Promoting active safety leadership

Identifying the individual and organisational antecedents of active safety leadership in construction supervisors

Report submitted to the IOSH Research Committee

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University of Liverpool

research report
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Abstract

Supervisors' commitment to safety is critical for reducing workplace accidents and injuries. Active safety leadership, defined by behaviours emphasising the importance of safety, encouraging employee involvement, and challenging poor practices, has been shown to increase employees' safety compliance and voluntary participation in safety. However, little is known about the ways in which these leadership behaviours may be promoted (ie their antecedents). The current research addressed this issue by identifying the individual (human) and organisational factors that help or hinder supervisors' engagement in active safety leadership. The construction industry was chosen as the research context as it consistently ranks among the most dangerous in terms of number of accidents and injuries. To understand the antecedents of active safety leadership, data were collected through focus groups ($n_{groups} = 10$; $n_{supervisors} = 69$) and a questionnaire survey ($n_{supervisors} = 82$; $n_{operatives} = 285$).

The results show that supervisors' active safety leadership behaviours are directly related to role autonomy (freedom to personally decide how to supervise operatives' safety) and the number of hours that supervisors spend on site with their operatives. Further, their leadership behaviours are indirectly related to the level of support that supervisors receive from their colleagues and the frequency of organisational constraints (eg subcontractor and foreign labour skills and attitudes). Preliminary analyses suggest that supervisors' engagement in active safety leadership is not influenced by the extent to which they share a trade, company or national identity with their operatives. These latter findings are tentative – especially with regard to nationality – as group sizes were relatively small.

In summary, the results suggest that supervisors' active safety leadership is shaped by the context in which they find themselves, rather than the individual qualities they possess. A supportive environment, particularly among colleagues, is especially important for increasing supervisors' feelings of role autonomy and consequently their engagement in active safety leadership behaviours.

Executive summary

Supervisors' active safety leadership* (eg coaching employees on safety and encouraging employees to raise safety concerns) has been shown to promote workplace safety. However, the way to increase these leadership behaviours is unclear. With the exception of four studies that specifically focus on the antecedents of safety leadership, in university science laboratories and through three case studies in construction, no systematic safety research has been carried out in this specific area.

To start to address this void, the current research aimed to identify the individual (human) and organisational factors that affect supervisors' active safety leadership. To this end, the research had a number of secondary objectives:

- to explore supervisors' perceptions of the factors that affect active safety leadership
- to measure the prevalence of these factors in construction and their relative importance in shaping safety leadership
- to examine the effects of supervisors' shared identification with their operatives (as measured by trade, company and nationality) on the supervisors' active safety leadership behaviours.

These objectives were addressed over two phases:

1. Ten focus group exercises with 69 supervisors from the construction industry were carried out to explore supervisors' perceptions of the factors that affect active safety leadership.
2. A questionnaire survey of 82 supervisors' experiences of a range of individual and organisational factors, and their engagement in safety leadership behaviours (as measured by their operatives ($n = 285$)), was conducted. Before the main survey, a pilot study was carried out with 13 safety, occupational and social psychologists and practitioners, and 24 supervisor–operative triads. The goal of the pilot study was to assess the psychometric properties of the tool before using it in the main survey.

The results from both phases of the research showed a general consensus on the factors that have the greatest impact on supervisors' active safety leadership in the construction industry. The main factors were found at an organisational level and related to:

- role autonomy (freedom to personally decide how to supervise operatives' safety)
- support from colleagues on safety issues
- general organisational constraints (lack of information, personnel problems and so on)
- role conflict (being tasked with incompatible requests)
- the amount of time spent on site with operatives.

Of these factors, role autonomy had the strongest direct effect on supervisors' engagement in active safety leadership. Indirect influences came from organisational constraints and colleague support for safety. Interestingly, preliminary analyses suggest that active safety leadership is not influenced by the extent to which supervisors share the same trade, company or national identity with their team of operatives. However, this finding is tentative – especially in regards to nationality – as group sizes were relatively small.

The results suggest active safety leadership may be understood as a balance between job resources and job demands. When job demands (eg organisational constraints) are high and job resources (eg colleague support, role autonomy) are low, supervisors are less likely to engage in active safety leadership than when the opposite situation exists.

At a practical level, these results suggest that organisations might benefit from directing their resources towards increasing supervisors' feelings of autonomy in their role – possibly through greater involvement in the decision-making process or by empowering them to schedule work tasks and select the methods used to perform tasks. At an academic level, the results imply that greater attention might be given to contextualising leadership and considering the importance of situational factors. While this is beginning to be recognised by some,[1] the literature is still dominated by discussion of individual antecedents.

* We use the term 'active safety leadership' for simplicity, and to reflect the proactive nature of engagement in these activities. These behaviours are akin to those captured in models of transformational safety leadership.

1 Introduction

1.1 Project background: context and aims

Setting the scene: the construction industry
Internationally and in Europe, the construction industry consistently ranks among the most dangerous as measured through accidents and injuries. The latest official statistics for the UK show that the construction industry had the highest number of fatal injuries of all the main industry groups, with a total of 53 in the period 2008/09.[2] Similarly, construction has the largest number of fatalities reported for any of the industry sectors in the US,[3] and European construction fatality rates are more than twice the average of other sectors.[4]

Compared to other industries, construction is unusual in its complexity and characteristics. Individuals working in this sector face greater physical demands and are readily exposed to biological, chemical, ergonomic, noise, and machinery-related risk factors. In addition to specialist plant, equipment and tools, the industry is defined by the existence of a highly mobile workforce with differing skill levels,[5] foreign labour,[6] competing goals of productivity and safety,[7] time pressures, environmental variables (eg inclement weather), and differing leadership and management hierarchies.[8,9] Being project-based, the construction industry is a dynamic, ever-changing environment that requires specific organisational structures to manage the demands of its wide-ranging activities and varied personnel involved in projects.[10] The competent organisation and management of temporary work structures (work teams or gangs) is pivotal to the smooth running of projects.

Construction projects include the building of new structures and additions, modifications and renovations of existing structures. These structures may be residential, commercial or industrial (the latter including heavy and civil engineering projects such as bridges, roads, railways and tunnels). Individual projects vary in size, duration and complexity. For instance, projects often involve many design, construction and supplier organisations that need to work as interfunctional teams.[11] Subcontractors are employed for specialist work (eg carpentry, plumbing, electrics) or on a 'labour-only' basis and can account for as much as 90 per cent of the total value of a construction project.[12] On some projects, the main operating company will merely act in a management capacity, while all labour and specialist work is contracted to small or medium-sized construction companies. The outsourcing of work and presence of subcontractors means that it is common to find decentralised decision-making and diverse attitudes towards the completion of work and safety.

Work-related incidents cause significant costs to individuals, organisations and the economy (eg lost working days). As well as the responsibility for the welfare of employees, construction companies have a duty of care to members of the public who may be affected by construction work and put at risk of accident and injury.[13] Addressing safety in the construction industry is therefore both important and complex.

In other industries, research has shown that workplace accidents may be reduced by supervisor engagement in safety leadership behaviours.[14–16] Recent findings from the construction industry support this conclusion.[17] These studies show that as supervisors become more active in leading safety (eg by showing commitment to good safety, encouraging employees' involvement in safety and challenging poor safety), employees show a similar increase in the extent to which they engage in safe behaviours.

However, despite the advantages associated with active forms of safety leadership, this style of behaviour is not found consistently. A number of reasons have been suggested for this, but no systematic research has been carried out to test the validity of these proposals empirically. The current research aimed to address this by identifying and testing the relative influence of different antecedent factors in promoting, or reducing, active safety leadership behaviours among construction supervisors. In this report the term 'active safety leadership' is used to mean the proactive, energising nature of these behaviours. In reality, behaviours are measured that are consistent with models of safety-specific transformational leadership – a style of leadership shown to improve employee safety in industry generally and construction specifically, and high quality leader–member exchanges.

1.2 Project aim and objectives

The current project had the principal aim of identifying the range of factors that affect supervisors' engagement in active safety leadership behaviours. Underlying this overall aim were a number of secondary objectives:

1 to explore supervisors' perceptions of the factors that affect active safety leadership
2 to measure the prevalence and relative importance of these factors in a sample of construction supervisors in the UK
3 to examine the effects of supervisors' shared identification with their operatives (as measured by trade, company and nationality) on the supervisors' active safety leadership behaviours.

1.3 Significance of the project

The research seeks to identify the range of factors that help or hinder supervisors' efforts to engage in active safety leadership. Subsequently, it aims to identify which of these factors is likely to have the biggest impact on supervisors' behaviours, and which may produce the most significant change in supervisors' behaviours if targeted by organisational initiatives. In many ways, this research is similar to work on group-level safety climate and consequently similar findings may be expected. However, while leadership and group-level climate are related, they exist as distinct constructs, which may or may not be influenced by the same factors. Therefore, it would be wise not to assume that the findings from climate research automatically transfer to leadership, but instead to focus specifically on leadership behaviours as the target of interest.

1.4 Outline of the project

The research was carried out over two phases that combined qualitative and quantitative methodologies. To inform these phases of data analysis, a review of the leadership and safety literature was conducted to identify individual (human) and organisational factors that were likely to be important in understanding supervisors' leadership behaviours. The report begins by summarising this review and proceeds to present and discuss the methods and findings of the two phases of data collection.

2 Literature review

2.1 Leadership theory

Leadership is a critical aspect of organisational life, contributing to improved manager–employee relationships as well as increased motivation and performance.[18] Considered a necessary tool for competitive advantage, leadership includes establishing direction, aligning people, and motivating and inspiring employees, which ultimately leads to organisational change.[18,19]

The most popular theory of leadership focuses on two styles of behaviour: transactional and transformational.[20] Transactional leadership is similar to management and is defined by an exchange between the leader (manager) and the follower (employee), where both parties fulfil their roles and receive something in return. Three dimensions of this style of leadership are:

- contingent reward (leaders reward employees for approved behaviours and discipline behaviours that are not approved of)
- active management by exception (monitoring of performance with intervention if necessary)
- passive management by exception (correction from the leader only when a problem arises).

It is generally considered that leadership styles such as these, which focus on rewards or the threat of their removal, suppress employees' commitment to quality and productivity.[21]

Transformational leadership builds on a transactional approach and augments its influence on employee behaviour.[22,23] This style of leadership focuses on motivating, inspiring and encouraging employees to improve their performance. In academic literature, transformational styles of leadership are characterised by behaviours reflecting:

- idealised influence (articulating a vision for the future)
- inspirational leadership (aspiring to attain a realistic goal)
- intellectual stimulation (challenging assumptions and traditional methods)
- individualised consideration (awareness and support of employees' needs).

Translated, these relate to inspiring a vision of the future, role-modelling, fostering the acceptance of group goals, demonstrating high performance expectations, providing socio-emotional support, increasing employees' awareness, and stimulating employees to think again about how work can be performed.[24]

A body of literature supports the notion that transformational leadership is more proactive than other forms of leading. It has been associated with a greater number of positive outcomes, such as employee achievement and growth, empowerment, increased organisational commitment, high levels of cohesion, and increased group level performance.[21,25,26] Based on findings such as these, it is reasonable to see why organisations might strive to attain this type of active – transformational – leadership in their management.

2.2 Safety leadership

In the domain of safety, leadership is concerned with the prevention of accidents, injuries and fatalities by reducing employees' unsafe behaviour. As with general leadership theory, safety leadership is considered to be more effective if it is transformational and defined by coaching, individualised consideration, support, and employee encouragement to raise safety suggestions and concerns. Transformational leadership, and relationships defined by high quality exchanges between supervisors and employees, have been shown to increase employees' open communication about safety, engagement in safe behaviours, safety commitment, and safety consciousness.[15,17,27–32] These outcomes are often attributed to the fact that transformational styles of safety leadership engender trust and respect from employees, which support the associated positive outcomes. For simplicity, and to reflect the proactive and energising nature of these styles of leadership, we use the term 'active safety leadership' to refer to the behaviours listed above.

The relationship between supervisors' leadership styles and employees' safety behaviour is well established. However, the factors that promote active safety leadership are less clear. A search of the safety literature identifies only four studies that explicitly and specifically test the factors that promote safety leadership behaviours.[33–36] Three of these studies focus on safety in university science laboratories and show that safety leadership is influenced by the size of the organisation and work

unit, accident experience of the leader and employees, age of the leader, and the leader's training experience.[34–36] The fourth study uses a case study method to explore leadership styles used by managers in the UK construction industry and shows that safety leadership is affected by the employing company and the factor of time.[33] Specifically, this study showed that directive management styles were adopted with subcontracted employees as managers perceived that they had less personal control in this area. This differed to the style used with employees of the main contractor company, where managers were more concerned with motivation and participation and adopted more active styles of leadership. Furthermore, managers adjusted their style depending on time and urgency, employing more directive methods when time was short.

These four studies identify a number of factors that may affect the way that leadership is managed in the safety domain. However, their insight is limited by context (eg science laboratories) or method and target (eg three case studies, managers). Research in other organisational domains and in safety more generally has identified a number of factors that may affect leadership behaviours. Some of these are different from those captured in the four studies above and some are the same. These two fields of literature yield important knowledge about the antecedents of active safety leadership. The following sections constitute an overview of the factors implicated by this literature in having an affect on either general leadership or general safety behaviours.

2.3 Antecedents of active safety leadership

2.3.1 Individual factors

Individual antecedents of active leadership refer to the human contribution. The main factors implicated in the general leadership and safety literature are:

- personality
- emotional intelligence
- self-efficacy
- motivation
- experience.

See Appendix 1 for a full list of definitions.

Personality

A growing number of studies have emphasised the impact of personality on leadership behaviours. These studies have shown that the traits of extraversion, neuroticism, openness, conscientiousness and agreeableness are significantly related to active forms of leadership.[37] Of the five traits, extraversion shows the strongest relationship to active leadership and consistently emerges as a significant antecedent. Openness, agreeableness, and conscientiousness also share a positive relationship with active leadership, while neuroticism has a negative relationship.[38,39] In simple terms, this research suggests that individuals with high levels of extraversion, openness, conscientiousness and agreeableness are more likely to engage in active leadership behaviours than those with high levels of neuroticism.

Emotional intelligence

Emotional intelligence (EI) is defined as people's ability to use emotions (their own or others') to guide the thinking and actions of themselves and others. EI has been associated with effective leadership in non-safety domains[14,40] and more recently also in safety.[41,42] Geller[41] proposed that an injury-free workplace requires leaders who have an awareness and control of their own emotions as well as an understanding of other people's emotions. Being aware of emotions allows a leader to adapt his or her behaviour to diffuse a situation or to motivate employees to engage in safety. Individuals high on EI are typically receptive to feedback, and actively encourage and praise safety. These behaviours are also characteristic of active safety leadership, which partly explains the link between the two.

Locus of control

The safety locus of control is concerned with an individual's perception of his or her control over external events in the safety domain.[43] Individuals with an internal locus of control believe that events, such as accidents, are under their control. Individuals with an external locus of control believe that 'accidents happen' and are beyond their control. Applied to safety leadership, it is possible that a high level of external locus of control will reduce active safety leadership behaviours, as a supervisor with an external locus of control believes that he or she has little control over their environment. In

contrast, a high level of internal locus of control may lead to an increase in safety leadership to prevent injury. Closely coupled with internal locus of control is empowerment (the degree to which someone believes that they can control their environment). Research shows that internal locus of control is effective at promoting safety when the individual holds a high level of empowerment.[44]

Motivation

Motivation, defined broadly as a drive that energises and directs behaviour, has been linked to active leadership behaviours.[45,46] Two main classes of motivation relate to internal sources (eg intrinsic pleasure) or external sources (eg reward or recognition for good safety).* Both types of motivation have been implicated in general safety behaviours.[47–49] In particular, extrinsic motivation is implicated more strongly in safety compliance and intrinsic motivation is implicated more strongly in safety participation and engagement behaviours. The latter finding is explained by the fact that individuals intrinsically motivated by a task (ie they find the task pleasurable, enjoyable and a challenge) are more likely to actively engage in it.[44,50,51]

Experience

Experience relates to the acquisition of a specific set of skills, job-relevant experience acquired through training, and a sense of perspective acquired through time spent in an organisation and job.[52] In the context of safety leadership, experience may relate to a specific job role (eg being a supervisor) or a specific work context (eg construction). Of particular importance is the relevance of a leader's previously held positions and the ability of experiences gained in those positions to enhance their technical and interpersonal skills. Research suggests that experience as a supervisor or in the construction industry may affect active safety leadership.

