Appendix I - Decision Support Tools

NB: The following has been extracted from Section 11 hence the numbering system.

11.6.1 Introduction

A Vehicle Incident Decision Support Tool (DST for short) is normally used in a revenue service environment to help train drivers and fleet control/maintenance centre support staff isolate train system faults, expediently, and determine the most effective course of remedial action based upon prevailing network circumstances.

The implementation of a systematic, computer based DST is considered business critical by many TOCs and forms an important part of any modern fleet management programme. Whilst the degree of system functionality may vary significantly between organisations, it is generally acknowledged that the principal objectives of the system should strive to achieve the following:

- The continuous development of Fleet/Operations relationships.
- Encourage train crew feedback on technical issues affecting revenue service.
- Minimise network service delays.
- Promote a culture of transparency and mobility of information.
- Conform to railway authority regulations where required.
- Drive reliability growth.

The benefits of implementing a DST are numerous and feedback from TOCs with live systems suggests that:

- There is a genuine return on investment/the process adds real value.
- Delays per incident are improving.
- The best systems incorporate a Defective on Train Equipment (DOTE), assistance guide, event timer and facility to export data to other TOC systems for post incident review.
- User engagement is increasing.

Example: FCC (now GTR) reported an incident data capture rate of circa 60% and Southern 90%.

11.6.2 System Automation & Staff Interaction

Ideally, the DST system should be internet hosted and Microsoft Windows compatible, relational and accessible from a range of proprietary IT devices including: tablets, smart phones and laptops.

The system should provide a standard template fault tree that can be populated with textual or pictorial information and uploaded into the main system database for fleet use. Some typical examples include the following: a diesel multiple unit may have fields for power packs, gear boxes, hydrostatics, etc.; and an electrical multiple unit may have fields for traction motors, transformers, and propulsion electronics. Some form of interactive DVD or virtual image architecture can also be employed to aid incident management such as the Interactive Virtual Train (IVT) tool described in Section 11.6.9 of the 20pp.

The system should automatically progress through the fault finding process based on feedback from the user in the form of question and answer prompts.

It is recommended that suitable interactive training materials or modules are included as an integral part of the system to ensure user skills are recorded and maintained. This may form part of a separate competence database or internet hosted facility.

Example: C2C Rail Ltd is moving towards a Google based competency system.

11.6.3 Timing Monitoring

When a train fault occurs and the DST system is accessed a timer should commence such that the elapsed time is flagged to the user in predetermined intervals, normally 5 minutes. In this way the time associated with fault diagnosis and corrective action can be monitored and/or recorded and subsequently used to inform reliability metrics (e.g. MTIN and DPI).

11.6.4 Location & Time Specificity

It is important that the system has the ability to account for the time and geographic location of a technical incident when communicating service critical information between driver and control centre so that effective decisions can made quickly based upon the prevailing circumstances.

Example: it would be critical to move a unit as soon as possible if there was a rush hour incident at Waterloo Station; conversely, during a rural off-peak incident the fleet management team may attempt to remove power and reset the faulty equipment in the first instance.

Ideally, the DST should be compatible with existing Global System for Mobile Communication – Railway (GSM-R) technology.

11.6.5 Interfaces

11.6.5.1 Links to DOTE & Assistance/Vehicle Recovery

Where a DOTE or similar management system exists, the DST should have relational functionality such that the rules for isolations and running rolling stock in a degraded mode are respected. The link should also permit the communication of information governing vehicle recovery, in particular the assistance policy relating to: the recovery of vehicles with another in-service unit or consist; preferred fleet configurations; available maintenance facilities and; platform constraints.

11.6.5.2 Links to Maintenance Management Systems & Other Data

Ideally, the system should be sufficiently flexible to permit communication with/access to information from other maintenance management systems and databases (e.g. TRUST, Bugle, Equinox, Genius, etc.). Some typical methods include: an html internet based tablet/smart phone system, which supports remote access; downloading fault logs for manual input to the maintenance management system; links to the incident history database for trend analysis; an engineering developed online wiki based system linked to trainbourne remote condition monitoring devices.

