

Health and safety in the building and construction sector - a comparative study of Sweden and Taiwan



Renovation of the City Hall Tower in Stockholm, Sweden in 1949. This year, a uniform and to some extent "modern" Occupational Safety and Health Act was established in Sweden.

Stockholm den 2 januari 2023

Sten Hebert

CEO, S Hebert Miljökonsult AB, consulting with focus on education concerning work environment in the construction industry at universities and in companies.

Summary

This research project has been carried within the framework of the Taiwan Fellowship Program 2022, funded by the Taiwan Ministry of Foreign Affairs.

In the study, background material, e.g. in the form of legislation, regulations, activities in the sector and statistics from Sweden and Taiwan respectively, was studied and compared. Information and views have been obtained from academic institutions, OSHA, Construction and Planning Agency, construction/professional organizations and individual persons.

It has been difficult to compare statistical data. But since the number of fatal accidents in the sector is significantly higher in Taiwan, it can be assumed with good reason that the same also applies to accidents at work and occupational diseases. The study has therefore evolved to mainly describe Swedish rules and measures that can be recommended to improve the situation in the construction sector in Taiwan. An interesting observation is that fatal accidents in construction in Taiwan constitute a significantly larger proportion of the total fatal accidents than in Sweden. 50% vs. 25%.

There are many similarities between the countries in terms of legislation, the interests of those I have spoken to, provisions/regulations, authorities, inspections, training opportunities and more.

The study has listed some reasons why the accident rates are better in Sweden. The most important of these reasons are:

- Awareness and tradition are important factors that can explain that there are fewer accidents and deaths in the Swedish construction industry.
- In Sweden, there are one comprehensive regulation focusing on the construction sector and just over twenty *detailed provisions* that have a direct impact also on the construction sector.
- Clearly identified and established work environment responsibilities. throughout the whole construction process.
- Responsibility for early stages is clearly defined – developer, CPD/BAS-P, architects and designers.
- Informal governance from the Swedish Construction Federation, such as training requirements for all workers to enter a construction site.

My overall ambition with the study is to improve the work environment in the construction sector. A zero vision for the number of deaths at work should be an obviousness. Hopefully, the study will inspire continued work - evaluations, seminars and discussions - at relevant authorities, institutions and companies in Taiwan.

Used terms

Building and construction. Includes both house and construction projects.

CPD (BAS-P)

Construction work environment coordinator for the planning and design of the construction work. Important function in Sweden, defined in the Work Environment Act and in separate regulations

CE (BAS-U)

Construction work environment coordinator for the execution of work. Important function in Sweden, defined in the Work Environment Act and in separate regulations.

Construction sector/industry

Includes buildings and infrastructure

Developer

Client, the company, or person who orders execution of building or construction work, the party commissioning building or civil engineering work.

ID06

ID06 is a system for easily identifying people in the workplace and connecting each person to an employer to promote healthy competition and safe workplaces in the construction industry. Administrated by a company related to The Swedish Construction Federation.

OSHA

Occupational Safety and Health Authority. An authority with responsibility for the work environment. In Sweden, this authority is referred to in English as Swedish Work Environment Authority.

Provision

Rules, instructions from an authority (sometimes the word “Regulation” is used).

Safety representative (Sweden)

Normally appointed by the union. Has far-reaching mandate, such as a right to stop work in the event of immediate danger.

Work Environment Plan (Sweden)

To be established for most construction projects. Must follow the requirements for the design. The developer has the overall responsibility.

Sanction fee (Sweden)

Is just a fee, not a fine and is normally paid by the employer. Fines are specified for certain paragraphs in certain regulations.

Table of contents

1. Background	6
2. Methodology	6
3. Acts and regulations in Sweden.....	8
3.1 The Work Environment Act	9
3.1.1 General	9
3.1.2 Building and construction	10
3.2 Detailed provisions/regulations about work environment.....	11
3.2.1 Building and Civil Engineering Work	12
3.2.2 Workplace design (AFS 2020:01)	17
3.2.3 Systematic Work Environment Management	17
3.2.4 Scaffolds (AFS 2013:04).....	18
3.2.5 Machineries (AFS 2008:3).....	18
3.2.6 Use of Work Equipment.	18
3.2.7 Use of Lifting Devices and Lifting Accessories	18
3.2.8 Inspection of Lifting Devices (AFS 2003:6).....	19
3.2.9 Ladders and Trestles.....	19
3.2.10 Mast and Pole Work (AFS 2000:6)	19
3.2.11 Ergonomics.....	19
3.2.12 Chemical Hazards in the Working Environment	19
3.2.13 Occupational exposure limit values (AFS 2018:01).....	20
3.2.14 Occupational Medical Supervision (AFS 2019:3)	20
3.2.15 Asbestos (AFS 2006:1)	20
3.2.16 Silica.....	20
3.2.17 Noise (AFS 2005:16).....	21
3.2.18 Vibrations (AFS 2005:15)	21
3.2.19 First aid and crisis support (AFS 1999:07).....	21
3.2.20 Rock and mining work (AFS 2010:1)	21
3.2.21 Blasting work (AFS 2019:2)	21
4. Responsibilities and cooperation	22
4.1 The employer's responsibility for the work environment.....	22
4.2 The employee	22
4.3 The safety representative.....	22
5. Swedish work environment authority	24
5.1 Inspection	24
5.2 Provisions and brochures in English	26

6. Sanction fees	28
7. Certification ISO 45 001.....	29
8. Swedish Construction Federation.....	29
8.1 General.....	29
8.2 Consulting.....	30
8.3 Education.....	30
8.3.1 Safe Construction Training	30
8.3.2 BUC, education company	30
8.3.3 Safety park.....	31
8.4 Management system.....	32
8.5 Work environment plan-guide	32
8.6 ID06, Identifying system	32
9. Statistics.....	33
9.1 General on the Swedish labor market	33
9.2 Building and Civil Engineering Work.....	36
9.2.1 Reported accidents in building and construction	36
9.2.2 Reported occupational diseases	37
9.2.3 Deaths from accidents at work, building and construction (Swedish companies).....	40
10. Taiwan.....	41
10.1 Legislation (OSHA).....	41
10.2 Legislation (Construction and Planning Agency)	42
10.2.1 Building Act.....	42
10.2.2 Other Acts and Regulations	43
10.3 Regulations, OSHA.....	44
10.3.1 Regulations Safety	44
10.3.2 Regulations Occupational Health	44
10.3.3 Regulations others (Occupational Safety and Health Education and Training Rules)	44
10.3.4 Standard Building Safety, Civil Engineering	45
10.4 Authority, OSHA	45
10.4.1 Organization and inspections	45
10.4.2 Education.....	46
10.5 Taipei Labor Inspection Office	46
10.6 Construction and Planning Agency, Ministry of Interior	46
10.7 Education. “Builders Federation/Association”	47
10.7.1 Yilan County Labor Education Association.....	47
10.7.2 Industrial Safety and Health Association	47

