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Field Operational Test
Cross-Cutting Study

Commercial Vehicle Administrative Processes

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16. Abstract

Commercial Vehicle Administrative (CVO) Processes Cross-Cutting report summarizes and interprets the results of several Field Operational Tests (FOTs) conducted to evaluate systems that increase the efficiency of commercial vehicle administrative processes. The FOTs considered in this report include: Automated Mileage and Stateline Crossing Operational Test, Midwest Electronic One-Stop Shopping, Southwest Electronic One-Stop Shopping and Heavy Vehicle Electronic License Plate One-Stop Shopping. The Operational Tests taught several technical lessons regarding applications development, communications, and interface with legacy systems. Significant institutional challenges surfaced during these tests. The report findings are organized in the categories of impact, user acceptance, technical lessons learned, institutional challenges and resolutions, and deployment. This report highlights the successes and problems these tests encountered while attempting to develop the technologies appropriate to effectively automate commercial vehicle administrative processes.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY *1*

REPORT BACKGROUND *2*

INTRODUCTION *2*

WHAT ARE COMMERCIAL VEHICLE ADMINISTRATIVE PROCESSES 3

FIELD OPERATIONAL TESTS CONSIDERED IN THIS ANALYSIS 3

Automated Mileage and Stateline Crossing Operational Test 3
Midwest Electronic One-Stop Shopping 3
Southwest Electronic One-Stop Shopping 4
Heavy Vehicle Electronic License Plate One-Stop Shopping 4

FINDINGS *5*

IMPACTS 5

Electronic One-Stop Shopping 6
The Credential Cycle 6
Cycle Time Impacts 7
Consistency and Uniformity 9
Application Preparation 10
Administrative Process Improvements 11

Automated Mileage and Stateline Crossing Operational Test 11
Fuel Tax Reporting 12
Benefits 13

USER ACCEPTANCE 13

Electronic One-Stop Shopping 14
Ease of Use 14
Preference 17
Frequency of Use 17
Convenience 17

Automated Mileage and Stateline Crossing Operational Test 18
State Agencies 18
Motor Carriers 19

TABLE OF CONTENTS (Continued)

TECHNICAL LESSONS LEARNED **19**

Application Development **19**
Communications **20**
Legacy Systems Interface **21**
Operating Platform **21**

INSTITUTIONAL CHALLENGES AND RESOLUTIONS **21**

Organizational Structures **22**
Records Reconciliation **22**
Process Reengineering **22**
Data Security and Use **22**

DEPLOYABILITY **23**

Electronic One-Stop Shopping **23**
Minimum Systems Requirements 23
Capital and Operating Costs 23
Support for Deployment 24

Automated Mileage and Stateline Crossing Operational Test **25**

SUMMARY ***25***

BIBLIOGRAPHY ***27***

EXECUTIVE SUMMARY

The 1980 deregulation of the motor carrier industry forced carriers to reduce costs and improve services to become more competitive. The deregulation also increased the pressures on state regulatory agencies as they attempted to process the applications of thousands of new carriers. Commercial vehicle administrative processes are the activities and transactions necessary to ensure that commercial motor carriers operate legally on the roadways. This report summarizes and interprets the results of several Field Operational Tests (FOTs) conducted to evaluate systems that increase the efficiency of these processes.

The FOTs showed that these systems have the potential to provide substantial improvements in efficiency and productivity compared to existing manual systems. Two of the One-Stop Shopping systems demonstrated the ability to reduce motor carrier labor required in preparing and submitting credential applications. These systems also showed the potential to reduce application errors and to minimize or eliminate delays in the review and approval of applications by state agencies.

The tested systems encountered varying degrees of user acceptance. The level of acceptance was generally consistent with the level of functionality offered by each system, and the degree to which each replicated the current processes. Two of the three systems met with relatively high levels of user acceptance, and users indicated a preference for switching to them permanently.

The Operational Tests taught several technical lessons regarding applications development, communications, and interface with legacy systems. Systems judged acceptable tended to be modular in design and to accommodate a degree of customization. The electronic data interchange technology used in the one-stop systems was generally reliable and effective. Operational requirements, such as the size of the data files and the transfer rate, will continue to be critical factors in the selection of the hardware and software. Additionally, because of the costs associated with replacement of legacy systems, any proposed system must be able to easily, effectively, and affordably exchange data with the users' current systems. Two of the one-stop systems demonstrated this capability to some degree.

Three significant institutional challenges surfaced during these tests. First, most existing state organizational structures have multiple agencies responsible for various commercial vehicle administrative functions. Enhanced coordination and data sharing between these agencies would improve administrative effectiveness. Second, the administrative processes still require a mix of electronic and paper-based forms. Ideally, the processes should be re-engineered to eliminate some requirements and increase connectivity among state and federal systems. Third, any proposed system must protect and secure the data supplied by motor carriers.

The increasing availability and decreasing cost of personal computers (PCs) makes deploying these systems a more achievable goal than when they were first tested. Since the implementation of these systems is likely to be a gradual process, the costs to equip a carrier or state agency with the computing power required can be spread over time. Software purchase, training, and operating costs are difficult to determine since all the tested systems were prototypes.

This report highlights the successes and problems these tests encountered while attempting to develop the technologies appropriate to effectively automate commercial vehicle administrative processes. It is significant to note that nearly all test participants felt that the deployment of some type of one-stop shopping system is inevitable, and that the benefits to carriers and state agencies would outweigh the costs.

REPORT BACKGROUND

In 1991, the U.S. Department of Transportation (USDOT) initiated a new program to address the needs of the emerging Intelligent Transportation Systems (ITS) field. This program solicited and funded projects, called FOTs. The tests were sponsored and supported by several administrations of the Department, including the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), and the National Highway Traffic Safety Administration (NHTSA).

The FOTs demonstrated potentially beneficial transportation products, technologies, and approaches. The FOTs implemented these products, technologies, or approaches on a limited scale under real-world operational conditions. These tests were an interim step bridging the gap between conventional research and development (that formed the idea), and full-scale deployment (that would see wide-spread use of the idea). FOTs typically included a local or regional transportation agency, as well as the FHWA, as partners in the project. The partners often included private sector providers of the equipment, systems, and services interested in demonstrating their idea. The FOTs concentrated on user service areas needing a "proof of concept" in order to achieve deployment goals.

A fundamental element of each test was an independent, formal evaluation. The evaluation produced a final report that detailed the test's purpose, methods, and findings. The evaluation aspect of the test intended to assess whether the product, technology or approach provided effective solutions at acceptable levels of cost, schedule, and technical risk.

As the sponsoring organization and a partner in many of the FOTs, the FHWA played a central role. FHWA supported the tests by providing a standardized set of evaluation guidelines and by helping coordinate and promote the relationships among test partners. The FHWA also acted as the communications clearing house collecting reviewing, and disseminating information about the tests.

Among the more than 80 FOTs, several tests encompassed the same or similar areas of interest. The FHWA is preparing several 'cross-cutting' studies that compare or synthesize the findings of multiple tests within a particular area of interest. The purpose of this series of studies is to extract from the separate tests the common information and lessons learned that are of interest to ITS practitioners and that could improve the testing and deployment of future applications of the subject technology.

This study focuses on the topic of Commercial Vehicle Administrative Processes.

INTRODUCTION

The deregulation of the motor carrier industry in 1980 dramatically changed the complexion of the motor carrier population within the United States. The removal of barriers to interstate operation, coupled with changes in the regulatory environment, resulted in explosive growth in for-hire trucking. The once rigid, heavily restricted atmosphere gave way to one that placed a premium on competitiveness. As a result, carriers were forced to reduce costs in order to remain competitive.

In the years since, the competitive nature of the industry has intensified. Customers have become increasingly demanding, and the adoption of integrated logistics processes like Just-In-Time (JIT) manufacturing, and integrated supply chains, have forced carriers to constantly reassess and adjust their operations. This intensely competitive environment forces carriers to constantly search for ways to cut costs, while simultaneously improving service.

The explosion of the carrier industry has also exacted a toll on the state agencies charged with administering the regulatory requirements. Some of the larger registration states, like California, Texas, and Illinois, are faced with issuing credentials to literally thousands of new carriers every year, in addition to fleets already located within their borders. State agencies must accomplish this task in spite of continuing pressure to reduce staffs and budgets.

Thus, pressure to increase the efficiency on both sides of the table remains constant.

WHAT ARE COMMERCIAL VEHICLE ADMINISTRATIVE PROCESSES?

The broad definition of commercial vehicle administrative processes consists of all activities and transactions that must take place in order for commercial vehicles to legally operate on the nation's roadways. Included in this definition are vehicle registration, carrier operating authority, fuel tax registration and reporting and permitting for the movement of over-dimensional vehicles and hazardous materials. For the purposes of this cross-cutting study, the focus is interstate trucking.

Specifically, this report discusses the efforts undertaken during four ITS FOTs sponsored by the FHWA. Three of these tests dealt with the electronic submittal, processing, and distribution of vehicle credentials and permits. The fourth focused on providing carriers and state agencies a means by which apportioned mileage could be captured and forwarded for use in the reconciliation of registration and fuel tax funds among states.