11.6.5.3 Links to Trainbourne Condition Monitoring

Some of the most advanced systems utilise trainbourne remote condition monitoring technology (RCM), which can be accessed remotely to diagnose faults, recognise tolerances and identify potential faults before they occur.

Example: Southeastern fleets have been fitted with RCM. As soon as a fault is logged, a breakdown of train systems and failure modes is made available, which the driver can then communicate to the control depot. The depot can subsequently access the system, obtain a cab view, isolate the fault, diagnose the problem and recommend a solution.

11.6.5.4 Recording System Usage

It is important that post event data is recorded and made available between systems so that it can be subsequently consolidated to inform performance analyses and reports including common reliability trends and metrics, return on experience, lessons learned, etc.

11.6.6 Change Control & Information Maintenance

Whenever business critical information is distributed for use within an organisation it is necessary to formally control its maintenance by establishing suitable review, approval and issuing mechanisms/authorities. The same is true when implementing a DST system, regardless of whether it is paper or internet based, and will ensure that fleet management/maintenance staff are working to accurate and current information. The challenge for TOCs, however, is to develop a practical application that is commensurate with its needs without losing control of technical content.

Whenever new fleet technology is introduced, or existing fleets undergo a modification programme, consideration of the impact to the DST should be part of the change control process.

11.6.7 System Implementation

11.6.7.1 Strategy & Funding

To ensure a fleet DST system is implemented successfully it is important that the initiative is addressed at a strategic level and justified by a robust business plan. Once a suitable business case has been developed and approved, a top-down management approach is recommended to ensure all the necessary resources are made available (e.g. manpower, planning and training; investment and funding; development, validation and integration requirements; regulatory compliance, etc.).

TOCs may wish to consider funding sources such as Future Railways, etc.

11.6.7.2 In-house Development

One cost effective solution may be to develop a system utilising existing in-house engineering and IT resources. This method can provide greater flexibility of resources and has the added benefit of ensuring that system requirements are customised to meet specific business demands. Whilst a number of proprietary virtual assistant technology tools exist, a good example of a generic application for managing customer conversations across mobile, web, and social media channels is the V-Portal product supported by Creative Virtual (http://www.creativevirtual.com/v-portal.html). A mock up can be found here: http://173.204.116.213/fleetdemostaging/.

11.6.7.3 Existing System Utilisation

A number of TOCs already employ DST systems and these are described in more detail in Section 11.6.7.4 below. It follows, therefore, that if mutually acceptable terms were agreed, the development of existing system architecture could be explored as an alternative to the in-house method outlined in Section 11.6.7.2 above. Such agreements would normally necessitate the drafting of formal contractual documents to safeguard any commercial and Intellectual Property Right (IPR) arrangements (e.g. nondisclosure and licensing requirements, copyright protection, patent and trademark registration, etc.). 11.6.7.4 Overview of Existing TOC Systems

Some examples of specific decision support tool applications follow:

- Southern has a 'Managing Train Fault Database' (MTF) that provides consistency for fault rectification. It includes a defect matrix and spreadsheet of on-call engineers. Drivers are taken through a step by step guide of what to check for in different scenarios. If it is unclear what the failure is then key critical questions are asked in the early stages. All drivers on the Southern network have access to mobile phones.
- Southeastern has an extensive engineering developed online 'wiki' based system that utilises ontrain remote condition monitoring. Remote access is via tablet or smart phone. A 'yardboard' gives an overview of depot activities and restrictions.
- C2C has complimented their paperback aide memoire system with an html internet based flowchart application that is available on tablets and smart phones. A teleconference facility between drivers, signallers, controllers and technicians is also planned for the future.
- First Group has an extensive web based fault tree system that permits external access. Remote access trials are underway using tablets. A dashboard gives visibility of all live incidents raised.
- London Midland adopts a general training aid that identifies critical systems and components using photographs and schematics.

