Side Guard Operational Issue: Loading Docks

OOIDA has raised concerns about potential side guard operational issues.

Posts on Side Guard OPERATIONAL Issues

"This link provides a spreadsheet of all railroad grade crossing accidents compiled by the Federal Railroad Administration for 2014-2018. In those five years for the population of trailers we currently have, including lowboys, car haulers, cattle haulers, beverage trailers, etc., there were ZERO fatalities coded as 'truck-trailer stuck on track.'

"Even if one were to assume a side guard at 18 inches high would create more hangups and accidents - and the standards on grade crossings say they won't - it is just not a statistically frequent fatal or injurious event in comparison to side underrides."
(email from engineer, 9/2/19)
Relevant research article

Maybe this is why the NTSB, the one responsible for investigating significant rail transport accidents, still recommended side guards for trailers.

Truck Trailer Manufacturers Association interviewed on side guard operational issues

Little consideration has been given to the impact underride guards would have on the daily operations of truckers.

Underride guards create challenges for trucks navigating grade crossings, high curbs, and other road conditions.

https://landline.media/ooida-letter-senate-opposing-underride/

https://landline.media/side-underride-mandate-costs-would-outweigh-benefits-ooida-says/

A 2002 Study by the University of West Virginia showed that trailers and trucks must be much lower to the ground than an underride guard to hang up on regulation railroad crossings and driveway and dock slopes. One need look no further than how low semi-tractors are to the ground, or low-boy trailers. or car hauling trailers, to dispel the notion an underride guard at 16 to 18 inches from the ground cannot operate safely over the road.

See this study: 2002 DEVELOPMENT OF DESIGN VEHICLES FOR THE HANGUP PROBLEM

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11. Contract or Grant No.
MAUTC Project #10

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West Virginia Division of Highways
Capitol Complex, Building Five
Charleston, WV 25305

13. Type of Report and Period Covered

Final Report

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15. Supplementary Notes

16. Abstract

The overall goal of this project was to develop design vehicles for use in evaluating the operation of low-ground-clearance, long wheelbase / overhang vehicles on extreme hump or sag profile alignments. The literature review indicated that while formal studies had been conducted to develop design vehicles, these vehicles did not include the information needed to assess hang-up susceptibility on a particular vertical alignment. In this study, relevant design vehicle dimensions for 17 hang-up prone vehicle types were developed. Relevant dimensions included wheelbase, ground clearance, and front and rear overhang. Results are presented in a format similar to that used to present design vehicle characteristics in the AASHTO design policy, i.e., both tabular and graphical form. These vehicles can be used in conjunction with the HANGUP software or other tools in designing vertical alignments that reduce the likelihood of hang-up problems. Since they are based on representative samples of both field-collected and manufacturers' data and have been evaluated using the HANGUP software, the researchers conclude that the design vehicles are reasonable and have a rational basis. The proposed vehicles should receive broad review with an eye toward inclusion in appropriate design policies and guidelines.

17. Key Words
Hang-Up, Design Vehicles, Ground Clearance, Wheelbase, Overhang, Rail-Highway Grade Crossings, Driveways

18. Distribution Statement

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damage to the undercarriage of the vehicle and to the pavement surface. In the worst case, major crashes attracting nationwide attention can occur. For example, a vehicle hung-up at a railroad grade crossing can be struck by a train, resulting in the loss of life and millions of dollars in property damage.

The hang-up problem is a significant highway safety issue. A vehicle classification count performed in West Virginia as part of previous research on the hang-up problem found that low-ground-clearance trucks made up about 5.7 percent of all trucks in the traffic stream (Eck and Kang, 1991). Eck and Kang (1991) reported that in Oregon, about one crash per year was the result of a low-ground-clearance vehicle hanging up on a railroad-highway grade crossing and being struck by a train. Furthermore, a regional director of an automobile carrier trucking firm reported 50 to 60 hang-up incidents per month involving auto transporters. Finally, the National Transportation Safety Board has issued a warning that crossing profiles with a high, hump-like alignment are potential impediments in the operation of long-wheelbase or low-ground-clearance vehicles (Eck and Kang, 1991).

