COMMERCIAL VEHICLE OPERATIONS (CVO) STRATEGIES IN KOREA

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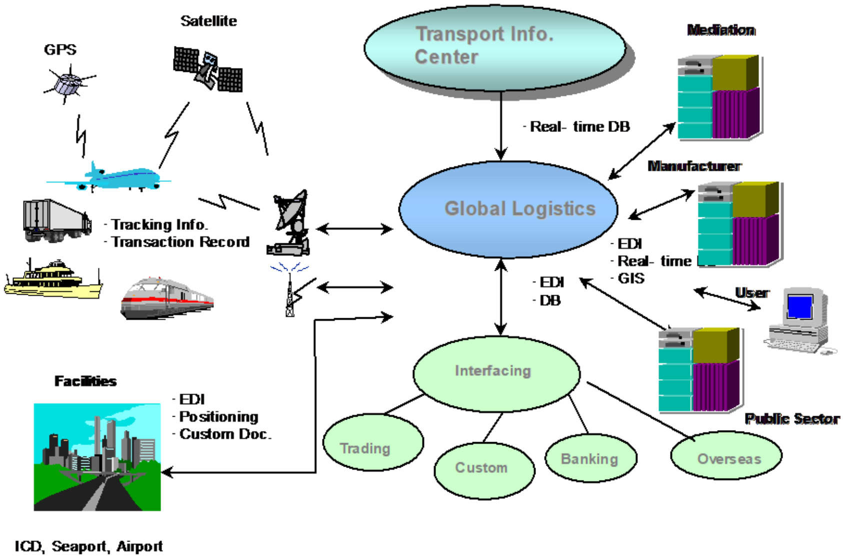
Introduction

In 1995, the Ministry of Construction and Transportation (MOCT) in Korea initiated a research project to establish a master plan for the nationwide Integrated Logistics Information System (ILIS) [5]. It aims to utilize existing and future information infrastructure and knowledge bases to build an integrated logistics information network that will provide comprehensive logistics information services for shippers and carriers in order to improve the efficiency of both inventory and information flows in their supply chains [1]. As a soft infrastructure, the nationwide logistics information infrastructure will be a critical element for Korea. The ILIS is an information network that facilitates the value-added logistics information services through transportation infrastructure and logistics facilities including rail terminals, truck terminals, warehouses. Services envisioned through the establishment of the ILIS includes Intermodal EDI (Electronic Data Interchange) services, Integrated DB (Database) services, CVO (Commercial Vehicle Operations) services and other value-added services (e-mail, BBS, Internet services, etc.) [4]. The ILIS is divided into 3 stages and each stage has following contents.

Figure 1. Overview of ILIS



Stage 1 (1996~1997): Establishment stage of the ILIS

EDI services for logistics data interchanges
- Improvement of existing EDI services,
- EDI services for import/ export documents,
- Development of EDI services for road transport.

DB services for logistics information provisions
- Development of public DB,
- Connection with DB in logistics-related networks.

Freight tracking and fleet management (CVO)
- System design and pilot services,
- Connection with information systems of major logistics facilities.

Stage 2 (1998~2000): Diffusion stage of the ILIS

EDI services for logistics data interchanges
- EDI services for all public documents,
- EDI services for all essential logistics documents.

DB services for logistics information provisions,
- Promotion of IP for developing value-added DB,
- Connection with DB in overseas networks
- Development of freight tracking DB.

Freight tracking and fleet management (CVO)
- Connection with ITS elements,
- Freight tracking services between major logistics facilities.

Stage 3 (2001~2015)

EDI services for logistics data interchanges

Introduction and application of CALS/ EC services

Multi-media EDI services.

DB services for logistics information provisions

Build integrated DB

Multi-media DB services.

Freight tracking and fleet management (CVO)

Real-time freight tracking services using ITS technologies,

Freight transport decision support services.

Based on an estimation of the quantitative benefits from the establishment of the ILIS, it is expected that the annual logistics cost savings will be 20 billion dollars. In 1997, 1.3 billion dollars (1.65% of projected total logistics costs) will be saved; 2.5 billion dollars (2.58% of projected total logistics costs) in 2000; and 16.2 billion dollars (7.97% of projected total logistics costs) in 2015.

