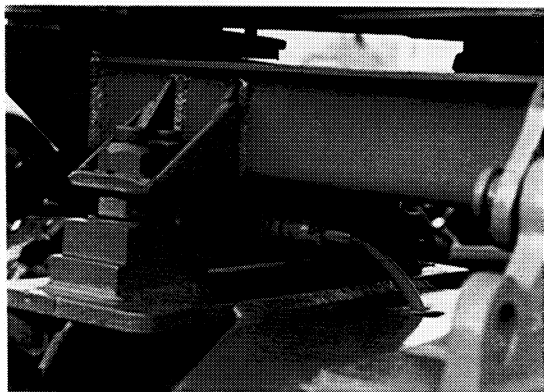
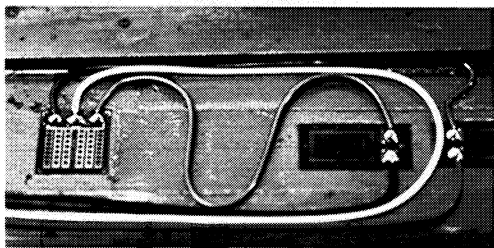


Weight Control for Highway Trucking

Electronic scales for vehicle payload management highlight a representative group of technology transfers in the field of transportation



Shown above is a LODEC load cell (bar with connector attached) that supports the bridgebeam on a logging trailer. Within the load cell, tiny strain gages (at right below) sense and measure the increased weight as logs are added to the trailer. An indicator in the cab of the truck (center photo) converts signals from the load cell into weight information and displays it to the driver.



In the trucking industry, continuing high operating costs and stepped-up enforcement of vehicle weight laws are generating broad interest in electronic payload management systems that originated in aerospace technology. Produced by LODEC, Inc., Lynnwood, Washington, these systems are scales that tell truck drivers or fleet operators the exact weight a vehicle is carrying at all times.

That's important to trucking productivity. An overloaded truck can damage highways and bring a costly fine, but an underloaded vehicle means reduced revenue and profit. With a highly accurate weighing device such as the electronic scale, a vehicle can be loaded to the legal limit on every trip, maximizing payload without risking an overweight ticket. Payloads can also be optimized for best fuel efficiency. Keeping truck loads within design limits offers bonuses in reduced breakage, vehicle downtime and maintenance costs.

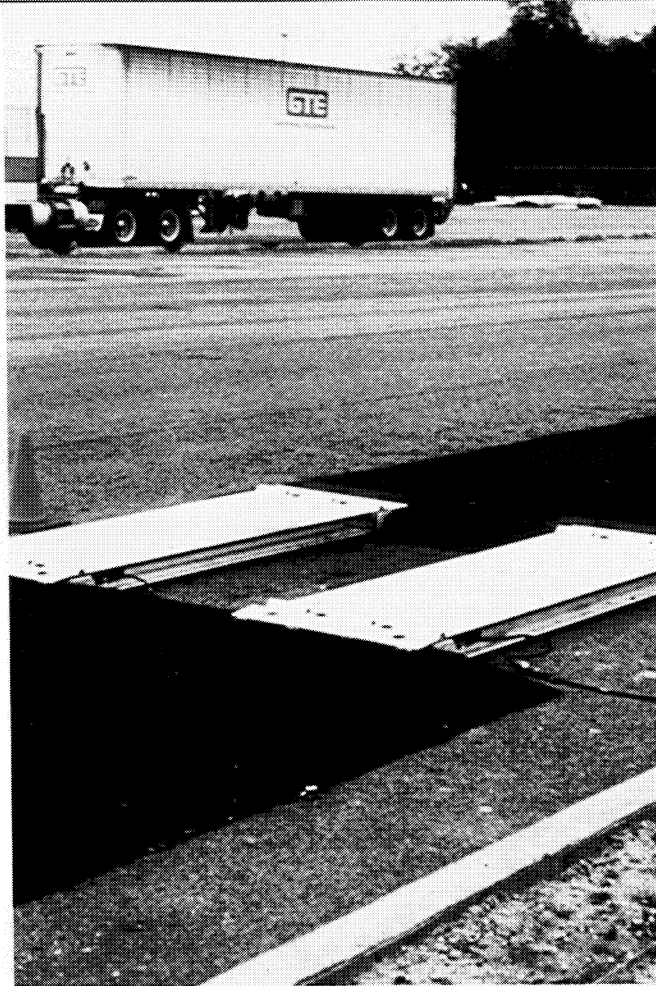
The most widely used LODEC product is an on-board electronic scale, mounted on the truck frame, that reports total truck weight to an indicator in the cab. The heart of the system is the load cell, machined from a solid bar of alloy steel and welded to the truck's supporting structure. Within the load cell are four strain gages. The load cell bends slightly—a few thousandths of an inch—under the applied load. As it does, the strain gages change their electrical resistance in proportion to the bending, which in turn is