Strategies to alleviate the hang-up problem must consider all the elements of the driver-vehicle-highway system. The vehicle design contributes to the problem through low ground clearances and long wheelbases or overhangs. Humped vertical profiles or sharp grade breaks are elements of the roadway that contribute to the problem. Finally, the unsuccessful attempt to cross a vertical profile with a vehicle that cannot negotiate it is the result of a poor decision on the part of the driver. Each of these elements are discussed below.

Vehicle Design

In the United States, the design of the components of commercial vehicles that impact the susceptibility of the vehicle to hang-up problems is essentially unregulated. Consequently, commercial vehicle characteristics vary greatly. In the economically competitive trucking industry, there is continuing pressure to haul larger and higher loads, and to make loading and unloading of the vehicle as easy as possible. Thus, the trend over time has been toward vehicles with longer wheelbases and lower ground clearances.

Roadway Design and Maintenance

A hump or sag profile alignment or one with sharp grade breaks may accommodate automobiles and conventional trucks with no problems. However, when a long wheelbase and / or low-ground-clearance vehicle encounters the alignment, a hang-up may result. Even if the

In summary, the preceding discussion has shown that the causes of hang-ups involve all elements of the roadway-vehicle-driver system. In addition, ownership and jurisdictional issues can contribute to the problem. To completely solve the problem, all these elements must be considered. However, solutions that focus on one part of the overall problem can also partially contribute towards the overall goal of solving the problem. Furthermore, the development of tools to analyze the problem will also contribute to its solution because they will provide improved capabilities for those specifically charged with the responsibility to prevent hang-ups. As described in the following section, the goal of this research is to contribute to the overall goal of preventing hang-ups through the development an improved hang-up analysis tool, namely design vehicles that address the hang-up problem.

1.1 Problem Statement

In some aspects of highway design, design vehicles are available so that the designer can dimension the roadway geometry to accommodate prevailing traffic. For example, when designing a turning radius at the intersection of two roadways, the designer can consult the Policy on the Geometric Design of Streets and Highways by the American Association of State Highway and Transportation Officials (AASHTO), also known as the Green Book (AASHTO, While conducting the field study, it became apparent that it is not feasible to design roadways to accommodate the lowest ground clearances and longest wheelbases because these were typically outliers in the sample. This could potentially lead to situations where either hang-up considerations are ignored because of the unrealistic measures that would have to be taken to accommodate vehicles of these dimensions, or it could lead to grossly over-designed highways. As a compromise, the wheelbase and ground clearance data were analyzed to determine the 85th percentile for each characteristic. These corresponded to a wheelbase of 30 feet and a ground clearance of 5 inches.

2.1.4 Summary of Previous Design Vehicle Research

Each of the documented efforts establishing vehicles had an overriding common methodology, the steps of which are presented below:

1. Establish the design vehicles to be developed by (a) anticipating the needs of the users of the end product and (b) observing the variability of the relevant vehicles in prevailing traffic
2. Determine the dimensions / characteristics to be defined
3. Collect data both in the field and from manufacturers / operators
4. Use the database to quantitatively define dimensions / characteristics either

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Don't Skirt Proper Maintenance on Trailer Aero Devices, Experts Say

If damage occurs, a fleet can take it to a dealer, where spare parts should be stocked for a free repair. Otherwise, the company will ship new parts to the shop free of charge, Smith said.

Meanwhile, different types of trailer aerodynamic devices need different inspection techniques.

The new skirts are designed to clamp onto chassis I-beams below where the intermodal box is situated to keep the two-piece side skirts intact and free from damage during loading. The skirts are also flexible and are hinged via fiberglass rods, allowing them to bend and flex when bottoming out at loading docks.