10.8 Statistics	48
11. International outlook	49
12. Comparisons.....	50
12.1 Overview	50
12.2 Statistics	54
12.3 Occupational Safety and Health Act	55
12.4 Legislation – Construction and Planning.....	55
12.5 Provisions	55
12.6 Authorities OSHA.....	55
12.7 Builders Federations.....	55
12.8 Awareness	56
12.9 Questionnaire, quotes, and comments	56
13. Conclusions	57
14. Final words	60
15. References.....	60

1. Background

This research project has been carried out within the framework of the Taiwan Fellowship Program 2022, funded by the Taiwan Ministry of Foreign Affairs, between mid-September and mid-December 2022. Project time was shorter than planned due to covid restrictions in Taiwan.

My intention has been to compare Sweden and Taiwan in terms of accidents and occupational diseases in building and construction. And then draw conclusions for suggestions for improvements in both countries. During the course of the project, it has become clear that the accident statistics look far better in Sweden. Therefore, the focus of the report has become possible improvements in Taiwan.

For the past 15 years, I have worked with work environmental issues in the construction sector with a focus on education at universities and in companies. Many of the descriptions of conditions in Sweden and the conclusions are therefore mainly based on my own experience.

2. Methodology

The report describes Swedish conditions and Taiwanese. The Swedish part is based on descriptions especially from Swedish Work Environment Authority, Swedish work environment act, Swedish provisions/regulations, Swedish Building Federation and my own knowledge and experience.

With regard to descriptions of conditions In Taiwan, facts, comments and assistance have been obtained directly from:

- Different departments at different universities in Taipei and in Yilan.
- OSHA, Taiwan.
- Study visits to two construction sites.
- One labor inspector.
- Knowledgeable individuals in the construction sector.

Web-sites:

- OSHA Taiwan.
- Construction and Planning Agency, Ministry of Interior.
- Taipei Labor Inspection Office Taipei City Labor Inspection Department.
- Yilan Industrial Safety and Health Organization.
- Industrial Safety and Health Association.
- Chienhua Bookstore, training books.

For obvious reasons, it has been easier for me to compile the Swedish background material.

Information about statistic has been obtained from Swedish and Taiwanese OSHA, English website. There have been difficulties in obtaining comparable statistical data – what is an accident or occupational disease, how does the reporting take place, how do the assessments take place, and so on? The study is therefore based on the number of reported fatal accidents. Figures for these are indisputable.

A questionnaire with questions related to conditions in Taiwan has been sent out. Seven responses were received and compiled. The survey contains nine multiple-choice questions and four supplementary general questions. The multiple-choice questions concern issues of responsibility and competence of the different actors, legislation and inspections.

- Do developers take responsibilities to ensure a safe working environment on the construction site?
- Do architects and designers take responsibilities to ensure a safe working environment on the construction site?
- Do contractors take responsibilities to ensure a safe working environment on the construction site?
- Do contractors have sufficient knowledge to ensure a good working environment?
- Do workers have sufficient knowledge to ensure a good working environment and to avoid accidents and diseases?
- Are health and safety legislation and regulations appropriately designed?
- Are health and safety legislation and regulations strict?
- Do official inspections of the work environment on the construction site take place?
- How do you assess safety consideration in general in the construction industry?

Additional questions:

1. Are work environment courses included in construction and civil engineering education at university? Please comment!
2. Do you know if the Taiwanese construction organization/association conducts activities (training/information) for its members in the field of occupational safety and health? Please comment!
3. Would you like to suggest any authorities, institutions, organizations, universities and people whom I should get in contact with?
4. Do you have any opinion concerning why there are relatively many fatal accidents, accidents and diseases in the building and construction industry in Taiwan?

Many conclusions in the report, are not "scientifically" verified, but the author's observations and reasonable judgments.

3. Acts and regulations in Sweden

In Sweden, there is a long tradition of safety consideration. The first cars in the world with seat belts as standard were the Swedish cars Saab and Volvo. The roller belt is a Swedish invention. The use of life jackets and bicycle helmets has been established for a very long time. In 1949, a uniform and to some extent "modern" Occupational Safety and Health Act was established. Safety representatives have been present at Swedish workplaces since as early as 1912! Even strong trade unions have pushed for safety thinking in Swedish workplaces. All measures taken can also be read in the statistics from 1955 to 2019. The number of fatal occupational accidents per 100,000 workers has *decreased by 95%*.

