STEP BY STEP TOWARDS AN INTEGRATED INFORMATION SYSTEM FOR TRANSPORT COMPANIES AND THEIR CLIENTS

SAUNA-AHO Jussi
Ministry of Transport and Communications
P.O.Box 235, SF-00131 Helsinki, Finland

1. INTRODUCTION

Information technology can be and is used in many points and by many partners in the transport chain which begins from the shipper's warehouse and ends at the buyer's warehouse. The use of information technology is increasing rapidly and the development towards integrated information systems is obvious.
This paper describes three important parts of these systems, namely EDI (Electronic Data Interchange) for transmission of transport information, ADP-based registers of transport clients and their addresses, and identification of consignments and goods units.
The three parts mentioned above must be seen together but they are handled here as if they were consequtive steps.
Identification of consigment, goods and transport units connected with EDI, client identification and their addresses will create a good and effective tool for the management of transport chains in the coming years.
The development and use of international standards in every one of the three parts are especially emphasized.

2. STEP ONE: ELECTRONIC DATA INTERCHANGE IN TRANSPORT SECTOR

2.1 Advantages of using EDI

Today the trade and transport industry depends in their information dissemination mainly on paper documents as they have done over the last centuries. The Phoenicians developed the first foreign trade procedures and introduced a forerunner to the maritime transport document, the bill of lading about 1000 B.C. They sent five to seven B/L to their counterpart, but each B/L was sent via a different way in order to make sure that at least one of them could have reached the destination in those unsure circumstances.

Nowadays an international transaction - on average - involves 20 - 30 partners and the number of original documents is about 40. The number of copies of these documents may be as many as 300 - 400.

The disadvantages of using these paper documents are obvious but difficult to quantify. They might account for approximately 3.5

to 7 per cent of the total cost of the transaction.
These figures are impressive enough to stimulate facilitation measures and a number of studies have been made in order to streamline
the traditional procedures.

The cost of traditional documentation and delays in transport caused by irrational documentary procedures might add 10 to 15 percent to the final cost of the transport operation.

Introduction of automatic transfer processing of transport information will solve a great number of the problems that face the semi-manual procedure. It will also be economically attractive because it will lead to logical working processing as a byproduct.
The EDI or "paperless" transfer and processing of information should result in the following:
- decrease in errors due to manual intervention
- increased possibilities of improving cash flows
- improved facility to utilize data in the inhouse systems for statistical, logistical and financial purposes
- fewer errors in interpretation of messages when using internationally agreed standards
- more efficient use of the physical means of transport, as data can be made available at an early stage
- improved opportunities to analyse the company's activities and to get an overall view about the different functions and their role in company's activities; it helps to indicate the weak points and, consequently, to make them stronger
- perhaps the most important, co-operation with partners and finding joint EDI solutions builds insight on both sides which leads to long-term understanding and loyalty- the foundations of competitive advantage.

These should result in an immediate saving of up to 7 percent due to reduction of the paper work. Investment and operating expenses caused by computers correspondingly increase costs which even prudently estimated are not more than a half of the above mentioned costs.
Total savings thus represent 3-4 percent of the final price of the product.
Computerized data transmission, furthermore, gives numerous possibilities at strategic level. It may be stated that the present bureaucratic way of data transmission has no possibilities to meet the future requirements of trade and industry.
Certain changes in logistic concepts within the industry will accelerate the importance of EDI in freight transport. First of all, the transition to Just-In-Time production requires flexibility and rapidity in transport which can be reached either by increased transport capacity or intensified steering and control. However, the latter is practically the only commercially viable alternative.

Some transport areas are showing a trend towards smaller units resulting in a growing amount of data required per ton of cargo moved. This trend requires improved tele-informatics as well.
The cash flows can be accelerated by speeding up the data transmission, especially in trades where the form of payment is letter of credit. Considerable savings can be achieved if the data con
cerning the delivery of material reaches in real time the bank effecting payment.

