



Trojan horse health and safety messaging

*An assessment of the long-term and
behavioural impact on construction
site operatives*

Prepared by **SCI and Loughborough University**
for the Health and Safety Executive 2006

RESEARCH REPORT 505



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An assessment of the long-term and behavioural impact on construction site operatives

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To assist in the dissemination of health and safety information to site operatives, SCI initiated the Trojan Horse project in 2004. The project was sponsored by the Health and Safety Executive and aimed to deliver positive safety messages to site operatives using messages on the medium they routinely work with. The study showed that the Trojan Horse messaging technique:

- Generated minimal interference with construction site works;
- Elicited positive responses from the operatives working on site and utilising components on which Trojan Messages were displayed;
- Resulted in high levels of awareness and information uptake with regards to the safety recommendations.

The report on the first phase of the study is available on the HSE website as report number RR336. The subsequent feedback from industry stakeholders was positive and it was recommended that a second phase of the project is carried out to assess the long-term impact of the messages.

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

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First published 2006

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ACKNOWLEDGEMENTS

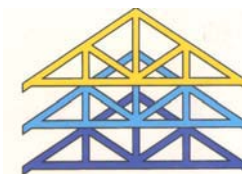
This project was sponsored by the Health and Safety Executive working in partnership with Skanska, Taylor-Woodrow, Multiplex, Mace, Bovis and Dover Trussed Roof Co. Ltd. The technical and logistical support provided by the organisations is gratefully acknowledged. In particular, we would like to thank the following people for their valuable contribution to the project:

Gavin	Archer	Skanska
Bob	Arnold	Multiplex
Bassam	Burgan	SCI
Margaret	Burns	Health and Safety Commission
Bill	Callaghan	Health and Safety Commission
John	Carpenter	Secretary to SCOSS
Peter	Chandler	Taylor Woodrow
Alan	Collier	Taylor Woodrow
Clare	Convy	SCI
Steve	Derbyshire	Taylor Woodrow
Alan	Harris	Multiplex
Russell	Hughes	Byrne Bros
David	Leer	Bovis Lend Lease
Benjamin	Legg	Skanska
Eddie	Meyer	Byrne Bros
Robert	Miles	Health and Safety Executive
Tony	Northcott	Mace
Katharine	Parkes	Oxford University
Mick	Pond	Taylor Woodrow
Roger	Pope	Roger Pope Associates
Stuart	Price	Hare
David	Rigden	Bovis Lend Lease
Chris	Shelton	Dover Trussed Roof Co. Ltd
Bob	Simpson	Health and Safety Executive
John	Tebbit	Construction Product Association
Brian	Van Campenhout	Skanska
Guillaume	Vannier	SCI
Tony	Whitehead	Health and Safety Executive
Stephen	Williams	Health and Safety Executive

The Trojan Horse Phase II project team consisted of:

Paul Thomas, HSE, Project Technical Client
Viken Chinien, SCI, Trojan Horse Project Manager
Alistair Cheyne, Loughborough University, Survey design/analysis
Deborah Walker, Loughborough University, Site surveys
Richard Day, The Concrete Society, Site surveys
Richard Barnes, The Concrete Society, Site surveys

The Trojan Horse project was a successful partnership between various organisations and companies including:



Dover Trussed Roof Co Ltd

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EXECUTIVE SUMMARY

One of the problems in the construction industry is that much of the workforce at site level is self-employed and there is little opportunity or incentive to invest in training. In addition, the current shortage of local construction operatives will inevitably result in the recruitment of more overseas workers who bring an additional set of challenges that have to be addressed, particularly in terms of their language skills, their working culture and previous health and safety training. It is crucial, therefore that safety information is made available to site operatives to build on their previous training or refresh and reinforce awareness of good health and safety practices. Trojan Horse messages are ideally suited for that purpose.

To assist in the dissemination of health and safety information to site operatives, SCI initiated the Trojan Horse project in 2004. The project was sponsored by the Health and Safety Executive and aimed to deliver positive safety messages to site operatives using messages on the medium they routinely work with. The study showed that the Trojan Horse messaging technique:

- Generated minimal interference with construction site works;
- Elicited positive responses from the operatives working on site and utilising components on which Trojan Messages were displayed;
- Resulted in high levels of awareness and information uptake with regards to the safety recommendations.

The report is available on the HSE website as report number RR336. The feedback from industry stakeholders was positive and it was recommended that a second phase of the project is carried out to assess the long-term impact of the messages.

The Phase II project was sponsored by the Health and Safety Executive and was led by SCI with Loughborough University and The Concrete Society as partners. A collaborative partnership was developed with Skanska, Taylor-Woodrow, Mace, Bovis and Multiplex who provided significant technical and logistical support to the project and helped deliver a successful outcome.

The research was overseen by a Steering Group comprising of senior health and safety representatives from industry whose main remit were to provide focus and direction to the study and to critically appraise the methodology adopted for the study. The process was independently peer reviewed at strategic intervals by a senior health and safety consultant from Hare.

The Trojan Horse Phase II aimed to assess the long-term and behavioural impact of the Trojan Horse safety messages. The objectives were to:

- To assess the levels of site operative awareness of Trojan Horse Safety messages;
- To assess the impact of messages in terms of behavioural change;
- To evaluate the lasting impact of these changes; and
- To investigate the underlying mechanisms associated with behavioural change.

Both health and safety messages were used in the second phase of the Trojan Horse project. Following discussions with the Health and Safety Executive, the Peer Reviewer and the Steering Group members, it was decided that the following issues were to be addressed in this study:

- Slinging of steel components;
- Unloading of trusses on level ground;
- Lifting correctly i.e. adopting the correct posture for lifting components;
- Wearing ear defenders to protect hearing.

The messages were displayed at specific point-of-use on the various sites that were surveyed in the study. The site surveys were carried out over a period of 4 months and consisted of both observations and face-to-face interviews with construction site operatives.

The interviews were based on 2 sets of questionnaires relating to the long-term impact assessment and the behavioural assessment. The Theory of Planned Behaviour was used as the framework to assess the behavioural impact of the Trojan Horse messages. The study tested four basic hypotheses, namely:

H₁: Site Operatives are aware of the Trojan Horse safety messages;

H₂: This awareness will result in adopting safe working practices;

H₃: Resultant changes in safety behaviour will be evident over a period of time;

H₄: Changes in behaviour will be associated with changes in attitude.

73 operatives were interviewed on 12 sites. The process was greatly facilitated by the logistical support provided by the companies participating in the project. Site management was very supportive of the project and the attitude of the site operatives was, also, positive. The key conclusions from the observation and interviews with the construction site operatives are:

- Awareness of the messages increased after repeated exposure to the messages;
- Observations of behaviour after implementation of the Trojan Horse message suggested a positive impact on operatives' behaviour;
- The social environment was found to play a central role in shaping the behaviour observed in this study.

A high-profile seminar was held on the 12th of September 2006 to disseminate the results of the study to the industry stakeholders. The feedback was positive and it is anticipated that the subsequent stage in the wider application of the Trojan Horse technique will involve the development of a Trojan Horse website.

1 INTRODUCTION

The '*Revitalising Health and Safety*' strategy [1] was launched in 2000 with the aim of improving health and safety performance in the construction industry. It sets out 3 national targets to be achieved by the industry by 2010, namely:

- 10% reduction in the fatalities and major injuries rate;
- 20% reduction in the work-related ill health cases;
- 30% reduction in working days lost per worker from work-related injury and ill health.

The targets are measured relative to the 1999/2000 incidence rates and it was aimed to achieve half the improvement by 2004. However, the recent Statistical Progress Report [2] concluded that:

- a) The mid-point target for a reduction of 5% in the rate of fatal and major injury has not been met. In fact, the rate of fatal and major injury rate is around 1% higher in 2004/2005 than in 1999/2000;
- b) There has been a significant reduction in the number of work related ill health cases and statistical analysis show that the 10% target by 2004 has probably been met;
- c) The reduction in working days lost per worker has possibly met the 15% target.

The latest figures published by the Health & Safety Executive (HSE) show that the number of fatal incidents for the first 9 months of 2005/2006 is 41. This is lower than the corresponding period in 2004/2005 which confirmed 56 fatalities. Despite this downward trend, these figures are still unacceptably high and it is crucial that all the relevant stakeholders continue to work together to deliver a safer construction industry.

1.1 BACKGROUND

A report by Loughborough University [3] in 2003 identified several key themes regarding the sources of problems with safety and the causes of incidents, namely:

- A skills shortage in the industry is leading to increased reliance on inexperienced workers, coupled with difficulties in verifying competency;
- Bonus payments act as a strong incentive, but encourage productivity over safety;
- Long hours culture in the industry results in fatigue, compromised decision-making, productivity and safety;
- Problems exist with availability, performance and comfort of PPE.

These themes are reflected in the main causes of fatal incidents as identified by the HSE:

- Falling through fragile roofs and rooflights;

- Falling from ladders, scaffolds and other work places;
- Being struck by excavators, lift trucks or dumpers;
- Being struck by falling loads and equipment;
- Being crushed by collapsing structures.

The activities associated with the above causes are routine on construction sites and incidents will continue to occur unless operatives are provided not only with the adequate level of supervision, training and education but also the right PPE and equipment to perform their tasks.

However, one of the problems, in the construction industry is that much of the workforce at site level is self-employed and there is little opportunity or incentive to invest in training. For instance, it is anticipated that this problem will increase in the near future in light of the fact that there will be a significant increase in the workforce level with the advent of the Olympic Games in 2012.

The current shortage of local skilled construction operatives will inevitably result in the recruitment of overseas workers to contribute to the development of the infrastructure for the Games. The latter workers, however, bring an additional set of challenges that have to be addressed, namely:

- a) Language skills: Many of the workers may not be able to read, write or understand English and this may lead to communication problems which can result in incidents;
- b) Working culture: It is most probable that working practices (management set-up and attitude) may differ from that previously experienced by the workers;
- c) Health & Safety Training: It is expected that a significant proportion of the workers will not have the prerequisite Health & Safety training.

It is crucial, therefore, that safety information is made available to site operatives to build on their previous training or refresh and reinforce awareness of good health and safety practices.

1.2 TROJAN HORSE PHASE 1

To assist in the dissemination of health and safety information to site operatives, The Steel Construction Institute initiated the Trojan Horse project in 2004. The project was sponsored by the Health and Safety Executive and aimed to deliver positive safety messages to site operatives using messages on the medium they routinely work with.

The study investigated the efficacy of Trojan Horse messages in raising awareness and imparting safety information directly to site operatives. Messages were designed in conjunction with various participating companies and trade associations. Site operatives from 4 different construction trades (steel erectors, steel decking specialists, truss rafter erectors and precast unit installers) were interviewed by trained field engineers following placement and delivery of the messages to site to assess their awareness of the messages and the level of information uptake from the messages.

