

Variable Crewing Research and Policy

Single Crew Test Design

Submitted to:



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APPENDICES

For Appendices, see separate report titled “Single Crew Test Design – Appendices.

GLOSSARY

CCD	CCD Design & Ergonomics Limited <i>A specialist Ergonomics and Human Factors Sub Contractor</i>
CCTV	Closed Circuit Television
DRA	Dynamic Risk Assessment
HA	Highways Agency
HF	Human Factors <i>Refer to report text for further details</i>
HFO	Human Factors Observer <i>A Test Participant, refer to report text for further details</i>
IMP	Incident Management Policy team (HA)
RCC	Regional Control Centre
SME	Subject Matter Expert <i>A Test Participant, refer to report text for further details</i>
TO	Traffic Officer
TOS	Traffic Officer Service
VMS	Variable Message Sign
ETM	Emergency Traffic Management
PT1	Pilots and Trials 1 <i>Highways Agency internal procedure</i>
KPI	Key Performance Indicators
TLC	Traffic Learning Centre <i>Highways Agency training department for Traffic Officers</i>

1 EXECUTIVE SUMMARY

- 1.1 The Incident Management Performance Team (IMP) is one of three teams making up the Network Policy Group within the Highways Agency's Network Service (NetServ) Directorate. The Group's mission is "to research, develop and deliver first class policy, advice and techniques to improve the operational performance of the Strategic Road Network".
- 1.2 The Highways Agency intends to deliver greater benefits through the Traffic Officer Service (TOS). There is unlikely to be any further funding available for additional staff, therefore this will have to be achieved through improvements in efficiency of the service. Variable crewing is being considered as one means of making these efficiency improvements.
- 1.3 The Incident Management Policy Team have been commissioned by the Traffic Management Division to explore the feasibility of variable crewing and its impact within the Traffic Officer Service, specifically at this stage to undertake a Network Test of single crewing.
- 1.4 For the purposes of this study, variable crewing includes the deployment of variable numbers of Traffic Officers (TO) within a patrol vehicle based on an assessment of need and prevailing conditions. A pre-requisite for the feasibility of variable crewing is that it is possible to operate single-crew patrols safely on the Network.
- 1.5 A test to determine whether a single-crew can operate safely is designed. This work has been carried out following the principles and methodology set out in the "Guide for the Design, Management and Delivery of Pilots and Trials on the Highways Agency Network".
- 1.6 This report considers the milestones of the project to date which are geared towards carrying out a test of single crewing on the Highway's Agency network.

2 INTRODUCTION

2.1 This document describes the methodology and development of the proposed Traffic Officer (TO) Single Crew Test, to be carried out on the Highways Agency's (HA) network. This test forms part of a larger programme examining the feasibility of introducing Variable Crewing of the Traffic Officer Service (TOS). The process by which the test was developed is described in detail in this report.

2.2 The report describes:

- Test Aims & objectives
- Test success criteria
- Test Operational Design (what the test is and how we keep it safe)
- Test Measurement Design (How the test will work)
- Test Logistics Design (Who will take part, when and where)

For further details refer to the Appendices to the report.

2.3 A pre-requisite of any on-network testing is that a form PT1 (Pilot and Trials 1) is signed as part of the HA's internal governance procedures. A form PT1 has been signed for this project and is available in Appendix E.

3 BACKGROUND

3.1 The HA's IMP Team is undertaking a programme aimed at improving incident management and associated policy. As part of this programme the HA appointed Jacobs to develop previous work relating to variable crewing of the TOS.

3.2 The previous work concerning TO variable crewing concluded that:

3.3 "A pre-requisite for the feasibility of variable crewing is that it is possible to operate single-crew patrols safely on the network"

3.4 The HA therefore wish to determine if Traffic Officers can operate on the network single crewed. This necessarily requires work to determine the controls and risk mitigations that will facilitate lone TO activity, whilst maintaining an acceptable safety tolerance.

