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DRIVING STANDARDS AGENCY
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DSA Delegated Examiner Research

Research report 3

Driving Standards Agency (DSA)

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DSA Delegated Examiners research: Review of the safety outcomes of delegated driving examiner arrangements

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Executive Summary

The Motor Vehicles (Driving Licences) Regulations 1999 allow MoD, Police and Fire and Rescue Services to appoint examiners to undertake driving licence acquisition tests for their staff. Such appointments must be approved by the Secretary of State for Transport to enable DSA on their behalf to ensure that all tests are conducted to a fair and uniform standard nationally. The Regulations also allow the Secretary of State for Transport to appoint Passenger Carrying Vehicle (PCV) driving examiners for bus and coach operators.

DSA have been aware of, over many years, a difference in pass rates between delegated PCV practical tests and DSA PCV practical tests. The reasons for such a difference are not simple to define, with many possible confounding factors such as different pre-test training environments, different geographical locations and driver demographics. The Transport Select Committee recommended in their report on the Department for Transport Annual Report 2005-2006 that the Department "*investigate fully the quality control system for ensuring high levels of competency by all PCV driving test candidates, and to carry out analysis of the subsequent collision rates of drivers who undergo the different training and testing regimes*".

The objective of this study is to test the hypothesis that drivers passing the PCV practical test under delegated arrangements have an equivalent safety record following commencement of professional driving as those passing the PCV practical test with a DSA examiner.

A controlled study approach was sought whereby driver performance of those tested by delegated examiners was compared with that of contemporaries from comparable organisations that were examined by DSA examiners. Individual bus and coach companies utilising delegated or DSA examination arrangements were contacted directly to identify cohorts of recently-qualified drivers. The safety records of these drivers were reviewed and a statistical comparison made of the accidents and incidents attributable to those within the cohorts.

There was difficulty in obtaining data from some bus and coach companies, though ultimately 14 companies agreed to participate in the study. The companies included both bus and coach operators, and were geographically distributed across England and Wales. No companies from Scotland participated in the study. Eight companies supplied data relating to delegated-examined arrangements only, 2 companies supplied data relating to DSA-examined arrangements only and 4 companies provided data relating to both arrangements. Thus in total there were data from 12 companies employing delegated arrangements and 6 companies employing DSA arrangements.

This study found evidence that drivers in companies utilising delegated examination arrangements were more likely to be reported involved in at-fault accidents within the first 6 months of passing the test than those in companies utilising DSA examination arrangements. Though the sample was relatively small, the observed differences were larger than would be expected by chance alone. The reason for these differences, however, cannot be answered by this piece of research, and reductions in the specification for the data in order to encourage more bus companies to take part meant that some explanatory power was lost.

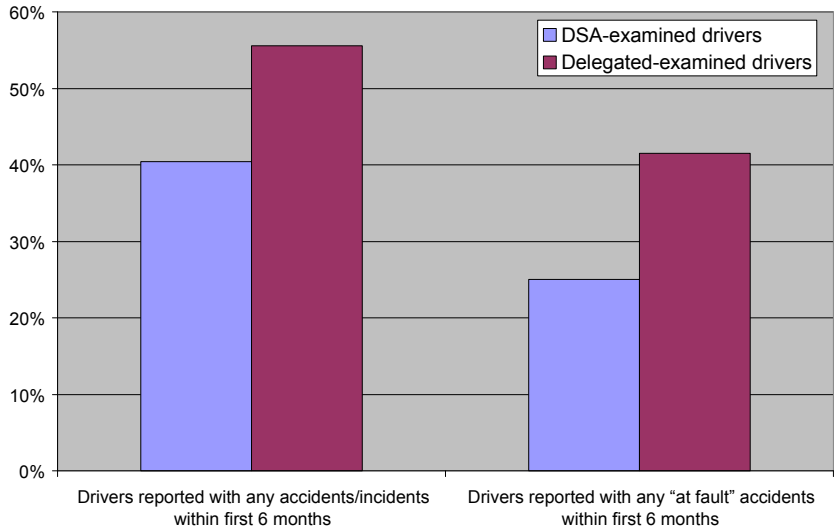

Figure 1: Comparison of DSA-examined and Delegated-examined drivers

Additional analysis would allow the causes of the differences to be more fully explored. It is recommended that the analysis is extended in the form of a within-company study where accident rates are compared for periods before and after delegated arrangements were adopted by particular companies. This was exploited for 4 companies in the current study and would serve to increase statistical power and provide better experimental control if the other 8 companies within the study who currently use delegated arrangements were able to provide historical data. To be fully controlled, historical data should also be sought from the companies utilising DSA-examiner arrangements. An investigation was undertaken to ascertain the likelihood of collecting sufficient additional data from relevant companies using a similar research protocol.

It is also recommended that the DSA investigate the cause of the difference in accident rates with a view to amending policy or process in this area.

Finally, it is recommended that the DSA investigate other types of organisation that utilise delegated arrangements (MoD, Police and Fire and Rescue Services) to determine the associated safety outcomes. A within-organisation study design should be adopted.

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1 Introduction

1.1 Contract

This report is prepared under contract DSA04507 on behalf of the DSA in accordance with QinetiQ proposal dated 24th September 2007 [1]. This report meets Milestone 4 Final Technical Report.

1.2 Background

1.2.1 Context

To ensure that driving standards are upheld the DSA conducts theory and practical driving tests for car, motorcycle, bus (PCV) and lorry (LGV) vehicle groups. The DSA also sets the standards for Approved Driving Instructors (ADI) and Compulsory Basic Training for Motorcyclists.

The Transport Select Committee recommended in their report on the Department for Transport Annual Report 2005-2006 that the Department "*investigate fully the quality control system for ensuring high levels of competency by all PCV driving test candidates, and to carry out analysis of the subsequent collision rates of drivers who undergo the different training and testing regimes*" [2].

The Motor Vehicles (Driving Licences) Regulations 1999 allow MoD, Police and Fire and Rescue Services to appoint examiners to undertake driving licence acquisition tests for their staff. Such appointments must be approved by the Secretary of State for Transport to enable DSA on their behalf to ensure that all tests are conducted to a fair and uniform standard nationally. The Regulations also allow the Secretary of State for Transport to appoint PCV driving examiners for bus and coach operators. The purpose of these delegated examiner arrangements is to allow these organisations the flexibility to arrange test appointments to suit their operational requirements, whilst at the same time being able to assure all interested parties that wider road safety issues are protected.

As part of retaining authorisation, the examiner and the organisation are required to keep suitable records, which may be inspected by DSA. A monthly record of tests passed and failed, plus the report forms from the driving tests conducted, are supplied to the local DSA Supervising Examiner.

In 2007 there were 73 delegated examiners employed by 67 bus companies. These examiners conduct around 10,000 theory and practical tests a year.

From May 2007, the DSA introduced enhanced supervision arrangements for all driving examiners, including delegated examiners.

1.2.2 Study objectives

There are currently discrepancies in the practical test pass rates for those drivers who undertake a PCV driving test with a DSA examiner, and those who are assessed by a delegated examiner. In 2007-08, the PCV test pass rate was 50%

for tests conducted with DSA examiners, and 59% for those conducted with delegated examiners.

