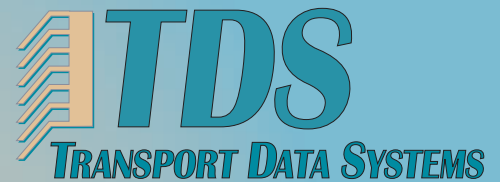
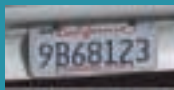


MODEL 351



Real Time Remote/Local Webpage



Length: 59 Feet Speed: 56 MPH

- Axle 1: Right Wheel - Single Tire - 2,500 Pounds
- Axle 1: Left Wheel - Single Tire - 2,350 Pounds
- Axle 2: Right Wheel - Dual Tire - 3,600 Pounds
- Axle 2: Left Wheel - Dual Tire - 3,700 Pounds
- Axle 3: Right Wheel - Dual Tire - 4,800 Pounds
- Axle 3: Left Wheel - Dual Tire - 4,600 Pounds
- Axle 4: Right Wheel - Dual Tire - 3,600 Pounds
- Axle 4: Left Wheel - Dual Tire - 3,700 Pounds
- Axle 5: Right Wheel - Dual Tire - 4,800 Pounds
- Axle 5: Left Wheel - Dual Tire - 4,600 Pounds

LOOP BASED REMOTE WEIGH SYSTEM

The integration of image capture with weigh-in-motion and vehicle classification enables the user to significantly enhance weight enforcement and infrastructure planning. The use of this system into a weight enforcement strategy provides significant benefits in terms of improved commercial vehicle safety, ensuring equitable competition in the commercial carrier industry and protecting public and private road assets from excessive and accelerated damage caused by overloaded commercial vehicles.

This technology has a number of applications in commercial vehicle weight enforcement, infrastructure development and road asset maintenance planning. It can be used to augment permanent weigh station operations by providing images and classifications for mainline WIM pre-screening systems, monitoring vehicle compliance to WIM sorter traffic signals and traffic signs, and for monitoring weigh station evasion routes. It may also be deployed in conjunction with mobile and remote weight enforcement as a pre-screening system, or as an automated stand alone monitoring system on remote routes. The data from this system can provide agencies with a visual record from which to engage in discussions with particular carriers detected as

chronic violators, or to assign preferred carrier status. The system may also be deployed in support of transportation planning activities to assist traffic engineers to evaluate future capital developments or help road asset managers plan preservation programs across specified segments of the road infrastructure. Other applications include urban weight enforcement and concentrated haul road weight enforcement. Finally, the system can be employed on toll roads to provide a more equitable method of assessing costs for patron use of the road.

This system provides the capability of generating vehicle alarms when a vehicle exceeds a specified limit associated with that vehicle class. The class determination is based on vehicle length, axle location, dual tires and weight per axle/tire. An alarm is generated when the vehicle exceeds speed or weight per axle/tire limits as defined by the customer. When an alarm is generated, the system captures video images of the front and side of the vehicle to provide for identification. The extracted license number and the associated images can be forwarded to a central server for insertion into a central database of violations.

OPERATIONAL PHILOSOPHY

To create a remote weigh system, Transport Data Systems has integrated its Weigh-In-Motion (WIM) vehicle classifier and image capture products. The system uses quartz sensors from Kistler to provide the raw pressure inputs from the tire crossings. This information coupled with accurate velocity data delivers accurate wheel by wheel weight measurements.

