10th International Conference on Concrete Block Paving
Shanghai, Peoples Republic of China, November 24-26, 2012

Developing Sustainable Construction – Experiences in the UK to Reduce Accidents and Long Term Health Conditions and to Improve Skills Associated with Construction Activity

John Howe BSc, CEng, MICE, MIEAust
Commercial Development Manager
Brett Landscaping & Building Products, United Kingdom
Tel + 44 7501 462 136
Email: john.howe@brett.co.uk

Summary

Governments, Non Government Organisations and industry have all sought to interpret 'sustainability' in ways relevant to their activities and there is now a vast array and opinions on all aspects of sustainability. In the United Kingdom of Great Britain and Northern Island (UK) it is accepted that sustainability encompasses environmental, social and economic issues (referred to as the three pillars of sustainability); sustainability is not just reducing CO_2 omissions. This paper focuses on two social aspects of sustainability; improvement of skills by providing accredited training and the development and implementation of safe working practices to avoid accidents and reduce long term health issues.

Keywords: Musculoskeletal disorders, Health and Safety Executive (HSE), chronic obstructive pulmonary disease, respirable crystalline silica (RCS).

Introduction

The UK's general construction industry output is worth over £100bn a year. It accounts for 8% of Gross Domestic Product (GDP) and provides employment for around 3 million workers. The sale of pre cast paving and kerbs are estimated to be worth £450 million per year.

No formal qualifications or skills recognition are required to become a commercial or domestic paving contractor and it is recognised that there is scope to improve skills. Despite a plethora of legislation the UK Government is concerned about the high incidence of long term ill heath conditions associated with construction activity.

The author has been involved in addressing these issues, from both an industry and a company perspective and reports on:
How the industry works with the Health and Safety Executive (HSE)
Development of a National Highway Sector Scheme (NHSS 30) training scheme
Development of a manufacture's independently accredited training scheme for domestic paving contractors.

Background

The UK Health and Safety at Work etc Act 19741 established the simple yet enduring principle that those who create risk are best placed to manage it. Whatever the corporate status, each risk maker has a range of duties that must be implemented to manage the risk.

The Act led to the setting up of the Health and Safety Commission (HSC) and the Health and Safety Executive (HSE), and established the HSE and local authorities as joint enforcers of health and safety law. In 2008 HSC and HSE merged to form a single entity known as the Health and Safety Executive (HSE).

HSE is the national government funded regulatory body responsible for promoting the cause of better health and safety at work within United Kingdom. It continues to work in close partnership with local authorities.

HSE and local authorities are independent regulators. Working in partnership, their primary focus is to assist duty holders in preventing work-related accidents and ill health.

The 1974 Health and Safety at Work etc Act and its underlying principles and philosophy and supporting Acts - such as Construction Design Management regulations: 2007, The Control of Vibration at Work Regulations 2005 (the Vibration Regulations), Control of Substances Hazardous to Health (COSHH) Regulations 2002 (as amended), The Control of Noise at Work Regulations 2005 and The Manual Handling Operations Regulations 1992 (as amended) - set out a legislative hierarchal framework for reducing risk.

The HSE doesn't always have the resources to enforce compliance and relies on a range of proactive measures, including stakeholder engagement, communications programmes and the provision of information and advice.

Ill Health versus Accidents

The UK construction industry employs more than 2 million people. The Labour Force Survey 2009/10[2] estimated that 82,000 people whose current or most recent job in the last year was in Construction, suffered from an illness which was caused or made worse by their job. Approximately 2.6 million working days were lost in 2009/10 due to occupational ill health in construction, whereas 0.6 million working days were lost as a consequence of workplace injury during the same year.

There are thousands of deaths of construction workers every year resulting from occupational ill health. Many of the 4,000 asbestos related cancer deaths occur each year from mesothelioma and lung cancer are construction related. In addition there is an estimated 600 deaths from silica related disease (lung cancer) each year. Over 50% of all occupational cancer registrations occur in the construction industry. Chronic Obstructive Pulmonary Disease (COPD), asbestosis, silicosis and occupational asthma are also significant respiratory diseases among construction workers. In comparison, in recent years the number of deaths from construction related accidents have been falling and there were 42 accident related deaths of workers in 2009/10[3].

Generally construction workers have a higher level of musculoskeletal disorders, in particular back problems, and also a far higher level of prescribed industrial diseases related to hand arm vibration and noise exposure than other workers.

