ON BOARD COMPUTERS

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Presented to the

Institute of Road Transport Engineers of New Zealand

SEVENTH INTERNATIONAL HEAVY VEHICLE SEMINAR

WELLINGTON

16 & 17 July 1998

On-board Computers-a social and commercial revolution in waiting for the road transport industry:

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Introduction:

The insistence of many to separate the technical or commercial aspects of industry from their social implications and context, has not only allowed many industries to avoid what some might consider their social responsibilities, but ironically, has blinded them to significant developments that would have had definite commercial benefits.

This condition seems particularly evident when we consider the introduction of information technology in the road transport industry and particularly when we look at the issue of on-board computers or information-based systems on heavy vehicles. Overwhelmingly these devices are asked to take on narrowly focused commercial tasks and ignore the enormous potential of such systems to enhance the operation of road transport in terms of safety, efficiency, career rewards and not least, but strangely, the "bottom line" for most operations.

The research that this paper arises from is a particular example of how the introduction of new technologies in an industry can not only be enhanced by social analysis, but also be redirected to include a complete network of social actors to achieve exciting new commercial initiatives.

In this case we investigated the social relationships that exist in the road transport industry by focusing on a largely neglected, but pivotal, member of the operation - the truck driver. A driver focused view allowed us to establish the ways in which drivers understand their world through interaction with one other and the extent to which they

tap into other available information sources. We could then extend our analysis of information systems to include the social relations that exist not only between drivers, but also between other critical stakeholders (managers, legislators, clients, suppliers etc.) and map (ethnographically) a network of transport industry people for whom information technology could provide significant benefit.

The product here then is not the technology, but mapping the social context into which such technology is required to operate. Further, by identifying a human framework within which this technology can operate, we have proposed an information tool using many available technologies that can be of benefit to all road transport industry stakeholders

The Driver as an Information Source and Receiver:

The research involved many hours of participant observation with drivers, which involves riding around with them during a typical working day. During the process we took extensive notes and later transcribed them and analysed them to establish a range of issues and, more importantly, the ways in which those issues are perceived and dealt with. This generated a picture of an industry from a driver view and allowed us to see not only the important issues, but also the amount of conflict or consensus drivers have towards those issues.

The most important discovery was that driver issues are not predominantly about the driving task itself, but mostly about the reception and dissemination of information. Further, the information mostly boiled down to issues of **Time** and **Load.** So what many see as worries about safety, government regulations, problems in source and destination yards etc. could often be expressed in terms of those two parameters. The important point is that the efficient transportation of goods is about knowing what you

are carrying, where it is and when it gets there. This might sound simple, but there are many instances in which those who require this information loose contact with the vehicle and its load.

The startling fact is that this information exists and is accessible by using existing information systems and channels. By concentrating on a driver-centred view of road transport, we have discovered that a powerful information receiver, storehouse and transmitter is not only under-utilised, but often ignored.

The most important finding here, then, is that the truck and the driver are an **essential information hub**. The truck and its driver carry immediate information about the load and its whereabouts. The driver carries much of the paperwork (invoices, bills of lading etc.) implicit in the commercial transactions and also information about the status of the truck and its legal requirements. There is also information the driver needs from external sources such as road conditions, new contracts or conditions at destination yards. So the situation calls for a complex network of information sites with the driver and his/her vehicle as an essential link in both sourcing and receiving information.

However, current providers of IT systems or on-board computers appear to have largely looked at the market as a series of independent or isolated problems and have merely managed to provide a set of largely unconnected solutions that are often badly realised. As a consequence the road transport industry rightly exhibits enormous nervousness towards the technology and its introduction.

This is not new. The whole world of IT solutions is dominated by poorly targeted solutions to perceived problems by software and electronic engineers (I can say this with some authority as I was one of them!). Unfortunately all too often they are ignorant of, or don't have the skills to examine, the social context and implications of

the problems and their solution. The important point here is not the existence of IT or a particular application, but the way in which all the stakeholders in an activity relate to themselves and others through the technology. Appendix 1 shows the range of technologies currently available to link the truck and its driver to all other parties interested in the road transport process. This is a powerful system, but it is only representative of possible connections between actual people. For it to function well it must examine the links as effective social relations and then specify the technical features to realise, construct or enhance those relationships.

