

## Motorcycle manoeuvres review: the feasibility and safety implications – phases 2 and 3

### Abstract

This study represented the second and third phases of research to explore whether the motorcycle manoeuvres for module 1 of the current practical motorcycle test could be revised and then moved from off-road sites to on-road sites. The study first assessed the feasibility and safety requirements of identifying and using on-road sites for trialling manoeuvres, before considering the practical and safety implications of conducting the manoeuvres on-road. Phase 2 used experienced riders (n=10) and Phase 3 involved test-ready learners (n=151). Phase 3 participants completed the proposed on-road manoeuvres and the existing module 1 manoeuvres under mock test conditions. Direct comparisons were made between the on-road and module 1 tests based on performance and subjective workload ratings for riders and examiners. A risk assessment and additional data from trainers were also used to address the research questions.

### Main findings

- Phase 2 data indicated that it would be possible to find a small number of on-road sites on which to trial the revised manoeuvres with test-ready learner riders. Adjustments were made to the existing safety criteria to help find further sites, and additional safety criteria were also identified. For example, it was concluded that Phase 3 trial sites would require a safe waiting area or sufficient road width to reduce the risk of riders being struck by passing traffic when waiting kerbside during the test.
- The Phase 3 test performance data showed that learners committed significantly more faults on-road than for the equivalent module 1 test. The significantly higher fault rate was primarily attributed to learners committing four times as many 'serious' faults on-road than in module 1 (any serious fault precludes a test pass being issued to a candidate). The overall fault rates were significantly higher for the on-road versions of the ridden U-turn and hazard avoidance manoeuvres in particular. Further analysis of fault rates showed that if a learner was going to receive at least one fault, in only one version of the test, it was significantly more likely to occur during the on-road test than on module 1; this would imply that the on-road test was more difficult than module 1.
- Weather conditions did not affect learner performance overall; fault rates remained significantly higher for the on-road test than for module 1 in both wet and dry conditions. However, as a result of two incidents that occurred during the emergency brake manoeuvre on-road in wet weather conditions it was concluded that a new safety criterion would be required for any future implementation of an on-road test to ensure that test sites offered a friction coefficient in all weather conditions that met a new minimum friction coefficient that does not currently exist.
- Data and comments from examiners and learners indicated significantly greater feelings of risk and vulnerability when carrying out manoeuvres on-road rather than for module 1.
- Analysis indicated that the number of hours of module 1 training, and the number of hours of additional time spent training for the revised on-road manoeuvres, had no effect on fault rates or workload levels.
- The risk assessment was updated using data from all 3 study phases. A wide range of incidents occurred during on-road trials, of which the vast majority were near-misses or non-injury incidents. Appropriate accident ratios from the Health and Safety Executive's accident ratio model were applied to estimate the number of incidents that may occur amongst the number of candidates currently tested at a national level.

## Background

The current practical motorcycle test in Great Britain is modular, with the first of two modules testing candidates' ability to control their motorcycle in an off-road area during a series of low and higher speed manoeuvres. Concerns have been expressed about the accessibility of the module 1 test (especially for candidates who are not within easy reach of one of the 56 test centres or other casual sites equipped with an off-road manoeuvring area) and also the safety of some of the current module 1 manoeuvres.

### Approach

A revised set of manoeuvres was devised by the motorcycle test working group, which could be conducted within standard road dimensions. Phase 1 tested these manoeuvres by inviting 'test ready' learners to ride through the manoeuvres on an off-road area mocked up with the carriageway dimensions of a real road. The primary changes to the manoeuvres, when compared with their module 1 equivalents, were introducing lateral space constraints for the manoeuvres by carrying them out within the width of a 7.5m road, and having a straight run-up (rather than a curved one) to the emergency brake and hazard avoidance manoeuvres.

Changes are summarised in the table below:

Module 1 manoeuvres	Revised mock road manoeuvres
On and off the stand/manual handling	Forward bay push / reverse bay push / pushed u-turn (each learner only did one of these)
Ridden u-turn (in 7.5m)	Ridden u-turn (in road width of 7.5m)
Slalom (no space constraints)	Slalom (in single carriageway of 3.75m)
Emergency stop from 30mph after curved approach	Emergency stop from 30mph after 85m straight approach
Hazard avoidance from 30mph after curved approach	Revised hazard avoidance from 30mph after 85m straight approach

Phases 2 and 3 of the research trialled the revised manoeuvres on-road with experienced riders and test-ready learners respectively.