proportional to the weight added to the truck. Electronic components in the load cell report the changes in resistance—through a connecting cable—to an indicator in the truck's cab, which converts the information to a digital display of truck weight. Some types of indicators signal an alarm automatically when a preset limit has been reached, or switch a pump on or off when a given amount of weight has been loaded or offloaded. LODEC guarantees the system's accuracy within one percent, but frequently gets much better accuracy; when properly installed and maintained, the company says, its on-board electronic scale can weigh an 80,000-pound vehicle with an accuracy within 300 pounds.

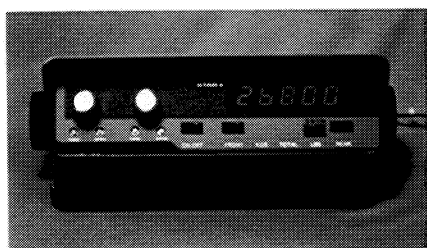
LODEC scales trace their origin to the space program of the 1960s, when ELDEC Corporation—then LODEC's parent company—acquired advanced electronic technology as a subcontractor on such projects as Apollo and the Saturn launch vehicle. From this experience evolved an electronic weight and balance system for the Lockheed C-5A military transport; it was used to calculate the gross weight and center of gravity of the giant airlifter prior to takeoff. During the aerospace recession of the 1970s, ELDEC began looking for alternative markets. LODEC, at that time the Industrial Division of ELDEC Corporation, initiated a program to adapt the weight and balance technology to commercial applications.

The first product was an on-board scale for logging trucks in the Pacific Northwest. Although there were

LODEC uses the same load cell technology, a spinoff from aerospace technology, in manufacturing electronic axle scales for weighing trucks and trailers to insure that they are within legal highway limits. At right is a portable version for use by truckers in remote locations or by weight enforcement officers on the highway.



systems for weighing trucks at terminals, there was no accurate method of weighing a vehicle in the remote mountain areas where logs were loaded; loggers had to rely on the "eyeballing" technique of visually estimating truck weight, which often resulted in overloading or underloading. The built-in electronic scale was a natural for loggers, enabling them to load to the maximum legal limit for highway travel without incurring fines. The Industrial Division's system consisted of four load cells, two on the truck



frame and two on the trailer frame supporting the truck and trailer bridgebeams, which in turn support the weight of the logs. The on-board scale proved highly accurate and it brought productivity increases of as much as 25 percent; demand for the system grew rapidly until today about 90 percent of all the log trucks operating from northern California through British Columbia have electronic scale systems. And since the technology is applicable to nearly all types of trucks, the success of the scale in the forest products industry quickly attracted the attention of other truckers. LODEC estimates

that there are now more than 10,000 vehicles using electronic on-board scales in the U.S., Canada, Europe and Australia.

In the mid-1970s, the Industrial Division adapted the technology to a related type of product, the axle scale system, used to insure that vehicle loads are correct before a truck leaves a loading area. Built in both permanent and portable versions, the system consists of two platforms, each of which contains two load cells; when trucks are driven over the platforms, data from the load cells is translated into the weight on each axle and total truck weight. The permanent version is used at truck terminals. Portable systems are used in trucking operations at remote sites and by highway weight enforcement authorities. In the latter application, weighing platforms are towed on a trailer behind a standard sedan and set up in less than 10 minutes at any selected site where there is reasonably level ground. A single enforcement officer can weigh trucks at the rate of one a minute from his patrol car.

In March 1981, the ELDEC Industrial Division became LODEC, Inc. when general manager Douglas G. Brooks—now president of

LODEC—and his management team purchased the division. In addition to on-board and ground scales, their load cells and accessories, the company produces a number of types of indicators and automatic calculating printers of various degrees of sophistication. Some of the more advanced indicators have capabilities that add a new dimension to electronic weight management: they measure incremental changes where a truck takes on weight or offloads weight at different stops. The systems have found wide application in trucking operations where incremental weight-change information is important for record keeping or billing purposes, for example, in liquid cryogenic carriers and vehicles used for agriculture, mining, asphalt spreading, batch mixing and feed delivery.

LODEC has become an international company with about one-third of its sales outside the U.S. The customer base includes more than a dozen foreign countries, more than 40 U.S. state and local government agencies, hundreds of major truck and trailer manufacturers, and numerous small truck and scale service facilities.