Harpur Hill, Buxton
Derbyshire, SK17 9JN
T: +44 (0)1298 218000
F: +44 (0)1298 218590
W: www.hsl.gov.uk

HEALTH & SAFETY LABORATORY

Manual Handling in the Irish Construction Industry: Summary Report, (ERG/09/21)

This is a brief summary of the main findings outlined in the full report prepared by the Health and Safety Laboratory (HSL) for the Health and Safety Authority (HSA) entitled "*Manual handling in the Irish Construction Industry, ERG/09/09*".

Project Leader: **Leanne Hunter**

Author(s): **Leanne Hunter, MSc, MErgS**
Christine Leah, BSc

Science Group: **Human Factors**

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1 AIMS AND OBJECTIVES

The aim of this research is to offer a comprehensive analysis of the nature of key manual handling tasks in the Irish construction sector and to develop task-specific recommendations to reduce the risk of musculoskeletal injury and ill health from manual handling.

To achieve this aim the following objectives were identified:

1) Undertake a comprehensive literature review of manual handling and musculoskeletal injuries and ill health in the construction industry in Ireland.

2) Identify from the literature, and Irish accident statistics, trades in the construction sector that are likely to be at most risk of musculoskeletal injury or ill health, and develop a list of the 'top 10' trades most at risk.

3) Undertake site observations of the 'top 10' tasks identified in the literature and from stakeholder consultation, on small and large construction sites, covering commercial and residential construction.

4) Report the findings of the site observations and make recommendations to reduce the risk of musculoskeletal injuries (musculoskeletal disorders, MSDs) in each of the 10 tasks observed in the field.

2 METHODS

To achieve the study aim and objectives several methods were used to ensure the manual handling tasks were relevant to Ireland:

1) A literature review was performed to identify construction tasks that have previously been studied across the world;
2) A long list of construction tasks were identified and condensed into the final short list of tasks through a consultation process with industry stakeholders in Ireland and Health and Safety Authority (HSA) construction Inspectors;
3) The 15 tasks that were short listed as a result of work phase 2 were observed on operational construction sites. Video footage was taken and observational and postural analysis was performed. Relevant information was also obtained from unstructured interviews with health and safety representatives and construction workers for the tasks.

3 MAIN FINDINGS

1) Incident statistics from the Health and Safety Authority (HSA), "*Summary of Workplace injury, Illness and Fatality Statistics 2006-2007*" reported that the top five accident triggers of non-fatal accidents for all sectors in Ireland for 2007 are manual handling (34.1%), slips, trips and falls on the same level (17.4%), fall from height (6%), fall, collapse or breakage of material (5.8%) and other movement by injured person (5.4%). All other triggers account for the remaining 31.3% (HSA, 2007[1]). These statistics are presented graphically in Figure 1.

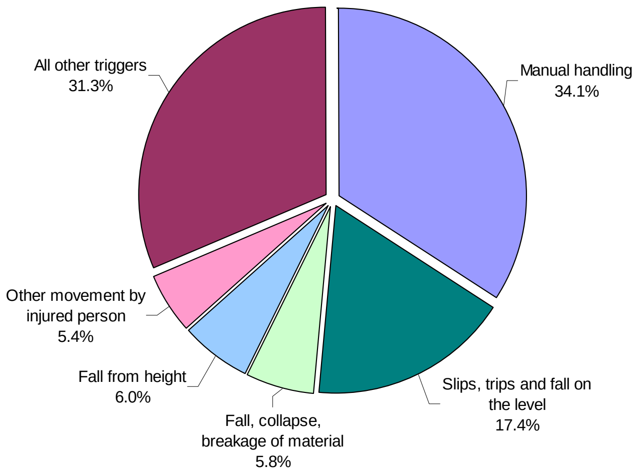

Figure 1. Top five accident triggers of non-fatal accidents, all sectors 2007 (reproduced from HSA data, 2007[1]).

2) Manual handling remains prevalent within the construction industry in the Republic of Ireland and continues to be a casual factor in a considerable number of injuries sustained by employees. 16% of all injures in this industry were found to affect the back and of these 45% were reportedly due to lifting and carrying activities (HSA, 2000-2002). More recent statistics show that in the construction sector manual handling accounts for approximately 27% of reported non-fatal injuries, and the most commonly affected body part is the back (17.4%)

3) Of the reported injuries in the constructor sector, 27.6% resulted in 4-6 days off work, 30.7% resulted in 7-13 days off work, 13.4% resulted in 14-20 days off work, 8.1% resulted in 21 days to 1 month off work, and 16.4% resulted in 1-3 months off work (HSA, 2007[1]).