There are many possible explanations of this apparent discrepancy. For example, companies with a higher test pass rate may simply be demanding a higher standard of driving before putting candidates forward for the PCV test. The objective of this study, however, is to test the hypothesis that drivers passing the PCV practical test under delegated arrangements have an equivalent safety record following commencement of professional driving to those passing the PCV practical test with a DSA examiner.

2 Analysis

2.1 Methodology

2.1.1 Outline of approach

The aim of the study was to provide an analysis of the safety outcomes associated with delegated examiner arrangements within bus and coach operating companies in comparison with the normal practical testing service provided by DSA.

A controlled study approach was adopted whereby driver performance of those tested by delegated examiners was compared with contemporaries from the comparable organisations that were examined by DSA examiners. Cohorts of recently-qualified drivers were identified, the safety records of these drivers were reviewed and a statistical comparison made of the accidents and incidents attributable to those within the cohorts.

2.1.2 Project stakeholder group

The study was overseen by a project stakeholder group incorporating members of DSA, the Confederation of Passenger Transport and GoSkills.

2.1.3 Data protection

To complete the study it was necessary to collect information relating to individual drivers' test histories and safety records. The data was stored in a de-personalised form and used solely for the purpose of a comparative assessment of DSA examined versus delegated examined driver safety. At no point were individual drivers' records, nor summaries for identifiable bus companies passed on to DSA in an identifiable form.

2.1.4 Development of initial assessment framework

In November 2007 an assessment framework was drawn up in consultation with the project stakeholder group and a data requirements document agreed with DSA [3]. This document is reproduced at Annex A.

The study team would seek to contact 50 bus or coach companies across the UK in the expectation that around 12 (6 DSA-examined and 6 delegated-examined) could be identified who would be willing to participate in the study. Companies utilising both delegated examiners and DSA examiners were sought where possible. Participation was entirely voluntary, and no payments were made to participating companies as the offer of a financial incentive might be perceived as compromising the impartiality of the study.

It was thought there was likely to be some underlying variation in reported accident rates between companies for a number of reasons, including risk exposure (the amount of miles driven per driver and the route types driven), methods of reporting (companies might have different thresholds for reporting incidents) and demographics (characteristics of the driver population). Thus where possible the selection of companies would be controlled to ensure a close match in terms of company characteristics between the DSA and delegated groups, though in practice the selection was very much dependent upon those companies willing to

participate. Uncontrolled differences would reduce the power of any statistical comparisons making it more difficult to identify differences between examination methods.

The following data was sought from each company:

Essential data

a. drivers who have passed test within last 5 years;

b. method of examination for each driver (DSA or delegated examiner);

c. date of test pass;

d. date of commencement of professional PCV driving;

e. whether currently employed or date of leaving company; and

f. safety data for each driver for up to 2 years following date of commencement of professional PCV driving (date and type of incident), focusing on first 6 months.

Desirable data

g. Age of driver;

h. Gender of driver;

i. Ethnicity of driver;

j. Driving licence number (for cross-referencing with DSA and DVLA data);

k. Amount and method of training;

l. Hours worked per week; and

m. experience of examiner (where delegated).

Additional data relating to the company and driver demographic was also sought, including size of company, type of operations (bus/coach) and area of operations (rural/urban, area of country, motorway driving).

2.1.5 Approach to bus companies

After relevant consultation, a list of 30 potential bus and coach companies for participation in the study was drawn up with the assistance of the project stakeholder group. Eight contacts were provided by the stakeholder group and 22 were obtained from public directories and internet searches. Each company was contacted over the period November 2007 – March 2008 by email and/or telephone and invited to participate in the study. The contact was accompanied by a letter from the Chief Driving Examiner explaining the background to the study. Each company was encouraged to participate and to supply data as described in the data requirements document.

The responses from the bus companies were mixed. Eighteen companies expressed interest in participation in the study, whilst the other 12 politely declined. Typical reasons given for not participating in the study were:

- The company only employs experienced drivers;
- Concerns over sensitivity of the data; or
- There were insufficient resources available within the company to meet the request.

Those companies who expressed an interest in participation generally observed that it would take some time to prepare the data. The study was wholly reliant on the bus/coach companies co-operation and goodwill and as such the timeline for collection of data was extended to meet their requirements.

Over the following 2 months all leads were pursued by telephone and email. As to be expected some companies who were originally positive about the study found that they were ultimately unable to participate, citing a lack of resources as a major reason. By May 2008 data had only been received from 3 companies together with a firm commitment on delivery from a further 3 companies.

2.1.6 Revision of assessment framework

By June 2008 there was concern that insufficient data would become available to draw meaningful conclusions from the study. Following consultation with the project stakeholder group, it was determined to relax the data requirements from each company in order to encourage a wider participation in the study. A revised data requirements document was drawn up and is reproduced in Annex B. The new data requirements asked for the following information for drivers who passed their test within the last 5 years and were employed for a minimum of 6 months following passing their test:

Essential data

a. The method of examination (DSA-examined or delegated-examined); and

b. For each driver, whether they were involved in any incidents or accidents (at fault or otherwise) during the first 6 months following passing their test (Answer yes or no).

Desirable data

c. Further details of any incidents/accidents (e.g. if more than one incident/accident the exact number, and whether the driver was considered at fault);

d. The length of time after passing their test that each incident occurred (or the date each driver passed their test and the date of any incidents in which they were involved); and

e. Basic data about the company itself (size of company, type of operations, area of operations and pattern of operations).

It was felt that the revised data requirements would reduce the burden on companies and thus increase the number that would be able to participate. This would be at the expense of collecting details which would allow some of the between-company variability to be accounted for in the analysis.

2.1.7 Final data collection

An additional final data collection exercise was undertaken between June and August 2008 using the revised data requirements. The Confederation of Passenger Transport gave additional encouragement to its members to participate and a further letter was produced by the Chief Driving Examiner. The original companies were re-contacted together with 10 additional companies who had not formed part of the original contact list.

The relaxed data requirements and extra push proved somewhat successful and ultimately 14 companies were able to provide data to the study.

2.2 Data sample

2.2.1 Dataset characteristics

Ultimately a total of 14 companies agreed to participate in the study and were able to supply data. The companies included both bus and coach operators, and were geographically distributed across England and Wales. No companies from Scotland were able to participate in the study.

Eight companies supplied data relating to delegated-examined arrangements only, 2 companies supplied data relating to DSA-examined arrangements only and 4 companies provided data relating to both arrangements. Thus in total there were data from 12 companies employing delegated arrangements and 6 companies employing DSA arrangements.

To be eligible for the study, each driver was required to meet the following criteria:

- the driver must have passed the PCV practical test not more than 5 years and not less than 6 months before the date of this study;
- the driver must have remained employed at the company for a minimum of 6 months following passing the test; and
- the accident record for the driver must be available for their first 6 months of professional PCV driving.

Company 12 was only able to supply data for those drivers who were involved in accidents or incidents within 6 months of professional driving. After discussions with the company it was possible to determine an estimate of total driver recruitment and retention over the relevant period and thus estimate the number of drivers who were not involved in any accidents or incidents.

