

ITS/CVO Systems Improve Safety

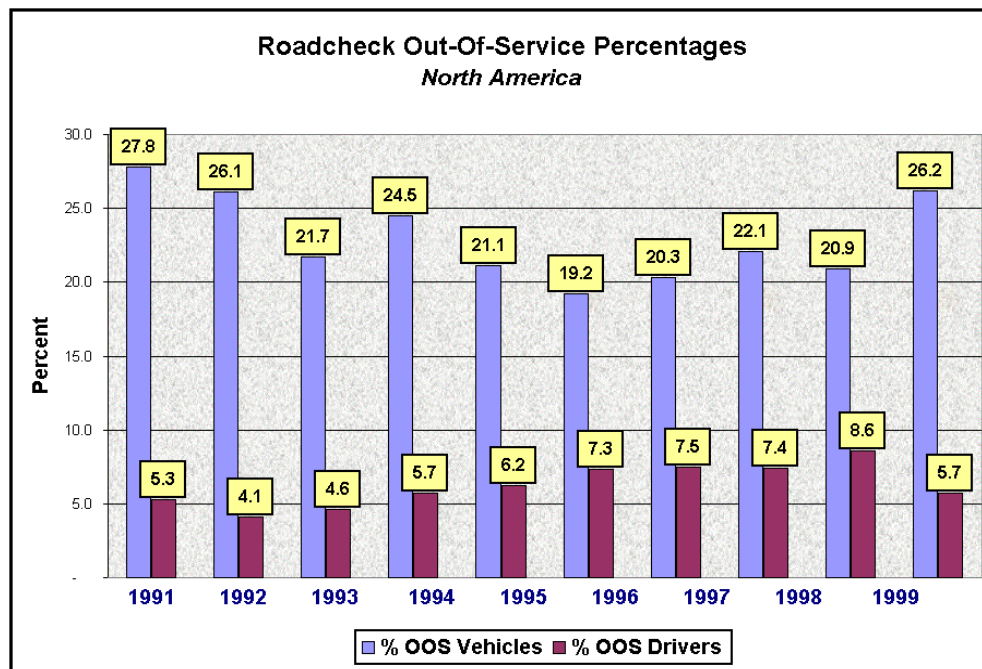
Benefits provided to:

- insurance agencies
- trucking industry
- road agency
- traveling public

The implementation of an automated preclearance system that checks a commercial vehicles weight, safety and credential status will provide benefits to the trucking industry, road agencies, and insurance companies. The benefits of increased weight enforcement to prevent damage to the highway infrastructure are clear and have been well documented. But this is only one part of the overall picture of weight control, inspections, and monitoring of commercial vehicle activities. The following information highlights several other issues related to CVO operations that are addressed by the implementation of automated preclearance systems.

SAFETY FITNESS: Motor carrier safety and weight regulations have always been a concern to road agencies and the general public. The mechanical condition of truck and the physical condition of the driver are contributors to road safety.

The figure shown below illustrates the percentage of drivers and trucks that were out of service during random truck inspections for the Roadcheck program. During Roadcheck 2000, more than 42,000 vehicles were inspected. Of those inspections, 26.2 percent of vehicles and 5.7 percent of drivers were placed out-of-service because of serious safety violations. (More statistics can be found at www.jjkeller.com/resourcecenters/roadcheck)



TRUCK HANDLING AND STABILITY: Overweight trucks on the road become a safety hazard to other vehicle due to decreased operational performance. Truck handling and stability properties that are affected by truck weight or configuration include rollover threshold, rearward amplification, braking, steering sensitivity, low-speed offtracking and high-speed offtracking. Overweight trucks increase the risk of traffic accidents.

Rollover Threshold

- Fatal rollover crash rates of tractor-semi trailers and five-axle doubles have been shown to increase with increased GVW (Fancher et al. 1989), as have non fatal crash rates (Ervin et al. 1983).
- Commercial vehicle rollover accidents are strongly associated with severe injury and fatalities. (Winkler et al. 2000)

Rearward Amplification

- Rearward amplification increases with increased GVW.
- Francher et al 1989 reported that the number of fatal truck crashes related to rearward amplification per mile traveled significantly increased as rearward amplification increased. This implies that, other things being equal, significant increases in GVW would increase the probabilities of the vehicle being involved in a fatal reward amplification crash.