FOTS CONSIDERED IN THIS ANALYSIS

Automated Mileage and Stateline Crossing Operational Test (AMASCOT)

The AMASCOT project was conceived in order to demonstrate the use of advanced Global Positioning Systems (GPS) technology to automate the capture and reporting of mileage for fuel tax apportionment and registration. Thirty vehicles were equipped with mileage-by-jurisdiction systems that recorded the mileage accrued in each jurisdiction through which they traveled. These systems were coupled with a jurisdictional boundary database and stateline crossing algorithm designed to detect when vehicles entered and exited different states. This mileage and position data was then integrated with fuel purchase data, and used to reconcile fuel purchase and apportioned mileage information necessary to electronically file fuel tax reports. Motor carriers and state agencies from Iowa, Wisconsin and Minnesota participated in the test.

The AMASCOT project was intended to evaluate the ability of the system to provide mileage data of sufficient quality to meet International Registration Plan (IRP) and International Fuel Tax Agreement (IFTA) requirements, and to transmit this information electronically from motor carriers to base jurisdictions.

Midwest Electronic One-Stop Shopping

The Midwest Electronic One-Stop Shopping (MEOSS) ITS FOT was conceived to demonstrate the application of technology to enhance the efficiency of the commercial vehicle credentialing and permitting processes. Software designed specifically for the FOT was intended to help ease administrative burdens placed on motor carriers and state agencies by automating portions of the process, and reducing the time required to obtain the desired credential through the use of Electronic Data Interchange (EDI). Using MEOSS, motor carriers could complete applications for credentials and permits using a personal computer (PC)/Windows based software application, then file them with the state electronically, via modem. State agencies could then access the application electronically, review the

information, and transmit an approval or rejection back to the carrier. MEOSS, thereby, was intended to reduce the credential cycle time by eliminating the need to mail or hand carry applications and credentials. The system had the potential to further decrease the cycle time by providing a validation feature aimed at reducing the likelihood of motor carriers submitting an incomplete or incorrect application.

Representatives from thirteen motor carriers, two commercial leasing companies, one motor carrier association, and various agencies from the states of Minnesota, Wisconsin, Illinois, Missouri, Kansas, Nebraska, and South Dakota, participated in the test. Using MEOSS, a motor carrier could apply for IRP, IFTA, and Single State Registration System (SSRS) credentials and permits, and Oversize/Overweight (OS/OW) permits.

Southwest Electronic One-Stop Shopping

The Southwest Electronic One-Stop Shopping (EOSS) system was, in many ways, similar to the Midwest system. It was developed with the same goal in mind, the reduction of the administrative burden of credential transactions.

The EOSS system provided a PC-based application to be installed on carrier and state agency computers. Users could access either of the two functional modules–the Information module or the Credential module–through a GUI. Using the Information module, the user could access information regarding what credentials were required to operate legally in any given state. Using the Credential module, carriers or service bureaus could complete applications either manually or by uploading information from their internal system, identify associated fees, arrange for electronic funds transfer to pay for the credentials, print or submit the application electronically, and print certain credentials. A unique functional capability offered by the EOSS system was its ability to deliver an automated response from the state system, which included an approved credential. This was accomplished by first, having each participating state designate a list of pre-approved carriers. Credential applications received from carriers were compared to entries on this list. If the carrier appeared on the list, the carrier's system was instructed to generate an approved credential. These credentials included permanent SSRS, and temporary IRP and IFTA. Permanent IRP and IFTA credentials were processed through existing procedures, and forwarded to the carriers at a later date.

Representatives from fifteen motor carriers, and various agencies from the states of Arkansas, Texas and Colorado, participated in the operational test. Using EOSS, a carrier could file for IRP, IFTA and SSRS credentials.

Heavy Vehicle Electronic License Plate (HELP) One-Stop Shopping

In the HELP One-Stop system, as in the other one-stop systems, an interactive data entry dialog prompted carriers to provide the information required in order to obtain credentials in each participating state. Using the system, carriers were able to determine credential requirements, calculate fees, make electronic payments through the HELP Service Center, then issue and print IRP credentials on-site.

The HELP system was designed as a modular, distributed computer system. It consisted of four modules–the Client Module, the Agent Server, the Front End Processor, and Vehicle Information System for Tax Apportionment/ Registration System (VISTA/RS). The Client Module consisted of a PC-based application designed to allow carriers to input information, and to issue approved credentials. The Agent Server consisted of a relational database, which was used to ensure data integrity between the Client Module and VISTA/RS. The Front End Processor was the proprietary communications interface with VISTA/RS. Finally, VISTA/RS

provides fee calculation, invoice generation, credentialing, and financial record keeping. VISTA/RS is used by several IRP jurisdictions to process IRP applications for carriers traveling in two or more IRP jurisdictions.

To use the HELP system, carriers and service agents could initiate a transaction from the Client Module, using data contained in a fleet database pre-populated, either by the VISTA system, or by representatives from the system developer, Lockheed-Martin IMS. Credential requests would then be electronically transmitted through the Agent Server and the Front End Processor, and into VISTA/RS. VISTA/RS would, in turn, process the transaction, generate required fees, and return the fee information back to through the Client Module. The Service Center provided technical support, and acted as a financial clearinghouse. For transactions initiated by the HELP one-stop system, the Service Center monitored overall payment flow, and reconciled Electronic Funds Transfer (EFT) payments with funds deposited into special accounts set up for the operational test. Throughout the process, applicants would periodically dial in to the service center to inquire about the status of submitted applications, authorize electronic payment, and receive approval to self-issue credentials.

Representatives from a total of twelve carriers, service bureaus, and leasing companies, and state agencies in California, Arizona and New Mexico, participated in the HELP One-Stop FOT. The HELP system was designed to accommodate requests for IRP and IFTA credentials, and OS/OW permits.

FINDINGS

While there are distinct differences in focus between the AMASCOT mileage apportionment FOT and the three One-Stop FOTs, there exists a complementary relationship among them. In theory, a system such as the one implemented under AMASCOT could provide a means by which credentialing might be accomplished more efficiently. In fact, as we will discuss later, a marriage of two systems such as the AMASCOT system and anyone of the one-stop systems could substantially alter commercial vehicle administrative processes.

This section presents the comparison of the similarities and differences of these tests and an interpretation of the results. Findings are organized into five categories:

- **Impacts–**the degree to which the systems and services under test effected change
- **User Acceptance–**how test participants reacted to the systems and services
- **Technical Lessons Learned–**insights gained regarding the technical performance, feasibility and approach toward each system and service
- **Institutional Challenges and Resolutions–**issues encountered during the FOTs, and any resolutions reached, and insights into the impacts these issues may have on deployment of the systems and services
- **Deployability–**insights regarding the degree to which the systems and services under test represent viable deployment alternatives

IMPACTS

The primary intent of each of the Commercial Operating Vehicle (CVO) administrative process FOTs was to provide a means for carriers, service agents and state agencies to improve efficiency and productivity. This was to be accomplished by automating a portion of the activities necessary to complete the required administrative process. In the case of each of the systems, applicants and state agencies were provided systems that had the potential to reduce

the time and labor required to input, review, and process the information required for credential issuance or account reconciliation. In addition, these systems had the potential to reduce the errors and inconsistencies inherent in current manual processes.

Electronic One-Stop Shopping

The three one-stop FOT evaluations were developed around a framework of evaluation goals, objectives and measures, some of which were common to two or more of the evaluations. The evaluation of system impacts focused on several objectives intended to assess the degree to which one-stop can improve overall productivity:

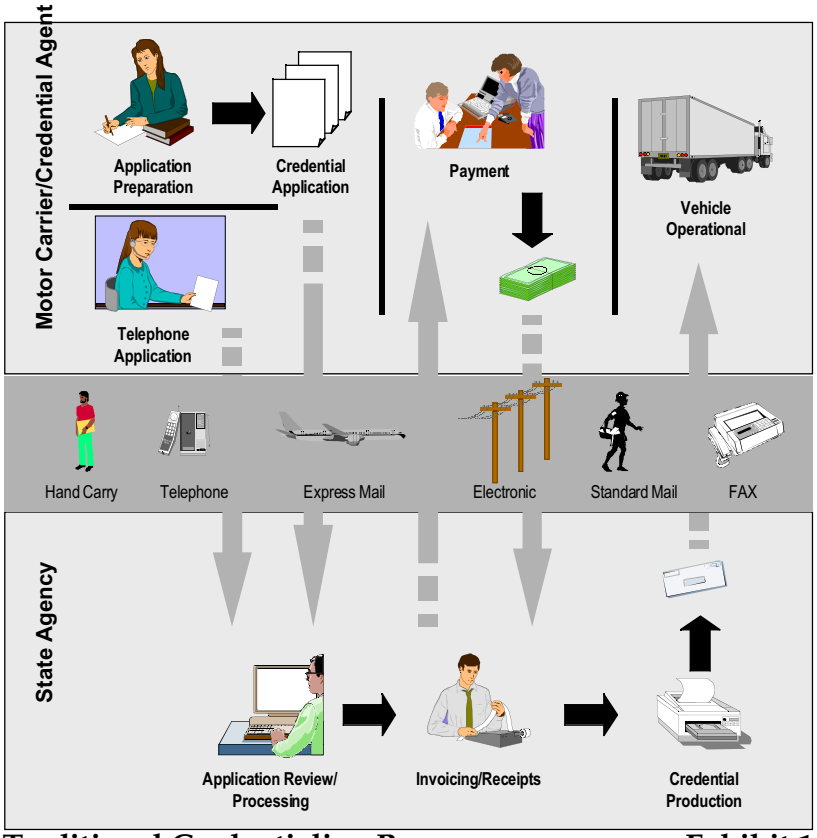
- Comparison of the application-to-issuance cycle times of current systems to the one-stop system
- Comparison of the consistency and uniformity of applications and credentials issued through current systems to those issued using the one-stop system
- Comparison of application preparation times of current systems to the one-stop system
- Assessment of improvements to credential administrative processes

For a number of reasons, none of the three one-stop systems were used extensively enough to provide statistically valid assessments of the impacts each had on productivity, consistency or uniformity. Collectively, less than 50 credential transactions were completed among the three tests. Most of these transactions were for supplemental credentials, which are usually obtained when vehicles are added to a fleet. However, anecdotal evidence from the tests supports the assertion that substantial improvements in efficiency and productivity are possible.