	Examination arrangements	No. of usable DSA-examined drivers in cohort	No. of usable delegated-examined drivers in cohort
Company 1	DSA	58	-
Company 2	Delegated	-	256
Company 3	Delegated	-	60
Company 4	Both	31	61
Company 5	Delegated	-	366
Company 6	Delegated	-	51
Company 7	Both	25	332
Company 8	Delegated	-	160
Company 9	Both	7	17
Company 10	DSA	14	-
Company 11	Delegated	-	23
Company 12	Delegated	-	162
Company 13	Delegated	-	59
Company 14	Both	1	6
TOTAL		136	1553

Table 1 – Usable driver data

2.2.2 Limitations with data

Though the number of *companies* participating in the study met the requirements identified in the assessment framework, the total number of *drivers* included within the study (1689) was well below expectations (5000). This is of particular relevance with the DSA-examined cohorts – there were only a total of 136 eligible drivers in this category. This primarily reflects the size of the companies utilising the DSA-examiner arrangement – the larger companies have in general adopted the delegated-examined arrangements leaving predominantly smaller companies utilising DSA examiners.

As the analysis was performed using a formal statistical analysis methodology, the effect of any reduced sample size would be a reduction in statistical power i.e. the study would be less likely to detect a difference between examining arrangement when one is in fact present. However, it remains a viable dataset for the purposes of the analysis as:

- the reported average number of incidents per driver was higher than anticipated, improving the power of the study;
- the DSA vs. delegated comparison was primarily a between-company comparison, it was more important that the number of companies within the DSA-examined group was maintained than the number of drivers; and
- 4 companies were able to supply data under both the DSA and delegated examiner arrangements enabling better control of between-company variation and substantially increasing the experimental power.

A full discussion of the statistical power of the study is given in Annex D. It is concluded that although the sample was smaller than that initially sought, it has in fact provided a more powerful comparison of examination arrangements than was planned for in the initial data requirements document.

2.3 Comparison of examination arrangements

2.3.1 Metrics

The primary measure used in this analysis was the proportion of drivers reported as being involved in any accidents or incidents within the first 6 months after passing their PCV practical test. This is expressed as two metrics:

- the percentage reported involved in any incident, whether at fault or not; and
- the percentage reported involved in at-fault incidents.

The classification of *all* and *at-fault* incidents was dependent upon the reporting procedures utilised by the individual bus companies. No attempt has been made to revisit the classifications or to review individual cases. It is observed that the vast majority of incidents are relatively minor and do not result in any harm to drivers, passengers or the public.

In some cases the company reported the fault of an accident as “unknown”. Accidents of this kind were counted towards the total for “any incidents”, but not counted as an “at fault” incident.

2.3.2 Statistical analysis

A formal statistical analysis methodology has been adopted to assess whether observed differences between examination arrangements could be explained by chance alone. Results are reported together with a “p-value”. This “p-value” is the probability that a difference as large as that observed could arise if in fact there was no difference between examination arrangements, and thus a low p-value is indicative of a true difference between the examination arrangements. In line with standard practice a p-value lower than 0.05 (expressed “$p<0.05$”) has been taken as evidence of a statistical difference. The null hypothesis was that there was no difference in reported accidents between the two examination arrangements. Full details of the analysis are given in Annex C.

2.3.3 Results

	DSA-examined drivers	Delegated-examined drivers
Drivers reported with any accidents/incidents within first 6 months	40.4%	55.6%
Drivers reported with any “at fault” accidents within first 6 months	25.0%	41.5%

Table 2 – Comparison of DSA-examined and delegated-examined drivers

Results are given in Table 2 and Figure 2. There was evidence that drivers in companies utilising delegated examination arrangements were more likely to be reported involved in at-fault accidents within the first 6 months of passing the test than those in companies utilising DSA examination arrangements ($p<0.05$).

The difference could not quite be confirmed for *any* accidents/incidents ($p=0.054$), though this would be considered statistically significant if expressed as a one-tailed test i.e. that “delegated-examined drivers were involved in *more* accidents/incidents” rather than “delegated-examined drivers were involved in a *different number* of accidents/incidents”.

2.3.4 Ancillary evidence

With the introduction of the revised data requirements in June 2008 it was no longer possible to complete an analysis comparing or factoring out individual or company differences. However, data supplied by the first 3 companies prior to June 2008 included the dates of each accident/incident for each driver within their first 6 months of professional driving together with the date they commenced driving. Of the 3 companies, one (company 1) utilised DSA-examination arrangements and two (companies 2 and 3) utilised delegated-examination arrangements.

Though there were insufficient data to perform a formal statistical analysis, it was possible to calculate the number of accidents/incidents experienced by each driver in each month following their commencement of professional driving. This is shown in figure 3.

Company 1 (DSA-examined) and company 2 (delegated-examined) showed a relatively constant accident/incident rate for drivers within their first 6 months. In contrast company 3 (also delegated-examined) showed a very high accident/incident rate during their first few months of professional driving, falling to a similar rate to the other companies by month 6.

The pattern is not proof of but is at least consistent with drivers in company 3 being approved for professional driving despite possessing a lower level of skill than drivers in the other two companies. Over the following months the level of skill within company 3 improves with experience to become closer to that of company 1 and company 2.

Unfortunately it is almost impossible to generalise from this finding. The suggestion is that the drivers in at least one company seemed to exhibit initially lower levels of skill than those in other companies, and that that company utilised delegated-examiner arrangements. It may say more about company 3 than it does about delegated-examination arrangements in general, and may reflect factors relating to the company (e.g. the drivers' exposure to risk on the routes driven) rather than the method of examination).

If however this is taken as evidence, then it also suggests that not all companies are the same. At least one company utilising delegated-examiner arrangements (company 2) appeared to demonstrate a consistently low accident rate for newly-qualified drivers.