Braking

- Changes in truck weight of 10 to 20 percent are not likely to affect practical stopping- distance capabilities of trucks, but more substantial weight increases would lead to demand for higher brake torque capacity, which may lead to poorer stopping-distance capabilities.

Steering Sensitivity

- The influence of GVW on steering sensitivity is of secondary importance relative to the influence of the variables mentioned above. Steering sensitivity slightly decreased with increased GVW.

Traffic Operation Characteristics

- Without modifications of engines and drive trains, increased truck weights would lead to greater speed reductions on upgrades and greater difficulties for trucks to merge, weave and change lanes on freeways.
- Other things being equal, increased gross weights may also increase the probabilities of brake overheating on long, steep downhill runs.
- Any one of these situations can have adverse traffic (delays and congestion) and accident implications. (TRB Special Report 225)

If vehicle dimensions, number of axles, and other aspects of the vehicle and component designs were unchanged, substantial increase in gross vehicle weight would lower rollover resistance in steady turns for all trucks, which may lead to more rollover accidents. For existing five-axle doubles, increased weight would also downgrade the rearward amplification behaviors, which may increase the probabilities of rear-trailer overturns during obstacle avoidance or sudden lane change maneuvers. In addition, increased gross weight would require brakes with a higher torque capacity, which, if not provided, would result in

trucks that were deceleration limited by brake torque capacity rather than by tire friction levels and fore-aft brake balance (TRB Special Report 225).

By enforcing truck weigh regulations; it can affect highway and safety operations by changing operating weights and weight-related performance characteristics such as rollover potential and speed, acceleration, and braking capabilities. (TRB Special Report 225)

Effect Of Trucks On Fatal Accident Rates

- The University of Michigan Transportation Research Institute analyzed the size of large trucks involved in fatal crashes from 1991 through 1996 for an FMCSA analysis brief. Of the 15836 trucks for which weight could be determined, 7564 (48 percent) weighed more than 60,000 pounds at that time of the crash. (FMCSA, 2000)
- Campbell et al (1988) evaluated crash types and found that a moderate increase in accidents rates for higher gross weights. The scatter of the data made it difficult to draw any conclusions.
- Fancher et al. (1989) evaluated the same data with the following results:
- Fatal involvement rates in rollover and ramp-related crashes increased with increased GVWs.
- For curve related crashes and crashes in which trucks rear-ended other vehicles, increased GVWs may increase fatal involvement rates, although the trend was not as conclusive as those for rollover and ramp-related accidents.

AVAILABILITY OF RESOURCES: One of the underlying principles of ITS is that the resources are not available to build more infrastructure, so better use must be made of the existing resources. The same principle applies to CVO monitoring. Increased focus on safety is needed, but the additional resources are usually not available, and reducing weight enforcement efforts is not an option.

Pavement damage

- Researchers in Idaho have estimated that a single weigh station covering a road length of 160 miles prevents approximately \$4 million in pavement damage over the course of ten years (Parkinson et al, 1992).
- An earlier FHWA study found that, nationwide, overloaded truck axles cause up to \$670 million per year in incremental pavement damage (Taylor et al, 2000 and TRB Special Report 225, 1990).

Effect of enforcement level on compliance

- A Canadian study in the province of Saskatchewan evaluated before and after data for a continuous enforcement condition and zero enforcement condition. The study showed that the violation rate of gross weight limits decreased to a low of 2.8 percent at continuous enforcement from 5.6 percent at normal enforcement. The violation dramatically increased to 18.6 percent with no enforcement.
- Similar studies in Virginia, Maryland, Arizona, Wisconsin, and Montana showed violation rates of 20% to 30% with low enforcement and 1% to 2% with high enforcement.