The Credential Cycle

For certain types of credentials, particularly IRP renewals and supplements, and OS/OW trip permits, carriers have long been dismayed by extended application-to-issuance cycle times. The most common cycle consists of several steps. A typical credentialing process is depicted in Exhibit 1.

First, the applicant completes the appropriate form, packages it with required support



Traditional Credentialing Process **Exhibit 1**

documentation (e.g., vehicle title, proof of insurance, etc.), and forwards it to the applicable state agency for review. Delivery method options typically include facsimile, traditional mail, express mail, and hand-carry. Once the agency staff has reviewed the application and entered the necessary information into their system, an invoice is generated and returned to the applicant. The applicant then prepares a check, and returns payment to the state. In the final step, the state issues the proper credential upon receipt of payment.

For hand-carried applications, the applicant may wait at the issuing agency location while processing takes place (this is most common for supplements, trip permits, and other requests containing relatively few vehicles, as with smaller carriers). Otherwise, he may return to the agency at a later date to deliver payment and pick up credentials.

The steps in the cycle can vary substantially depending on the credential requested, and the issuing state. For example, many states accept applications for OS/OW permits over the telephone and it is common for carriers to simply request extra IFTA decals at renewal, since the cost is relatively insignificant.

For IRP renewals, the total elapsed time between when the state issues a renewal notice, and the carrier receives its new annual credentials often stretches into several months. This is significant because between the time the carrier submits its renewal information, and the new registration year begins, larger carriers often add vehicles to their fleet, which requires them to submit applications for supplements.

No vehicle can legally operate without proper credentials. Carriers are understandably anxious to get new vehicles operating and generating revenue as soon as possible, therefore, cycle time for supplemental credentials can be critical. Usually, as soon as a carrier or service agent receives vehicle title information, credentials are requested. In many cases, a temporary credential is also requested in order to get the new vehicle into operation immediately.

In the case of OS/OW trip permits, again, the carrier must wait for the proper permit to be issued. Since trip permits are obtained on an as needed basis, and have a fixed life span, lead-time is often short. While some states have adopted the use of self-issue permits, where application and approval are handled over the telephone, others still require conventional application processing.

Cycle Time Impacts

Each of the three one-stop systems demonstrated some proficiency in reducing the duration of portions of the overall process. By providing the capability to exchange information using EDI, for instance, all three systems offered potential time savings in the submission of applications, and the issuance of certain credentials. This was particularly the case with applicants that traditionally use standard mail, or have staff deliver applications and pick up credentials.

Of the carriers participating in these tests, those with smaller fleets and lower overall levels of internal automation tended to favor these methods. Since standard mail delivery usually takes from one to three days, and hand carrying includes the time, expense and inconvenience associated with driving to and from state offices, EDI offered users instantaneous delivery at minimal cost.

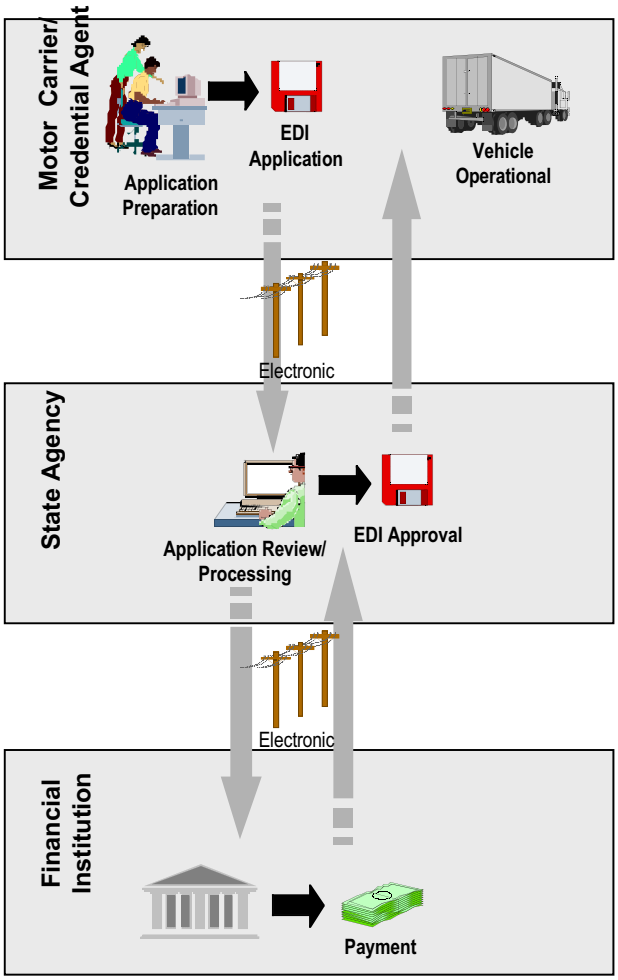
Of course, the speed of EDI transmissions are a function of the transmission capabilities of the computer hardware used, and the capacity of the communications network and receiving systems. However, with potential time savings easily on the scale of orders of magnitude, the advantages of this capability are obvious. While specific figures regarding the savings derived from this capability were not captured, particularly since

no charges other than those for phone usage or Value-Added Network (VAN) access were assessed, users potential economies are readily apparent.

Another portion of the process where efficiency gains are possible is the review and approval of submitted applications. Though exceptions exist, most states rely on a largely manual process. State agency personnel review written applications, or take application information over the telephone, and enter information into state systems, some of which have the capability to generate invoices. Some agencies have developed systems in-house to automate portions of the process, and others subscribe to commercially available services such as VISTA/RS. Nonetheless, human intervention is a fundamental part of the process, and a significant source of processing delay.

The basic operating concept for electronic one-stop shopping is illustrated in Exhibit 2. Ideally, all transactions would be performed electronically, including credential payment through a participating financial institution. Each of the three test systems incorporated some or all of the capabilities illustrated here. Two of the three one-stop systems were designed to provide an automated state agency response that required little or no manual intervention for credentials to be issued. These systems had the capability to accept applications and issue approval or rejection, and in some cases, allowed the applicant to generate the credential at their location, or self-issue from stock given to them by the responsible agency.

This capability effectively minimized or eliminated the delays associated with the time that elapses between when an application is received at the state, and when credentials are issued—ordinarily a lengthy process that includes invoicing and payment. *Largely as a result of this feature, observed application-to-issuance cycle times were dramatically reduced for certain credentials.* Transactions that



Electronic One-Stop Process **Exhibit 2**

typically take as much as several months to complete were completed in as little as several minutes for some credential types. For example, users of the HELP system indicated this process could consume as much as 12 weeks for an IRP supplement using traditional methods. Using the HELP one-stop system, reported times for this process ranged from just over one day, to two-and-one-half days. Likewise, carriers using the Southwest system were impressed with the time savings offered by that system.

While results can be expected to vary depending on the credential type and the state information requirements, and obviously the system design, it can generally be concluded that systems which

employ automated application review capabilities have the potential to provide significant reductions in application-to-issuance cycle times.

The third system required state agency representatives to access applications through the PC on which they were received, manually review them, manually send an approval or rejection notice and invoice using the system, and manually forward the credentials using existing processes. So while users might experience some cycle time savings stemming from the electronic transmittal of this limited information, due to the nature of the system design, it is unlikely that cycle time reductions comparable to those observed using the other systems would be possible. Any potential improvements would probably come from the elimination of the need to mail or hand deliver applications to the state, a capability common to all three systems.

At this point, it is important to understand that simply reducing the overall time it takes a carrier to receive a credential once an application is submitted does not constitute a benefit in every case. For instance, some credentials, particularly annual renewals for carriers with low fleet turnover, are often not viewed as time sensitive. If it takes several months for a state to generate credentials, the state and carrier simply account for that delay by initiating the transaction early enough to allow sufficient processing time. In contrast, many OS/OW trip permits are very time sensitive. Since they are often requested with little lead time, the ability of a state to process a request and return a permit in a timely fashion is significant.