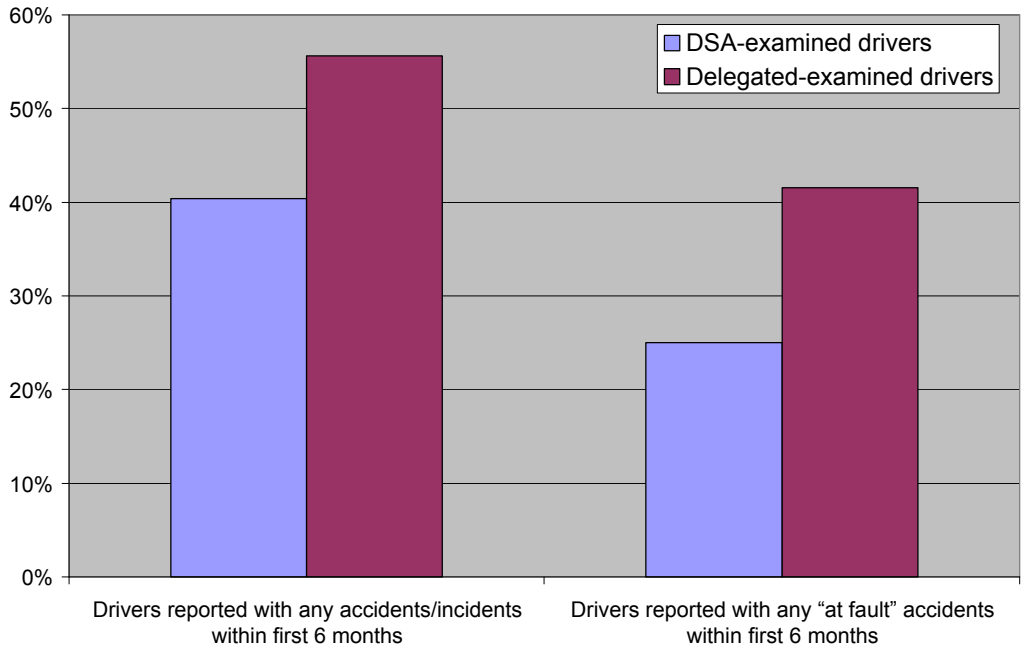

Figure 2 – Comparison of DSA-examined and delegated-examined drivers

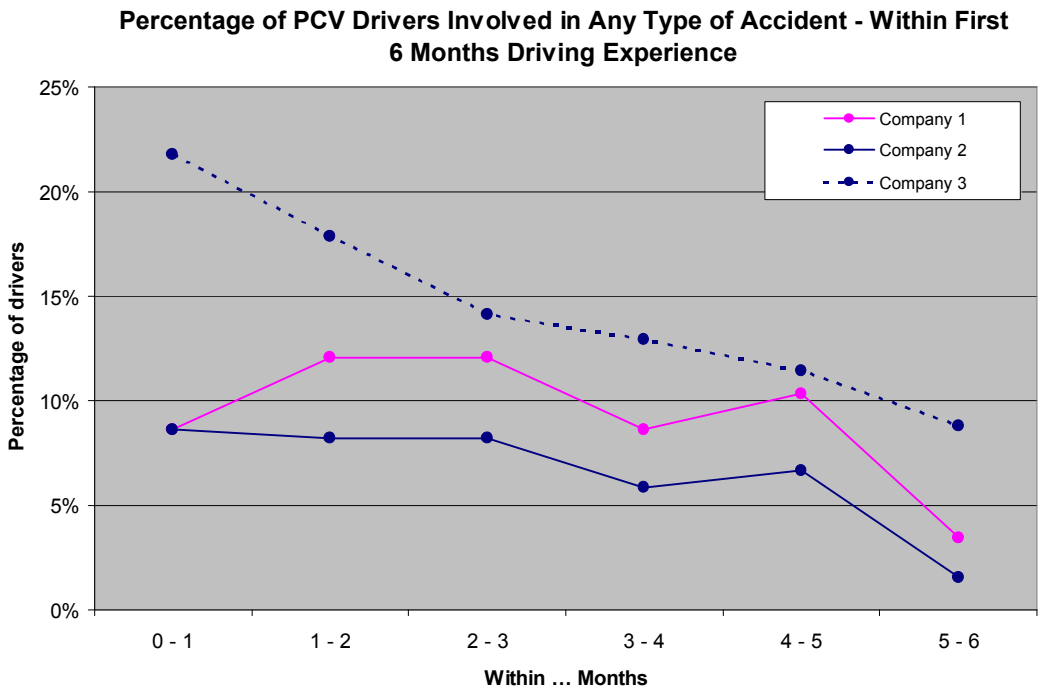

Figure 3 – Six-month accident/incident trend for newly-qualified drivers for 3 companies. Company 1 is DSA-examined, companies 2 and 3 delegated-examined

2.4 Interpretation of results

2.4.1 Main finding

There is evidence here that the reported rate of drivers experiencing at-fault accidents within six months of passing their test was on average higher for delegated-examined drivers than for DSA-examined drivers. The observed differences were larger than would be expected by chance alone. The equivalent effect for *any* accidents/incidents could not quite be confirmed; however this might be expected as the data will contain the "noise" of not-at-fault incidents.

This does not imply that every company employing delegated-examined drivers experiences an increased at-fault accident rate, but rather that on average the companies employing this arrangement experience a higher rate than those that do not.

2.4.2 Relative magnitude of accident rates

It was determined that 40.4% of DSA-examined drivers were involved in *any* accident/incident within the first 6 months of professional driving whilst 25.0% were involved in *at-fault* incidents. The difference between these two figures is explained by drivers who were involved only in *not-at-fault* incidents/accidents. It is possible to estimate the probability that a driver was involved in a not-at-fault incident/accident as (0.404 – 0.250) / (1 – 0.250) = 20.5%. This calculation factors in the possibility that the driver may have been involved in both an 'at-fault' and 'not-at-fault' accident/incident.

For delegated-examined drivers, the corresponding *any* and *at-fault* figures were 55.6% and 41.5% respectively. It is therefore estimated that the probability that a delegated-examined driver was involved in a *not-at-fault* incident/accident as (0.556 – 0.415) / (1 – 0.415) = 24.1%. These findings are summarised in Table 3.

	DSA-examined drivers	Delegated-examined drivers
Estimated proportion of drivers reported with "*not-at-fault*" accidents/incidents within first 6 months	20.5%	24.1%
Drivers reported with any "at fault" accidents within first 6 months	25.0%	41.5%

Table 3 – Comparison of DSA-examined and delegated-examined drivers incorporating estimate of not-at-fault accidents/incidents

It is interesting to observe that the estimated rate of *not-at-fault* accidents/incidents for the two examination arrangements is broadly similar. This of course is exactly what might be expected and provides some validation of the study methodology.

Equally interesting is the observation that the estimated rate of *not-at-fault* accidents/incidents is similar to the estimated rate of *at-fault* accidents for the DSA-examined cohort, whereas this is not the case for the delegated-examined cohort.

If it were supposed that all road users were equally skilled and that accidents were characterised by one road user being at fault and one not being at fault, then over time each road user would expect to be involved in an equivalent number of *at-fault* and *not-at-fault* accidents. If however it was assumed that there is variation in the skill levels of road users, then you would expect relatively unskilled drivers to be involved in more *at-fault* accidents than *not-at-fault* accidents, regardless of the routes driven. Thus it could be argued that the pattern of results for DSA-examined drivers within their first 6 months is consistent with them possessing a level of skill close to the average level of road-users taken as a whole, whereas delegated-examined drivers appear to be involved in a higher proportion of at-fault accidents than would be expected for an averagely-skilled road user.

2.4.3 Alternative interpretations

There are a number of alternative explanations that might be put forward to explain the pattern of observed data. These are discussed below.

Different bus companies used different criteria for classifying "all" or "at fault" incidents. Although it is possible that companies used different criteria for classifying incidents, the analysis shows that on average the companies utilising delegated examiner arrangements reported a higher rate of at-fault incidents than those utilising DSA examiner arrangements. The analysis shows that this is statistically unlikely to be explained solely by a difference in the reporting methods used.

Companies employing delegated examiner arrangements tended to operate more hazardous routes. It is certainly the case that the companies employing delegated examiner arrangements are in general the larger companies. It is conceivable that the size of company is in some way correlated with the hazards associated with their routes, for example if the larger companies tend to operate in mostly urban environments. Whilst we cannot rule this out from this study, we might also expect this to be associated with an equivalent increase in not-at-fault incidents. However, as described in section 2.3.4, the data was consistent with an equal not-at-fault incident rate for each of the examiner arrangements. Additionally 4 companies within the study utilised both examiner arrangements and hence acted as their own control within the study.