## Phase 2

Building on the findings from Phase 1, Phase 2 piloted the revised manoeuvres on-road with a small sample of 10 experienced riders (7 trial days across 4 locations).

## Phase 3

Phase 3 trialled 151 test-ready learners, all of whom completed the revised manoeuvres on-road and the module 1 manoeuvres at a test centre. The trials took place at 11 different locations across England and 13 different on-road sites were used. All learners were accompanied by their trainers, who provided them with additional training for the revised manoeuvres. On attending, each learner was assessed by a DSA examiner on the module 1 and on-road manoeuvres (the order was pseudo-randomised). DSA examiners were sourced from nearby test centres and were supervised by senior DSA examiners. Data were collected from learner, examiner and trainer questionnaires, and from systematic observations of the trials made by staff from the research team on site. The findings comprised workload data from learners and examiners, test performance data (fault and competence ratings) from examiners, training records from trainers, focus groups and interviews with trainers, supplementary questionnaire data from all groups, and risk assessment data collected by the project team.

## Research findings

### Phase 2

On-road sites to trial the proposed manoeuvres were identified using online mapping tools and in-person site assessments. Sites were assessed against a set of safety criteria developed in Phase 1. Of the 95 potential sites identified as possibly suitable for trialling, 44 sites were surveyed in person. Fifteen of these were found to be suitable for trialling with experienced riders.

Traffic flows during trials ranged from 0.4 to 5.6 road users per minute. A low traffic flow was necessary but not sufficient for site suitability. The nature of flow (constant, versus busy 'bursts') was at least as important.

Test duration varied from 8–20 minutes. The shortest test durations were measured at the sites with the lowest traffic flow, but the longest test was also measured at a site with a flow near the bottom end of the range observed (1.7 road users per minute). This illustrates that a low traffic flow does not guarantee a short test.

The riding times for each manoeuvre were very similar to those observed in Phase 1 (e.g. means of 14 seconds for the ridden U-turn and 22 seconds for the hazard avoidance). Per test, riders waited in the road on their motorcycles for 6–13 minutes, during which time they were at some risk of being struck by passing traffic.

A wide range of safety criteria were set for on-road trials following the outcome of Phases 1 and 2. The safety criteria focused on establishing an on-road manoeuvring area with accompanying run-up and run-off zones, within which there were multiple requirements regarding street furniture, road dimensions, road layout and traffic flow. Warning signs were also used to notify other road users of the tests. When applied correctly, these criteria were considered effective in minimising the probability of a hazardous event occurring, and reducing the severity of any possible outcomes.

### **Phase 3**

Sites and trial procedures identified in Phase 2 were carried forward to Phase 3 to enable trials to be conducted on-road with learners.

### **Fault and competency data**

The test performance data showed that learners committed significantly more faults on-road than for module 1. Senior examiners' ratings of learner competence were also significantly lower on-road than for module 1. The significantly higher fault rate was primarily attributed to learners committing four times as many serious faults on-road than in the equivalent module 1 test. The overall fault rates were significantly higher for the on-road versions of the ridden U-turn and hazard avoidance manoeuvres in particular. Likewise, for the on-road versions of these manoeuvres, senior examiners rated learner competence as significantly lower than for the equivalent module 1 manoeuvres.

Further analysis of fault rates also showed that if a learner was going to receive at least one fault (or at least one serious fault – which can be used as a proxy for failing the test) in only one version of the test, it was significantly more likely to occur during the on-road test than on module 1; this implied that the on-road test was more difficult than module 1.

### **Effect of weather**

There were 73 trials in dry conditions and 71 in wet conditions; however, of the 71 wet trials, only 42 included higher speed manoeuvres trialled at the required speed of 30 mph (the remaining trials either omitted the higher speed manoeuvres or conducted them at a slower speed). The speed restriction was imposed as a result of two incidents that occurred during the emergency brake manoeuvre on wet roads. It was concluded that the friction coefficient of wet road surfaces varied

substantially and it could not be assumed that they would offer friction levels that were similar to the high-grade, uniform surfaces used for the module 1 test.

As a consequence, an ethics decision was taken to not test the emergency brake and hazard avoidance manoeuvres on-road at 30mph when any surface moisture was present. This restriction was a response to the anticipated reduction in the friction coefficient of road surfaces when wet.

Weather conditions did not affect learner performance overall; fault rates remained significantly higher for the on-road test than for module 1.