The main conclusions from the study were as follows:

- Messages were easily applied to a range of components with minimal interference to both site and manufacturing works;
- Site operatives were generally highly aware of the Trojan Horse messages. The results also indicated that other site messages had minimal impact on the awareness of the operatives;
- The recall and interpretation of the messages by the operatives was very good. This implies that the Trojan Horse messaging results in levels of information uptake similar to that achieved by actually showing an operative the message.

A consultation with industry stakeholders, which included Major Contractors Group (MCG) members and various trade associations, was held where the results from the study were presented. The feedback from these industry stakeholders was positive to the extent that they endorsed the messaging technique. The industry stakeholders recommended that longitudinal surveys are carried out to assess the long-term impact of the Trojan Horse messages and that the technique be extended to cover general safety and health issues.

The Trojan Horse Phase I report is available on the HSE website as Research Report 336 at <http://www.hse.gov.uk/research/rrpdf/rr336.pdf>.

1.3 OBJECTIVES OF TROJAN HORSE PHASE II

The first phase of the Trojan Horse study has shown that the technique can be successfully applied to various components thereby delivering safety information directly to site operatives. The objectives of the second phase of the Trojan Horse project were to address the following issues:

- Long-term or longitudinal impact of the messages - Constant exposure to the messages may result in reduced impact of the Trojan Horse technique. The current study investigated this effect by carrying out face-to-face interviews with site operatives to test their awareness of the messages over a period of time;
- Behavioural Impact of the messages - It was recognised that one of the factors that will contribute to an improvement in the health and safety performance of the industry is a positive change in the behaviour of site operatives. Site observations of behaviour and face-to-face interviews with operatives were carried out to assess whether Trojan Horse messaging elicited any positive changes in behaviour;
- Health issues - The messages were extended to address health issues particularly those relating to manual handling, which can lead to musculoskeletal disorders (MSD). The latter accounts for two-thirds of all days taken off work in the construction industry.

1.4 SCOPE OF WORK

To achieve the above objectives, the study was split into several stages as follows:

- a) Identification of key health and safety issues to be addressed in the study and the design of pictorial messages to illustrate best practice;
- b) Involvement of companies willing to apply the messages to product components and to facilitate access to site for observation and interview of operatives;

- c) Survey design to assess the long-term and behavioural impact of the Trojan Horse messages;
- d) Application of the survey to sites identified in conjunction with the partner companies. This included both behavioural observation of site operatives in relation to the issue addressed in the message and face-to-face interviews;
- e) Analysis of the data to validate (or otherwise) the survey hypotheses;
- f) Recommendations on the long-term and behavioural impact of Trojan Horse messaging and its practical application.

1.5 PROJECT SET-UP

The project was sponsored by the Health and Safety Executive (HSE) and was led by The Steel Construction Institute with Loughborough University and The Concrete Society as partners. Paul Thomas, Specialist Inspector (Construction) at the HSE, acted as the HSE technical liaison officer and provided significant input to the study.

It is noteworthy to point out that Dr Katharine Parkes of Oxford University was enlisted to carry out a review of Trojan Horse Phase I and the proposed phase II study particularly the behavioural aspect of the study. The findings from this independent review are published in a separate report [4] submitted to the HSE.

The project set-up was similar to that for the first phase of the study. It was crucial to enlist the participation of industry stakeholders to advise on the methods and procedures adopted for the study; hence, the appointment of a peer reviewer and the formation of a steering group.

1.5.1 Peer Reviewer

Stuart Price of Hare Ltd was appointed as peer reviewer with the following role:

- a) To critically appraise the project methodologies before declaration to the Steering Group and before committal;
- b) To appraise intermediate results in the form of draft reports; and
- c) To provide mentoring advice on procedures and deliverables before committal.

1.5.2 Steering Group

The Steering Group, shown in Table 1, comprised of six senior health and safety representatives from various construction sectors with the following remit:

- To provide focus and direction to the study;
- To critically appraise the methodology adopted for the study particularly in relation to the various construction types;
- To advise on issues raised by the peer reviewer and the working group.

Table 1 Steering Group members for Trojan Horse Phase II

Name	Company
John Carpenter (Chairman)	Secretary to SCOSS
Steve Derbyshire	Taylor Woodrow
Roger Pope	Roger Pope Associates
Benjamin Legg	Skanska
Chris Shelton	Dover Trussed Roof Co. Ltd
John Tebbit	Construction Products Association
Paul Thomas	Health & Safety Executive
Tony Whitehead	Health & Safety Executive
Bassam Burgan	SCI

1.5.3 Participating Companies

The success of the second phase of the Trojan Horse project hinged on the assistance of companies to facilitate the surveys. The companies provided both technical and logistical support for the Trojan Horse project particularly in terms of:

- a) Providing sites and facilitating access to carry out surveys;
- b) Advising on the design of the messages and the relevance of the message for each site;
- c) Placing/attaching/sticking the messages on components;
- d) Identifying site operatives to participate in the surveys.

The companies involved in the second phase of the project were, in alphabetical order:

- Bovis Lend Lease;
- Dover Trussed Roof Co. Ltd;
- Mace;
- Multiplex;

- Skanska;
- Taylor Woodrow.

1.5.4 Industry Support

The Trojan Horse project has received keen interest from industry stakeholders including various trade organisations (British Constructional Steelwork Association, Truss Rafter Association, Precast Flooring Federation, Construction Products Association) and members from the Major Contractor's Group.

The project has also been endorsed by the Chair of the Health and Safety Commission, Bill Callaghan and has been brought to the attention of the Construction Industry Advisory Committee (CONIAC). John Tebbit acted as a representative of CONIAC within the Trojan Horse Steering Group.

1.6 TIMELINE

A summary of the methodology and timeline for the study is shown in Figure 1. The project started in June 2005 and the final report was submitted to the Health and Safety Executive in September 2006. The results of the study were disseminated at a meeting held at the HSE offices in London on the 12th of September 2006.

As illustrated in Figure 1, there were a total of 5 Peer Review and Steering Group meetings at various critical stages within the project. These meetings provided valuable advice on:

- the design of the messages;
- the placement of the messages; and
- the survey design.

The Peer Reviewer and the Steering Group members also facilitated the enlisting of companies for the site surveys.

A detailed description of the methodology is given in Section 2.

1.7 REPORT OVERVIEW

Section 2 provides an overview of the methodology adopted for the Trojan Horse study. Section 3 describes the identification and design of the health and safety message used in the current study.

The survey design is presented in Section 4. It includes a description of the survey hypotheses and the survey questionnaires. Section 5 provides an overview of the site surveys carried out in this study. The survey analysis and results from the study are reported in Section 6. The conclusions are given in Section 7. The feedback from stakeholders on the outcomes of the project is summarised in Section 8.

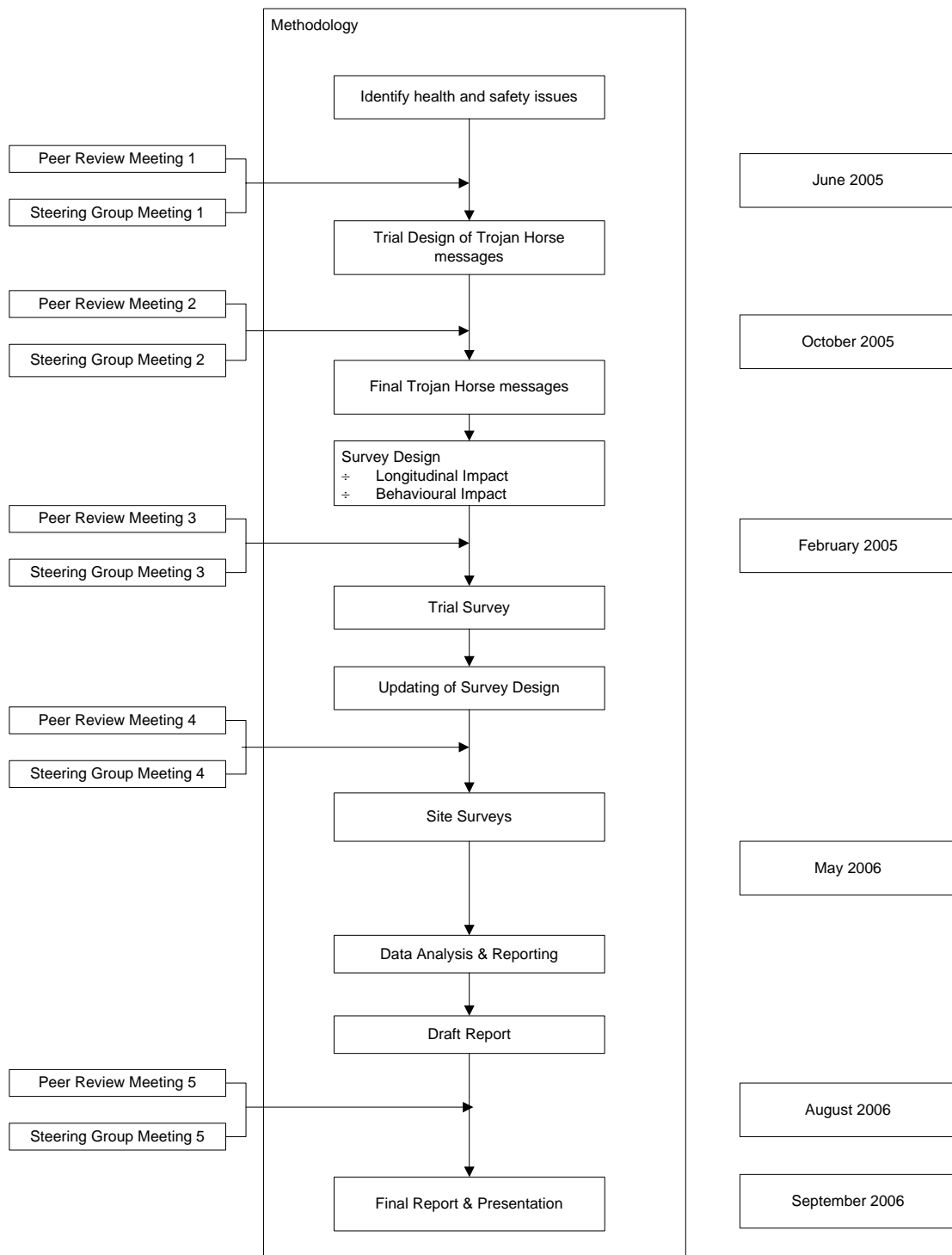


Figure 1 Flowchart showing methodology and timeline for Trojan Horse Phase II

2 OVERVIEW OF TROJAN HORSE PHASE II METHODOLOGY

The scope of work for the second phase of the Trojan Horse project included an assessment of the long-term (or longitudinal) impact of the messages and of the behavioural impact of the messages on site operatives. The long-term impact assessment resulted from the recommendations of the post Phase I meeting with industry stakeholders.