4) The 10 tasks that are covered in the main report (in alphabetical order) are:
   - The tasks undertaken by a block layers mate/assistant;
   - Cable pulling;
   - Concrete finishing;
   - Glazing installation;
   - Manhole installation and access;
   - Pipe/drain installation;
   - Plasterboard handling and installation;
   - Scaffold assembly/disassembly;
   - Steel tying (e.g. handling and reinforcement);
   - Stone cladding installation.

5) All the tasks observed were considered to expose individuals to a medium to very high level of musculoskeletal injury and ill health. It is considered that installing and handling glazing and the tasks undertaken by a block layers assistant are particularly high risk activities.

6) The musculoskeletal injury and ill health risk level for the tasks will vary from site to site depending on a number of factors such as:

- The weight and frequency with which the loads are handled;
- The tools and mechanical handling aids that are used;
- Any space constraints that may restrict the postures of individuals;
- Communication and co-ordination issues when working as part of a team;
- Time pressures and work demands to complete work.

4 SUMMARY OF FINDINGS FOR INDIVIDUAL TASKS OBSERVED

4.1 Block layers mate/assistant

- The tasks undertaken by a block layers assistant are highly repetitive and physically demanding. The tasks undertaken are likely to expose workers to a high risk of MSD injury. This is because they work in forward bent postures for a significant amount of their workday whilst handling loads of approximately 24kg repetitively for long durations.
- In addition to their main tasks they may also be asked to carry out a range of other tasks and are generally used to complete physically demanding work around the building sites. For example, helping to fill the tubs of mortar and assembling and disassembling scaffolding or other temporary structures for the block layer(s) to work from.

4.2 Cable pulling

- This may be a moderate to high-risk task for developing a MSD and will depend on the amount of manual handling individuals have to undertake and the postures that they have to adopt to pull the cables.
- The highest risk activities will be manually lifting and placing the reels onto the reel stand and rolling and turning the reels when moving them on site. Pulling large and heavy cables over long distances and in awkward locations is also considered to have the potential to present a high risk (e.g. up the side of walls and along ceilings).
- Working outside may expose individuals to extreme weather conditions that may increase the risk of developing a MSD, as well as slip and trip incidents.

4.3 Concrete finishing tasks

- These tasks represent a medium to high level of MSD risk to workers. This is due to the repetitive activities involved when power floating, particularly the repetitive twisting of the trunk, and the static muscular force to control the power floating machine. During manual floating the constant forward bending/stooping, forward reaching, and the high frequency of repetitive motions of the arms will increase the risk of MSDs workers are exposed to.
- External pressure and specific timeframes in which the floating tasks have to be undertaken may place workers under additional pressure to get the job done and this may increase their risk of MSD.

4.4 Glazing Installation

- Manually handling and installing glazing units is likely to expose individuals to a high to very high risk of MSD, particularly if the units are installed manually. This is predominately due to the size and weight of the units handled and the awkward postures (e.g. reaching above shoulder height, forward bending and twisting) that may be adopted when installing them. In addition, barriers such as the scaffolding may further restrict access when installing the glazing units, as individuals will have to bend and reach forward more to manoeuvre the units into position even with the use of a crane. Transferring glazing units from delivery vehicles onto trolleys will also restrict the workers posture.

- Communication and co-ordination is very important in both manual and mechanical installation. Clear communication is required to ensure that all team members know exactly what they are doing and how they are doing it before the operation begins, to ensure that the MSD risks when handling the glazing units are controlled as much as possible.
- By the nature of the work the glaziers are typically exposed to the elements. Individuals are also likely to have to work outside and from scaffolding, which will increase their exposure to extreme weather conditions such as the cold, a known risk factor for MSDs.
- The condition of scaffolding and any tools lying about in the work area will increase the risk of slipping and tripping hazards which will be exacerbated if a load is being handled at the time, increasing the risk of sustaining a MSD.

4.5 Manhole/Access Cover Installation

- Mechanical handling can still present a low to medium risk of musculoskeletal ill health due to the forces exerted and potential for awkward postures.
- Manual handling (by teams and individuals) of manhole components presents a high risk due to load weight and postural factors, and should be avoided.

4.6 Accessing/Opening Manhole/Access Covers

- Accessing manholes may present a medium to high level of MSD risk to workers. This will depend on the frequency that individuals have to access the areas, the cover weight, the tools and equipment that they have to lift the covers, and the condition of the cover and the surround that it is set in.
- Manholes are set predominantly in public areas such as pavements and roads and therefore there may be additional pressures to get the work completed quickly to minimise disruption.