Accident exposure

Accident experience has been shown to affect leadership behaviours.[36] This experience may relate to accidents sustained personally or to witnessing someone else having an accident. Both types of exposure increase active safety leadership as a means to prevent similar future incidents and associated negative consequences.

Self-efficacy

Self-efficacy refers to an individual's judgment about their own capability to achieve a certain task (eg good safety) or maintain certain behaviours. Self-efficacy has been shown to influence the initiation, intensity and persistence of a behaviour, thus affecting an individual's involvement in a task and governing whether they persist with the task in the face of obstacles.[53] Applied to the domain of safety, self-efficacy research suggests that a supervisor's perception and judgment of their ability to influence employees' safety behaviours is likely to affect their motivation to engage in safety leadership.[54] Supervisors high in self-efficacy are more likely to engage in active safety leadership than those low in self-efficacy, as a result of their assessment of their personal ability to succeed in achieving this goal.

2.3.2 Organisational factors

Compared to individual (human) antecedents of leadership, organisational (or contextual) factors have received relatively little attention in the leadership literature.[1,33,55] In the following sections, a range of organisational factors that have been shown to influence supervisors' engagement in active leadership in other domains will be outlined. These include factors specific to a supervisor's responsibilities (eg overload and conflict) and those specific to the situation in which supervisors find themselves (eg culture and structural features).

Role demands: overload and conflict

Role overload, defined as excessive work demands, has been related to a reduction in safety behaviours[29] and an increase in workplace injury.[27,56] These findings are often attributed to the fact that multiple demands increase a person's complacency and risk-taking behaviours because of faulty decision-making caused by cognitive strain. These demands are accelerated when time pressures increase as individuals begin to rely on cognitive heuristics (mental shortcuts) to process information, make decisions or avoid some of their responsibilities.[57,58] In the case of safety leadership, these shortcuts allow supervisors to continue on a task (eg production) but have a negative impact on their engagement in safety. Therefore, when role overload is high, supervisors are less likely to actively engage in safety and may be more likely to adopt a passive approach to leading safety.

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* External sources of motivation relate to organisational factors, but are listed here, as motivation is an internal drive.

Role conflict refers to a lack of congruent expectations both within and between job roles.[31] Compared to role overload, research is less conclusive regarding the impact of role conflict on safety. It is generally accepted that being tasked with incompatible goals can negatively affect performance. However, studies have shown that these negative effects can be reduced with high levels of role autonomy[59] (the extent to which a role allows an individual independence and discretion to schedule work, make decisions and choose methods for task completion). When role autonomy is high, the effects of role demands are lessened. However, when role autonomy is low, conflicting demands may have a negative impact on performance. Similar results have been suggested for individual power, where higher levels are related to more engagement in safety behaviour.[60–63] This research suggests that supervisors experiencing role conflict reduce their engagement in active safety leadership when role autonomy is low, but not when it is high.

Situational constraints

Situational constraints are characteristics in the workplace that are beyond an individual's control, but directly affect their safety performance.[64,65] Examples of situational constraints include poor equipment, interruptions from colleagues, and incorrect or insufficient information. These constraints may negatively affect supervisors' ability to engage in active safety leadership because of their tendency to direct attention towards other issues. In some respects, situational constraints may be considered as an extra demand placed on supervisors, which further reduces their focus on safety.

Organisational support

Several studies have suggested that active forms of leadership are promoted by cultures categorised as innovative and supportive because of the flexibility that they afford leaders to make decisions.[66–68] In the context of safety, a number of studies have shown that perceived organisational support for safety has a positive influence on supervisory leadership (ie it increases active engagement), which increases employees' safety.[69–71] These studies suggest that organisational (including management) support for safety may facilitate active safety leadership among supervisors.

Subcultures

Research suggests that leadership behaviours are dependent, in part, on the characteristics of employees. These characteristics may relate to employees' skills and abilities or their attitudes and values regarding safety. Research in the area of subcultures has shown that employees' attitudes and values are often fragmented and differ widely within organisations.[72,73] This may result in more than one leadership approach being used by a single supervisor. Two prominent subculture value systems in the construction industry relate to migrant labour (or nationality) and subcontractors.

Migrant labour

National culture has been shown to affect safety attitudes and behaviours.[74–76] These influences are particularly prominent in the UK construction industry as a large percentage of the workforce is non-British. As noted by Bust *et al*.,[77] the composition of the construction workforce has changed from comprising mostly Irish 'navvies' to including Poles, Lithuanians and citizens of other A8 countries (the Eastern European countries which joined the EU in 2004). This change creates challenges for supervisors in terms of active leadership because it brings with it differences in culture, language, safety training, education and co-operation.[78] It is possible that different nationalities, together with their differences in attitudes, language and safety ethos, will call for different styles of leadership. Mayo *et al*.,[79] for example, found that leaders in heterogeneous groups rated their self-efficacy lower than those in homogenous groups and were less likely to adopt active leadership behaviours that focused on initiating change and inspiring followers.

Subcontractors

As a group, subcontractors are more likely to suffer an injury or accident as they engage in more risk-taking behaviour in response to a payment-by-results system. They typically work longer hours or take safety shortcuts to achieve more output. When economic pressures are high, these behaviours are intensified as subcontractors compete for work on a decreasing number of projects.[80] Dwyer[81] argued that the disorganisation resulting from subcontracting (eg multiple subcontractors working together laterally and vertically) is a major cause of injury. This is partly due to the ambiguity that disorganisation creates for safety systems, for example in questions of who is responsible for employees' safety and how existing systems can be implemented within a fragmented workforce. This creates problems for supervisors' efforts to lead on safety, as they are unclear about which employees they are responsible for and the level of power they have to shape their safety behaviours.

Distance and contact

A small number of studies have suggested that leadership behaviours may be influenced by the physical distance and frequency of contact between supervisors and employees.[82] Leaders in close proximity to workers are more likely to use relational charisma (characteristic of styles akin to active leadership) than leaders in more distant positions.[83] Furthermore, Luria *et al*.[84] found that employees' visibility to supervisors increased the number of positive exchanges, which in turn promoted safety. Collectively, these studies suggest that supervisors are more likely to employ active safety leadership when they are in close proximity to employees and have frequent interaction with them.

In summary, the leadership and safety literatures suggest that supervisors' active safety leadership is a product of both individual and organisational factors. At an individual level, personality, motivation, emotional intelligence and experience appear to be important. At an organisational level, cultural attitudes, job demands and job resources are likely to play a role.

3 Project design

The aim of the current research project was to identify the factors that affect supervisors' active safety leadership behaviours. To this end, the project used a mixed-method approach of qualitative and quantitative methodologies over two phases.

3.1 Phase 1: focus groups

A qualitative method was used in Phase 1 of the project to explore the factors that supervisors perceive to be strong influences on their safety leadership behaviours (Objective 1). This method has several strengths and limitations:

- strengths:
  - focus groups provide a rich contextual understanding of an issue through first-hand accounts of people's experiences, thoughts, and feelings
  - the researcher is present to aid discussion and probe any issues that require clarification
  - context, relationships and processes can be documented
- limitations:
  - focus groups may be considered subjective
  - they are open to the interpretation and bias of the researcher (researcher reflexivity)
  - they often tap fewer issues than quantitative data because of their focus on depth rather than breadth.

3.2 Phase 2: questionnaire survey

A quantitative method was used in Phase 2 of the project to test and validate the findings from the focus groups on a larger scale (see objectives 2, 3 and 4).

- strengths:
  - questionnaires are relatively quick to administer on a large scale
  - they are user-friendly to those in industry who are familiar with this method
  - they are relatively objective in the conclusions they allow based on the analysis of questionnaire responses

- limitations:
  - questionnaires may generate biased responding if they are designed or administered poorly
  - they often prevent elaboration on an issue
  - the issues to be addressed are determined by the researcher.

In both research phases, steps were taken to minimise the limitations associated with each methodology. Details on these steps are documented in the methods section of each data collection phase.

3.3 Ethical approval

In both phases of the project, ethical approval was gained from the University of Liverpool's Psychology Ethics Committee. This committee operates according to ethical guidelines set out by the British Psychological Society.

4 Focus group methodology

Focus groups were conducted with construction supervisors to explore their perceptions of factors that influence – positively or negatively – active safety leadership behaviours (Objective 1). The exact factors to be explored were not dictated by the researcher, but emerged naturally from discussions with supervisors.

4.1 Sample

The sample comprised 69 supervisors from 10 construction projects in the UK. The sample represented eight contractor companies. The average working tenure of participants in the role of supervisor was nine years (range: nine months–40 years). Of the 69 supervisors, one was female and the remainder were male (which is characteristic of the industry).

4.2 Data collection

The data were collected through semi-structured focus groups that took place in a private conference room. The main objective of each focus group was to explore the factors that acted as barriers or facilitators to active safety leadership, from the perspective of the supervisor. Following a short discussion of what active safety leadership reflects, each supervisor was asked to note down the main factors that helped or hindered engagement in these behaviours. These factors were then discussed by the group, and probed and explored by the researcher. This process was effective for assessing differences and similarities within the group, and the relative importance of different factors and experiences in shaping safety leadership. Efforts were made to keep the questions as non-leading as possible, which was achieved by avoiding the use of any questions that made reference to a specific individual or organisational factor (unless this factor was raised by a supervisor).

The focus group discussions were recorded digitally and subsequently transcribed verbatim. Each discussion lasted for an average of one hour and comprised six to ten supervisors from different companies and trades. Each supervisor gave written informed consent to their participation and the recording of focus groups.

4.3 Data analysis

A modified grounded theory approach was used to collate the data by using codes taken directly from the transcripts and the literature. Two researchers agreed a definition for each code and these were used to analyse each response given by a supervisor. A number of codes were used per response, which made it possible to identify commonly occurring codes or themes. Coding in this way facilitated the development of higher-order categories, which comprised codes that shared a common theme (eg codes relating to support from management and colleagues were grouped as ‘social support’). Whether supervisors presented these categories as factors that helped or hindered safety leadership was noted. Two researchers agreed the coding* and higher-order categories. The main themes emerged as key factors that affected supervisors’ engagement in active safety leadership.

* A sample of focus group transcripts was coded independently by both researchers, which showed 85 per cent agreement in coding.

5 Focus group findings

Analysis of the focus group data identified key factors that affect supervisors' engagement in active safety leadership. These reflect individual and organisational factors as detailed in Table 1.

Individual factors	Organisational factors
Experience Accident exposure Habit Motivation Locus of control	Role demands Role autonomy Discipline procedures Subcultures Safety culture Social support Frequency of contact

Table 1
Leadership antecedents from focus group discussions

The results of the focus groups showed that individual antecedents of active safety leadership were discussed less frequently than organisational antecedents. Organisational factors are perhaps considered more tangible and in this sense are easier to discuss and attribute meaning to. Consequently, the relative weight given to these two groups may, in part, reflect a methodological artefact. The individual and organisational factors deemed most important to supervisors' engagement in active safety leadership are summarised below. Example quotations are given in Appendix 2.

5.1 Individual antecedents

This section lists the individual (human) factors that were highlighted throughout the focus groups as important influences on active safety leadership. Many of these factors mirror those documented in the literature on general leadership and safety behaviours.

Experience

Of the individual factors affecting supervisors' engagement in active safety leadership, experience – both practical and interpersonal – was identified as important. Many supervisors commented that experience in the industry had provided them with a set of skills that has helped them to relate to employees (referred to as 'operatives' for the remainder of this discussion), gain respect from operatives, develop high-quality supervisor–operative relationships and reduce risk. It was further suggested that the effect of supervisors' experience on active safety leadership may be moderated by operatives' age and experience. More specifically, experienced supervisors were more likely to engage in active safety leadership if operatives were younger and less experienced than if they were older and more experienced.

Accident exposure

Similar to findings reported in the literature,[36] several supervisors discussed the effects of personal experience of accidents on their safety leadership behaviour. Personal experience of an accident, or witnessing an accident (very often involving an operative), was associated with increased engagement in safety. Integral to these comments was the notion that accident exposure is effective at promoting supervisors' engagement in safety because it increases their safety awareness and subsequent behaviours. This awareness seemed to be long-lasting, presumably as a result of the negative feelings that accident exposure evokes.

Habit

Across several of the focus groups, supervisors referred to the influence of habit on their behaviour. This was discussed in terms of 'bad habits' acquired from working in the industry for a long time (some participants had 40 years' experience). For some supervisors, this created difficulties in adjusting to new ways of working and many mentioned reverting to habitual behaviour when under pressure (eg deadlines or production targets). When this occurred, active engagement in safety reduced, as did the consistency with which supervisors emphasised and recognised safety.

Motivation

There was an implicit suggestion that safety leadership behaviours are determined in part by the type of drive that motivates supervisors' behaviours. Discussions of 'price work' and performance indicators highlighted the belief among some supervisors that some individuals may engage in

shortcuts (or allow their operatives to do so) to finish a job and receive a monetary reward. It was also noted that organisational performance indicators that fail to recognise good safety and instead focus on production may negatively affect some supervisors' safety behaviours. These discussions suggested that supervisors motivated by extrinsic sources were less likely to consistently engage in active safety leadership. This is especially so when extrinsic pressures are powerful and/or emphasise production over safety. The counter to this suggestion is that intrinsic motivation (ie engagement in safety because it may be pleasurable and challenging) is likely to promote active safety leadership.

Locus of control

It was suggested in several focus groups that locus of control affected active safety leadership. Several supervisors discussed accidents and injury as things that 'just happened' or were natural for the construction industry ('it's the nature of the beast'). Other supervisors commented that accidents happen irrespective of supervision, as they are usually due to some unforeseen or unique event. Attitudes such as these reflect an external locus of control for safety (eg a belief that supervisors cannot control events such as accidents). These attitudes were often associated with more passive forms of leadership.

5.2 Organisational antecedents

A number of organisational factors emerged as significant influences on supervisors' safety leadership behaviours. Many of these factors reflect job demands (eg role conflict) or job resources (eg role autonomy), as defined by various models.[59] A number of additional factors also emerged at an organisational level, which are discussed below.

Role demands

All the focus groups agreed that role demands had a significant impact on supervisors' ability to actively engage in safety leadership. In all focus groups, supervisors discussed the negative impact of:

- programme pressures
- balancing conflicting goals (eg getting the job done on time and getting it done safely)
- multiple responsibilities (eg supervising operatives on site, paperwork in the office, overseeing the work of different trades).

The complex relationship between role demands and active safety leadership is summarised as follows. An increase in pressures (time, budget and workload) and responsibilities (increased on-site activity, office-based work, need to work alongside operatives) leads to feelings of role conflict between production and safety. This increase in pressure results in decreased levels of active supervision, including the ability to watch operatives, and a lack of co-ordination between trades. Many supervisors reported feeling a need to cut corners to satisfy the multiple demands placed on them.

An illustration of the role overload problems that supervisors experienced is provided by the process of dealing with operatives with inadequate skills. Supervisors believed that they needed to spend more time with these operatives, but that this was often not possible because of production and contract pressures. This leads some supervisors to adopt a more directive leadership style or complete a task themselves because it takes less time and effort. Completing a job personally places more strain and role overload on the supervisor, which has a detrimental effect on their active engagement in leading safety.