The Phase II study also recognised the fact that while operatives are generally aware of Trojan Horse messages and gain safety information from those messages, it does not necessarily follow that this will lead to a positive change in their behaviour. The current study, therefore, addressed the behavioural impact of the messages and endeavoured to qualitatively and quantitatively assess the behaviour of site operatives over a fixed period of time.

This section reviews existing literature on similar messaging techniques and describes the long-term and behavioural impact assessment. The methodology adopted for the study is also discussed.

2.1 LITERATURE REVIEW

There are very few examples of studies that have used similar tactics as the Trojan Horse safety messaging. However, a recent study carried out by Kurz et al. [5] used a Trojan Horse technique to assess its influence on levels of water and energy consumption in 166 households in Western Australia.

The study compared the effect of information leaflets, attunement labels and socially comparative feedback on the actual levels of water and energy consumption in the various households. Attunement labels are labels that carry information on the water and energy-use affordances of various objects and appliances and which were placed at the actual point of interaction between residents and the environmentally relevant objects. In the comparative feedback scenario, households received feedback sheets which provided residents with graphical feedback on their level of water/energy consumption and how these levels compared to other similar households participating in the research.

The results of the study showed that the use of attunement labels had an impact on the water consumption with a 23% reduction in consumption. No significant reduction in consumption was obtained in households provided with the information leaflets and the comparative feedback. The findings from the study suggest that the most effective way to reduce the water and energy consumption is to target the actual point of interaction between the consumers and the environmentally relevant objects.

A similar conclusion was found in a study carried out by Burt, Henningsen and Consedine [6] who evaluated the adoption of a correct lifting technique based on symbols stuck on packaging. The study investigated whether the presence or absence of a symbol depicting correct lifting posture affected the way office workers lifted a package. It was found that the presence of the correct lifting symbol resulted in a significant increase in the use of the correct lifting technique.

In a review of the first phase of the Trojan Horse, Parkes [4] noted that whilst there are other examples in the literature of the use of safety messages and signs on construction sites and other work areas, the Burt et al. [6] study is the only example of experimental evaluation of safety messages presented in 'Trojan Horse' style.

These above studies ([5], [6]) have shown that a positive change in the behaviour of a target group can be effected by interaction with relevant messages at point of use. The Trojan Horse phase II study sought to assess the behavioural issues in the context of health and safety issues on construction sites.

2.2 STEERING GROUP

The first phase of the study concluded that that site operatives were aware of the Trojan Horse messages and gain information from them. However, the study did not assess whether the awareness and information uptake from the messages decay with time i.e. whether through over-exposure to the Trojan Horse messages, the site operatives no longer pay any attention to the messages. This is generally the case for health and safety messages displayed on posters around the site, as illustrated in Figure 2.



Figure 2 Health and Safety messages on a construction site

Possible ways of circumventing the natural decay of the impact of the Trojan Horse messages are to:

- a) Constantly refresh the messages;
- b) rotate the media/format of the message delivery;
- c) only use the Trojan Horse messages in blitz campaigns to address topical/seasonal issues.

In the present study, the long-term or longitudinal awareness of the site operatives are tested over a period of time via face-to-face interviews on the content and format of the messages.

2.3 BEHAVIOURAL IMPACT ASSESSMENT

The behavioural study aimed, amongst other things, to develop protocols and interview/survey schedules, including items designed to assess individual attitudes and beliefs, and psychosocial aspects of the construction site environment. In particular, these protocols were designed to capture the elements of the Theory of Planned Behaviour [7, 8], which was employed as the underlying conceptual framework for the behavioural analysis, as well as information on the safety messages themselves.

The Theory of Planned Behaviour has five main elements encompassing:

- 1) An individual's **attitudes** towards a particular behaviour (including the expected outcomes of behaviour *and* value of those outcomes to the person);
- 2) The **subjective norm** they perceive to be operating (including beliefs about how favourably or unfavourably other people would react if the behaviour were performed);
- 3) The **perceived behavioural control** that the individual has over the behaviour (including the ease or difficulty in performing that behaviour);
- 4) An **intention to behave** will result from the influences of these three factors and finally;
- 5) The actual **behaviour** results from this intention and potentially some influence of perceived control.

The relationships within the theory are shown in Figure 3.

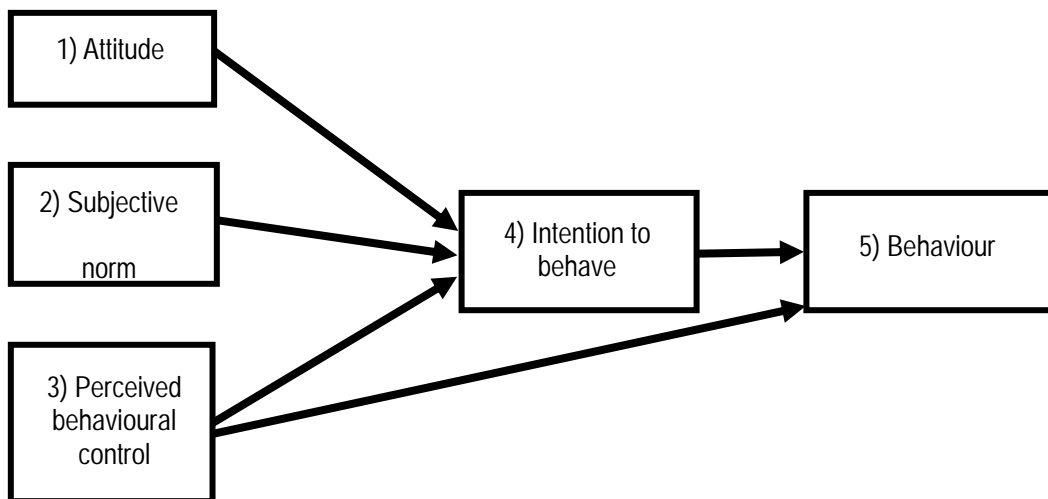


Figure 3 Theory of Planned Behaviour

For the Theory of Planned Behaviour to be tested in this environment, it was essential that the factors in the model are related to the specific target behaviours. Consequently, a short survey (of around 30 items) was proposed to capture individual views on the first four of these factors, with the actual behaviour being recorded through direct observation.

An additional problem of applying this theory to the safety arena, is that, for the most part, the Theory of Planned Behaviour is applied to volitional behaviours where the participants have a great deal of choice over the behaviour. It could be argued that safe behaviour in an occupational setting is, in theory, less volitional than general health or lifestyle behaviours. It is, therefore, important that confidentiality is assured to participants to encourage honest answers and that some measure of social desirability is included in the survey.

The design of the behaviour impact study is discussed in detail in section 4.

2.4 METHODOLOGY

The methodology adopted for the second phase of the Trojan Horse study is shown in Figure 1. It consisted of the following stages:

- a) Identification of health and safety issues relevant to the construction industry and to the selected construction types. The issues were identified based on discussions with the Health & Safety Executive and relevant trade associations.
- b) Design of messages to illustrate the above issues. The messages had to conform to certain criteria most notably that they can be easily understood without the help of any text. The messages used in the study are described in section 3.
- c) Design of a survey to assess both the long-term and behavioural impact of the messages. This involved:
 - definition of survey hypotheses;
 - design of survey questionnaires (both for the longitudinal and behavioural impact assessment) to test the hypotheses;
 - piloting of the survey; and
 - updating of the survey questionnaires based on the pilot survey.

The survey design is described in a section 4.

- d) Definition of the procedure for carrying out the site surveys. This involved close collaboration with participating companies in order to ensure that the survey team had the appropriate level of logistical support to carry out the site surveys. This is described in detail in section 5.
- e) Collation of the results and data analysis. This is presented in Section 6.
- f) Dissemination of results and conclusions via final report and presentation. The conclusions from the study were reported at a meeting held on the 12th of September 2006 at the HSE Rose Court offices.

3 DESIGN OF MESSAGES

In contrast to the first phase of the Trojan Horse study, both health and safety issues were addressed in the second phase. A survey of the main health and safety issues affecting the construction industry was carried out and is described below.

The criteria for the design of the messages and the final messages used for the study are described in sub-sections 3.2 and 3.3.

3.1 HEALTH & SAFETY ISSUES

The main health issues in construction as identified based on discussions with the HSE and stakeholders are:

- a) Manual handling leading to muscular skeletal disorders. The prevention of work-related injuries such as back pain and managing them in the workplace is one of the priorities of the Health and Safety Commission. The incidence of muscular skeletal disorders is illustrated in Figure 4 [9] which shows the number of over 3-day injuries sustained while handling, lifting or carrying for the period 1996/97 to 2004/05p where p denotes provisional.

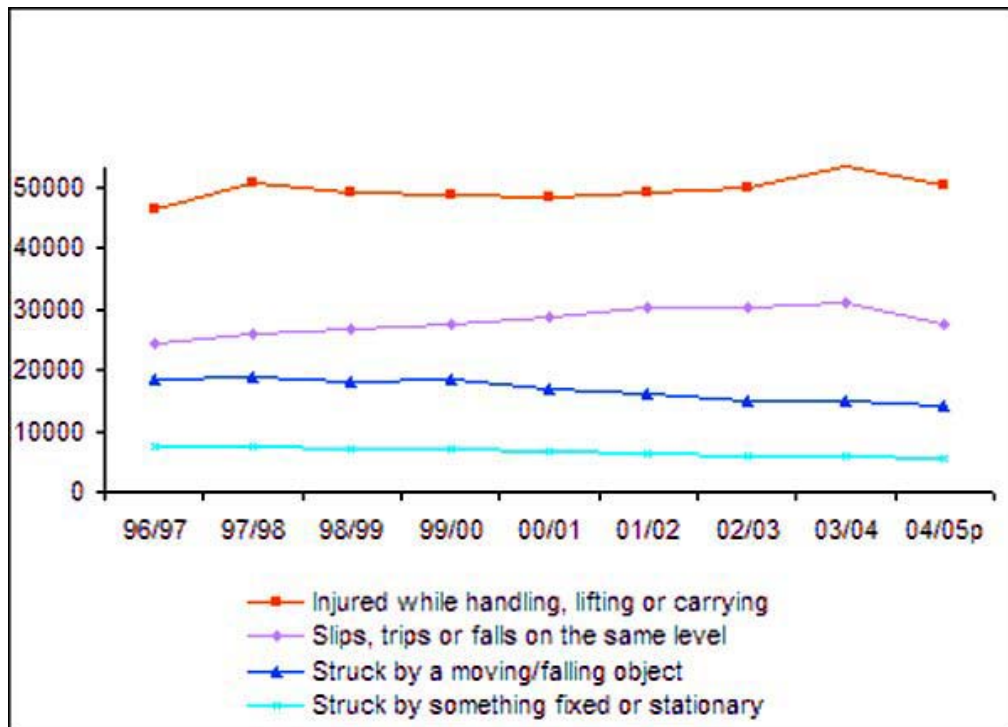


Figure 4 Over 3 day injuries to employees by kinds of accidents 1996/97 to 2004/05p

As can be seen from the graph, manual handling accounts for approximately 42% of all over 3-day injuries. It must be noted that these figures are industry wide but the trend is similar in the construction industry where manual handling accounted for about 38% of the over 3-day injuries for the period 1996/97 to 2002/03p.

b) Over exposure to noise leading to hearing loss. In addition to hearing loss, people can also develop tinnitus (ringing, whistling, buzzing or humming in the ear), a distressing condition which can lead to disturbed sleep.

c)

The Control of Noise at Work Regulations 2005 [10] came into force on the 6th of April 2006 with a view to protecting persons against risk to their health and safety arising from exposure to noise at work. These Regulations are particularly relevant to stakeholders in the construction sector as operatives in that industry are exposed to particularly high noise levels during certain operations.

d) Hand arm vibrations causing desensitisation of nerve endings leading to vibration white finger. This irreversible condition which affects the nerves and circulation is caused by long term use of hand held vibrating equipment and tools. Operatives in the construction industry are particularly at risk as routine activities generally involve the use of vibrating tools such as sanders, grinders, disc cutters and concrete breakers.

