Commercial transport trucks derive their revenue by transporting goods on highways. Thus, if they are hauling heavy cargo they will maximize their return and load to the legal weight limit and in some cases may be overloaded. Modern highways and toll operators screen truck weights to avoid the damage caused by overweight trucks and the corresponding maintenance costs. Further, recognizing the economic benefit to the truckers, the highway operator, through the toll system, can charge trucks a toll based on their axle and vehicle weight.

International Road Dynamics Inc. (IRD) has developed a Weigh-In-Motion toll system (WIM@Toll) that allows highway operators and concessionaires to charge trucks based on truck weight. WIM@Toll facilitates a toll charge based on the economic value the highway provides to commercial vehicles, charging more for heavily loaded trucks and less for light or unloaded vehicles. In addition, it provides a means of screening for damaging overloaded vehicles.

The concept of WIM has a long history in data collection applications in transportation infrastructure planning. This has expanded to use in enforcement for sorting compliant from violating vehicles to increase the throughput and ease congestion at inspection stations. The wear and tear on pavements, bridge structures, and other components of the transportation infrastructure caused by an individual vehicle is related to the weight of that vehicle or axle. In fact, as gross vehicle and axle weights increase, the damage to highway and bridge infrastructure increases exponentially, as was concluded by the American Association of State Highway Officials (AASHTO) highway study. An increase in loading thus results in an exponential increase in the acceleration of road damage. WIM systems installed by IRD combat road damage by providing accurate data for traffic planners and by identifying overloaded trucks.

**WIM FOR TOLL STATIONS**

IRD uses its Intelligent Sensor Interface and Network Controller (iSINC) to control WIM systems at tolls. The iSINC is a CE certified roadside electronic control unit with hardened electronics suited to outdoor applications over a wide temperature range. While the iSINC is used for toll system operations, it also has applications in traffic monitoring and data collection, automated weigh station operations and traffic security systems. The iSINC controller is modular and can simultaneously connect with a variety of WIM sensors and toll system peripherals. The peripherals include lane...
control signs, traffic lights, axle sensors, single and dual tire sensors, vehicle presence detectors, fare display signals, automatic vehicle identification (AVI) systems, camera systems, dimensioning sensors, toll barrier gates, communication systems and credential databases.

At toll stations IRD integrates its Slow Speed Weigh In Motion (SSWIM) scales or PAT Bending Plate WIM scales to the iSINC controller. IRD is a system integrator and is able to deploy various transponder based solutions including radio frequency identification transponders as well as passive and active microwave transponder solutions.

WEIGHING STRATEGIES

In order to change to a toll strategy that charges by weight and penalizes overloading, it is necessary to both weigh and classify vehicles. There are three main options for doing this.

The first is to have static weigh stations on the toll way. While being the most accurate, this method has a number of drawbacks. Vehicle throughput is very slow, resulting in delays and congestion. It requires an additional large infrastructure investment and staff to build and man the weigh station. The departure from the weigh station and merging of heavy vehicles with the main traffic stream poses a safety hazard. Thus, the GVW accuracy of the static weigh stations, though being the best, comes at a high initial investment and equipment cost to the buyer. The added cost to the user also includes the delay and slow down caused by the time taken by the traditional scales to calculate the GVW.

A second option is to have high-speed WIM lanes on the roads or toll way. This requires identifying all heavy vehicles at highway speeds with transponders or license plate recognition (LPR) cameras for vehicle tracking and recognition.

The third option is to have SSWIM lanes at toll plazas. This could be either each lane of the toll plaza or a number of exterior lanes at a toll plaza depending on the traffic flow and usage. This method integrates the weighing operation into the normal toll collection process at the plaza. The WIM operation requires little additional delay. When combined with electronic toll collection (ETC), this system can process the majority of vehicles without stopping, while still allowing manual collection from vehicles that have not subscribed to the ETC program. The efficiency is significantly increased by having some WIM toll lanes reserved for ETC vehicles only.

IRD’s WIM@Toll system installed in Mongolia using IRD’s slow speed WIM scales. IRD’s system also includes automatic vehicle identification (AVI) using RFID transponders and readers

“When combined with ETC, this system can process the majority of vehicles without stopping, while still allowing manual collection from vehicles that have not subscribed to the ETC program”
WEIGH IN MOTION

WEIGH IN MOTION

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