Companies involved in the study were self-selecting and may not have been representative of the industry as a whole. The companies all participated on a voluntary basis and as such may have represented in some way a skewed sample of the industry. However unless self-selection operated differently for delegated and DSA-examined companies it is not clear how this would have materially impacted the results of the study. And as 4 companies within the study utilised both examiner arrangements, it seems unlikely that there would be much influence on the results.

The results are a statistical aberration and do not apply to the industry as a whole. The use of significance testing at $p<0.05$ implies that there is a less than 1 in 20 chance that the observed differences would have arisen if in fact there was no difference between the two examination arrangements. It is therefore unlikely that the results are a statistical aberration. However it may be prudent to undertake a confirmatory study.

3 Conclusions

3.1 Main conclusion

Though based on a relatively small sample, there is statistical evidence here that the reported rate of drivers experiencing at-fault accidents within six months of passing their test was higher for delegated-examined drivers than for DSA-examined drivers. The observed differences were larger than would be expected by chance alone.

This does not imply that every company employing delegated-examined drivers experiences an increased at-fault accident rate, but rather that on average the companies employing this arrangement experience a higher rate than those that do not.

3.2 Variations in pass rate

It also does not necessarily follow that some examiners are passing candidates who have not met the legally-defined minimum driving standard. It may for example be the case that all drivers have met the minimum standard, but that those entered for DSA-examined tests exceed the minimum standard by more than those entered for the delegated-examined tests.

If this were the case, however, it would not explain why DSA-examined candidates experience a lower pass rate than delegated-examined candidates as described in paragraph 1.2.2 though there may of course be other explanations of this. For example if a delegated examiner chose on occasion to discount a failed test rather than issue a formal fail, then the pass rate might look artificially high.

Alternatively, perhaps the range of skill of those entered for DSA-examined tests is greater than those entered for delegated-examined tests. If this were the case, then DSA examinations could still exhibit a lower pass rate, but those drivers passing could have a higher average level of skill compared to delegated-examined drivers who were all *just* good enough to pass the test.

4 Recommendations

DSA may consider that additional evidence is required to support the analysis. In this case, in line with the findings regarding experimental power, it is recommended that it is extended in the form of a within-company study where accident rates are compared for periods before and after delegated arrangements were adopted by particular companies. This was exploited for 4 companies in the current study and would serve to increase statistical power and provide better experimental control if the other 8 companies within the study who currently use delegated arrangements were able to provide historical data. To be fully controlled, historic data should also be sought from the companies utilising DSA-examiner arrangements. An investigation was undertaken (reported at Annex E) as to the possibility of collecting additional data from existing contacts. However it was concluded that the current research protocol was unlikely to generate sufficient data to meet the needs of the study.

It is recommended that the DSA investigates the cause of the difference in accident rates with a view to amending policy or process in this area.

It is recommended that the DSA investigates other types of organisation that utilise delegated arrangements (MoD, Police and Fire and Rescue Services) to determine the associated safety outcomes. A within-organisation study design should be adopted.

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[1] DSA Delegated Examiners research: Review of the safety outcomes of delegated driving examiner arrangements: Resubmitted Proposal Version 3.0 QINETIQ/EMEA/iX/BID0704217, 13 September 2007.
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A Original data requirements document

QinetiQ Ref: QINETIQ/EMEA/IX/PL0706630

Version: 1.0

November 2007

The basis of the analysis of a "controlled" study where the safety of drivers examined under delegated examination arrangements will be compared to those examined under DSA examination arrangements. Key to this is matching as closely as possible the two samples.

Data protection. To complete this study it may be necessary to collect information relating to individual drivers' demographics, test history, safety record and any driving penalties received. It may also be necessary to collect certain de-personalised information for the purpose of cross-referencing data sets (e.g. employee numbers, driving licence numbers). This data will be used solely for the purpose of a comparative assessment of DSA examined vs. delegated examined driver safety. At no point will individual drivers' records nor summaries for particular bus companies be passed on to DSA in an identifiable form.

Part 1. Identification of candidate bus companies

We need to identify a list of candidate bus companies utilising delegated examiners and a control group utilising DSA examiners. Each candidate bus companies from the delegated group should be matched as closely as possible to a company from the control group for:

Essential data

a. size of company

b. type of operations (bus/coach)

c. area of operations (rural/urban, area of country, motorway driving)

d. pattern of operations (e.g. 24 hr)

Desirable data

e. whether company participates in the DQM programme

It may not be possible to create an exact match for all factors (e.g. size of company). Where possible this will be controlled for within the analysis. If it is not possible to control for a factor, then the analysis plan will be re-visited. Companies utilising both delegated examiners and DSA examiners will be sought if possible.

We will be seeking a sample of 5,000 drivers (2500 delegated examined and 2500 DSA examined). If it is assumed that delegated examiner companies pass approximately 100 drivers per year and that we can obtain 4 years worth of data per company, our final sample should cover around 12 companies (6 delegated examined and 6 DSA examined). The number of candidate bus companies should therefore be somewhat larger than this (perhaps 25 delegated and 25 DSA examined) as we may not be able to obtain all the necessary data from each company. It may be necessary to include more DSA examiner companies than delegated examiner companies as they will on average be smaller, though it is

intended to seek to use data only from the larger companies. It is anticipated that the stakeholder group can provide guidance and assist with contact information for the candidate bus companies.

Part 2. Data from bus companies

The following data will be sought from each company:

Essential data

a. drivers who have passed test within last 5 years

b. method of examination for each driver (DSA or delegated examiner)

c. date of test pass

d. date of commencement of professional PCV driving

e. whether currently employed or date of leaving company

f. safety data for each driver for up to 2 years following date of commencement of professional PCV driving (date and type of incident), focusing on first 6 months

Desirable data

g. Age of driver

h. Gender of driver

i. Ethnicity of driver

j. Driving licence number (for cross-referencing with DSA and DVLA data)*

k. Amount and method of training

l. Hours worked per week

m. experience of examiner (where delegated)

* if driving licence numbers are available, may be able to get b, c, g and h from DSA

Part 3. Data from DSA and DVLA

The following data will be sought from DSA and DVLA cross-referenced by driving licence number:

Desirable data

a. Test history (e.g. number of fails/passes and dates of practical and theory tests)

b. Experience of examiner (where DSA)

c. Penalties notified to DVLA (type and date)

Part 4. Data from insurance companies

Where possible, data will be sought from insurance companies cross-referenced by driving licence number:

Desirable data

a. Incidents by date and type

B Revised data requirements document

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Data protection. To complete this study it may be necessary to collect information relating to individual drivers' demographics, test history, safety record and any driving penalties received. It may also be necessary to collect certain de-personalised information for the purpose of cross-referencing data sets (e.g. employee numbers, driving licence numbers). Please note: At no point will individual drivers' records nor summaries for particular bus companies be passed on to DSA in an identifiable form.