4.7 Pipe/Drain Installation

- The working postures are reasonably favourable, and the push-pull forces applied in controlling and positioning the suspended pipes are considered to be low. Overall, the musculoskeletal ill health risk is considered to be low to medium.
- Other factors may increase the risk of MSDs. These factors include: The condition underfoot, especially if it is particularly uneven or there are other obstacles (e.g. piles of earth or tools) obstructing their access, the lighting levels, and strong wind conditions.
- Working as a team requires good communication with all team members, including the excavator driver to minimise the risk of accidents occurring as a result of poor communication or co-ordination. This may be particularly challenging when there is a lot of noisy equipment in use.

4.8 Plasterboard Installation

- Handling and installing plasterboard represents a medium to high level of MSD risk. This is predominantly due to the weight and unwieldy nature of the plasterboard. The handling and installation tasks are highly repetitive and awkward postures (e.g. bent forward, trunk twisting and reaching with the hands above shoulder height) can be adopted. For example, when installing plasterboard on ceilings and walls, when lifting plasterboard up onto scaffolding and when measuring and cutting it.

- Fixing plasterboard to the ceiling exposes individuals to a higher MSD risk compared to fixing to walls. This is due to the static nature of the activity when holding the plasterboard in position overhead and the repetitive hammering or use of a power drill above shoulder height with the neck hyper-extended.
- Individuals will be most at risk from lower back injury due to the frequent handling of the plasterboard. The risk of neck injury is likely to be increased due to the hyperextension required when installing plasterboards to ceilings. The shoulders and upper limbs are also likely to be at an increased risk of developing a MSD, due to the repetitive use of power tools, particularly at or above shoulder height.

4.9 Scaffold Assembly/Disassembly

- Scaffolding is a repetitive task and is physically demanding, placing workers at a medium to high risk of sustaining a MSD. This is due to the weight and frequency of the loads handling and the awkward postures that are often required (e.g. forward bending and twisting of the trunk, neck hyper-extension, lifting and reaching above shoulder height).
- Parts of the body most at risk of sustaining a MSD and are particularly vulnerable are the back, shoulders, neck, and upper limbs.
- Scaffolders have to work in a variety of site locations (internal/external) and may be exposed to extreme weather conditions, and are likely to be at an increased risk of falling from height.
- Scaffolders often have to work to tight deadlines when the scaffolding must be assembled/disassembled to allow other trades access to parts of the building.

4.10 Handling and Tying Steel

- Handling and tying rebar represents a medium to high level of risk of MSD, this is due to the restricted and awkward stooping and squatting postures workers operate in for extended periods of time.
- Steel fixers may also be at a high risk of ULDs due to the highly repetitive twisting actions of the wrist and forearm and when applying a force to the pliers (e.g. when cutting the wire).

4.11 Stone Cladding: Handling and Installation

- Installing stone cladding is a highly repetitive and skilled task, which represents a medium to high level of MSD injury risk, particularly to the lower back and upper limbs.
- Awkward postures are often adopted, especially when working on scaffolding as the scaffold structure may impede the ability to move freely and act as a barrier. For example when fitting cladding, individuals may have to support the weight of the cladding while reaching away from their body, placing additional stress on the lower back.

5 RECOMMENDATIONS

General recommendations from this study are outlined below, however, additional general recommendations from the Health and Safety Executive (HSE) guidance (United Kingdom) that apply at design and organisation levels are covered in greater detail and presented in the full report in Appendix 4 (Section 10.4). Specific recommendations are provided for each of the ten tasks discussed in this report, and these along with the risk factors are presented in Table 1.

5.1 General Recommendations

Overall recommendations from this study and previous recommendations from HSE (2000) guidance are:

1) Hazardous manual handling tasks should be avoided where possible. For example, eliminating features from the design that are difficult to install or that create manual handling problems for contractors and workers. It is important that designers and those specifying products are aware of any health and safety issues, including manual handling issues that may arise out of certain design features, construction methods or through using certain products. If alternative products are available that will reduce the risk from manual handling that individuals are exposed to, then these need to be seriously considered. In order for designers, engineers, etc, to develop an increased understanding of the health and safety risks, particularly from manual handling during the construction process, it is recommended that time is spent on site with health and safety personnel. This may help to improve their understanding of the manual handling risks and to keep up-to-date with current work methods and any issues surrounding the work methods during the construction process.