The incresed use of EDI in transport will be sure and rapid as LaLonde forecasts (in Wandel's report (1). According to his study 45-80 per cent of all shipments are expected to have the main document on EDI by the year 2000 in Western Europe. Individual big companies report much faster penetration of EDI (Wandel (1).

2.2 COST 306 a European development project

In Europe it has been recognized that the freight transport industry plays a key role in European integration. A modern transport system is a key factor in this development. The transport system must be able to arrange the exchange of goods between countries in a flexible, fast and economic way. This requires introducing high level technology in freight transport. One feature of the high-tech is an efficient information system between different transport partners.

The Finnish wood and paper industry participated in a pilot project of EDI for its export transport in 1978. The experiment and its results were so encouraging that the conclusions drawn were "EDI has come to stay".

In 1983 Finland proposed a research project on the use of EDI in the transport sector to the COST Transport Committee. COST (European Co-operation in the Field of Scientific and Technical Research) is an EC (European Community) organisation that initiates and motivates collaboration on European high-tech projects.
The planning time of the project was three years and the project started at the end of 1986. The name of the project is COST 306 "Automatic Transfer of Transport Information".
The COST 306 is a forum for co-operation between governments, trade facilitation organisations, commercial companies and research institutes. Almost all Western European countries are involved in the COST 306 project, figure 1.

The first and major objective of COST 306 was to demonstrate the feasibility of computer communication of transport related data between trading partners in natural transport chains whe-

Franch	The Netherland
Federal Republic of Germany	Italy
United Kingdom	Spain
Denmark	Belgium
Sweden	Portugal
Finland	Austria
Norway	Yugo-Slavia
Switzerland	(EC Commission)

Figure 1 COUNTRIES PARTICIPATING IN THE COST 306 PROJECT

re those partners are in different European EC and EFTA countries (EFTA stands for the European Free Trade Association). This has after years of work resulted in the production of a COST 306 manual (2), which provides practical quidelines for the incorporation of automated procedures to accommodate the chain of transport events.

The principal activity of COST 306 is a demonstration project, where the developed transport messages are being trialled in international transport in a commercial transport environment.

Within the transport sector industry a considerable number of systems have been developed in recent years. These systems exist for airports, seaports, railways, road carriers, airlines, shipping lines, customs, etc. They have been based on different message standards and as a consequence there has been a certain proliferation of non-standard solutions. COST 306 contributes to the promotion of a standard solution in European transport.

The COST 306 messages are based on the international standards that have been developed by the United Nations Economic Commission for Europe (UN/ECE) in Geneva, notably:
- the Trade Data Elements Directory (TDED)
- the EDIFACT syntax rules; EDIFACT stands for Electronic Data Interchange For Administration, Commerce and Transport.
Both TDED and EDIFACT are ISO standards today.

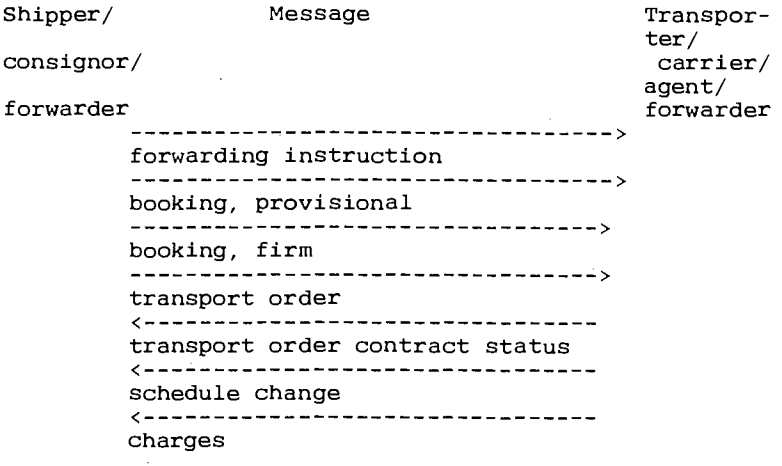
The COST 306 messages are derived from an International Transport Message Scenario ITMS. The project group of COST 306 has developed messages with the assistance of message group design experts from many countries in Europe.
The COST 306 messages (the information flow messages of the ITMS scenario) are seen in figure 2.