The highest risks associated with paving and kerb laying are musculoskeletal disorders caused by manually handling heavy kerbs and large format flags and the inhalation of dust generated from dry saw cutting blocks, flags and kerbs. There are also additional risks such as hand/arm vibration (HAVs), as well as other risks associated on construction activity.

Clearly this situation isn't desirable or sustainable and the UK paving industry, led by Interpave, The UK Precast Concrete Paving and Kerb Association, along with initiatives from manufacturers is taking a proactive role in reducing ill health related to construction activity.

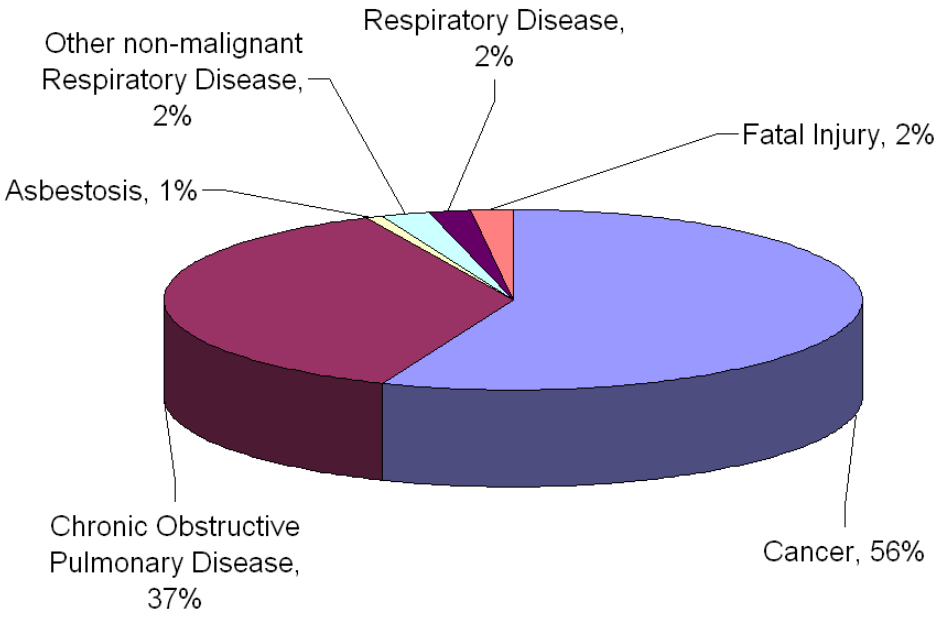

Figure 1 - Ill Health versus Accidents (source HSE)

Handling Precast Concrete Kerbs

In 2003 the HSE approached Interpave seeking its support, along with that of the construction industry, to address the issues of musculoskeletal disorders caused by kerb laying.

With the exception of most motorways and rural roads, the majority of kerbs are precast concrete, typically weighing up to 100kg and despite the requirements set out in the *Manual Handling Operations Regulations 1992*[4] the majority of kerbs were handled and laid manually.



Figure 2 – Repetitive manual laying of standard precast kerbs weighing up to 100kg is a potential cause of musculoskeletal disorders and injuries.

The HSE called a stakeholders meeting which was attended by representatives from local authorities, contractors, handling equipment suppliers and the kerb manufacturers. At this meeting the HSE announced that they needed the industry to improve its kerb handling practice and generally mechanise the process. They set out a 12 month action plan for change, to which there was great resistance by many representatives at this first stakeholders meeting with major contractors and local authorities claiming that it wasn't possible, the costs will be too high and it would create an uneven playing field.

The HSE also informed every local authority in the UK of its intentions and objectives and, unusually, issued a moratorium regarding non compliance to the Manual Handling Regulations within this period.

In consultation with Interpave, the HSE produced guidance - *HSE Construction Information Sheet No 57, Handling Kerbs: Reducing the risk of musculoskeletal disorders (MSDs)*[5] which is based on risk assessment and a hierarchy of control measures as set out in the Manual Handling Operations Regulations. The hierarchy for reducing risk in kerb and flag laying is:

- **Elimination** - Eliminate manual lifting of kerbs and flags at the design stage.

- **Total Mechanical** - ensure kerbs and flags are always handled and laid mechanically (e.g. using vacuum devices, mechanical grabs, etc). This is the preferred solution for new build and refurbishment work.

