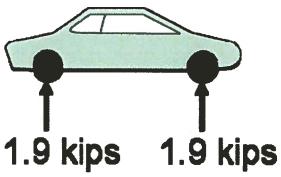
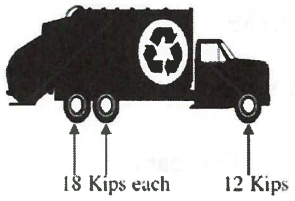
Load Damage from Trash Trucks

The damaging effect of the passage of an axle of any load can be represented by a number of 18,000-pound equivalent single axle load. The load damage factor increases as a function of the ratio of any given axle load raised to the fourth power (1). For example, one application of a 20,000 pound single axle load is slightly less than 8 times as damaging as a 12,000 pound single axle load $(20/12)^4$.

For our example, we will use a passenger car with a total weight of 3,800 pounds (2) or 1,900 (1.9 kips) per axle. The trash truck will be loaded to the maximum weight without needing a permit from CDOT of 48,000 pounds. Typically, the maximum load on the steering axle is 12,000 pounds (12 kips) and the remaining 36,000 pounds will be evenly distributed on the other two axles (18 kips per axle).





In this example, the damage from one combination truck is equal to 9646 cars.

Here is the math:

Front axle = $(12/1.9)^4$ = 1,591 cars
Rear axles = $(18/1.9)^4$ = 8055 cars

References

(1) AASHTO Guide for Design of Pavement Structures 1993 page I-11
(2) Statement of Clarence M. Ditlow Director of the Center for Auto Safety before the Senate Committee on Commerce, Science and Transportation in Washington DC on December 6, 2001.

Pavement Design
Cars versus Trash Trucks

In the structural pavement design process for CDOT, we convert all types of vehicles and various axle configurations to an 18,000 pound equivalent single axle load (18 k ESAL). These conversion values can be found in the appendix D of the AASHTO Guide for the Design of Pavement Structures.

For our example, we used the information for a terminal serviceability of 2.0

2 kip single axle = .0002
Therefore, 1 car = .0004 ESALs

12 kip single(driving) axle = 0.189
36 kip dual axle = 2.76
Therefore 1 trash truck = 2.949 ESALs

1 combination truck = (2.949 / .0004) cars
1 combination truck= 7,372 cars

The top 5 enemies of asphalt

We're back! This blog entry is designed to shed some light on common asphalt problems, provide a surprising look into their causes, and offer some simple steps toward solutions that minimize costs. We invite you to post a comment with any questions or feedback.

Heavy Trucks

Problem — Asphalt fails much faster in areas exposed to garbage trucks, delivery trucks, moving trucks, and buses.

Reason — In asphalt engineering terms, heavy vehicles have much higher ESALs (Equivalent Single Axle Loads) than lighter weight cars. There's actually an exponential, not linear, relationship between a vehicle's weight and its impact on the asphalt. A typical car is .0006 ESALs (a 4,000 pound car with 2 axles) where a large garbage truck may be 1.4 ESALs. That garbage truck is the equivalent of more than 2,000 cars! The slower the truck is traveling, the more damage it is doing, as well. It may cruise through the roadways but it slows and stops at the collection areas – prolonging the pain, and the damage, to the asphalt.

What to do – Fill cracks in heavy traffic areas. Water intrusion itself is not a problem, but heavy loads combined with the softened, moisture-sensitive soils in much of the Bay Area leave asphalt with a weak foundation upon which it will bend and break.

Minimize heavy truck traffic through your property and re-locate collection areas, if possible.

If you have high turnover (residents/tenants move frequently) consider instituting a move-in/move-out fee to cover damage from moving trucks.

When doing reconstruction work, install much deeper asphalt sections (perhaps 4-6") along the truck route and at the collection area and thinner asphalt sections (2.5-3") in parking areas. Don't install the same thickness of asphalt everywhere unless all areas get the same amount and type of traffic.

Sunlight

Problem — Areas exposed to sun turn gray and age much faster than those in shade or covered by carports or parking garages.

Reason — Extended exposure to sunlight can cause oil to suffer accelerated oxidation, which reduces its ability to hold the rocks together. On a molecular level, asphalt reacts with oxygen faster in the presence of ultraviolet (UV) radiation from the sun.

What to do — Protect the surface of the asphalt with a sealcoat. Apply less sealcoat, perhaps a single coat (or in some cases, none at all) in areas that are rarely, if ever, exposed to UV rays.

We're growing. Now offering San Diego area services.

Learn more...

Sign up for our newsletter

Email Address :

Submit

RECENT ARTICLES

Pavement Design – From Intuition to Good Science

Saving the Paving: The Asphalt Maintenance Guide for Managers & Board Members

The Pavement Life Cycle