The COST 306 demonstration phase lasts until 1st May 1989. About 40 companies from 10 Western European countries participate in the demonstration. These companies include ship-

pers, shipping lines, forwarders, carriers, railways, consignees, port operators and port authorities.

2.3 Standards for EDI - when ?

At the first stage of EDI big companies developed their own strictly inhouse solutions. At the second stage the ANSI X.12-standards were introduced in the USA and the TDI-standards in Europe.
Now - at the third stage the development is leading to the introduction of global standards for EDI. These global standards have two parts: standards for creating the messages to be transmitted and the protocols used for the communication between computers.



The response message can be sent to in both directions:

Figure 2. COST 306 MESSAGES (INFORMATION FLOW MESSAGES OF THE ITMS SCENARIO) (2)

The global standards for data representation are called the UN/EDFIFACT-standards. Certain parts of these standars are already available, and some parts are still to be developed.

The EDIFACT gives the guidelines how to create the electronic messages so that the computers can handle them in a right way and the information in the form of electronic messages can be transferred from a computer to a computer irrespective of the type of computer and the type of communication used.

Based on the EDIFACT guidelines and standards, specific standard messages will be developed for different activities. The first approved standard message is the Commercial Invoice.

The so-called COST 306 messages have been taken by the EDIFACT Message Development Group MD2 and by the North American transport group as the basis for the first transport UNSM (United Nations Standard Message). This set of messages is called the IFTMFR (International Forwarding and Transport Message Framework). It is now under development.
During the year 1989 the manifest message will be prepared and included into the IFTMFR. The IFTMFR will be launched for trial use in September 1989 by the UN/ECE.

The use of EDIFACT-standard messages will be started firstly in international trade and transport. In Europe the use of EDIFACT standards has already been started by many companies but the 1993 (opening of the internal market of EC) will give a great impetus to it.
In the domestic transaction the use of EDIFACT will develop step by step in the 1990s.

The opportunities of using EDI will improve remarkably when the communication protocols are further developed. One step futher will be taken in February 1990 by which time the CCITT working group will define the contest of the X.400 protocol for EDI (P-EDI).

The introduction of international standards in EDI means that the transmission of information from computer to computer can happen in open environment. In other words the communication parties do not need to agree bilaterally beforehand on how to communicate.

Also, the support through new products by the hardware/software industry is increasing. E.g. when this paper was being written IBM announced a series of EDI translators that complement the products and support services available from IBM.

3. STEP TWO: NATION WIDE REGISTERS OF TRANSPORT CLIENTS AND THEIR ADDRESSES>

In order to transfer EDI messages from senders to receivers in information networks routing rules and identification of senders and receivers are needed.

When the use of EDI in the transport sector, as well as in other sectors, increases, the need to identify the EDI clients (message senders and receivers) will increase respectively. On the other hand, when transport information will be transmitted rapidly there will be a need for an effective way to find the plants of the transport clients.

In many countries several transport companies have already developed their own ADP-based registers on transport clients and their addresses. That is why the use of the computer-readable addresses will increase rapidly. Wandel (1) forecasts that 50-80 percent of all shipments are expected to have computer-readable
addresses by the year 2000 in the US and Western Europe but only 1-18 per cent in Eastern Europe.

However, one transport client can be a client to many transport companies. If and when every transport company creates and updates its own registers on clients and their addresses it means a multiple work and a lot of extra expenses. The solution to these two problems will be to create an ADP-based register on clients and their addresses (incl. geographical coordinates) which covers most of the transport clients in the country.