Consistent with the suggestions of others,[56] the current study shows that supervisors believed that having too many responsibilities leads to complacency and, consequently, personal unsafe behaviour or shortcuts. While complacency places the supervisor at risk of an accident, it also sends a message to operatives that safety is secondary to production. Furthermore, it can reduce operatives' perceptions that supervisors consistently engage in active safety leadership. Central to these focus group discussions was the feeling that supervisors' performance was sometimes judged by meeting production rather than safety targets. This implies that targets set by senior management have an influence on supervisors' level of active safety leadership.

Role autonomy or control

A lack of role autonomy – or the inability to personally control the organisation or supervision of work – was identified as a further influence on supervisors' active safety leadership. Supervisors frequently made reference to unworkable procedures and the problems of trying to implement safety procedures on site. Non-workable procedures were highlighted as a hindrance to the easy completion

of tasks and a reason for rule-bending by operatives. This created extra pressure on supervisors to manage safety, but also created a personal conflict when trying to implement safety procedures that supervisors themselves lacked a commitment to. Some supervisors believed that management could be idealistic in their expectations of how work should be completed and the extent to which procedures would be adhered to; this highlights the need for flexibility and a regard of specific contexts where rules may need to be relaxed. In situations where supervisors have little autonomy over how jobs are performed, active safety leadership was negatively affected by organisational constraints and demands. However, when role autonomy was high, supervisors were likely to show greater engagement in active leadership. This is partly due to the sense of greater responsibility for operatives' safety engendered by greater role autonomy, but also to the fact that role autonomy lessens the negative impact of role demands.

Disciplinary procedures

Supporting the significance of role autonomy in active safety leadership, several of the focus groups raised the notion that safety leadership styles were imposed in part by organisational procedures. This was implied most strongly in relation to disciplinary procedures, which supervisors believed created divisions and ill feeling among operatives and between operatives and supervisors. This was particularly so for supervisors who preferred to adopt a consultative approach with operatives and to discuss their unsafe behaviour. For these supervisors, the disciplinary system forced a style of leadership that was different from their natural approach. More importantly, it forced a style of leadership that was less active (in terms of coaching operatives) and more reactive. Although a few supervisors agreed with the disciplinary system, they generally agreed that it should be used as a last resort after talking to operatives in an informal, friendly way to establish why they were behaving unsafely. For some supervisors, an informal discussion was used to justify the use of disciplinary procedures to the operative. This combination of informal discussion and formal discipline explains how active safety leadership is diluted (or reduced in frequency) by organisational factors. However, all supervisors recognised that disciplinary procedures were designed to improve safety.

Social support

Supervisors consistently emphasised the importance of social support in promoting active safety leadership. Social support was discussed in relation to the organisation, immediate managers and colleagues. All supervisors believed that the co-operation and communication of all occupational groups involved in the day-to-day running of construction projects helped them to actively supervise safe working on site. Social support acted as a buffer against role demands in that high levels of social support weakened the negative impact of role overload and conflict (eg multiple and sometimes conflicting responsibilities) on supervisors' active safety leadership.

In all of the focus groups, supervisors agreed that having a supportive management team was crucial in their efforts to show good leadership on safety. Supervisors believed that it was especially important for managers to value and trust the supervisors' experience and skills, which may be different to those of office-based supervisors. In view of this, supervisors believed that inadequate consultation between their group and management could result in reduced communication and respect, and low-quality exchanges. Through role-modelling processes, it is possible that similar behaviours are adopted by supervisors. This was partly implied in the connection the supervisors made between the degree to which their safety is recognised and rewarded (eg through verbal praise) and the degree to which they themselves engage in these behaviours.

Of the different groups providing support, supervisors emphasised the importance of support from their peers (ie other supervisors) in facilitating active safety leadership. The importance of both professional and personal relationships was emphasised, and supervisors reported feeling at an advantage for having long-term relationships with their colleagues. This contrasts with the relationships between large and small subcontractor company management, where large subcontractor company supervisors reported relatively less support from smaller company management and associated difficulties of actively leading safety. The familiarity, trust and knowledge that supervisors develop with colleagues from the same company does not develop with subcontractor companies because of limited interaction, a lack of close proximity, and different emphases placed on safety relative to production.

Safety culture

Reference was made to the importance of the organisation's safety culture in promoting active safety leadership. Supervisors discussed efforts to increase safety awareness (and safety culture attitudes) among all occupational groups, and referred to the positive impact of a good safety culture on

leadership. Positive safety cultures provide a supportive environment in which supervisors can challenge unsafe behaviour and feel supported by the organisation. It also provides safety-specific training, which complements experience to achieve high levels of engagement in safety through education. Furthermore, it reduces the effects caused by role overload, which was a seen as a significant barrier to leadership.

Subcultures

Supervisors referred to the role of subculture attitudes in influencing active safety leadership. More specifically, they discussed the attitudes, mentality and personality of operatives in light of their own approach to leading safety. Many supervisors spoke of operatives who have lax attitudes towards safety, most notably those who are younger with less construction experience and those closer to retirement age and hence less likely to adapt to new methods. Some operatives were described as having 'bad attitudes' which affected supervisors' ability to lead them on safety. The opinion that operatives' behaviour was fixed due to their nature or personality affected supervisors' leadership behaviours, as many acknowledged that they were unsure what to do in these circumstances. In these situations, supervisors questioned their own power to influence operatives' behaviour. In some respects, these discussions reflect a sense of external locus of control, except that here, supervisors believe they are powerless due to operatives' attitudes rather than 'fate'.

Supervisors identified foreign labour as having an influence on their ability to engage in active leadership. They drew attention to differences in foreign operatives' attitudes towards health and safety. Some believed that these differences were due to cultural differences in the way that operatives regarded risk and the 'value of life', and others related this to differences in the health and safety procedures of companies in different countries. Similar to UK subcontractors, supervisors believed that foreign operatives' drive for monetary gain (caused through 'price work') creates barriers to their ability to actively lead on good safety because foreign employees may resist changing their behaviour to improve safety. An additional confounding factor in this relation was supervisors' inability to communicate with non-English-speaking operatives. This had a direct impact on their ability to ensure safe working and a lack of certainty regarding foreign operatives' understanding.

Frequency of contact

The level of contact between supervisors and operatives affected safety leadership. Many supervisors expressed dissatisfaction with the elements of their role that took them off site and away from operatives. Supervisors stated that they could prevent unsafe behaviour if they spent the majority of their time on site, being available and visible to operatives and actively leading them on safety. This contact enables supervisors to identify risk-taking behaviours and breaches of rules, and to be on hand to manage unpredicted events. Supervisors appeared to relate their presence on site to a missing link in a chain of events that could lead to accidents. Furthermore, supervisors believed that it was important to be on site in order to offer extra supervision where and when it was needed. This was in relation to new or inexperienced operatives and in circumstances where operatives were working on 'live' sites. Supervisors believed that it was important for operatives to know their whereabouts, indicating that visibility and availability was a factor important in the development of relationships between them and their operatives.

5.3 Conclusion

The focus groups identified a number of individual and organisational factors that affect construction supervisors' engagement in active safety leadership. In the main, these factors are found at an organisational level and relate to role demands and support. Supervisors emphasised the impact of role overload (caused by multiple responsibilities) and role conflict (caused by managing production and safety) as factors that reduce their opportunity to engage in active safety leadership. The effects of these factors are intensified by a lack of role autonomy, or control, that construction supervisors report experience of. From the group discussions it was clear that a lack of autonomy manifested itself as a lack of control over the approach to be taken when leading operatives on safety or determining how jobs are carried out. One factor that was suggested as a way of moderating these effects is social support. The importance of receiving support from direct managers, subcontractor companies and, in particular, colleagues, was emphasised as a positive influence on the ability to engage in active safety leadership. Supervisors also suggested that support from operatives through positive safety culture attitudes and greater safety awareness facilitated their engagement in active leadership behaviours.

The findings from the focus groups were used together with the literature review to inform the development of a questionnaire that defined Phase 2 of the study. The following sections outline the development of the questionnaire and main survey results.

6 Survey methodology

To test the prevalence of leadership antecedent factors in the construction industry, and to identify the relative importance of these factors in predicting active safety leadership behaviours (objectives 2–4), a survey was carried out. This phase had three stages, which related to questionnaire development, pilot testing, and the main survey.

6.1 Questionnaire development

The questionnaire was developed to measure the main antecedents of supervisors' active safety leadership. The exact factors to be included in the questionnaire were taken from the literature review and focus groups findings. Existing measurement scales for potential inclusion in the questionnaire were identified during the literature review. A scale was considered for inclusion if it was shown to be reliable and valid, and if it had been used in a number of previous studies. Using existing scales was particularly important for the individual factors of personality and emotional intelligence, as these measures take a number of years to develop and refine.

6.1.1 Measurement scales: active leadership and antecedent factors

Active safety leadership

Supervisors' active safety leadership was measured using an extended version of the safety-specific transformational leadership scale.[27] This scale captures the leadership behaviours discussed by supervisors during the focus groups, such as sharing a safety vision, encouraging operatives to get involved in safety, and coaching. The scale has good reliability and validity, and correlates with measures of safety performance.[15,17] Responses were made on a five-point scale that ranged from 'never engage in these behaviours' (1) to 'always' (5). To control for method effects, this scale was completed for each supervisor by their operatives (see below for more detail).

Personality

Five dimensions of personality that relate to extraversion, agreeableness, neuroticism, conscientiousness and intellect were measured using the 20-item International Personality Item Pool (IPIP) short-form questionnaire.[85] The measure has good convergent validity, correlating significantly with dimensions from the NEO-FFI, EPQ-R, and the Big Five Inventory.[85–87] Responses were made on a five-point scale that ranged from 'very inaccurate' (1) to 'very accurate' (5).

Emotional intelligence

Emotional intelligence (the ability to use feelings and emotions to guide thinking and behaviour) was measured using a shortened version of the Emotional Intelligence Scale.[88,89] The scale comprises three dimensions that relate to optimism and mood regulation, use of emotions, and appraisal of emotions. Twelve items were taken from the original scale to tap these three dimensions (four items from each dimension). Responses were made on a five-point scale that ranged from 'very inaccurate' (1) to 'very accurate' (5).

Self-efficacy

Self-efficacy (belief about one's personal ability to achieve a goal) was measured using a newly developed scale, which was created according to established guidelines.[54] Questionnaire items were developed to reflect supervisors' personal confidence to influence operatives' safety compliance, active engagement in safety, prioritisation of safety, and general safety behaviours. Responses were made on an 11-point confidence scale that ranged from 'I cannot do it at all' (0%) to 'highly certain I can do it' (100%).

Locus of control

Safety locus of control (beliefs about whether accidents can be controlled or simply happen) was measured using a shortened six-item version of the Safety Locus of Control Scale.[43] This scale has been used in a number of studies.[43,90] Responses were made on a seven-point scale that ranged from 'very strongly disagree' (1) to 'very strongly agree' (7).

Safety motivation

Six dimensions of safety motivation were measured that relate to engaging in safety because it is:

- intrinsically important
- a personal value

- avoids punishment
- receives recognition from colleagues
- receives recognition from supervisors
- receives recognition from a manager.

The items were developed for this study from comments made during the focus groups. Responses were made on a five-point scale that ranged from 'never' (1) to 'always' (5).

Accident experience

Accident experience was measured by asking supervisors how often they have personally been involved in, or witnessed, an accident or near miss while on site. Responses were both dichotomous (yes/no) and continuous (number of personal/witnessed accidents).

Role overload

Role overload (specifically, having too many tasks for the time available) was measured using items from existing scales.[60,91,92] Responses were made on a five-point scale that ranged from 'never' (1) to 'always' (5).

Role conflict

Role conflict was measured using items from the general role conflict scale.[91] Responses were made on a five-point scale that ranged from 'never' (1) to 'always' (5).

Role autonomy and control

Role autonomy was measured in relation to control over supervisory style (ie being able personally to decide how to supervise operatives' safety), and role control was measured specifically in relation to control over risk (ie making jobs safer by contributing to risk assessments and method statements). Items were taken from validated scales used in non-safety domains[93–95] and adapted to be specific to safety. Responses were made on a five-point scale that ranged from 'never' (1) to 'always' (5).

Organisational constraints

Organisational constraints were measured using an adapted version of the Organisational Constraints Scale (OCS),[65] which has been used in a number of studies.[96–98] Twelve structural constraints, which were identified during the focus groups as a negative influence on supervisors' ability to fulfil their role, were listed in the questionnaire. These include poor equipment and supplies, organisational rules and procedures, and other personnel (eg operatives, management). Responses were made on a seven-point scale that ranged from 'never' (1) through 'less than once per month' (3) to 'several times per day' (7).

Safety support

Safety-specific support from colleagues and management was measured using an adapted version of the general social support scale.[99,100] The scale was both adapted to be specific to safety and extended to include support from managers and supervisors as well as colleagues. Responses were made on a seven-point scale that ranged from 'very strongly disagree' (1) to 'very strongly agree' (7).

Safety culture

Safety culture was measured using a validated short three-item scale.[47] Responses were made on a seven-point scale that ranged from 'very strongly disagree' (1) to 'very strongly agree' (7).

Visibility

The visibility of supervisors to operatives, and consequently of operatives to supervisors, was measured by asking how often supervisors are visible to their operatives on an average day, and how many hours (on average) supervisors spend on site with their operatives. Responses to the visibility question were made on a scale that ranged from 'once' (1) to 'hourly' (4).*

Demographics

A number of demographic factors were measured, specifically supervisor's age, nationality, trade, length of time in the industry. This section also asked about the role of the supervisor, the number of operatives they supervise, and their employing company.

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* Studies measure visibility through observational methods (eg Luria *et al.*[84]). This method was not an option in the current project and so questionnaire items were developed to capture the same information.

6.1.2 Measurement scales: active leadership validation

In addition to the main measurement scales, two sets of validation scales were included to test the importance of active safety leadership for construction safety. These scales measured passive safety leadership (which was expected to have a weaker (and negative) influence on operatives' safety behaviours compared to active safety leadership) and operatives' safety behaviours (which were expected to be positively related to active safety leadership).

Passive safety leadership
Passive leadership behaviours (eg avoiding safety issues) were measured using a validated scale.[15] Responses were measured on a five-point scale that ranged from 'never engage in these behaviours' (1) to 'always' (5).

Operatives' safety behaviours
Two main classes of operatives' safety behaviours were measured that relate to safety compliance (eg wearing personal protective equipment, complying with safety procedures) and discretionary safety behaviours. Discretionary behaviours were grouped as affiliation (eg helping, looking out for the safety of colleagues) and challenging (eg raising safety concerns, reporting workers who violate safety procedures). Validated scales were used to measure these behaviours.[101,102] These behaviours were measured through operatives' self-reporting on a five-point scale that ranged from 'never engage in these behaviours' (1) to 'always' (5).

6.2 Pilot study

Before the main survey, a pilot study was carried out to test the reliability and validity of the questionnaire measures for the target population (first-line construction supervisors). This pilot study had three parts:

1 A sort task was used in which a sample ($n = 13$) of occupational, industrial and social psychology practitioners and academics were asked to sort newly developed questions into their relative scale (eg role autonomy, self-efficacy) using definitions that were provided.
2 A pilot survey was carried out with 24 supervisor–operative triads (eg 24 supervisors and 48 operatives) using the questionnaire. This was to allow for preliminary reliability and validity checks.
3 A group of supervisors and safety professionals were asked to comment on the content of the questionnaire for clarity of meaning and appropriate word use.

6.2.1 Pilot study results

The pilot study showed that most scales were reliable and valid measures. A small number of questionnaire items were identified as being vague, difficult to understand, or requiring extended response options. These items were changed before the main survey.

6.3 Main survey

6.3.1 Sample

The sample used in the main survey was taken from five construction sites in the north of England. The survey was not confined to a single subcontractor company or a single trade, but included any supervisor that met the inclusion criterion (ie was a first-line supervisor with operatives on site) and was happy to participate in the survey. The inclusion criteria for operatives were that they reported to a supervisor who also took part in the survey, and were happy to participate in the research. Where possible, four operatives were surveyed per supervisor. When this was not possible (for example, if the supervisor was responsible for fewer than four people), all operatives were given the opportunity to participate in the survey. This resulted in two supervisors with one operative, eight supervisors with two operatives, 21 supervisors with three operatives, and 51 supervisors with four operatives. In total, 82 supervisors and 285 operatives participated in the survey.