- **Partial Mechanical** - ensure that the maximum amount of the kerb or flag handling process is undertaken mechanically (e.g. using mechanical solutions to get the kerb or flag near its final position). Using smaller/lighter kerbs or flags, or substituting with block paving or using handling aids will further reduce the risks from any residual manual handling.

- **Manual Handling** - in rare cases where it is not possible to use any of the above solutions, short stretches of kerb and flags may be laid manually. Where this is necessary, workers should be trained in good handling techniques. The use of lighter weight kerbs or devices that allow two people to share the lift will reduce the risk of injury.



Figure 3 - Laying kerbs with mobile vacuum handling equipment (left) and scissor clamps (right).

At the second stakeholders meeting the attitude of the majority of attendees had changed. The hierarchy of controls to reduce risk was accepted, and mechanised installation was no longer seen as a major obstacle to construction or costs.

Interpave developed guidance that encompasses the HSE guidance but gives far more information on equipment. Additional guidance was also produced by Interpave addressing the issue of handling and laying precast concrete paving flags and an extensive promotional campaign was embarked on.

In October 2011 Interpave guidance on kerbs and flags was revised and combined into a single document, Handling kerbs and flags - Guide to the Handling of Precast Concrete Kerbs and Paving Flags6. Interpave still continues to promote the free download of this guidance via its web site and PR in the construction press. By June 2012 over 5,000 copies of this guidance had been downloaded.

Reducing respiratory disease in kerb, paving and block cutting

A Health and Safety Executive (HSE) report *'RR595 - The burden of occupational cancer in Great Britain'*[7] estimates that more than 500 construction worker deaths annually are from lung cancer attributed to exposure to respirable crystalline silica (RCS). The current Workplace Exposure Limit (WEL) is 0.1 mg/m^3. RCS is generated when concrete is saw cut

dry and on-site research has shown that cutting with hand-held power saws without water suppression produces a level of RCS exposure many times the WEL within seconds.



Figure 4 - Dry saw cutting produces harmful respirable crystalline silica dust

In 2007 as part of the Disease Reduction Programme, the HSE instigated a Supply Chain initiative to address this issue.

Key stakeholders within the supply chain were identified and played a full and equal role in determining the objectives that would deliver the project aim. A working group chaired by an HSE representative was established with representatives from:

- Construction
- Manufacturers (Interpave)
- Hire Companies & Associations
- Local Authorities
- Highways Agency
- Subject Experts
- Training Bodies
- HSE

One of the key objectives was to establish clear and updated good practice for kerb, paving and block cutting by the end of 2007. Interpave took a proactive role and produced detailed guidance, *Cutting Paving* [8] based on a hierarchal approach '**AMC'** – Avoid, Minimise, Control as summarised below.

Avoid and **M**inimise cutting

- design and set-out the layout for paved areas using modular dimensions (paving block dimensions) and also apply them to penetrations or obstacles needed within the paved area
- use closure blocks or precast surrounds to obstacles.



Figure 5 - The use of closure and half blocks to avoid the need for cutting at edges