Economic Situations and Logistics Prospects

The World economy confronts a critical time and the state of the U.S. business logistics system is disturbing. In 1998, U.S. business logistics costs were equal to 10.7% of Gross Domestic Product (GDP). In 1993, the logistics costs were equal to 10.2% of GDP. That increase of 0.5% of GDP translates to a $40 billion loss of productivity. During the last 10 quarters, U.S. economy has experienced real growth of about 4%. The manufacturing productivity continues to be solid. Service sector productivity has been difficult to measure, but it is clear that information technology and communications are improving its efficiency. Real wages are up, but their cost is below the increases in productivity. So inflation is under control somewhere below 2% due to productivity and global competition in cars, trucks, metals, electronics, apparel and so on.

Another new reality is that the productivity of the U.S. Business Logistics System is directly linked to the declining inflation since 1982. In May 1997, the Bureau of Economic Analysis introduced the U.S. inflation GDP chain price index. This compares the trends of U.S. logistics cost and inflation for the past 20 years. Using the most recent revised levels from the U.S. Department of Commerce, logistics productivity peaked in 1993. During 1997, the cost of business logistics system increased to 10.7% of nominal Gross Domestic Product. The investment in all business inventory in agriculture, mining, construction, services, manufacturing, wholesale, and retail trade was $1.325 trillion. Cost of carrying inventory includes interest a commercial paper rates and the total warehousing costs are estimated based on the U.S. Census report of public warehousing businesses. Taxes, obsolescence, depreciation, and insurance follow the Alford-Bangs formula used in this methodology.

Transportation costs are very important and the engine that drives the logistics system is trucking industry. Intercity trucking costs increased by nearly 10% and local trucking increased by 8%. Trucking share of the nation's freight bill is slightly above 80%. In 1997 trucking exceeds the total expenditures for the entire intermodal transportation industry. The mere one year increase in trucking costs is greater than all of intermodal costs.

Expenditures for rail services in 1997 were flat so were the other surface transport services. Domestic air freight increased by 8%; International air freight increased by 14%. Logistics administration is imputed at 4% of total logistics costs. Since 1982, the improvements in inventory efficiency have been huge as we learned how to replace inventory with more nimble and reliable transportation service. The challenge for logistics managers is to place inventory and transportation with advanced planning systems and communications. Following is logistics expenditure for each country estimated by D. Bowersox in 1997 [6].

Table 1. Logistics Expenditure Sizing 1992 and 1996

Region	Country	Logistics$	LOG/GDP	Logistics$	LOG/GDP
N. America	Canada	68,521	12.0	70,191	12.0
	Mexico	51,744	15.5	49,753	14.9
	United States	717,494	11.5	795,265	10.5
	Total	837,759	11.7	915,209	10.8
Europe	Belgium/Lux.	27,978	11.8	32,573	11.4
	Denmark	19,214	13.5	22,440	12.9
	France	153,318	11.6	171,230	11.1
	Germany	266,962	13.6	306,264	13.0
	Greece	12,943	13.2	15,269	12.4
	Ireland	7,592	14.8	9,611	14.3
	Italy	146,236	12.0	137,027	11.3
	Netherlands	39,194	12.2	44,495	11.3
	Portugal	12,192	13.2	12,871	12.7
	Spain	69,263	12.0	67,022	11.5
	United Kingdom	121,919	11.5	122,344	10.6
	Total	876,811	12.4	941,146	11.8
Pacific-Rim	Hong Kong	14,274	14.3	20,992	13.7
	Japan	427,164	11.5	522,982	11.4
	Korea	39,545	12.8	59,764	12.3
	Singapore	7,048	14.2	13,076	13.9
	Taiwan	28,569	13.6	35,686	13.1
	Total	516,599	11.8	652,500	11.6
Remaining Other Countries		662,923	12.9	916,168	12.9
		2,894,092	12.2	3,425,023	11.7

Sources: D. Bowersox and R. Calantone, "A View of Global Logistics Costs," 1997.

CVO in Intelligent Transport Systems

Elements of ITS

The Korean government, especially the Ministry of Construction and Transportation (MOCT), has put a lot of effort into implementing ITS in Korea. MOCT established the strategic plan for ITS in Korea in August 1996 and a more detailed plan in July 1997 [4]. ITS has five subsystems: Advanced Traffic Management System (ATMS), Advanced Traveller Information System (ATIS), Commercial Vehicle Operations (CVO), Advanced Public Transit System (APTS), and Advanced Vehicle Control System (AVCS). Similar to other countries that have implemented ITS, the Korean government hopes that ITS will solve transportation problems such as congestion, air pollution, safety with advanced technologies and telecommunication systems. Major elements of CVO with other subsystems are as follows: Electronic clearance for improving the logistics administration procedure (CECS); Freight and fleet management system for improving efficient freight transportation systems (FFMS); Hazardous material carrying fleet management for effective response for hazardous carrying transport (HMMS); Automatic roadside safety inspection system for improving safety in freight carrying vehicle operations using AVI and WIM (ARIS).