The Control of Vibration at Work Regulations 2005 [11] came into force on the 6th of July 2005 with a view to protecting persons against risk to their health and safety arising from exposure to vibration at work.

e) Handling of substances (cement, adhesives, plaster) leading to burns and dermatitis.

f) Asbestos related diseases. An estimated 3500 people die each year from mesothelioma and asbestos related lung cancer as a result of past exposure to asbestos.

The identification of safety issues for Trojan Horse Phase II was based on the incident analysis carried out in the Phase I study [12]. Following discussions with the Peer Reviewer and the Steering Group members, it was proposed to use 2 safety and 2 health messages for the Trojan Horse Phase II study. The selected health and safety issues and messages are described in section 3.3.

It was not practical to illustrate all the health and safety issues listed in 3.1(a) to (e) in the present study due to time and budget constraints. In addition, the main objective of the study was to assess the long-term and behavioural impact of the message rather than the content of the message.

3.2 CRITERIA FOR MESSAGES

The design of the messages had to conform to certain specific criteria, namely:

a) Visually communicable: Messages must stand on their own i.e. operative should be able to understand the messages without the underlying text.

b) Observable behaviour: Issues depicted in the messages must be observable.

c) Common problem: Messages must address problems that are commonly encountered on construction sites.

d) Possible/operative's discretion: The messages must address issues that are achievable by the operative or under his control.

e) Location of message: The messages must be clearly visible to the site operative.

- f) Not interfere with site works: The messages must not interfere with the normal activities of site operatives.

It must be noted that the messages have been designed purely for the current research project and have been peer reviewed by industry stakeholders. However, this does not imply that the right ways shown of carrying out each of the activities are the only correct methods. For example, there are other correct methods for lifting components that do not involve chains.

3.3 PHASE II MESSAGES

Both health and safety messages were used in the second phase of the Trojan Horse project. Following discussions with the Health and Safety Executive, the Peer Reviewer and the Steering Group members, it was decided that the following issues were to be addressed in this study:

- a) Slinging of components (Figure 5): This safety issue was addressed in the first phase of the Trojan Horse. It was decided to re-use the same message as slinging of components is still a major issue in the industry. In addition, this message satisfies all the criteria listed previously.
- b) Unloading of Trusses (Figure 6): This issue was identified by the Truss Rafter Association as a particular problem in the industry. It relates to the fact that operatives carry out the unloading operation on ground which is not level thereby creating a hazard.
- c) Lift Correctly (Figure 7): This health issue relates to musculo-skeletal disorders caused by incorrect lifting of components.
- d) Protect your hearing (Figure 8): This health issue relates to the damage that may be caused to hearing by regular exposure to high noise levels.



Figure 5 Message used to show right and wrong way of slinging components

Always Unload On Level Ground

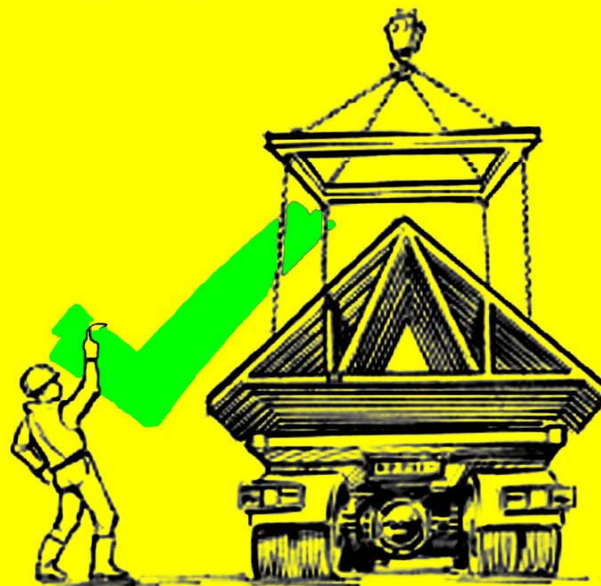
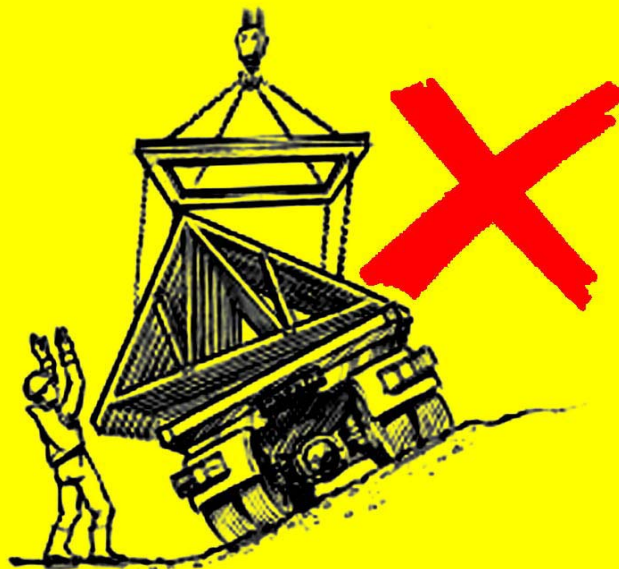


Figure 6 Message used to show the right and wrong way of unloading trusses

Avoid Back Problems Lift Correctly



Figure 7 Message illustrating the right and wrong posture for lifting

Protect Your Hearing Wear Ear Defenders



Figure 8 Message highlighting the use of ear defenders to protect against high noise levels

4 Survey Design

The survey design was based, in part, on that employed in Phase I of the Trojan Horse project. In addition to the levels of awareness assessed in that phase, the current study aimed to assess the behavioural and potential longitudinal impact of Trojan Horse messages.

Evaluation of Trojan Horse messages were based on both questionnaire/interview methods, as used in Phase I of the project, and independent behavioural observations to assess overall behavioural change. In particular, the assessment methods were designed to capture the elements of the Theory of Planned Behaviour [7, 8], described in section 2.3, which is being employed as the underlying conceptual framework for the behavioural analysis, as well as information on the safety messages themselves.

4.1 SURVEY HYPOTHESES

The principal aims of the study were:

- To assess the levels of operative awareness of Trojan Horse Safety messages;
- To assess the impact of messages in terms of behavioural change;
- To evaluate the lasting impact of these changes; and
- To investigate the underlying mechanisms associated with behavioural change.

From these aims, four basic hypotheses were proposed:

H₁: Site Operatives are aware of the Trojan Horse safety messages.

H₂: This awareness will result in adopting safe working practices.

H₃: Resultant changes in safety behaviour will be evident over a period of time.

H₄: Changes in behaviour will be associated with changes in attitude.

These hypotheses were tested through the application of interview questionnaires and behavioural observations.

H₁ required the assessment of levels of awareness of the safety message after delivery. H₂ required assessment of the behaviour associated with the message, both before and after each message is delivered. In addition, hypothesis H₂ also required an assessment of the levels of awareness of the message after delivery. H₃ required repeated assessment of the safety behaviour associated with the message, as well as an assessment of the continued levels of awareness of the message. Finally, H₄ required assessment of the four 'predictor' variables associated with the Theory of Planned Behaviour. This was assessed prior to the initial message delivery and at the end of the study.

4.2 QUESTIONNAIRE DESIGN

In order to collect data to investigate the hypotheses, three separate tools were developed namely two questionnaire based assessment and an observational assessment. The two questionnaires, which were administered via structured face-to-face interviews with the site

operatives, were formulated to assess (i) the impact and awareness of the safety messages; and (ii) the relationship between attitudes and perceptions, and the target behaviours. Finally observational protocols were developed in order to assess any changes in the target behaviours

4.2.1 Longitudinal Impact and Awareness Questionnaires

The longitudinal impact questionnaire collected basic demographic information, including previous health and safety training and awareness experiences. In addition, as in the Phase I study, awareness and understanding of the messages was assessed in this questionnaire. This questionnaire was redesigned without the initial demographic information for use after message deliveries 2 and 3.

4.2.2 Behavioural Impact Questionnaires

This questionnaire focussed on the four ‘predictor’ variables associated with the Theory of Planned Behaviour (Figure 3); attitude to the behaviour; how others view the behaviour; control over the behaviour; and intention to behave.

An initial bank of potential survey items [13, 14, 15] were developed, and included four items relating to each predictor variable. All response scales employed a five point Likert scale, ranging from strongly agree to strongly disagree, to be completed during interview.

4.2.3 Behavioural Observations

The aim of the behavioural observation was to assess the specific target behaviour relating to the message employed. Behaviour was assessed over a period of time prior to any interviews and related to observable aspects, for example when observing lifting behaviour, posture and loading were taken into account. Behaviour was then rated as ‘always safe’, ‘partially (or sometimes) safe’ or ‘unsafe’.

4.3 PROCEDURE

In order to test the hypotheses a ten step study design was developed incorporating the application of the above methods:

1. Initial on site behavioural observation and behavioural impact questionnaire;
2. Message delivery 1;
3. On site behavioural observation and longitudinal impact and awareness questionnaire;
4. Subsequent on site behavioural observation (after around 2 weeks);
- 5.-9. Message deliveries 2 and 3 with above steps repeated;
10. Final on site observation and repeat attitude questions.

The procedure is illustrated in Figure 9.