So this project set out to not only understand how drivers communicate and construe their world, but also where that world is situated in terms of the other parties involved and how they all connect through information flows.

To try and map this process ethnographically, the field data were subjected to a range of analyses.

Stakeholder Analysis:

Here we examined all other persons or institutions that are present in the transport of goods by road. These include drivers themselves, industry organisations, transport customers, equipment suppliers, fleet operators, regulatory bodies, government departments, servicing organisations, other road user groups, insurance suppliers and even ourselves as researchers. The important point of this analysis was to establish what interaction was occurring between these groups, with the truck and driver at the centre. From this we began to look at the look at the information flows that were required to establish productive dialogue to address the issues arising from the field data. Also during subsequent analyses we returned to the stakeholder groups identified in this analysis to see how new perspectives such as changed situation or information flows etc, would be perceived by each of the stakeholders.

The stakeholder groups were further analysed to see how issues from the drivers, that had been identified as either consistent or contested, were influenced by these other groups. For instance we found much of the information about the load in a regulatory environment was largely consistent between drivers, as they were all required to obey the law. Although attitudes by waged versus owner operators in terms of knowing about excess load were different. But for say fleet operators versus owner operators, there were entirely different needs for such regulatory information, since one was involved directly with the driving task itself and the other was not.

The following diagram summarises the interaction between drivers and other stakeholders and particularly highlights links between the various groups. Part of the driver tool we have developed not only establishes new connections within this framework, but also with the important extra feature that it places information at the right place, in the right form and the right time.

