

## Design Criteria For Enhancing Cleanability and Welfare Characteristics of Pig Transport Trailers

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Transporting pigs from one farm to another location for various reasons has been associated with several disease outbreaks. Currently, regular and thorough cleaning and disinfection procedures are routinely implemented to maintain a clean and biosecure environment in the trailer.

However, various aspects of trailer design and construction significantly impact the cleanability and welfare characteristics of the trailer, such as surface smoothness, exposed screws and weld joints, and presence of structures and hard-to-clean areas that may be prone to dirt accumulation. Animal transport trailers that are poorly designed in terms of cleanability are difficult to sanitize and cause significant downtime, increased costs

and inconsistent cleaning results, thereby posing increased biosecurity risk.

Recent studies evaluating the effect of trailer design on production losses and welfare have found that stress responses and welfare are affected differently depending on the trailer compartment used. Correa et al. (2014) studied potbellied trailers which are commonly used in Canada and found that some compartments had negative impact on the health of pigs transported. Flat deck trailers with hydraulic lifts can reduce loading stress, as ramp angles above 20 degrees also cause handling problems in pigs during loading and unloading. More work needs to be done to improve the animal welfare characteristics of trailer designs.

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An assessment tool (such as design criteria in a form of a checklist) has been used by various industries that have high regulatory requirements (e.g., aviation, healthcare, fleet transport, mining, and construction). They have reported significant benefits especially for routine and emergency procedures (Major et al., 2020; Myers, 2016; Ogden et al., 2016, Thongprayoon et al., 2016; Torous et al., 2020). In this project, a design criteria for cleanability and welfare characteristics of pig transport trailers was developed to provide the industry with an assessment tool for swine transport trailers to guide the design process in addressing inherent problems on trailer biosecurity and animal welfare.

### What we did

The approach for this study involved a comprehensive literature review to gather available information on key design components for assessing cleanability, worker safety, and welfare that have been developed and/or evaluated in other industries. Results of the literature search were supplemented by surveys and interviews of various stakeholders such as truckers, wash bay operators, trailer manufacturers, veterinarians, pig producers, and other experts to develop a design criteria tailored for swine transport trailers. These components were used to develop the initial draft of the design criteria that covered the following aspects of the trailer: hygiene and cleanability, safety, and animal welfare. Each aspect included recommended guidelines, with a detailed description of each guideline presented as a glossary.

The developed design criteria was then field-tested and validated by applying the criteria on 10 different swine trailers in use in the Canadian swine industry, including potbelly, gooseneck straight deck, hydraulic lift, and straight deck trailers. The different components of the design criteria were re-assessed and refined throughout all trailer visits and inspections to ensure that the overall design criteria are appropriate and user-friendly. In addition, a rating scale was developed for cleanability, safety, and welfare characteristics to enhance its overall applicability in the industry.

### What We Found

A comprehensive information search of more than 100 relevant literatures yielded 127 key design components. Following further assessment, 51 key components were selected based on their potential impact on ease of cleaning, worker safety, and level of comfort of the animals during transport. These 51 key components were presented to a variety of swine stakeholder groups through surveys and interviews to identify gaps and evaluate their applicability to livestock transport trailers.

For the hygiene and cleanability aspect, it was suggested that smooth flooring would undermine safety, so the addition of checkered grips on the floor is desirable. Surfaces such as walls and ceilings, however, should be smooth as much as possible. Animal-safe interior coatings for surfaces should also be considered to reduce the adhesion of soil and dirt. Difficult-to-reach areas, as well as open-ended panels or tubes should be capped or welded to ensure a continuous seal, avoiding dead spaces and allowing for thorough washing. A hollow floor approach is recommended for trailer interior design because it allows truck wash operators to remove the upper deck floors and gain a standing room, which increases the ease and efficiency of cleaning. In addition, a ceiling that can be opened would allow



the truck wash operator to stand on the upper decks to increase cleaning efficiency.

For the safety category, two main suggestions were proposed by the respondents - adjustable decks and perforated partitions. Adjustable decks are preferred over fixed decks to allow easier access and working posture for truck wash personnel. A slotted or perforated partition could further improve airflow circulation inside the trailer.

For the animal welfare aspect, it was suggested that ramps for loading and unloading should be avoided in future trailer designs. This point from the survey participants is consistent with literature findings that hydraulic lifts lessen the stress of loading for the animals (Correa et al., 2014). It was also noted that ventilation and insulation would be more efficient for climate management in the trailer. Another respondent also mentioned that the adjustability of the pen adds convenience in accommodating different animal herd sizes.

### Trailer design criteria

Based on the information gathered from literature and survey, a draft of the design criteria was developed, which was then field-tested and validated by inspecting ten different trailers throughout Western Canada. The first draft of the design criteria for cleanability, safety and welfare went through seven iterations to remove extraneous components, improve friendliness of the user interface, and optimize the flow of inspections and presentation of each trailer design criterion or question. A significant gap in the structure or flow of the design criteria was identified during the trailer inspections. It was resolved by re-structuring the design criteria so that inspections are performed by compartments (i.e., front, middle, and back) and portions (i.e., exterior and interior) of the trailer, resulting in a smoother, more efficient, and user-friendly assessment tool. Another concern that arose during the trailer visits was the manner in which each criterion was presented. The first

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**Figure 1. A snapshot of the refined design criteria for cleanability, safety and animal welfare of pig transport trailers.**

version of the design criteria were mostly presented through the use of keywords, which may require the user to frequently review the supporting documents while on the field. As a result, each criterion was modified from keywords to questions to improve clarity and efficiency.

In addition, a rating scale for cleanability, safety, and welfare characteristics were established to enhance its overall applicability in the swine industry. Each component of the design criteria will be rated as Pass, Marginal, Unacceptable, or Replace, with an equivalent score of 1, 0.50, 0.25, and 0, respectively. A description of each rating scale was provided to maintain consistency of the rating scale throughout the number of checklist users. The overall score will be calculated at the end of the checklist so that each aspect of the trailer (i.e., cleanability, welfare, and safety) is evaluated from 0 to 10, with 10 being the highest score on the rating scale. In addition, an electronic version of the design criteria has been developed to provide end users with a more accessible interface (e.g., smartphones, tablets, laptops) when being used in the field. The electronic version can also provide a concise data report for easier review and interpretation, as well as facilitate compilation of the entire dataset. A snapshot of the final checklist is shown in Figure 1.

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