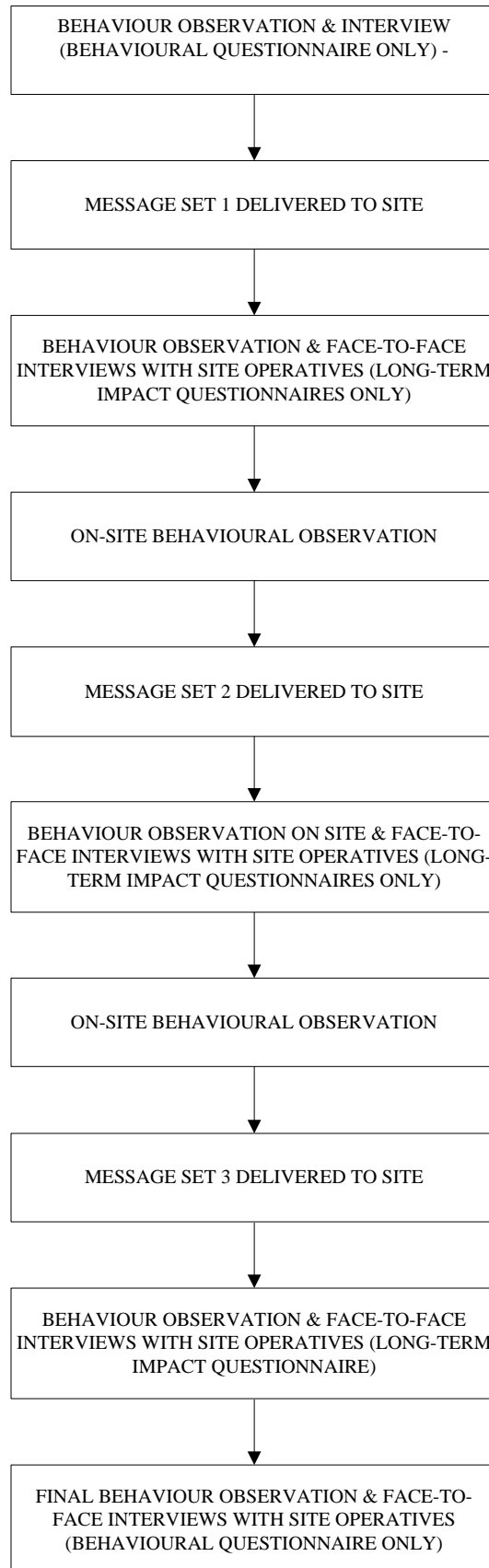


Figure 9 Survey Procedure

4.4 PILOT SURVEY

A pilot survey, involving steps 1 to 3, was carried out on one site over a period of two weeks. This trial survey was designed to test out the questionnaire interview protocols and to assess ease of observation. The ear defender message was used in the pilot survey. The results of the trial can be summarised as follows:

- It was possible to observe safe and unsafe behaviour on the initial site visit.
- Conducting structured interviews were reasonably easy and brief.
- It was difficult to differentiate five grades of response in the behavioural impact questionnaire. The scales were therefore reduced to a three point version where, for example, the operative could 'agree', 'neither agree nor disagree', or 'disagree'.
- The physical length longitudinal impact and awareness questionnaire was compacted for practical on-site use.
- The major operational difficulty was tracking the same operatives over the survey period.
- Another practical difficulty related to the effective placement of the messages.

The questionnaires used in the final study are shown in Appendix A.

5 SITE SURVEYS

The assessment of the long-term impact and behavioural impact of the Trojan Horse messages were carried out via face-to-face interviews with operatives on construction sites. This section provides a description of the survey process including the selection of the study group, the application of the messages on site and some issues/problems encountered on the various sites during the surveys.

5.1 PARTNER COMPANIES

As mentioned in section 1.6.3, the sites were provided by various companies who were keen to participate in the study. A partnership was developed whereby the various site managers were consulted on the selection of the message for their respective sites and on the application of the messages on site in terms of both the staff resource/s to place the messages and the component/s where the messages will be placed

In addition, the site managers also identified a study group i.e. a group of site operatives who are most likely to suit the required criteria for the survey as described below.

5.2 SELECTION OF STUDY GROUP AND SITES

The selection of the study group was a key aspect of the Trojan Horse phase II study. In order for valid and meaningful conclusions to be drawn from the survey process, it was crucial that the study group selected conformed to certain requirements namely:

- a) the members of the study group will be working on the site for the duration of the survey process i.e. the same operatives are observed/interviewed at each stage of the survey;
- b) the members of the study group carry out or are involved in the activity depicted on the health and safety message placed on the site;
- c) the number of site operatives in the study group to be as large as possible in order to get sufficient data for analysis;
- d) the site operatives work under the same supervisor for the duration of the survey process.

It was recognised at an early stage that it may be difficult to get a study group that conforms to the first requirement as the workforce at site level tend to be transient due to the short life span of the various activities on construction sites.

In cases where such a group could not be established on a particular site, it was proposed to follow the study group to different sites. This approach was deemed acceptable provided that the various sites do not differ significantly in terms of size and health and safety environment.

The criteria for the selection of sites included:

- the duration of works relevant to the issue shown in the Trojan Horse message must exceed at least 8 weeks to allow sufficient time for the survey process;
- the site management facilitate the accessibility to site operatives for both the observations and face-to-face interviews.

5.3 SITE SURVEYS

Surveys were initially carried out on 17 sites by experienced field engineers from The Concrete Society and by behavioural scientists from Loughborough University. The survey process, as illustrated in Figure 9, was only completed on 12 of those sites mainly due to the fact that the same operatives were not available at certain stages.

The details of the various sites are provided in Tables 2 to 5. The main findings from the survey process can be summarised as follows:

- Site management was fully involved throughout the survey process and facilitated access to the site operatives.
- The most widely used message was ‘Avoid Back Problems: Lift Correctly’. This was due to the fact that:
 - It was a recurrent activity that was relevant to most sites;
 - It could be easily applied (between pallets of blocks);
 - The target group of site operatives involved in lifting is larger than other activities.
- The messages relating to unloading of trusses and wearing ear defenders were not used for several reasons including:
 - There were logistical issues in the application of the unloading of trusses message as the survey team needed to be present when the trusses were being unloaded. This was difficult to achieve as practical site realities implied that delivery time could not be accurately forecasted in advance to allow for efficient planning by the survey team.
 - It was proposed to attach the message relating to ear defenders to the cable of grinders and, also, stuck onto the grinder itself. However, the grinding activity is not as recurrent as lifting and, also, involves a smaller sample of operatives.
- The site operatives generally exhibited a positive attitude during the interviews. It was clear, however, that the subtleties of the behavioural questionnaire were lost on a small proportion of the operatives.

The behavioural observation was carried out without any difficulty on most of the sites. On 2 sites, the amount of time for observation was limited as the survey person was accompanied at all times on the site.

Table 2 Descriptions of sites A, B and C

Site ID	Site A	Site B	Site C
Type of Construction	House build on green field site	House build and apartments on green field site	House build on green field site
Message	Lift Correctly	Lift Correctly & Sling Safely	Lift Correctly
Target Group	10 operatives including bricklayers, labourers & ground workers	12 operatives including 10 bricklayers/ labourers and 2 banksmen	5 bricklayers
Comments	Messages placed by assistant site manager on pallet loads of blocks in compounds.	Messages placed in pallets of block in compounds and also near tower crane.	Messages placed by fork-lift driver prior to delivery of pallets of bricks from the compound to the individual bricklaying sites.

Table 3 Descriptions of sites D, E and F

Site ID	Site D	Site E	Site F
Type of Construction	Demolition, refurbishment and new build: 2 by 14 storey student accommodation blocks	Mixed redevelopment over 40 acres –retail, leisure car parking and accommodation.	Two phase residential development consisting of 4 storey timber framed apartment block, timber cassette floors/ brick and block masonry façade and 5 storey steel framed apartment block with precast floors, metzec walls with brick and block masonry façade.
Message	Lift Correctly	Sling Safely	Lift Correctly
Target Group	6 operatives comprising of carpenters	6 operatives including banksmen, slingers	6 operatives including scaffolders, bricklayers and hod carriers
Comments	Messages were placed by the project manager in work areas specific to the carpenters	Messages placed by health and safety officer on columns where the cranes operate.	Covered 2 trades namely scaffolders and bricklayers. This posed a few problems in terms of catching all the initial operatives on each visit.

Table 4 Descriptions of sites G, H and I

Site ID	Site G	Site H	Site I
Type of Construction	Major office development comprising 3 buildings. Building 1 is 13 storeys high. Buildings 2 & 3 (where the surveys were conducted) are both 10 storey buildings with additional 2-storey deep basement. All 3 buildings are concrete-framed structures.	Large shopping centre complex of steel frame construction. Two main phases being constructed concurrently. The floors were profiled steel concrete composite decking. Some in-situ concrete core construction.	Refurbishment of a very large office complex previously occupied by the Home Office. Mainly secondary trades.
Message	Sling Safely	Sling Safely	Lift Correctly
Target Group	6 operatives comprising of banksmen.	5 operatives including in-situ concrete supervisor, craneage supervisor and banksmen.	6 operatives including labourers, stonemasons, fork lift operator and window installer.
Comments	Messages placed on steel column formwork. It was observed that there were a large number of signs on this site.	Messages were placed on steel elements within a storage area and also on elements already lifted to an upper floor ready for final lifting and erection.	Messages placed in areas where operatives were working.

Table 5 Description of sites J and K

Site ID	Site J	Site K
Type of Construction	Domestic housing sites.	Domestic housing sites.
Message	Sling Safely	Lift Correctly
Target Group	3 operatives comprising of trussed rafter installers/carpenters	6 operatives including scaffolders and bricklayers.
Comments	Messages placed on selection of rafters at the fabricators before delivery to site.	Messages were placed on stacks of materials and stillages for accessories.

6 SURVEY ANALYSIS AND RESULTS

The main aim of the survey analysis was to test the four hypotheses set out in section 4 of this report. This was achieved by examining levels of message awareness and associated behaviour over time, examining the relationships between respondent attitudes and perceptions, and behaviour associated with the Trojan Horse safety messages.

The following sub-sections provide a description of the sample involved in the study, an analysis of operative awareness levels throughout the study, an examination of operative behaviour throughout the study period, and finally an analysis of the relationships between behaviour and underlying attitude.

6.1 SURVEY HYPOTHESES

Overall 73 operatives from 12 sites were involved in the initial stages of the study. Practical issues, for example holiday, sickness and termination of employment, meant that this number declined slightly as the longitudinal study progressed. Table 6 shows the numbers involved at each stage in the study (as outlined in section 4). Each set of respondents is a sub-set of participants at the previous stage.