11.6.7.5 Generic Customer Requirement Specification (CRS)

A generic CRS for a Vehicle Incident Decision Support Tool has been developed by ATOC in collaboration with various industry stakeholders and is included as Appendix G of the 20pp for reference. The CRS addresses both commercial and technical requirements and can be used as a guideline for DST development/procurement.

11.6.8 Incident reduction tools

The list below is some examples of incident management tools which are used by several different TOCS, the list is not exhaustive but shows where certain concepts could be developed to meet individual company requirements. It should be noted that all the concepts shown below can be used on several different media types from paper, smart phones and tablets etc.

IVT – Interactive Virtual Train is a tool that has been designed to simulate the workings of various types of roling stock through an interactive DVD. It contains Computer Generated Images (CGI), video segments and written documents on a range of train based equipment and failure modes. It can be used for a wide range of activites such as training, incident management, fault finding and simulation of defects all in a safe environment with no need to take a resource out of traffic.

DOTE – every TOC should have a 'Defective On Train Equipment' standard. This will have been risk assessed to ensure that all failure modes have suitable response and locations to take out of traffic are correctly documented. The standard will include mitigations that are needed for degraded

working modes on stock (such as example speed restrictions) to enable it to remain in traffic where this is permissible.

Virgin Trains uses the concept of a B6 document. This is a contingency planning document that details on a fleet basis how a failed train can be used for the remainder of the current journey and then for the remainder of the day. This document is issued to the Fleet Engineer, Control and drivers so that everyone involved in a failure is clear on what actions are required limiting confusion in the event of a failure.

Some TOCS have on line tools which show where isolation cocks are located and also the procedure for carrying out the isolation. These tools are used by the fleet engineers within the control centre; this information is then passed onto the driver at the incident. This process enables the driver to be guided and thus reduce the overall incident time. These online tools also contain much more information on incident reduction techniques. Southern Trains have developed an online Management of Train Failures tool with guides for the controller which allows for accurate information to be passed to the driver.

Phone a friend – Northern, Southern and SWT have a Maintenance Controller working 24/7 in each Control office (Manchester/York). All staff that requires technical assistance will contact the Maintenance Controller, who will direct them accordingly and in conjunction with the Control team make the most suitable decision to manage the situation.

Fleet cards/in cab notices (layout of train) - this enables the driver to have all the phone numbers which are critical to managing an incident. In cab notices allow for exactly the same numbers of the fleet cards but it also shows a layout of the train depicting axle numbers etc.

Aide memoirs – are concise small guide books which are used to remind the driver of what to do in the event of a train failure e.g. the sequencing of isolations as well as giving critical information such as train layout, critical phone numbers etc. These have proved quite successful for fleets where failures are getting rarer due to improved reliability.

Train position mapping – this is often achieved from the Wi-Fi positioning and some TMS systems. This allows a map to be viewed of where all the fleet are positioned simultaneously and also allows for the positioning of a failed unit relative to access points and hazards such as canals, rivers etc.

RCM - Remote Condition Monitoring – Trains may be fitted with various methods of RCM. This will vary between fleets depending on the TOC, age of fleet and level of investment that has been made. Some examples of RCM would be engine monitoring systems, door monitoring systems, remote OTMR downloads, GPS based systems, electrical monitoring systems etc. As technology develops it is expected that more and more RCM systems will be fitted to trains

Blocks – on West Coast there is an agreement that where a failed train needs to extend its couplers that a driver requesting a block will be granted the block as a priority, this is to minimise overall delay. This priority also applies to other failures where line blockages are required to inspect the train. In many cases it is better to take the block early rather than to delay.

Southern have a ‘Managing Train Fault Database’ (MTF) that provides consistency for fault rectification.