6.3.2 Data collection

Supervisors and operatives were recruited through opportunity sampling; more simply, they were taken from those available on site during the time of the survey. Both groups were approached and asked to take part in a study on safety in construction. It was stressed that participation would be confidential and anonymous, and information was also provided on the nature of the study and what was required from their participation. On agreement to participate, supervisors and operatives were asked to sign a consent form and were then given a questionnaire by one of the researchers to complete on site (in a conference room) during work time.

Supervisors were asked to complete measures on all individual and organisational factors included in the questionnaire. Operatives were asked to rate their own engagement in safe behaviours and the extent to which their supervisor engaged in specific leadership behaviours. Using operative rather than supervisor reports of leadership behaviours had the advantage of reducing social desirability effects (eg supervisors over-reporting personal engagement in behaviours believed to be desirable) and same-source bias (or mono-method bias). Same-source bias occurs when data on both 'predictor' variables (eg antecedent factors) and 'outcome' variables (eg leadership behaviours) are collected from the same source, and as a result may lead to inflated measures of association between factors. Using a separate source, such as operatives, of data on outcome variables has been advocated as one solution to this potential problem.

Supervisors and operatives completed their questionnaires in separate rooms to ensure that responses were honest and unbiased by the presence of the other group. A researcher was present during the completion of questionnaires to clarify any ambiguity and to collect completed questionnaires.

6.3.3 Survey data analyses

All analyses were carried out using SPSS 17. Data screening was carried out using exploratory data analysis (eg boxplots) and descriptive statistics (eg skewness values and *z*-scores). The scores used in the main analyses were the average responses to the questions that comprised each measurement scale.* The reliability of each scale was tested using item analysis and Cronbach's alpha. Comparisons between independent groups were achieved using *t*-tests (two groups) and Analysis of Variance (multiple groups). Associations between measures were tested using Pearson correlations and analyses identifying the strongest predictor of leadership were carried out using stepwise regression analysis. Regression analysis identifies the factors that have the strongest effect on a criterion (in this case supervisors' safety leadership) when all other factors are controlled. In exploratory analyses, such as this study, a stepwise method is regarded as a suitable approach. Unless specified, a two-tailed test was applied to the results to interpret significant effects or differences. When specific predictions were made, a one-tailed test was used. In all cases, a critical value of $p < 0.05$ was applied to the interpretation of significant results.

* Two exceptions are organisational constraints and personality measures, which are cumulative scales. In the descriptive sections of the results, these have been averaged to make them visually comparable to other scales.

7 Survey findings

Before the main analyses were conducted, the data were screened for missing values, normality and outliers. This process showed that all measures were approximately normally distributed with no significant outliers. Two of the 82 supervisors had more than 10 per cent missing data. These missing values were non-randomly distributed throughout the data and so the two cases were deleted from all analyses. In accordance with this, the responses from the two supervisors' operatives ($n = 8$) were also omitted. In total this left 80 supervisors and 277 operatives in the final sample.

7.1 Sample characteristics

First-line supervisors
Of the 80 supervisors, 75 were male and two were female (three supervisors did not disclose their gender). The average age of supervisors was 42.5 years (SD = 9.05; median = 43). The supervisors had a combined average working tenure in the construction industry of 22 years (SD = 11.08; median = 22), and had worked in the role of supervisor for an average of 8.27 years (SD = 6.72; median = 6). The sample of supervisors represented 41 companies, 27 trades, and seven nationalities (see Table 5 in Appendix 3). In summary, two companies (1 and 3) were over-represented in the sample, as were joiners, bricklayers, heating installers, and British/English supervisors.

Operatives
Of the 277 operatives, 258 were male and three were female (16 did not disclose their gender). The average age of operatives was 36.3 years (SD = 11.03; median = 36). Operatives had a combined average working tenure in the construction industry of 23.8 years (SD = 19.88; median = 20). The average time that operatives had worked with their current supervisor was 9.6 months (SD = 23; median = 3; range = 1 month to 6 years*). The sample of operatives represented 40 companies, 30 trades and seven nationalities (see Table 6 in Appendix 3). In summary, two companies (1 and 3) were over-represented in the sample, as were general operatives, electricians, pipe fitters, and British/English operatives.

7.1.1 Active safety leadership score

Supervisors' engagement in active safety leadership was measured by up to four of their operatives. To check the appropriateness of aggregating individual operative responses to a group level (ie of combining responses into a single score), a within-group interrater reliability statistic, r_{wg},[103] was calculated. The r_{wg} statistic represents the degree of interrater agreement between members of a group. In this case, members are operatives reporting to the same supervisor. Values for this statistic range from 0.00 (no agreement) to 1.00 (complete agreement across members). A value of 0.70 is often considered to be an acceptable level of agreement for aggregation. Across the 80 supervisor groups, r_{wg} ranged from 0.24 to 1.00. Although the mean r_{wg} was 0.81, thus suggesting that aggregation was appropriate, 11 groups had an rwg of < 0.70. To ensure statistical robustness and reliability of the main survey results, we omitted these 11 groups' data from the main analyses.† The reduced data set of 69 supervisors had a mean average r_{wg} of 0.88.

7.2 Active safety leadership and operatives' safety behaviours

The validity (or importance) of supervisors' active safety leadership for construction safety was tested in two ways. First, the leadership scores were correlated with operatives' self-reported safety behaviours to test whether a positive relationship existed. Second, the strength of these associations was compared with those between passive leadership and operatives' safety behaviours. Based on existing research, it was expected that active safety leadership would have a stronger positive influence on operatives' safety behaviours when compared to the negative influence of passive safety leadership. Given these expectations, a one-tailed test was used to interpret the results.

Table 2 shows the statistical associations between operatives' safety behaviours and supervisors' safety leadership. An upward arrow indicates a positive association (ie as one factor increases, so does the other) and a downward arrow indicates a negative association (ie as one factor increases, the other decreases). The strength of these associations can fall in the range 0.00 ± 1.00. A value closer to ±1.00 indicates a strong association between two factors (eg leadership and operative behaviours) and

* One operative reported a working relationship with the current supervisor of 20 years.

† Analysis with the full data set, including groups with $r_{wg} < 0.70$, produced the same pattern of results as the reduced data set.

a value closer to 0.00 indicates a weak relationship. The actual strength of the associations found in the current data is presented next to the arrow.

Table 2
Association between operatives' safety behaviours and supervisory leadership

Operative safety behaviour		Active leadership	Passive leadership
Safety compliance behaviours		↑ 0.64**	↓ –0.47**
Affiliation behaviours	Helping (helping colleagues with safety)	↑ 0.63**	↓ –0.30**
	Stewardship (behaving to benefit others' safety)	↑ 0.66**	↓ –0.38**
	Civic virtue (looking out for others' safety)	↑ 0.52**	↓ –0.23*
Challenging behaviours	Whistleblowing (reporting safety violations)	↑ 0.56**	
	Voice (raising concerns regarding safety)	↑ 0.67**	↓ –0.31**
	Initiating change (making suggestions to improve safety)	↑ 0.65**	↓ –0.35**

Note: Results based on one-tailed test. ↑ = positive association; ↓ = negative association. The figures next to the arrows are the strength of associations (range 0.00 ± 1.00). ** $p < 0.01$; * $p < 0.05$.

Table 2 shows that supervisors' active safety leadership is significantly and positively related to all operative safety behaviours. It has the strongest positive relationship with operatives' voice behaviours ($r = 0.67$; $p = 0.001$) and stewardship ($r = 0.66$; $p = 0.001$), and the weakest relationship with civic virtue behaviours ($r = 0.52$, $p = 0.001$). In contrast, passive safety leadership has a weaker but in most cases significant negative relationship with operatives' safety behaviours. Passive leadership has the strongest negative association with safety compliance ($r = –0.47$, $p = 0.001$) and stewardship ($r = –0.38$, $p = 0.001$).

Regression analyses show that of the two types of safety leadership (which are negatively correlated: $r = –0.68$), active leadership is the strongest predictor of all operative safety behaviours and explains 27–47 per cent of the variation in these measures. These results emphasise the importance of supervisors' active leadership behaviours in shaping operatives' safety behaviours in the construction industry.

7.3 Levels of active safety leadership

The mean level of active safety leadership reported for supervisors on a five-point scale was 3.72 (SD = 0.68). Analyses were carried out to test whether this level of engagement varied as a function of supervisor demographics. In particular, differences were examined between supervisors grouped according to their working tenure in the industry, their tenure in a supervisory role, the number of operatives they supervise, their age and their trade. For ease of interpretation, the 28 trades represented by the sample of supervisors were reduced to three groupings that reflect general building (1), mechanical/electrical (2), and fit-out/finish (3). Analyses showed no significant differences between the leadership scores of the different trades belonging to each group, thus supporting the decision to aggregate the scores across trades in each group. The trades covered by each of these groups are as follows:

- Group 1: banksman, bricklayer, carpenter, concrete, drainage, general operative, window fitter, joiner, logistics, machine driver, plasterer, scaffolder, steel fixer, stores
- Group 2: engineer, electrician, heating, maintenance, mechanical, pipe fitter, plumber, sheet metal, welder
- Group 3: dry lining, flooring, insulator, painter, window insulator.

The levels of active safety leadership reported for supervisors grouped by demographic factor are shown in Figures 1 to 4. In brief, the results show that the highest levels of active safety leadership are reported for supervisors:

- with over 21 years' experience in the industry
- with 3–5 years' experience in the role of supervisor
- with responsibility for more than 15 operatives
- aged 41–45
- working in trades in Group 3 (fit-out/finish).

However, while these groupings score relatively higher than others on measures of active safety leadership, the differences between the groups are not statistically significant on any of the demographic measures (ie $p > 0.05$). These results suggest that the extent to which supervisors engage in active safety leadership is not determined by demographic characteristics. The other antecedents that this research considered, which are outlined in the following sections, are individual and organisational factors.

7.4 Individual and organisational antecedents of active safety leadership

Scale reliability

Before the main analyses of individual and organisational antecedents of active safety leadership were conducted, the reliability of each measurement scale was estimated using Cronbach's alpha. The results (see Appendix 4) show that, with the exception of six scales, most measures have moderate to excellent internal consistency ($\alpha > 0.60$). Ten scales were identified as having one poorly fitting item. These poorly fitting items were removed from their respective scales to improve reliability. Before removing an item, both researchers checked that it could be interpreted as conceptually distinct from the other items that comprised the scale. The six scales that retained their poor reliability related to four dimensions of personality, a single dimension of emotional intelligence, and external locus of control. Based on these low estimates, these scales were omitted from the main analyses. One exception is external locus of control, which has been shown to have reliability estimates comparable with those reported here.[90] Consequently, external locus of control was retained in the main analyses.

Descriptive statistics of the individual and organisational factors measured in the survey are summarised in Sections 7.4.1 and 7.4.2. In Section 7.5 the relationship between these factors and supervisors' active safety leadership is tested. The main predictor of active safety leadership in the sample surveyed is then tested.