In Sweden the client and address register (Swedish Goods Address Number, GAN) was taken into use in 1987.
In Finland the feasibility study on the need and on the contents of the register (3) was made in 1987-88 by the working group set by the Ministry of Transport and Communications. The proposed contents of the Finnish client and address register is seen in figure 3.
The decision to make a detailed plan for building up the register will be made by the Ministry of Transport and Communication in the near future. Before the decision Parliament has to approve the bill which makes it possible for the enterprise identifiers to be publicized.

4. STEP THREE: AUTOMATIC IDENTIFICATION OF CONSIGNMENTS AND GOODS UNITS IN THE TRANSPORT CHAIN

4.1 Need for identification

The identification of consigment is needed in order to

Information on the enterprise

- name
- visiting address
- mailing address
- identifying number of the enterprise (known as business enterprise number given by the tax authority)

Information on the plant

- name
- visiting address
- mailing address
- one or several "goods transport" addresses
- one or several identifying numbers of "goods transport" addresses
- coordinates
- province (county)
- commune
- telephone number
- field of activity

Figure 3. PROPOSED CONTENTS OF THE FINNISH CLIENT AND ADDRESS REGISTER (3)

link the flow of information with the physical movement of cargo. This kind of system can bring both flows together as and when required in such a way as to enable control of despatch and delivery procedures, feedback on package status or directional sorting.

The freight movement should be as secure as possible. This requires that any individual consigment can be reliably tracked at any point along the logistic chain.

The solution to the problem mentioned above lies in the use of a single and unique identification "tag" by all the parties in the logistic chain. This is common at present only within companies or between business partners.

A package bearing a brief encoded message would become the key to additional or parallel information flows, as well as carrying a substantial amount of data in itself (4).

The identification methods to be discussed here concern goods

units (packages or parcels) and are based on the bar code technique. The other methods like escort memory which, for the time being, are mainly used for identification of transport units (railway waggon, container etc) are not discussed here.

4.2 Present day systems

The EAN 13 (EAN stands for the European Article Numbering Association) code is used widely in the mass production sector. This code serves either to identify the product itself, or to identify the package type of a specified number of units of the product. Such codes are unequivocal and therefore do not allow cross-indexing with individualised transport data or files. The system does however present the advantage of being based on the membership index of all major companies in the mass distribution sector, thereby permitting easier identification of each member than is possible by other methods (4).
The EAN 13 code has a wide use and they meet a real need as far as shippers, and above all retailers, are concerned.

The ODETTE (Organisation for Data Exchange by Tele Transmission in Europe) project has developed standard proposals for product and transport package identification to be used in the car manufacturing sector (5).
The ODETTE transport label is in two sections

1) An optional transport destination label containing "shipping" information with a recommended layout (e.g. customer address, unloading gate etc.)
2) A required transport package label containing "product" information (e.g. part number, quantity etc) to the same format as AIAG (AIAG-B-3 is the standard for shipping/parts identification labels recommended by the Automotive Industry Action Group in the United States).

The transport package label is itself in two sections.
a) A mandatory bar code section (part number, quantity, supplier code, serial number)
b) A special data area with a recommended layout (e.g. part description, date of manufacture).

The EDIFACT standard provides for the conditional use, in the message header, of a Common Access Reference (CAR). The CAR is created either by the buyer, the shipper or by the carrier. It allows successive data movements concerning any single trade to be permanently linked and indexed by means of a key comprising a maximum of 35 alphanumeric characters.
For the time being use of CAR is not wide, only some count-

ries, e.g. Finland, are using it.
The purpose of CAR would, in addition to identifying the transaction, also be to link the physical consigment to the transaction. However, for the time being the procedure of CAR does not extend to the identification of the package itself, and it is therefore useless in terms of tracking physical freight movements (see, however, chapter 4.4).

The UN Trade Data Element Directory (TDED) contains at Item No 7102 a suggestion for a consigment reference number (17 alphanumeric characters on several lines). But also here the nature of the information to be encoded has not as yet been specified.

Some companies have introduced their own "closed" identification systems. A package will be assigned an identification number for administrative purposes at the beginning of any movement. The number normally will also contain information on routing and eventual destination. The number of characters is limited, enabling them to be read rapidly and accurately.

