

A review of workplace transport safety and HSE commissioned work on manual handling and delivery of goods

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A review of workplace transport safety and HSE commissioned work on manual handling and delivery of goods

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The Health and Safety Laboratory (HSL) was approached by the Health and Safety Executive (HSE) Workplace Transport programme to carry out a general literature review in the area of workplace transport safety. After discussions to establish the scope of the work, the project team identified that, for completeness of information, a review concerning the related aspect of manual handling and delivery of goods should also be included. This report presents the results of the literature review in the areas of a) workplace transport safety, and b) manual handling and delivery of goods.

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EXECUTIVE SUMMARY

This report presents the findings of a literature review in the areas of A) workplace transport safety and B) manual handling and delivery of goods conducted by the Health and Safety Laboratory (HSL) for the Health and Safety Executive (HSE) Workplace Transport Programme.

Objectives

The aims and objectives of the respective literature reviews were as follows:

Part A) Workplace transport safety

The aim of the work was to carry out a literature review in the area of workplace transport safety. The objectives were as follows:

1. Carry out a comprehensive literature review in the area of workplace transport safety utilising previous HSE research, namely the work by Dickety et al. (2003); Marlow and Dickety (2004), and Harley and Cheney (2005); and
2. Establish whether there have been any significant developments in the subject area since this previous research was completed.

Part B) Manual handling and delivery of goods

The aim of the work was to provide an overview of HSE commissioned projects concerning manual handling and delivery of goods. The objectives were as follows:

1. Identify previous work commissioned by HSE concerning manual handling and delivery of goods, and help provide a centralised database with links to the reports;
2. Summarise the information concerning practical measures for controlling risks, and;
3. Identify outstanding issues, i.e. those for which few or no solutions exist or for which there are still known residual risks.

Main Findings

Part A) Workplace transport safety

A limited number of studies were identified that specifically examined workplace transport safety between 2005 and 2008. Drawing on this literature as well as on the broader transport research, the findings complement previous HSE work. Specifically:

- Several studies were found that focused on the characteristics and causes of workplace accidents mainly, although not exclusively, in the construction industry. In general, the types of accidents and causes identified complement existing knowledge in this area.
- Recent research on forklift truck safety has highlighted the importance of considering vehicles' emergency braking times and distances when managing workplace transport activity. This line of research, however, has not been replicated across other types of workplace transport vehicles.
- There has been an increasing emphasis on examining potential applications of Intelligent Transport Systems (ITS) to enhance workplace transport safety. ITS refer to developments in communication and computing technologies that aim to enhance safety and efficiency in all modes of transport and industry (e.g. intelligent speed adaptation or seatbelt systems). Initial findings suggest that these systems may be effective in preventing workplace transport accidents (in conjunction with other risk control measures).

- Several studies were identified that examined the long-term effects of working with workplace transport equipment. The emphasis has been on the prevalence of musculoskeletal disorders among fork-lift drivers in particular. This line of research suggests that vehicle design, driver skills and behaviour may all contribute to the development of musculoskeletal disorders.
- The broader transport literature suggests that personality characteristics, such as agreeableness and conscientiousness, are associated with more positive safety attitudes and lower levels of accident involvement. Further, individuals who are motivated to act safely tend to experience fewer work-related accidents. Managers and supervisors may influence subordinates' safety motivation by valuing and endorsing the importance of safety.
- It is widely recognised that safety climate plays an important role in workplace accident prevention and a number of studies were found within the general transport literature that confirmed this. However, no studies were identified in the academic literature that examined the effects of safety climate in the context of workplace transport.

Part B) Manual handling and delivery of goods

One hundred and thirty-six reports were identified of which 87 were considered most relevant to workplace transport. These covered the subjects of risk factors, risk assessment, control and prevention measures, guidance and worker training. Most of the reports were for reactive support projects on manual handling tasks that had been commissioned with HSL's Ergonomics Section or HSE's Human Factors and Ergonomics Specialist Group (CSD 4).

- These reports indicate that HSE's use of ergonomics specialist resources has been focused on repeated handling operations, which occur at a single workplace rather than during peripatetic work. Peripatetic work, however, falls under the jurisdiction of both HSE and Local Authority Environmental Health Officers (EHOs). However, until quite recently Local Authority EHOs did not have access to specialist ergonomics support.
- Based on the recommendations in the reports, and in accordance with the hierarchy of control suggested in Regulations, it was possible to summarise the control measures for different task operations.
- Two outstanding issues were identified from the studies, which related to the definitions of task activities and the use of guidance.