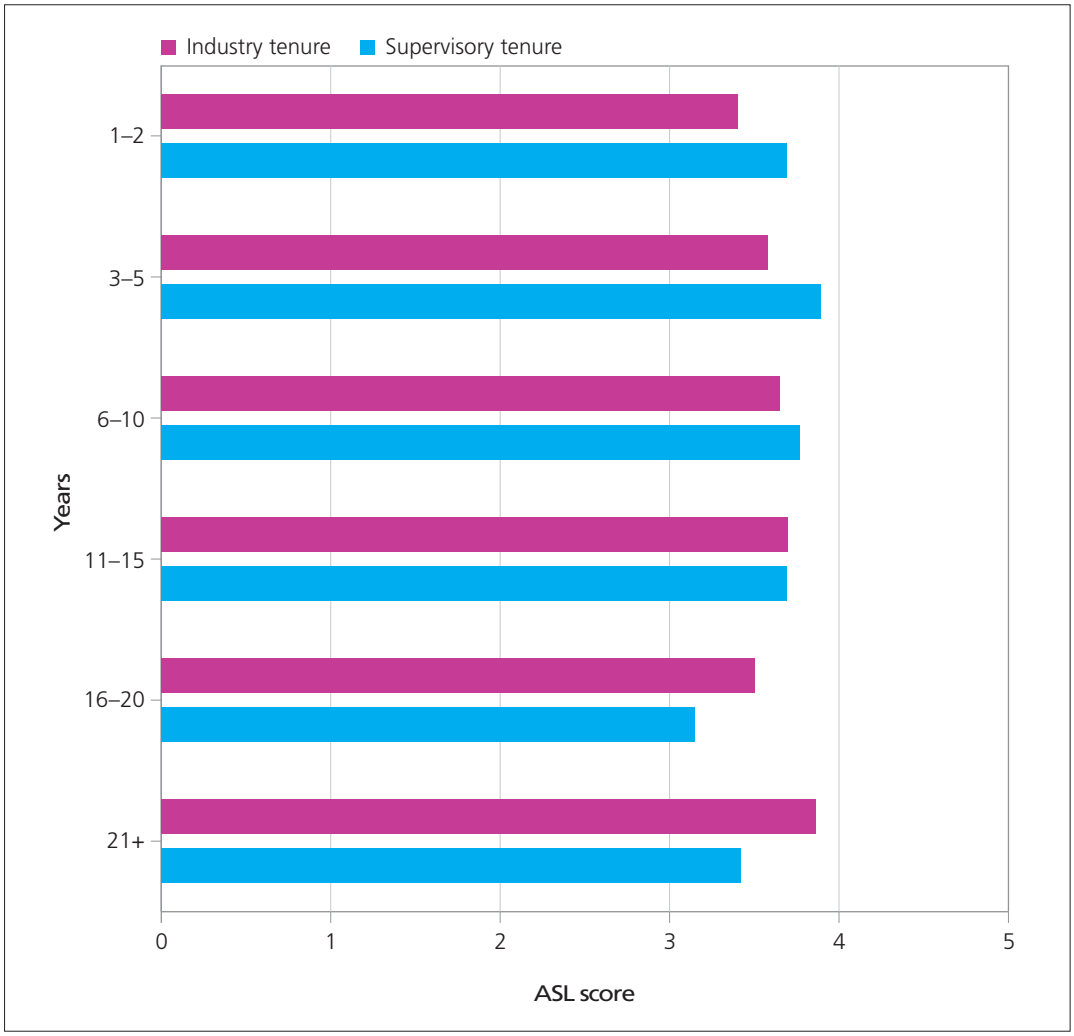

Figure 1
Active safety leadership by industry and supervisory tenure

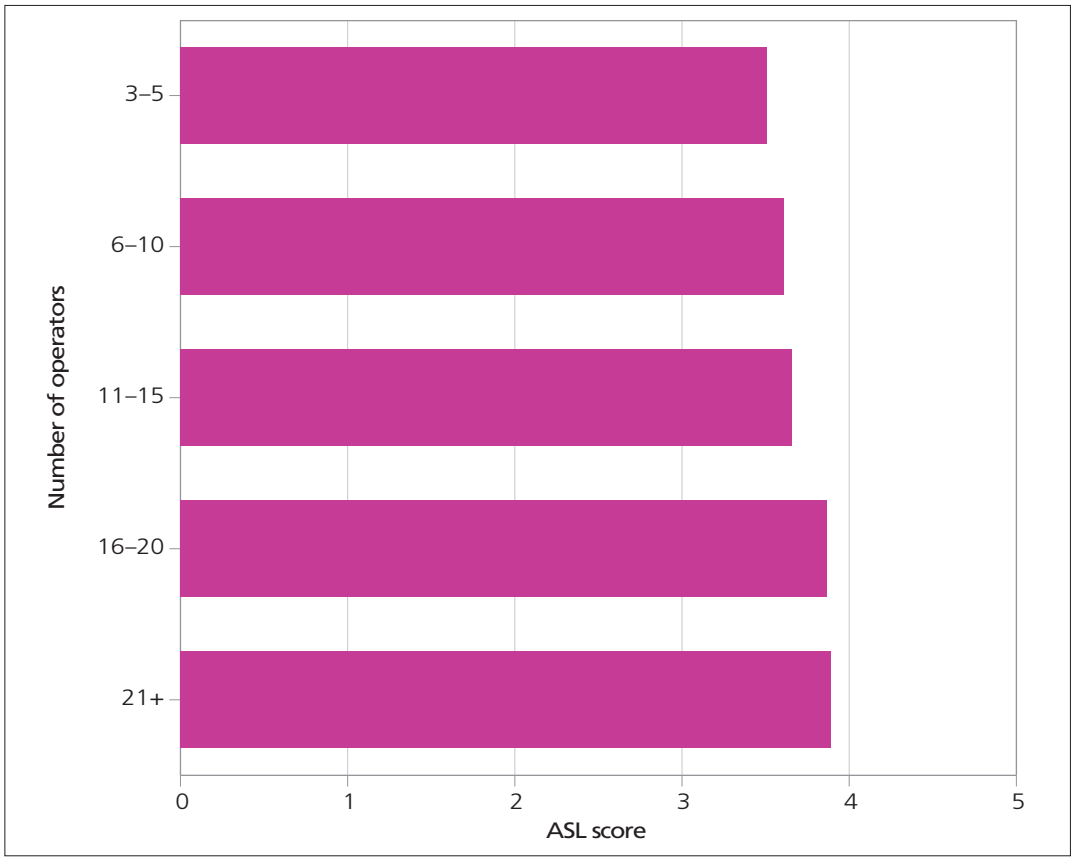

Figure 2
Active safety leadership by number of operatives

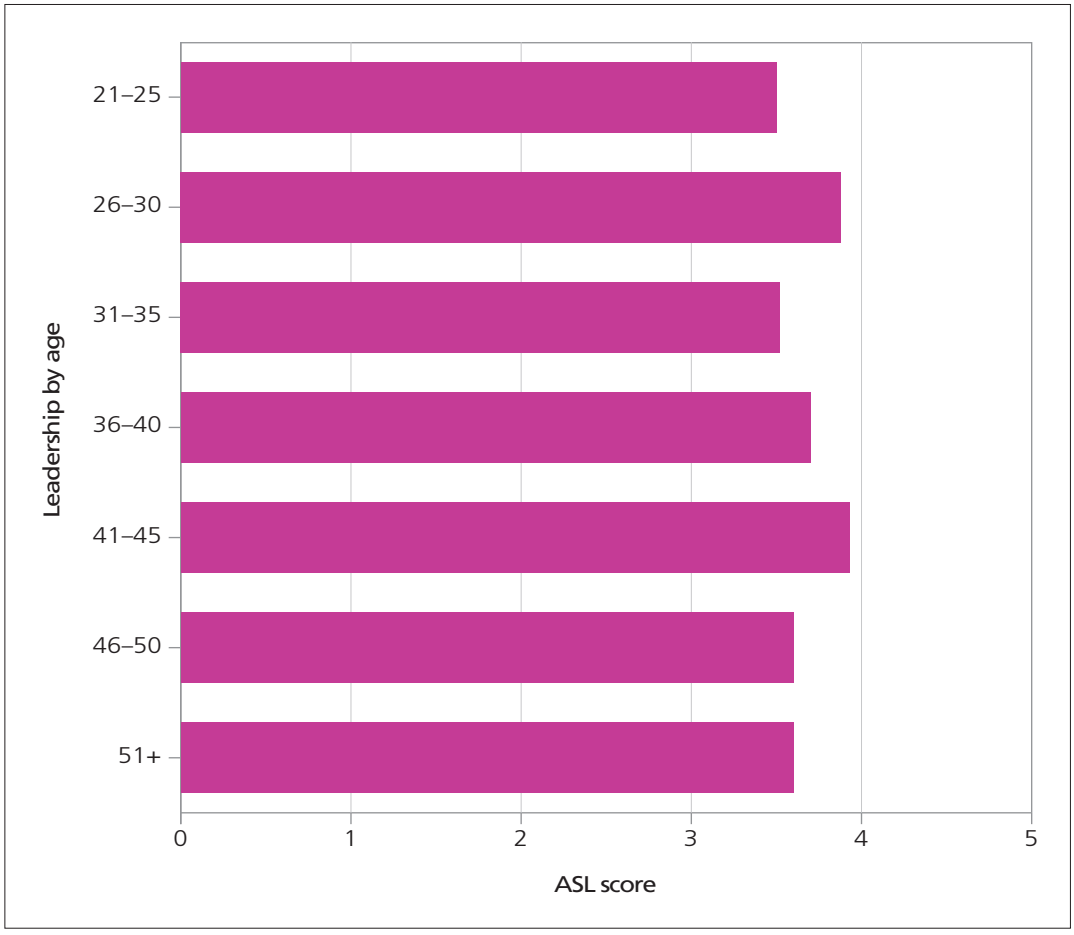

Figure 3
Active safety leadership by age

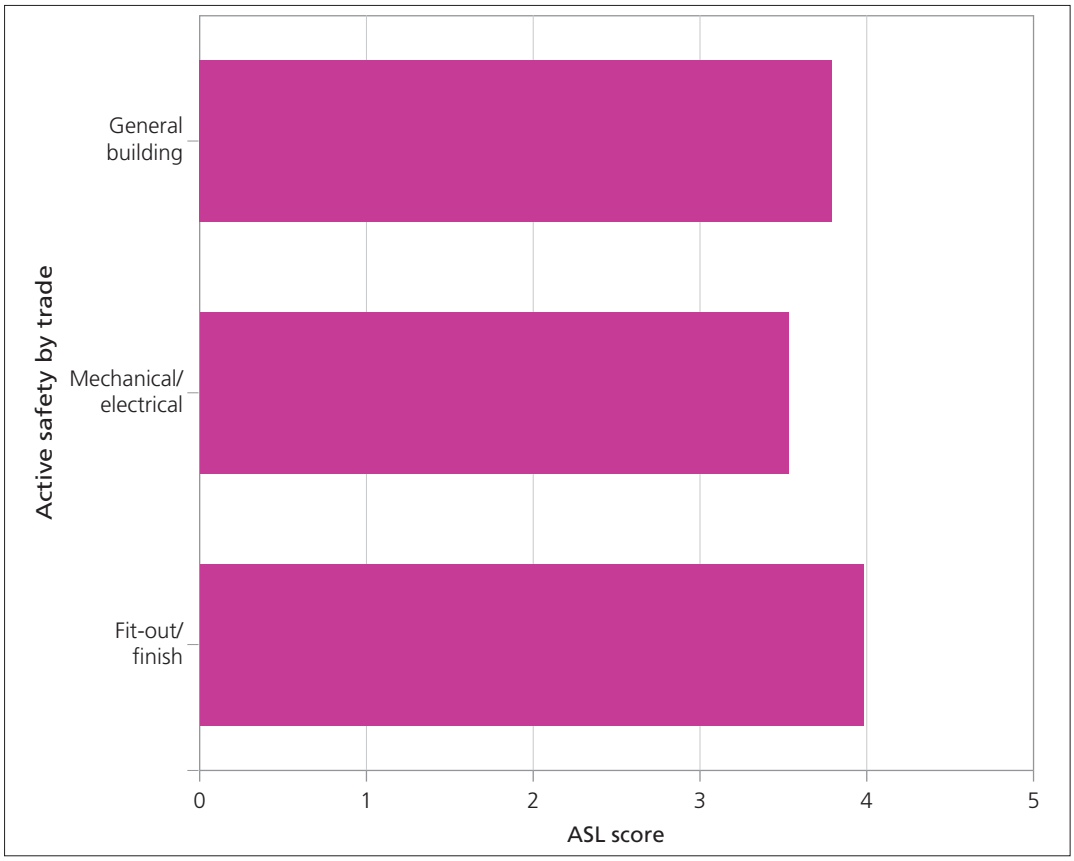

Figure 4
Active safety leadership by trade

7.4.1 Individual factors

Figures 5, 6 and 7 show average personality, emotional intelligence, self-efficacy, locus of control, and motivation scores for supervisors. Table 3 documents supervisors' accident experience. In summary, the results show that:

- supervisors score highest on agreeableness (personality measure) and using emotions to shape behaviour (emotional intelligence measure)
- supervisors report the most confidence (self-efficacy) in promoting safety compliance among operatives, and the least (although by no means low) self-efficacy in getting operatives to prioritise safety when production pressures are high
- supervisors agree that accidents can be avoided (internal locus of control) and disagree with the notion that accidents are due to fate (external locus of control). Of the different forms of motivation, supervisors agree most strongly that they try to maintain and improve safety because they hold safety as a personal value and because it is intrinsically important to them (eg challenging and interesting). They are least motivated by colleague recognition
- around half of the sample of supervisors have experienced an accident or near miss on site, or have witnessed another person having an accident. The median number of personal accidents is 1 (range = 1–6) and the median number of personal near misses is 1 (range = 1–13). A significantly smaller number of supervisors have witnessed a fatal accident on site (18 per cent), with most of these supervisors reporting a single experience. (It was not clear from the data whether these fatal accidents referred always to different events or in some cases to the same event.)

Table 3
Supervisors' reported accident exposure

Accident measure	Agreement frequency	%
Accident experience on site	28	41
Near-miss involvement on site	37	54
Witnessed a fatal accident on site	12	18
Witnessed someone else have an accident on site	40	60

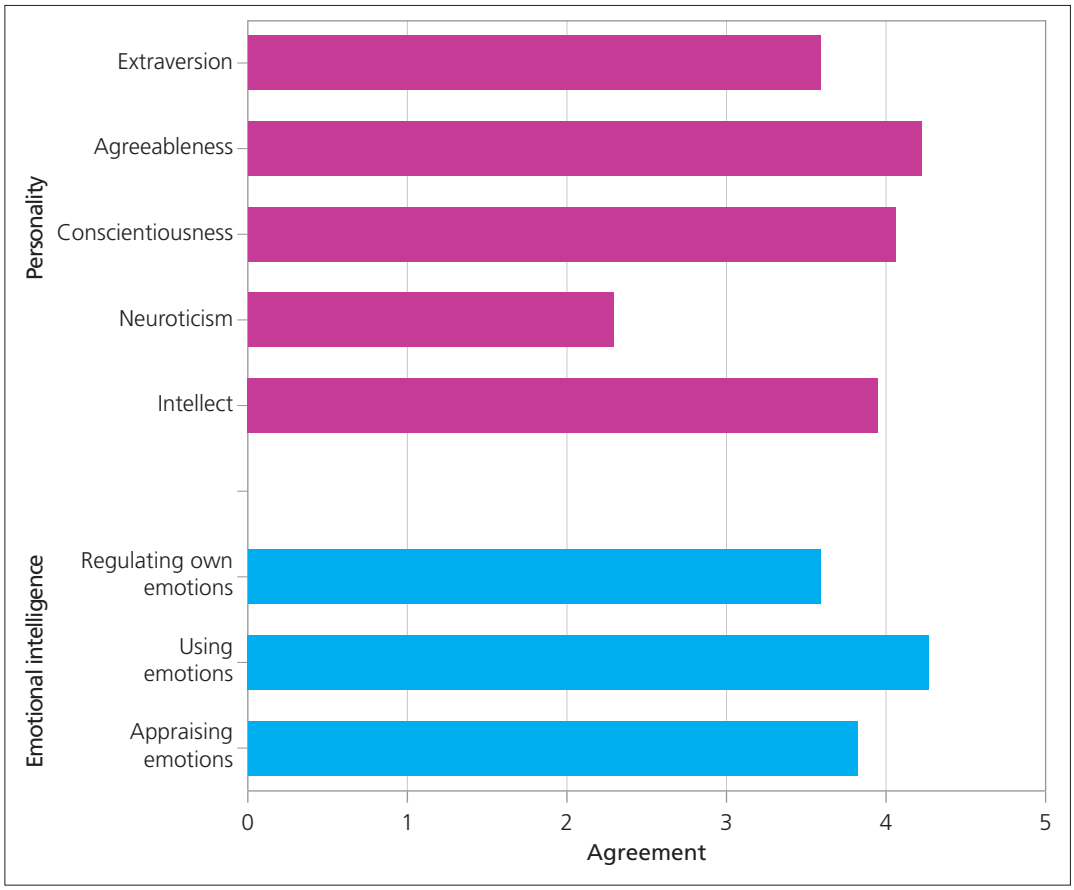

Figure 5
Supervisor personality and emotional intelligence scores

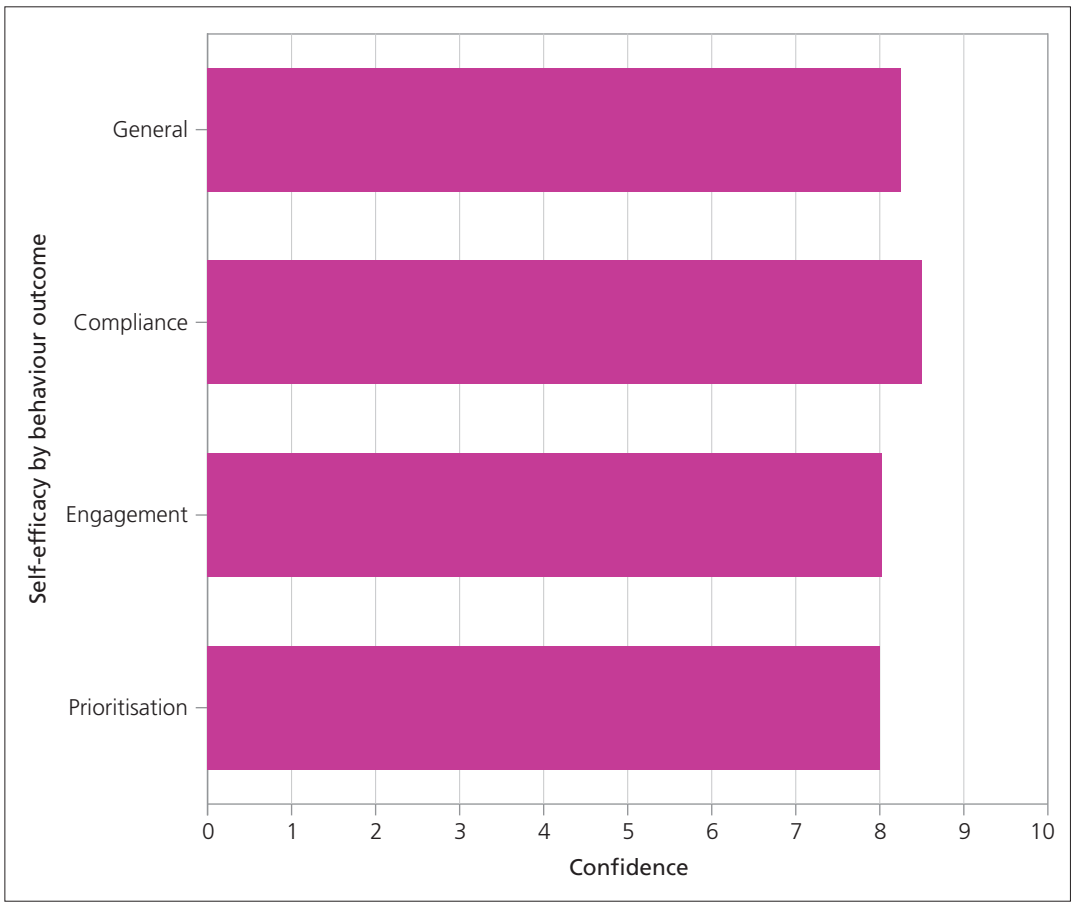

Figure 6
Supervisors' levels of self-efficacy to influence operatives' safety behaviours