### **Test timings**

The time taken to complete each manoeuvre on-road was observed and recorded. The mean time required to complete all on-road manoeuvres was 15 minutes. The times observed ranged from 9.5 minutes to 27 minutes. In total, riders spent almost 11 minutes per test on average waiting on the road kerbside, during which time they were at risk from passing vehicles (particularly on roads with frequent 2-way traffic). Implementation of an on-road test would require additional time to prepare the test area, thus the average on-road test at implementation was estimated at 26 minutes. This excludes setting up any speed measuring equipment and carrying out site specific risk assessments.

### **Workload data**

Data and comments from examiners and learners indicated significantly greater feelings of risk and vulnerability when carrying out manoeuvres on-road rather than for module 1. The self-report data from learners showed that the on-road test generated significantly higher levels of subjective workload than module 1, in particular the on-road versions of the ridden U-turn, emergency brake and hazard avoidance manoeuvres.

### **Training**

Analysis indicated that the number of hours of module 1 training, and the number of hours of additional time spent training for the revised on-road manoeuvres, had no effect on fault rates or workload levels.

Trainers reported that most of the manoeuvres could be trained safely on-road if required, although many would choose to develop skills off-road initially. The consensus was that four of the five proposed manoeuvres (ridden U-turn, slalom, emergency brake and hazard avoidance) would require an increase in training time as a direct consequence of moving them on-road.

Trainers expressed substantial concern over the hazard avoidance manoeuvre, claiming it was too

dangerous to train on-road, particularly without access to the same risk controls that examiners would have available. In addition, there was concern that only a limited number of on-road sites would be suitable for training and testing within a specific area so competition would exist for training and testing time at these sites.

### Risk assessment

The risk assessment was a structured and systematic process, using expert judgement and data from the trials, to estimate the frequency and consequence of anticipated hazardous events occurring during each manoeuvre.

A wide range of incidents occurred during on-road trials, of which the vast majority were near-misses or non-injury incidents. The risk assessment identified that these incidents, which were across a range of the manoeuvres, often had the potential for more serious outcomes. Moreover, the majority could only occur on-road as they related to features only present in the on-road environment (and not in a module 1 off-road area).

Appropriate accident ratios from the Health and Safety Executive's accident ratio model were applied to extrapolate from the types of incident captured by the on-road trials to the larger numbers of candidates tested at a national level. The estimates suggest that if the current module 1 test were replaced with the on-road manoeuvres trialled for this study, under similar conditions, between 447 and 561 'major' incidents (requiring 3 days or more off work from injuries sustained) could be expected.

### Conclusions

These findings indicate there was a difference in the competencies and assessment standards for the on-road test when compared with the current module 1 test. These differences were not attributed to motorcycles with different power outputs, or any other factor such as the width of the on-road site or the number of hours training that learners had received.

Interpretation of the findings implies that the on-road manoeuvres are simply more difficult than the module 1 manoeuvres for learners to perform, in terms of their performance as measured by examiners against the required test standards, and in terms of the subjective workload they experienced as candidates.

It is feasible to test many of the manoeuvres in a range of weather conditions. However, it is concluded that a new safety criterion would be required for any future implementation of an on-road test; specifically, on-road sites would need to be tested to ensure that they offered a friction coefficient in all weather conditions that met a new minimum friction coefficient that does not currently exist.

When considering the additional site preparation and minimum risk assessment activities, the timing data indicated that the average on-road test would require at least 26 minutes, with 25% of tests requiring 28 minutes or longer, and 10% of tests requiring 31 minutes or longer. This excludes the time taken to set up any speed measuring equipment and carry out site specific risk assessments.

It was necessary to survey 6 roads for every 1 suitable road found within a 5-mile radius of a test centre.

### About the project

This study explored whether the motorcycle manoeuvres required by EU Directives to be part of the practical motorcycle test in Great Britain could be carried out on the road safely and practically. Phases 2 and 3 conducted on-road trials of the revised manoeuvres with experienced riders and test-ready learners respectively. Conclusions were drawn from the subjective workload ratings of learners and examiners, the test fault and competency reports from examiners, data and observations collected from trainers, and risk assessment data.

### Further information

The full report **Motorcycle manoeuvres review Phase 2 and Phase 3 report** by S. Tong, S. Helman, C. Fowler, E. Delmonte, and R. Hutchins is published by the Transport Research Laboratory as a free web download from [www.trl.co.uk](http://www.trl.co.uk) These Findings can also be downloaded free of charge from <https://www.gov.uk/government/publications/road-safety-research-and-statistical-reports>

Although this research was commissioned by the Department for Transport, the findings and recommendations are those of the authors and do not necessarily represent the views of the DfT.