Recommendations

Part A) Workplace transport safety

The report makes several suggestions for future research in the area of workplace transport that further complements and adds to previous HSE work.

- The area of ITS merits further research attention including establishing the relative merits and drawbacks of different types of ITS, their suitability for different tasks and work environments and their effects on both driver and organisational safety.

- Research is required into the long-term effects of working with workplace transport equipment for operators other than fork-lift drivers. A better understanding of measures that organisations can take to ameliorate the long-term effects of vibration exposure is required. These would include a consideration of both vehicle design factors and driver skills and behaviour.
- The links between driver fatigue, work demands and workplace transport accidents have not been consistently examined. Consistent with the recommendation of Harley and Cheney (2005), more research is required in this area.
- It is widely acknowledged that safety climate is an important contributing factor to workplace accidents, however studies within the workplace transport area are lacking. Intervention studies are required to examine the ways that organisations can create a positive safety climate. These studies could evaluate the effectiveness of any interventions by considering actual accident rates and/or near misses.

Part B) Manual handling and delivery of goods

It would be worthwhile to consider further work:

- To develop sector specific guidance, and;
- To investigate different control measures that could be applied across sectors.

Table 1. Types of Intelligent Transport Systems and potential applications

Types of Intelligent Transport Systems	Description and potential application to workplace transport safety
Proximity laser scanner	The scanner detects persons or objects and can slow down the speed of vehicles. They also trigger alarms and lights to warn the operator. They can help prevent collisions with pedestrians or other vehicles especially when the driver is distracted.
Microwave motion sensors	Alert pedestrians and other vehicles of approaching equipment such as forklift trucks. Audible and visual alarms are produced until vehicle has passed through. They are typically installed on vehicle and/or busy pedestrian intersections.
Movement trackers	Record the speed, location and heading of vehicles in real time and can warn pedestrians and other drivers of potential collisions.
Fleet management systems	They provide preventative maintenance and training certification monitoring. They can include keyless access control and ensure that only authorised drivers with current training credentials can use specific equipment. These systems may help prevent accidents associated with poor maintenance of vehicles and lack of or inadequate driver training.
Infrared communication technologies	They utilise an invisible 30-foot beam, which scans the area around the vehicle. Strategically placed receivers detect the vehicle's proximity and activate warning systems such as flashing lights or audible alarms. This system could give early warnings of vehicles approaching in areas where oncoming vehicles are not yet visible (e.g. blind corners, around machinery).
Intelligent seatbelt systems	Systems that prevent vehicles from starting when the handbrake is not engaged and the driver is not restrained by a seatbelt or another device. These may be used to counter unsafe working practices such as not wearing seatbelts which has been shown to be prevalent among forklift operators.
Intelligent speed adaptation systems	These systems warn the operator when driving in excess of the speed limit and/or prevent the speed limit from being exceeded. Speed limiters may also reduce the maximum speed of a vehicle such as a forklift depending on the load, its height and turning radius.
Rear parking sensors	These sensors warn the operator of any objects in close proximity to the vehicle when reversing. Camera-based systems allow the operator to see what is behind the vehicle.
Load weighing devices	These devices monitor the weight of loads and can be designed to interrupt lifting operations when a load reaches a set limit in order to prevent the vehicle from overloading. They can help prevent stability-induced accidents (such as forward tipovers that result from lifting loads that are too heavy for forklift trucks).

Sources: Horberry et al. (2006), Lawrence (2007) and Stanton and Salmon (in press)

Table A 1 List of the relevant reactive support projects commissioned by HSE – Letter/summary reports

