ABOUT THE AUTHORS

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Administrator
State of Oregon Department of Transportation
Motor Carrier Transportation Division

Gregg has served in multiple executive leadership positions in the transportation industry throughout his career, and since 1996 has been the Administrator for ODOT’s Motor Carrier Transportation Division. Under his leadership, the Motor Carrier team has pioneered and implemented ideas that bring efficiencies to government and the trucking industry by simplifying compliance and regulatory requirements, while safeguarding the Oregon transportation infrastructure.

Gregg has supported a number of innovative projects and partnerships to modernize trucking and transform the way carriers and regulators do business in Oregon, while delivering superior customer service, and recognizing the vital economic interests of the commercial transportation industry.

BRIAN MICHIE
Senior Vice President/Founder
ERoad

Brian founded EROAD in 2000 with the goal of developing a technology-based solution to modernize paper-based road tax systems. In his capacity as Senior Vice President, Brian has overall responsibility for company strategy and market development, stakeholder relationships, and communications.

Brian was responsible for the establishment of the company’s American-based subsidiary, EROAD Inc, and managed the development of the Oregon electronic weight-mile tax solution and payment gateway. Brian is an economist with extensive experience in the infrastructure, government and technology sectors.
In 2014, technology company, EROAD Inc. (ERoad), with the support of the Oregon Department of Transportation (ODOT) and the Oregon Trucking Association (OTA), implemented the first GPS cellular based electronic weight-mile tax solution in North America. Developed to automate Oregon’s weight-mile tax program for commercial motor carriers, the successful deployment is characterized by a number of innovative elements which are described and analyzed by this case study.

The development and operation of the electronic weight-mile tax service was undertaken by EROAD with the support of ODOT and the OTA, but without state government funding. Instead EROAD relies on voluntary subscription and enrollment by commercial carriers who pay a monthly fee for a portfolio of tax, compliance and commercial services. ODOT independently built the interface to automatically receive weight-mile tax reports and payments generated by the EROAD service. The system, known as Oregon Truck Tracking Online (OTTO), allows authorized “OTTO vendors” access to electronically file weight-mile tax reports, Flat Fee Tax reports and pay the fees and taxes associated with the reports via Direct Payment (ACH).

The paper discusses the electronic weight-mile tax technology, the public policy environment, the procurement and approval process, the commercial model, the agency’s role and perspective, and the response from the industry. Although not explicitly labelled as a public–private partnership (PPP or P3), the electronic weight-mile tax project represents an important case study in how a traditional government service can be efficiently upgraded and operated by a private business venture with a significant increase in economic welfare through the reduction of administration costs and improved service levels. The Oregon electronic weight-mile tax project also provides some useful insights in the context of the wider desire to modernize legacy compliance and tax programs.

ABSTRACT

“This is a great example of how state auditors can help government and business use cutting edge technology to save money and improve performance,” said Secretary of State Kate Brown. Secretary Brown praised ODOT Director Matt Garrett for seeking the audit before deciding to partner with the New Zealand-based EROAD, Inc. “Too often, auditors are brought in because something has gone wrong. Director Garrett’s decision to have auditors review a pilot project before the state entered into a partnership demonstrates just the kind of innovative thinking we need in government.”

Kate Brown, Governor of Oregon
(Former Oregon Secretary of State)
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1.0 INTRODUCTION

OREGON ELECTRONIC WEIGHT-MILE TAX IMPLEMENTATION

In 2014, technology company, EROAD Inc. (EROAD), with the support of the Oregon Department of Transportation (ODOT) and the Oregon Trucking Association (OTA), implemented the first GPS cellular based electronic weight-mile tax solution in North America. The introduction of an electronic weight-mile tax service is characterized by a number of innovative elements in terms of technology, procurement, project funding, risk allocation and operations which are described and analyzed.