2) It is important to carry out risk assessment to identify and develop a safe system of work when undertaking any manual handling construction task. Using handling aids or devices where appropriate is essential in reducing the risk of musculoskeletal injury or ill health from manual handling. Planning work activities is also important to ensure the correct tools and/or equipment are available when and where required in order to reduce the risk of workers improvising or taking short cuts which may result in hazardous manual handling of loads. If any handling aids or devices are introduced they should be trialled initially to determine if they reduce the risk of musculoskeletal injury or ill health from manual handling or if they introduce new health and safety risks. Hiring tools or equipment is recommended initially during the trial period. A risk assessment should be undertaken before any new tools or devices are used. Trials will determine if the equipment is practical and under what circumstances it should be used.

3) Encouraging effective communication and sharing of information within the industry and with product suppliers and specifiers may help to reduce the risk of musculoskeletal injury or ill health from manual handling. For example, asking suppliers to clearly label the weight on loads so that they can easily be identified by individuals. Key industry stakeholders could also share information on good practice or successful interventions in reducing the risk of manual handling with others in the industry.

5.2 Task Specific Recommendations

A summary of the risk factors and recommendations for each of the ten tasks is presented in Table 1 on the following pages. However, it is also important to consider the general recommendations discussed above, in regard to those who design buildings and those that specify products in conjunction with the specific recommendations made. For example, avoiding unnecessary handling tasks or identifying safe systems of work through risk assessment if the tasks cannot be avoided.

Table 1. Summary of tasks observed, risk factors and recommendations for risk reduction.

Task	Risk Factors	Recommendations
Tasks performed by a brick/block layers mate / assistant	**High:** These tasks: • Are physically demanding • Highly repetitive • Require workers to adopt awkward forward bent postures • Require workers to handle heavy loads	**Planning:** • Organisation is a key element to ensure blocks are delivered where they are needed. The closer they are delivered to where they are being used, the shorter the distance they will have to be carried. • Plan the work so a teleporter or other mechanical device can be used to lift the mortar and blocks up to elevated working areas. • Lay out the work area where large mortar tubs are filled, so they can be directly transported by teleporter or crane. This will avoid the need for individuals to manually manipulate the tubs so they can be lifted mechanically. **Use of mechanical aids to reduce handling distances:** • Use a block clamp where possible (via crane or teleporter, etc) to transport the blocks to where they are required. • Use handling aids (e.g. teleporter, lift, etc) to move large mortar tubs into position to where they are needed. **Enable better working posture:** (e.g. by raising the small buckets off the floor when shovelling the mortar). This will also mean that they are lifting the buckets from a raised height and do not have to bend down as far and this will reduce the stress placed on the lower back.
Cable Pulling	**Medium to High:** Depending on: • The cable weight • The frequency of handling • The adoption of awkward postures	**Planning:** • To reduce the amount of manual handling the type of reels and where they are needed should be planned in advance. • Working in pairs or larger teams for longer cables should help to assist in the installation process. **Use of mechanical aids:** When reels are too large to be handled manually, handling aids should always be used to ensure the reels are placed as close as possible to where they are required.

Table 1 continued. Summary of tasks observed, risk factors and recommendations for risk reduction.

Task	Risk Factors	Recommendations
Concrete Finishing	**Medium to High:** Depending on the method adopted when power floating (e.g. mechanical or manual means). For example: o The amount of twisting and force required to control the machinery, or, o The amount of stooping and reaching when manually power floating	**Planning:** Any equipment or machinery used should be readily accessible and available when required to ensure that mechanical power floats do not have to be manually handled over obstacles. **Rest breaks and job rotation:** It is important to ensure that individuals get enough rest from performing the highly repetitive tasks to avoid muscle fatigue. This will be particularly important if manually floating and working in crouched, stooped, or other awkward postures, or if twisting repeatedly when mechanically power floating. **Equipment maintenance:** Ensure that mechanical power floating equipment is regularly maintained according to manufacturers specifications.
Glazing installation	**High to Very High**: Due to: • The size and weight of the glazing units • During manual installation: workers have to handle and lift the heavy units • The awkward postures adopted: as the units have to be installed in a set location	**Planning:** • Plan as to how the glazing units will be transported to where they are required needs to be considered. This is particularly important during manual installation to reduce the carrying distance of the units. The use of mechanical handling aids should also be investigated to reduce the carrying distances and may help with improving work postures (e.g. specialised trolleys). • Mechanical handling systems and access: Glass vacuum lifter and cranes or other handling aids should be used where possible to install glazing. Scissor lifts may also be useful for getting as close as possible when installing the glazing at height. **Weight labelling:** Clearly displaying the weight of individual glazing units would help glaziers to identify heavy units.