Two side skirt construction options are available for intermodal chassis, including Freight Wing's original Dense Matrix Polyethylene (DMP) plastic construction version and a composite material that has a low coefficient of thermal expansion, allowing the skirts to hold their flat panel shape. https://www.fleetequipmentmag.com/freight-wing-introduces-chassis-side-skirts/

The max SAE recommended dock slope is 6%. See attached. You can find this also attached Nova Dock Planning Guide online that says max 10% slope in extreme light-loaded situations. A defense expert, Bonanti, in several cases showed that the AngelWing would actually *clear* by nearly 6 inches, even when the dock slope is 10% and the wheels are full rearward (which means the trailer is most likely to bottom out due to the extended wheelbase).

6. ***Maximum Gradient***—For most efficient operation, the maximum gradient at docks should not exceed 6%.

7. ***Turning Radius***—Since turning radii vary extremely with make, type, and combinations of vehicles, manufacturers' data books and other sources must be consulted and the physical aspects of the property must be considered. (See SAE J695b.)

8. *Sources of Information*

8.1 Data received from representative fleets.

8.2 Current Yearbook, Tire and Rim Association, Inc., Akron, Ohio.

Type	Representative Tire Sizes [1]		Maximum Overall Tire Diameter, in	Loaded Vehicle Floor Heights, in
	Tube	Tubeless		
City vehicles	7.50 x 20	8.00 x 22.5	39	44 ± 2
	8.25 x 20	9.00 x 22.5	41	46 ± 2
	9.00 x 20	10.00 x 22.5	43	48 ± 2
Over-the-road vehicles	10.00 x 20	11.00 x 22.5	44	52 ± 2
	10.00 x 22	11.00 x 24.5	46	54 ± 2
	11.00 x 20	12.00 x 22.5	46	54 ± 2
	11.00 x 22	12.00 x 24.5	48	56 ± 2

It is preferable that the dock be slightly lower than the truck floor to permit opening of the doors.

Average Vehicle Dimensions for Use in Designing Docking Facilities for Motor Vehicles

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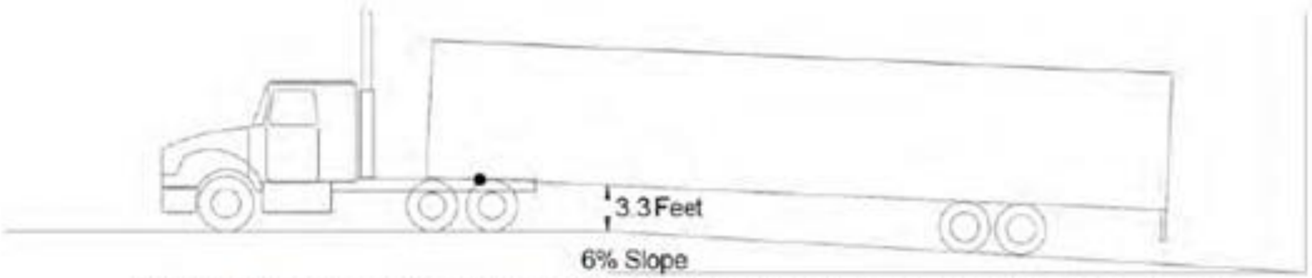

Figure 7 - Clearance of the a 53' Semitrailer loading/unloading cargo on a 6% recessed ramp.