3.1 The Work Environment Act

3.1.1 General

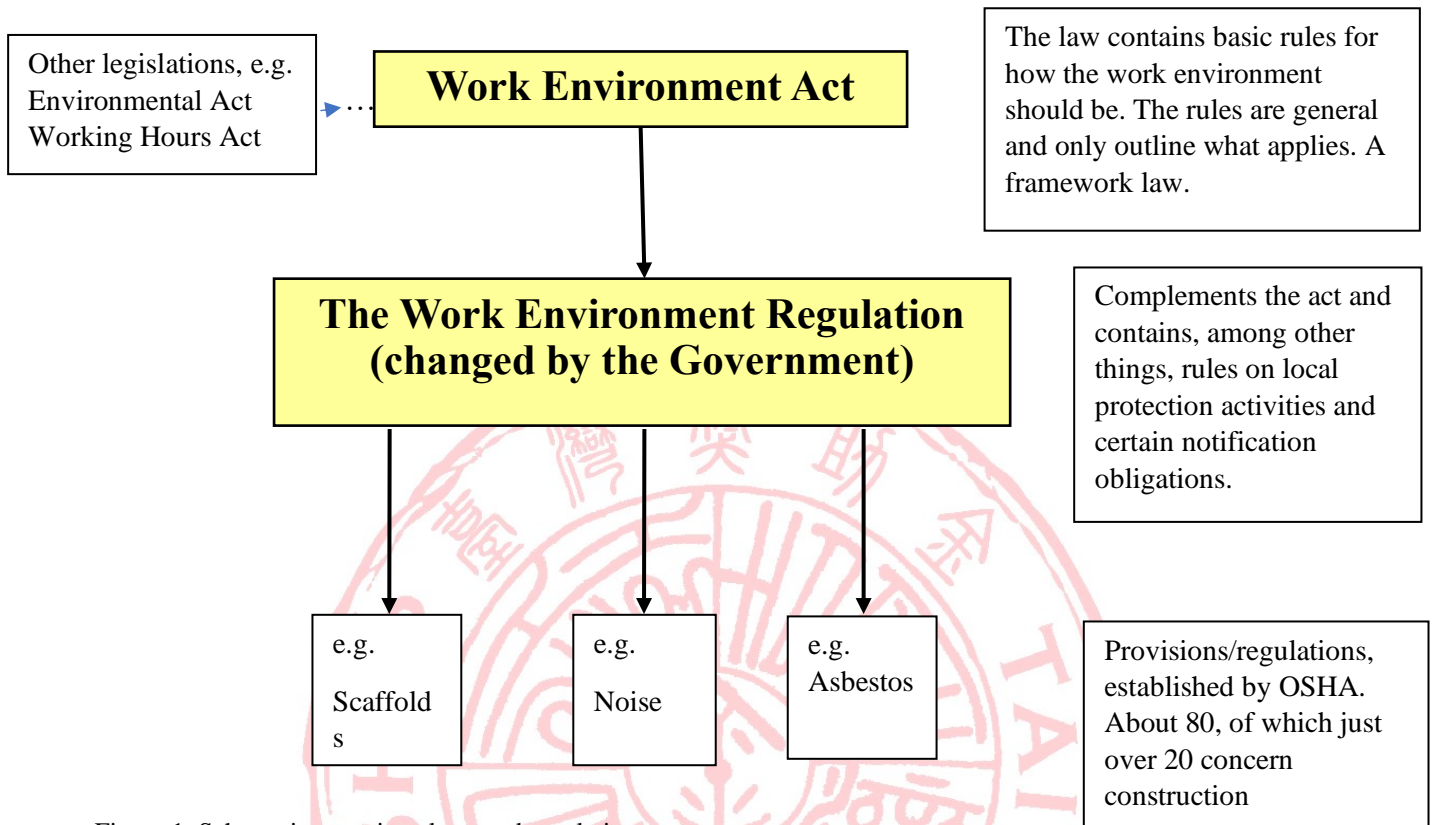


Figure 1. Schematic overview, laws and regulations.

The current statutory foundations on occupational safety and health are laid down in the Work Environment Act (1977:1160), with ongoing updates. [Work Environment Act \(1977:1160\)](#)
[Non-official translation \(government.se\)](#)

The purpose of the Act is to prevent illnesses and accidents in the course of employment and to otherwise achieve a good work environment. The Work Environment Act defines the outer framework of work environment regulations in Sweden. The Act contains rules on the state of the work environment, the responsibility for the working environment, the mandate of the Work Environment Authority to issue provisions/regulations, inspections, stipulations on minors, local co-operation concerning the working environment, safety representatives, official supervision of compliance with the Work Environment Act, prohibitions and injunctions, penalties, sanctions and sanction fees and finally the right of appeal against decisions.

The Work Environment Act must be viewed in conjunction with other labor legislation, such as the Working Hours Act (1982:673), Environmental Act (chemical substances) and the Domestic Work Act (1970:943). The Work Environment Act is supplemented by detailed rules that are laid down by the Work Environment Authority, which has been given extensive power to issue provisions concerning the working environment. These provisions can, for example, refer to occupational exposure limit values (AFS 2018:01), use of work equipment

(AFS 2006:4), workplace design (AFS 2009:2), and systematic work environment management (AFS 2001:1).

The employer has the main responsibility for the work environment and must take all measures needed to prevent the exposure of employees to the risk of ill-health or accidents at work. The employer's responsibility for the work environment includes to systematically plan, direct and control activities in such a way that the work environment of the operation will meet the requirements of work environment legislation. This responsibility is explained in a special regulation which contains Provisions and General Recommendations by the Work Environment Authority on Systematic Work Environment Management. This regulation has similarities with ISO 45001, Occupational Health and Safety Standard Management System. This instrument contains more detailed provisions on the procedure to be followed by the employer in discharging his responsibility.

The Work Environment Authority supervises the observance of the Work Environment Act and of the provisions/regulations issued pursuant to the same. The Work Environment Authority ensures that laws and regulations are followed by inspecting, and by communicating injunctions and prohibitions. The Authority is also responsible for official statistics, providing information, responding to inquiries, and to follow developments in the area of occupational safety and health.

In the Swedish Work Environment Act there are general demands which apply regarding the working environment at work. Another important act, the Working Hours Act, describes how much you may work per day and to which extent you have the right to breaks and recesses at work.

The law stipulates that serious accidents and incidents (incident - that could have led to a serious accident) must be reported to the relevant authorities.

3.1.2 Building and construction

Only one specific industrial sector is clearly mentioned and regulated in the Act - Building and construction work.

The **developer** i.e., the company or person who orders execution of building or construction work must:

1. Ensure at each stage of planning and design that health and safety considerations are taken into account with regard to both the construction phase and future use.
2. Appoint an appropriate construction work environment coordinator for the planning and design of the work CPD (BAS-P) with tasks specified.
3. Appoint an appropriate construction work environment coordinator for the execution of work CE (BAS-U) with tasks specified.

Note:

- The developer and the coordinator(s) are responsible for the tasks being carried out.
- The client may delegate work environment responsibilities to an independent contractor by a written agreement.
- For consumer contracts, the contractor automatically assumes responsibility for the working environment.
- Normal employer responsibility for all contractors still remains on the construction site.

Architects and designers must at each stage of the planning and design of a construction or civil engineering work, within the framework of their assignments, ensure that health and safety considerations are taken into account in terms of both the construction phase and future use.

Only one specific industrial sector is clearly regulated in the Act - Building and construction work. Other sectors are not mentioned particularly. Four important functions are defined – the developer, architects and designers, the coordinators for planning, CPD/BAS-P and for execution of work, CE/BAS-U.

3.2 Detailed provisions/regulations about work environment

The Swedish Work Environment Authority is the authority that has been tasked by the government to decide what is applicable for the work environment in more detail. The authority therefore issue provisions/regulations which specifies what applies for the work environment. In total, there are about 80 provisions published. They are quite different in nature – some provisions contain strict directives with fees, some are more descriptive and informative. Below are more than 20 provisions described, that are relevant for building and construction work. The headings below are in many cases linked to an English translation of the regulations. Many of the provisions, i.e. *Systematic Work Environment Management* applies not only to construction activities, but to all relevant activities on the labor market.