Driver Centred View of Stakeholders

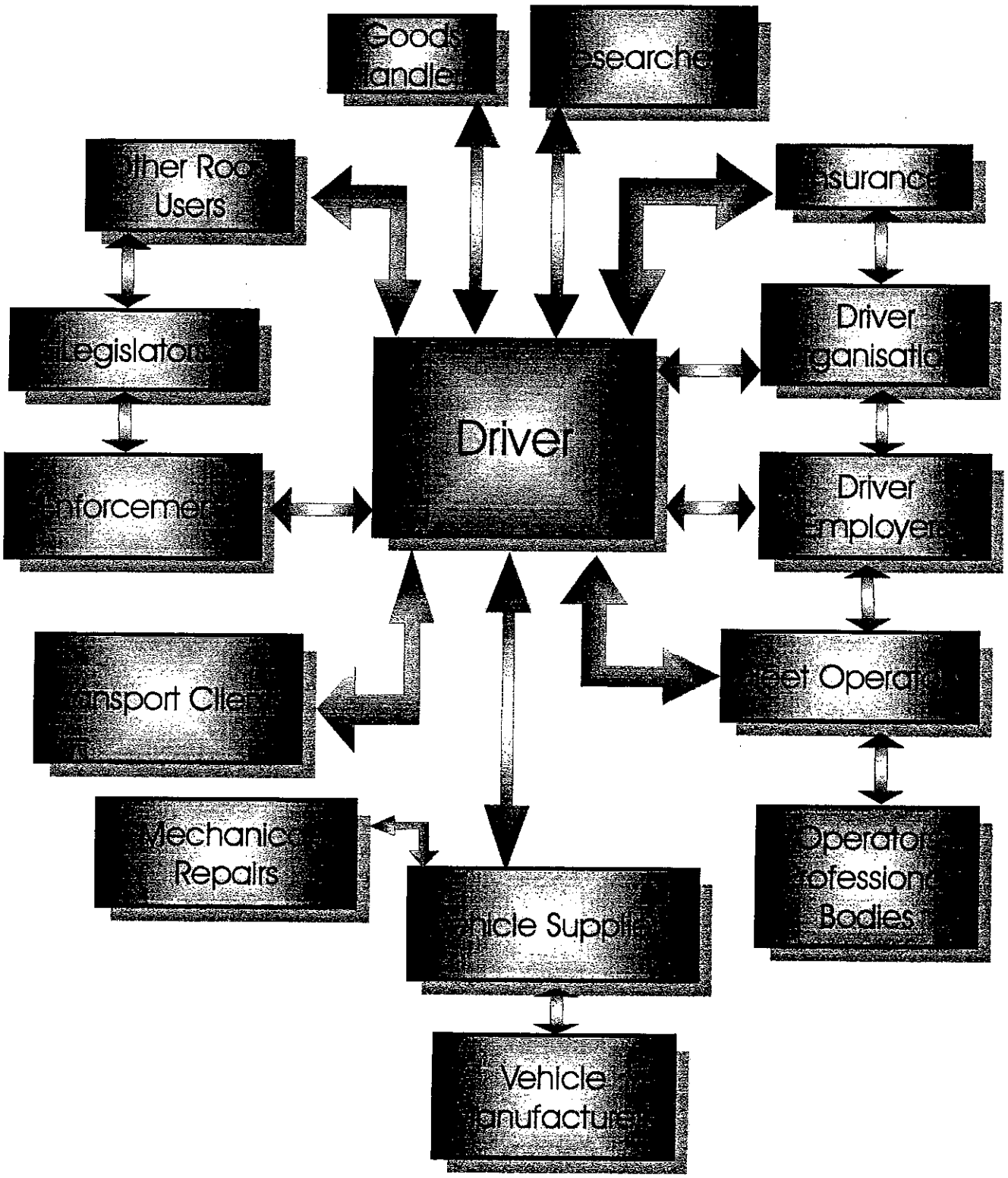


Figure 1

Situation Analysis:

The drivers and their problems were then analysed in terms of the position of the truck and driver. The information required at places such as on highway, at source yard, at destination yard, at the truck stop, the repair shop and at home doing the accounts was tabulated. This was analysed and formulated into a series of negative statements that formed objectives or a specification for a tool to solve the range of problems identified. Again the issues of load and time were evident, but here we could overlay them with a solution that involved the distribution of information through a system that modelled the driver and the truck as a significant element or hub of an interconnected information system. The result of this was to not only be able to take a more holistic approach to IT solutions for road transport, but we were able to propose a system that provides self improvement for drivers and others merely by engaging with it.

An original aim of mapping driver culture ethnographically was to come up with some "tool" to improve performance of the driving task. The tool now proposed does more than that. It integrates all other stakeholders and removes the need to propose one off solutions and allows ongoing performance reviews and solutions to perceived problems. So rather than a one off course on driver safety or some punitive regime to improve performance, this system provides interactive communication between stakeholders that attempts to place information where it is needed in a form that is appropriate. But more importantly it allows the stakeholders to select their information, change it were appropriate and comment on how the system could be improved or just highlight actual problems for other stakeholders to comment on.

Such a system is possible by using existent technology and integrating those functions by using our system specification.

Essentially we have been able to understand the power structures within the road transport industry and seen that the information flows are synonymous with power relations. The specification does not necessarily break down those structures; it merely allows stakeholders an appropriate view of their position within it. The ability to then engage in some dialogue should allow all stakeholders to participate not only in the development of road transport but to improve their position within it.

Existing Systems:

Part of the project involved a survey of existing on board systems. It was from this survey that we realised that the IT industry had selectively managed to identify many of the problems that were highlighted in our analyses. However the problem with their proposed solutions has really has been twofold.

Firstly they often proffer solutions that are confusing to non-users of scientific or computer-based systems. That is not everybody can operate or interpret the input and output devices that are considered trivial by long time users and designers. So we have a proliferation of systems that provide confusing or poorly accessible information. Some transport operators also question the reliability of these systems in a heavy vehicle environment. This is a real consideration as a number of systems do have reliability difficulties and have damaged the reputation of the technology in general. But systems can and are being designed that are perfectly reliable. This demonstrates an important principle regarding the social impact or implications of new technology. Certain issues can be part of the discussion surrounding its uptake, but they often obscure other conditions/ problems that are at the root of the rejection. Here, reliability is used to reject systems when they are really more interested in

obscuring illegal activity or perhaps some embarrassing ignorance of the technologies. Systems designers should therefore consider the technical competence and social situation of those affected by and using the technology.