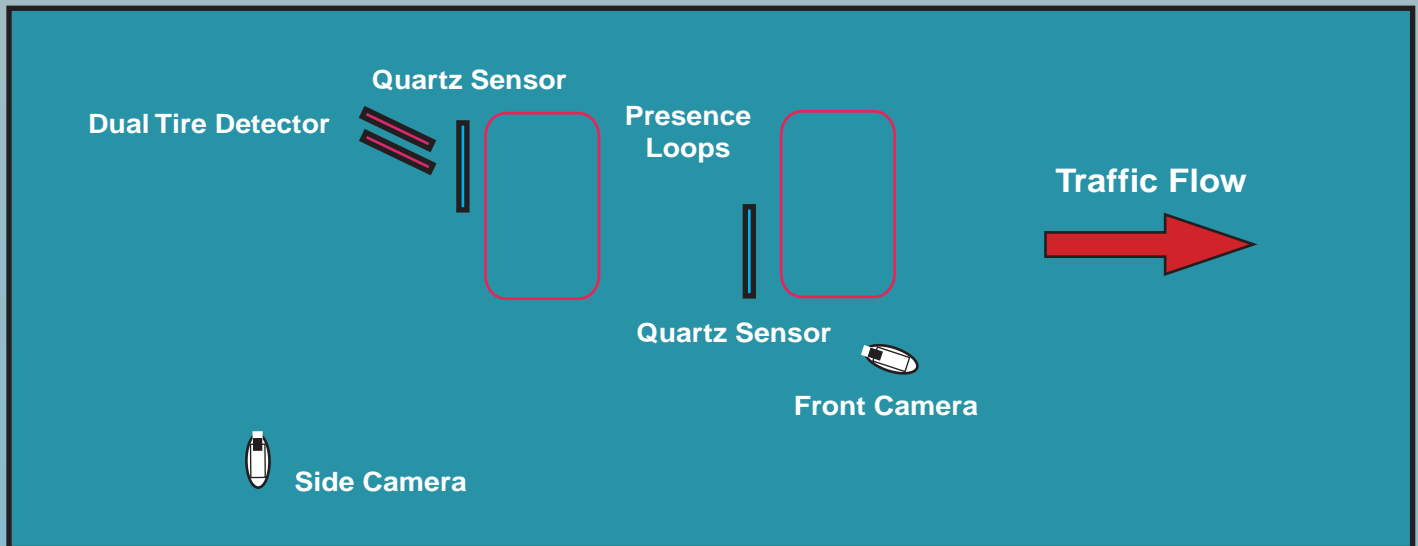
The Kistler quartz sensor provides a measure of the total pressure that is applied to the sensor during the period that the wheel is actually on the sensor. To determine the actual weight, the unit requires the speed of the vehicle. The system includes multiple loops to determine the velocity of the vehicle and to

based dual tire detector allows the user to determine the existence of dual tires on each axle.

This combination allows the RWO processor to evaluate each vehicle using axle locations and tire counts along with length and width and height profiles.

STOP AND GO TRAFFIC

In order for the quartz sensors to operate properly, the vehicle can not stop on the sensors. Neither the loop system or the overhead dual laser provide continuous velocity updates. Therefore if stop and go traffic exists on a regular basis, it is imperative



provide vehicle separation.

As an option, the TDS RWS can be modified to use a dual beam laser scanner in place of the loops to separate vehicles and to profile them in width and height. The scanner provides a velocity measurement when the vehicle initially penetrates the beams. This velocity plus the quartz sensor outputs can provide accurate and reliable vehicle weight information. It also provides for excellent vehicle separation.

The quartz sensors can also fill the requirement for axle detection, thereby eliminating the need for additional axle detectors. A separate fiber optic

that the vehicles be metered through the measurement area. In order to accomplish this, a separate traffic light and/or gate is used to control the entry of the vehicle into the measurement zone. This technique not only guarantees a more accurate weight measurement but also increases the fundamental accuracy of the vehicle classifier.

Front and side images are captured for every vehicle. An alarm is generated when an out of tolerance vehicle is detected. The captured images are then stored locally in a database for review and can also be transmitted to a central server for additional processing.



BASIC DESIGN

The system includes a pair of loops, an axle/weight/dual tire detection system, dual image capture systems and a computer system for processing the sensor data. The system is capable of providing the following information about a vehicle.

- Length of the vehicle(s) - Number, weight and location of axles.
- Existence of dual tires.
- Vehicle speed.

The axle/weight detection system provides information about each axle on the vehicle. The weight sensing is done by Kistler Lineas quartz sensor. The quartz sensors provide an indication that an axle is passing through the weighing zone. The quartz sensor transmits pressure data that when combined with the velocity from the loop crossings provides a measurement of the weight of the axle. The optional dual tire detector provides the number of tires on each axle.

RWS PROCESSOR

The RWS processor is an Intel based PC running the Linux operating system. The interface to the central server is available in serial form via RS-232 or RS-422 or via a 10/100baseT network connection.