Logistics Information related Systems

Parallel to the ITS, the Korea government implemented the Integrated Logistics Information Systems (ILIS) to enhance the logistics competitiveness of industries. Commercial Vehicle Operations (CVO) are designed to apply various ITS technologies in order to reduce transportation costs and improve the efficiency and safety of freight and fleet operations. CVO, a subsystem of Intelligent Transport Systems (ITS) have been developed in the context of Integrated Logistics Information Systems (ILIS), as well as ITS. Recently, the Korea Transport Institute and Korea Telecom Inc. established a lower-level strategic plan and system design of CVO, and Korea Telecom Inc. is currently in charge of establishing CVO as a part of Integrated Logistics Information Systems (ILIS). Two systems for CVO are Freight and Fleet Management System (FFMS) and Hazardous Material Management System (HMMS). This paper briefly describes the system architecture and services of CVO and also introduces CVO related activities in Korea, along with future plans and budgets. Current operational tests and deployment of CVO include the following:

- KT (Korea Telecom) commercial vehicle information systems with vehicle tracking services,
- Container-terminal EDI services and the gate automation system of the Ministry of Maritime Affairs and Fisheries (MOMF). These pilot tests show quite promising results. We examined twenty trucks for KTs service. The results of MOMFs gate automation system are based on seven gates of the BCTOC and twelve of the PECT.

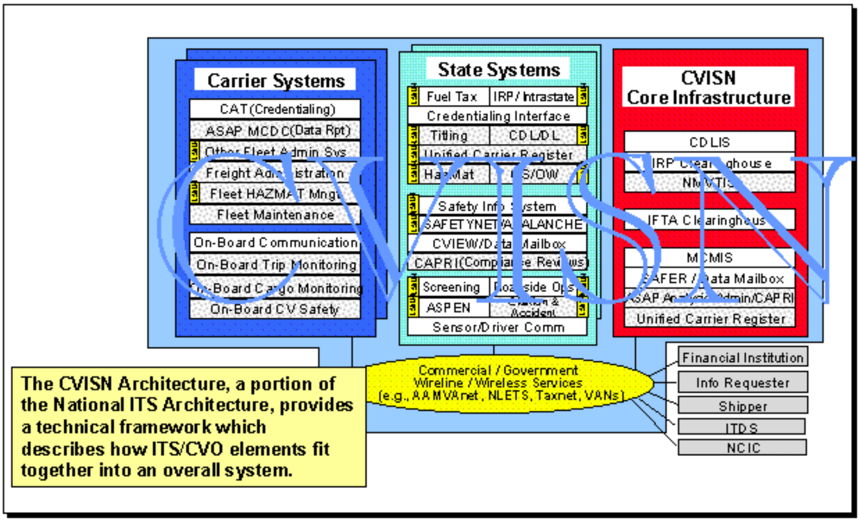
Commercial Vehicle Information Systems and Networks

Intelligent Transportation Systems (ITS) are transportation systems which utilize information, communication, sensor, and control technologies to achieve improved levels of performance. The U.S. DOT has developed a National ITS Program Plan for ITS which provides a new vision for surface transportation in America. The ITS Program includes seven major elements [7]:

Travel Transportation Management
Travel Demand Management
Public Transportation Management
Electronic Payment
Commercial Vehicle Operations (ITS/ CVO)
Emergency Management
Advanced Vehicle Control Safety Systems

The ITS/ CVO element includes the ITS technologies which uniquely support Commercial Vehicle Operations (CVO). The scope of CVO includes the operations associated with moving goods and passengers via commercial vehicles over the North American highway system and the activities necessary to regulate these operations. It includes activities related to safety assurance, commercial vehicle credentials and tax administration, roadside operations, freight fleet management, and vehicle operation. The term commercial vehicle information systems and networks (CVISN) refers to the ITS information system elements that support CVO. CVISN includes information systems owned and operated by governments, carriers, and other stakeholders. It excludes the sensor and control elements of ITS/ CVO.