Many of the provisions apply to areas that are not directly associated with fatal accidents, rather with occupational diseases, such as the regulations Noise, Workplace Design, Chemical work environment risks and Ergonomics. The most serious works with a risk of fatal accidents are described, for example, in Building and Civil Engineering Work (3.2.2), Scaffolding (3.2.4) and Use of Lifting Devices (3.2.7)



Figure 2. There are approximately 80 provisions.

3.2.1 Building and Civil Engineering Work

[AFS 1999:3 Building and Civil Engineering Work \(av.se\)](#)

Basic and general rules for the construction industry and apply to employers, employees, sole entrepreneurs. The regulation is an adaptation to the European "Construction Sites Directive" and covers several types of work, including planning and design. The regulation is extensive with 100 paragraphs in just under 70 pages (including appendices and comments). It does not apply to the design of work premises. Sanction fees are specified for deficiencies regarding the work environment plan, prior notification, work from height and roof work.

The provision defines what counts as Construction and Civil Engineering. Here a distinction is made between maintenance and operation. The operation of a building or plant does not count as construction work.

The responsibilities for the developer, the designers, for the work environment coordinator for the planning and design (CPD/BAS-P) and for the work environment coordinator for the execution of work (CE/BAS-U) are developed on the basis of the Work Environment Act. A prior notification must be made by the client for large project. A health and safety plan must be drawn up under certain conditions. The main part of the regulation then contains practical instructions for various work steps, for example for demolition, excavation, work at height and passing vehicle traffic.

The developer

The developer is responsible for:

At every stage of planning and design, see to it that special consideration is paid to the work environment aspects of the project:

- The positioning and design of the object or structure.
- The choice of building products and material.
- The choice of structures for foundation, framework systems or other load-bearing elements.
- The choice and design of structure completion.
- The choice of installations and their positioning.
- The choice of interior fittings.

The developer shall, at every stage of planning and design, see to it that special consideration is paid to the work environment during the construction phase in the following respects:

- The construction time and the times allowed for sub-stages shall be ample enough for the work to be done at a pace whereby the risk of illhealth and accidents is averted.
- Transport of building materials, demolition spoil and equipment shall be possible in a manner acceptable from the point of view of the work environment.
- The establishment area shall normally be large enough for the offices, personnel facilities etc., needed for all activity on the construction site to be accommodated without excessive congestion.
- Prior to demolition, rebuilding or renovation of an object or part of an object, the risks of health-endangering materials shall be taken into account, as well as the risk of the stability of the object or part of it being jeopardised while work is in progress.

Administrative tasks for the developer:

- Document the object with regard to work environment aspects.
- Designate the coordinators CPD/BAS-P and CE/BAS-U. Formal requirements for these functions are specified in the regulation. They must have experience (design, control and construction production) and have undergone defined training. The developer must ensure their competence.
- Make prior notification.
- Establish Work Environment Plan.
- The client's responsibility can be transferred to an independent contractor.

Architects and designers

Architects and designers must consider and predict the work and work environment consequences that the designs will entail, such as:

- To consider what methods of work the proposed solution implies
- To propose materials, delivery methods and assembly methods that do not require heavy personal lifting, other physical risks or involve a safety and health hazard.
- That space is available for the necessary equipment and aids.
- How protective devices and access routes are placed.
- The permits which may be required for the safe conduct of the work.
- The necessary preliminary investigations which may be required for the safe conduct of the work.

This does not mean that the measures should be planned in detail, this is the responsibility of CPD/BAS-P during the design stage and CE/BAS-U during the production phase. But the designer should discuss the solutions with CPD/BAS-P at an early stage so that the solutions developed are also practicable.

The construction work environment coordinator for the planning and design, CPD/BAS-P

A building work environment co-ordinator can be either a legal person (company) or an individual person. CPD/BAS-P should have the training, competence and experience that is necessary, including experience of design. This must be able to be verified by the developer.

Examples of responsibilities:

- Planning regarding time and space, so that risks of ill health and accidents are prevented.
- Establish and keep the work environment plan up to date until production starts.
- Plan project documentation.
- Design coordination, participate in the planning and management of the project.
- Update relevant documents and hand them over to CE/BAS-U.

The construction work environment coordinator for the execution of work, CE/BAS-U

A building work environment co-ordinator can be either a legal person (company) or an individual person. CE/BAS-U should have the training, competence and experience that is necessary. This must be verified by the developer. CE/BAS-U also need experience of the carrying out of building and construction work and experience of work with coordination, management and governing of building projects. Only one CE/BAS-U per workplace!

CE/BAS-U "owns" the workplace, in terms of the work environment. The developer has a back-up responsibility for the function working. This responsibility can be transferred to the main contractor. Can be moved from one contractor to another and back to the developer during the project.

Examples of responsibilities:

- All entrepreneurs' employer responsibility remains.
- Responsible for the schedules. The work must be time and space planned so that risks to health and accidents are prevented.
- Site coordination of common issues.
- The responsibilities of special protective devices are clarified.
- Refine and keep the work environment plan up to date and accessible to everyone.
- Documentation regarding the object, relationship documents and various work / risks (e.g. documents regarding asbestos, scaffolding and silica).
- Organize a joint protection activity, primarily ensuring that that safety rounds are carried out.
- Coordinate the verification of compliance with relevant health and safety regulations and the work environment plan.
- The work to prevent risks is coordinated. Form coordination committee with all major entrepreneurs.
- General protection devices and rules of order and protection exist and are applied.
- Order, cleaning, access roads, and so on.
- Prior advance notification and keep it up to date.
- Ensure that staff facilities and sanitary facilities are set up to the necessary extent.
- Take joint action to ensure that only authorized persons have access to the workplace.
- Technical devices are duly inspected and tested.
- Drivers of such device have sufficient competence.
- Ongoing control of, for example, scaffolding if several contractors use this.

Far-reaching responsibilities through the construction process are further specified for the three functions, the developer and the two coordinators, CPD/BAS-P and CE/BAS-U. The coordinators need training, competence and experience. Must be verified by the developer.