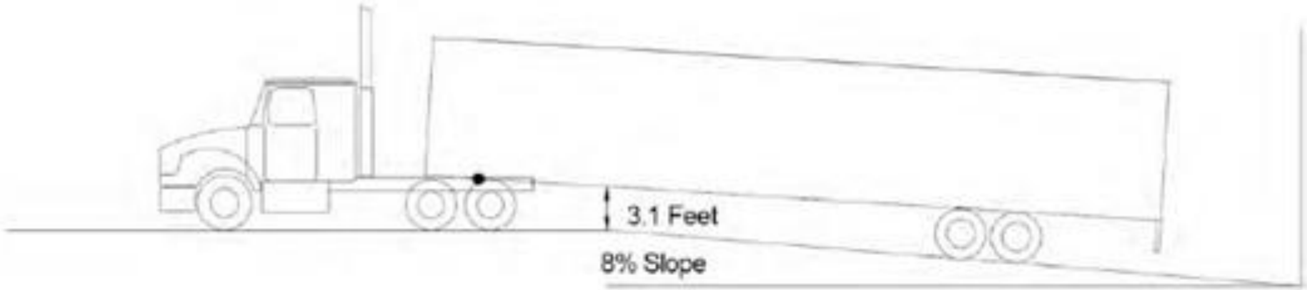

Figure 8 - Clearance of a 53' Semitrailer loading/unloading cargo on an 8% recessed ramp.

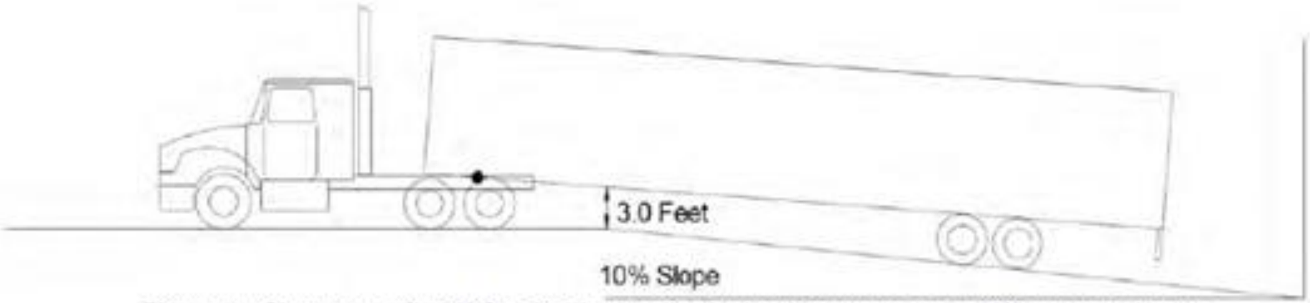

Figure 9 - Clearance of a 53' Semitrailer loading/unloading cargo on a 10% recessed ramp.

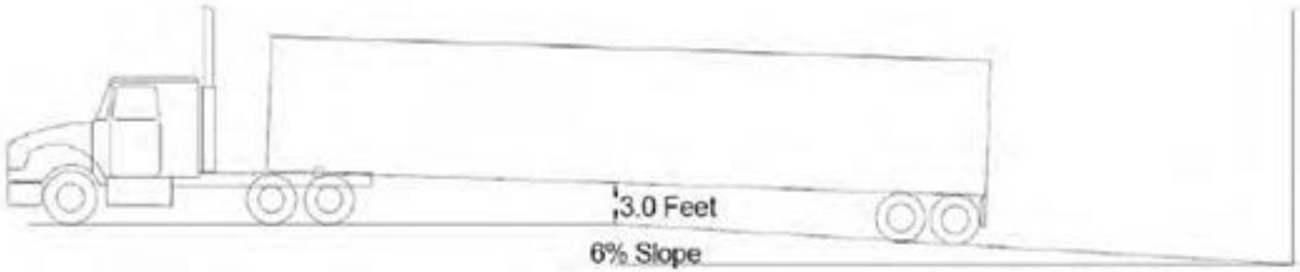

Figure 10 Clearance of a 53' Semitrailer loading/unloading cargo on 6% recessed ramps.