4.3 An example of goods unit identification proposed for the Finnish forest industry

The Finnish forest industry is using the bar code as a goods unit (package/parcel) identifier but for the time being the use varies from a company to another. That is why the identifiers in use do not fill the needs of transport operations.

Based on the experience until now a proposal has been made for goods unit identification to be used in the transport of Finnish forest industry products. The main features of the proposal are as follows (6):

1) a goods unit identifier should serve mainly to trace the physical movement of goods unit (package/parcel) from a warehouse of a manufacturer to the warehouse of the client.

2) a goods unit identifier should be based on a 16 digit barcode (Interleaved 2/5 system which is a numeric code)

3) the contents of the code consists of two sequences as follows:
- the sequence of 6 last numbers are reserved for identification of the origin country and of the manufacture/factory
- the 3 first numbers identify the country

(ISO 3166 Codes) and
- the 3 last numbers identify the manufacturer/factory

- the sequence of the first 10 numbers can be freely used by the factory (according to its own needs).
E.g the first 4 numbers can be a contract/order number, the next 4 can be a package/parcel number and the last 2 numbers a year identifier.
Those factories that use an IFRA-code can select the first 8 numbers for a package/parcel number and the 9th and 10th number to a year identifier.

4) the tecnical features of the printable code must be similar by the all users.

The communication relations of the system are seen in figure 4.

4.4 Need for international harmonisation and standards of identification

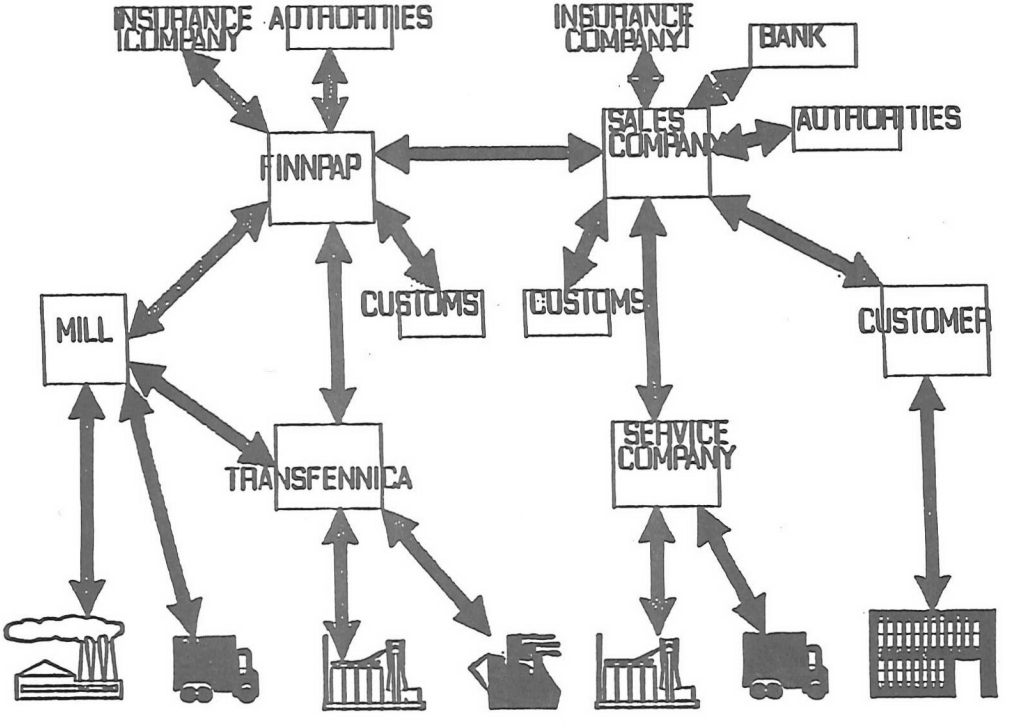
The present use of identifiers in the transport sector points out clearly that there is a need to create international standards for identification. Only then is it possible to make transport procedures more efficient and less costly.
In spite of the good development work carried out in some branches (e.g. ODETTE and forest industry) the need for standardising is great because the use of barcoding will increase rapidly.
LaLonde (in Wandel's report (1) forecasts that 60 to 85 percent of logistically thinking enterprises will use barcoding in their shipments by the year 2000.