Figure 2. Structure of CVISN (http://www.its.dot.gov/links.htm)



Concept

This section describes the envisioned situation for CVO approximately a decade from now, after ITS technology has been fully implemented. First the mission, vision, and objectives for CVO are listed. A set of guiding principles for CVISN is defined. These items provide a foundation for discussing the envisioned situation. The key operational concepts for the envisioned CVO situation are summarized. These are organized into two major groups: improvements in safety and efficiency, use of electronic business transactions. The role of each stakeholder in achieving the envisioned situation is discussed. Cooperation among stakeholders is critical to achieving the vision. The use of measures of effectiveness is discussed. These will be used to evaluate plans and assess results to ensure that CVISN projects and investments are focused on producing measurable benefits. Finally, several major cross-functional concepts are described. These concepts are the cornerstones of the CVISN approach to many CVO capability areas.

Mission and Vision

A mission statement briefly says why an activity exists. The purpose of CVO is to transport goods and people using trucks and buses on the North American highway system. It provides a service to its customers, shippers and travelers. A vision statement briefly says how a mission will be carried out in the future if improvements are implemented successfully. The vision for CVO is that safe and legal trucks and buses travel like cars. In other words, they can move freely from state to state and across North American international borders. They are typically not stopped or slowed down for credential, weight, and size checks. They are not burdened with excessive paperwork related to safety, taxes, and credentials. To achieve the CVO vision, some existing systems must be modified or new information systems must be developed. These must provide high quality and timely information to CVO stakeholders. Information technology is critical to achieving the vision of efficient and seamless operations. Information must flow quickly and reliably among governments and carriers to enable all stakeholders to perform their tasks effectively and efficiently. Checks that are currently done manually must be done via automated means.

Objectives

The goals of the ITS program are stated as follows:

Improve Safety,
Increase Efficiency,
Reduce Energy Environmental Impact,
Enhance Productivity,
Enhance Mobility,
Create ITS Industry.

The CVO objectives listed support the overall ITS goals. In most cases a direct link is obvious. The only one which may not have an obvious link to the goals is the last: to ensure regulatory compliance and equitable treatment. Governments have an obligation and need to establish and enforce regulations related to safety, environment, road use, and taxation. They must enforce these in an equitable manner to ensure fair competition. It is a fundamental principle that fair competition will improve productivity, which ties back to the ITS goals. The information system objectives are intended to support the achievement of the CVO objectives. Information system projects should not be advanced as technology for its own sake. Such projects should show a clear benefit and connection to CVO objectives. These are considered as fundamental direction to the CVISN architecture project. Improve CVO efficiency effectiveness: Information technology is the key to improvement of CVO processes. Many current bottlenecks can be alleviated with automation. Promote consistency among processes and data: Inconsistency makes compliance for carriers more complex and expensive. Consistency reduces costs and improves productivity. Improve availability of timely, accurate data: People make better decisions when they have better information. Likewise, automated processes are most effective when they operate with the most complete and accurate set of information available.

Safe and Efficient Operations

It is envisioned that in the year 2005, trucking operations have become much more efficient, largely due to the availability of accurate information in electronic form. In 2005, the vast majority of trucks are equipped with ITS toll and traffic management transponders which transmit messages to and receive messages from the roadside. A clearance message transmits vehicle, carrier, driver, and specially regulated load type identifiers to roadside readers. The identifiers are used to access status information stored in government information systems. Credential, tax, permit, and safety status are checked and compliance verified at mainline speeds. Carriers which participate in clearance programs can operate trucks with no paper credentials on-board. Trucks can be equipped with a variety of equipment to improve productivity and safety. These include mobile communications systems, navigation and tracking systems, on-board vehicle monitors, collision avoidance devices, crash restraints, and vision enhancement equipment. Vehicle owners decide what to buy based on the specific costs and benefits to them. Carriers use fleet management systems to optimize schedules, routing, and maintenance. A wide range of accurate and timely information is available to support this processing: freight data, vehicle data, highway data, and traffic data. Intermodal transfers are supported by electronic data interchange. Many carriers maintain databases of the location of each shipment. Standards are available to support cross carrier queries and tracking, so a shipper can find the location of their shipment via an electronic query. En-route delays have been virtually eliminated. Electronic verification is used to check the vast majority of vehicles at mainline speeds. Support for just-in-time (JIT) manufacturing is improved with the elimination of unpredictable delays. When inspections occur, they are conducted quickly with the aid of automated safety inspection equipment. Many vehicles are equipped with on-board monitoring equipment. Results from this equipment can be voluntarily provided to the roadside at mainline speeds and can be used as a direct input to the automated inspection equipment. International border crossings occur with little or no delay. Routine shipments are often cleared as the vehicle passes at mainline speeds. Immigration and Naturalization Service and customs checks are aided by the exchange of electronic transactions and proceed with limited manual intervention. Electronic transactions support intermodal interchange among trucks, railroads, ships, and air freight lines. All trailers and containers are equipped with a standard intermodal tag. This tag can be read on highways, on rail lines, at truck and rail terminals, and at shipyards. Some carriers maintain trip logs electronically for their own purposes.