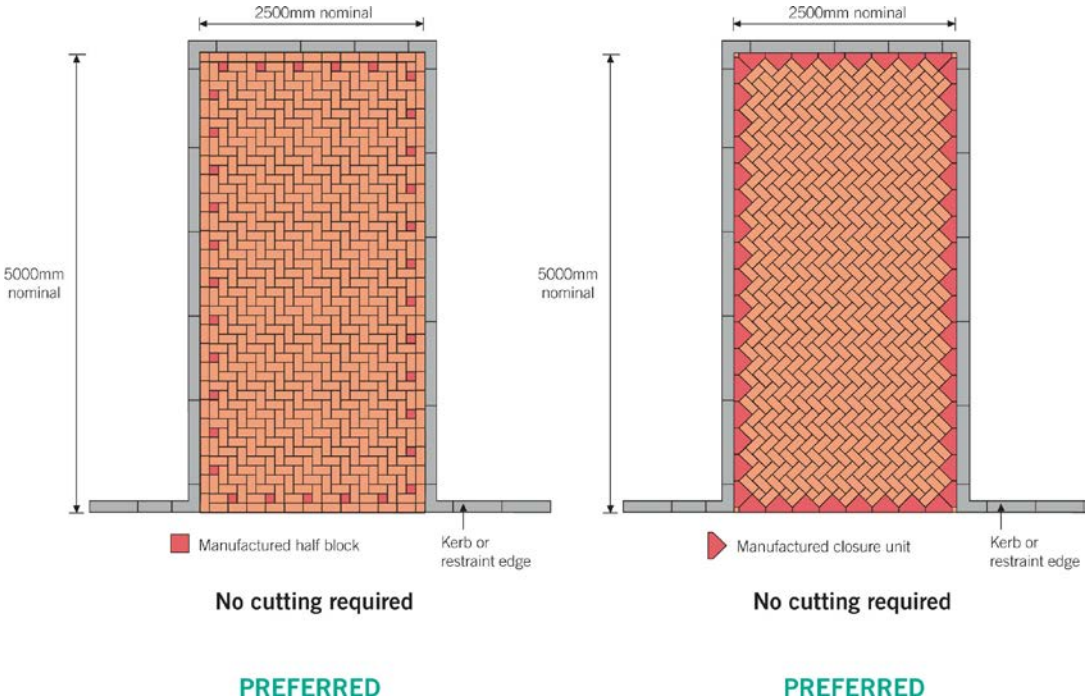

Figure 6 - Avoid or Minimise cutting: the preferred method of setting out to avoid cutting.

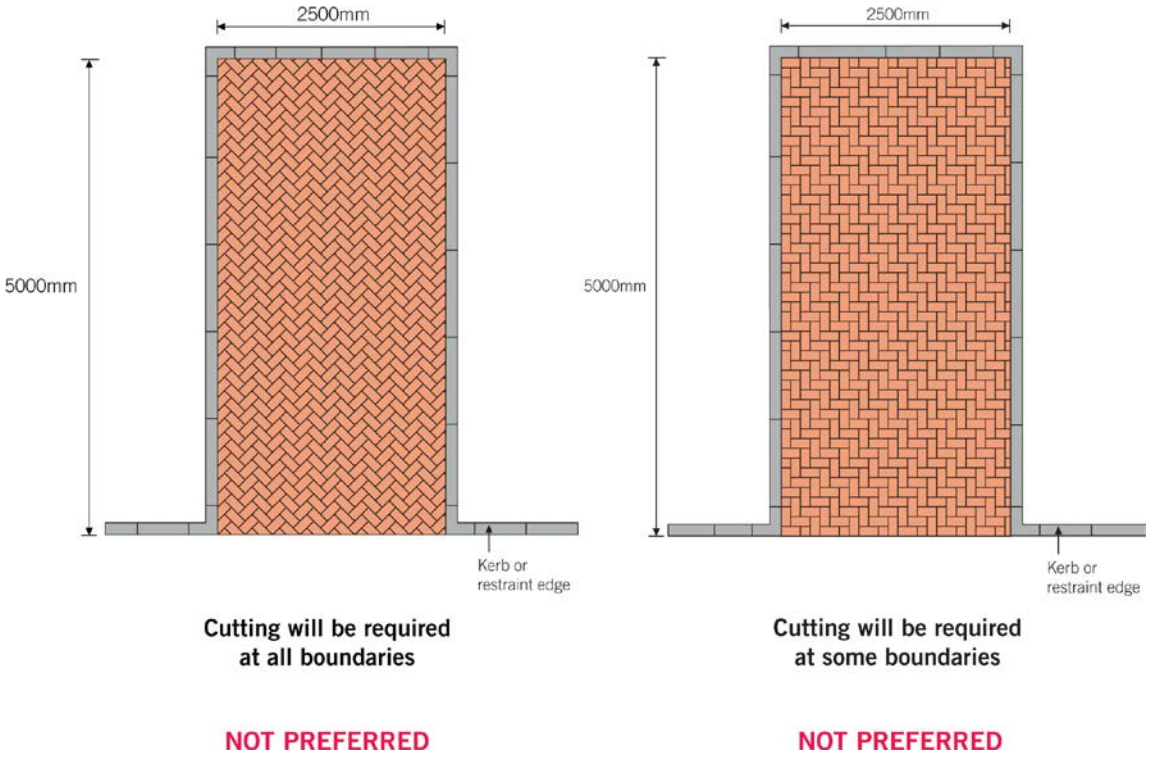

Figure 7 – Non-preferred method of setting out, cutting will be necessary

Control - if cutting is necessary

- Use block splitters or guillotines, so not to produce RCS
- If saw cutting, use either mains water or a pressurised water suppression bottle to suppress the dust, and the operative to wear a high quality mask (FFP3) and appropriate personal protective equipment
- Blocks and small flags to be cut on a bench saw
- Large flags and kerbs to be cut with a hand held saw



.