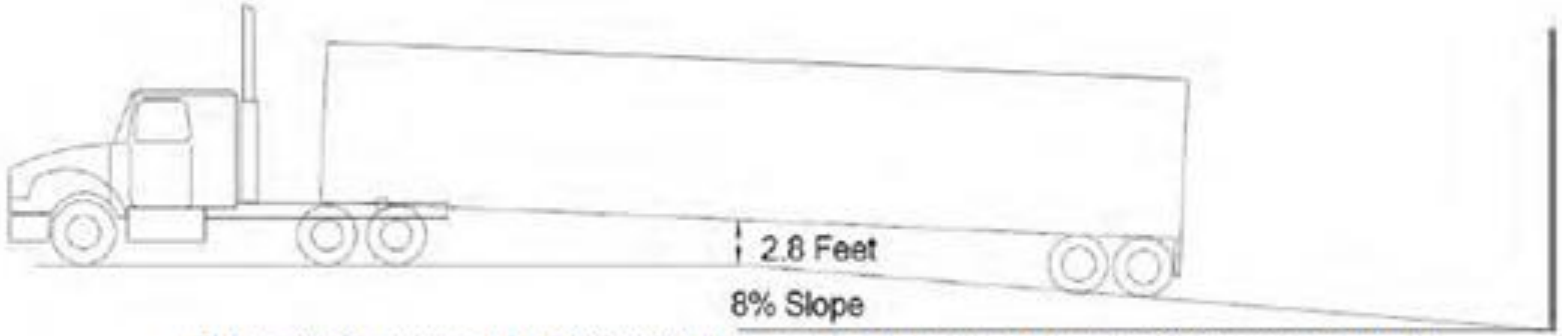

Figure 11 Clearance of a 53' Semitrailer loading/unloading cargo on 8% recessed ramps.

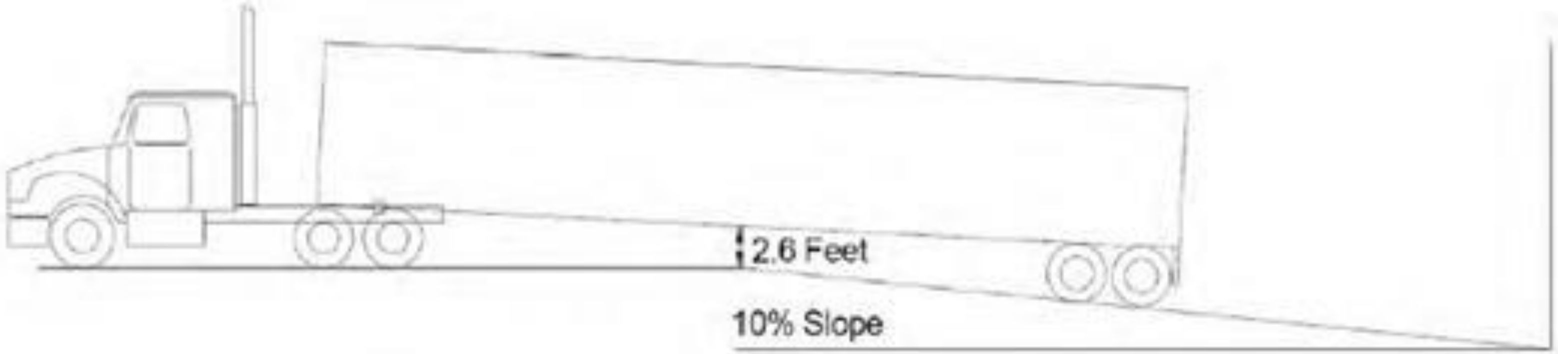

Figure 12 - Clearance of a 53' Semitrailer loading/unloading cargo on 10°% recessed ramps.