Secondly and more importantly, is the fact that the solution to a specific problem is often the birth of another. So if the specification of an IT system is directed at a single problem or a particular stakeholder, it will often cause problems elsewhere in the industry. An interesting example of this is the driver reports generated by some vehicle management systems. Various parameters such as fuel flow, speed, brake applications are monitored and form the basis of a report to rate drivers over a prescribed period. Many of these are used punitively to supposedly improve drivers. However, we found that if this information is used to give drivers a chance to review themselves continuously, not only did the driving task improve in terms of efficiency, but they also encouraged other drivers to use and comment on their experiences and improvements. Drivers presented with a report and punishment also colluded, but, in their case, they looked for ways in which they could punish the operators through actions that the technology could not detect.

In the first instance, the communication between the operators and the drivers is constricted; in the second it is opened out and has commercial benefit for all.

In terms of the technology, the designers see a commercial opportunity to supply equipment to the operators who after all pay the bills. The problem is that everyone is second-guessing everyone else.

Again this is a cultural problem with designers who think they know best for the industry. "We are the experts able to second guess the industry". But the real experts in any industry are the participants and to solve problems it is normally necessary to have some sort of dialogue between interested parties. Often in the past this has not

only been inadequate, but also technically impractical. With the introduction of IT and a range of interconnection technologies (GPS, the Internet, high-speed data transfer across phone lines, RF, satellite etc.) we now have the environment in which it is technically possible to allow a comprehensive and commercially powerful dialogue between all our stakeholders. The irony is that the attitude of the industry and the technocrats often negates this possibility. It is difficult to let go an existing system, so new technology is often only adapted to perform pre-existing tasks and the possibilities for radical change are not realised.

For instance systems proposing the replacement of logbooks with electronic versions have been proposed. But what do the various stakeholders really want? There are many, and often conflicting, views. For instance some like the existing versions because they are easy to "fiddle". Others don't trust electronically recorded data not to be lost or interfered with. In fact the idea of logs is to monitor driving hours with a view to limit driving by drivers while fatigued. However it is often felt that driving hours is a poor measure of fatigue anyway, so any information system should be capable of adapting to new measures as part an integrated whole. The system then should not only look at existing needs, but the discussion surrounding those "needs" and continually propose and promulgate solutions in an open dialogic environment.

In appendix 3, we have constructed a chart of the huge range of available information technologies and looked not only at the functions they provide, but also the target end-user. Compare this with a system that targets all stakeholders by setting up an information loop that integrates all the functions on these charts. This research is saying that what is missing is the framework to link these functions and users. Such links are in fact **socio-technical interfaces** that not only allows the appropriate

linking of peoples and technologies but are dynamic in establishing a continual dialogue between the stakeholders to initiate change and development.

Pie in the sky?

No because the system proposed while holistic and inclusive, does not pretend to be the final answer. It merely provides the framework for the dialogue and the industry players provide the information and solutions through continuous re-evaluation of problems, solutions and ideas. It takes the process from a reactive isolated set of solutions to an evolutionary proactive approach.

The Tool Specification:

Here is what you've all been waiting for the answer to the universe, life and beyond. But I am afraid that in life things are not that simple. The research has identified a generic information system that can perform the function required. It has also some great suggestions as to what some of the actual features the tool will provide, but if I were to itemise these I would be no better than the existing systems. It is now up to the industry to take this approach and seed a system that starts working for and with it. In the coming months we will be running workshops that demonstrate the idea to the industry so they can determine the initial form of the system that they can pick up and run with.

So far then the system links the truck and driver to other stakeholders. The driver has access to a range of information that he chooses to look at. The information system is expandable to include any imaginable stakeholder. Access is via voice activated systems and usually does not involve unfamiliar interfaces. Drivers will establish a bulletin board to exchange information, but will also access directly regulatory functions (like paying road user charges etc.), commercial functions (invoicing,

advertising, generating weigh bills, paying insurance etc.), maintenance (the engine could talk directly to service sites).