Driver information

For drivers passing who passed their test within the last 5 years and were employed for a minimum of 6 months following passing their test:

Essential data

a. The method of examination (DSA-examined or delegated-examined)

b. For each driver, whether they were involved in any incidents or accidents (at fault or otherwise) during the first 6 months following passing their test (Answer yes or no)

Desirable data

c. Further details of any incidents/accidents (e.g. if more than one incident/accident the exact number, and whether the driver was considered at fault)

d. The length of time after passing their test that each incident occurred (or the date each driver passed their test and the date of any incidents in which they were involved)

Company information

It would be desirable to collect some basic data about the company itself:

a. size of company (number of drivers)

b. type of operations (bus/coach)

c. area of operations (rural/urban, area of country, motorway driving)

d. pattern of operations (e.g. 24 hr)

C Statistical analysis

A formal statistical analysis methodology has been adopted to assess whether observed differences between examination arrangements could be explained by chance alone. Results are reported together with a “p-value”. This “p-value” is the probability that a difference as large as that observed could arise if in fact there was no difference between examination arrangements, and thus a low p-value is indicative of a true difference between the examination arrangements. In line with standard practice a p-value lower than 0.05 (expressed “$p<0.05$”) has been taken as evidence of a statistical difference. The null hypothesis was that there was no difference in reported accidents between the two examination arrangements.

The two key metrics in this study are effectively probabilities – the probability of *any* accident/incident within first 6 months of professional driving or the probability of an *at fault* accident within first 6 months of professional driving. The study forms a mixed-effect design where companies are considered to be a random effect (i.e. they are considered to be a random sample of UK companies from which we wish to deduce the characteristics of the UK as a whole), and examination type is considered to be a fixed effect (i.e. we wish to deduce specific characteristics for the two examination methods). The analysis is unbalanced in terms of number of drivers within each company and number of companies utilising each examination method. The comparison between examination methods is considered to be partially *within-company* and partially *between-company* as the sample contained data from companies using only one type of examination arrangement and data from companies using both types of examination arrangement.

As each driver either does or does not have an accident, an appropriate statistical model might be a mixed-effect generalised linear binomial model with a logistic link function of the form:

$$y = t_i + c_j + (tc)_{ij}$$

where t represents examination type,

c represents the company

$$c_j \sim N(0,\sigma^2_c)$$

$$c_{ij} \sim N(0,\sigma^2_{tc})$$

$$\text{Probability of accident} = e^y / (1 + e^y) \qquad \textit{[equ. 1]}$$

However to simplify the computational approach it was determined to use a alternative formulation:

$$\text{Probability of accident} = t_i + c_j + (tc)_{ij}$$

where t represents examination type,

c represents the company

$$c_j \sim N(0,\sigma^2_c)$$

$$c_{ij} \sim N(0,\sigma^2_{tc}) \qquad \textit{[equ. 2]}$$

and consider the analysis in the form of a mixed-effect analysis of variance. It is observed that though analysis of variance demands that errors are *normally* distributed with equal variance and that here the errors associated with each

individual data point would be *binomially* distributed, the contrast between the two levels of 'type of examination' is effectively a difference of means over many individuals and companies. Thus, by the central limit theorem, its associated error is closely approximated by the normal distribution and analysis of variance constitutes an appropriate methodology.

In the original data requirements document it was assumed that additional covariates (e.g. type of bus operations) would be collected to at least in part explain the between-company variability. However, this was downgraded from being 'essential' to being 'desirable' in the revised data requirements document in order to encourage greater participation in the study. As a consequence insufficient data were ultimately collected to allow such covariates to be included in the analysis.

The data were analysed using bespoke mixed-effect modelling software utilising a REML algorithm. An equi-correlated block diagonal covariance matrix is assumed. There was no statistical evidence that σ^2_{tc} was non-zero, so the term was excluded from the analysis.

	DSA-examined drivers	Delegated-examined drivers
Drivers reported with any accidents/incidents within first 6 months	40.4%	55.6%
Drivers reported with any "at fault" accidents within first 6 months	25.0%	41.5%

Table C-1 – Accidents/incidents for DSA-examined and delegated-examined drivers

	Drivers reported with any accidents/ incidents within first 6 months	Drivers reported with any "at fault" accidents within first 6 months
Predicted value of $t_2 - t_1$	0.129	0.141
Statistical test t_1 vs. t_2	F = 4.471; df = 1,13 p = 0.054	F = 5.509; df = 1,13 p = 0.036
Estimate of σ_c	0.183	0.190

Table C-2 – Summary of statistical analyses

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Results were reported in terms of a t-value (calculated from the F-value within the analysis) and number of degrees of freedom. Thus there was evidence that drivers in companies utilising delegated examination arrangements were more likely to be reported involved in at-fault accidents within the first 6 months of passing the test than those in companies utilising DSA examination arrangements ($t=2.35$; $df=13$; $p<0.05$).

The difference could not quite be confirmed for *any* accidents/incidents ($t=2.11$; $df=13$; $p=0.054$), though this would be considered statistically significant if expressed as a one-tailed test i.e. that "delegated-examined drivers were involved in *more* accidents/incidents" rather than "delegated-examined drivers were involved in a *different number* of accidents/incidents".

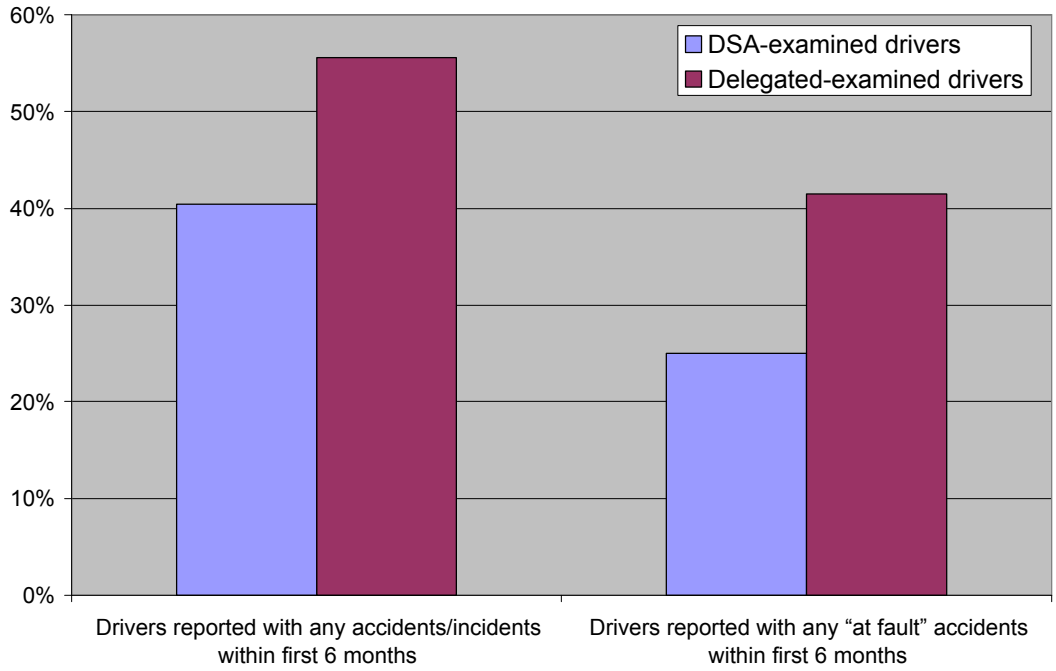

Figure C-3 – Comparison of DSA-examined and delegated-examined drivers

D Power of the study

The statistical power of a study is the probability that the study will be able to demonstrate a statistically significant difference. The power depends on the characteristics of the metrics in question and on the study design itself. Key elements are:

- Inherent variability in data. If the measure is question has a high degree of inherent variability, it will be more difficult to prove a statistical difference.
- Size of underlying condition difference. It is easier to demonstrate statistical significance when the underlying differences between conditions are large.
- Sample size. In general terms the more data that is collected, the easier it becomes to demonstrate a statistical difference.
- Between-group vs. within-group testing. It is usually easier to demonstrate statistical differences when other sources of variability are controlled for. Thus a study where the *same* group of people is subjected to each condition under investigation is generally more powerful than one where a *different* group of people is subjected to each condition. This is because different groups will vary in ways over and above those caused by the condition under investigation and thus add extra sources of variation to the study.