Table 1 continued. Summary of tasks observed, risk factors and recommendations for risk reduction.

Task	Risk Factors	Recommendations
Manhole installation (Manual and mechanical)	**Medium to Very High:** Depending on the method of installation: **Mechanical installation:** Lower risk, due to: • The use of a mechanical aid to lower the manhole rings or frame into position. • Depends on the force applied when manoeuvring it into position **Manual installation:** Higher risk (high to very high), due to: • The weight of the loads handled • Adoption of stooped postures	**Planning:** The installation process should be well planned to minimise risks and communicated to workers so that individuals know exactly what they are doing and how. All tools and equipment should be readily available and in good condition. **Use of mechanical aids:** Where possible mechanical lifting aids should be used to transport and lower the manhole into position to reduce manual handling performed by workers. **Communication:** Good communication needs to be practiced between all team members when working as a team so they can safely undertake the installation. **Housekeeping:** The area around the installation should be kept clear of any tripping hazards, and the area should be cordoned off accordingly to protect both workers and members of the public.

Table 1 continued. Summary of tasks observed, risk factors and recommendations for risk reduction.

Task	Risk Factors	Recommendations
Accessing Manholes	**Medium to High:** Depending on: • The type of cover accessed (e.g. traditional covers that require workers to lift the cover weight will present a greater MSD risk). • The weight of the covers • Condition of the covers and ease of access • The postures adopted when opening covers	**Short-term recommendations:** • Provide appropriate training to ensure that all individuals know how to lift the covers using the equipment in a safe manner. • Check that they have all the equipment and it is easily accessible before they go onsite. • Work together, clearly communicating and coordinating the team lift of the covers. Matching physical characteristics and strength would be beneficial. **Medium-term to long-term recommendations:** Employers installing manhole covers should consider alternatives based on: • How frequently they will need to be accessed. • The long-term risk of MSD injury they are exposing their employees to. • A cost-benefit analysis could be conducted to identify the short-term costs of installing different types of covers versus the long-term costs of injury compensation, sickness absence payments, training new employees, etc, due to injuries relating to MSDs from this type of work.
Pipe and drain installation	**Medium:** Due to: • Awkward stooped forward postures, but may increase if: • The amount of force required to push and manoeuvre concrete pipes into position is excessive	**Planning:** Companies should have clearly developed strategies for installing drainage pipes. These strategies should ensure that the correct equipment is available when and where it is required **Training:** All individuals should receive suitable and sufficient training to reduce the risk of MSDs. This is particularly important because individuals have to work in teams and communicate with others (e.g. excavator drivers, other workers or contractors). **House-keeping:** In order to ensure that the workers have sufficient access to the trench the area should be kept as clear as possible, removing any obstacles that may cause tripping hazards. This will help to provide workers with easier access to the trench, or when standing at the side of the trench when they are manipulating the drainage pipe into position.

Table 1 continued. Summary of tasks observed, risk factors and recommendations for risk reduction.

Task	Risk Factors	Recommendations
Plasterboard installation	**Medium to High:** Due to: • The repetitive nature of the tasks • The postures adopted (e.g. bent forward, reaching above shoulder height, neck hyper-extension) • The weight and unwieldy nature of the plasterboard handled • Plasterboard may be handled several times before it is fitted	**Planning:** A safe system of work should be developed to reduce the level of MSD risk individuals are exposed to. For example: • Consideration needs to be given as to how the plasterboard and work tools are going to be delivered to the area where they are required. • Planning the best method(s) to lift plasterboard, particularly when fitting ceilings in large buildings (e.g. the use of a plasterboard lift) or similar mechanical aids should be considered in the first instance. However, in some circumstances in the absence of mechanical aids a team approach is recommended. • Use of mechanical aids: Mechanical aids, such as cranes, lifts, and trolleys, should be used to transport the pallets/stacks of plasterboard as close to where they are required as possible. **Work methods:** Where possible raised plasterboard stacks should be used to measure and cut the plasterboard to reduce the amount of forward bending of the trunk.
Scaffolding assembly / disassembly	**Medium to High:** These tasks: • Are highly repetitive • Physically demanding • Can require the adoption of awkward body postures	**Planning and Organisation:** • To transport the stillages to as close as possible to where they are required, planning and organisation is particularly important, especially on larger sites where there might be high demand for crane or teleporter use • It would be beneficial to have separate stillages for each component to reduce the amount of time spent sorting through stillages. **Use of mechanised equipment:** Mobile elevated work platforms or scissor lifts should be used when appropriate to transport individual components up or down the scaffold. **Job rotation and breaks:** Workers should have sufficient breaks or changes in activity to allow for rest and recovery. Frequent, shorter breaks are preferred to fewer, longer breaks.

