

Securing loads on curtain-sided lorries – Project outline

Introduction

The project seeks to establish the best practice for securing loads on curtain sided lorries across various industry sectors. Best practice in this case is defined as those methods that are the most practical, involve the least risk of loads becoming unstable or falling, least risk to the operator/driver, and are practicable.

The project encompasses five work packages (WPs)

WP1 – Information gathering to identify the full range of currently used and alternative methods for securing of loads, and their attendant risks and benefits. This work package will also involve a literature search, industry consultation and site visits.

WP2 – Following on from WP1, WP2 is an assessment of the effectiveness of each identified method through a series of computer simulations of common manoeuvres using different loads.

WP3 – Identification of improvements/alternatives to existing methods based on analysis of results from WP1 and WP2. Rigorous assessment of improvements by computer simulation.

WP4 – Physical validation/testing in two phases, quasi-static lorry load simulation and workability and practical application of restraining methods.

WP5 – Cost benefit analysis of most practical, least risk methods and presentation of the output in a clear format that allows a comparison between them.

The ultimate aim of the project is to deliver a comprehensive review of practical methods of securing loads on curtain sided lorries and offer practical, robust standards on load restraint and minimising the risks to health and safety of personnel working on and around curtain-sided vehicles.

Scope of work

The scope of the project includes consideration of a range of methods currently used in the UK and abroad, as well as alternative methods for securing of different heavy cargoes on curtain-sided lorries. Reference will be made to current European Standards and Best Practice guidelines, as well as regulations and guidance from countries outside the EU.

The project will involve assessment of the level of risk for the various systems under a range of normal vehicle manoeuvres with different load types. Each method will bring its own risks and benefits and these will be considered. Consideration will also be taken of the differing cargoes that may be transported and the risks and issues associated with them.

Interpretation of the data from the information gathering stage and the computer analysis will feed into a cost benefit analysis that will present the costs (or benefits) to employers and the costs (or benefits) to society of adopting best practice in terms of control of health and safety risks.

Work Package 1: Information Gathering

A comprehensive review of methods most commonly used in the UK for securing different cargoes/loads on curtain sided lorries will be carried out. This will utilise a combination of literature reviews, user, manufacturer and regulator experience and first hand evidence gathered from visits undertaken by HSL staff.

Literature review – This will be a comprehensive desk-based information review to; Identify a range of methods most commonly used in the UK for securing different cargoes/loads on curtain sided lorries
Identify other methods not in common use or currently in use internationally;
Identify other systems that are likely to be available in the future, both nationally and internationally.

Contact exploitation – Much of the detailed information required about each method is not available via published literature, and that it will therefore be necessary to contact relevant parties directly in order to elicit this information. These parties may include:

- Manufacturers
- Trade associations and Trade Unions
- Standards bodies
- Users
- Modifiers
- HSE
- Other laboratories

Site visits – A number of visits will be organised that will provide first hand evidence of UK-based systems currently in use. Experience has shown that evidence such as this is key in both gaining a greater understanding of the practical issues and generating a realistic picture of the various techniques in operation.

The output from this task will be a comprehensive list that identifies and describes both current and alternative methods used to secure cargoes on curtain sided lorries.

Work package 2: Computer Simulations

The effectiveness of the methods outlined in Work package 1 will be examined using AutoDesk Inventor (AI) and VisualNastran Motion (VNM). It is anticipated that a maximum of five current methods and five alternative methods will be examined using the following range of loads: reels, bales, roll cages, bags and palletised goods.

By combining our engineering expertise, previous work in this area and exploiting the information gained from the site visits, we will determine the most appropriate combination of vehicle manoeuvres to examine with reference to the above loads. Cornering (in particular through ‘S’ bends) and pulling off uphill represent two of the most demanding scenarios likely to be encountered. Input parameters will be defined by examining previous work in this area and combining this with our engineering judgement.

Work package 3: Analysis of alternatives and recommendations

The information gathered in WP1 and the computer simulation results from WP2 will inform the process of considering improvements to the solutions reviewed. Up to this point, all the techniques considered will have been available for use either in the UK or elsewhere. This task considers alternatives and improvements that could be made and quantifies any subsequent changes in risk.