Electronic Business Transactions

It is envisioned that in the year 2005, the vast majority of CVO business transactions are being conducted electronically. This includes transactions among carriers, shippers, government agencies, and insurance companies. In 2005, carriers apply and pay for credentials electronically, including operating authority, registration, and permits. They file and pay taxes electronically. Carriers deal with a base state for all routine business transactions, including registration, permits, taxes, and clearance. The base state handles any allocation of fees or taxes to other states, simplifying carrier administration. Credentials are distributed electronically. Information from one process (e. g., registrations) is available to other processes (e. g., fuel tax) in a timely manner. This avoids redundant data entry, improves data accuracy, and provides data to support better decision making. It permits cross checks such as denying registration to a carrier with a poor safety history. Some aspects of audits are conducted electronically with participating carriers. For example, compliance reviews may be streamlined using electronic data exchanges between a state system and a fleet management system. Information from the fleet management system may be compared to state records to complete the compliance review more effectively and efficiently. States deal with carriers electronically, but they also deal with each other electronically. They routinely interchange electronic information about operating authority, registration, tax, clearance, and safety transactions.

Shipping transactions are primarily electronic. Shippers place orders, track freight movement, receive invoices, and make payments electronically. State highway planning and enforcement operations are planned and managed based on comprehensive, timely information. The information is gathered as a byproduct of the administrative processes and roadside processes. It is anonymous; in other words, carrier and driver identifiers are removed and only the overall statistics are used. Data privacy and integrity are assured via encryption and password techniques.

CVISN Stakeholder Roles

Carriers

For a carrier to get the full benefit of ITS programs, it must make some level of investment in technology. The minimum level is to install a standard transponder on their vehicles. This allows participation in paperless truck and electronic screening programs. Depending on their own cost/ benefit analysis, they may also choose to make further investments in fleet management software, on-board computers, mobile communications, office automation, electronic data interchange, and other technologies that improve their internal processes.

Drivers

Drivers need to participate in CVO projects as a partner in developing and evaluating innovative technology applications (e.g. smart cards). Participating drivers can support CVO initiatives through trade associations and unions.

States

Participating states must make an investment in information systems and other ITS technology. They must enhance their systems for licensing, credential and tax administration, and safety assurance to be compatible with the national architecture. This primarily means supporting standard electronic data interchange (EDI) transactions. They must establish an information infrastructure to provide data necessary for electronic screening to fixed sites and to mobile units. They must provide the data necessary to support electronic screening to other states.

Operational Tests Consortiums

Test efforts and consortiums can modify their systems to demonstrate CVISN concepts and standards.

Shippers Public

Shippers are expected to benefit from the improved availability of information brought about by the CVISN initiative. The public will benefit from improved safety, transportation services, and government efficiency. As these benefits begin to be realized, support from shippers and the public will expedite further improvements.

Federal Government

Federal Government will expedite the deployment of ITS technology by providing technical, managerial, and funding support. The CVISN architecture effort is a key element of technical support which provides a technical framework for states to implement their systems. Funding support will be provided for infrastructure developments, key research projects, operational tests, and deployment efforts. The level of funding will depend on Congressional action.

Service Providers Manufacturers

ITS program has an overall goal to develop an ITS industry. The CVO program development and deployment approach relies heavily on private industry to provide computer, software, and communication technology and services to meet the architecture. It relies on vehicle manufacturers to incorporate on-board technologies first as add-on equipment and eventually as an integral part of commercial vehicle manufacturing.

Professional Trade Associations

Professional and trade associations can organize their memberships to participate collectively in ITS efforts. They can provide a channel for outreach and feedback. They can prioritize issues and help build consensus for national programs.

Measures of Effectiveness

A measure of effectiveness (MOE) is a quantitative expression of the success of a system in achieving a specified objective. A guiding principle of the CVO program is: Measures of effectiveness are used to evaluate the planned and actual performance of CVO technology and projects. They are measured during operational tests and after systems have been deployed to assess the success of the test or deployed system. They are also used when evaluating proposed changes to existing systems. Stakeholders must agree to collect data to determine MOEs in a manner consistent with defined standards. For example, states must collect accurate accident data for accidents involving commercial vehicles. This data collection must occur consistently year after year so that long term trends can be determined. In particular, it must be available to support operational tests so that the impact of changes can be measured.