Prior notification

The developer shall, prior to the commencement of the work, send a Prior Notification to the Work Environment Authority concerning construction sites:

- Where work is expected to last for more than 30 working days and where more than 20 persons will on any occasion be employed simultaneously or
- Where the total number of person-days is expected to exceed 500.

Work Environment Plan (safety and health plan)

The developer shall ensure that a work environment plan (safety and health plan) is drawn up and is available before the construction site is set up, if:

- Any of the works specified in the regulation needs to be carried out in connection with the building or civil engineering work.
- The work is of such extent that a prior notice is mandatory.

A sanction fee can be imposed if a Work Environment Plan has not been drawn up, or if it contains deficiencies. CPD/BAS-P draws up the work environment plan and CE/BAS-U keeps the plan up to date. The developer has an overall responsibility during the all the building process.

Thus, the work environment plan shall be based on a risk inventory and must contain the following:

- A. The rules to be applied on the construction site
- B. A description of how health and safety work shall be organised
- C. When works as per 1-13, below, are involved, a description of the special measures to be taken during the construction phase in order for the work environment to meet the requirements of the Work Environment Act and all applicable regulations.
 1. Work entailing a risk of falls to a lower level where the difference in level is two metres or more
 2. Work entailing a risk of burial under earth falls or engulfment in loose soil
 3. Work with chemical or biological substances constituting a particular danger to safety and health or involving a legal requirement for medical supervision
 4. Work which exposes the workers to ionising radiation requiring the designation of controlled or supervised areas
 5. Work near high voltage power lines
 6. Work entailing the risk of drowning
 7. Work on wells and tunnels and on underground works
 8. Work carried out underwater with diving equipment
 9. Work carried out in a caisson with a compressed-air atmosphere
 10. Work involving the use of explosives
 11. Work involving the launching, assembly and dismantling of heavy prefabricated components or heavy shuttering elements
 12. Work in a place or area with passing vehicular traffic
 13. Demolition of load-bearing structures or health-endangering materials or substances
- D. If the work is to be carried out on a site where other activity will be in progress simultaneously, account shall be taken of this in the plan.

Normally, a work environment plan must be drawn up for all construction projects. A template for the Work Environment Plan is described in section 8.5.

Practical instructions in the regulation Building and Civil Engineering Work, examples

A large part of the regulation contains practical instructions for how the work should be carried out on a construction site:

- General (access, planning of the work area, traffic routes, spread of fire, storage rooms, staff quarters).
- Installations for electricity, gas and water.
- Reception and storage facilities.
- Evacuation.
- First aid, fire.
- Traffic routes.
- Lighting.
- Transportation of construction products and other materials.
- Waste management.
- Storage and arrangement of materials.
- Fall to a lower level etc. (>2 m). Sanction fees up to 40 000 USD!
- Special risk areas.
- Personal protective equipment.
- Demolition work.
- Roofing work. Sanction fee if fall protection is lacking, up to 40 000 USD
- Passing vehicular traffic.



Figure 3. Passing vehicular traffic is dealt with in the Building and Civil Engineering work regulation.

Most of the provision “Building and Civil Engineering Work” consists of extensive practical instructions/recommendations for different types of work at a construction site.

3.2.2 Workplace design (AFS 2020:01)

This provision applies to the design, design and operation and maintenance of workplaces, in and adjacent to buildings and construction works, as well as signs, markings and signals. The regulation clearly specifies responsibility for the developer, CPD/BAS-P, planners and designers.

For workplaces in the construction and civil engineering industry, the provisions applies only in completed premises and in sheds. The provisions on staff facilities, lighting, and signs and signals also apply in unfinished spaces. Examples of areas covered:

- Room design in general.
- Traffic routes.
- Floor.
- Stairs and ladders.
- Staff areas, storage areas, changing rooms, washrooms, toilets dining area and rest area.
- Evacuation, alarms and fire protection.
- Climate and installations.
- Daylight, lighting.
- Noise.

3.2.3 Systematic Work Environment Management

[Systematic Work Environment Management, AFS 2001:1 \(av.se\)](#)

Specifies requirements for basic activities in the work environment management in general. Valid for all companies and employers. Covers all employees/workers and all conditions of the work environment.

All companies must carry out a risk assessment at least once a year. The risk assessment then forms the basis for measures and follow-up. The company must document its work environment management, have a work environment policy and describe routines and the responsibilities within the company.

The methodology is similar to the workflow for the introduction and application of occupational health and safety management systems according to ISO 45001.

All companies and businesses/employers must conduct a systematic work environment management. This corresponds to the requirements of ISO 45001, The International Standard for Occupational Health and Safety Management

3.2.4 Scaffolds (AFS 2013:04).

[Scaffolding \(av.se\)](#)

The provisions for scaffolding apply to scaffolds and encapsulation construction. The provision contains, for example, material requirements, regulations for type examination, marking and instructions, as well as regulations and recommendations for placement and design.

Scaffolding may only be erected by a trained person and a plan for its construction shall be drawn up. There are provisions on material requirements for the scaffolding, fall protection and protective roofs. The scaffolding must be regularly checked.



Scaffolding, Stockholm, not carried out in accordance with the regulation

Figure 4. Scaffolding

3.2.5 Machineries (AFS 2008:3)

All machineries must be type-approved and labelled according to European rules and standards. Sanction fees.

3.2.6 Use of Work Equipment. [AFS 2006:4 Use of work equipment \(av.se\)](#)

A general description of the protective measures for the use of work equipment.

3.2.7 Use of Lifting Devices and Lifting Accessories. [Use of lifting devices and lifting accessories \(av.se\)](#)

Working conditions shall be investigated and the hazards assessed when lifting devices and lifting accessories are to be used. Examples of questions to be assessed:

- The stability of the lifting devices in different ground and weather conditions.
- Access to danger zones.
- The practical and theoretical knowledge possessed by the employees.
- Work beneath an elevated load and hoisting of persons.
- Use and selection of lifting accessories.
- Securing of load, load coupling and manual load control.

- Coincident work zones and use of several lifting devices for lifting a common load (tandem lifting).
- The life expectancy and maintenance of lifting devices and lifting accessories.

A lifting device or lifting accessory may be used only by a person who is closely familiar with the work and has the theoretical and practical knowledge needed for safe use. This knowledge shall include current work environment rules and relevant aspects of the lifting device's and lifting accessories', such as:

- Structure.
- Operation.
- Manoeuvring.
- Properties.
- Use.
- Limitations.
- Maintenance.
- Inspection.