3.5 The HA has decided that a Live Network Test of single crewing is an appropriate means to determine these controls and mitigations. The methodology has been developed to facilitate such a test.

4 AIMS AND OBJECTIVES

4.1 The 'live' network test aims to record subjective and objective data for a range of measures which collectively provide a description of the operational performance of Traffic Officers. The test will record performance data with the TOs patrolling the network and managing incidents under normal operational conditions, in so far as is possible.

4.2 A key aspect of the test is that it will be applied to both double and single crews in order that a direct comparison of performance can be made. Any significant differences in performance between single and double crewing will subsequently be used to make inferential risk and safety analyses. The output

from these analyses, together with potential mitigation measures, will form the basis for an assessment of the feasibility of single crewing.

- 4.3 The 'live' network test is intended to be a pragmatic assessment of the feasibility of single crewing. The methodology has been specifically developed with this in mind; the use of complex telemetry and detailed batteries of intensive tests (such as computer based psychological testing methods) have been avoided on the basis that they would be difficult to administer in a 'live' network environment.
- 4.4 Specific objectives addressed by the test design include:
- The test will be a comparative assessment of TO performance under both single and double crewing
 - The test will be deployed in "live" network conditions
 - The test will use additional vehicle resource and will not interfere with or compromise normal TO operations
 - The test will not compromise safety of the test participants
 - The test will not require material change or adaptation of the TO vehicles
 - The test will be relatively easy to administer in a "live" environment
 - The test will not make unreasonable demands on the TO's attention or time
 - The test will not materially affect the availability of a patrol vehicle for deployment.
- 4.5 Individual tests will be non-invasive and will not require complex technology or in-vehicle equipment.

5 SUCCESS CRITERIA

- 5.1 The Project Team has undertaken a number of measures to ensure a successful outcome to the project, these are –
- PT1 Approval
 - Independent Check on Test Design (See Appendix E2)
 - Proof of Concept Session at Samlesbury
 - Risk Assessment of Test Design
- 5.2 The Project Team has incorporated changes into the Test Design as a result of the activities listed above to ensure that safety is appropriately addressed.
- 5.3 The Project Board has met at regular intervals during the development of this project to see that overall governance is in place.
- 5.4 It should be noted that in the terms of the test "success" is the achievement of a clear conclusion from the test. The conclusion is not pre-determined by wider Agency directives; the conclusion will be based solely on the test data.
- 5.5 For further details of success criteria, see Appendix E.

6 OPERATIONAL HIGHLIGHTS

- 6.1 A Proof of Concept session was held at Samlesbury Aerodrome, near Blackburn in February 2010. The session involved several procedures being

carried out by volunteer traffic officers singly crewed, within a controlled environment. They were then taken through the various test methods within a classroom environment.

- 6.2 This aims of the proof of concept session were –
- Check that the various data collection techniques were suitable and practical for a Live Network Test
 - Develop the role of the SMEs and show that they could collect and record useful data
 - Develop and agree testing procedures / protocols and timings with TOs
 - Develop and agree test safety procedures and risk mitigations, especially in relation to observation of incident management outside of the vehicle.
- 6.3 A review of the existing Traffic Officer procedures was undertaken by senior TOs to assess their suitability for single crewing (See Appendix A2 and A3). Recommendations were made which included procedures that should not be carried out during the test and for those procedures that would require additional briefings prior to commencement of the Live Network Test.
- 6.4 The procedures review was then risk assessed by HA National Health and Safety see Appendix E1 for details.
- 6.5 A Briefing Note is now being prepared which will incorporate the findings from the completed milestones described above. This Briefing Note will then be used to deliver key information about the test to all test participants. A briefing session will be held prior to the commencement of the live network test, over a two day period. The briefing session will be delivered within a classroom environment as well as having practical elements which will be delivered within a controlled environment.