The MOE data must be carefully analyzed to determine trends and understand the factors which caused them. Further process improvements can then be recommended based on knowledge of the current situation and good estimates of the expected benefits from improvements. The MOEs listed above are a core, top-level set that will be used to evaluate the overall effectiveness of CVO programs. These measures are readily understood by all stakeholders, including the public, legislators, and governors. They will provide the basis for evaluating progress, determining the return on previous investments, and justifying further expenditures. Note that MOEs are estimated through analysis of lower level technical performance measures. This is a quantitative expression of some measurable, technical characteristic of a system which is key to the effectiveness of the system.

Major Cross Functional Concepts

Information Exchange

Some concepts are key to more than one CVO capability. The items listed above represent the major cross-functional concepts central to the information exchange aspects of CVISN; concepts critical to the use of the information exchanged will be described in the next section. Each information exchange concept will be described in more detail on subsequent pages. The concepts are also discussed under specific CVO capability areas in later sections of this document.

Authoritative Sources

This term also known as a system of record, is used to refer to that information system which can provide the correct answer to a question. The authoritative source is the final arbiter in case of conflicts about data validity. It is the legal source of the data. Data which have been authenticated by the authoritative source have been proven to be genuine. In some cases, data are stored immediately and authenticated later by authorized personnel or systems.

Indirect Sources

This acts on behalf of an authoritative source to answer questions. Some authoritative sources may provide information to one or more indirect sources to facilitate giving answers to customers.

Automated Information Exchange

Information sharing within a single jurisdiction and across jurisdictions using electronic networks is a cornerstone of the CVISN initiative.

Standard IDs for Carriers, Vehicles, Drivers, Cargo, and Trip

To enable cross-referencing and standard look-ups in multiple information systems, a common scheme for identifying carriers, vehicles, drivers, cargo, and trip must be adopted for interstate and intrastate operators.

Carrier, Vehicle, and Driver Snapshots and Reports

Information exchange will be enabled through the use of standards. Many elements of CVO require information about the current and past safety performance and credentials status for carriers, vehicles, and drivers. Collecting the most-used information into standard messages will simplify systems since interfaces can be defined once, rather than negotiated between every pair of stakeholders.

Data Integrity, Security, and Ownership

Information systems are only as good as the quality of the data they use. Data must be accurate, current, and safe from tampering or unauthorized disclosure. Authoritative sources are the official repositories for the data.

Electronic Data Interchange (EDI)

Computer-to-computer exchanges between stakeholders will be standard messages that use the features of EDI.

Dedicated Short Range Communications (DSRC)

Communications between a commercial vehicle and ”roadside facilities” such as the carrier’s facility, CV Check Stations, or toll facilities will be accomplished using dedicated short range wireless communications. Standards are required to ensure that a vehicle can operate in multiple jurisdictions without changing equipment.

Information Use

The items listed above represent the major cross-functional concepts central to the information usage aspects of CVISN. Each will be described in more detail on subsequent pages. The concepts are also discussed under specific CVO capability areas in later sections of this document.

Use Data to Focus on High Risk Operators

Improving access to data will enable roadside and deskside activities to identify and focus on high risk operators.

Verify Data Before Citing

To streamline operations, data will be provided from the infrastructure on a daily or more frequent basis. But whenever a citation or other action with legal implications is about to be taken, enforcement personnel should check with the authoritative source to verify the status of any related credentials.

Clearinghouses

Each state requires that operators have valid credentials and pay fuel taxes. Under base state agreements, operators apply for credentials and pay taxes in base states. The base state must properly allocate fees and taxes to other jurisdictions in which the applicant operates. Central “clearinghouses” may be developed to handle the allocation of fees, sharing of supporting data, and initiation of electronic fee transfers among member states.

Limited Data Stored on the Vehicle

Limited data needed by the government will be stored on the vehicle's DSRC transponder. The data recorded on-board will enable roadside facilities to identify the carrier, vehicle, driver, and trip (trip required only for international border crossings). Other data written to the tag during a trip will make results of clearance and inspection activities available instantly to the next roadside facility and to the carrier.

Paperless Vehicle

By equipping the vehicle with a tag and using the identifiers retrieved from the tag as indices into infrastructure data, it will be possible to reduce or eliminate altogether the need to carry paper permits and other paperwork on the truck. Paper copies will become backup material rather than primary sources of credential information.

Electronic Fee Payment

Paying fees electronically will streamline administrative tasks.