In either case, an equally appropriate measure of the ability of a system to improve efficiency and productivity is the degree to which it reduces the amount of labor required to complete the set of tasks necessary to complete and process applications.

Consistency and Uniformity

As discussed above, two of the systems provided dramatic time savings by providing an automated application screening process that could potentially eliminate the labor required by state agency representatives to review and process applications and deliver credentials. This was accomplished, at least in part, through the inclusion of error-checking capabilities in the software. By employing this feature, the systems were able to capture input errors, and notify data entry personnel when basic clerical rules had been violated.

In theory, this would allow for the correction of some input errors prior to the delivery of the application to the responsible agency. As was the case with conducting cycle time reduction analysis, data sufficient to conduct a statistical analysis of the consistency and uniformity of applications and credentials were not obtained. However, user responses regarding the utility of this feature were usually favorable. As was the case with many of the measures used by these three tests, results regarding the value of this feature varied depending on the type of credential requested. For instance, an SSRS renewal application is relatively straightforward and brief, and errors tend to be more infrequent than for more complex applications such as IRP renewals, where each vehicle is listed along with its projected annual mileage by jurisdiction, and other data elements.

It should be noted, however, that under the limited use conditions experienced during the operational period for each system, some users did indicate they saw little or no benefit of this feature. From a state perspective, this finding was attributed to the fact that, during the test, these users were still required to manually verify the accuracy of the applications to the same level of detail as those received through conventional means.

Application Preparation

One task in the credentialing process that continues to hold significant promise for improved efficiency and productivity concerns the application preparation time.

The most dramatic potential reductions are associated with annual IRP renewals. Typically, a carrier or service agent receives a renewal notification from its base state. Included in this package is a state-generated printout of the previous year's registration information. Carriers then take this printout, which can run into the hundreds of pages, and manually comb through it to verify and/or edit the information. Carriers with larger fleets (several thousand power units and trailers), often expend several person-weeks of labor during this process.

The completion of IFTA quarterly returns is another task where a one-stop system has the potential to effect significant time savings. The basic thought is that, if carrier fleet information could be drawn directly into an application from an existing database, labor savings would be realized due to the elimination of the time consuming data entry process. In addition, the potential elimination of the errors that occur during that process would result in substantial benefit to the applicant by reducing the likelihood of filing an incorrect return.

While each of the three systems tested had the capability to retrieve information from the databases resident in each system, each had to be initially populated with carrier and fleet data. This is the point at which the systems took vastly different approaches. One system relied completely on the applicant to populate the database by requiring them to manually input carrier and fleet information. This meant that during the limited testing period, applicants were essentially completing electronic applications by entering the same data required on paper forms. Because they were populating the database as they completed applications, they were unable to realize much of the benefit of having the database. Consequently, because this represented little change from current application processes, differences between application preparation times with and without the system were neither measured nor perceived. Had the testing period extended over a period long enough for them to have been able to utilize the database, the results may have been different.

This result is in stark contrast to those observed using the other two systems. *Because each of the other systems provided a means for applicants to extract information from existing databases to complete applications, application preparation times, and applicant perceptions, were substantially different.* Although the analysis was again limited by the lack of transaction volume, typical application preparation time was reduced from hours to minutes. When these results are multiplied by the volume of applications generated by larger carriers with high fleet turnover, the administrative savings could become very significant.

The principle of providing a means of accessing current databases also has implications regarding the ability of a state to achieve economies of scale. All states, either internally, or through a third party, maintain records regarding carriers that operate within their boundaries. Information regarding credentials issued to these carriers constitutes a significant portion of that information. The data that populates these records, some of which is in electronic form, represents information gathered and entered over significant periods of time.

The existence of this data, and the systems within which they reside, represent a substantial investment on the part of the agencies. As such, there is inherent value in providing a means to access and maintain the information stored therein. As state agencies look toward the

future, they face difficult decisions regarding whether they should continue to use their current legacy systems, or invest in migrating to more modern systems.

In either instance, it is important that every available utility is extracted from current systems. One means by which this can be accomplished is the development and implementation of "helper" systems, such as those for electronic one-stop shopping, with the capability to interface with existing systems. The need for this capability was illustrated in the responses received from state agency representatives. *They indicated that, for a one-stop system to be truly valuable, it needed to provide a means of interfacing with existing databases and information systems.*

Administrative Process Improvements

The state agency representatives participating in each of the three operational tests tended to agree that, in their current form, one-stop systems offer substantially more benefit to carriers than to states. This can be partially attributed to at least three issues.

First, state users of the MEOSS and EOSS systems were required to continue to process applications using the traditional process. In the case of MEOSS, almost none of the state agencies intended to issue actual credentials using the system. With EOSS, the system generated permanent credentials for only a limited subset of all credential types, leaving agency representatives to process applications and deliver permanent credentials consistent with current processes. With the HELP system, agencies were tasked with auditing credential transactions completed using the system, an added task in place of traditional processing.

The second issue stems from the limited availability of the systems to applicants, either due to its prototype nature, or the carrier selection and approval process. Until these systems become more prevalent, the percentage of total credential transactions a given jurisdiction will receive through them will remain quite small, leaving agency representatives to continue to conduct the bulk of transactions through traditional means, while imposing the additional burdens associated with operating dual systems.

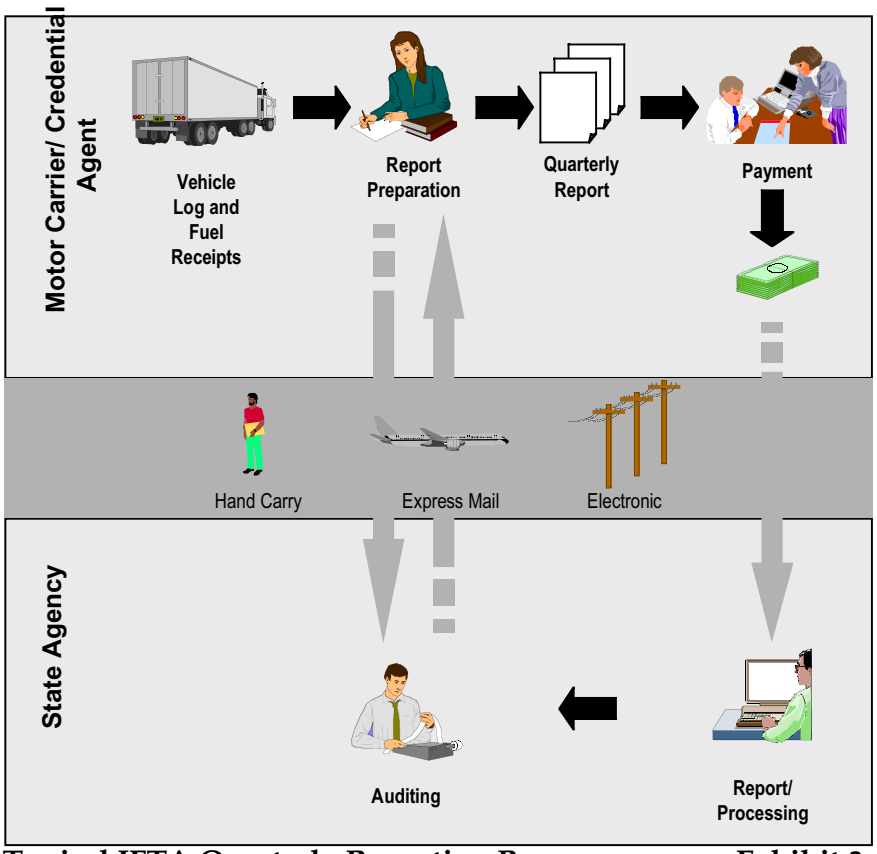
Finally, the fact remains that many agency personnel see this type of system as a step backwards–particularly those that either receive applications over the phone and release permit numbers for self-issuance, or those that use in-house systems to which they've grown accustomed. *Agency users were in agreement, however, that refined versions of these systems could offer significant potential benefits to them as well.*

AMASCOT

Currently, data used for the reporting of apportioned mileage to jurisdictions is collected and processed using a largely manual process. Each driver records the mileage accrued and fuel purchased in each of the jurisdictions within which he/she travels. This information is then transcribed onto state forms and forwarded to the carrier's base jurisdiction. Once received by the agency, the information is transcribed into the state system, where financial records are reconciled, and payment is made to other jurisdictions. Since they are used for quarterly IFTA filings, the data that populates these forms and databases is the very same data captured and reported during the credentialing process.

The evaluation of the AMASCOT system impacts focused on the following objective:

- Document current processes and costs of IFTA and IRP processing and auditing administration and identify possible impacts of automated data collection and electronic filing on these processes and costs



Typical IFTA Quarterly Reporting Process **Exhibit 3**

Fuel Tax Reporting

Since the IFTA and IRP data requirements and processes are similar, and fuel tax reporting is conducted on a more frequent quarterly basis, the impact evaluation focused on the IFTA reporting process. A typical reporting cycle is illustrated in Exhibit 3.