IMAGE CAPTURE SYSTEM

The RWS will capture an image of the vehicle for use in determining the ownership of the vehicle. The image capture system can be set up to capture either the front license plate of the vehicle or the right hand side of the vehicle including the USDOT number. If required, two cameras can be implemented within a single processor to provide for both images.

This camera provides high resolution lane coverage over a capture area of approximately 10 feet wide by 6 feet high. The size of this coverage coupled with accurate triggering insures that a single image will include the vehicle license plate. The resolution of the camera coupled with the low noise performance provides an excellent image for optical character recognition. TDS has developed a companion OCR package for use with this camera.

EVOLUTION

This design is based upon TDS's extensive experience in the fields of automatic vehicle classification, license plate capture and violation enforcement. TDS has over 400 lanes of high accuracy automatic vehicle classifiers and image capture systems in operation on toll roads.

QUARTZ SENSOR

Kistler's LINEAS WIM Type 9195C is a force sensor with quartz elements. The sensor is a modular element that is installed into a slot that has been saw-cut across an asphalt or concrete road. When a force is applied to the sensor surface, the quartz disks yield an electric charge proportional to the applied force through the piezoelectric effect. The electric charge is converted by a charge amplifier into a proportional voltage which can then be processed as required. Key characteristics include:

Excellent long term stability.

Measures very accurately at both walking and freeway speeds.

Insensitive to temperature changes.

Frost-resistant and protective against ingress of water.

Quasistatic and dynamic calibration are possible.

Wide measuring range.

The sensor is not dislodged from the road and can be reground by up to 10 mm in the event of road deformations.

The sensors are available in 0.75 and 1.0 meter lengths. Two or more sensors can be connected together to make a longer single sensor strip. Several sensors that are installed adjacent to one another can be connected electrically in parallel and operated with a single charge amplifier. The output signal then corresponds to the sum of the forces acting simultaneously on all sensors connected.

A sand/epoxy grout secures the sensor strips into the pavement slots. After curing, the hardened grout and the exposed top surfaces of the sensor modules are ground flush with the surrounding pavement using a belt sander. After grinding, the sensors may be immediately exposed to traffic. An overnight post cure is recommended before calibration and acceptance tests are performed.

CHARGE AMPLIFIER

The industrial charge amplifier (Type 5038A2Y43) is a 2 channel amplifier. Each channel converts the charge output of the Lineas sensor to a proportional voltage. The adjusting potentiometers are designed as plug in units to avoid the need for recalibration when an amplifier is replaced. The

unit requires an unregulated 15 to 20 volt DC supply. Its key features include:

Robust aluminum diecast housing

Vibration proof

No adjustments required

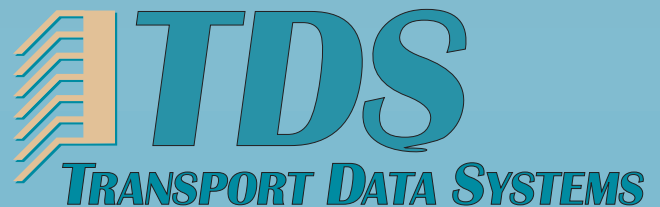
The outputs of the sensor amplifier are brought to the lane controller over special cables capable of extending the distance from the sensor amplifier to over 80 feet. The signals are fed into a digital processing card which contains a 12 bit analog to digital converter.

DUAL TIRE DETECTOR

The dual tire detection will use two fiber optic treadles, each with a length of 1.7 meters. The two fiber optic treadles are placed at a nominal 35 centimeter (14 inch) separation at an angle of 30 degrees relative to the flow of traffic. The fiber optic treadle can be installed directly into the road surface.

In those applications where a quicker replacement is required, TDS offers a steel treadle frame and carrier combination. The frame is installed into the roadway and the carrier is then bolted into the frame. The fiber treadle is encapsulated with resin into the carrier by TDS. The user then installs the carrier into the frame. The fiber cable is routed through the junction box on the end of the frame. This allows for the replacement of a failed treadle in less than two hours using standard tools.

The fibers are connected to a two channel amplifier located near the RWS processor. The outputs of the amplifier are sent to the RWS processor via an RS-422 serial channel.



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