Science & Technology Group Report v1

Corporate Specialist Division 4

Ergonomics Team

Huntingdonshire District Council – Ergonomics assessment of Eurobin handling arrangements	
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Executive Summary

Following concerns being raised by HSE about the manual handling (pushing and pulling) of 1100 and 1280 litre Eurobins containing glass for recycling, I contacted Mr Steven Howell at Huntingdonshire District Council to set up a visit to look at the issues. On 9 February 2009 we made a number of joint visits to recycling collection points and discussed the work and recorded forces pushing and pulling bins. The forces needed to push-pull the Eurobins varies significantly depending on factors such as wheel alignment, severity of thresholds, quality of ground surface, slopes, level of fill. We recorded forces which exceeded the HSE risk filter figures (recommended maximum push pull forces to protect the majority of the working population), which indicates an increased level of risk of manual handling injury. A number of the forces recorded exceeded additional guidance from HSE research – indicating an increased risk of manual handling injury when the task is performed by individual operators. Additional risk factors including long periods of driving / sitting, and 'cold' heavy manual handling will in my opinion further increase the risk of injury. In my opinion the risk of injury to operators individually handling Eurobins is high and an appropriate means of reducing the risk would be to ensure that two operators perform this task.

1 INTRODUCTION

I was asked by Mr Paul Hoskins (HM Inspector of Health and Safety) to contact Mr Steven Howell at Huntingdonshire District Council (HDC) to provide ergonomics advice regarding the emptying of communal recycling bins. Concerns were raised by Mr Hoskins about the arrangements for operators to carry out this work on their own. These concerns were primarily concerning the manual handling risks involved in pushing and pulling the 1100 and 1280 litre Eurobins containing glass.

I carried out joint visits with Mr Steven Howell (HDC Health and Safety Co-ordinator) to five sites in the Huntingdonshire district on 9 February 2008. I also met with Mrs Christine Rowland (HDC Health and Safety Advisor to the council).

This report provides the findings from our joint visits and puts them in the context of current manual handling legislation, guidance and findings from previous research.

2 SITES VISITED

- **Sainsbury's Supermarket – Huntingdon**
  - Block paved stand with drop kerb access point, slight slope downwards towards access point

Figure 1. Sainsbury's site – threshold onto block paving

- **Huntingdon Garden Centre**
    - Tarmac stand – at edge of road, no thresholds / kerbs etc, no slope

Figure 2. Huntingdon Garden Centre

- **Co-op Supermarket / Rainbow Centre – St Ives**
    - Tarmac stand in large enclosure, no thresholds

Figure 3. Co-op supermarket

- **Sawtry**
  - Tarmac stand – slight slope upwards

- **Great Staughton**
  - Concrete stand surrounded by earth / gravel, sloping downwards away from stand

Figure 4. Great Staughton

My understanding is that there are approximately 100 recycling sites across the Huntingdonshire district, of which some are only paper recycling. The number of glass recycling bins varies between sites but my understanding is that typically there will be between three and six glass recycling bins.

3 FINDINGS FROM VISITS

3.1 Work arrangements

Two operators carry out the task of emptying recycling bins in the region. Before concerns about the work were raised, the drivers travelled separate routes and visited sites alone. My understanding is that currently as a temporary risk reduction measure and as part of an ongoing audit, the drivers are driving each in their own vehicles to the same sites and handle the bins together.

The operators typically work a 37 hour week, starting at 06:30 and finishing at approximately 13:30 to 14:00. The work is not job-and-finish and has not been for a number of years.

3.2 Pull forces

During the visits the forces needed to initiate movement of the bins were measured, and the forces needed to maintain rolling movement. These are summarised below in table 1. Findings confirmed that pull forces will vary considerably depending on how full the bins are, wheel alignment and ground surface / presence of thresholds. Table 1 provides figures for the

sample of bins / sites which we looked at and it is likely there will be variation outside these figures.