In some cases, for complicated cranes, an approved education certificate is required. An employer ordering an employee or outsourced worker to use lifting devices or lifting accessories shall have documentation concerning that person's practical and theoretical knowledge and skills with regard to safe use of the equipment.

3.2.8 Inspection of Lifting Devices (AFS 2003:6)

Lifting devices must be inspected – first, assembly, after redevelopment and periodic inspection. There are high sanction fees if the equipment is not inspected.

3.2.9 Ladders and Trestles

[Ladders and Trestles \(AFS 2004:3 Eng\), provisions \(av.se\)](#)

Must be type approved, otherwise sanction fees. The provision contains recommendations regarding use.

3.2.10 Mast and Pole Work (AFS 2000:6)

The provision for mast and post work applies to masts, poles, struts, access devices and climbing devices. The provision covers such things as training, check-ups and follow-ups, equipment and medical control in connection with height work.

3.2.11 Ergonomics

[Ergonomics for the prevention of musculoskeletal disorders, AFS 2012:2 \(av.se\)](#)

The employer's responsibility is very clearly emphasized. The employer must ensure that no one is harmed by their work, that no one works monotonous and repetitive, that workers have knowledge, access to information and appropriate protective equipment. The regulation also describes more as a textbook different work situations from an ergonomic perspective.

3.2.12 Chemical Hazards in the Working Environment.

[Chemical Hazards in the Working Environment, Provision 2011:19 \(av.se\)](#)

A comprehensive provision, covering not only the construction industry, but also the chemical and oil industries. Important questions for construction activities:

- A risk assessment must be drawn up when chemical work environment risks are feared.
- Chemical products shall be listed and described.
- Chemical products must be labelled with warnings according to international standards.
- The current safety data sheet shall be available.
- Paints with organic solvents may only be used under special conditions (technical or cultural-historical reasons).
- The use of allergenic products, e.g. epoxy and isocyanates, are heavily regulated. Sanction fees!
- In certain work situations, the employee must have a written permit to carry out the work (explosive atmosphere, enclosed spaces, etc.).

3.2.13 Occupational exposure limit values (AFS 2018:01)

The exposure limit value for a substance is the maximum acceptable content of the substance in the air at the workplace. Exposure limit values apply to dust, smoke, fog, gas and steam. Some examples:

Wood dust	2 mg/m ³
Respirable silica dust	0,1 mg/m ³
Cement dust, respirable	5 mg/m ³
Asbestos	0,1 fibers/ml

3.2.14 Occupational Medical Supervision (AFS 2019:3)

Examples of work where medical check-ups are required are, when exposed to:

- Vibrations
- Allergenic chemical products, e.g., epoxy and isocyanates
- Asbestos - some synthetic inorganic fibers
- Silica (quartz)
- Lead
- Great physical exertion

Scope, execution and interval are specified in the regulation. Sanction fees!

3.2.15 Asbestos (AFS 2006:1)

Has been widely used as a building material. It is estimated that 400 000 tons of asbestos-containing material remain in the Swedish building stock. The use of asbestos has been prohibited since 1982. The developer or owner of a building must be able to provide information on whether the building contains asbestos.

Permits must be in place for the demolition and removal of asbestos. The work is carried out by special companies. Requirements for staff to have been trained. The waste must be labelled and handled in the specified manner. Sanction fees!

3.2.16 Silica

There is currently a great focus on the silica problem in Sweden. Partly in view of the lung disease silicosis, and partly in view of the increasingly common chronic-obstructive-pulmonary-disease, COPD. The regulation stipulates a documented risk assessment in the

event of silica exposure, measures, regular checks of dust-fighting equipment, medical checks of personnel. Exposure limit, see clause 3.2.13. Sanction fees!

3.2.17 Noise (AFS 2005:16)

Contains designated limit values, 80 and 85 dBA in average over the day, when the employer must take specified measures. The regulation also contains ample information about noise problems and noise protection.

3.2.18 Vibrations (AFS 2005:15)

Contains designated limit values for the two types of vibration – full-body and hand-and-arm vibrations. The limit values are linked to the maximum working time, when work with vibrating tools may be carried out. Vibration injuries are increasing in number.

3.2.19 First aid and crisis support (AFS 1999:07)

[First aid and crisis support, AFS 1999:07 \(av.se\)](#)

Before an injury has occurred, a preparedness must have been established in which, among other things, the division of duties and responsibilities has been determined. Planning must be made of what aids may be needed in the form of equipment for first aid, access to transport vehicles, alarm systems and more. Planning and organizing first aid and crisis support is not a "once and for all" job. It is important that the planning is followed up and up to date. Procedures should be in place for this.

3.2.20 Rock and mining work (AFS 2010:1)

The provision addresses issues concerning stability, ventilation, communication, evacuation, fire risks, the presence of radon (sanction fees), means of transport and so on.

3.2.21 Blasting work (AFS 2019:2)

Rules for blasting and rock work, which must be complied with. It is particularly important that all those involved in the workplace are informed about the risks and how to behave at locations where explosive work is carried out.

A person working as a so-called blasting manager shall have proven theoretical knowledge and one year's practical experience. Explosives workers need to have a good knowledge of the risks and how to avoid them. The requirement stipulating that theoretical knowledge must be documented can be met by a certificate from the training provider. One way of documenting knowledge is by means of a 'blast card'.

There are just over 20 provisions with impact on building and construction. Building and Civil Engineering work is the most important regulation, see section 3.2.1. The other relevant provisions are different in nature. Some with sharp instructions and some with recommendations.

4. Responsibilities and cooperation

The responsibilities are primarily described in the Work Environment Act.

4.1 The employer's responsibility for the work environment

The employer is always obliged to see that the work can be carried out without risk of ill health or accidents. This is stated in the Work Environment Act. This means, among other things, that the employer is obliged to ensure that the person who will carry out a job receives sufficient instruction and really has the right skills. The staff must not just be aware of possible risks, but also be able to avoid these risks.

The Work Environment Act states that the employer and the employee should work together in the work environment management. Even if the employer has the utmost responsibility for the work environment, it is a stated requirement that the organized work environment management should be run together with the employees and their representatives. The employees' representative is in the first place the safety representative.

4.2 The employee

The employee's responsibility is established in the Work Environment Act. The employee must participate in work relating to the work environment and take part in the implementation of the measures needed to create a good work environment. The employee must comply with directions issued, use the safety equipment and exercise the caution otherwise needed to prevent illness and accidents. An employee who discovers that work involves an immediate and serious danger to life or health must immediately notify the employer or a safety representative. The employee is not liable to pay compensation for any loss resulting from her or his non-performance of work pending instructions regarding the resumption of work.