The case study reviews the:

1. Project timeline
2. Policy environment
3. Electronic weight-mile tax technology
4. Approval framework
5. Commercial and regulatory pilot
6. Independent audit
7. Public policy analysis
8. Agency role and perspective
9. Industry role and perspective
TIMELINE

1995
ODOT investigates satellite based
electronic weight-mile tax collection

2009
ODOT undertakes TRUE pilot project to demonstrate
GPS based electronic weight-mile tax collection

2009 – 2010
ERoad meets ODOT and OTA to discuss
the possibility of introducing a commercial
electronic weight-mile tax service

2011
MAY 2013
OTA survey of pilot carriers
MAY 2013 – JUNE 2013
Regulatory Pilot
JULY 2013 – NOVEMBER 2013
Oregon Secretary of State Audit
DECEMBER 2013
Electronic weight-mile tax solution
receives unqualified opinion from
Oregon Secretary of State Audits Division

2012
MAY 2013
OTA survey of pilot carriers

2013
MAY 2013
OTA and EROAD execute Alliance
Agreement
JUNE 2013
ODOT Audit
APRIL 2014
Commercial electronic
weight-mile tax service launched
JUNE 2014 – OCTOBER 2014
ODOT and EROAD develop interface to support
electronic weight-mile tax payment
OCTOBER 2014
OAR Electronic Truck
Tracking Rule published

2014
JANUARY 2014
First electronic weight-mile tax
report received by ODOT
NOVEMBER 2011 –
SEPTEMBER 2012
ERoad funds and develops
prototype weight-mile tax service

2015
DECEMBER 2014
ODOT approves EROAD as first Electronic
Highway Use Tax system provider
First electronic weight-mile tax payment made
WEIGHT-MILE TAX PROGRAM

Commercial vehicles weighing more than 26,000 pounds are required to pay weight-mile tax in Oregon. The weight-mile tax is based on two factors: a vehicle combination’s declared weight and the distance traveled on public roads. Oregon statutes direct that the tax rate is based upon a vehicle’s declared weight, which is to be declared prior to the operation and at the heaviest weight to be operated in each configuration for the reporting period. In addition, the number of axles becomes a criteria when the vehicle’s weight exceeds 80,000 pounds. The applicable tax rate is multiplied by the number of miles traveled in each configuration to determine the tax owed.

Proceeds from the weight-mile tax totaled approximately $297 million during FY 2014, or 15% of total revenues for ODOT. Weight-mile tax proceeds are included in the state’s Highway Fund, which is used to construct, preserve, and maintain public highways, roads, streets, and roadside rest areas.

ODOT’s Motor Carrier Transportation Division (MCTD) is responsible for registering commercial vehicles weighing more than 26,000 pounds, and administering Oregon’s weight-mile tax for these vehicles. Approximately 300,000 trucks are currently registered to operate in Oregon and are subject to the weight-mile tax.

Most carriers submit a consolidated monthly weight-mile tax report including each of the vehicles they operate. This tax report contains a record of both taxable and exempt mileage. When carriers submit hardcopy tax reports, division employees must manually input the information into ODOT’s mainframe computer system. Alternatively, a motor carrier may enter the required information directly into MCTD’s Trucking Online application, which automatically determines the amount of the tax and supports ACH and credit card payments.

RECORD KEEPING

Oregon Administrative Rule (OAR) 740-055-0120 specifies that motor carriers are required to maintain detailed travel records as the basis for calculating weight-mile tax. This information must be retained for at least three years and be available for inspection by the MCTD upon request. The information that must be maintained for each truck includes:

- the dates of each trip and origin and destination points;
- Oregon entry and exit points;
- actual Oregon miles for each trip;
- pickup and delivery points in Oregon for each trip;
- routes traveled for each trip;
- daily beginning and ending odometer or other mileage recording device readings for each vehicle;
- load tickets and/or bills of lading for each shipment transported;
- identification of any exempt miles claimed, including beginning and ending odometer or other mileage recording device readings for the exempt portion of each trip; and
- vehicle configurations.

OAR 740-055-0120 provides for carriers to use records generated from on-board devices, vehicle tracking systems, or other electronic data recording systems for the purposes of meeting their weight-mile tax requirements, providing that the electronic records meet all the above requirements and are available in printed format upon request.
ELECTRONIC WEIGHT-MILE TAX

Background
The Oregon state government has a long history of exploring technology solutions to reduce the burden of record keeping requirements and help motor carriers prepare and submit weight-mile taxes. In particular Oregon, as one of a handful of remaining weight-mile tax states, found itself in the position of fending off industry arguments that the weight-mile tax method of highway use taxation was administratively too burdensome requiring excess record keeping effort and expense on the part of industry that preferred a fuel tax.