In this scenario, vehicle logs and fuel receipts are gathered, and the information is entered into the appropriate forms, allocated to specific jurisdictions as necessary. Based on the report, if any additional taxes are due, payment is attached, and the report is forwarded to the carrier's base state. Once the report is reviewed, the necessary accounting data is reconciled. Should a carrier be selected for an audit, state auditors work with carrier representatives to obtain the supporting documentation necessary to conduct the audit.

Given the limited availability of current cost data, and the difficulty inherent in capturing actual benefits with a limited sample of participants, quantifying the impacts of the AMASCOT system was not possible. Instead, a case study approach that focused on the participants' perceived expected benefits was used.

For this case study, carriers, service agents, leasing companies, and state agencies participating in the test were asked to assess the potential benefits of a concept system. This concept system would essentially offer the functionality offered by the system actually used during the test, but would be configured to more closely represent a system that might be deployed.

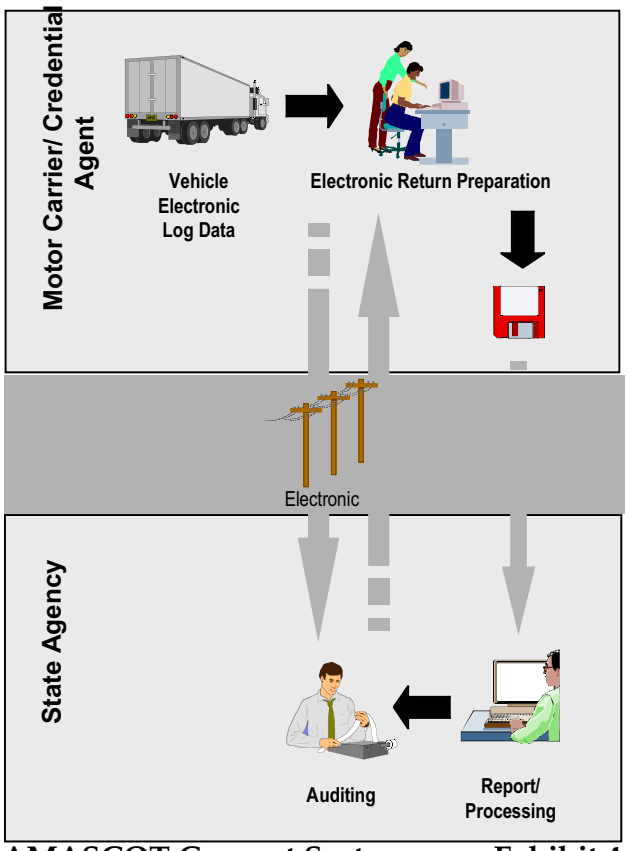
The concept system was defined as consisting of an on-board recording device, that gathered position and mileage data, and a computer at the carrier location. This computer would be used to pre-process the data as required to satisfy audit stipulations, transform the data for use with their existing fleet management software, handle processing necessary for filing returns, and retain data for auditing. This concept system is graphically depicted in Exhibit 4.

Responses gathered during interviews with participants were tabulated to gain insight into the relative costs and potential improvement areas.

Benefits

Based on current processes, state agencies responsible for IFTA indicated potential benefits falling into two categories—Processing Benefits, and Auditing Benefits. Information regarding current state processes was gathered, and based on the defined system model, agency representatives were asked to estimate potential impacts to processing and auditing activities.

State agency processing staff in the three participating states generally concurred, in varying degrees, that the automated mileage data collection and filing system would result in increased reporting accuracy, reduced data entry, more efficient data storage and retrieval, and less time spent resolving inaccuracies. Auditing staff in the three states also cited additional likely benefits: the ability to audit the electronic data using specially developed audit software, improved ease of querying information, decrease in the time required to perform audits, improved data accessibility resulting in greater audit efficiency, and increased reporting accuracy. While general agreement exists regarding the types of potential benefits, the assignment of specific values for each is problematic. The magnitude of the benefits would depend on the level of implementation among carriers and service agents.



AMASCOT Concept System **Exhibit 4**

Among responding carries, service agents and leasing companies that acknowledged that the concept system offered potential impacts, there was general agreement that the cost of compliance with IRP and IFTA requirements would be reduced through savings in data entry, paperwork, and a reduction in data errors and associated reconciliation. *While these respondents estimated benefits on the order of 33 to 50 percent, they felt strongly that a system like AMASCOT would be considered for implementation only if it offered additional functionality, and corresponding benefits.*

USER ACCEPTANCE

User acceptance can be characterized as the degree to which the levels of functionality, utility, and value provided are acceptable to users. The qualitative nature of the bulk of the data gathered for these four tests underscores the significance of user acceptance findings as indicators of the ability of the systems–or system concepts–to facilitate the delivery of a service of value to their potential users. The primary goal of user acceptance evaluation is to assess the extent to which the systems and services under the test satisfy user requirements and preferences.

Electronic One-Stop Shopping

While the combined technical results of the three one-stop evaluations offer insights into the technical feasibility of the one-stop concept, it is the user acceptance and preference findings that provide valuable understanding as to the appropriateness and perceived value of the different approaches.

Each of the three one-stop evaluations employed a combination of surveys and interviews with system users to gather user acceptance data. The objectives identified for each test were largely the same, again reflecting their common planning. The following is a composite list of those objectives.

- Assess the ease of use of the one-stop system as compared to present systems
- Assess motor carrier/service agent/state agency acceptance of the one-stop system, including user preferences
- Assess frequency of use
- Assess improvements in convenience due to the use of one-stop systems

Ease of Use

While each of the three systems used a GUI to prompt the user for input, each took a somewhat different approach to gather the necessary information. As discussed earlier, one system required the user to enter all information manually initially, until its database became populated. The other two systems made provision, in some cases, for uploading information from existing databases. Each of the systems provided some degree of built-in error checking. Information transmittal methods also varied among the three systems. The table provided on the following page as Exhibit 5 illustrates some of the basic functional characteristics for each of the three systems.

Overall user acceptance results for each of the three systems are summarized in Exhibit 6. Ease of use, for discussion purposes, can be divided into two major areas. The first has to do with the actual look and feel of the interface itself. Because each system used a Windows-based GUI incorporating such features as drop-down menus and point-and-click navigation, it follows that users well versed in these types of operating systems would experience a higher level of comfort when using the systems. The findings from the three tests were consistent with this premise. Users from carriers, service agencies and state agencies that regularly use PCs tended to rate the ease of use of the interfaces for each system from acceptable to very good. Users unfamiliar or uncomfortable with PCs were, as a group, less likely to rate the interfaces favorably.

The second ease of use area concerns the ease with which users could complete the processes required to conduct transactions. It is in this area that user responses regarding the three systems diverged. The differences were most often attributable either to specific capabilities (or the lack thereof), or process logic.

From a carrier/service agent perspective, one capability that met with favorable responses concerned the ability to reduce the labor associated with populating fleet data fields. This was done by either using an interface with existing systems, or by reducing repetitive entry of such information as carrier and vehicle identification, or both.

Each of the systems tested provided this capability to some degree. As mentioned previously, all three were capable of allowing users to retrieve information from databases designed into the systems. Of course, these databases had to be populated in some manner prior to providing users with any utility.

System Characteristic	One-Stop System		
	MEOSS	**EOSS**	**HELP**
Provision of Filing Requirements Information to User	List of required data fields provided in validation results summary	〈 Separate "Information Module" containing guidance regarding filing requirements 〈 Data entry screens indicated which fields were required	〈 List of required data fields provided in validation results 〈 Support staff at Service Center
Data Entry Methodology	〈 Manual first time data entry into pre-defined data fields. Ability to choose from previously entered data. 〈 Drop down lists for commonly used entries or limited choice fields. 〈 Separate groups of entry screens for each credential type. 〈 User-defined data entry sequence	〈 Manual or database uploading for first time or subsequent data entry into pre-defined data fields. 〈 Drop down lists for commonly used entries or limited choice fields. 〈 Single scrolling screen for each credential type 〈 System-guided data entry sequence	〈 Carrier database pre-populated using VISTA or by system developer (manual data entry), or manually by user 〈 Drop down lists for commonly used entries or limited choice fields 〈 Sequential screens for data entry 〈 System-guided data entry sequence with visual cues
Data Validation Methodology	〈 Manual selection of validation of required fields 〈 Automatic validation notification prior to transmittal	〈 Automatic validation of required fields and syntax prior to transmittal 〈 Summary screen provided list of remaining data entry requirements	Automatic validation of required fields and syntax prior to transmittal
Data Transmission Methodology	EDI via direct modem-to-modem dial-up connection initiated by user	User defined choice between: 〈 EDI via Value-Added Network 〈 Print and forward via Fax, mail or walk-in	〈 EDI via direct modem-to-modem dial-up connection initiated by carrier for certain credentials 〈 Print and forward via Fax for certain credentials
Application Review and Approval Methodology	〈 Application accessed at PC and reviewed using conventional process 〈 Notification of approval or rejection transmitted via EDI	〈 For EDI – automatic system review and response using look-up table for pre-approved applicants 〈 For Fax, mail, walk-in – conventional review process	For EDI – automatic system review and response from Service Center through carrier inquiry for pre-approved applicants (state agencies perform monthly audits)
Credential Delivery Methodology	Traditional credential delivered via conventional process (mail, fax, hand-carry, self-issue)	〈 For EDI – permanent or provisional permanent credential included in automatic response 〈 For Fax, mail, walk-in – conventional process	〈 Carrier or service bureau self-issued credentials using state provided stock

One-Stop System Functional **Exhibit 5**

Another relatively well-received capability was the error checking function. Each of the three systems provided users with the ability to validate the accuracy and completeness of an application prior to submittal. Each of the systems was capable of identifying data fields that were incorrectly left blank, while two were capable of verifying that proper syntax was used for specific entries (e.g., vehicle identification numbers in proper alphanumeric format). Most users felt this was a useful feature that could potentially reduce the number of applications submitted containing errors. Negative user responses regarding this feature were largely attributable to the means by which the validation function was initiated–users forced to manually execute the routine tended to respond less favorably.