Electronic Data Interchange

Electronic Data Interchange (EDI) is the electronic exchange of business information in a format that permits computer generation and processing of the message. This processing reduces or eliminates paper transactions, and allows automated processing storing of data. EDI standards and user implementation guides define the structure and meaning of messages passed between trading partners. The American National Standards Institute (ANSI) provides an infrastructure for defining maintaining open EDI standards. Use of EDI allows automatic message generation, processing and response. Thus, end user systems can preprocess and filter messages according to that user's particular requirements. Use of open standards supports the exchange of data among the thousands of computers involved in CVO. EDI transactions are largely system independent. This approach already has considerable support and use in the transportation industry. Implementation of EDI is supported by readily available commercial products using multiple communication options. The ANSI Accredited Standards Committee (ASC) X12 maintains and updates the standards as required to accommodate changing regulations, business practices, and technology. Initial development of EDI standards for CVO is concentrating on the X12 syntax. UN/EDIFACT, recognized by ISO as an international EDI standard, is not presently in wide use in American CVO businesses. As the UN/EDIFACT standard becomes more widely used, X12 transactions used in CVO will be migrated.

Since the message data comes from, and ends up in, a user data base, it is possible for other user programs to look at, and act on, the received information. In straightforward cases, this can extend to acting on the data and automatically generating a return message. Thus, for example, an electronic application by a carrier to register a vehicle might trigger an electronic approval, an electronic request to the carrier for more data, or a request for human assistance, depending on the content of the application.

Dedicated Short Range Communications (DSRC)

Dedicated short range communications (DSRC) allows data transfer between a moving or stationary vehicle and the roadside at a specific location. DSRC is a necessary element to deliver multiple ITS User Services to commercial vehicles: Commercial Vehicle Electronic Clearance (Domestic International), Automated Roadside Safety Inspection, Freight Mobility, Electronic Payments Traffic Control. A DSRC link consists of two elements: a roadside reader and a tag (sometimes called a transponder) located on each separable element of the vehicle. The CVISN goal for DSRC is to establish a family of tags with a range of capabilities. A basic tag (called a Type I or

Automated Equipment Identification [AEI] tag) would provide read-only capability of a single ID. It would typically be used on containers, trailers, and even some cargo. This type of tag is commonly used in rail and ocean shipping today. A read/ write tag would be used on the power unit. It could be stand-alone with a built in interface to the driver for ID entry, bypass notification, and in-vehicle signing. (A stand-alone read/ write tag is referred to as a Type II tag.) Or, it may be connected to a keypad, smart-card reader, or other control panel in the dashboard. (A read/write tag with an external interface port is referred to as a Type III tag.) It may also be connected to an on-board computer. The decision as to what (if any) tag to use is the carrier's. The goal is to be able to support the basic ITS User Services with a simple, inexpensive tag to encourage widespread, voluntary implementation by carriers. The DSRC is key to the concept of a "paperless truck". The tag would be used to store minimum ID information. This identification information from the tag would allow roadside readers and associated computer systems to locate detailed, current status information in the infrastructure (i. e., in roadside and administrative center computer systems). The DSRC tags would serve as the interface to support all roadside government applications. It may optionally be used by carriers to support their proprietary applications.

In addition to the ID information, applications will also record screening and payment events on the tag using standard formats. The screening event data will provide a record of the date, time, location, weight, bypass status, out-of-service (OOS) status. This record may be used by the carrier or the subsequent roadside check station. Carriers may have optional, proprietary applications that support writing other detailed shipping and tracking information on the tag. Establishment of a flexible, open DSRC standard allows proprietary definition of the contents of selected messages.