<i>S/No.</i>	<i>Report ID</i>	<i>Location</i>	<i>Authors</i>	<i>Year</i>	<i>Title</i>	<i>Objectives</i>	<i>Work tasks/objects handled</i>
1	ERG/08/07	HSL-Ergonomics Reports Library	Jones, A	2008	Assessment of two load restraint methods at UPM Kymmene	To assess load restraint fastening task To identify measures for risk reduction	Pushing to activate ratchet / Restraining straps for securing loads on lorries
2	ERG/08/06	“	Smith, M and Riley, D	“	Assessment of manual handling activities during home delivery of white goods at Chester Home Delivery Platform	To review training and manual handling practices To assess risks for injury to delivery drivers	Repeated handling, load and unload trailer / Delivery of white goods at domestic premises
3	JS2004987	“	Oxley, L	2006	Manual handling risks at Blackheath Products, Halesowen	Assess the risks from handling of work surfaces Provide methods for risk control	Repeated handling, order picking / Various work surfaces at warehouse
4	JS2004754	“	Stanley, L	“	Assessment of manual handling activities at Morgan Retail UK, Ltd	Appraise the risk for musculoskeletal disorders Make recommendations for reduction of the risk	Repeated handling, load and unload trailer / Boxes of accessories in warehouse
5	JS2004685	“	Leah, C and Birtles, M	“	Manual handling risks in furniture handling at DFS Taunton	Appraise the risks for musculoskeletal disorders	Repeated handling, load and unload truck, pushing and pulling / Furniture units, sofas during and after production
6	JS2003927	“	Jones, A and Birtles, M	2004	Appraisal of manual handling risks in the distribution and collection of Portaloo's	Assess the manual handling risks in the distribution activity	Unload and load truck, repeated handling, pushing and pulling / Portaloo's at commercial premises
7	JS2003893	“	Stanley, L	“	Assessment of drum handling at GB Lubricants and Fuels	Assess the manual handling risks when unloading from pallets and stacking into freight container	Repeated handling, load and unload trailer container / Filled 25 L drums at warehouse
8	JS2003888	“	Jones, A and Marlow, P	“	Hanson Myrefield Garages	Appraise MSD risks in the erection of concrete garages	Repeated handling, unload truck, pushing and pulling / Building parts at work site

Table A1 List of the relevant reactive support projects commissioned by HSE – Letter/summary reports (continued)

<i>S/No.</i>	<i>Report ID</i>	<i>Location</i>	<i>Authors</i>	<i>Year</i>	<i>Title</i>	<i>Objectives</i>	<i>Work tasks/objects handled</i>
9	JS2003876	HSL-Ergonomics Reports Library	Stanley, L and Ferreira, J	“	Assessment of bale and mattress handling at Take Ltd	Appraisal of risks for musculoskeletal disorders	Repeated handling, pushing and pulling / Bales and mattresses during and after production
10	JS2003706	“	Ferreira, J	“	Assessment of manual handling operations in Stansted Airport baggage hall	Appraisal of risks for musculoskeletal disorders	Repeated handling, load and unload aircraft hold, pushing and pulling / Passenger baggage at airport
11	JS2003368	“	Marlow, P and Birtles, M	2003	Ergonomics evaluation of MSD issues at European Friction Industries Ltd, Bristol	Appraise the risks of MSD in the production tasks	Repeated handling, pushing and pulling / Trolleys in factory during production
12	JS2003327	“	Bunn, J	“	MSD risks in reel room activities at Newsquest (Sussex) Ltd	Appraise the risks of MSD in handling tasks	Pushing and pulling / Large reels of paper in factory
13	JS2003215	“	Marlow, P and Riley, D	“	MSD risks at Grampian Country Pork, Malton	Appraisal of risks for MSD in handling tasks	Repeated handling, pushing and pulling / Boxes and wheeled devices during production
14	JS2003214	“	Marlow, P and Riley, D	2002	Appraisal of the risks of musculoskeletal / manual handling injury at Browns 2000	Appraisal of risks for MSD in flat pack furniture production, packing and dispatch	Repeated handling, load and unload truck / Flat pack furniture during production and at customer premises
15	JS2003098	“	Milnes, E	2003	Assessment of the ergonomics issues involved in second level or ‘step-up’ order picking using the Lansing N20 picking truck	Assess the associated ergonomics issues Assess the manual handling risks	Repeated handling, order picking / Boxes of products at warehouse
16	JS2003044	“	Birtles, M and Monnington, S	2004	Assessment of manual handling and manual manipulation tasks at Polestar Print and Copy	Examine ergonomics issues surrounding the work tasks	Repeated handling, pushing and pulling / Bundles and hand trucks at factory
17	JS2002960	“	Riley, D	2002a	Manual handling operations at Wessex Foods Ltd	Assess the risks from manual handling operations	Repeated handling, pushing and pulling / Boxes in factory

Table A1 List of the relevant reactive support projects commissioned by HSE – Letter/summary reports (continued)