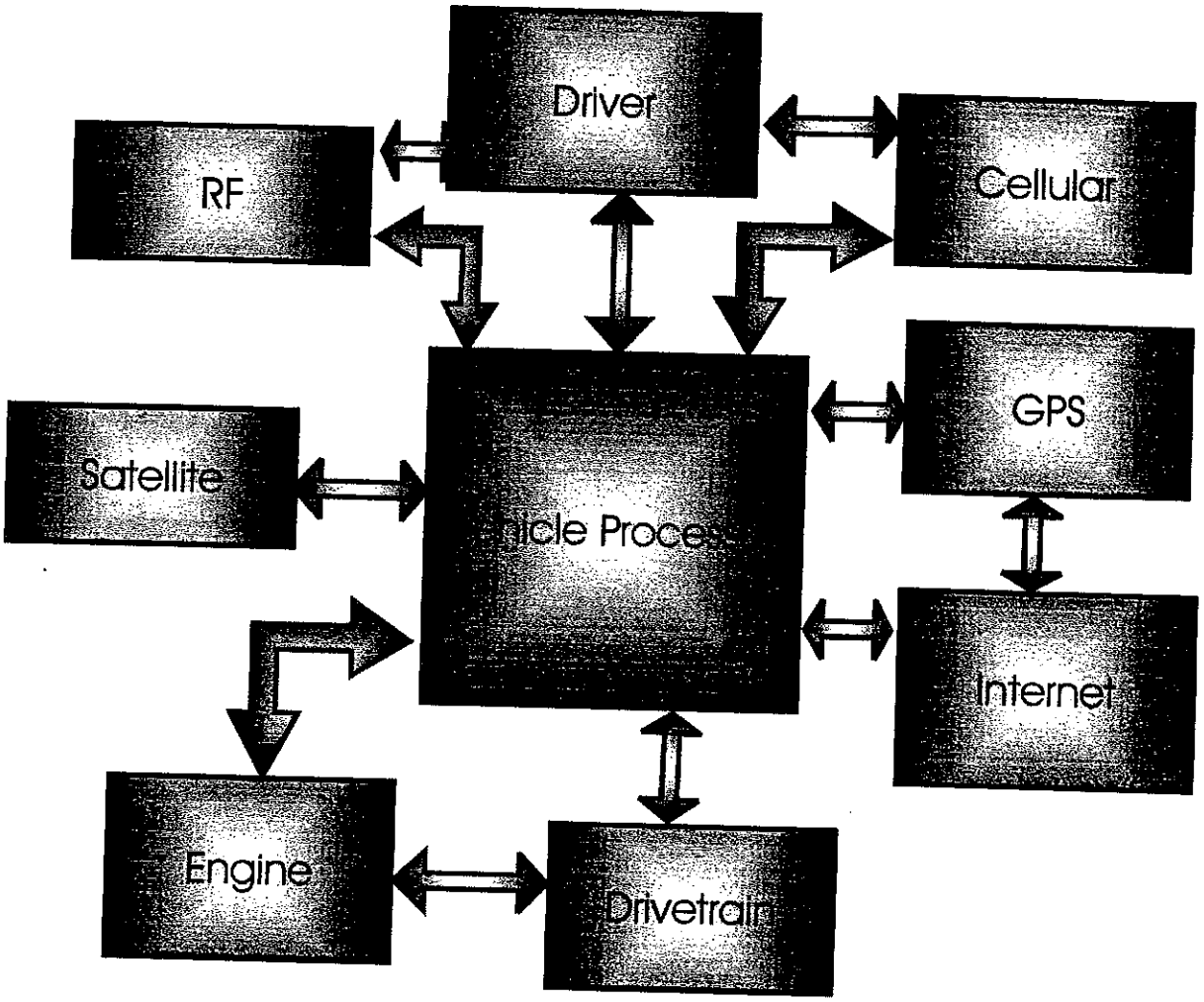
These ideas are not new, we just propose to link them and make them more accessible in a range of user-selectable and friendly forms. Given that scenario there is an immediate advantage in that the information provides far more benefit to the whole road transport industry and developments tend to take the whole industry with them and are less prone to be distorted by ill-conceived solutions to ill-defined problems.

Summary:

- Information technology exists and must perform in a social as well as economic context
- IT solutions must be conscious of being embedded in a complex social system
- Current IT offers some good specific solutions but needs to be integrated into an industry-wide and linked system
- We have proposed a social framework that links and provides an interactive evolutionary approach to the introduction and development of IT.
- The next step is to "seed" the system by agreeing specific actions with New Zealand road transport industry stakeholders

Appendix 1

Information Flows with Driver as Information Hub



* Note social relations are established through existing links and affected by establishing new links.