In 1995, ODOT's efforts to streamline and automate weight-mile tax collection led to consideration of a CWARUM (certified wide area road use management) solution reliant on a system of geo-synchronous low earth orbiting satellites that maintained connection to earthbound commercial trucks via a roof mounted satellite transceiver. Although not technically viable at the time, the idea would prove to be prophetic.

Truck Road Use Electronics
In 2009, ODOT began work on a project to demonstrate that satellites could form the basis for an electronic weight-mile tax solution. Named TRUE (Truck Road Use Electronics), the project was undertaken at the request of Oregon Congressman Peter DeFazio, then chairman of the House Highway and Transit Subcommittee. Using a modified cellphone to receive GPS signals, the TRUE application converted the position coordinates to mileage totals using ODOT maps. The application then calculated the tax due for the miles traveled on taxable roads based on the applicable tax rates.

In January 2010, ODOT partnered with a Portland-based trucking company to install its TRUE devices in five of their trucks. Throughout the month of February, ODOT collected GPS signals from the devices and generated a month-end report of the total miles traveled on Oregon roads and the total weight-mile tax due for the trucks. The TRUE pilot verified that the concept of electronic weight-mile tax could lower administration costs for both carriers and ODOT, and produce an acceptably accurate tax filing.

ERoad
In 2011, New Zealand technology company EROAD approached ODOT and the OTA with a proposal to undertake a pilot of its GPS-cellular based weight-mile tax collection and reporting solution. The electronic weight-mile tax solution was based on the technology platform EROAD had implemented to modernize the New Zealand weight-mile tax system.

The New Zealand electronic weight-mile tax deployment was funded entirely by EROAD with no funding or commitments provided by the New Zealand government who approved the solution on a non-exclusive basis. ODOT independently built the interface to automatically receive weight-mile tax reports and payments generated by the EROAD service. The system, known as OTTO, allows authorized “OTTO vendors” access to electronically file weight-mile tax reports, Flat Fee Tax reports and pay the fees and taxes associated with the reports via ACH. EROAD relies on voluntary subscription and enrollment from the trucking industry who pay a monthly service fee for a range of tax, compliance and commercial services delivered with a single technology platform. In operation since 2009, EROAD now collects over $300 million per annum in weight-mile taxes from commercial carriers on behalf of the New Zealand Transport Agency.

The EROAD in-vehicle hardware (Ehubo) and web application was approved after an extensive field pilot in New Zealand, independent technical testing and a third party security review. The independent testing verified that the Ehubo was accurate to within 99.9% of a calibrated odometer. The EROAD electronic weight-mile tax solution was approved by the New Zealand Transport Agency under a legislative framework set out by the New Zealand Road User Charges Act created specifically to govern the approval and operation of electronic service providers.


3.0 TECHNOLOGY

IN-VEHICLE HARDWARE (EHUBO)
A core element of EROAD’s system is its electronic distance recorder, the Ehubo, which sits within the vehicle and records, stores and continuously transmits encrypted data via the cellular network. The Ehubo captures distance, location, route and a variety of additional operational data from the vehicle. EROAD’s Ehubo is specifically designed to be tamper-evident, operate at a wide range of temperatures and consume very little energy. The Ehubo measures distance traveled with a high degree of accuracy, using a combination of internal and external sensors including vehicle data, GPS and micro-electrical-mechanical systems (MEMs).

WEB SERVICES (DEPOT)
Vehicle information received from the Ehubo is processed by EROAD’s application server and made available to users via a secure website, called Depot, from which the information can be viewed, saved and exported or downloaded. Depot provides customers with a user friendly application to pay and manage their weight-mile tax obligations and engage with EROAD’s additional fleet management and commercial services.

PAYMENT GATEWAY
The EROAD solution meets the required security and financial standards to conduct electronic commerce, and support integration with government tax and transport agencies. This enables EROAD to retrieve and maintain motor carrier records, and support carriers to file and pay their weight-mile tax obligations.
APPROVAL FRAMEWORK

Oregon’s weight-mile tax regulations allow motor carriers to use electronic systems to meet record keeping requirements as long as they provide all of the required elements included in the administrative rules, and tax reports are complete and accurate. However because there were no existing electronic weight-mile tax service providers, ODOT needed to develop a process to establish that EROAD’s solution fully supported carriers to meet Oregon’s weight-mile tax record keeping requirements. In addition ODOT also wished to explore the possibility that technology could be used to electronically collect and remit weight-mile taxes from carriers for the benefit of the state government. The final agreed verification process employed the following steps:

1. Commercial field pilot.
2. Regulatory field pilot.
3. ODOT audit.
4. Oregon Secretary of State audit.
5. Self-certification.