Table 1 continued. Summary of tasks observed, risk factors and recommendations for risk reduction.

Task	Risk Factors	Recommendations
Tying steel	**Medium to High:** Due to: • Adopting awkward forward bent/stooping postures • Highly repetitive use of the upper limbs	**Planning:** The steel rebar needs to be delivered as close as possible to where it is required to minimise the distance it is carried. The space available to access the area and where the rebar is stored also needs careful consideration to ensure workers have sufficient space to work in. **Tools and Equipment:** As an alternative to using pliers there are a number of tools available on the market, which can be used for automatically tying rebar and should be investigated further. E.g. bent handled pliers to improve wrist postures and automatic tying tools that eliminate the repeated twisting action in the wrist and keep the individual in an upright posture.
Stone cladding installation	**Medium to High**: Due to: • The highly repetitive nature of the tasks • The heavy loads handled • Adoption of awkward postures (e.g. forward bending and twisting, and reaching above shoulder height) • Each stone cladding panel may have to be handled multiple times	**Planning and Organisation:** • In the first instance consideration should be given by designers when specifying products (e.g. weight, installation method). • A workbench could be used, or the stack of stone raised higher to reduce the amount of bending or squatting when measuring, cutting, and drilling stone. **Use of mechanical aids:** • The stones should already be on pallets as delivered by the manufacturer. This should make them relatively easy to transport around site by a pallet truck, forklift, teleporter, etc. Pallets should be placed as close as possible to where they are required, but not so they are in the way of the workers. • If working on scaffolding, the stones should be mechanically lifted into position and a trolley or pallet truck should be used to move them to where they are temporarily placed for use. • Consideration should be given to using lifting aids such as a vacuum-lifting device if larger stones (e.g. those weighing 50kg or more) are handled. **Team handling and communication:** Always undertake the lifting of the stones in teams of two, and try and match the individuals in terms of their strength capabilities and size. **Training:** Appropriate on-the-job training should be provided to ensure that assistants know what they are doing and what is required of them.

6 CONCLUSIONS

In conclusion, this study has been effective in applying a practical approach to investigate manual handling tasks occurring within the construction environment. It has also been successful in identifying possible risk reduction measures for each of the tasks investigated. It is important to remember that any interventions or changes in work systems introduced into the workplace should involve the individuals performing the tasks from the outset. They should also be trialled initially to identify any new risk factors that may have been introduced into the work environment prior to widespread implementation. Any interventions should be trialled and evaluated in the field, with real workers in real work environments.

This study has met the specified aims and objectives, and this document should serve as a focussed starting point, or baseline for stakeholders in the construction industry to work together to develop best practice guidance and to investigate risk reduction measures. This approach poses many challenges for the industry and will require stakeholders to work together adopting a joined-up, holistic approach when planning future construction projects. The focus should be to fully consider health and safety issues during every aspect of the construction process. Encouraging a greater awareness and understanding of health and safety issues on all levels, by all concerned, in a construction project is of paramount importance.

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8 GLOSSARY

CIF	Construction Industry Federation (CIF)
HSA	Health and Safety Authority (Ireland)
HSE	Health and Safety Executive (United Kingdom)
HSL	Health and Safety Laboratory (An agency of the HSE in the UK)
Manual Handling	Refers to "*any transporting or supporting of a load by one or more employees and includes lifting, putting down, pushing, pulling, carrying or moving a load, which, by reason of its characteristics or of unfavourable ergonomic conditions, involves risk, particularly of back injury, to employees.*"
MSDs	Musculoskeletal disorders, refers to any disorder or injury to the musculoskeletal system including muscles, tendons, ligaments, nerves.
PPE	Personal protective equipment (e.g. gloves, safety footwear, high visibility vests, etc).
ULDs	Upper limb disorders, refers to any disorder or injury to the upper limbs, including, muscles, tendons, ligaments, and nerves.
WRMSDs	Work related musculoskeletal disorders refer to any MSDs that are caused by work activities
WRULDs	Work related upper limb disorders refer to any ULDs that are caused by work activities.