Table 1 - 53' Semitrailer Clearance

19.69" Clearance with Side Underride	**6 % Slope Clearance**	**8 % Slope Clearance**	**10 % Slope Clearance**
Tire Location Forward	39.6" - 25.31" = **14.29"**	37.2" – 25.31" = **11.89"**	36" – 25.31" = **10.69"**
Tire Location at Maximum Aft	36" – 25.31" = **10.69"**	33.6" – 25.31" = **8.29"**	31.2" – 25.31" = **5.89"**

The review of recognized road surface Design Standards shows that supposed operational issues due to side guard ground clearance are not encountered during dock use nor at railroad crossings.

https://www.regulations.gov/document/NHTSA-2015-0118-0064

A side guard such as that tested by the IIHS would not create a ground clearance hindrance on the maximum 6% dock slope as set forth in Society of Automotive Engineers' SAE J699. Analysis conducted by Christopher Bonanti, formerly NHTSA's Associate Administrator for Rulemaking, shows that ground clearance is maintained with 10% dock slopes, even with the trailer axles set at the full rearward position. This data shows hanging up on submerged docks is not a detriment to the implementation of side underride protection.

https://www.regulations.gov/document/NHTSA-2015-0118-0064

National-Research-Council-Canada-Report_Patten.pdf

National Research Council Canada | Conseil national de recherches Canada

Centre for Surface Transportation Technology | Centre de technologie des transports de surface

NRC·CNRC

Test Report

Effects of Side Skirts and Wheel Covers on Heavy Trailers

Prepared for:
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Jeff Patten, P. Eng.
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William Mayda, P. Eng.
Gordon Poole, P. Eng.

Project 54-F3833

Projet 54-F3833

Figure 5 – Example of low rider side skirt

As with most devices, there are compromises that should be considered. In order to maximize the effectiveness of side skirts, they should be mounted as low to the ground as possible. However, very low side skirts are prone to damage as trailers and trucks break over road disturbances such as rail road tracks and snow banks. It is generally accepted that most side guards and side skirts are mounted between 8 and 16 inches above the ground, depending on the application and the type of material used.

National-Research-Council-Canada-Report_Patten.pdf, p. 21

Dock-Planning-Standards-Guide.pdf, p. 6

Dock Approach

The maximum grade percentage from the loading dock to the vehicle is determined by the height of the dock (discussed in detail in Set the Dock Height on page 10). When using electric powered loading equipment, the maximum grade percentage is 10%. For gas or diesel powered loading equipment the maximum grade percentage is 15%. If these grade percentages are exceeded, damage to handling equipment and load spillage may result.

If the plant floor is at grade, or has a low grade, recess the truck parking area so that the trailer bed will be at about the same height as the plant floor (Figure 8). The parking area will slope down toward the dock. This slope should be 6% or less. If heavy loads are expected, the slope should not exceed 5%. If necessary, slope may be increased to an absolute maximum of 10%, and only for light loads. Steep slopes may cause loads to topple.

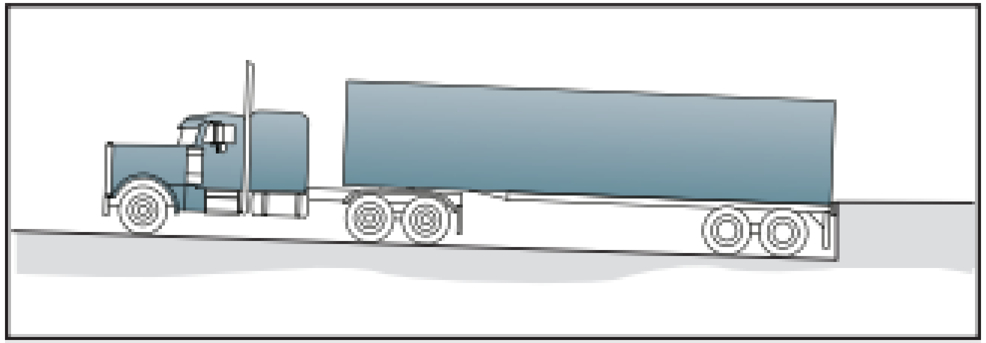

Figure 8