so that when the vehicle driver released the steering wheel, the weight of the vehicle would return to the lower most position. Thereby, returning the steer wheels to the on-center straight-ahead position where the turning-lift effect is diminished and does not have an adequate stabilizing effect on the steer wheels. Slanting the spindles aft at the top end, also creates a steer wheel castering effect that results in highly adverse crosswind driving characteristics. Because with each crosswind gust the lateral force of the wind caused the steer wheel to caster steer the vehicle downwind, requiring almost continuous driver

steering corrections to maintain directional control, resulting in a major cause of driving fatigue. Because slanting the king pins aft at the top end to achieve the turning-lift effect also creates steer wheel castering, the term caster angle was used, thereby giving rise to the mistaken belief that steer wheel castering was beneficial to the directional stability of a motor vehicle, when in fact steer wheel castering makes no contribution to directional stability. In addition to the lack of stability, there were two additional major operational problems related to the unstable behavior of the steer wheels. The long-standing puzzling excessive steer wheel tire wear problems, and the loss of directional control during a steer wheel tire blowout.

It was reasoned that a suitable heavy vehicle precision steer wheel control component would make a major contribution to solving all of the steering and controllability problems that simply could not be solved by the geometry of the steer wheels. The time had come for advancing the state of the art in safer heavy vehicle stability and control technology. _{C5}

Tests were conducted on heavy trucks, buses, and recreational vehicles using precision instrumentation. It was observed that with a highway speed of sixty-five miles per hour, when the center line of the steer wheel contact patch was off-center by as little as ten one-thousandths of an inch, the vehicle would make a lane change in ten to twelve seconds. From this, it was reasoned that the steer wheels needed to be controlled in the on-center position with great precision, except when the vehicle driver was intentionally steering away from center. When the driver releases the steering wheel, the

Howard Power Center Precision Steer Wheel Control System returns the steer wheels to the on-center position with enough force to maintain directional stability in all driving modes, especially during adverse driving conditions such as strong crosswinds and rutted and slanted road conditions.

Over the many years, aftermarket providers have attempted to improve heavy vehicle drivability with so called stabilizer devices that only nibbled at the problem and simply did not provide precision steer wheel control.

The Heavy Vehicle Operational Problems That Are Solved By The New Technology:

- The Howard Precision Steer Wheel Control Technology completely does away with the heavy vehicle operational problems that cannot be solved by variations in the steering geometry.
- The Howard Technology completely solves the puzzling steer wheel tire cupping and excessive tire wear problem. Operators are reporting a 75,000 mile increase in tire mileage that will more than pay for the new technology.
- The Howard Technology completely does away with the steer wheel tire blowout controllability problem. With more than five thousand Howard Precision Steer Wheel Control Systems in service, there have been a surprising number of steer wheel tire blowouts reported by heavy vehicle drivers that were amazed at the easy straight line controllability.
- The Howard Technology makes a dramatic reduction in driving fatigue and related heavy vehicle catastrophic highway accidents.
- The Howard Technology does away with road wander and steering wheel pull on crowned and slanted roads.