The identification problems exist at many levels and they vary from one branch to another.

In transport operations there is a need to identify at least
a) a shipper
b) a consigment and, within it, a goods unit, such as a package or a parcel and
c) a transport unit such as a container, a railway waggon or a trailer.

For the time being there is no common acceptable solutions for these problems. Anyway there are attempts going on towards standardized solutions. Some of these attempts will be mentioned here.

Figure 4. COMMUNICATION RELATIONS IN A GOODS UNIT IDENTIFICATION SYSTEM ((9) Finnpap, M. Ojamo, 1989)



One is an introduction of the CAR (Common Access Reference) and developing it further. In 1978 the ECE/FAL Recommendation No.8 "Common Access Reference" was adopted, whereby i.a. Governements were recommended to adopt the CAR as a compulsory or recommended data element in relevant national or private documentary procedures. Based on some positive developments and experience the UN/ECE/FAL/WP.4 decided at its session in March 1988 to re-activate the work concerning CAR. The purpose of this decision is to study and, possibly, to revise the Recommendation No.8. Based on this decision two proposals made for UN/ECE/FAL/WP.4 in 1988 are mentioned here as examples: the one is a French proposal (7) (figure 5) and the other is a Finnish proposal (8) (figure 6).

The Transport group of EC TEDIS programme (Trade Electronic Data Interchange Systems) started also a study on the matter this year.

Hopefully, common standars can be created. Otherwise it is necessary to continue with branch standards and to develop more of them.

5. CONCLUSIONS

The use of information technology in the transport sector is rapidly increasing. The need for development towards integrated information systems based on international standards is obvious.
EDI (Electronic Data Interchange) for transmission of transport information is an essential part of the information systems. A necessary requirement for a wide use of EDI is the development of international standards; standards for creating messages to be used in transmission of transport information and standard protocols for transmitting the messages from one computer to another. The EDIFACT will be an international standar for creating of messages. Based on the EDIFACT and on the sectoral development work like the European COST 306 project transport messages will be developed. The IFTMFR (International Forwarding and Transport Message Framework) and the Manifest message will be available by the year 1990.

In order that the EDI messages can be routed from senders to receivers the client identification register, in addition to routing rules, is necessary. The client address register is also necessary in order that the transport from client to client is carried out effectively.

The identification of consigment and goods units makes it possible to state the status of consigment and to follow and locate the goods/transport units at certain points of a tran-