COMMERCIAL PILOT

Overview
The commercial field pilot had as its primary goal to undertake a demonstration of the electronic weight-mile tax service and additional value-added services for the purposes of validating the technology and obtaining feedback from motor carriers. Its second objective was to undertake an internal exercise to compare manual weight-mile tax, and trip records prepared by carriers for the purposes of meeting their statutory requirements with the records automatically generated by the electronic weight-mile tax solution.

EROAD was responsible for the comparison of the manual and electronic records, and other analysis relating to the commercial pilot. Commercial pilot data and results were subsequently presented in an aggregated and anonymous basis. In addition ODOT provided a letter of comfort stating that any data created by the commercial field pilot would not become part of a carrier’s weight-mile tax records for the purposes of any audit.

With the assistance of the OTA, eleven Oregon-based transport carriers agreed to participate in a technology pilot of EROAD’s electronic weight-mile tax service beginning in October 2012. The pilot carriers represented the following industry sectors:

1. Line-haul;
2. Urban delivery;
3. Logging;
4. Inter-state; and
5. Heavy haulage.

Key Findings
From October 1, 2012 to March 31, 2013, 63 pilot vehicles traveled 1.2 million miles providing sufficient scale achieved to meet the commercial pilot goals. Key findings from the commercial pilot:

1. Comparison of Ehubo and odometer distance records within ± 1.0%.
2. Comparison with electronic and paper weight-mile tax reports highly correlated.
3. Electronic and exportable records supported carriers to meet the record keeping requirements of OAR 740-055-0120.
4. Overall carrier feedback positive and good relationships established.
5. A number of technical, installation and user issues identified and addressed.
6. No major gaps identified, but requirement to support in-vehicle configuration changes raised by pilot fleet.
**REGULATORY PILOT**

The purpose of the regulatory electronic weight-mile tax pilot was to generate data that could be used to independently verify the accuracy and reliability of the electronic weight-mile tax solution. To ensure an independent comparison between the paper and electronic records during the regulatory pilot, participating motor carriers submitted weight-mile tax reports as usual but were not given access to the electronic data or reports. This arrangement created two sets of data that could then be evaluated, similar to a blind-trial experiment.

Seven motor carriers from the commercial pilot agreed to participate in the regulatory weight-mile tax pilot. Consisting of 30 vehicles, the regulatory pilot fleet recorded details for about 300,000 miles of travel for the May 2013 and June 2013 tax periods. The regulatory pilot electronic data and reports and paper based records were then independently examined by the MCTD Audit Division and the Oregon Secretary of State’s Audits Division.

**OREGON SECRETARY OF STATE AUDIT**

The Oregon Secretary of State Audits Division was asked by the MCTD to undertake an independent evaluation of:

- whether the EROAD system accurately and reliably captured and calculated weight-mile tax information,
- whether the EROAD system documentation met the requirements of OAR 740-055-0120; and
- the information system processing environment for EROAD including access, security, privacy, change management, backup procedures and disaster recovery.

The regulatory pilot audit consisted of two groups of work. The first examined the results of the field pilot while the second stream evaluated EROAD’s operational and development processes using a performance audit framework.

**Field Pilot Audit**

The audit of the regulatory field pilot:

- reviewed data and reports generated during the regulatory pilot period for accuracy and compliance with record keeping requirements;
- compared EROAD pilot records to the manual records maintained by motor carriers;
- performed tests of the data reported by the devices installed in pilot;
- determined whether independently collected weigh station reports of trucks in the EROAD pilot matched the trip data reported at the EROAD Depot for time and location;
- reviewed selected pilot routes against an external mapping source;
- analyzed significant variances between EROAD and carrier reports; and
- examined reports from external testing organizations that performed direct tests on the Ehubo device.