Paperless Vehicle

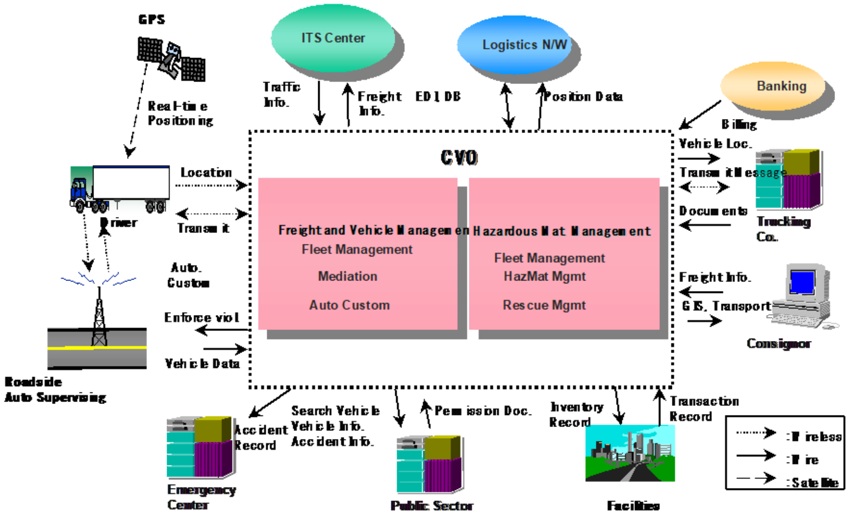
The concept of a paperless vehicle may be realized once a state has equipped roadside personnel with computers and network hook-ups sufficient to access safety and credentials data stored electronically in the infrastructure. Likewise, the state must make available to the roadside the information necessary to verify credentials status. Decals, bingo cards and stamps, registration papers, tax documentation, and special permits will be stored electronically off the vehicle in the infrastructure. If a vehicle is equipped with a transponder, the roadside system can read the identifiers from the tag and look up those IDs in the infrastructure to check safety and credentials status. If a vehicle does not have a tag, or the tag has malfunctioned, the same linkage can be made if the driver is able to provide the IDs to the roadside personnel.

Paper copies representing the credentials may be carried on the truck as back-up material, rather than the primary indication of proper credentialing. For this concept to become reality, legislative actions must be taken in many states. Electronic signatures must be accepted. Infrastructure data must be considered valid, and access to that data must be reliable. Additionally, the all enforcement personnel must be equipped with reader devices to access the IDs on the tag and data from the infrastructure. As more and more states embrace information systems and electronic data exchange, the reliance on paper documents on-board the vehicle can be reduced. Some credential evidence on the vehicle is expected to continue to be present to aid in safety and enforcement actions. A license plate, HazMat placard, and the transponder itself each represent on-board credential evidence that is likely to remain on the vehicle for some time to come. But a paper registration, paper permit, and other paper forms of credentials should be unnecessary except as back-up to the electronic systems. A paperless vehicle may be several years in the future, but the implementation of improved information systems and access methods should make it a possibility.

Electronic Fee Payment

To streamline CVO the payment of fees and commercial vehicle taxes should be conducted electronically. The existing banking networks provide the foundation for accomplishing electronic funds transfers for CVO. Carriers, owners, drivers, and other kinds of stakeholders in CVO are associated with some financial payment methods (credit account, debit account, etc.). Likewise, government agencies are associated with financial institutions and accounts. To accomplish electronic fee exchanges, the payers and receivers must establish standards for payments that are in concert with existing banking arrangement.

Figure 3. CVO constitution in Korea



CVO strategy in Korea

As a future plan, CVO programs will be deployed in three stages: stage 1 (present~2000), stage 2 (2001~2005), and stage 3 (2006~2010). In stage 1, early deployment of FFMS is planned and regional management centers will be established in Seoul and Pusan. In addition, operational tests are planned for automated electronic clearance services for trucks. In stage 2, regional management centers will be established in the six metropolitan areas (Seoul, Pusan, Daegu, Kwangju, Incheon, Ulsan). Operational tests are planned for

HMMS, and FFMS services will cover major highways and expressways, as well as the above-mentioned six metropolitan areas. In the final stage, CVO services will cover the nation-from urban areas to rural areas and from highways to arterial. Investment by the year 2010 is estimated to reach approximately 267 billion won (220 million dollars) for ILIS and 28 billion won (23 million dollars) additionally due to enlargement of services for HMMS, resulting in total costs of 295 billion won (243 million dollars).

The rise of logistics costs in recent years has become a grave concern of both the Korean government and private companies [2]. Due to insufficient budgets for infrastructure, the government vigorously started the national logistics system network, the ILIS (Integrated Logistics Information System); the system includes CVO services, which also appear in ITS. The gate automation service shows quite promising results, other container terminals plan to provide similar services. The results of Korea Telecom Inc. for vehicle tracking service are also promising, but the results are not statistically significant, other than the number of trips because the sample size was too small. The second operational test is scheduled for 1998, and we expect the test to show significant results. There are some obstacles in deploying CVO. The decrease in commodity flows due to the recent economic crisis in Korea is a major obstacle. Prices on some devices and equipment have increased rapidly because of a rise in exchange rates, which also delays the schedule of deployment. Nevertheless, as the government reduces investment in infrastructure, such as roads, railways and ports, ILIS and CVO are the only viable solution to reduce freight costs and logistics costs in the near future.

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