<i>S/No.</i>	<i>Report ID</i>	<i>Location</i>	<i>Authors</i>	<i>Year</i>	<i>Title</i>	<i>Objectives</i>	<i>Work tasks/objects handled</i>
26		HSE/HSL Ergonomics Home website *	Monnington, S.	2006a	Manual handling risks and controls during signal cable installation work at the railway trackside	Describe the range of risks for injury Provide suggestions for risk control	Repeated handling, pushing and pulling / Signal cables at track side areas
27		“	Monnington, S.	2006b	Manual handling risks and controls during concrete fabrication work at Aggregate Industries	Examine company action taken in relation to manual handling risks.	Repeated handling / concrete building sections and cast moulds in production areas
28		“	Quarrie, C.	2008a	Musculoskeletal disorder risks from roll cage operations at Leighton Hospital, Crewe	Review and assess risks in the tasks Provide information and guidance for risk control	Repeated handling, load and unload truck, pushing and pulling / roll cages, bundles in laundry and dispatch areas
29		“	Quarrie, C.	2008b	Musculoskeletal disorder risks at Sunlight Service group Ltd	Review risks in roll cage pushing Provide information and guidance for risk control	Repeated handling, load and unload truck, pushing and pulling / roll cages, bundles in laundry and dispatch areas
30		“	Quarrie C	2008c	Manual handling risks in baggage handling	Assess the risks in loading baggage Provide information on reasonable risk controls	Repeated handling, load and unload hold, pushing and pulling / Passenger baggage, trolleys, dollies at airport
31		“	Quarrie, C. and Dodd-Hughes, K.	2007	MSD risks at Pak Mecca	Assess the risks loading furniture Provide information on reasonable risk controls	Repeated handling, pushing and pulling / furniture units, wheeled storage racks in production areas
32		“	Quarrie, C. and Tootle, K.	2006	Manual handling at Argos Direct, Manchester	Summarise the key risks associated with pushing and pulling of rail cages Provide recommendations for risk reduction	Repeated handling, pushing and pulling, order picking / Boxes, crates, roll cages in retail store warehouse

Table A2 List of the relevant reactive support projects commissioned by HSE – Full HSL

<i>S/No.</i>	<i>Report ID</i>	<i>Location</i>	<i>Authors</i>	<i>Year</i>	<i>Title</i>	<i>Objectives</i>	<i>Work tasks/objects handled</i>
38	ERG/08/21	HSL-Ergonomics Reports Library	Riley, D	2008	Manual lifting in large teams at country homes (Anglia) Ltd	Assess MSD related risks with large 22 man team	Repeated handling / Large timber board, plywood at production area
39	ERG/08/20	“	Leah, C	“	Musculoskeletal disorder risks at Devonshire Pine Ltd (Furniture manufacture)	Appraise risks for injury to workers Propose recommendations for risk reduction	Repeated handling, load and unload lorry, pushing and pulling, home delivery / Furniture, hand trucks
40	ERG/08/16	“	Okunribido, O	“	An ergonomics assessment of delivery of animal carcasses to retail butchers premises	Identify common handling techniques applied Evaluate the risks from different perspectives Identify key hazards and useful controls	Repeated handling, load and unload vehicle, pushing and pulling, home delivery / Animal carcasses at domestic premises
41	ERG/08/15	“	Riley, D; Oxley, L; Tapley, S	“	Musculoskeletal ill-health risks for airport baggage handlers: Report on a stakeholder project at EMA	Collect data on baggage weights/frequency Assess risk in current handling methods Evaluate new extending belt technologies	Repeated handling, load hold / Passenger baggage at airport
42	ERG/07/31	“	Okunribido, O	“	Development of guidance for application during inspection of manual unloading / loading of freight containers	Provide key risk assessment questions Assist to identify/select useful handling aids Increase awareness of available solutions	Repeated handling, unload container, pushing and pulling / Boxes, reels, furniture, white goods, etc at various sites
43	ERG/07/30	“	Okunribido, O; Stanley, L et al.	“	An ergonomics investigation of manual unloading/loading of freight containers	Obtain first hand information about tasks Assess risks of injury to workers	Repeated handling, unload container, pushing and pulling / Boxes, reels, furniture, white goods, etc at various sites

Table A2 List of the relevant reactive support projects commissioned by HSE – Full HSL (continued)