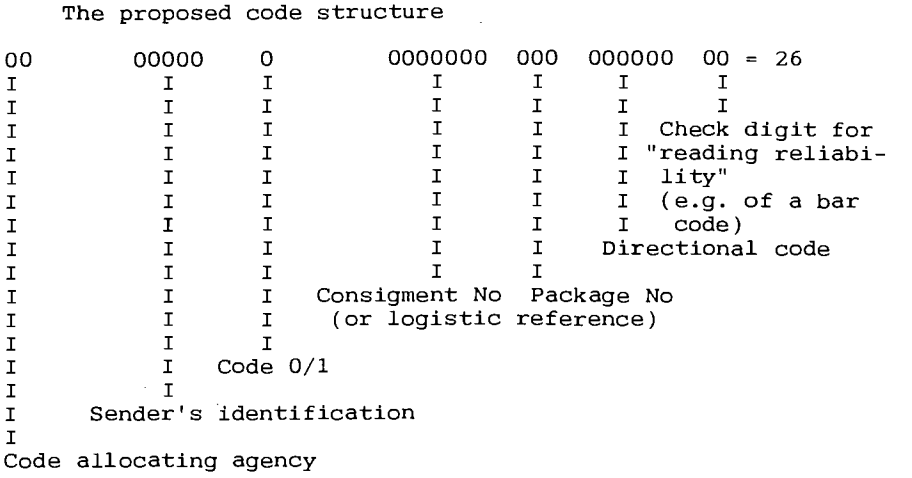
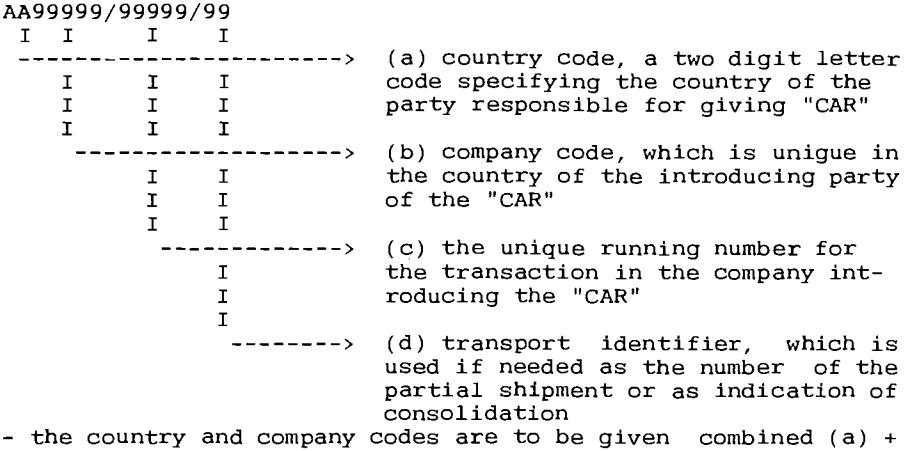


Figure 5. A FRENCH PROPOSAL ON IDENTIFICATION FOR TRANSPORT PURPOSES (7)



- the country and company codes are to be given combined (a) + (b)
- company code (b) is to be separated from the running number used in the transaction (c) by slash "/"
- the running number in a transaction (c) is to be separated from the transport identifier (d) by slash "/".

Figure 6. A FINNISH PROPOSAL ON CAR (8)

port chain, like in the warehouse, in port, at frontier points etc.
The EDI and the identification of clients (senders and receivers), as well as, the identification of consigment and goods units together will create a good and effective tool for the management of transport chains in the coming years. This is especially true if the development is based on the use of international standars.

REFERENCES

1. Wandel S. Telematics in Goods Transport, Round Table 78, European Conference of Ministers of Transport, Paris 1988
2. COST 306 "Automatic Transmission of Transport Information" Demonstration Manual, Final Version, March 1988 and Part II, August 1988, European Cooperation In The Field Of Scientific And Technical Research, Brussel.
3. Tavaraliikenteen asiakas- ja tavaraosoitenumerointi, Esitutkimus, Liikenneministeriö, Julkaisuja 25/88, Helsinki 1988
4. Harmonisation des proce'dures d'identification automatique des colis lie'e a` la normalisation des e'changes de donne'es informatiques dans le transport: EDI et codes a` barres, Synthe`se des travaux du GREDIT 1987/1988, Centre de Productivite des Transport, Janvier 1989
5. ODETTE Transport Label Standard, Draft, Organisation for Data Exchange by Tele Transmission in Europe (ODETTE), Group 8, Revision 1, 23rd June 1988.
6. Viivakooditutkimus, Osa 2 Kollitunnisteen kehittäminen, Osuuskunta Transfennica/Merikapt. Ilkka Varsio, 1989
7. A study on a standard unique consigment identification by Centre de Productivite des Transports (CPT, Paris), in UN/ECE/TRADE/WP.4/R.539, 6 June 1988.
8. A Finnish Proposal for Revision of ECE/FAL Recommendation No.8 "Common Access Reference", in UN/ECE/TRADE/WP.4/R.570, 23 December 1988.
9. Finnpap/Mr. Ojamo, Telephone discussion.