Appendix I - Decision Support Tools

The following has been extracted from *Section 12*.

12.6.1 Introduction

A vehicle incident Decision Support Tool (DST) 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 on 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 principle objectives of the system should strive to:

- Continuously develop fleet/operations relationships.
- Encourage traincrew 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 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%.

12.6.2 System automation and 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, smartphones and laptops.

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.

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.

12.6.3 Timing monitoring

When a train fault occurs, and the DST system is accessed, a timer should commence to flag the elapsed time to the user at predetermined intervals, normally 5 minutes. This allows the time associated with fault diagnosis and corrective action to be monitored and/or recorded and subsequently used to inform reliability metrics (e.g. MTIN and DPI).

12.6.4 Location and time specificity

The system must be able 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 on prevailing circumstances.

> Example: It would be critical to move a unit as soon as possible if there were 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.

12.6.5 Interfaces

12.6.5.1 Links to DOTE and assistance/vehicle recovery

Where a DOTE or similar management system exists, the DST should have relational functionality to respect the rules for isolations and running rolling stock in a degraded mode. 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.

12.6.5.2 Links to maintenance management systems and 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 are an html internet-based tablet/smartphone system, which supports remote access; downloading fault logs for manual input into the maintenance management system; links to the incident history database for trend analysis; an engineering developed online wiki-based system linked to trainborne remote condition monitoring devices.

12.6.5.3 Links to trainborne condition monitoring

Some of the most advanced systems utilise trainborne 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.

12.6.5.4 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.

12.6.6 Change control and information maintenance

Whenever business critical information is distributed 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, as it will ensure that fleet management/maintenance staff are working with accurate and current information. The challenge for TOCs, however, is to develop a practical application 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 on the DST should be part of the change control process.

12.6.7 System implementation

12.6.7.1 Strategy and funding

To ensure a fleet DST system is implemented successfully, it is important that it is addressed at strategic level and justified by a robust business plan. Once a suitable business case has been 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 Innovate UK, RSSB Grant, etc.

12.6.7.2 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 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 (creative virtual). A mock up can be found here: fleet demo staging.

12.6.7.3 Existing system utilisation

A number of TOCs already employ DST systems and these are described in more detail in *Section 12.6.7.4* below. It follows, therefore, that if mutually acceptable terms were agreed, the development of existing system architectures could be explored as an alternative to the in-house method outlined in *Section 12.6.7.2* above. Such agreements would normally necessitate the drafting of formal contractual documents to safeguard any commercial and Intellectual Property Right (IPR) arrangements (e.g. non-disclosure and licensing requirements, copyright protection, patent and trademark registration, etc.).

12.6.7.4 Overview of existing TOC systems

Some examples of specific decision support tool applications:

- 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 online 'wiki'-based system that utilises on-train remote condition monitoring. Remote access is via tablet or smartphone. A 'yard-board' gives an overview of depot activities and restrictions.
- C2C has complemented their paperback aide memoire system with an internet-based flowchart application that is available on tablets and smartphones. 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

London Midland adopts a general training aid that identifies critical systems and components using photographs and schematics.

12.6.7.5 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. The CRS addresses both commercial and technical requirements and can be used as a guideline for DST development/procurement.

12.6.8 Incident reduction tools

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

- Interactive Virtual Train is a tool that has been designed to simulate the workings of various types of rolling 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 various activities such as training, incident management, fault-finding and defect simulation, all in a safe environment with no need to take a resource out of traffic.
- Every TOC should have a 'defective on train equipment' standard. This will have been risk-assessed to ensure that all failure modes have suitable responses, and locations to take out of traffic are correctly documented. The standard will include mitigations needed for degraded working modes on stock (such as speed restrictions) to enable it to remain in traffic where permissible.
- Virgin Trains uses a B6 contingency planning document that details on a fleet basis how a failed train can be used for the remainder of the current journey and 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.

- Some TOCS have online tools which show where isolation cocks are located and the procedure for carrying out the isolation. These tools are used by fleet engineers within the control centre; this information is then passed on to the driver at the incident. This enables the driver to be guided, thereby reducing 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.
- Northern, Southern and SWT have a maintenance controller working 24/7 in each control office (Manchester/York). All staff requiring technical assistance 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 ('phone a friend').
- Fleet cards/in-cab notices (layout of train) enable the driver to have all phone numbers critical to managing an incident. In-cab notices allow for exactly the same numbers as the fleet cards but show a layout of the train with axle numbers, etc.
- Aide memoirs are concise guide books 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 critical information such as train layout, critical phone numbers, etc. These have proved quite successful for fleets where failures are less common due to improved reliability.
- Train position mapping often uses the Wi-Fi positioning and TMS systems to provide a map of where all the fleet are positioned simultaneously and also the positioning of a failed unit relative to access points and hazards such as canals, rivers, etc.
- RCM (remote condition monitoring) is fitted in trains in different forms and will vary between fleets depending on the TOC, the age of the fleet and the level of investment. It could be engine monitoring systems, door monitoring systems, remote OTMR downloads, GPS-based systems, electrical monitoring systems, etc. As technology develops, it is expected that RCM systems will become increasingly common.
- On West Coast there is an agreement that where a failed train needs to extend its couplers, a driver requesting a block will be granted it as a priority 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 implement the block early rather than delay.

Southern have a managing train fault database (MTF) that provides consistency for fault rectification.