**Performance Audit**

The performance audit of the EROAD information system processing environment was conducted by Oregon Secretary of State Audits Division in accordance with generally accepted government auditing standards, using criteria that included high level control objectives from Control Objectives for Information and Related Technology (CobiT) along with control techniques and audit procedures from the Federal Information System Control Audit Manual (FISCAM). FISCAM includes audit criteria and guidance consistent with standards developed by the National Institute of Standards and Technology. Additional criteria employed to assess the EROAD solution included relevant laws, rules, and regulations governing ODOT.

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Key Findings

The audit of the EROAD hardware and web-based weight-mile tax and services platform (system) received an unqualified opinion from the Oregon Secretary of State Audits Division based on the following key findings:

1. System accurately and reliably captures and calculates Oregon weight-mile tax information from commercial motor carriers.

2. System-generated mileage reports were accurate within one percent and system records matched the specific locations carriers reported for the selected trips.

3. System-generated reports contained all required data elements to meet record keeping requirements, sufficiently captured motor carrier operations, and applied correct weight-mile tax rates.

4. System data, reports and records were more reliable and accurate than the paper-based records compiled and filed by carriers.

5. Manually prepared weight-mile tax reports and records contained errors that did not exist in the same reports and records processed by system.

6. System provides a secure and stable environment for transmitting, processing and storing motor carrier weight-mile tax information.

7. Logical access to client accounts was appropriately restricted and monitored.

8. Reasonable controls were in place to ensure all changes to system code are tested and approved prior to implementation, and only approved code operates in the production environment.

9. System controls reasonably ensured the availability of backup files for the web-based application, customer data, and source code, and ensured critical security related updates would be applied when needed.

10. Effective controls to provide reasonable assurance its system was protected against unauthorized access (both physical and logical).

ODOT AUDIT

MCTD’s Audit Group conducted a comparison of the electronic records and reports against the pilot carriers’ tax records and reports. In addition the MCTD used data collected by ODOT and other enforcement agencies at weigh stations and roadside vehicle safety inspections to verify the EROAD data and records.

Key Findings

1. When used appropriately, the Depot contains all record keeping elements required by OAR 740-055-0120;

2. There is abundant vehicle trip data available in the EROAD Depot and in all cases, the auditor was able to verify vehicle mileage with greater accuracy when employing the Depot versus the carrier’s standard records;

3. With the exception of one scale observation, auditors found all time and location data from EROAD to match data collected by ODOT and other enforcement agencies at weigh stations and roadside vehicle safety inspections; and

4. The EROAD system was more accurate than the manual, paper record keeping system currently maintained by the pilot motor carriers.

SELF-CERTIFICATION

Self-certification by a technology vendor against international standards provides its clients and stakeholders with assurances around the quality of its product and operational processes. In EROAD’s case, the company declares it operates in accordance with internationally accepted control objectives and practices for privacy, security and information systems, including Common Criteria, and the National Institute of Standards and Technology cryptographic standards. Referred to as FIPS 140, these standards were created to coordinate the requirements for cryptographic modules which include both hardware and software components for use by departments and agencies of the United States federal government.

EROAD has completed the procedures to be approved for Common Criteria and FIPS 140-2 (Level 3). This process required EROAD to submit its security module, and development and operating processes, to an extensive independent lab evaluation involving cryptographic and algorithm testing, initialization tests, vulnerability testing, and penetration testing.

3 Gayle Green, Ryan Sinkc and Scott Lundquist, Testing of EROAD Pilot Electronic Weight Distance Tax Reporting, Motor Carrier Transportation Division, Oregon Department of Transportation, (2013).
AGENCY PERSPECTIVE

Approval Framework
The regulation of technology-based products and services is challenging because technology and supporting standards evolve rapidly. This means that the adoption of a comprehensive set of design specifications for hardware, software, interfaces and communications underpinning an electronic weight-mile tax solution is problematic because this approach:

• can impose unnecessary restrictions on the design of solutions;
• limits the industry’s ability to adopt emerging and lower cost technologies;
• raises costs through the requirement to support legacy systems; and
• ignores the reality that regulators face a significant information asymmetry compared with technology vendors.

For these reasons the Oregon electronic weight-mile tax approval framework, which employed a combination of outcome-based requirements, independent audit and vendor self-certification, represents a sensible and workable approach to the approval of technology-based services. An additional observation is that the Oregon approval framework is likely to promote competition because any vendor who develops a product that meets the performance criteria is able to enter the market for electronic weight-mile tax services.