Table 6 Sample size at key stages

Study Stage	Number of participants
1	73
3	65
6	55
9	45

6.1.1 Demographic Information

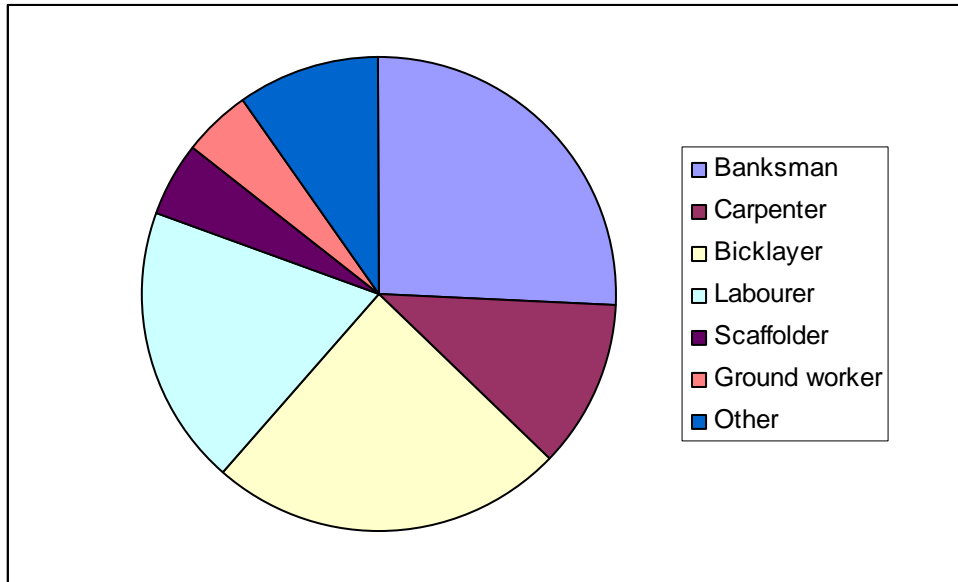
Demographic information was collected at stage 3 of the study. The average age of respondents at this time was 36.5 years and ranged from 19 to 65 years. In terms of industry experience the average time spent in the industry was 15.4 years, ranging from 2 to 46 years experience. Operatives were also asked about their time on site and the average number of weeks on their current site was 33.5 weeks and this ranged from 1 to 104 weeks.

85% (53 operatives) of those interviewed at stage 3 were in possession of a health and safety qualification of some description, including CSCS cards, CTA slinger certificate and NVQs. This is a very similar proportion of qualified operatives as reported in Phase I of the Trojan Horse research.

In terms of the operatives' activities, Figure 10 shows the distribution of job types in the sample population. Again this only applies to those operatives who completed the interview at stage 3 of the study, and highlights those jobs done by 3 or more respondents. The others category includes forklift drivers, stone masons, and window installers.

The final pieces of demographic information requested from operatives concerned whether or not they had attended an induction and/or a toolbox talk on their current site. 84% of those responding confirmed that they had received a site induction, with only three operatives claiming not to. In terms of toolbox talks, 70% reported that they had attended one and the vast majority of these (85%) had taken place recently. 93% of those attending a toolbox talk reported that it had covered some health and safety issues.

Figure 10 Job descriptions of study participants



6.2 MESSAGE AWARENESS

Awareness of the Trojan Horse Safety messages was tested at three stages in the research, after each message was placed. Table 7 shows levels of awareness at each of these stages, indicating the percentage (and numbers) of operatives who (having been interviewed) had seen and understood the messages, as well as the numbers of operatives who recognised the message when prompted.

Table 7 Levels of message awareness

Study Stage	Number(percentage) of participants aware	Number of participants aware after prompt	Total awareness
3	33 (50.7%)	17 (26.1%)	76.7%
6	29 (52.7%)	12 (21.8%)	74.5%
9	25 (55.6)	15 (33.3%)	88.9%

The effects of repeated exposure to the messages can be illustrated by examining data from participants involved at all stages of the study. The number of participants who were not initially aware of the message at stage 3, but were aware at stage 6 was 6 (representing an increase of 9.6% on the stage 3 figure). There was no comparable increase at stage 9, although the numbers were smaller at that time.

As can be seen from Figure 11, total awareness of the messages was relatively high, although dips slightly at stage 6. Unprompted message awareness, however, shows a gradual increase across the three stages.

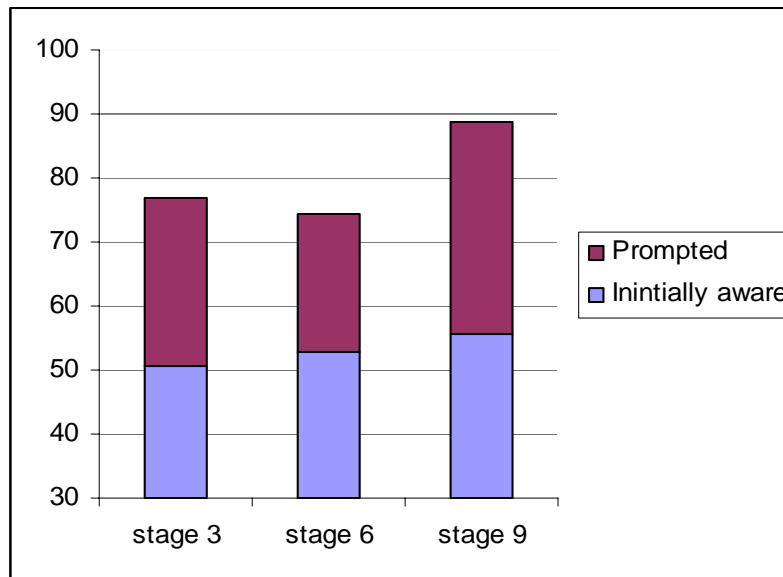


Figure 11 Total percentage message awareness at key stages

6.2.1 Message Awareness and Demographic Differences

The influence of age, experience and qualification on message awareness was also examined. There were no differences evident in terms of age or qualification between those who were aware of the messages (without prompting) and those who were not. There was evidence, however, of a difference relating to experience in the industry. Those who were initially aware of the safety messages had significantly lower average industry experience (13.8 years) than those who were not initially aware of the messages (22.1 years), according to an independent sample t-test ($t = 2.241$, $p < 0.05$). This might suggest that either those with more experience become desensitised to safety messages in general, or those with less experience spend more time scanning their new environment.

6.3 SAFE BEHAVIOUR

Behaviour relating specifically to the messages delivered was observed (whenever possible) primarily at stages 1, 3, 6 and 9 of the study. The percentage of this observed behaviour that was recorded as completely safe is shown in Table 8.

Table 8 Safe behaviour at key stages

Study Stage	Percentage Safe
1	61
3	78
6	83
9	87

Figure 12 illustrates the largest change in safe behaviour occurs after the first message, with smaller increases occurring at the later stages.

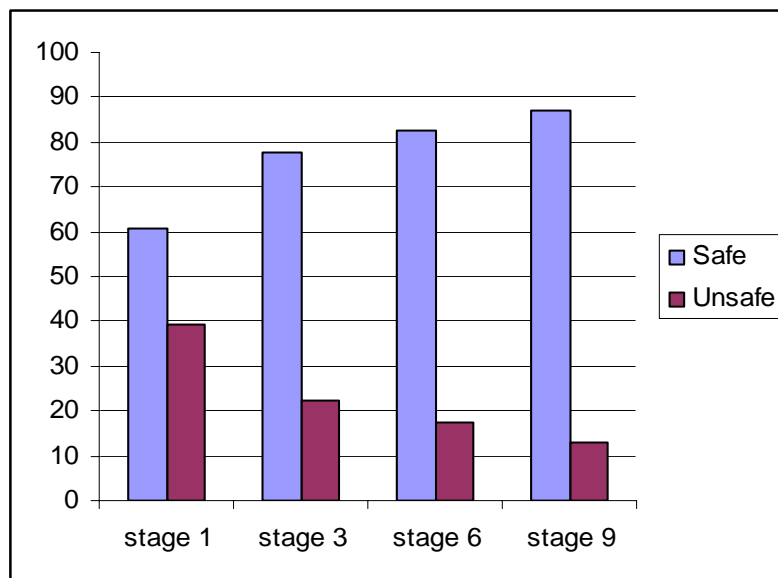


Figure 12 Percentage safe and unsafe behaviour at key stages

An examination of Table 8 and Figure 12 suggest that the use of Trojan suggests that the use of Trojan Horse messages may be associated with an increase in safe behaviour. More light may be shed on this if we examine the change in behaviour in those for whom data is available throughout the study. It was noted that:

- All of those who behaved safely at stage 1 continued to behave safely at stage 3;
- Of those who behaved unsafely at stage 1, 4 participants (or 15% of those observed) behaved safely at stage 3;
- Similarly, all of those who behaved safely at stage 3 continued to behave safely at stage 6;
- Of those who behaved unsafely at stage 3, 1 participant (or 7% of those observed) behaved safely at stage 6;

- There was no change in behaviour for those observed at stages 6 and 9. It should be noted, however, that the numbers actually observed in stages 6 and 9 are considerably lower than at the earlier stages.

6.3.1 Safe behaviour and message awareness

The impact of the Trojan Horse Messages on behaviour can be examined further by examining the changes in behaviour of those who were aware of the safety messages and those who were not. The numbers of those who were aware of the first message, and whose behaviour was observed before and after the messages were introduced were calculated.

Of those aware of the message, 15 behaved safely at stage 1 and 19 at stage 3, an increase of 4. None who behaved safely subsequently behaved unsafely. Of those not aware of the initial message there was no change in behaviour.

6.3.2 Safe behaviour and demographic differences

Relationships between age, experience and qualification, and initial safe behaviour were also examined. There were no differences evident in terms of any of these demographic variables between those who behaved safely and those who did not.

6.4 UNDERLYING ATTITUDES AND BEHAVIOUR

The behavioural aspects of this study also aimed to examine changes in attitude and perception that might underlie any changes in behaviour. The Theory of Planned Behaviour [7, 8], described in detail in Section 2 was used as a framework for this investigation. The structure of this model in the construction environment was first examined, and then any changes in attitudes and perceptions were explored.

6.4.1 Theory of Planned Behaviour

As a first step in the analysis of attitude and behaviour, the structure of the Theory of Planned Behaviour was examined in the available data from construction sites. The theory (illustrated in Figure 3) states that an individual's attitudes towards a particular behaviour, evaluations of how others view that behaviour and the control they have over behaving, will result in an intention to behave and subsequently the actual behaviour.