<i>S/No.</i>	<i>Report ID</i>	<i>Location</i>	<i>Authors</i>	<i>Year</i>	<i>Title</i>	<i>Objectives</i>	<i>Work tasks/objects handled</i>
44	ERG/07/28	HSL-Ergonomics Reports Library	Riley, D	“	Literature review update: Reducing the risks associated with the manual handling of air passenger baggage, narrow bodied aircraft	Present information on methods of loading narrow body aircraft for risk reduction Identifying knowledge gaps	Repeated handling, load hold, pushing and pulling / Passenger baggage, dollies at airport
45	ERG/07/23	“	Oxley, L	“	Assessment of MSD risks when pushing and pulling wheeled refuse collection bins	To assess MSD risks to collectors	Pushing and pulling / Wheeled bins in city areas and streets
46	ERG/06/28	HSL Reports & Papers Library	Okunribido, O and Yeomans, L	2006	Ergonomics assessment of MSD and ULD risks associated with manufacture of food products	Provide expert assessment of MSD and ULD risks associated with different work tasks	Repeated handling, pushing and pulling / Bags, blocks of lard, trolleys, hand trucks in production areas
47	ERG/06/27	“	Okunribido, O	“	Ergonomics evaluation of ... and handling of trolleys during manufacture of pottery	Provide an appraisal of the risks for MSD	Pushing and pulling / Trolleys hand trucks in production areas
48	ERG/06/12	“	Stanley, L	“	Typical manual handling activities performed in retail carpet stores: The risks and how to reduce them	Identify specific risks in task (unloading) To offer recommendation for risk reduction	Repeated handling, load and unload truck, pushing and pulling / carpet, underlay rolls, buggy, trolley in store areas
49	ERG/06/08	“	Jones, A; Stanley, L et al.	“	An appraisal of the manual handling of coffins during funerals with recommendations	Assess the associated risks for injury Make recommendations for risk reduction	Repeated handling, load and unload hearse, pushing and pulling / coffins, trolleys at funeral home, cemetery, etc
50	ERG/06/03	“	Okunribido, O	“	Manual handling of heavy barrels in a factory – An ergonomics assessment	Evaluate the risks for injury and advice on appropriate controls	Repeated handling, pushing and pulling / Filled large barrels in production and warehouse areas
51	ME/06/08	“	Norton, G Isherwood, R	“	Avery Dennison Milton Keynes Pedestrian Pallet truck and paper roll	Investigate circumstances whereby a paper roll moved off a pallet during transfer by a hand truck	Pushing and pulling / hand truck in production areas

Table A2 List of the relevant reactive support projects commissioned by HSE – Full HSL (continued)

<i>S/No.</i>	<i>Report ID</i>	<i>Location</i>	<i>Authors</i>	<i>Year</i>	<i>Title</i>	<i>Objectives</i>	<i>Work tasks/objects handled</i>
52	SOFS/06/05	HSL Reports & Papers Library	Marlow, P	“	Moving goods safely initiative Phase 1 valuation	Identify effective intervention strategies Inform wider roll-out of the approaches in UK	Not specified
53	ERG/05/37	“	Jones, A	2005	An appraisal of the manual handling and musculoskeletal risks at UPS Ltd.	Assess risks for injury from tasks performed, Provide recommendations for risk reduction	Repeated handling, load trailer container, sorting / Mail boxes, parcels, bags in warehouse, distribution centre
54	ERG/05/33	“	Okunribido, O	“	Manual handling during order picking in distribution centre	Identify specific risk factors and critique company training programme	Repeated handling, order picking / Boxes, bags, crates of product at warehouse, distribution centre
55	HE/05/02	“	Jones, A; Codling, A et al.	“	Occupational health case studies in construction	Broaden the range of case study materials that illustrate the benefits of managing risks to workers health	Pushing and pulling / Hand trucks, trolleys on construction site
56	ERG/04/10	“	Riley, D	2004	Manual handling in the rail sector in South Wales	Identify major causes of injury Present effective and practical control measures	Repeated handling, pushing and pulling / Rail lines, trolleys, sleepers at trackside, depot areas, station platform
57	ERG/03/21	“	Marlow, P and Milnes, E	2003	Ergonomics evaluation of MSD issues at Nicholas & Harris Salisbury	Assess the risks presented by a range of tasks (load/move laden trolleys/wheeled racks)	Repeated handling, pushing and pulling, order picking / Sacks, bags, boxes, hand trucks, trolleys in production, storage areas
58 59	ERG/03/18 ERG/03/24	“	Boocock M and Birtles, M	“ “	Ergonomics evaluation of manual handling operations of UK ambulance staff, with particular emphasis on ...use of carry chairs	Examine behaviour of crews when moving patients Determine the risks associated with transfers of seated patient	Repeated handling, pushing and pulling load ambulance / Patients, carry chairs in city areas and patients homes
60	ERG/03/16	“	Ferreira, J	“	Assessment of manual handling risks with baggage handling at Edinburgh Airport	Investigate risks in the baggage handling task	Repeated handling, load hold, pushing and pulling / Passenger baggage, dollies at airport