7 MEASUREMENT DESIGN HIGHLIGHTS

- 7.1 A Test Design was initially developed by CCD Ergonomics, a specialist sub contractor, in December 2009.
- 7.2 This was developed further (See Operational Highlights), and a finalised Test Design was agreed. This included amendments made as a result of the proof of concept session held in February 2010 at Samlesbury.
- 7.3 The North West region was chosen as the location for the test as the Business Case from previous commission of the scheme offered the most benefit for holding the test here.
- 7.4 The test will not be undertaken on night shifts and will only take place on 3 Lane Motorways within the HA network. The test will not extend to Managed Motorways as there is none currently in the region, also All Purpose Trunk Roads will not be considered for the test.
- 7.5 A proposed range of test methods was reviewed in discussions with the HA IMP and the Jacobs Project Team, taking account of various factors such as cost, practicality, resources, safety risk and timescales. These are described in detail in Appendix C2. The key points of agreement were:
- The live network test would measure comparative TO performance in dual and single crew

It was agreed that there are few, if any, practical ways of directly testing risk or safety (except by analysis of historical records) and that the “test” would therefore concern itself with measuring TO performance, through assessment of workload, task time, number of errors, heart rate and so on, from which an assessment of risk / safety could later be inferred. For example, poor driving performance during a radio call might indicate increased risk to a single crewed TO.

- The live network test would be “comparative”

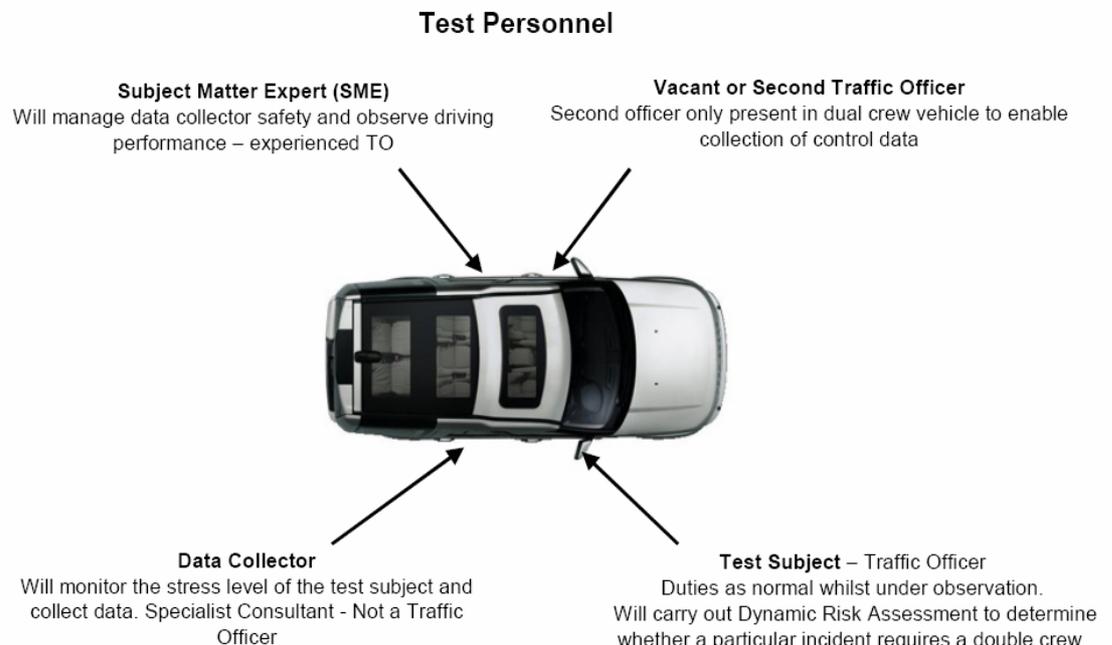
In the absence of suitable baseline data on existing TO performance, the live network test will include both double and single crewed vehicles in order that a direct comparison can be made between TO performance under both conditions.