The behavioural impact questionnaire (described in section 4) aimed to capture these four elements. Questions relating to each element were combined and the relationships between the four elements and observed behaviour were examined using a path analysis. This analysis was based on the questions asked and behaviour observed at stage 1 in the study. The fit of the data to the model was tested using structural equation modelling. The initial model, following the relationships shown in Figure 3, resulted in reasonable fit of the data (full indices of fit are shown in Appendix B), but post hoc tests suggested a direct relationship between Subjective Norms and Perceived Behavioural Control in this sample. A revised model including this relationship was tested resulting in a good fit to the data (indices again shown in Appendix B). The resulting model, with significant relationships is shown in Figure 13. This Figure includes standardised coefficients, indicating the strength of relationship between the elements in the model.

The model represented in Figure 13 suggests that links can be made between attitude and behaviour in this sample. The revised model differs from the theoretical one in two respects: i) there is no link between behavioural control and intention to behave, and ii) there is a new link

between subjective norms and behavioural control. This would suggest a greater direct role for the views of colleagues in perceptions of control and the development of intention to behave, highlighting the potential role of the safety culture of the worksite.

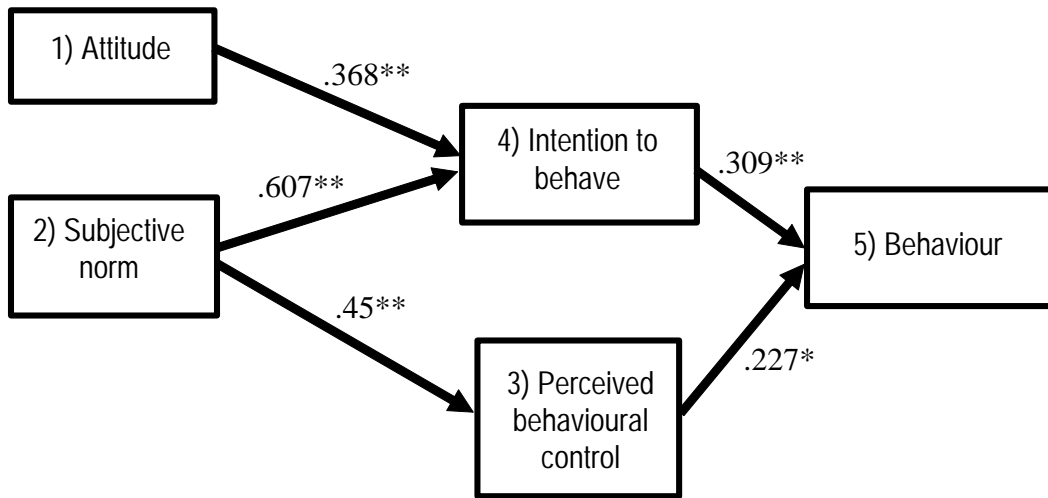


Figure 13 Theory of planned behaviour in construction sample

6.4.2 Attitude Change

Given the relationship between attitudes and observed behaviour, it is useful to assess the impact of the safety messages by examining changes in attitude. Attitudes and perceptions were assessed at stages 1 and 10. Average scores for each of the four elements at both stages are shown in Table 9.

Table 9 Average attitude scores

Attitude Element	Mean at Stage 1	Mean at Stage 10
Attitude to behaviour	2.92	2.94
Subjective norms	2.52	2.57
Perceived control	2.48	2.51
Intention to behave	2.85	2.9

While Table 9 shows a very slight increase in positive attitudes and perceptions at stage 10, subsequent statistical analysis (paired sample t-tests), however showed that these were not statistically significant. It should be noted that each element was assessed on a three point scale, and so the initial assessments were largely positive, before the message intervention.

7 CONCLUSIONS

The conclusions from the analysis of the survey data can be summarised as follows:

Hypothesis 1: Site Operatives are aware of the Trojan Horse safety messages

The results would suggest that the delivery of messages is effective - the numbers of operatives aware of the messages was relatively high after the first delivery (75%) and increased at the final delivery (88.9%). We can conclude that the messages were relatively easy to see and understand (the awareness measure included 'aware and able to describe' before and after prompt). This lends weight to the whole Trojan concept and is in line with the findings of phase 1.

Hypothesis 2: Awareness of Trojan Horse messages will result in adopting safe working practices

Examination of the behavioural observation data indicates that there may be some influence of the message on the exhibited safe behaviour. In absolute terms safe behaviour increased over the study. Focusing on changes, the only behaviour change observed related to those who had behaved unsafely subsequently behaving safely after seeing the message. We cannot discount the potential influence on behaviour of being observed, but there was no similar change in behaviour for those who were not aware of the message but also underwent observation. We can conclude here that Trojan seems to be effective in raising awareness of the correct procedures and is in line with the literature discussed in the opening sections of the report.

Hypothesis 3: Resultant changes in safety behaviour will be evident over a period of time.

Changes in behaviour and levels of awareness also seemed to continue over the relatively short period of the investigation. While this is encouraging it might be beyond the scope of the current study to claim there is any lasting effect, although repeated exposure over a short period of time would seem to work. Any issues of desensitisation to the messages would need to be investigated over a longer period.

Hypothesis 4: Changes in behaviour will be associated with changes in attitude.

The final aspect of behaviour that the study was interested in related to the relationships between attitudes and perceptions and behaviour. The resultant model, based on the Theory of planned behaviour provides evidence for such a link, but also highlighted the central role of 'Social Norms' - other people's view of the behaviour in the development of an intention to behave and in the amount of control there may be over that behaviour. As already stated, this would suggest that the social environment (often characterised in some conceptualisations of safety culture) could play a central role in shaping the behaviour observed in this study. This has implications for any message and/or education programme and suggests that it would be beneficial to address safety cultural issues in addition to individual attitudes and practices when addressing behavioural change.

Overall, the results of both the Phase I and Phase II studies have shown that the Trojan Horse Health and Safety Messaging technique is effective in raising awareness and imparting information to site operatives on health and safety issues. The Phase II study has indicated that use of Trojan Horse messages can lead to a positive change in the behaviour of site operatives.

In general, pictorial descriptions of activities are clearer and easier to understand than textual descriptions. One of the factors in the success of the Trojan Horse messaging technique was the simple, clear and unambiguous way of communicating with the site operatives. The pictorial messages have proved to be an effective tool for conveying health and safety information and, although this study focused on the construction industry, this technique can be applied across a whole range of sectors including the transport sector, the aviation sector, the medical sector and the offshore sector.

8 FEEDBACK FROM INDUSTRY AND FUTURE OF TROJAN HORSE

The results of the Trojan Horse Phase II study were disseminated to the wider industry via a meeting held at the HSE Rose Court offices on the 12th of September 2006. Key health and safety personnel within various major contractors, construction clients and trade associations attended the high-profile event.

8.1 OVERVIEW OF PRESENTATIONS

The seminar was chaired by Stephen Williams, HSE Head of Construction, and the opening address was given by Margaret Burns, HSC Commissioner. She pointed out that the Trojan Horse project potentially has implications for other industries apart from construction in terms of communicating with the workforce. She added that Trojan Horse messages would be particularly useful in today's increasingly diverse workforce.

The project set-up and results were presented by the project team comprising of Paul Thomas, Viken Chinien and Alistair Cheyne and the application in other industries was discussed by Robert Miles, HSE Principal Specialist Inspector. Robert gave an overview of applications in several industries including the transport sector, the aviation sector, the medical sector and the offshore sector.

Benjamin Legg and Steve Derbyshire, respectively of Skanska and Taylor-Woodrow, provided feedback from companies that participated in the project particularly from the point of view of the site managers and site operatives involved in the project.

Finally, John Carpenter discussed the proposed way forward for the Trojan Horse Health & Safety Messaging based on initial discussions with the HSE. A detailed description of the future direction of the Trojan Horse is given below.

8.2 TROJAN HORSE: WHAT NEXT?

The results from both the Phase I and the Phase II study have shown that site operatives exhibit a high awareness of the Trojan Horse messages. The Phase II has also shown that:

- Awareness of the messages increase after repeated exposure to the messages;
- Observations of behaviour after implementation of the Trojan Horse message suggest a positive impact on operatives' behaviour.

The positive outcomes of the study have led the Health and Safety Executive to recommend the use of Trojan Horse messaging as part of the overall health and safety strategy of companies. It is envisaged that major contractors would assume ownership of this messaging technique and, working in conjunction with trade associations and the HSE as facilitators, exhibit leadership in enabling the large-scale application of the Trojan Horse messages.

In order to facilitate the uptake of the Trojan Horse technique, it has been proposed to develop a Trojan Horse website and a Trojan Horse toolkit as described below.

8.3 TROJAN HORSE WEBSITE

The development of a Trojan Horse website would assist in:

- Disseminating the messaging technique to the wider industry. The website would help in promoting the technique to all stakeholders involved in the construction industry including construction clients, major contractors, trade associations, suppliers, sub-contractors and manufacturers.

It is envisaged to extend the use of this technique to other sectors including transport, medical, aviation, offshore, agriculture and manufacturing. The collation of all information on the website would facilitate the dissemination of the Trojan Horse messaging.

- Providing a database of ready-to-use messages. The process for developing the messages is illustrated in Figure 14.

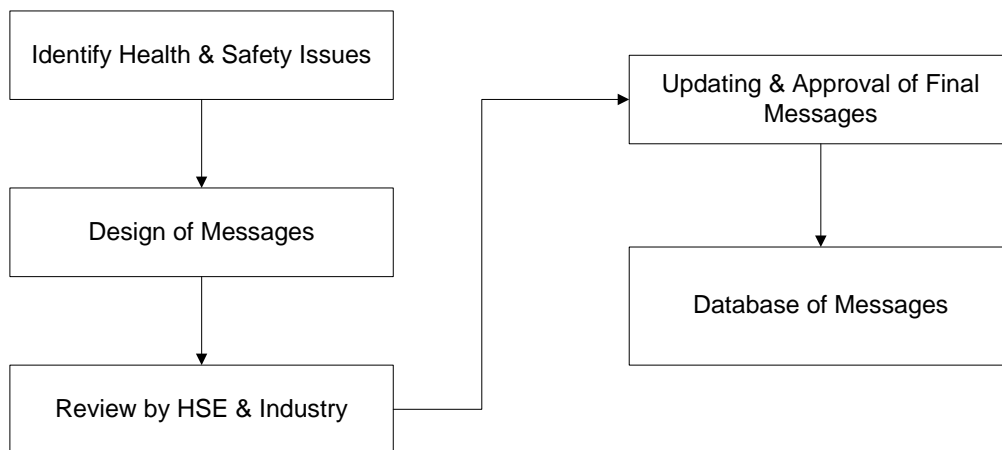


Figure 14 Procedure for developing database of messages

The steps involve the identification of health and safety issues related to the industry under consideration e.g. for construction, the issues can be subdivided into various categories according to the construction type namely steel components, precast concrete, truss rafters etc.