Table 1. Eurobin pull forces measured on 9 February 2008

Level of fill	Ground surface	Slope	Wheels aligned / not aligned	Pull force * initiation ** sustained
empty	Up a drop-kerb threshold		aligned	*392N / 255N
empty	Tarmac	level	not aligned	*157N
empty	Tarmac	level	aligned	**59 to 20N
¼	Blocks	Slight down	not align.	*266N
¼	Blocks	Slight down	aligned	*105N
½	Tarmac	Slight up	not aligned	* >412N no movement
½	Tarmac	Slight up	aligned	*392N
½	Tarmac	Slight up	aligned	**235N
full	Blocks	Slight down	part aligned	*>313N no movement
full	Blocks	Slight down	aligned	*334N

Note: 1kgf = 9.81N

Due to ice and snow on the gravelled areas pull forces were not measured at Great Staughton because it would have been unrepresentative and unsafe.

HSE guidance on the manual handling regulations[1] states in its risk filter that a guideline push-pull force for men starting and stopping a load is approximately 200N (150N for women). The guideline for keeping the load in motion is approximately 100N (70N for women). These guideline push-pull figures are based on research which indicates these levels would provide reasonable protection from musculoskeletal injury to around 95% of working men and women. The HSE risk filter and the force levels it recommends are not 'limits' but the guidance states that where they are exceeded a thorough risk assessment should be carried out.

The forces which we recorded show that even partially filled bins can exceed HSE push-pull risk filter levels by a factor of two. The guidance states that '*Even for a minority of fit, well-trained individuals working under favourable conditions, operations which exceed the guideline figures by more then a factor of about two may represent a serious risk of injury*'.

Various other guidance documents (for example British and International Standards), and research literature also recommend lower pull initiation forces than several of those which we recorded. For example a 226N upper limit for male operators pulling and pushing while standing[2].

3.3 Wheel Alignment

Wheel misalignment is a key factor increases the push-pull initiation forces. Wheels can go out of alignment naturally when emptied bins are returned to their stand position and

[1] L23 Manual Handling Operations Regulations 1992 (as amended): Guidance on Regulations. HSE Books
[2] Ferreira, J et al (2004) Review of the Risks Associated with Pushing and Pulling Heavy Loads. RR228 – Health and Safety Laboratory Report.

manoeuvred into place. Because all four wheels steer even if operators kick the front wheels into alignment the rear wheels may still be misaligned, which would still result in an increased initial pull force.

Although operators may be able to kick the front wheels into alignment, over time this may increase the level of maintenance needed on the wheels. It is also an easy task for operators to avoid or overlook (e.g. if they are working quickly because they are behind on a work schedule or if the weather is poor). Even if wheel alignment is recommended as standard working practice it is likely that in many cases operators will attempt to pull bins before aligning the wheels.

3.4 Thresholds

Even relatively small thresholds (height differences between two adjacent ground surfaces) can significantly increase the pulling force on empty bins being returned to the stand. Figure 5 shows the threshold at Sainsbury's Huntingdon which caused approximately 100N increase (minimum) in the pulling force, taking it beyond the HSE filter figures.

Figure 5. Threshold at Sainsbury's Huntingdon

3.5 Slopes

The forces for pushing and pulling which were recorded reflect to some extent the additional difficulty caused by pulling or pushing up a slope. The site which I visited with the most pronounced slope downwards from the stand was at Great Staughton, which was combined with an uneven earth and stone ground surface.

Unfortunately due to snow and ice it was not possible to get a measure of the pull force away from the stand or back onto it. However, after emptying because of the ground conditions and slope I would anticipate a high sustained force and a high initial push-pull force back up the slope. There is also a threshold which is more pronounced than at the Sainsbury's site and which I would expect to significantly increase the push-pull force and cause it to exceed the risk filter figures. Figures 6 and 7 show the stand, slope and threshold at Great Staughton.

Figure 6. Stand and threshold at Great Staughton

Figure 7. Stand threshold at Great Staughton

3.6 History of incidents

Based on discussions, it is my understanding that operators have previously reported injuries which they have related to the manual handling (pushing and pulling) of the bins. A relatively low total number of injuries have been reported but this is likely to reflect the small total number of operators who carry out this task regularly, rather than the level of injury risk. Overall refuse collectors tend to have a higher than average level of musculoskeletal disorders due to the strenuous nature of their work.

