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Myth: One Truck Does More Damage than 9,600 Automobiles.

In order to justify tolling heavy-duty trucks, proponents often cite an obscure statistic from a 1979 General Accounting Office study that a single "tractor-trailer has the same impact on an interstate highway as at least 9,600 automobiles.[1]" It is important to understand the origins of this myth, as the data behind the phrase originates from the highly regarded American Association of State Highway Officials (AASHO) Road Test, what is now the American Association of State Highway and Transportation Officials (AASHTO). The Road Test was "to study the performance of pavement structures of known thickness under moving loads of known magnitude and frequency.[2]"

Construction for the Road Test began in Ottawa, Illinois in August 1956. The project consisted of 7 miles of two-lane pavements in the form of six loops and a tangent, half concrete, half asphalt. The road contained 836 test sections which employed a wide range of surface, base, and subbase thicknesses, and included 16 short-span bridges. Test traffic was inaugurated on October 15, 1958, with the Department of Defense providing heavy vehicles and drivers. The AASHO Road Test ended November 30, 1960.[3] The majority of the test sections were deliberately under-designed in order to achieve pavement failure during the tests, while the few remaining sections, built according to the modern standards of the day, withstood hundreds of thousands of axle loads.[4]

The test results demonstrated a geometric relationship between axle loads and pavement effects, so that even a small increase in axle loads could have a large effect on pavement wear. On the other hand, the data also determined that a small increase in pavement strength of thickness would accommodate a large increase in axle loading, which researchers rarely mention.

The intent of the study was to help engineers determine load-related pavement requirements as the test data established the relationships for pavement structural designs based on expected loadings over the life of a pavement. The data from the Road Test helped to create a standard value for axle weights, called "equivalent single axle loads," or ESAL. An ESAL represents an 18,000-pound single axle load, which is assigned a value of 1.00.

For example, a standard 5-axle tractor-trailer weighing 80,000 pounds has an ESAL value of 3.83. This is determined by examining the various axles, i.e. the steer axle (12,000 lbs.) and the tandem axles (34,000), and adding them together (0.19 for the steer axle + 1.82 for one tandem + 1.82 for the second tandem = 3.83 ESALs). In comparison, a two-axle passenger car weighing 4,000 pounds has an ESAL value of 0.0002 for both the front axle and rear axles, equating to a total ESAL value of 0.0004. Thus, a single tractor-trailer has the same impact as 9,600 passenger cars (3.83 ÷ 0.00014 = 9,600).

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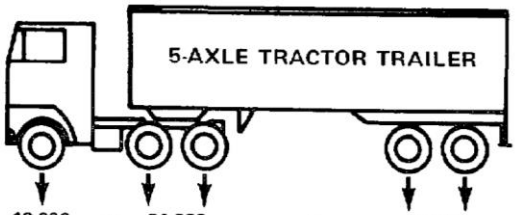
[1] https://www.gao.gov/assets/130/127292.pdf
[2] https://en.wikipedia.org/wiki/AASHO_Road_Test
[3] https://www.fhwa.dot.gov/infrastructure/50aasho.cfm
[4] "The "9,600 to 1" Numbers Game: Bad Math, Not A Measure of Damage," New Jersey Motor Truck Association Bulletin (Oct 2007), pg. 12-13.

EQUIVALENT DAMAGE CAUSED BY LOADED
5-AXLE TRACTOR TRAILER



TRUCK AXLE WEIGHTS	12,000 POUNDS	+	34,000 POUNDS	+	34,000 POUNDS	=	80,000 POUNDS
EQUIVALENT NUMBER OF AUTOS	500 AUTOS	+	4,550 AUTOS	+	4,550 AUTOS	=	9,600 AUTOS

However, the issue at hand is not that simple as there are several other factors to consider other than ESAL equivalency. First, we must consider the two types of pavement, flexible or rigid. Modern designs utilize flexible pavement, which lowers the ratio to approximately 800 to 1,000 cars per single truck. Moreover, if engineers design the roadway properly, considering both the depth and type of concrete, the pavement will be more durable as one additional inch of concrete slab would allow for twice the number of ESAL applications without reducing the life of the highway.

The Transportation Research Board has said "when a highway is properly designed…it will not be damaged by the traffic it is designed to support. This is an important point because there are prevalent misconceptions that trucks damage pavements more than passenger cars. This is only true when (1) the pavements are under-designed for the amount of truck traffic that is actually using them; (2) trucks, through overloading generally, are imposing heavier axle loads than anticipated; or (3) other factors not properly evaluated in design have affected the ability of pavements to support traffic.[5]"

Thus, the pavement damage is not due simply to heavy-trucks but because the state or federal builders did not design the highways correctly. The reason for the excessive damage is more likely that the construction companies utilized less concrete and less flexible concrete slabs than the infrastructure required.

Other factors to consider for pavement wear seldom mentioned are:

1. Underlying soil
2. Roadbed design
3. Pavement type
4. Pavement thickness
5. Weather effects
6. Deferred maintenance

[5] *State Laws and Regulations on Truck Size and Weight*, National Cooperative Highway Research Program Report 198, Transportation Research Board (1979)