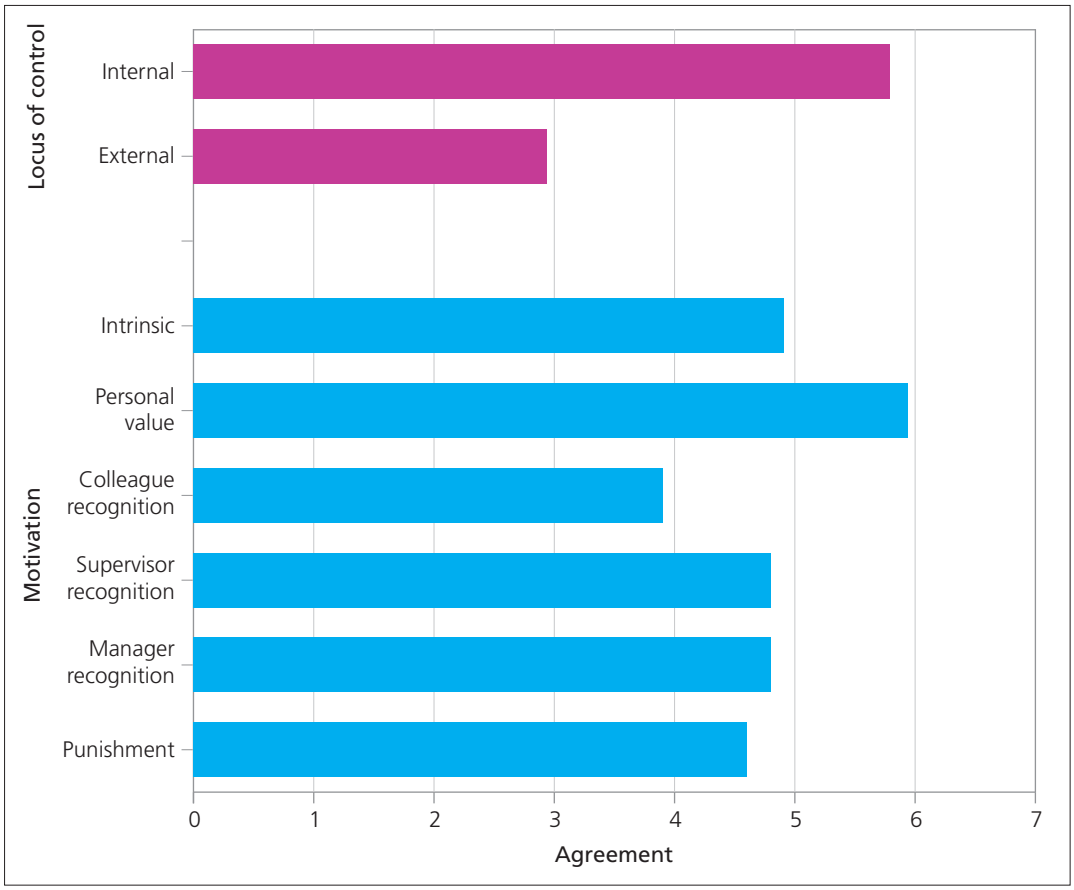

Figure 7
Average levels of locus of control and types of motivation

7.4.2 Organisational factors

Figures 8, 9 and 10 show average levels of role demands and control, organisational structural constraints, and support. In summary, the results show that:

- supervisors experience occasional role conflict and overload, but they frequently experience control over their contribution to risk reduction and autonomy in the way that they lead on safety
- supervisors experience organisational constraints relatively infrequently. With the exception of subcontractor and migrant workers' safety attitudes and task information, other constraints occur less than once monthly. The former constraints occur twice a month on average
- supervisors express positive attitudes towards receiving social support for safety, and about the main contracting company's safety culture (ie management commitment to safety)
- supervisors report that they are visible to their operatives several times a day, which correlates with operatives' ratings ($r = 0.30$). Operatives report a lower frequency of supervisor visibility, which corresponds to the fact that supervisors are responsible for a number of operatives and so may not be visible to all operatives at any one time.

7.4.3 Supervisor–operative alignment

To establish whether supervisors' engagement in active safety leadership was affected by their degree of shared company, nationality or trade identity with their operatives (ie group alignment), group comparisons were carried out. Four levels of group alignment were compared:

1. supervisors share a (company, trade, nationality) identity with all of their operatives
2. supervisors share a (company, trade, nationality) identity with all but one of their operatives
3. supervisors share a (company, trade, nationality) identity with only one of their operatives
4. supervisors do not share a (company, trade, nationality) identity with any of their operatives.

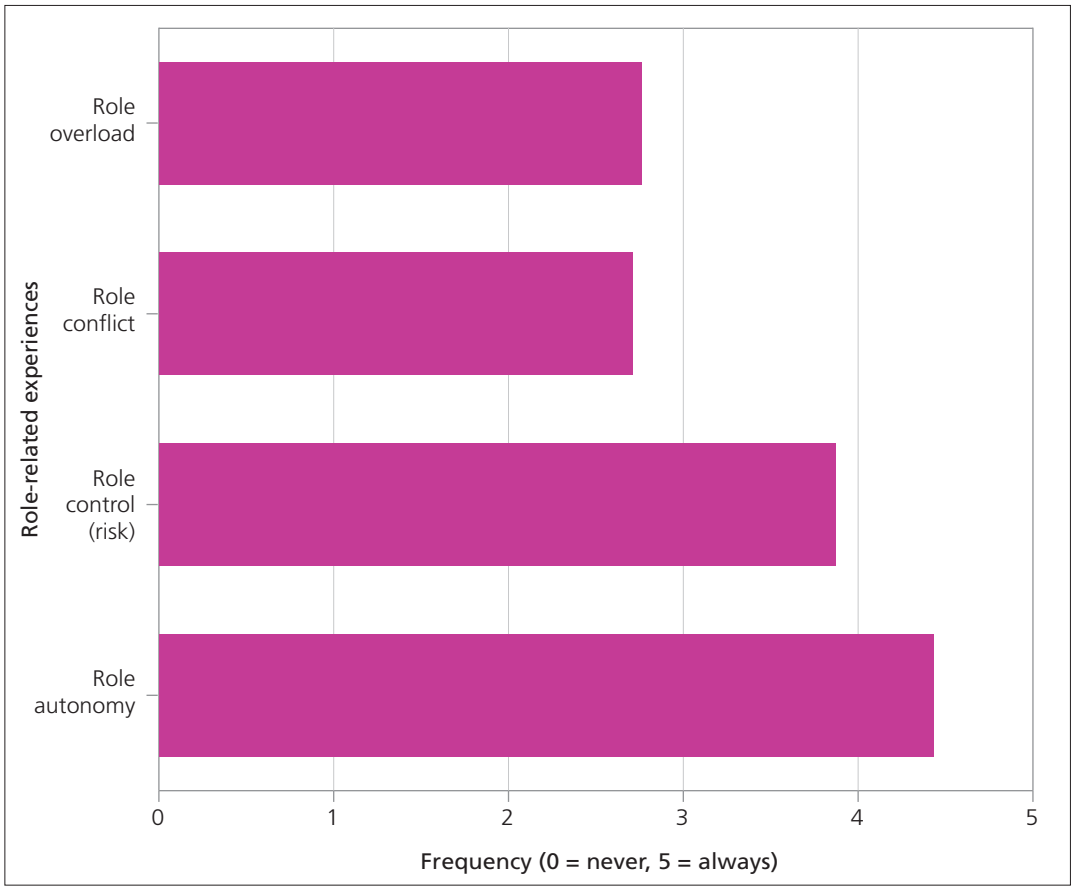

Figure 8
Frequency of role-related experiences

These four groups are labelled strong alignment (1), semi-strong alignment (2), weak alignment (3), and no alignment (4). The level of active safety leadership in each condition is shown in Figure 11. This shows the highest engagement in active safety leadership from supervisors with a shared company and national identity with only one of their operatives (weak alignment), and those supervising a group of operatives all from a different trade (no alignment). The levels reported across all groups are relatively similar, with analyses showing no significant differences for company alignment, $F_{(3,68)} = 0.44$, $p = 0.72$; trade alignment, $F_{(3,68)} = 0.67$, $p = 0.57$; or nationality alignment, $F_{(3,68)} = 2.10$; $p = 0.11$.

7.5 Correlates of active safety leadership

Correlation analysis was carried out to identify the individual and organisational factors to which active safety leadership is significantly and directly related. The results show that supervisors' active safety leadership, as measured by operatives, has a positive association with supervisors' reported role autonomy ($r = 0.26$, $p = 0.029$) and the number of hours that supervisors spend on site with their operatives ($r = 0.24$, $p = 0.046$).

7.5.1 Significant predictors of active safety leadership

Regression analyses were carried out to identify the strongest direct and indirect predictors of supervisors' active safety leadership when all other factors are controlled. Before proceeding to the results, an important caveat must be noted in connection with the use of the term 'predict' in this section. All measures (antecedents and supervisors' leadership behaviours) were collected at the same time; therefore the term 'predict' should not be taken to mean that a given factor X *caused* the future behaviour Y. Rather it should be interpreted as the factor that has the strongest association with the behaviour, and which might be expected to produce the biggest change in supervisors' active safety leadership if it were altered.

Direct predictors

A regression model was tested in which significant correlates of active safety leadership (role autonomy and number of hours on site with operatives) were predictor variables and the active safety leadership score was the criterion (outcome) variable. The results show that role autonomy is the only

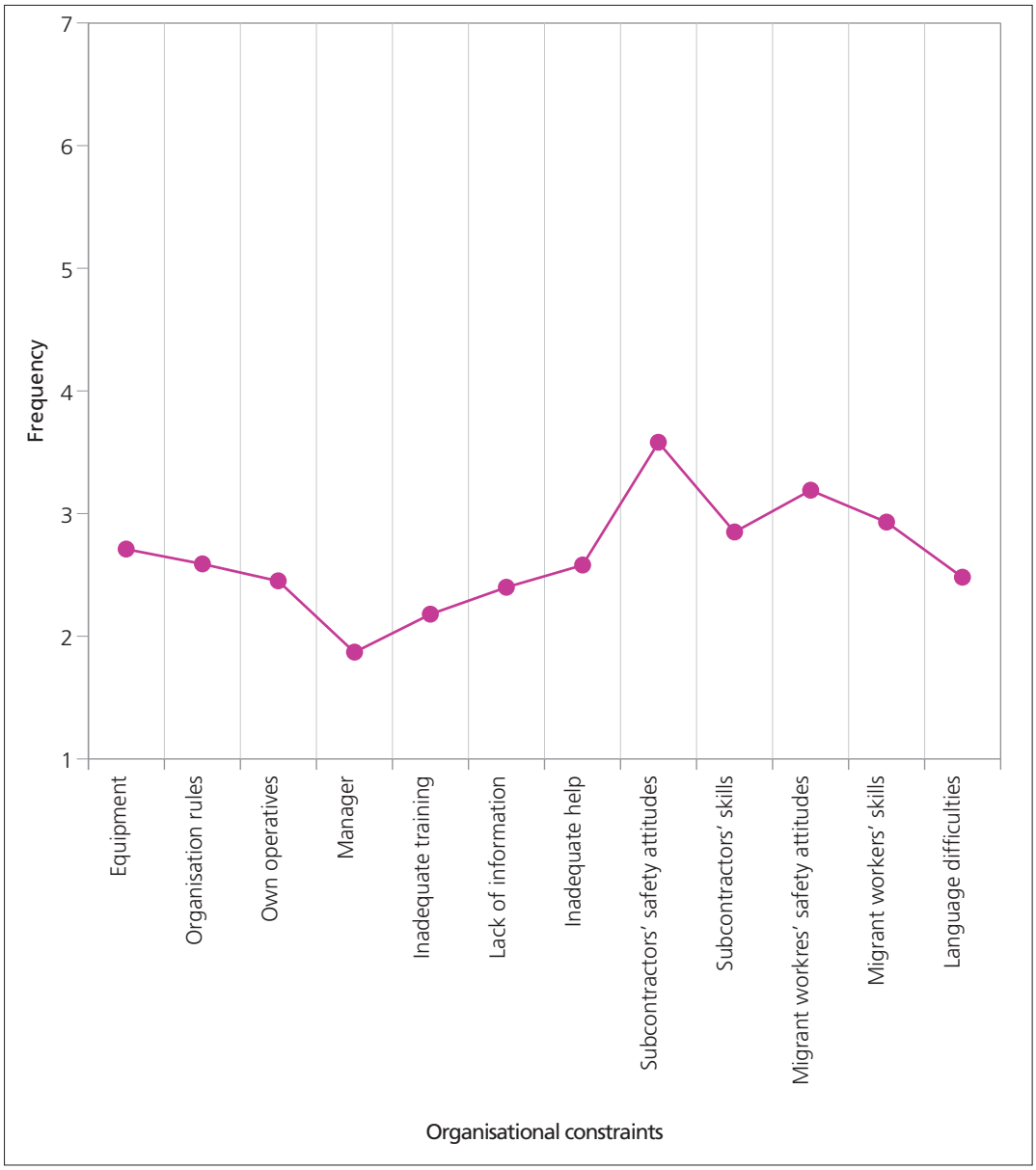

Figure 9
Frequency of organisational structural constraints

significant predictor of supervisors' engagement in active safety leadership when both predictors are considered together. Role autonomy explains 7 per cent of the variance in active leadership behaviours.

At a theoretical level, the small amount of variance accounted for by role autonomy suggests that other variables, not measured in the survey, are affecting leadership behaviours. These may relate to individual factors (such as personality dimensions, measured using reliable scales), or specific measures of production pressure, such as the emphasis given to this by management. At a statistical level, the relatively small percentage of variance may be due in part to the fact that role autonomy and leadership were measured by different sources (ie supervisors and operatives respectively), which is known to reduce the strength of associations and the ability of a predictor to explain an outcome to a large percentage.

Indirect predictors

A second set of analyses was conducted to identify indirect predictors of active safety leadership. Indirect predictors are factors that influence role autonomy, and consequently active safety leadership. Factors that are significantly correlated with role autonomy are shown in Table 4. Upward arrows indicate a significant positive association and downward arrows indicate a significant negative association. The exact strength of the associations and level of significance is shown next to the arrow.