- Vehicles

The same type of vehicle needs to be used for the single and double crew test conditions; the vehicle identified for use during the single crew test was the Land Rover Discovery. The TOS uses a number of other vehicles, but these had limited spare weight capacity, leading to potential for overloading during the test. These vehicle types were therefore rejected.

- A Subject Matter Expert (SME) would accompany a Human Factors Observer (HFO)

The SME would be a highly experienced TO who would accompany the test HFO at all times, firstly with responsibility for HFO safety, secondly in order to provide expert assessment of TO performance; thirdly to provide operational back-up to support the lone TO, should an event or incident during the test require it. The illustration below outlines the in-vehicle setup during the test -



- Testing can be halted at any time if the Traffic Officer or Subject Matter Expert doubts TO’s single crew ability to protect self, responders or public. The test will be abandoned and the vehicle will revert to dual crew.

- If Traffic Officer doubts TOS single crew ability to resolve congestion - call back-up
- The Test Priorities will be as follows –
 - 1) Protect self
 - a. Create a safe workplace for self
 - b. Inform employer
 - c. Maintain safe workplace for self
 - d. Return workplace safely into operational use
 - 2) Protect incident responders (Once 1 is achieved)
 - a. Gather and relay information
 - b. Create sterile scene for responders including access and egress
 - c. Maintain sterile scene for responders including access and egress
 - d. Return scene safely into operational use
 - 3) Protect public (Once 1 and 2 are achieved)
 - a. Actions to protect public
 - 4) Resolve congestion (Once 1, 2 and 3 are achieved)
 - a. Actions to reduce congestion.

At the discretion of the TO subjects or the SME, testing can be suspended should the nature of any event or incident be judged, on the basis of dynamic risk assessment, to warrant it. It was agreed that the test would be designed to comply with this key safety requirement. The vehicle therefore retains the capacity to respond in the same way as any other patrol.

- In-vehicle observers

The test would be administered by competent HFOs with suitable training and experience, one of whom would travel in a TO vehicle at all times. The HFO would administer tests and record data, both in the vehicle when travelling and outside when attending incidents. The HFO would be under “control” of the SME at all times for safety purposes. HFOs will direct any communication from members of the public to the operational TO. A clear means of communication will be rolled out at briefing sessions for the Live Network Trial.

- The test vehicles would be considered as “normal” resource

Crews involved in the test would be treated by RCC operators as “normal” TO crews capable of being dispatched to selected incidents (see Appendix A2) regardless of whether they are single or double crewed. This aims to avoid any results bias that might otherwise arise from the RCC determining which incidents should be attended on an ad-hoc basis. The presence in the vehicle of the SME (who is also an experienced TO) will mean that reversion to double crew mode is always possible, should an incident require it.

- Key Performance Indicators

The HA have considered that RCC and / or TO KPI related factors might have potential to affect the test validity. For example, operators concerned about maintaining incident clear up rates or similar, might prefer to use double

crewed unit to a single crewed unit. KPI data will however continue to be collected throughout the test duration and this data will be used as an addition to the results data pool. Effects on test validity will be assessed using comparison of KPI data before the test, during the test in dual crew mode and during the test in single crew mode.