The reviewed solutions will be critically examined to see if there are any practical changes that can be made that might significantly improve their performance. Any suggested improvements will be subjected to the same rigorous computer simulation as the existing methods and any subsequent changes in risk quantified.

Work package 4: Physical validation/testing

The work package will be split into two distinct practical phases.

Phase 1: Quasi-static lorry load simulation

The engineering laboratory at HSL is equipped with a Universal Test Bed (UTB), used for assessing the tension, compression and fatigue characteristics of a wide range of large-scale engineering components and structures. It features a reinforced concrete floor measuring 18x3 metres designed to allow fixing of loading frames and hydraulic actuators in a wide variety of configurations.

A simulated curtain-sided lorry bed will be designed, manufactured and installed on the strong floor. A series of authentic loads will be secured to the bed using a limited number of 'best practice' methods as identified during the computer simulations. These may be a combination of existing commercial systems and improved designs. A number of loading conditions as experienced by the lorry during normal use will be simulated – side/front to back forces, etc to simulate various high-force manoeuvres including cornering and braking. Displacements and loads will be measured but the key question that will be addressed is whether the restraints survive.

This laboratory-based assessment is the most appropriate way of quantitatively comparing the effectiveness of the various options. It will provide physical data on the effect of a variety of loading scenarios on a range of real-life loads.

Phase 2: Workability and practical application of restraining methods

In the second phase of practical testing, a full-size curtain-sided lorry will be used to examine both the practicality and the in-service performance of the 'best practice' methods

A curtain-sided lorry will be hired for a week. To examine the practicality of the chosen methods, the time taken to secure a range of loads will be measured and a qualitative assessment of their workability determined. Once secured, the lorry will undertake a journey around a pre-determined route on the roads in Derbyshire. The

route will be chosen to maximise the potential forces experienced by the loads during the journey and will be of an adequate length to ensure that the test scenario is realistic.

Once the lorry returns to HSL, the condition and position of the various loads will be measured and the acceptability of the restraining methods determined. Examining any movement experienced by the load is a particularly important part of the study as it is known that a large proportion of incidents occur during unloading and not whilst driving. The load may well be 'secure' during the journey but may be free once the curtain is opened.

These tests will provide invaluable information for the cost-benefit analysis. A direct comparison of strength and containment ability will be assessed during the quasi-static physical simulation. The pertinent methods will then be examined purely on the basis of physical practicality and workability by assessing the time and complexity of implementing each method. This is to be done by loading a curtain-sided lorry. The final phase of the work package will provide complete validation of each method by taking real-life loads out on the road.

A combination of computer simulation, physical simulation and real-life application studies will provide all the necessary information for the subsequent cost-benefit analysis.

Work package 5: Cost benefit analysis and reporting of findings

A cost-benefit analysis of the most practical, least risk methods established from WP 2 and 3 will be carried out. The cost benefit analysis will compare the net benefits of the subset of methods that are identified as potentially feasible and effective following the computer simulation work described in WP 2 and 3.

The cost side of the net benefit equation includes the costs of implementing the alternative methods for securing common heavy loads, including costs of any mechanical items required to assist the described methods, as well as costs of dissemination and training. The other broad category of costs includes financial costs associated with the incidence of ill health incurred as a result of accidents resulting from unsecured heavy loads. These costs may be incurred by the employee, employer and by society more widely, including time off work, reduced productivity, and NHS treatment costs.

The benefits side of the cost benefit equation include the monetary valuation of the health impact to the affected employees and the benefit to society as a whole. Probability distributions describing the uncertainty in each of the parameters informing the cost benefit analysis will be derived in order to inform an extensive sensitivity analysis of the resulting net benefit estimates.

The health valuations will be based on a postal survey to ascertain valuations specific to the types of injury that occur due to incorrect loading of lorries. It should be noted that this survey was not included in the original project costing.

Project schedule and reporting

The proposed study will be completed within a 12-month period. Interim reports will summarise progress at the completion of each WP and a final report will be issued at the end of the project. This will outline the results of the research in detail and will offer recommendations and guidance to HSE on future strategy. If considered appropriate a seminar to present findings to industry could be organised.

In addition, it is anticipated that five project meetings will be held, with exact dates to be agreed. It is expected that these meetings will be held in November 2006, February 2007, April 2007, June 2007, and August 2007.