Process logic is defined as the sequencing of a step or set of steps that must be executed to complete a process. For the purpose of this discussion, the credentialing process is broken down into several major steps: application preparation, application submittal, application receipt, application review, application approval/rejection, invoicing (as applicable), payment, and credential delivery. Within each of these steps is a set of tasks that must be completed.

When designing the one-stop computer software, each of the systems developers obviously had to first take into consideration the data that would be required to satisfy the regulatory requirements of each participating jurisdiction. They then had to develop a product that would allow for the entry, review, and approval of the required data, and the completion of the transaction.

On the applicant side, two decidedly different approaches to this requirement were taken. One approach was to categorize data requirements into groups, and provide input screens that allowed users to select the category of data to be entered, and populate the data fields as desired. The alternate approach was to provide users with a sequential data entry process that resembled their traditional process.

Not surprisingly, of the three systems tested, those systems that employed process logic which allowed users to complete their tasks in a sequence, similar to those used in their traditional processes, tended to receive higher marks for ease of use than those that did not.

System	Respondent	Ease of Use	Preference	Frequency of Use	Convenience
EOSS	Carriers	👍	👍	👍	👍
	Agencies	👍	👍	👍	👍
MEOSS	Carriers	👎	👎	👎	👎
	Agencies	👎	👎	👎	👎
HELP	Carriers	👍	👍	👍	👍
	Agencies	-	-	-	-

Electronic One-Stop User Acceptance **Exhibit 6**

As was the case regarding impacts, users' perceptions regarding ease of use also tended to vary based on the specific credential being requested–generally, the more complex the application, the more importance placed on the process logic. In forwarding the application, applicants generally favored the simplest approach. While each of the three systems required the applicant to initiate the transmittal, users responded negatively to the one system that also required the applicant to follow up this transmittal with additional inquiries to determine the status of an application. The other two systems required either a manual or automatic response from the state agency.

From a state agency perspective, the three systems offered dramatically different levels of ease of use. Since the HELP system was designed for use only by applicants and Service Center representatives, the agencies in participating states actually had no exposure to the system, and would not have exposure to the system, other than through monthly audits of transaction records. As such, agency representatives were not asked about the system's ease of use.

Of the two systems requiring agency user involvement, ease of use perceptions lay at opposite ends of the spectrum. Users of the EOSS system were very positive regarding its ease of use, and felt that the system was easy to learn. In contrast, representatives recruited to use the MEOSS system often avoided using the system because of difficulties getting the system set up, and the complexity of some of the processes. Additionally, many felt that, since the system was not able to provide the level of functionality originally anticipated, it did not offer an acceptable alternative to current processes, particularly given the need to conduct those processes in parallel with transactions initiated using MEOSS.

Preference

To gain a further understanding regarding user acceptance, users in all three tests were asked whether they would prefer to use one-stop, or continue to use their current processes. Basically, users' responses were a reflection of the degree to which each of the systems represented an improvement over current processes, and were influenced by the ability of each system to deliver functionality and utility relatively consistent with expectations. Users of the HELP and EOSS systems tended to have better experiences with the systems than did the users of the MEOSS system, and subsequently rated them higher. The responses regarding MEOSS were likely influenced by the early difficulties which the users had getting the software up and running, which led to a lack of use.

It is logical then, that users' preferences were consistent with perceived benefits. Carriers and service agents that used the HELP and EOSS systems indicated a preference to use one-stop shopping, while users of the MEOSS system either preferred to continue to use current processes, or opted to reserve judgment until such time as they could sample a more fully functional system.

Frequency of Use

Often, the most revealing measure of the acceptability of a system is the frequency with which it is used–the more acceptable the system, the more users are compelled to use it. While insufficient frequency of use data exists from these three tests to make a statistical argument, the patterns of use observed by the evaluators are quite telling. None of the three systems were overwhelmed by demand, but two, HELP and EOSS, saw regular use during their respective evaluation periods. Both systems were used to complete credential transactions. In contrast, the MEOSS system was subjected to minimal use. This is not surprising, given user perceptions regarding its lack of functionality, and the difficulty many experienced during early attempts to use it.

Convenience

These results carry over directly to the improvements in convenience as perceived by users. Carriers, service agents, and state agency representatives using the HELP or EOSS systems felt that one-stop shopping systems such as these, offered substantial improvements in the convenience with which credentials and permits could be applied for, and processed. Carriers were particularly positive in this regard.

AMASCOT

The user acceptance assessment for the AMASCOT was based on a combination of user experience with the test system, and perceptions regarding the concept system described earlier. As such, the observed acceptance of the concept system must be considered as a function of the level of perceived benefits.

State Agencies

State agency acceptance was assessed using a case study approach, where agency processing staff and auditing staff were asked to complete questionnaires. Because IFTA administration processes among the three states varied significantly, each state was studied independently. However, as discussed later, some broad conclusions are possible. Each of the three states had staff assigned to process quarterly returns, and separate staff responsible for conducting carrier audits. As such, the user acceptance findings were presented for each user group within each state.

The processing staff in Iowa were among the most receptive. *In spite of having limited knowledge of the deployed AMASCOT system, respondents thought it likely that they would reap substantial benefit, primarily in the form of time savings, from the implementation of such a system.* Since staff levels have been reduced in recent years, most felt the implementation of such a system would free up time to complete other duties. *Processing staff in Minnesota were slightly less receptive to the concept.* As was the case in Iowa, the staff surveyed had limited knowledge of AMASCOT. They felt their current system was adequate, and that, while the concept system might offer some benefit, it also created the potential for data to be lost. *Of the three states, the processing staff in Wisconsin was the least receptive to the concept system.* They, too, professed little or no knowledge of the AMASCOT effort, but were confident their current system was adequate, and didn't anticipate substantial improvements would come from the concept system. Wisconsin currently uses the VISTA/RA system, and a comparative review of processing maps among the three states suggests their procedures may be slightly less complex that in either Minnesota or Iowa, which could explain their position to some degree. The evaluator postulated this lukewarm reception was likely due, at least in part, to staff concerns regarding job security.

Results among auditing staff, who were, incidentally, more knowledgeable about AMASCOT than the processing staff, were generally consistent with those of the processing staff. In Iowa, where most fleets are small, and 75 to 80 percent of audits performed are limited reviews of carrier records, auditing staff were receptive to the concept, and cautiously optimistic of its benefits. In Minnesota, where approximately 65 percent of commercial vehicle fleets consist of 5 or fewer vehicles, and 9 fleets have over 500 vehicles, auditing staff were highly receptive to the concept system. In both states, staff cited improved accuracy as the primary potential benefit, and the ability to free up additional staff time for other duties as an important supplemental benefit. As with the processing staff, the auditing staff in Wisconsin was less enthusiastic than those in the other states.

Without further information, it is difficult to speculate as to the reasons for what might be considered a tepid reaction to the concept system. Each of these states has participated in other operational tests, and each has experienced varying levels of success in these efforts. It is unclear whether these experiences, or other factors, such as level of automation, staff familiarity, and comfort with technology, or current modernization efforts, had an effect on responses. In general, however, there was agreement that such a system would have to be deployed to a large portion of the carrier population before substantial benefit would be realized at the state level. This is due primarily

to the relatively large proportion of small carriers.

Motor Carriers

Carrier input was sought through interviews with representatives from six participating companies. Four for-hire carriers, one private fleet operator, and one leased fleet operator were asked to describe their current methods for assessing new technologies, to offer their assessment of the technology demonstrated in the AMASCOT system, and to assess the applicability and potential value of the concept model.

Carrier response regarding system function and potential benefit was generally favorable. All agreed that the concept system had the potential to reduce the costs associated with data entry and reconciliation of records with the state auditors. However, with the exception of only the largest carrier, none felt the concept system, as described, would be considered for implementation. Instead, they felt it should either offer additional functionality, like the ability to produce electronic driver logs and reconcile fuel purchases with mileage records, or be offered as an add-on to a fleet management system.