- Driving simulator tests not considered feasible

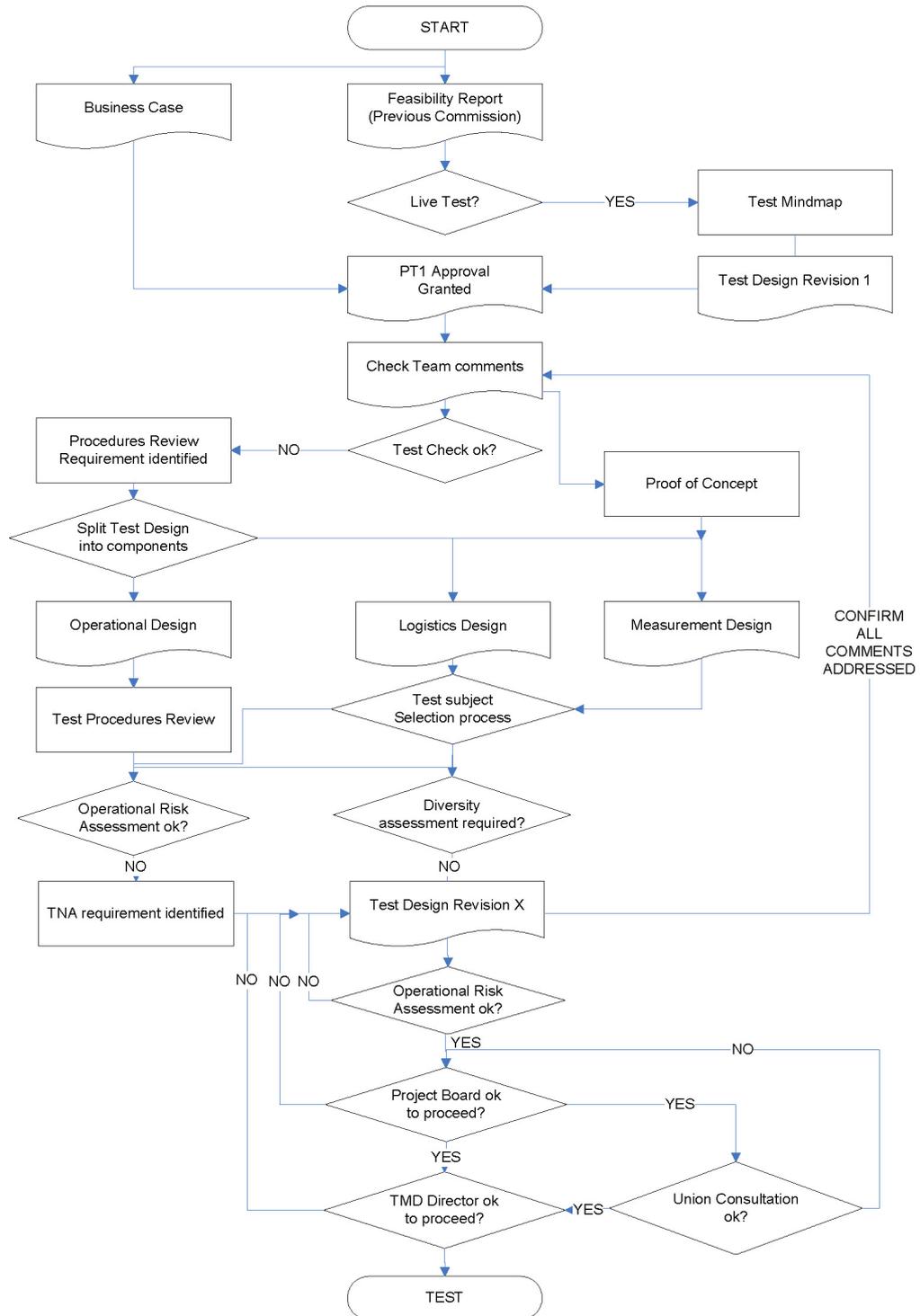
CCD considered the opportunity for making controlled experimental comparison of driving performance under single and double crewing, particularly in relation to handling incoming communications, operations of lights etc, through use of a computer controlled driving simulator. However, timescale, costs and resources combine to make this impractical.

8 LOGISTICS DESIGN HIGHLIGHTS

- 8.1 The Test Design required a minimum of 14 test subjects for the test to have scientific validity. An invite for the opportunity to apply for participation in the Live Network Test was sent to Traffic Officers in the North West region and a test participant selection workshop was held. The process for selecting test subjects and SMEs is detailed in Appendix B2.
- 8.2 Following the selection process, it was necessary to develop a roster for the live network test. This was developed by Jacobs and the HA.
- 8.3 The roster was developed as a sample in order to determine the duration of the Live Network Test and to inform the Project Programme (See Appendix B3). This exercise also ensured that any unforeseen problems with the programming of the test could be identified and resolved. See Appendix B1 for a sample of the roster to be used for the Live Network Test.