WEIGHT AND SAFETY VIOLATIONS ARE LINKED: Identifying overweight trucks can also help to identify other problems related to safety and credentials.

- Recent studies have shown a correlation between overloading and safety non-compliance. A Wisconsin study found that as many as 70 percent of overloaded

trucks were in violation of motor carrier safety and driver regulations. This indicates that overloaded trucks are three times as likely to be in violation of safety regulations when compared with the estimated safety violation rate for general truck traffic.

BENEFITS OF AUTOMATION: Preclearance systems allow agencies to perform the same tasks in a more efficient manner, resulting in better use of resources and increased enforcement.

- Weight based sorting systems allow 60% to 80% of the legal weight trucks to bypass because they are not in violation
- Transponder based programs can automatically verify safety and credentials and provide an authorized bypass to 90% or more of participating vehicles.
- WIM systems increase the identification of violations and result in substantial increases in violation detection for some regulations such as bridge compliance.
- Legal carriers receive the benefits of compliance, providing greater incentive for safe and legal operations.
- An Illinois study showed that normal highway segments had 38% fewer accidents than similar sections with weigh stations, attributed to the traffic disruption or exiting and entering trucks. (Barnett, Benekohal)

COST SAVINGS FROM EXPERIENCE: The implementation of a preclearance program has potential cost benefits for the trucking industry, the enforcement agency, and the highway agency.

ITS Awards

- In 2000, the Oregon Greenlight project won an ITS America award for a ITS program demonstrating cost savings. This year, the Prepass program has been nominated for the same award.

Maryland

- A cost-benefit analysis of the Commercial Vehicle Information Systems and Network (CVISN) program in Maryland estimated benefit/cost ratios for a variety of ITS/CVO applications. The ratios are based on a 10-year lifecycle for the project, with full deployment of the system in the first year and participation in the program by industry increasing gradually in the early years, more rapidly in the middle years and leveling off in the final years of the lifecycle. Findings include:
 - Overall benefit/cost ratios ranging from 3.17 to 4.83,
 - Roadside operations of safety enforcement with benefit/cost ratios between 4.01 to 6.08,
 - The benefit/cost ratios for state agencies are between 1.41 and 1.66, and
 - Commercial motor carriers achieving benefit/cost ratios between 6.49 and 10.71.

Oregon Greenlight

User Operational Costs Savings

- Reductions in time delay resulting from mainline electronic screening of truck traffic are acknowledged as one of the primary benefits of the Oregon Green Light system. Truckers save, on average, 5 minutes per bypass.

- Given the current preclearance activity, the trucking industry will save on average 630,000 hours of travel time. However, with the ongoing growth of the Oregon Green Light program, Oregon expects to far exceed the current level of user benefits.

Safety Benefits

- With electronic screening and the issuance of bypasses to trucks operating on the mainline fewer lane changes, and passing operations around commercial vehicles slowing to enter a weigh station, are required. Therefore there are additional benefits to be gained from decreased risk of accidents from traffic queues at weigh stations (Brock, 1999 and Barnett, 1999)
- Another safety benefit results from carriers with known history of good safety, weights, dimensions, and credentials compliance, being bypassed on the mainline without having to enter the weight enforcement facility. Thus, safety inspections can concentrate on carriers that report to the weigh station, which are more likely to need the time and attention of enforcement officers (Montagne, 2000).
- The Oregon Green Light system provides commercial carriers with the incentive to improve their safety record in order to enroll in Oregon's Trusted Carrier program.

Pavement Damage

- With 21 improved weigh stations enhancing the ability to minimize overloaded trucks in Oregon, it is estimated that Oregon could save well in excess of \$80 million during the next 10 years in reduced road impact damage due to commercial vehicle overloading. These benefits are associated with: (1) the effect of deteriorating pavement conditions on fuel economy, tire wear, and other related maintenance costs, (2) time delays suffered during pavement resurfacing, reconstruction, rehabilitation, and maintenance, and, (3) time delays suffered due to traffic control related to remodeling, upgrading, and/or reconstruction of weigh stations.

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