3.7 Additional Factors to Consider

Previous investigation of refuse and recycling operations by the Health and Safety Laboratory[3] (HSL) has shown that Eurobins can become stuck in the 'up' / emptying position on the refuse truck's lifting mechanism. I have observed this situation resulting in operators pulling on the wheels to free the bin. It is possible that the mechanism on the trucks used by HDC are designed so that no sticking occurs, I was not able to assess this. However, if sticking does occur, an operator trying to free the bin / mechanism on his own would in my opinion be a high risk operation not only from an over-exertion point of view but via possible injury from the bin striking the operator etc. An additional aspect of the risk is that in the event of any injury or incident, operators may be at a remote site and may not be able to get timely assistance.

The same HSL investigation concluded, based on visit findings and previous research, that wherever possible the Eurobins should be handled by two operators. The lifting mechanism on the vehicle which we observed needed two operators to activate controls simultaneously for it to work. This was considered an advantage because it would reduce the likelihood of operators handling the bins individually.

3.8 Handles

The proximity of the bins to each other (side-to-side) means that operators will generally be unable to get a good grip on the fitted handles which are at the sides. This will mean that typically the operators use the lifting bar to pull the bin, which introduces some additional risks – described below. Figure 8 shows typical proximity of bins.

[3] Pinder, A., Milnes, E (2002) Manual Handling in Refuse Collection. Health & Safety Laboratory Report HSL/2002/01

Figure 8. Proximity of bins

- The lifting bar is positioned horizontally approximately 1200mm above the ground. The fitted handles are vertical bars on the sides of the bins which allow for adjustment of grip height for pushing and pulling. The advantage of the vertical bars as handles is that operators of different heights can grip them at their individual optimal level for exerting push-pull.

- The HSL report on pushing and pulling, on the basis of a wide ranging literature review makes the following recommendations on handle height:

  'The optimum height for a handle for pushing and pulling is between 910 mm and 1120 mm above the ground, depending upon operators stature. In general, the handle should be a little below elbow height. A middle height of 950 mm is a good compromise for most people'

  The fitted handles have a height range of 720mm to 1000mm which includes the optimal compromise height of 950mm. However, the lifting bar is higher than the recommended height range. Many operators, other than particularly tall males, would find that the lifting bar is higher than elbow height and consequently not in an optimal position for exerting a strong pulling force.

- The horizontal arrangement of the lifting bar and the need for the fingers to be curled up into it means that operators would have to exert pulling force with their forearms in supination (palms tilted upwards). Pushing and pulling using vertical handles would allow the forearms and wrist to remain in neutral posture. Movement of the forearm away from neutral will reduce the force available to operators so any pulling force will comprise a higher proportion of their maximal exertion of the shoulder and arm muscles, increasing the risk of injury.

- The lifting bar is an enclosed right angle which means that the operator is not able to use a power grip when pulling, instead the fingers must be bent 90 degrees around the bar. This essentially turns the finger into a lever with a mechanical disadvantage compared to a power grip, resulting in increased tension in the tendons running through the carpal tunnel and an overall lower pulling capability.

- Finally, during bin emptying on the truck the lifting bar can become contaminated with broken glass which can cut the operators fingers; a consequence of the lifting bar not being designed primarily as a handle.

3.9 Control – emergency stopping and steering

On some sites with significant slopes a bin might gain momentum which may result in a single operator having to exert significantly greater effort to control it than is reflected by the figures in table 1. Although brakes are fitted to the bins, a single operator may be pulling from the centre of the front of the bin using the lifting bar and may not have quick access to the brake. A frequent cause of critical manual handling injuries is operators trying to catch / stop items which lose control or fall, and exerting excessive forces while in awkward postures.