9 TEST DEVELOPMENT HISTORY

- 9.1 The illustration below outlines the milestones of the project –



9.2 The following briefly explains how the proposed Variable Crew Test was arrived at and the key concepts and decisions which underpin its design.

9.3 Previous work on variable crewing discussed the need for a test and recommended various aspects of TO activity and / or performance that might be measured. However, none of the studies reach any conclusions on:

- The relative value of different measures in answering the research question

- What data might be collected
 - What test methods might be employed to capture that data
 - Which data and methods might be practical in a “live” operational environment
 - The resource and logistical requirements to ensure that the test output has reasonable levels of scientific validity.
- 9.4 The project team developed the previous work undertaken by others. This was done by considering a range of methods for gathering data and measuring the performance of TO's. This included liaison with the Traffic Learning Centre (TLC). We also used CCD's experience of similar assessments in other fields.
- 9.5 A proof of concept session was held at Samlesbury airfield, near Blackburn (See Appendix C3).
- 9.6 Following the successful conclusion of the proof of concept session, and subsequent minor amendments to some methods and procedures resulting from discussions with Jacobs and the HA, the methodology for the Test was finalised.
- 9.7 The Test Design Methodology report was then subject to a check by the HA's Independent Check Team, and separately by HA's National Health and Safety team. A checking workshop was held in Manchester on the 31st March 2010.
- 9.8 The Independent Check Team made several comments (See Appendix E2), these were considered by the Project Team and either appended to the Test Design or rebutted with reasons for that rebuttal included.
- 9.9 The current Traffic Officer Procedures were reviewed (see Appendix A2 and A3) with the aim of assessing which procedures, if any, could not be attempted during the single crew test or would require adapting in order for them to be attempted during the single crew test.
- 9.10 A risk assessment was used to determine which, if any, procedures were unsafe or posed a significant risk to be considered within the Test, for details see Appendix E1.
- 9.11 The Check Team comments and the review of the Traffic Officer Procedures highlighted the need for a Briefing Note to be produced for the participants of the Test. This would also be delivered alongside a Briefing Session combining a classroom led presentation and a practical dry run of some of the procedures within a controlled environment. This Briefing Session will aim to communicate the test effectively to all participants and to further reinforce the importance of safety by allowing Test Subjects to practice procedures within a controlled environment.
- 9.12 The Test Participants were carefully selected against a range of factors; these are explained in detail in Appendix B2. The Test Participants were asked to complete a form (See Appendix B2), following expressions of interest, HA Team Managers then nominated staff they felt suitable. The HA Team Managers also had to discuss their selections with the Operating Manager for that Outstation (an HA TO base).
- 9.13 Traffic Officers who were not sufficiently experienced were excluded from the test; this was based on safety grounds.

9.14 The Test Participants deemed suitable were then submitted to Brian Hensby for final consideration. A Test Participant Workshop was held on the 13/08/2010 at Rob Lane Regional Control Centre, this workshop was attended by –

- Brian Hensby (Regional Operating Manager),
- Alan Apps (HA Project Sponsor),
- Jacobs Project Engineer,
- Jacobs Project Engineer.

The purpose of the workshop was to ensure that the Test applicants were selected fairly and independently and to reflect the make up of the TOS. Female and disabled applicants were included for this reason. Those present at the workshop agreed that a random selection was the fairest way of selecting participants from the remaining pool of Test applicants.

9.15 Following the Test Participant Workshop, Jacobs began the process of planning the Test into the rosters of the Test Participants. The roster was then issued to Greg Taylor for checking, upon completion of this checking phase it was then possible for the HA to roster the Test against live roster data.

9.16 Due to delays in preparing for the Briefing Sessions, the Live Network Test was delayed and the planning of the roster was cancelled.