Pictorial messages illustrating the issues identified are subsequently designed and reviewed by the HSE, relevant trade associations and companies. The messages are updated based on the critical appraisal from reviewers and are uploaded onto the website where they can be readily used by all stakeholders.

- Providing feedback on the application of Trojan Horse messages and on the impact on operatives. The website can be used as a focal point where site managers can provide feedback on the various issues relating to the Trojan Horse Safety messaging technique including:
 - Where to stick/attach the messages
 - How to stick/attach the messages
 - Feedback from site operatives on messages

- Observation of frequency of incidence of issue depicted in Trojan Horse message

8.3.1 Trojan Horse Toolkit

The Trojan Horse Toolkit would assist companies in the practical application of the Trojan Horse safety messaging technique particularly in providing companies with:

- Guidance notes on do's and don'ts;
- Advice on methods of attachment;
- Advice on placement of messages.

The toolkit will essentially provide guidance on the various steps shown in Figure 15.

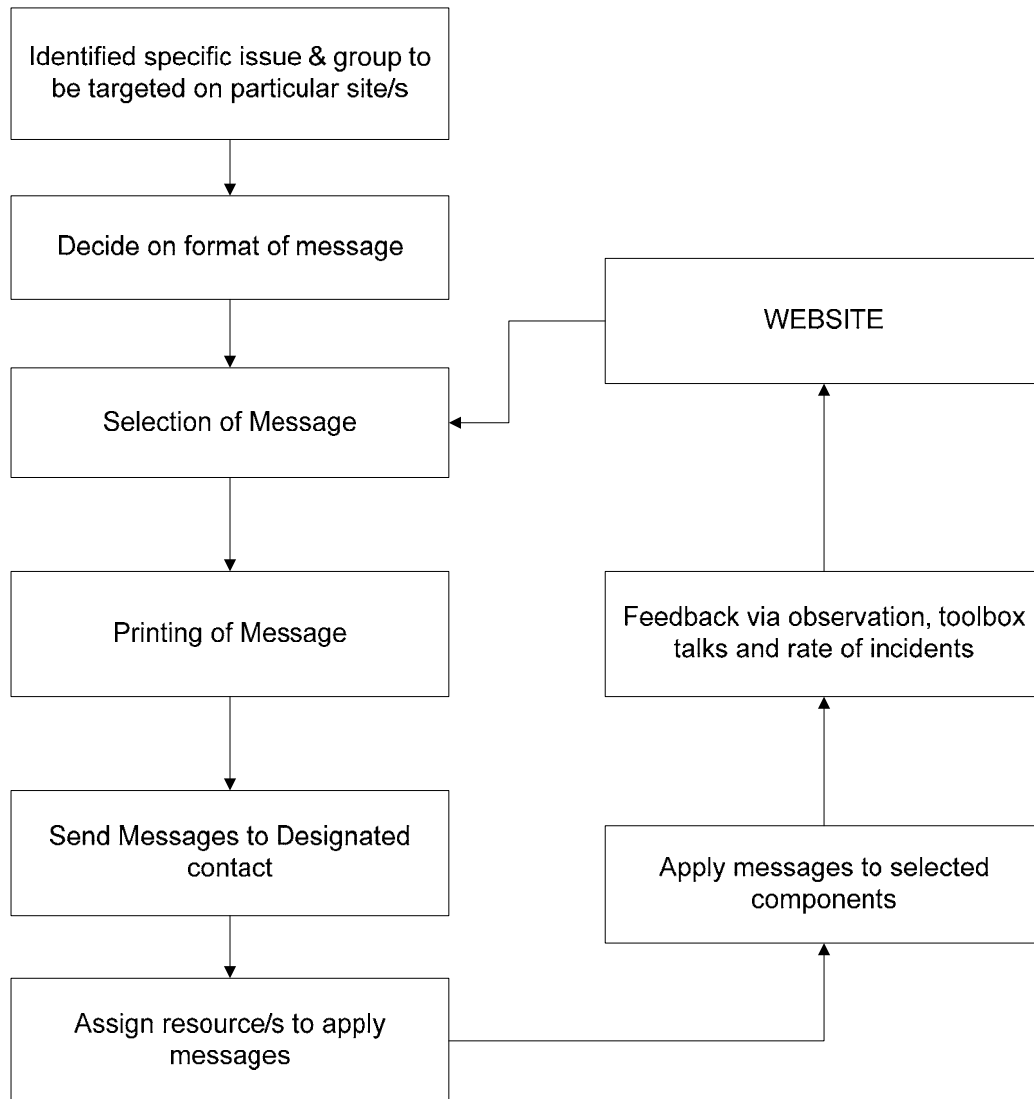


Figure 15 Steps to practical application of the Trojan Horse technique.

8.4 FEEDBACK FROM STAKEHOLDERS

The feedback from industry was positive and the stakeholders endorsed the findings from the project. Several issues were raised in relation to the application of the messages namely:

- It was noted that the Trojan Horse messages can reinforce existing good practice by showing correct way of carrying out an activity and, also, root out any doubt as to the correct method.
- The reinforcement of health and safety issues via Trojan Horse messages can in the long-term result in the correct procedure/method depicted in the message becoming embedded in the safety culture similar to the adoption of safety hats.
- It was pointed out that the positive change in safety behaviour may have been partially due to the fact that the operatives were aware that they were being observed. While it was acknowledged that there was probably a degree of Hawthorne effect, it was argued that this was minimal as operatives who were not aware of the Trojan Horse messages and who did not behave safely at the first stage of the survey continued to behave unsafely at subsequent stages.
- There should be consistency in the messages so that the same procedures/methods of carrying out an activity are illustrated in the messages.
- There is a need to assess the impact and progress made by using Trojan Horse messages. This can be achieved by reviewing the frequency of incidence of the issues depicted in the Trojan Horse messages and by direct observation of the behaviour of operatives.
- The Construction Product Association via its Industry Affairs Director, John Tebbit, has volunteered to act as the liaison with product manufacturers to facilitate the dissemination of the Trojan Horse technique.
- The website was seen as the right way forward. The HSE will act as facilitator and issues relating to funding and website maintenance need to be addressed.

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APPENDIX A

ID		Date:		Site:	
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TROJAN HORSE PHASE II

THEORY OF PLANNED BEHAVIOUR QUESTIONNAIRE

Administration notes

Please make sure all questionnaires have some form of ID to relate the operatives results to the observed behaviours and so we can track them throughout (preferably name or some ID number (refer to the site manager if necessary)). Please emphasise the confidentiality of what they tell you. Make any notes about interviewee's ability, etc. at the end of the questions.

Please ask the questions **exactly** as written, so maintain consistency across all the field trials.

Introduction

I'd like to ask you some questions about practices relating to **manual handling** on your site and within your work team.

- Everyone feels differently about these so there are no right or wrong answers, we are interested in your opinions and what you think.
- Everything you tell me will be treated in the strictest confidence, so please be as honest as you can.
- Your responses will not be passed to anyone other than the independent research team looking at these issues.
- Some of the questions may seem very similar but they are trying to get at slightly different aspects of your experience with lifting safely.

A. I'd like to start by asking you what you think about manual handling

1. Is there any point in lifting correctly?

No	Sometimes	Yes
1	2	3

2. Do you think lifting correctly is important?

No	Sometimes	Yes
1	2	3

B. Now, what about ease of action?

3. Do you find it easy to lift correctly?

No	Sometimes	Yes
1	2	3

4. Can you always lift correctly when need to?

No	Sometimes	Always
1	2	3

5. Do you decide when you are going to lift correctly?

No	Sometimes	Yes
1	2	3

C. Now, how do you think other people in your work team feel about lifting correctly?

6. Do other people think lifting correctly is important?

No	Sometimes	Yes
1	2	3

7. Would anyone else bother if you didn't lift correctly?

Never	Sometimes	Always
1	2	3

8. Do other people on this site take care to lift correctly?

Never	Sometimes	Always
1	2	3

D. Finally, I'd like to ask you about lifting correctly in the future.

Again please be as honest as you can. Everything you've told me is just between us. Your views will be combined with results from a lot of other people on various sites.

9. Do you normally plan to lift correctly?

No	Sometimes	Yes
1	2	3

10. Do you always want to lift correctly?

No	Sometimes	Yes
1	2	3

11. The next time you need to, do you think you will lift correctly?

No	Possibly	Yes
1	2	3

E Is there anything else you'd like to tell me about lifting correctly?

Thank you for your time and for helping out with the study.

Any notes on the interview process/interviewee?

APPENDIX B

Structural equation modelling (SEM) was used to examine the relationships between the Theory of Planned Behaviour variables. The models described in this study were estimated using maximum likelihood techniques within the EQS 5.1 program. Although maximum likelihood is based on the assumption that variables are multivariate and normally distributed, there is growing evidence that it performs well under a variety of non-optimal conditions, including ordinal variables, and even for a very low number of categories.

A critical issue in relation to any model is the assessment of the overall model fit, or how well the data fits the proposed model. The most widely used index for the assessment of a specified model fit is the chi-square (χ^2) statistic, where a non-significant and small χ^2 value indicates that the observed data and not significantly different from the proposed model. Other indices, based on different rationales which correct for potential sample size problems, have been developed. No single index seems sufficient for a correct assessment of fit and researchers are advised to use a variety of indices from different families. Accordingly, one index from each main 'family' has been included in the evaluation of the models presented here. These include an absolute fit index, a type 2 incremental fit index, a type 3 incremental fit index and a measure of the error in the model.

Absolute fit indices directly assess how well a model reproduces the sample data. The goodness-of-fit index (GFI) performs better than any other absolute index. Incremental fit indices measure the proportionate improvement in fit by comparing a target model with a restricted baseline model, usually a null model in which all the observed variables are independent. The Tucker-Lewis index, or non-normed fit index (NNFI), a type 2 incremental fit index, and the comparative fit index (CFI), a type 3 incremental fit index, have been included here. A value of 0.9 for all of these indices has been proposed as a minimum for model acceptance. Finally, the Root Mean Square Error of Approximation (RMSEA) was also used as a fit index. This index is computed based on sample size and the noncentrality parameter and degrees of freedom for the target model. A value of the RMSEA up to 0.05 would indicate a good model fit; a value of about 0.08 or less would indicate a reasonable error of approximation; and values greater than 0.1 indicate poor model fit. The initial model was modified based on the results of a Lagrange Multiplier (LM) test. The LM test indicates potentially significant relationships within the data which were not specified in the initial model. The indices of fit for both models are shown in Table B.1 below.

Table B.1 *Goodness-of-fit indices for Theory of Planned Behaviour Model*

Model	χ^2	d.f.	Prob.	CFI	GFI	NNFI	RMSEA
1	70.75	10	ns	0.809	0.904	0.681	0.207
2	70.75	10	ns	0.994	0.970	0.985	0.041



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