Although we measured starting and sustained pull forces, the operators will also have to exert steering and stopping push-pull forces. Stopping forces are likely to be similar to the initial pull forces. Steering forces will vary greatly depending on surface condition / type, the weight of the load and the speed of the bin / rate of change of direction needed.

3.10 Driving

The dispersed locations of the recycling sites means that operators have to drive long distances, both in total and between many consecutive sites.

There has been an association shown between driving for long periods / long distances and back pain / lower back musculoskeletal disorders. Research shows this to be exacerbated by intermittent heavy manual handling activities. A typical example where this has occurred is delivery drivers who show significantly higher levels of back pain compared with the general population. In the two key aspects mentioned above; long periods of sitting / driving and intermittent heavy manual handling, the Eurobin round shows strong similarities to a typical delivery drivers task.

Factors which may contribute to this problem include static seated postures and ‘cold-handling’ (i.e. going from very low levels of physical activity – driving – to high levels of physical exertion, without muscles having a chance to adapt and warm up). Overall the combined driving with excessive manual handling is likely to increase the risk of injury.

4 DISCUSSION

4.1 Work arrangements

My understanding is that currently the two operators drive separately to the same sites in order to perform any two person handling.

Arrangements previously have recommended that if an operator finds a bin to be too heavy to move, he is to call the second operator to ask for assistance. This strategy is in my opinion prone to failure because of lone workers tendency to try to complete their work on their own and avoid reliance on other people. The strategy is also potentially costly in petrol and lost working time.

The operators can broadly predict which bins are used most heavily and they use that knowledge to empty the bins when they are half filled. This is a useful strategy for controlling the manual handling risk however that knowledge is held by the individual operators. If an operator is on holiday or sick-leave their replacement would not understand that strategy and may leave certain bins to become full. This may result in either the replacement operator or the original operator when he returns to work pulling full bins when this may have been avoided.

4.2 Kerbside Recycling

Discussion during my visit indicated that the council may consider in the future a move towards kerbside recycling, as a way of reducing or eliminating the large recycling bins. Kerbside recycling is not without risk in terms of manual handling, exposure to traffic etc. as well as being labour intensive. In my opinion, in terms of the personal risks faced by operators, two-person teams collecting recycling from Eurobins would potentially be favourable to kerbside recycling.

4.3 Site Maintenance

My understanding is that because many of the recycling sites are on privately owned or non-council land, they may not be adequately maintained. This could result in thresholds onto the stands becoming more pronounced as softer surrounding areas erode (where the stand is not surrounded by tarmac or concrete etc.). The ground surrounding stands may also become potholed and uneven causing sustained pulling forces to be increased. My expectation is that it would be difficult to impose a standard and monitor / ensure repairs on many of these sites, which reduces the effectiveness of such a strategy as a risk control measure.

4.4 Mechanical Assistance

Powered tugs are available for pulling multiple Eurobins simultaneously. However, these are more suitable for large fixed sites. The tugs weigh a considerable amount (e.g. approximately 90kg) and would therefore not be a straightforward solution for multi-site use by a single operator who would need to transfer them on and off his vehicle.

5 CONCLUSIONS

Regulation 4(1)(b) of the Manual Handling at Work Regulations requires that where it is not reasonably practicable to avoid the need for employees to undertake manual handling operations which involve a risk of their being injured, a suitable assessment must be carried out, and appropriate steps taken to reduce the risk of injury to the lowest level reasonably practicable.

Overall manual handling (pushing and pulling) of the 1100 and 1240lt Eurobins presents a significant risk of manual handling injury to operators when performed individually. The main risk factors are as outlined below.

- the force needed to move the bins due to
    - weight of bin and contents
    - wheel misalignment
    - thresholds
    - slopes
    - poor quality ground surfaces
- poor upper limb posture during pulling
- alternating between periods of vehicle driving and excessive manual handling

Remote working is an additional area of concern, if an operator is injured lack of timely assistance may make the problem worse.

In my opinion this task requires two operators in order for the risks to be kept to a lower level. The forces are sufficiently high that even two operators handling together may sometimes be exposed to an increased risk of manual handling injury. However, effective training and awareness of the issues should help to control those risks adequately.