During the interviews, carrier respondents were asked to offer input regarding the attributes that would be necessary for the system to be acceptable. The more general comments included the need for a passive system that was accurate, reliable, easily maintainable, offered substantial data storage capacity, and was upgradeable. More specific comments were offered, as well. These included the capability to integrate the system with carrier legacy systems, and the ability to make individual systems installed in trucks set up to match the vehicle odometer.

As is often the case with ITS/CVO system implementations, carriers also expressed some concerns and reservations they held regarding the implementation and use of such a system. These primarily dealt with the level of detail of the data captured, and the use of the data by state enforcement officials. *Because this system has the ability to track individual movements, locations and times with a high degree of accuracy, some are concerned that such information might be used to monitor carrier activities.* Carriers also indicated that any such system would have to offer the carrier the capability to control access the data regarding their fleet, thereby allowing them to release only the data required to meet fuel tax reporting and auditing requirements.

TECHNICAL LESSONS LEARNED

The technologies employed in the systems discussed in this report largely represent the application of proven technologies to new service areas. Each involves the gathering and movement of information for the purposes of enhancing the efficiency of administrative processes. As such, the technical lessons learned during their execution tended to be incremental, and based primarily on choices made by the system developers in each case, as opposed to significant advances in the state of the art.

Lessons learned from the four tests can be classified into several categories: application development; communications; legacy systems interface; and operating platform.

Application Development

Most larger carriers, and many state agencies, currently utilize software applications that were either designed specifically for them, or are adaptations of commercially available packages. As such, they have become accustomed to having the use of systems that meet the specific needs of their operations. One of the challenges faced, by each of the system developers with varying levels of success, was the development

of software applications that met the specific needs of the individual participants without creating something too complex and costly, to be considered suitable for deployment. Generally speaking, the systems that met with larger success and acceptance tended to be modular in design, which allowed for the incorporation of the necessary core functionality required by all, while allowing for relatively simple modification, so as to accommodate the specific needs of individual user organizations. *This result underscores the importance of querying potential users for input throughout the design, a common practice among the developers of the more successful systems.*

Another issue system developers must consider in future efforts is the level of technology literacy of the intended users. It was not uncommon to find both public and private participants who had little or no experience with PCs. Smaller carriers often do not use PCs when filing for credentials or preparing quarterly returns, and as a result, require a considerably more user-friendly interface than those who regularly use them. This is particularly true when the carrier is also responsible for system setup. Many respondents claimed to have been comfortable with the use of PCs, yet were not familiar or comfortable with the installation of software–a task considered by more computer literate individuals to be quite simple.

Communications

Three primary means of data communications were used among the tests. The AMASCOT system utilized satellite communications to transmit data from the vehicle-mounted system to the system developer, and land-based EDI to exchange it among the participants. The one-stop tests all used some form of EDI.

The AMASCOT system relied on the use of commercially available off-the-shelf satellite communications systems and components currently marketed by Rockwell, to transfer vehicle position data to the system developer. This communications method was used as a means for the developer to receive data in real-time, and was not envisioned as part of a deployed system. As such, this capability was not evaluated independently. It did appear, however, to provide the performance necessary to support the delivery of the intended service. A deployed system would provide a means for data to be stored on the vehicle, and downloaded at a carrier facility.

Land-based EDI communications provided a relatively reliable and cost-effective approach for exchanging data between carriers/service agents and state agencies in all four tests. The approach for providing the physical link between parties differed somewhat among the systems under test, and some met with more success than others. Two primary approaches were used–direct dial telephone modem-to-modem interfaces, and access via VAN services. In both scenarios, modems were used to connect and transfer data. As such, portions of the reliability and transfer speed were functions of the capabilities of the hardware and software components and the quality of the telephone connection. As with the satellite communications equipment discussed earlier, these were Commercial Off-The-Shelf (COTS) items.

The primary communications lesson learned was that operational requirements tended to have a significant impact on the acceptability of the method of transfer. The size of the data files being transmitted, and the rate at which transfer requests are sent to receiving systems, are both critical factors to be considered when selecting system hardware and software. For instance, agencies receiving large volumes of temporary credential requests will need systems that can rapidly handle the incoming volume. Hence, any given system design must take these factors into account.

Finally, in order for these systems to effectively communicate with each other, standard file formats must be used. Largely, as a result of these, and other similar tests, a number of draft transaction set standards are currently either in development or under review by governing bodies.

Legacy Systems Interface

Almost without exception, both the private and public participants indicated that the largest remaining issue was the ability of each of these systems to be interfaced with legacy systems. As was stated earlier in this report, these systems represent substantial investments of time and money. In many cases, because of the costs associated with their replacement, they also represent the systems that will be in place for a number of years to come. In order for new systems and services to receive the acceptance necessary for encouraged widespread deployment, an effective alliance between these systems and legacy systems must be developed.

Each of the system developers for these four FOTs felt confident that their system could be effectively and affordably interfaced with legacy systems, provided open standards are used. However, with the exception of one leased fleet owner in the Southwest One-Stop FOT, these interfaces were not explored. Given the importance placed on this feature by participants, future efforts in this area should focus considerable effort on the delivery of this capability.

Operating Platform

With the exception of the AMASCOT on-vehicle system, the primary operating platform used in each test was the PC. The PC was chosen because of its proliferation and availability, and the ease with which new applications can be developed for it. As PC prices continue fall (well-equipped machines with reasonably fast processors can be purchased for less than $1000), more and more Americans are getting the opportunity to gain experience with them. From that standpoint, the selection of the PC as the platform seems quite logical. Unfortunately, it also creates a problem in some cases.

Small carriers (less than 50 trucks), many of whom choose to perform their credentialing and fuel tax reporting in-house, may not be willing to dedicate the necessary resources to this purpose. Whatever equipment they have is likely to be called upon to perform multiple duties, and staff are less likely to be experienced in PC use. Hence, many may be excluded from participation in these programs in the near term.

From the state perspective, credentialing and permitting agents, many of whom have held their positions for extended periods of time, have become not only accustomed to performing their duties using current systems, but quite efficient as well. As a result, asking them to switch platforms may not only cause consternation, but may actually result in a degradation of efficiency.

INSTITUTIONAL CHALLENGES AND RESOLUTIONS

Prior to the start of the operational tests discussed in this report, the general consensus among ITS/CVO experts was that the primary barrier to the implementation of these systems was more institutional than technical in nature.

Experiences gained during these four tests suggest two things. First, the remaining technical challenges, while not terribly complex, are nonetheless easily underestimated. Particularly when it comes to the development of software. Second, although agencies and carriers are familiar with the institutional barriers they face and recognize, they must be addressed before full deployment can be achieved, most have not been able to identify and implement effective solutions.

Organizational Structures

The primary remaining challenges can be classified into four broad categories. The first stems from the organizational structures that exist in most states. *With few notable exceptions, most states still have multiple agencies responsible for the separate administrative functions.*

From a credentialing perspective, functions regarding revenue, regulation, and safety are still performed by different groups, usually using separate legacy systems designed to perform to the specifications of the specific agency. This is the case even in states that have implemented "One-Stop Shops" where multiple functions are performed in a single facility. While customer service is undoubtedly enhanced through the co-location of representatives, substantial potential efficiency gains are likely possible if further coordination is pursued, particularly with regard to systems interfaces and cross-functional representatives.

Records Reconciliation

The second primary challenge stems from the reconciliation of electronic and paper-based records. *The requirement to provide supporting documentation and verifiable, auditable, and secure records remains a significant hurdle in the quest to deploy ITS/CVO systems aimed at improving administrative processes.* In many cases, the barriers are statutory in nature, and will require legislative action to change them.

Process Reengineering

To this point, most implementations have been focused on the use of technology to automate processes. Unfortunately, little has been done in the way of examining and reengineering the processes themselves. The need to provide supporting documentation in addition to electronic information in paper form continues to represent the most obvious, and perhaps, the most difficult process issue to overcome. The ideal solution is likely one that includes a combination of connectivity among state agency information systems, and federal databases, and the elimination or modification of requirements.

Requiring credential applicants to file supporting documents effectively negates much of the benefit of an electronic credentialing system. The need to provide original signatures remains an issue for deployed systems, as well. While one system offered users the ability to submit an electronic "signature" using a four-digit personal code, another FOT required applicants to submit an application to participate, upon which was affixed a single original signature that served as a blanket signature for all credential applications filed through the system. While both approaches worked well under the restrictive enrollment conditions present in an FOT, it is uncertain whether either will be acceptable long-term solutions from a statutory standpoint. Questions also remain regarding the use of electronic funds transfer in lieu of guaranteed funds, which most states still require prior to the issuance of credentials.

Hence, it is process reengineering that holds the key to resolving many of these issues. As such, it will remain difficult to implement effective technical solutions until the processes they are intended to support undergo rigorous examination and refinement.

Data Security and Use

The remaining issue category is that of data security and use. Since the deregulation of the trucking industry in 1980, competition has become fierce. As a result, carriers have become increasingly cognizant of the need to protect the confidentiality of their fleet records from competitors. Additionally, since information technology first became prevalent in the motor carrier population, carriers have been wary of providing fleet operational data to regulatory agencies. Sometimes referred to as

the "big brother" issue, this wariness often translates into reluctance on the part of carriers to participate fully in implementations. This is particularly the case with systems such as that tested under the AMASCOT, where vehicle locations are recorded at all times. Of particular concern is the use of this data by enforcement officials, and the ability of parties unknown to the carrier to access the information.