According to the Work Environment Act, the employer has a far-reaching responsibility for the work environment. Employees also have a designated limited liability.

4.3 The safety representative

The employer and safety representative should cooperate to create a good work environment. This applies to both local and regional safety representatives. The safety representative has, in the Work Environment Act, been guaranteed a number of mandates. Normally, the safety representative is appointed by the trade union. If there is no union activity at the workplace, employees can appoint safety representative. The safety representative has, among other things, the authorization to:

- Get training/education.
- Be a part of actions which concern the relationships in the work environment.
- Participate during the planning of new premises and working methods as well as changes of these.

The safety representative has the right to demand measures. It is to the employer that the safety representative should turn with demands for measures for a satisfactory work environment.

If the safety representative considers that the employer does not follow the stipulations of the Working Hours Act about extra time, extra overtime and emergency overtime, the representative can also make demands for measures. If the safety representative is not satisfied with the answer to the request, or if there is no answer at all, the safety representative can turn to the Work Environment Authority.

In case of immediate or serious danger for the lives of the employees, the safety representative can decide to stop work (a so-called *safety representative stop*) and wait for the Work Environment Authority to take a position in the matter.

If the safety representative discovers shortcomings in the work environment, he can ask the employer to fix these shortcomings. If the safety representative does not know which measure is necessary to solve the shortcomings in the work environment or are unsure of the scope of them, he can demand that the employer carry out an investigation.

Chief safety representative

When there are several safety representatives at a workplace, the chief safety representative must coordinate their activities and represent the safety representatives externally. The chief safety representative should, for example, take up issues that concern more than one safety area and the chief safety representative works at the entire workplace. If there are chief safety representatives from several different trade union organizations at the workplace, the organizations may decide which chief safety representative has the authority for the different safety areas.

How the local safety representative and the chief safety representatives allocate their tasks is decided by the trade union organization that appointed them. The trade union organization should document the arrangement decided upon in minutes or similar.

The chief safety representative also has the right to stop work in case of serious and immediate danger.

Regional safety representative

Normally a regional safety representative (a person employed by the trade union) is appointed if there is no local safety representative. The Regional safety representative does not have right of access to workplaces that have a safety committee. There must be at least one member in the regional safety representative's trade union organization at the workplace for the representative to have authority there.

Regional safety representatives have the same tasks and authority as other safety representatives. It can sometimes be an advantage that the regional safety representative is not employed at the workplace when demands about work environment improvements are presented.

The safety representative is normally appointed by the trade union. The employer must cooperate with the safety representative to achieve a good working environment. The safety representative can stop certain work if it involves serious and immediate danger.

5. Swedish work environment authority

[Start - Arbetsmiljöverket \(av.se\)](http://www.arbetsmiljoverket.se) (English)

The authority has two main tasks – to draw up regulations and conduct inspection work. Number of employees is about 650.

On the website there is information about the Work Environment Act, regulations, brochures, statistics, theme pages, education, work environment issues in various industrial sectors, FAQ's in the construction sector.

5.1 Inspection

The inspection department consists of five regions: region north, region middle, region west and region south. In each region, there are also branch offices locally.

Employed inspectors: 278

The inspectors work in planned supervision, in on-call groups by region that handle mandatory supervision or in government-wide supervision.

Some inspectors work in one of these fields, while others work in two or all three of the fields. The organization is different depending on the region. Building/construction inspections take place in all three fields.

In the planned supervision, work is carried on in national supervisory activities, where currently there are three supervisory activities aimed at the construction industry: "A safe working life safety culture in the construction sector", "A safe working life personal fall protection equipment" and "National supervision: preventing accidents in construction".

Within the “emergency groups”, safety representative stops and reports of accidents and incidents are handled according to Work Environmental Act.

Some inspectors handle permit applications and notifications of asbestos handling and demolition. Supervision in these cases is linked to construction sites. There are a few inspectors per region who do this in part of their service.

In addition, tips are taken care of. These often deal with construction activities, such as workers climbing on roofs without fall protection. The tips can be handled by all inspectors and handled a little differently depending on the region.

Construction activities are also inspected within the joint supervision of the different authorities - tax administration and working permits.

In conclusion, it can be stated that there is a rather complex organization within the Inspection Department in terms of which inspector inspects what. There are no inspectors employed to work with construction supervision full-time. But in practice, it can still be the case that an inspector basically only works with construction supervision if, for example, he works with supervision in the national construction supervision projects and in addition goes on the construction tips that come in.

Construction supervision is a priority enforcement activity as it is an industry that is affected by many incidents and accidents.

There is no specific statistics about how many inspections are aimed at construction. However, in year 2021, 603 inspections and follow-up inspections were carried out within the national supervisory activity "National supervision: preventing accidents in construction".

Total number of inspections in Sweden (red) and inspections with action requirements (yellow)

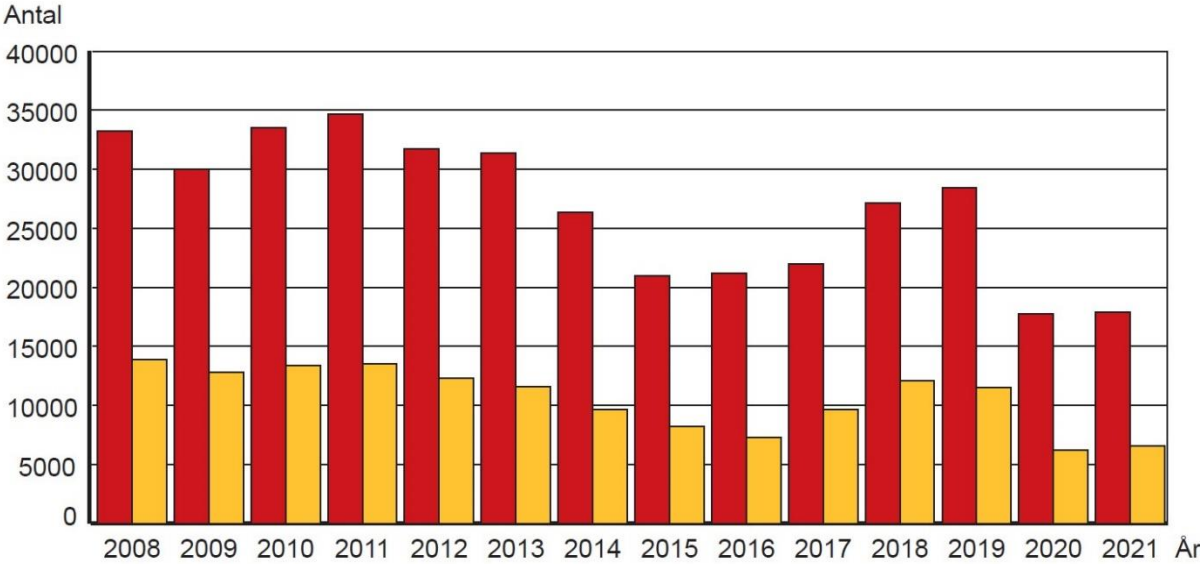


Figure 5. Inspections in Sweden.