Figure 10
Average attitudes regarding social support and safety culture

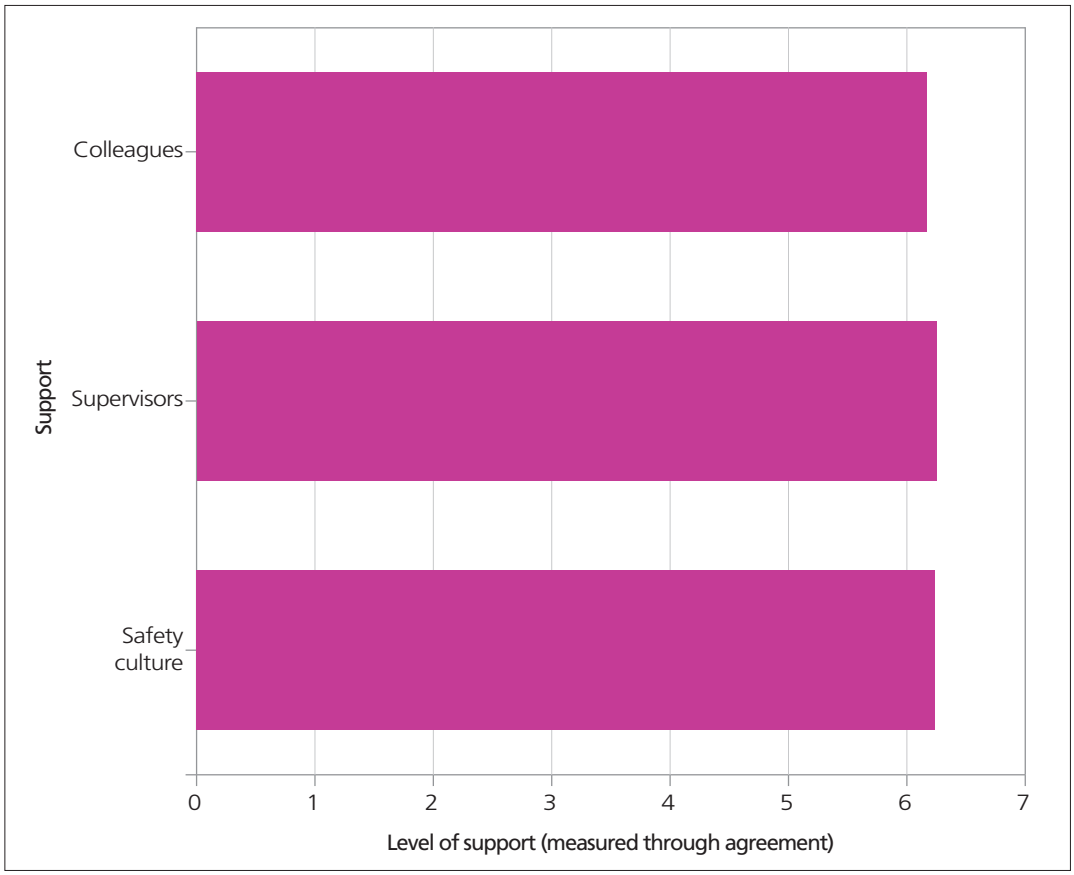

Figure 11
Active safety leadership by group alignment

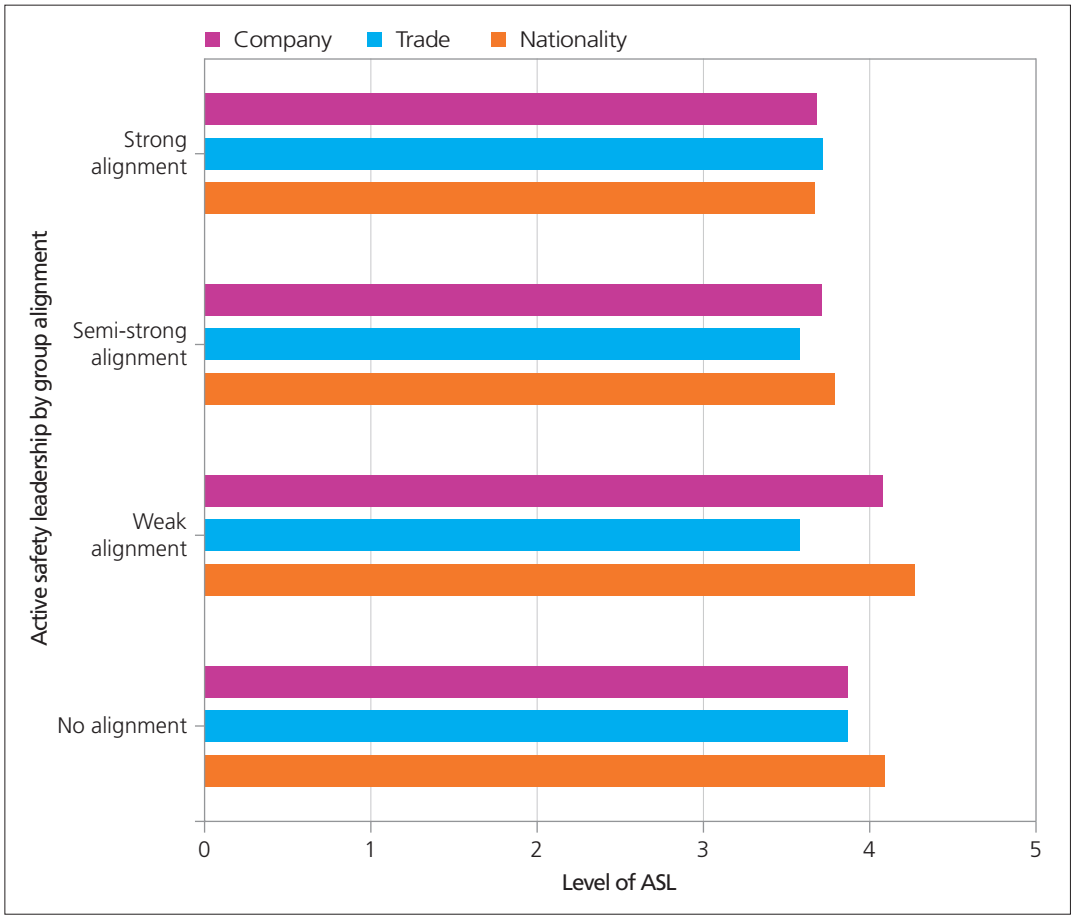

Table 4 shows a number of factors that are significantly associated with role autonomy. Of these factors, a regression analysis shows that supervisors' role autonomy is significantly predicted by support from colleagues, $\beta = 0.36$, $p = 0.01$, and organisational constraints, $\beta = -0.28$, $p = 0.02$. Support from colleagues increases supervisors' feelings of role autonomy and organisational constraints decrease supervisors' feelings of role autonomy. Together, these two factors explain 26 per cent of the variance in supervisors' reported role autonomy. A diagram of the pattern of results suggested by the regression analyses is presented in Figure 12.

Table 4
Association of role autonomy with antecedent factors

Antecedent	Role autonomy
Individual factors	
P: Intellect	
EI: Mood regulation	
EI: Using emotions	
SE: General safety	↑ 0.37*
SE: Engagement in safety	↑ 0.37**
SE: Prioritise safety	↑ 0.37*
SE: Comply with safety	↑ 0.28*
External locus of control	↓ –0.29*
Internal locus of control	↑ 0.29*
M: Intrinsic motivation	
M: Personal value	
M: Colleague recognition	
M: Supervisor recognition	
M: Manager recognition	
M: Punishment	
Accident experience	
Near-miss experience	
Organisational factors	
Role conflict	↓ –0.34**
Role overload	
Role control (risk)	
Role autonomy	
Organisational constraints	↓ –0.38**
Safety support: colleagues	↑ 0.48**
Safety support: supervisors	↑ 0.47**
Safety culture	↑ 0.41**
Visibility	

Note: Arrows indicate significant correlations. ↑ = positive association; ↓ = negative association. The figures next to the arrows are the strength of associations (range 0.00 ± 1.00).
** $p < 0.01$; * $p < 0.05$.

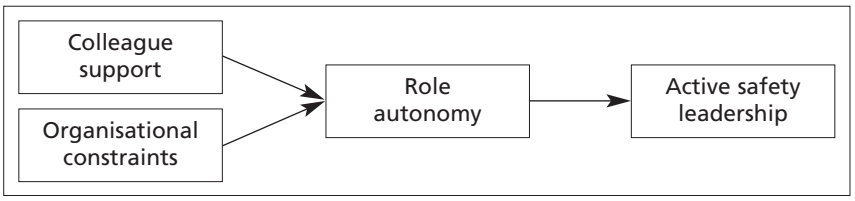

Figure 12
Pictorial representation of main results

8 Discussion and conclusion

The aim of the research was to identify the factors that affect construction supervisors' active safety leadership behaviours (eg coaching operatives on good safety, encouraging operatives to voice their concerns about safety, adopting a consultative rather than directive approach, and recognising and praising good safety). The term 'active safety leadership' has been used for simplicity, and to reflect the proactive and energising nature of these behaviours. In leadership theory, this style defines transformational safety leadership and high quality supervisor–employee relationships.

To address the main research aim, the research had several sub-objectives, which sought to:

- explore supervisors' perceptions of the factors that affect active safety leadership
- measure the prevalence of these factors in the construction industry
- establish the relative importance of these factors in shaping leadership behaviours
- test whether levels of active safety leadership are affected by the degree to which supervisors' share a company, trade or national identity with their operatives.

To achieve the research aim and sub-objectives, several supervisors were recruited from different construction projects (primarily building and restoration) in the north of England to participate in focus groups or an on-site survey. Each method focused on a number of individual (human) factors (eg emotional intelligence, self-efficacy) and organisational factors (eg role demands, social support), which previous theories suggested might have an impact on supervisors' safety leadership behaviours. In general, the two phases of data collection produced a consensus in factors that significantly influence supervisors' leadership behaviours. Some of these factors map onto findings reported in the literature, while others do not. These findings are discussed in the following sections.

8.1 Perceptions of leadership antecedents

Supervisors' perceptions of the factors that affect active safety leadership were explored through a number of focus groups. This allowed differences in perspectives and experiences between supervisors from different trades and companies, and those with different supervisory experiences, to be identified and explored. The results of these group discussions showed that despite the diversity in supervisor characteristics, a general consensus existed in the perceptions of factors that have an important influence on supervisors' ability to engage in active safety leadership.

Across all of the focus groups, supervisors emphasised the influence of organisational factors on leadership behaviours. In particular, they stressed role demands (overload and conflict) and role autonomy. In most cases, the problems of having high or low levels of these factors were emphasised. For instance, supervisors stressed that multiple responsibilities (eg managing paperwork and on-site activity), managing both production and safety, and having low levels of autonomy over the way that operatives' safety is supervised were seen as factors that hinder the ability to engage in active leadership behaviours. Factors that were implicated as potential moderators of these negative effects were support from operatives (in the form of positive safety attitudes and greater safety awareness) and support from colleagues.

Factors that were discussed relatively less frequently were found at an individual level. Supervisors discussed the potential impact of accident exposure and its positive relationship with engagement in safety. There was also the implication that active safety leadership was related to supervisor motivation. It was suggested that supervisors motivated by monetary factors (eg price work) engaged less in active safety leadership than those who held safety as a personal value. With the exception of these two factors, and the influence of habitual behaviour, no other individual level factors emerged with any salience during the focus groups.

On the surface, the findings from the focus groups failed to support the dominant perception in the leadership literature that individual factors play a main role in leadership behaviours. Analyses of the focus group discussions suggest that safety leadership is more likely to be a product of the situational demands placed on supervisors and their freedom to navigate their environment and the challenges it poses. For the supervisors involved in the focus groups, situational factors played a stronger role in shaping the frequency of their leadership behaviours than did their personal disposition.

A closer inspection of the results, however, suggests that the relative prominence of organisational factors may partly reflect the methodology used. More specifically, focus groups have the potential to

evoke external rather than internal attributions of behaviour, especially when behaviours occur less frequently than desired. Consequently, it is possible that the supervisors referred to tangible aspects of organisational life as a reason for their engagement (or lack thereof) in active leadership behaviours. This possibility was not controlled for in the focus groups, in keeping with the desire to make these discussions as free-flowing as possible. However, it was a limitation that was addressed in the questionnaire survey. Here, supervisors were asked to respond to a number of individual and organisational measures. The fact that their operatives rated their leadership behaviours further increased the objectivity in any associations that emerged.

8.2 Main predictors of active safety leadership

The results of the survey offered support to the general findings from the focus groups. Organisational factors emerged as more influential in shaping supervisors' engagement in active safety leadership than did individual factors. The immediate antecedents of supervisors' engagement in active safety leadership were their perceived role autonomy (freedom to control how they supervise operatives) and the number of hours they spend on site with operatives. The latter finding is not a new one,[84] but emphasises the importance of frequent contact between supervisors and operatives in encouraging active leadership. Through frequent contact, supervisors are able to develop relationships with their operatives that encourage open communication and constructive criticism. Regular contact also allows supervisors to identify operatives' needs and coach them in these areas.

The suggestion that an increase in contact between supervisors and operatives is associated with an increase in supervisors' engagement in active safety leadership poses potential challenges for the industry. During the focus groups, supervisors discussed factors that reduce their time on site, in particular paperwork associated with new policies, and the problems this creates for engaging in active safety leadership behaviours. The implication in these discussions was that initiatives designed to improve safety have the potential to harm safety if they require paperwork to be completed. The conflict between paperwork and on-site activity was not explicitly explored in the questionnaire survey and could be a focus of future research. More specifically, further work could focus on whether a relationship between paperwork and leadership exists, and if so, what steps might be taken to ensure that paperwork is completed more efficiently and with minimal impact on the time that supervisors spend on site.

Although important, the impact of contact between supervisors and operatives was secondary to the importance of role autonomy. The results from the survey showed that role autonomy was the strongest immediate antecedent of supervisors' engagement in active safety leadership behaviours. As supervisors perceive more control over how they supervise operatives, they show an increase in the extent to which they engage in active safety leadership behaviours. The relationship between autonomy and job involvement has been shown by others[104,105] and may be explained through basic psychological needs. Autonomy is often presented as a basic psychological need, which, when satisfied, leads to greater involvement in an activity.[106,107] Individuals who can freely choose to pursue an activity, and who can also master the activity and have significant support from others, are more likely to engage in an activity as they find it intrinsically satisfying and enjoyable. When an activity becomes externally driven (or controlled by external forces), an individual's interest in it reduces and so does their engagement in it.

The current study showed support for this theory. In particular, the findings highlighted the importance of autonomy and social support in supervisors' engagement in an activity (specifically leadership behaviours). The absence of any significant effect of competence is likely to be due to the absence of an objective or subjective measure of this in the questionnaire survey. In relation to social support, the results showed support from colleagues to be particularly important. Although traditionally support and commitment from management has been implicated as the strongest influence on workplace safety,[108] emerging research is showing that an important role is played by colleagues.[71,109] The results of this research support this emerging conclusion. For the supervisors involved in this study, colleague support for safety played a stronger role in shaping their perceived role autonomy than support from their own managers. One possible explanation for this finding is that supervisors interact more regularly with their colleagues than with senior management. As their colleagues are responsible for teams that they work alongside, their support would be immediate, necessary for the successful completion of tasks, and imperative to ensuring jobs are completed safely. When this support is low, supervisors may experience this as an extra demand placed on them (negotiating safety with colleagues or their operatives), which will reduce feelings of autonomy, support and possibly the effort needed to inspire and motivate operatives to engage in safety.

A second, and somewhat weaker, influence on supervisors' perceived role autonomy was the salience of organisational constraints. Organisational constraints are characteristics in the workplace that are often beyond an individual's control but affect their behaviour – in this case, safety leadership. The most frequent organisational constraints reported by the sample of supervisors involved in this research were subcontractor and migrant employees' safety attitudes and skills, and organisational rules and procedures. These findings are consistent with documented research, which identifies these two groups as having a strong, and often negative, impact on safety in construction.[78] They also offer some support to the focus group findings that procedures may reduce supervisors' engagement in active safety leadership. The main example of this that emerged from the focus groups concerned the effects of disciplinary procedures. Other procedures that fall into this category (ie that are potentially counterproductive to safety), are worthy of further investigation.

While the current research identified significant correlates of active safety leadership, these were few in number. Further, the results showed that the immediate antecedent of leadership accounted for only a small percentage of the variance. While this finding should not reduce the importance attached to this finding (as any increase in safety leadership is likely to bring improvements in workplace safety), it does suggest that other factors, which were not captured in the survey but possibly emerged in the focus group discussions, play an important role. Future research should seek to expand the measures used in this study to offer more coverage. Potential areas include a specific measure of production pressure, an objective measure of training received in a leadership and supervisory role, and more reliable measures of personality and other individual factors (see below).

8.3 Study limitations

The research reported here had a number of limitations that should be addressed. First, the questionnaire survey relied on cross-sectional data that were largely the result of self-reporting. One concern with this type of data is that 'prediction' in its truest sense cannot be established, as this requires longitudinal data. The context of the current research (construction) makes longitudinal studies difficult, because of the transient nature of the workforce and the large representation of contractor company personnel. Although 'prediction' in its truest form could not be tested here, the results of the correlation and regression analyses identified clear factors that have a relationship with the frequency of supervisors' engagement in active leadership behaviours. It is quite possible that these same factors would emerge as significant influences in longitudinal studies, especially as role autonomy has been shown in a number of other studies to be an immediate antecedent of behaviour.

Second, the results identified a number of measurement scales that suffered from poor reliability. These related to personality traits, emotional intelligence and, to a lesser extent, external locus of control. While low levels of reliability have been reported for external locus of control in other studies, measures of personality have been shown to perform reliably in other contexts. The reason for their poor reliability in the current research is unclear. Future research would benefit from either identifying and correcting the reason for these scales' poor reliability, or identifying a more reliable measure of personality for this sample. By doing this, it will be possible to have a more valid test of the role of personality in construction supervisors' safety leadership.