So, in order for carriers to agree to take part, in addition to providing them a measurable return on investment, agreement must be reached regarding the use of the data. A convincing case must be made that the use of the information provided will be limited to a predefined, uniformly applied standard, and that sufficient protection of the data, perhaps in the form of encryption, will be provided.

While the issues identified here do not represent an exhaustive list, they do represent the most significant issues.

DEPLOYABILITY

Many factors contribute to the overall deployability of a system or service. Aside from the ability to function properly, a system must represent a useful, affordable investment that meets the needs of its intended users, and applicable regulatory requirements.

Electronic One-Stop Shopping

The assessment of the deployability of one-stop shopping systems focused on three areas:

- Determine the minimum system configuration requirements
- Estimate the deployment capital and operating costs
- Assess the state agency/motor carrier positions on deployment

Minimum System Requirements

The availability of capable, affordable PCs, and corresponding enhancements in telecommunications technologies, have opened up many possibilities for automating administrative processes. The amount of computing power that is available for relatively modest prices continues to grow. It is this proliferation of affordable computers that made the development of electronic one-stop shopping systems a viable goal.

PCs constituted the core hardware for each of the three systems under test. All three software packages were designed to run in a Microsoft Windows environment, and required the use of a modem to transmit data. According to the system developers, two were designed to run on a computer with a 486 processor with between 8 and 16 megabytes (MB) of random access memory (RAM). The third was designed to require a 586 (Intel Pentium or equivalent) processor with 16MB RAM. This system was also required to have an 850MB hard drive. No hard drive specifications were offered for the other two systems. Computers with these basic capabilities are readily available for relatively little money, usually less than $1000. Some users needed to have additional telephone lines installed in order to use the modem, but these costs were typically less than $50 per line.

Capital and Operating Costs

On a per-unit basis, these systems are indeed affordable. It is when agencies and carriers must equip entire departments with computers that doing so can become an expensive proposition. This is more likely to be an issue on the state agency side for two reasons. First, carriers large enough to have several people performing credentialing, and that are not already equipped are more apt to have the resources necessary to make the investment. Second, frequent technology turnover and capital equipment purchases are not the norm in most state

agencies. These agencies are usually more financially constrained, and equipment is often retained until the end of its useful life. It is important to note, however, that because the percentage of carriers using such systems is not likely to grow rapidly in the near term, equipping the entire credentialing staff at one time at a given agency is not likely to be required.

The remaining unknown capital cost is that which is associated with the purchase and use of the software. *Each of these three packages could be considered prototype in nature. As such, accurate capital costs could not be defined.* However, a number of states have begun implementing production systems since these tests were completed. Actual costs can likely be obtained from implementing agencies and carriers in states such as Kentucky and Maryland.

Operating costs are also very difficult to quantify at this point, for the primary reason that the prototype nature of the systems under test was not sufficiently advanced to offer any useful indications as to what the operating requirements will be. These costs are likely to consist of the labor associated with using the system, the training of users, phone charges and/or charges associated with the use of a VAN, and costs associated with product technical support.

It is assumed that system use will be designated to existing state agency, carrier or service bureau employees, and that these employees will require training ranging from basic Windows skills to one-stop software use. Obviously, the cost of training will be dependent upon the level of instruction needed, and the complexity of the end product. Hence, those systems that provide users with an intuitive interface and familiar process logic are likely to require less expensive training programs.

Telephone charges will be a function of the frequency of use of the system, the size of the files being transferred, and whether calls are local or long distance. Large carriers located outside of the local calling areas of the agencies with which they conduct business that choose systems requiring telephone-based information exchange are likely to incur the largest phone related expenses. Users of VANs will likely have access to a local phone number. Software maintenance costs remain an unknown at this point, again due to the prototype nature of the systems under test.

Support for Deployment

Despite the inconsistency of the results of users' attempts to use the three systems, nearly all participants felt that some type of electronic one-stop shopping system should be deployed. *State agencies, most of which perceived that the bulk of benefits of the implementation of these systems would accrue to carriers, were supportive of implementation, particularly if deployed systems could be designed to provide a direct interface to exiting legacy systems.* Some indicated this legacy system interface would be a prerequisite for participation. As actual examples of benefits accrued by states implementing these systems become available, support for implementation is likely to grow.

Carriers generally perceived that they would benefit from the implementation of one-stop shopping. As a result, they too, were supportive. *Many felt that deployment was, in fact, inevitable.* Support is also likely to grow if interstate interoperability is provided. This is particularly true if the ability to provide a means for carriers to apply for multi-state over-dimensional permits is added.

Interestingly, carriers and agencies appear to be divided over the issue of EFT. States are supportive of the concept, and feel it is a necessary component if electronic one-stop shopping is to achieve its full potential. Some

carriers, on the other hand, are somewhat reluctant to support a technology that they perceive, accurately or not, may impinge upon their ability to maintain full control over their funds.

AMASCOT

Deployability was not addressed as a separate evaluation goal in the AMASCOT program. Nonetheless, insight can be gained through a reexamination of the user acceptance findings discussed earlier.

While certain individuals within some agencies were reluctant to endorse the system, presumably due to concerns over job security, most felt it was both desirable and feasible. Since the bulk of the costs will be borne by the carrier, there appear to be few financial impediments to state implementation.

Carriers, by contrast, remain less than committed to the concept. While most recognize the potential benefits, two main issues must be addressed before large-scale implementation can be expected to occur. The first is simply the capital cost associated with hardware purchase and installation. Carrier reluctance can probably be effectively tempered by the integration of the capabilities offered by a system like that demonstrated with current available satellite-based fleet management systems. The second issue is related to data security and access control. As was discussed earlier, carriers need assurances that the distribution of the data for their fleet will remain under their direct control, and that it will be used only for its intended purpose, and not for the enforcement of unrelated laws or regulations. *Carriers appear to be willing to support the concept provided these concerns are addressed to their satisfaction.*

SUMMARY

FOTs, by design, are intended to offer a means to broaden the knowledge base in a particular area by placing prototype systems and services in the hands of potential users, and gathering information as to their ability to make an impact, meet user needs, and provide value sufficient to warrant deployment. Within this definition, each of these FOTs was successful. The experiences gained here represent a substantial foundation upon which deployment can occur. Deployment, in fact, is already happening. Many of the lessons learned during these four tests are being applied to implementations taking place under the Commercial Vehicle Information Systems and Networks (CVISN) program.

Electronic one-stop shopping systems are fast becoming a reality. Several states are preparing for roll-out of systems that build on those examined here. The questions that remain include:

- What will it take to enlist enough carriers for state agencies to realize substantive benefits?
- Can these systems be effectively integrated with legacy systems?
- Is the combination of a desktop computer application and EDI the optimal approach?
- How can the electronic purchase of credentials be extended into the vision of a paperless vehicle?

Some have postulated that electronic one-stop shopping will expand rapidly once implemented, particularly with the proliferation of the internet and World Wide Web (WWW) based technologies and services. Several system developers are already developing web-based credentialing applications. This approach introduces both additional opportunity and

additional risk. On the positive side, it offers users access to electronic purchasing systems without requiring them to purchase or install software specifically for this purpose, and it allows them to access multiple states without having to establish a separate connection with each one. It also offers the state the ability to modify the application as desired without having to distribute software to carriers and service bureaus. Conversely, it also brings with it the challenges associated with conducting business over the internet. Some carriers have expressed concern over the security of internet transactions, and smaller carriers are less likely to have access to the internet.

Legacy systems integration appears to be the major remaining technical issue. This is the case on the part of carriers and agencies alike. This is an issue that is also being addressed in current applications. The emergence of transaction set standards will make the development of translation software less technically complex, and will reduce risk.

The widespread deployment of automated mileage recording and reporting systems faces a more difficult challenge. Some unanswered questions include:

- What combination of features and price will make such systems attractive to carriers?
- What needs to be done to provide acceptable levels of data security and control?
- How can these systems be integrated with existing fleet management systems, and electronic credentialing systems?

The connection between electronic one-stop shopping and automated mileage recording and reporting is obvious. If mileage recording systems can be integrated with electronic credentialing systems, a carrier may someday be able to download mileage data directly into a electronic credential application system, transmit them over the internet, pay for them using EFT, and broadcast electronic credentials back out to its fleet. The time and costs associated with this process could potentially drop dramatically under this scenario.

The primary barriers continue to be institutional in nature, and can be classified into three categories:

- Statutory
- Organizational, and
- Participatory

The first two deal primarily with ingrained philosophy and process. As discussed earlier, in order for these systems and services to reach their potential, the administrative processes themselves, and the organizations responsible for their execution, must undergo extensive review and reengineering. It is counterproductive to simply automate existing processes that are inefficient and/or ineffective. The third category deals with the reluctance of carriers to participate in implementations they perceive may make it easier for agencies to regulate their activities, or that place confidential information at risk. Resolution of issues within each of these categories represents a significant challenge.

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