A number of risk reduction options have been noted in this report (e.g. the current arrangement of two vehicles / two operators, knowledge of bin use patterns, powered tugs etc). In my opinion a straightforward and effective risk reduction measure would be to specify that the work be performed by two operators – team handling – rather than by individuals.

6 APPENDIX 1 – FURTHER INFORMATION ON MANUAL HANDLING

Manual handling injury risk factors

Manual handling is associated with a large proportion, around one third, of the accidents reported each year to HSE. Most of these are described as sprains and strains (musculoskeletal disorders – MSD). Typically, reports cite the back as the body region concerned. (HSE, 1998).

Ergonomics and medical research has helped to clarify the main risks of back disorder associated with manual handling. Physical activities associated with an increase risk of back disorder are: heavy physical work; lifting and handling of loads; and awkward postures (e.g., bending and twisting) (Bernard, 1997; De Beeck and Hermans, 2000). The use of objective measures of the extent of physical loading to the lower back (e.g. spinal loading) during manual handling has contributed to the strength of these associations (De Beeck and Hermans, 2000).

The specific factors that modify the extent of the loading to the lower back are as follows:

- The load

  The weight of the load / force needed to push and pull, its size, shape, stability and grip.

- The task

  The postures adopted (twisting, stooping and reaching), repetition, duration of the activity and carrying or pushing and pulling distance.

- The environment

  The space available to move, floor condition, changes in levels and weather conditions.

- The individual

  The capability and characteristics of the operator, level of knowledge and experience, underlying health problems.

(HSE, 1998)

Psychosocial factors may also influence the health of workers (for example, aspects of work design such as how much control people have in their jobs and the support they receive from supervisors / co-workers).

These factors can act in combination making the risk greater. It is the factors described above that need to be considered when assessing the risks posed by a manual handling operation.

Key manual handling information and guidance

HSE has published a free leaflet entitled *"Getting to Grips with Manual Handling"* (INDG 143, published 1993, revised 2000 and 2004). This document sets out the duties of an employer with regard to identifying and assessing manual handling risks. To aid this process it includes guideline load weights for lifting. It also sets out ways of reducing the risks of injury, for example, can the load be made easier to grasp? And that training should cover the use of mechanical handling aids.

The main risk factors of musculoskeletal injury associated with manual handling are outlined in *"Guidance on the Manual Handling Operations regulations, 1992 (as amended)"* (L23, published 1993, revised 1998 and 2004). This document sets out a clear method by which manual handling risks can be identified and assessed. It sets out an ergonomics approach to assessing manual handling risks by breaking an operation down into specific risks posed by: the task, the load, the environment and the individual. This provides a structured approach to tackle manual handling and enables easier identification of what needs to be done to reduce the risks. Appendix 3 in L23 provides an assessment form and a worked example, weight guidelines are provided to aid this process In Appendix 1 of L23.

"Manual Handling Solutions You Can Handle" (HSG 115 published 1994) illustrates methods available to eliminate or reduce manual handling risks. In this document there are numerous examples of lifting aids and devices.

The Manual Handling Assessment Charts (MAC, published 2003) have been developed to help the user identify high risk manual handling activities. The tool can be used to assess the risks posed by lifting, carrying and team manual handling activities. It is designed to help you understand, interpret and categorise the level of risk of the various known risk factors associated with manual handling activities. The MAC incorporates a numerical and a colour coding score system to highlight risky manual handling tasks. The MAC has been used to highlight the key risks identified during the visit. Details on the use, training and background to the MAC can be found at:

www.hse.gov.uk/msd/mac/index.htm

A free leaflet entitled *"Are You Making the Best Use of Lifting and Handling Aids"* (INDG 398, published 2004) provides many examples of devices that can be used to reduce or eliminate manual handling risks. It also provides a few case studies and a useful checklist on factors to consider when selecting lifting and handling aids.

HSE also holds a great deal of information on its website on MSD:

www.hse.gov.uk/msd

These are useful sources of information on the assessment and control of manual handling risks.