



South Carolina
Department of Transportation



U.S. Department
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SUMMARY REPORT

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South Carolina
Department of Transportation
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RATE OF DETERIORATION OF BRIDGES AND PAVEMENTS AS AFFECTED BY TRUCKS

The modern freight industry has been pushing the limits of traditional standards for truck size and weight. Adding to the problem, freight loads that exceed design standards are accelerating the deterioration of the pavement and bridge infrastructure. Additionally, competitive modern commerce is continuously demanding loads well in excess of the current standards established by various federal and state departments of transportation (DOTs). Consequently, some state DOTs are now reassessing the impact of oversize and overweight loads, as well as the fee structures used for permitting these exceptions.

Facing an exceptional challenge of maintaining state roadways with ever-shrinking financial resources, the South Carolina Department of Transportation (SCDOT) commissioned this study to examine multiple facets of the impact of overweight trucking. The objectives of this study were to:

- Investigate the impact of heavy vehicle traffic on pavements and bridges in South Carolina; and
- Develop policy recommendations based on technical analysis and the modern political and institutional environment in South Carolina.

Clemson University conducted this study to i) model pavement and bridge deterioration, ii) investigate the adequacy of standard practices in state agencies for dealing with this deterioration and iii) understand how trucking industry perceives those practices.

The primary concern with any pavement design is the amount of truck traffic that the pavement must endure throughout its life. Pavement damage costs due to overweight trucks were estimated using truck distributions based on the weigh-in-motion (WIM) data collected at the St. George WIM station on I-95.

Though bridges compose a small percentage of total highway mileage, their costs, construction time, and traffic disruption upon failure or temporary closing significantly impact highway system performance. Moreover, the catastrophic nature of bridge failures in terms of fatality, property loss, and traffic disruption necessitates maintaining the structural integrity and serviceability of bridges and merits substantial consideration. Pavement and bridge deterioration analysis revealed that pavement and bridge damages increase significantly with incremental weights. Combined bridge and pavement damage costs per mile for different overweight truck types, as estimated in this study, are summarized in the following table.

Additional damage costs for overweight trucks allowed by typical SC overweight permits¹ (2012 US \$)

Truck type	Damage cost per mile
2-axle, 35-40 kips	\$0.32
3-axle, single unit, 46-50 kips	\$0.15
3-axle, combination, 50-55 kips	\$0.30
4-axle, single unit, 63.5-65 kips	\$0.10
4-axle, combination, 65-70 kips	\$0.34
5-axle, 80-90 kips	\$0.38
6-axle, 80-90 kips	\$0.18
6-axle, 90-100 kips	\$0.42
6-axle, 100-110 kips	\$0.75

Truck type	Damage cost per mile
7-axle, 80-90 kips	\$0.11
7-axle, 90-100 kips	\$0.25
7-axle, 100-110 kips	\$0.45
7-axle, 110-120 kips	\$0.70
7-axle, 120-130 kips	\$1.03
8-axle, 80-90 kips	\$0.09
8-axle, 90-100 kips	\$0.19
8-axle, 100-110 kips	\$0.35
8-axle, 110-120 kips	\$0.54
8-axle, 120-130 kips	\$0.79

¹*Damage costs due to additional weight (i.e., from the legal weight limit to the maximum weight limit)*

User fees to recover costs for overweight vehicles are of five basic structures: flat, distance based, weight based, weight and distance based, and axle based. Each type has inherently unique characteristics related to fairness, precision of allocation, and implementation complexity. The incidence of each type of user fee will fall in various ways according to vehicle types and industries using those vehicles. While South Carolina’s trucking stakeholders contributing their perspectives to this study did not reveal consensus on how overweight fees in the state should evolve, but some common points did emerge from multiple interviews. Fundamentally, representatives of well-intentioned shipping companies expressed concern that raising fees will encourage illegal trucking without permits, and the effectiveness of enforcement is nationally unclear since staffed weigh stations have given way to automated transponders. Enforcement planning must coincide with a revision of South Carolina’s overweight fees. Other considerations should include effects of overweight fee policies across jurisdictions and consistency in the mega-region.

To recover additional costs of damage imparted by overweight trucks for load in excess of the legal weight limit in an axle based fee structure, damage fee will vary between \$24 and \$175 per trip for different overweight truck types, while a flat fee structure will charge all overweight trucks \$65 per trip (including \$10 administrative permit processing fee). Consideration of axle load, axle configuration and trip length in the fee structure will reflect damage imparted by each overweight truck more accurately. The fee estimates provided in this study do not consider user fees paid through fuel tax, vehicle registration, or other fees. Under the current fee structure, overweight trucks in South Carolina pay \$30 for a single trip permit, and \$100 for an annual permit which is equivalent to 3.33 trips. These flat fees do not consider the relative damage due to incremental increases in vehicle weights and trip distances. An Ohio DOT study found that with an annual permit, on average, 24.8 trips were made by an overweight truck.

Interviews showed that fundamentally, South Carolina’s trucking stakeholders do not hold common ideas on the objective of overweight permits and fee structures. South Carolina will not likely find fee revisions politically viable until a consensus develops among stakeholders on the objectives of overweight permitting and fees. Since no consensus is reached among stakeholders at this point, proactive mitigation strategies, such as pavement and bridge design for overweight loading should be considered and pursued. SCDOT and trucking industry representatives should work together in an ongoing focus group to develop common understanding of issues, consensus around objectives, and provisions for fairness that will address industry concerns.

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