In the original data requirements document, it was determined that the study should seek a sample of 5,000 drivers (2500 delegated examined and 2500 DSA examined). The sample should cover around 12 companies (6 delegated examined and 6 DSA examined), and the basis of comparison would be between-company though within-company data would be sought if available. In fact, the final data set comprised only 1689 drivers overwhelmingly examined under delegated arrangements, but the comparison between examination methods could be performed on a part-within and part-between company basis.

Having completed the study, we are now able to estimate the inherent variability in the data. Thus it is now possible to estimate what the power of the study would have been had the original data requirements of a between-company comparison utilising 5000 drivers been achieved. This is summarised in table D-1.

	Minimum detectable difference between examination arrangements (expressed in percentage points) with 50% power, $p<0.05$
Original data requirements: 6 companies of 400 delegated-examined drivers and 6 companies of 400 DSA-examined drivers	22 %

Table D-1 – Minimum detectable difference had original data requirements been achieved

Thus the study as originally conceived would have only been likely to detect a difference between examination arrangements if the difference had been 22 percentage points or larger. The study as ultimately completed was able to detect a statistically significant difference of only 14 percentage points. Despite the smaller sample size the study actually delivered more power.

The explanation of this apparent anomaly is in the value of 4 the companies that provided data for both DSA-examined and delegated-examined drivers. The observed between-company variations in the study were relatively large (perhaps reflecting differences in routes or differences in reporting methodology). Therefore the companies who were able to supply data for both delegated and DSA examination arrangements effectively subtracted out some of this variability by acting as their own control. This had substantial benefit in increasing the power of the study as a whole.

Similar calculations can be performed to examine the expected power of proposed study designs and thus optimise the shape of future studies. Table D-2 contains an examination of expected minimum detectable differences for a variety of study designs. The smaller the 'minimum detectable difference', the more powerful the study. As described in Annex C, it was not possible to determine a good estimate of σ_{tc} from the current study and so by way of a sensitivity analysis data is provided for an assumption of $\sigma_{tc} = 0$ and for $\sigma_{tc} = 0.09$.

It can be seen that in general terms:

- The within-company designs offer significantly better power than the between-company designs, even when the total sample size is relatively small.
- For the between-company designs in particular, it is better to collect data from a large number of companies even if the sample size from each is relatively small than it is to collect larger samples from a smaller number of companies.

The estimates of power for the between-company designs may be pessimistic if it is possible to identify company factors (e.g. type of bus operations) that explain part of the observed differences in accident rates. However as it was not possible to do this in the current study, it is not possible to provide a reliable estimate of what, if any, effect this might have on the power of these studies save to observe that the power could not exceed that of the equivalent within-company study.

		Minimum detectable difference between examination arrangements (expressed in percentage points) with 50% power, $p<0.05$ assuming $\sigma_{tc}=0$	Minimum detectable difference between examination arrangements (expressed in percentage points) with 50% power, $p<0.05$ assuming $\sigma_{tc}=0.09$
Within-company designs	4 companies of 100 drivers each (50 delegated-examined and 50 DSA-examined) Total = 400 drivers	12 %	20 %
	6 companies of 50 drivers each (25 delegated-examined and 25 DSA-examined) Total = 300 drivers	12 %	16 %
	6 companies of 100 drivers each (50 delegated-examined and 50 DSA-examined) Total = 600 drivers	8 %	14 %
	12 companies of 50 drivers each (25 delegated-examined and 50 DSA-examined) Total = 600 drivers	8 %	12 %
Between-company designs	4 DSA-examined companies of 100 drivers each and 4 delegated-examined companies of 100 drivers each Total = 800 drivers	32 %	35 %
	8 DSA-examined companies of 25 drivers each and 4 delegated-examined companies of 200 drivers each Total = 1000 drivers	27 %	29 %
	12 DSA-examined companies of 25 drivers each and 6 delegated-examined companies of 100 drivers each Total = 900 drivers	22 %	24 %
	20 DSA-examined companies of 25 drivers each and 12 delegated-examined companies of 100 drivers each Total = 1700 drivers	16 %	16 %

Table D-2 – Minimum detectable differences for various study designs

E Initial investigation of additional data sources

E.1 Background

This annex is prepared under the Phase 2 optional extension to contract DSA04507 as described in the proposal 1-LTNWT dated 18 June 2009.

In 2008 QinetiQ undertook a study to test the hypothesis that drivers passing the PCV practical test under delegated arrangements have an equivalent safety record following commencement of professional driving to those passing the PCV practical test with a DSA examiner. There was difficulty in obtaining data from some bus and coach companies, though ultimately 14 companies agreed to participate in the study. The companies included both bus and coach operators, and were geographically distributed across England and Wales.

The study found some evidence that drivers in companies utilising delegated examination arrangements were more likely to be reported involved in at-fault accidents within the first 6 months of passing the test than those in companies utilising DSA examination arrangements. Though the sample was relatively small, the observed differences were larger than would be expected by chance alone. However there was insufficient evidence to demonstrate this could be explained by the difference in examination arrangement alone.

Therefore it was recommended that further research is required in order to validate or otherwise disprove the finding. It was recommended that additional data would be sought to extend the analysis to provide more robust conclusions to the analysis.

Stage one of the programme is an initial investigation to explore the data already captured and identify new sources of data. QinetiQ has revisited the contacts made earlier, specifically with the four ‘within-company’ organisations, to see if more detailed data can be captured easily.

QinetiQ has also make use of the contacts with stakeholders to evaluate the likelihood of making new contacts to increase the number of ‘within-company’ organisations.

The end of stage one is marked by this annex which includes:

- a realistic assessment of the likelihood of capturing further data by company (although not naming the companies);
- a realistic assessment of the likelihood of capturing data from a wider range of ‘within-company’ companies; and
- a list of the companies in terms of their profile (e.g,. number of tests by examination type) and how representative the sample is likely to be.

Stage two of the programme would be the collection and analysis of the extra data from the bus and coach operating companies identified in stage one. The decision on whether to proceed with stage two will be taken by the project steering group.

E.2 Analysis

An initial investigation into experimental power deemed that for an additional "within-company" study to add significant value we would be seeking to identify one or more of the following additional sets of driver records:

a. at least 20-30 additional DSA-examined driver records for each "within-company" company (4, 7, 9 and 14), and preferably a similar number of additional delegated-examined driver records for companies 9 and 14;

b. at least 30-50 additional driver records for 3 – 4 companies for which we had already collected data representing a *different* method of examination from the data already collected for that company; or

c. at least 60-100 additional driver records for 3 – 4 companies for which we had not already collected data, representing both examination methods within each company.