Appendix 2 Summary of On-Board Computer Products

PRODUCTS	FEATURES: Vehicle/Engine or Driver Performance																Vehicle Tracking			Communication			FORM OF OUTPUT					TARGET AUDIENCE		
	vehicle activity	engine activity	fuel	maintenance reqts	driving time	trip monitoring	distance travelled	driver activity/ driving habits	speed	braking	engine idle time	accel/deceleration	accidents/safety related events	warnings/alarms	driver coaching	tamper indicator	load/trailer info	vehicle location GPS	navigation	digital/electronic	fax	voice	digital/electronic	paper	tables	graphs	various	management	drivers	insurance companies
AT Inc Logitrak Vehicle Tracking Software																	X	X	X	X			X					1	2	
Automatic Data Logging Systems Inc Ontrak Trucklog	X	X	X	X	X		X	X	X		X						X	X		X			X					1		
Compucat Vehicle Tracking System					X	X	X	X	X			X					X	X	X	X		X					X	1	2	
CS Electronics TrakManager	X	X			X	X	X	X									X	X		X		X						1	2	
Cummins Inroads Reporting Software																				X			X	X	X	X	X	1	2	
Cummins/Cadec Celect RoadRelay	X	X	X	X	X	X	X	X	X	X	X		X	X	X					X			X				X	1	2	
Data Burst Technologies																		X	X	X		X					X	1	1	
Datumtech Corp. AVL & DataLogger	X		X		X		X		X									X		X		X	X		X	X	X	1	2	
Davis/CCSI DriveRight	X			X	X	X	X	X	X			X	X	X		X							X	X	X	X		1	2	
Detroit Diesel Corp. ProDriver		X	X	X	X	X	X		X	X	X		X	X									X	X				1	2	

CONT.

Key X-Feature Present; 1-Primary Concern; 2-Secondary Concern: 3-Some or Minor Concern

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Drivemate	X	X	X		X	X	X		X	X	X		X		X		X	X					X	X	X	X		1	1	3
Dynafleet Information System		X	X		X		X	X	X								X	X	X	X		X	X					1	2	
Eaton Fleet Advisor	X		X			X		X	X		X	X						X		X			X	X	X	X		1	2	
Electronic Design Company/Orbital	X					X		X	X					X				X		X		X	X					1		
Elexor Associates Inc VMS	X	X	X			X			X	X	X	X		X			X			X		X	X				X	1	2	
Fleetcom EVAS	X	X	X		X	X	X		X		X		X	X				X		X		X	X	X	X	X	X	1	2	
HighwayMaster																		X		X	X	X						1	2	
Intouch AVL Technology									X								X	X		X	X	X					X	1	2	
Invertix Fleet Monitoring System	X					X												X										X		
Kivtronics Co-Driver VMS	X	X	X		X	X		X	X	X	X		X	X	X								X				X	1	2	

CONT.

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Leafield AVM Ltd VeMIS	X	X	X		X	X	X	X	X	X	X		X	X	X		X	X		X			X				X	1	2	
Likkuva Systems Retki VLR System						X												X	X	X		X	X					1	2	
Likkuva/ ComROAD ITS	X								X									X	X	X		X	X					1	2	
Magellan GPS Equipment																		X	X	X									1	
Neotech Mobile-Trak I & II	X				X	X	X	X	X		X	X				X		X		X			X	X	X		X	1	2	
On-Board Computers	X	X				X												X	X				X						1	
QUALCOMM OmniTRACS	X	X	X	X		X	X	X			X		X				X	X		X			X	X				1	2	
Scientific Atlanta Orbcomm		X															X	X		X										
Simac Systems Logiq Interactive Fleet Mgt System		X							X					X			X	X		X		X	X	X				1	2	3
Xata Fleet Mgt System	X	X	X	X	X	X	X	X	X	X	X		X					X	X	X		X	X				X	1	1	

Key X-Feature Present; 1-Primary Concern; 2-Secondary Concern: 3-Some or Minor Concern