Figure 8 - **C**ontrol - If cutting is required, can a block splitter (above) be used?



Figure 9 – Control - If saw cutting is required, suppress (control) the generation of respirable crystalline silica by water suppression.
Note pressurised water suppression bottle and appropriate personal protective safety equipment when saw cutting

The Working Group was responsible for producing information including a DVD that demonstrated safe cutting practice, paviours' marking chalk branded with a safety message, web information and communication leaflets. The video can be downloaded from the HSE www.hse.gov.uk and Interpave www.paving.org.uk websites.

Reducing Ill Health in Road and Highway Paving Work

This HSE supply chain initiative commenced in 2011 and is ongoing. It followed the successful project on kerb, paving and block cutting and handling, and expanded to a wider brief covering all health risks within the paving road and highway work sector of the industry. The objective of this initiative is to continue and expand the dissemination of information to a broader audience, addressing the following:

- Respiratory risks
- Noise
- Vibration
- Dermatitis
- Musculo-skeletal disorders
- Asbestos
- Solar radiation

The project brief set out by the HSE states that the deliverables will address the tasks that give rise to health hazards and will be targeted specifically at those sectors of the industry that have influence.

It will educate through the provision of key information on good practice along with a range of practicable measures and interventions to improve worker health in paving, road and highway work.

National Highway Sector Scheme 30 (NHSS) for the Installation, Maintenance and Repair of Modular Paving

In the UK, the strategic road network including motorways and major trunk routes are the responsibility of the Highways Agency on behalf of a Government department, the Department of Transport. Highways Agency work is constructed in accordance with the *Specification for Highways Works*[9].

At the next level, with the exception of private roads, Local Authorities are responsible for local roads and pedestrian malls in their geographical location and there would be a significant quantity of precast concrete paving and kerbs in these applications; this is likely to grow with the increased demand for permeable pavements.

The *Specification for Highway Works* is also very widely used by Local Authorities in the UK when they are carrying out works on or adjacent to the highway. In this context, a Quality Management Scheme works on the principle that a good quality system manages a trained and competent workforce who is carrying out the clear instructions of the customer and will produce consistently what the customer wants and expects. To achieve this objective, numerous National Highway Sector Schemes [NHSS] have been set up to improve skills and knowledge related to work associated with highway construction and maintenance. Competency is demonstrated by a combination of knowledge and assessed installation techniques

There are already over 20 NHSS schemes including fencing [NHSS 2], road marking [NHSS7] and asphalt surfacing [NHSS 16].

Compliance to NHSS is mandatory for companies carrying out works for the Highways Agency.

An NHSS scheme (NHSS 30) for Modular Paving is currently being developed by a team from Highways Agency, The Association of Directors of Environment, Economy, Planning & Transport (ADEPT) representing the County Councils of England, Interlay (The Association of Block Paving Contractors), Interpave, Construction Skills and others knowledgeable about competency and training qualifications. The scope of the project will encompass the surfacing and is categorised as follows:-

1.) Concrete and clay pavers or stone setts laid on an aggregate laying course

2.) Concrete and clay pavers or stone setts laid on a mortar laying course with mortar joints

3.) Concrete and natural stone flags clay pavers laid on an aggregate laying course

4.) Concrete and natural stone flags clay pavers laid on a mortar laying course with mortar joints

Separate competency endorsement is required for each of the options. Kerbs, channels & edgings, linear drainage and setting ironwork are also to be included and competency endorsement achieved.

It is proposed to implement this training scheme by the end of 2012.

Domestic Contractor Training

Brett Landscaping and Building Products (BLBP) operates an installer register for domestic contractors, known as the Brett Approved Installer (BAI) Register. The contractors on this register are vetted and monitored to ensure they provide a high level of service and competency to their customers.

In 2011 the author developed a comprehensive course - Design and Construction of Domestic Paving for Brett Approved Installers. Consisting of 10 units, the course was subsequently accredited in full by LANTRA, the U.K's sector skills council for land based and environmental industries, as a Customised Award. In 2011 BLBP were approved as a training provider with the author accredited as the trainer.

BLBP's objective in providing this training is to improve overall skills of BAI domestic paving contractors, including their responsibility for health and safety, therefore increasing the value and desirability of attaining BAI registration.

As well as offering practical construction training, the course includes relevant associated topics such as awareness of appropriate legislation, health and safety, site investigation and design procedures.