The fourteen companies that participated in Phase 1 of the study were re-contacted by telephone and/or email during July and August 2009, with particular emphasis on the four companies that were known to have employed both DSA and delegated examination arrangements. They were asked if they held any additional accident data, and whether they would be willing to participate in a future data collection exercise. This exercise identified a total of 5 potential sources of additional data. Where companies held additional data it typically related to new drivers who had commenced driving since the original data collection exercise, or to periods preceding those that had previously been supplied

In parallel a representative of the Confederation of Passenger Transport canvassed their member companies to identify potential participants who have experienced periods with and without delegated examiners.

Additionally five companies were contacted by email that initially expressed interest in the original "Phase 1" study but ultimately were unable to participate.

E.3 Results

The companies were categorised according to the likelihood of being able to supply data as follows:

- *High*. Holds additional data and willing to participate;
- *Medium*. Holds additional data but expressed some reservation over participation, typically regarding the effort involved;
- *Low*. Unable to participate; or
- *Nil response*. No reply received from company.

Where the company was deemed to have a 'high' or 'medium' likelihood of participation, an estimation of the quantity of available data was derived by considering the data previously supplied, the period covered for the 'new' data and the examiner type.

The estimated quantity of additional available data is given in Table E-1.

		Original data collection		Estimated additional available data		
	Examination arrangements	DSA-examined drivers	Delegated-examined drivers	Likelihood of obtaining additional data	Est. additional DSA-examined drivers	Est. additional Delegated-examined drivers
Company 1	DSA	58	-	High	20	-
Company 2	Delegated	-	256	Low	-	-
Company 3	Delegated	-	60	Nil response	-	-
Company 4	Both	31	61	Medium	-	30
Company 5	Delegated	-	366	Nil response	-	-
Company 6	Delegated	-	51	Nil response	-	-
Company 7	Both	25	332	Low	-	-
Company 8	Delegated	-	160	High	-	30
Company 9	Both	7	17	Low	-	-
Company 10	DSA	14	-	Low	-	-
Company 11	Delegated	-	23	High	-	20
Company 12	Delegated	-	162	Nil response	-	-
Company 13	Delegated	-	59	Nil response	-	-
Company 14	Both	1	6	Medium	-	50
Others		-	-	Low	-	-
TOTAL		**136**	**1553**		**20**	**130**

Table E-1 – Original and estimated additional available data

Of the four 'target' companies that were known to have employed both DSA and delegated examination arrangements, only two (companies 4 and 14) reported that they may be able to participate further. Company 4 offered data from the period 2008/9 since the original study which related solely to delegated-examined drivers, but expressed some reservations regarding the effort involved. Company 14 offered data from pre-2008 that also represented solely delegated-examined drivers, but reported that "*the data can only be obtained by a time consuming trawl through driver records … we could not guarantee to meet a deadline*".

The three other companies that would be able to participate in a future study all said they would be able to supply data from the period 2008/9 since the original study. In each case only one examination arrangement would be covered: 2 companies employing delegated arrangements and one employing DSA-examined arrangements.

QinetiQ received no positive responses when contacting companies who had previously expressed interest to participate but who had not yet done so.

Likewise, the representative of the Confederation of Passenger Transport was unable to identify additional member companies able to participate in the study who have experienced periods with and without delegated examiners.

E.4 Conclusions

The likelihood of capturing further data from existing companies. Additional data collection from 5 existing companies might yield an additional 20 DSA-examined drivers and 130 delegated-examined drivers. There may be some challenges associated with obtaining this data, most notably the ability of the companies to provide the necessary time and effort to assemble the additional data.

Whilst this represents a little under 9% additional data overall, it represents nearly 15% additional data in currently under-represented "DSA-examined" category.

Further, while each company could only supply *additional* data for a single method of examination, 80 of the 130 additional drivers would be for companies for which we already hold data for multiple examination methods, representing an increase of nearly 17% in our "within-company" data pool.

The likelihood of capturing data from a wider range of 'within-company' companies. QinetiQ received no positive responses when contacting companies who had previously expressed interest to participate but who had not yet done so. Likewise, the representative of the Confederation of Passenger Transport was also unable to identify additional member companies able to participate in the study who have experienced periods with and without delegated examiners.

A total of 40 bus and coach companies were contacted in the original ("Phase 1") study, the majority of which were contacted twice during separate collection phases (Nov 07 – Mar 08 and Jun 08 – Aug 08). Of these only 14 (35%) were ultimately able to provide data. It is reasonable to presume that the companies most likely to participate have already done so.

Thus it is concluded that we are unlikely to identify any more companies willing to participate using the current research protocol.

How representative the sample is likely to be. As stated, we may be able to add some data for those companies already collected, though it is deemed unlikely to materially widen the pool of companies included in the analysis.

However the original study already provided some evidence that companies that employed DSA examination arrangements showed on average a better safety outcome than those that employed delegated examination arrangements. The predominant issue is that any observed difference might also be explained by differences in size, demographics, route types or reporting procedures between the different companies. Hence the primary purpose of this exercise was to identify whether additional "within-company" data was available i.e. data for companies covering periods when they employed both examination arrangements. In this way the companies might be used as their own "control".

Unfortunately if we factor in the 80 extra drivers that might be added to a "within-company" study, we predict that the ability of the trial to detect differences in examination method is improved by just 0.4 percentage points (from a minimum detectable difference of 14.2% to a minimum detectable difference of 13.8%, assuming 50% power and no company x arrangement interaction). It is therefore concluded that even with the additional data any additional data collected here is unlikely to add significant value to a "with-company" analysis.

This is confirmed by our failure to meet our initial targets as described in Section 2.1. We were only able contribute to sets ‘a’ and ‘b’ (additional data for existing companies), and in each case we were not able to identify the required mix of examination arrangements. We were only able to identify additional *delegated-examined* driver records for companies 4 and 14, and we were only able to identify data for other companies using the *same arrangement* as that previously collected for each company.

E.5 Overall summary

It is concluded that if Stage Two were to progress using the additional data identified here, then it would be unlikely to be able to materially improve the robustness of the findings of the original study.

Whilst a “within-company” comparison may ultimately prove fruitful, after three attempts at data collection (two in “Phase 1” and one as part of this study) it is concluded that data collection according to the current research protocol appears unlikely to generate sufficient data to meet the needs of the study.

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Abstract

The objective of this study was to test the hypothesis that drivers passing the PCV practical test under delegated arrangements have an equivalent safety record following commencement of professional driving as those passing the PCV practical test with a DSA examiner. A controlled study approach was adopted. A total of 14 companies agreed to participate in the study and were able to supply data. There was evidence here that the reported rate of drivers experiencing at-fault accidents within six months of passing their test was higher for delegated-examined drivers than for DSA-examined drivers. The observed differences were larger than would be expected by chance alone. DSA may like to gather additional data in which case a within-company study is recommended. It is further recommended that DSA investigates the causes of the differences in accident rate with a view to amending policy or process in this area, and investigates other types of organisation that utilise delegated arrangements.

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