Third, the study was conducted in the construction industry, which may limit the extent to which the results may be generalised to other contexts. The fact that the results of this research share similarities with those reported in the general literature adds some support to the probability that the results will transfer to other industrial contexts. This is supported by the fact that the factors that were shown to be the strongest predictors of leadership behaviours in this study (eg role autonomy, social support and organisational constraints) are not unique to the construction industry.

Fourth, and related to the third limitation above, the sample comprised mostly English employees and supervisors, which may restrict the findings to this sample. Provisional results shown in this report suggest that nationality did not affect safety leadership behaviours in a significant way. However, this was based on only a small number of non-English participants, and consequently it should be interpreted with caution. Future research would benefit from testing the effects of nationality on active safety leadership and its antecedents in a sample where different nationalities are reliably and more evenly represented.

8.4 Conclusion

Overall, the research reported in this report suggests that the extent to which supervisors engage in active safety leadership depends on their role autonomy and the number of hours they spend on site with operatives. Role autonomy, the more important influence of the two, is promoted through

colleague support and reduced by organisational constraints. Somewhat promising is the finding that factors that increase role autonomy are more powerful influences than those that reduce it. The implication of these findings for safety is that accidents may be reduced through the development of environments defined by supportive colleague relationships. These types of relationship were discussed in the focus groups as developing over a period of time. While this may be difficult to achieve in the construction industry, owing to the transient workforce, it is a goal worth pursuing.

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Appendix 1 – Definitions of terms

Accident experience	Witnessing on-site accidents or personal involvement in accidents
Emotional intelligence (EI)	Awareness and use of self and other emotions to guide behaviour
• Optimism/mood regulation	Regulation of emotion in self and others; using emotion positively
• Utilisation of emotion	Utilisation of emotion to solve problems
• Appraisal of emotions	Appraisal and expression of emotions in self and others
Experience	Measured in terms of number of years worked in the construction industry and as a supervisor
Locus of control (LoC)	Supervisors' perceptions of their control over safety events
• Internal LoC	Belief that events (eg accidents) are under individual control
• External LoC	Beliefs that events (accidents) are due to chance or fate
Extrinsic motivation	Behaviour driven by external sources (eg pay, avoiding punishment)
Intrinsic motivation	Behaviour driven internal sources (e.g., satisfaction, enjoyment)
Near miss	Any incident that occurs which could have resulted in a person being hurt or injured had the circumstances been slightly different
Organisational constraints	Factors within the organisation which restrict the way supervisors lead on safety, such as inadequate training, poor equipment or supplies and inadequate help from others
Personality	Individual traits and characteristics
• Extraversion	Positive, ambitious, influential, values personal relationships, enjoys change
• Neuroticism	Negative future view, anxious, likely to attend to negative emotions
• Openness to experience	Creative, imaginative and insightful
• Conscientiousness	Disciplined, hard-working and with high levels of integrity
• Agreeableness	Co-operative, trustworthy and considerate to others
Role autonomy	Freedom to personally decide how to supervise operatives' safety
Role conflict	Different and incompatible demands placed on supervisors
Role control (risk)	Opportunity to determine methods that reduce risk (eg method statements)
Role overload	Excessive work demands placed on a supervisor
Safety compliance	Complying with safety rules and procedures in order to maintain a safe working environment
Safety culture	Shared attitudes or values that the organisation holds about safety
Safety recognition	Recognition from management or the organisation for good performance on safety
Safety support – colleagues	Support on safety issues from colleagues
Safety support – management	Support on safety issues from management
Safety support – supervisors	Support on safety issues from supervisors
Self-efficacy	An individual's belief in their ability to complete a task or engage in a particular behaviour

Subculture	Subset of organisational groups who have shared sets of meanings which may differ from the predominant organisational culture
Supervisor visibility	Level of visibility (physical proximity and actual visibility) of supervisors to operatives

Appendix 2 – Example quotations from focus groups

Experience	It's somebody who's basically comes from the ground, learnt their trade, worked with the lads, worked with various different trades, you have a laugh with the lads. It's just experience and with experience you gain respect.... It's all about respect, being a good supervisor, good listener, good communicator. (FG1) Somebody with experience can minimise the risk, although they're not exactly doing it to the letter of the law; when you've got experience you can minimise the risk. (FG7)
Accident exposure	I think it's actually when you see an accident right in front of you. That's one of the biggest things. (FG10) It makes you more aware of the seriousness of it. I mean I've watched a guy fall through a hole about 40 foot above and he landed on the concrete just in front of me. And it makes sure that you don't stand on a piece of wood that's covering a hole, well you don't stand on a piece of wood in case there's a hole underneath it. It does make you aware when you've seen a man with broken legs and ribs. (FG2) I've seen two fatalities in this game, in this business. I was stood four feet away from one of them when it happened, so it certainly changed my life. (FG1)
Habit	Like we're the dinosaurs amongst us, who are used to doing it this way. It's very hard to change your habits. (FG2)
Role demands/role conflict	The pressure you're under of getting the job done. You may think you're the best safety man but if you've got someone roaring and shouting at you to get the job done, there's fines of x amount of pounds coming your way, you'll find some way of getting that job done. (FG7) The closer you get to handover period, you find that everyone's getting pushed for time and rushing around and there's more people working in an area than there usually would be. And then that slows things down and it can put pressure on, you know, whether it's safe now. (FG9) Now with your health and safety, you're doing everything right on that, you're doing well and that, that's ... that's grand. You'll still get shouted at for missing your programme. (FG10)
Role overload	There's a helluva lot of responsibility. I mean, when you're the supervisor, you're the supervisor, you're the nursemaid, you're the babysitter, you're the trainer, you're the guy that makes sure they're doing the job right, so you're the specifier, virtually, you order the materials, you've got to make sure they're working with the right gear, you're the safety guy, you're the manager, you're the project manager... (FG6) You get to a point there where you have probably got 10 hats and you only do the job 10 per cent as well as you should be doing it because you have got that much to do. (FG2) I mean the responsibilities you've got far outweigh the amount of men you look after. I think they put too much on one man for a job this size. (FG9)
Role autonomy	See, a lot of senior management don't realise and they don't take into account the actual way in which we work out on site, and some of the things that come our way is absolutely ridiculous. (FG1) The chief engineer said: 'You're not doing it to the method statement' and I said: 'I've done it to your method statement and it

	doesn't work and doesn't work safe – you have to amend your method statement.' This was because he'd just done a method statement and sent it out and expected us to adhere to it. He hadn't asked the advice of the qualified. (FG9) Well a lot of it, if they'd asked the people that's actually doing the jobs for some assistance in timescales and planning, it would run a lot better. (FG7)
Safety culture	It's coming more to the fore now isn't it, health and safety? You know, I mean years ago you never heard about it, but now it's on a weekly basis, something new comes up at meetings. Someone has to take it seriously. (FG2) I think everyone's attitude changes over time anyway. I mean the more time goes on, new things come in and then you sort of realise that, you know, the way you used to do a job five years ago is not the way to do it, but that's just about learning. (FG8) I mean we want everybody to go home at nights with no problems.... Alright, accidents do happen, but we don't want to see them happen and we do try to avoid it at all costs. (FG2)
Disciplinary procedures	If your lads are working under you, you should be able to speak to them, otherwise you shouldn't be a supervisor and it's as simple as that. You shouldn't need to issue them with cards. (FG1) I think the most important thing we're missing here is, with all these rules and regulations, we've got to motivate these blokes... and you're getting all these rules and regulations, and rebelling against them, and it's just like, he's making life harder for us because at the end of the day, we've still got to be there, talk to them, motivate them and get the job done. (FG5) If you shout at them saying: 'You've done wrong, there's your card, go for induction' then, you know, they don't understand what they've done wrong. It's about education. (FG10) Basically you don't need to go chucking these cards at people, unless it's an absolute lunatic or you just can't get through to them, and then, he wants to be gone for the health and safety of everyone else. (FG1)
Support	I've got a project manager and whatever I decide he will back me 100 per cent and that's what you need. (FG7) I think people appreciate what you do. They don't often come up to you and pat you on the back that often. They don't say 'Thanks for pointing that out. Actually, yeah you're right.' (FG9) I mean like myself, these two guys here, we have shared ups and downs about everything haven't we? In and out of work, you know what I mean and it does make a big difference. So there is never sort of, any barriers up, it makes a big difference, hell of a difference. (FG1) You try and get on with everyone, I think. You know, I mean we all work together here, and er, we're all good friends… mostly [laughter]. (FG2)
Subcontractors	The sub-contractor bases his day on how much he produces and how much he can actually make in terms of financial reward, where we tend to put health and safety as top priority which it is. (FG6) So they want to get as much done in a day to make as much money in a day and that supersedes anything including their own safety. (FG6) You are expecting your men to implement the same safety features when there is a divide in the type of safety features that one company use and the other lot use... and it's whether they listen to you when you tell 'em 'cos you're not of their trades and they are sub-contracted to some other part of the company. (FG1)

	Unfortunately it's price work, so if they don't do the work, they don't get paid, so they're always in a rush, it's like because they're rushing, because they're not thinking. They're not calm, accidents happen, it's got to be controlled. It's harder for us to supervise, it's harder for us to say 'whoa', you know? (FG8)
Foreign labour	But I mean trying to communicate what you want them to do, how you want them to do it, how you want them to go about it safely as well and getting them to understand it. You know, sometimes you can explain it to them and they might nod and agree, but... it's that question whether they have understood it or are they just nodding. (FG10) On my gang I've got quite a few foreign labour and that's quite an issue, there's a language barrier. There's nothing wrong with the labour, it's just the communication. (FG7) You shout to somebody who is up a scaffold that you know something is going to hit him, and he's waving his hands thinking you're being nice to him, you know. (FG2)
Operative characteristics	I feel frustrated if I know for a fact that I've got somebody in a position that somebody else put in that position, and I've got to supervise them and I know they're no good in that position. Then I get frustrated because I'm fighting a losing battle. (FG9) People with bad attitudes, you feel like you're wasting time talking to them, but you've still to keep going back and telling them. You know it's a complete waste of time, you still got to do it. (FG5) Operatives that are arrogant and they don't want to learn. That makes it very difficult. (FG10)
Frequency of contact	I think there's perhaps too much time spent on the paperwork side of safety and not enough time walking around site looking at what's going on – 'cos if you're out there more, they won't do such silly things. (FG2) It stops you going around and seeing what's happening on site. And if you're on site, then you can stop something going wrong. (FG2) I've got to sort, like, flit between all these jobs and the minute my back's turned, who's to say that these guys are going to continue working safely? (FG6)

Appendix 3 – Demographic data

Table 5
Demographics (company, trade, nationality) of supervisors

Company	Freq.	Valid %	Trade	Freq.	Valid %	Nationality	Freq.	Valid %
5	1	1.4	Fixer	1	1.3	Australian	1	1.3
6	1	1.4	Rain screen	1	1.3	Canadian	1	1.3
7	1	1.4	Heating	1	1.3	Indian	1	1.3
11	1	1.4	Dry lining	1	1.3	Northern Irish	1	1.3
12	1	1.4	Insulator	1	1.3	Irish	2	2.6
13	1	1.4	Plasterer	1	1.3	Welsh	2	2.6
14	1	1.4	Flooring	1	1.3	English	17	21.8
15	1	1.4	Steel fixer	1	1.3	British	53	67.9
20	1	1.4	Carpenter	1	1.3	Missing	2	–
22	1	1.4	Drainage	1	1.3			
23	1	1.4	Scaffold worker	2	2.5			
26	1	1.4	Concrete	2	2.5			
27	1	1.4	Cladding	2	2.5			
31	1	1.4	Roofer	2	2.5			
36	1	1.4	Painter	2	2.5			
10	2	2.9	Window insulator	2	2.5			
18	2	2.9	Logistics	2	2.5			
29	2	2.9	Engineer	4	5.1			
4	3	4.3	Mechanical	4	5.1			
41	3	4.3	Pipe fitter	4	5.1			
2	4	5.8	Plumber	4	5.1			
3	17	24.6	General operative	5	6.3			
1	21	30.1	Bricklayer	6	7.6			
Missing	11	–	Electrician	6	7.6			
			Joiner	8	10.1			
			Foreman	14	17.7			
			Missing	1	–			

Table 6
Demographics (company, trade, nationality) of operatives

Company	Freq.	Valid %	Trade	Freq.	Valid %	Nationality	Freq.	Valid %
8	1	0.4	Mechanical	1	0.4	Jamaican	1	0.4
9	1	0.4	Carpenter	1	0.4	Kosovan	1	0.4
16	1	0.4	Steel metal	1	0.4	Albanian	1	0.4
41	1	0.4	Stores	1	0.4	Moldovan	1	0.4
30	1	0.4	Maintenance	1	0.4	Zimbabwean	1	0.4
34	1	0.4	Steel fixer	2	0.8	Irish	4	1.5
35	1	0.4	Welder	2	0.8	Polish	4	1.5
38	1	0.4	Insulator	3	1.1	Welsh	4	1.5
39	1	0.4	Flooring	3	1.1	Lithuanian	5	1.8
40	1	0.4	Logistics	3	1.1	Indian	7	2.6
21	2	0.8	Machine driver	3	1.1	English	109	40.1
28	2	0.8	Banksman	3	1.1	British	134	49.3
36	2	0.8	Window insulator	4	1.5	Missing	5	–
37	2	0.8	Heating	4	1.5			
14	3	1.2	Engineer	5	1.9			
15	3	1.2	Fixer	7	2.6			
17	3	1.2	Dry lining	7	2.6			
20	3	1.2	Cladding	8	3.0			
7	4	1.6	Roofer	8	3.0			
11	4	1.6	Painter	8	3.0			
12	4	1.6	Fitter	8	3.0			
13	4	1.6	Rain screen	10	3.7			
18	4	1.6	Scaffold worker	11	4.1			
19	4	1.6	Concrete worker	14	5.2			
22	4	1.6	Plumber	16	6.0			
23	4	1.6	Bricklayer	17	6.4			
25	4	1.6	Joiner	22	8.2			
27	4	1.6	Pipe fitter	23	8.6			
31	4	1.6	Electrician	24	9.0			
32	4	1.6	General operative	47	17.6			
33	4	1.6						
10	5	2.0						
29	5	2.0						
26	6	2.4						
5	7	2.7						
6	9	3.5						
4	10	3.9						
2	13	5.1						
3	56	21.5						
1	62	24.2						
Missing	22	–						

Appendix 4 – Reliability estimates of measurement scales

Table 7
Reliability estimates of measurement scales

	Factor	Cronbach's alpha
Individual factors	Personality: extraversion	**0.44**
	Personality: agreeableness	**0.51***
	Personality: conscientiousness	**0.33***
	Personality: neuroticism	**0.42***
	Personality: intellect	0.60*
	Emotional intelligence: mood regulation	0.61
	Emotional intelligence: using emotions	0.58*
	Emotional intelligence: appraising others' emotions	**0.39***
	Self-efficacy: general safety	0.70
	Self-efficacy: engagement in safety	0.83
	Self-efficacy: prioritising safety	0.78
	Self-efficacy: complying with safety	0.72
	Internal locus of control	0.64
	External locus of control	**0.45***
	Motivation: intrinsic	0.65
	Motivation: personal value	0.72
	Motivation: recognition (supervisor)	0.78
	Motivation: recognition (manager)	0.76
	Motivation: punishment	0.62
Organisational factors	Role conflict	0.58*
	Role control (risk)	0.68*
	Role autonomy	0.79*
	Role overload	0.81
	Safety support: colleagues	0.87
	Safety support: supervisors	0.94
	Safety culture	0.93
Leadership measures	Active leadership	0.84
	Inactive (avoidant) leadership	0.73

NB: This table includes only those factors that are measured with a scale of items.
* These scales have had one item removed to improve internal consistency.
Bold figures indicate poor reliability.

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