The course offers ten individual units designed to provide participants with theoretical and practical hands-on training. The trainees have the option of completing one or all of the 10 units that are applicable to them or their employer business:

- Legislation and Health and Safety
- Site Investigation
- Properties of Blocks, Flags and Construction materials
- Pavement Design - Block Pavements
- Town & Country Planning Act - permitted development rights for Front Gardens (England only)
- Pavement Design - Precast Concrete Flag Paving
- Pavement Detailing
- Base Construction
- Block Installation
- Flag Installation

The trainee's competency is enhanced by a combination of theory, class room exercises and practical exercises. At the completion of each unit, trainees are assessed by written tests, assessment of class room exercises, observational assessment and verbal questions for the practical content.

During the practical construction exercises, the trainees are also observed and monitored for safe working practices.

Trainees receive a certificate and Skills Card from LANTRA that records each training unit that has been successfully completed. On completion of all 10 units, participants are awarded a Special Recognition Certificate by BLBP.

Conclusions

As an industry we have been focussed on manufacturing, design and aesthetics. There is, however, an opportunity and perhaps a moral obligation to drive behavioural change by improving our sustainability credentials, addressing construction safety and the longer term health issues of our workforce and, at the same time, improving quality of construction.

The HSE's own evaluation of the project *Reducing respiratory disease in kerb, paving and block cutting* project was posted on the HSE Community web site but not published. It concluded that the project has succeeded in reaching a wide range of organisations and that larger construction sites have seen the biggest changes in implementing safe working practices. However, attempts to engage architects and designers outside the stakeholder meetings proved to be less successful. Similarly, reaching small paving contractor businesses carrying out domestic work, as well as Local Authority term contractors, was identified as a problem. This may be due to a lack of awareness of the dangers or perception of the measures as a nuisance which increases costs for no obvious immediate benefit.

Diamond or resin blade hand-held power saws have been available for over 30 years and the hire industry reported that prior to the *Reducing respiratory disease in kerb, paving and block cutting* project, only one water suppression bottle for every 3 saws was available for hire, although mains water or other methods of water supply may have been available on site. Ill health as a result of construction activity often has a long latency period and so, even if there was 100% compliance now, ill health and deaths caused by dry saw cutting, will continue to occur for many years to come and possibly rise before declining.

A major negative comment from contractors made at the stakeholders meetings identified the need for consistent compliance and enforcement so that any costs or changes associated with implementing safe work practices are incurred by all contractors, avoiding a financial advantage to contractors who are prepared to allow or work unsafely.

The manufacturers of kerb and flag handling equipment have commented that there was an enormous interest and procurement of handling equipment in 2004 as a result of the Handling Precast Concrete Kerbs project however the sales of the equipment have slowed significantly in the last few years. This may be because the majority of contractors who undertake this type of construction, now have the equipment or the impetus of these initiatives has waned, or is simply a reflection of the economic and construction downturn now being experienced.

All those involved in reducing ill health recognise that the messages must be continuously promoted and disseminated to as wide a construction audience as possible.

It is in manufacturers' interests that the products they manufacture and sell are installed correctly and safely. The two largest manufacturers in the UK run installer training schemes to improve knowledge and skills. Schemes such as the National Highway Sector Scheme 30, which in time will effectively become mandatory for work associated with highway construction and maintenance and possibly Local Authority work, will further improve and maintain quality and benchmark good practice.

References

1. The Health and Safety at Work etc Act 1974

2. The Labour Force Survey 2009/10, Economic and Social Data Service.

3. HSE - Project Brief, Reducing Ill Health in Paving & Highway Construction Work, June 2011

4. The Manual Handling Operations Regulations 1992

5. HSE Construction Information R5 Sheet No 57, Handling Kerbs: Reducing the risk of musculoskeletal disorders (MSDs)

6. Handling kerbs and flags - Guide to the Handling of Precast Concrete Kerbs and Paving Flags, Interpave

7. A Health and Safety Executive (HSE) report 'RR595 - The burden of occupational cancer in Great Britain

8. Cutting Paving - Guide to the Cutting of Precast Concrete Paving and Kerbs, Interpave

9. Specification for Highways Works – Highways Agency

Acknowledgements

Dr Robert Ellis - Health and Safety Executive
Neil Jones - Probst Handling equipment
Interpave - The Precast Concrete Kerb and Paving Association