OAR 740-065-0000: Electronic Truck Tracking Reports
Following the successful approval process and development of a secure interface to support EROAD to collect and remit weight-mile taxes on behalf of commercial carriers, ODOT introduced a rule, OAR 740-065-0000, to provide clarity for motor carriers and vendors looking to enter the market for electronic weight-mile taxes. The OAR had the following goals:

• promote the development and use of the latest technologies to improve the operating efficiencies of the state and trucking industries in Oregon;

• promote the use and development of automated electronic systems operated by authorized third party service providers that accurately and reliably transmit, process and store operating data from motor carrier vehicles that allow the generation of tax reports and transmission of taxes and fees for the use of highways under Oregon weight-mile tax; and

• specify the procedures and requirements for the third party service providers that operate the automated electronic systems and the motor carriers that choose to participate in the voluntary program.

Procurement Model
Like the procurement model adopted in New Zealand, the development of an electronic weight-mile tax service was undertaken by EROAD with no funding or commitments provided by ODOT. The agency did however make a substantial commitment of staff time to support EROAD to develop the electronic weight-mile tax service and also incurred costs to undertake an audit of the regulatory pilot results. In addition ODOT independently built the interface to automatically receive weight-mile tax reports and payments generated by the EROAD service. Finally ODOT incurred costs associated with the Oregon Secretary of State Audits Division to undertake an additional audit of the EROAD solution on its behalf.

No formal benefit cost analysis has been undertaken, but on balance, the procurement model to successfully modernize a traditional tax program in a timely fashion was cost effective and low risk in the context of many comparable government sponsored technology and IT projects.
Economic Benefits
Economic benefits generated for the agency and the wider industry from creating an electronic alternative to the legacy weight-mile tax program have not been quantified but are expected to be substantial over a medium term timeframe. In particular economic benefits will arise from:
• no requirement to directly fund weight-mile tax automation project;
• fewer paper-based processes and reduction in agency administration and processing costs;
• reduction in unintentional errors and evasion by carriers;
• lower audit costs from generating accessible and consistent carrier records;
• support and reinforce Oregon’s commitment to innovation in the wider transport sector;
• improved industry experience; and
• enhanced integrity of the weight-mile tax program.

CARRIER PERSPECTIVE
Oregon Trucking Association
Initial discussions about introducing a commercial electronic weight-mile tax into Oregon involved trilateral meetings between ODOT, EROAD and motor carriers, represented by the OTA. An agreement was subsequently reached between OTA and EROAD whereby the association would lend support to the commercial pilot in return for a modest level of sponsorship and visibility around the pilot results. Eleven OTA members volunteered to participate in the commercial pilot and EROAD hardware was then fitted for 63 vehicles. Following completion of the commercial pilot in April 2013, a subset of this fleet then agreed to participate in the two month regulatory pilot.

To validate the performance of the EROAD electronic weight-mile tax service, the OTA conducted an anonymous survey of all of the pilot carriers.4 The survey focused on the following areas: customer service, product installation/use, documentation, and overall experience in working with EROAD. The survey revealed that participants were highly satisfied with their exposure to the electronic weight-mile tax solution and their experience with working with EROAD.

The positive survey of the pilot carriers provided the OTA with the confidence to formalize an Alliance Agreement with EROAD. This had as its goal to support technological solutions that can result in cost savings to carriers in operation costs, increase carriers’ ability to comply with state and federal regulations and enhance operational management controls.

Return-on-Investment
Motor carriers generate a positive return-on-investment (ROI) from a wide range of services available on the EROAD technology platform. It is difficult to isolate the benefits from adopting an electronic weight-mile tax solution, but carriers report that the EROAD service generates benefits from:
• correctly and reliably calculating Oregon taxable miles in a secure environment;
• accurately deducts private-road and out-of-state travel;
• eliminates mistakes and unintentional errors in reporting and filing;
• generates accurate and auditable weight-mile tax reports in an approved format;
• generates electronic and exportable records to meet OAR record keeping requirements;
• supports electronic payment of weight-mile taxes;
• lowers administrative and compliance costs for carriers; and
• generates other economic benefits from a range of value-added services including electronic IFTA reporting, fleet tracking and electronic driver logbooks.

4 Oregon Trucking Associations, OTA-EROAD Commercial Pilot Survey Results, (2013).