5.2 Provisions and brochures in English

The Swedish Work Environment Authority is responsible for drafting provisions in the work environment area. In total, there are about eighty different provisions. Some provisions are also available in English, [Provisions - Arbetsmiljöverket \(av.se\)](#). For provisions on construction, see section 3.2!

The Swedish Work Environment Authority also publishes brochures in certain designated areas. The number of brochures is about 110. The brochures are usually based on a certain provision. The provision is explained in an easy way with the help of illustrations and short explanatory texts. Some of the brochures are available in other languages. [Brochures - Arbetsmiljöverket \(av.se\)](#). Of the brochures, about 20 are relevant in some part to construction.

The following are available in English:

Sanction fees. [Brochure, Information about sanction charges, ADI 687eng \(av.se\)](#)

Responsibilities [Who is responsible for what within building and construction? \(ADI 704\), brochure \(av.se\)](#)

Safer building and civil engineering work. [Säkrare bygg- och anläggningsarbete, Engelska, ADI 539Eng \(av.se\)](#)

[Safer Building \(ADI 659 Eng\), brochure - Arbetsmiljöverket \(av.se\)](#)

[Protect yourself against falls from height \(ADI 703\), brochure - Arbetsmiljöverket \(av.se\)](#)



Figure 6. The front page of the brochure “Load ergonomics in the construction industry”, 15 pages.

6. Sanction fees

Sanction fees and fines – what is the difference?

A sanction fee is a *fee*, while fines are a *penalty* one is sentenced to in a court of law. To break a stipulation that carries a fine is seen as a criminal act. Such a work environment case is therefore dealt with by the police and goes further to the prosecutor and the court.

Earlier, several stipulations in the Swedish provisions carried a penalty and the employer could be sentenced to fines if they broke them. From 1 July 2014, several provisions carry a sanction fee.

The employer can still be sentenced to fines if you give incorrect information, remove a safety device or if you violate your obligations to report accidents and serious incidents to the Work Environment Authority. Fines as a penalty also remain in place for certain stipulations about minors. Fines can also be issued in connection with an accident, where the person who caused the accident is held liable.

The inspectors check that provisions are followed. During inspections, the inspector will inform how the inspector have perceived the work environment and which shortcomings should be fixed. If some of the shortcomings are that you have not followed a stipulation which carries a sanction fee, the inspector will report this further within the Swedish Work Environment Authority. The case will then be investigated internally.

The Authority make a decision after the inspection. If it is decided that the company should pay a sanction fee, a so-called fee injunction is sent. The company can approve this within a certain time. Here the fee to be paid is also stated.

Who can be obliged to pay a sanction fee?

Regulations about sanction fees are normally directed towards employers and it is the employer who, in such a case should pay a sanction fee. This can be companies, organisations, municipalities, county councils or the state. Other parties than employers can need to pay a sanction fee, for example to those who hire in manpower.

Manufacturers and importers are examples of actors who could have to pay sanction fees if certain stipulations for products are not followed. In the building sector there are some stipulations which mean that whoever has the assignment, such as developers, construction work environment coordinators for planning and design (CPD), and construction work environment coordinators for the execution (CE) could be obliged to pay a fee.

How is the sanction fee decided?

Some fees are so-called fixed fees. It is clear from the paragraph text how much should be paid, and the fixed fee is the same for everyone. In some few cases dealing with products, the fixed sanction fee is combined with a certain per cent of the product's sales value.

In most cases however, the sanction fee is differentiated, which means that larger employers must pay more than small employers. The amount of the sanction fee is then calculated according to the number employed in the company or organisation. Both employed and hired are counted, irrespective of whether they work fulltime or part time.

All employed under the same organization number are counted, not just those who work at the inspected workplace. Employers with 500 or more employed pay the maximum fee, irrespective of how many of those are active.

Examples of sanction fees:

- Not to draw up a work environment plan or if it has deficiencies 5,000 USD
- Demolishing/decontaminating asbestos without a permit or training 40,000 USD
- Using an unattended lifting device 40,000 USD
- Not to establish a risk assessment in case of silica exposure 15 000 USD

A sanction fee is precisely a fee, not a fine for a criminal act.

Applies to certain paragraphs of certain provisions.

Normally, a larger company pays a higher fee.

7. Certification ISO 45 001

According to the international organization for standardization ISO (<https://isotc.iso.org>), the number of certificates according to ISO 45001, Occupational Health and Safety Standard Management System in 2021 is:

	Number of certificates	Number of sites
Taiwan	1866	4340
Sweden	534	2504

There are significantly more certificates in Taiwan than in Sweden. *A sign of a growing awareness of occupational safety and health issues?*

Here it can be mentioned that the Swedish Construction Federation has its own integrated management system as a complement for small and medium-sized companies. See section 8.4!

8. Swedish Construction Federation

8.1 General

The Swedish Construction Federation is an industry and employer organisation with 3 800 member companies for construction, civil engineering and specialised companies that want to build Sweden on a foundation of fair principles. The number of employees in the Swedish construction industry amounts to about 300,000 people.

Membership criteria

The Federation promotes the professional reputation of the industry by safeguarding ethical business practices and construction quality. Membership in the Swedish Construction Federation requires the applicant company to meet for instance the following criteria
The company and its representatives undertake to:

- Follow the Community Building Sector's Code of Ethics
- Apply the Construction Companies' Code of Conduct

Cooperation must be characterized by mutual respect, something that is important not least in terms of practical cooperation on the construction site and the *safety of the individual employees*.

Safety is one of the priorities of the Federation:

” We work to ensure that everyone in the construction industry has a healthy and safe work environment”.

The Swedish Construction Federation wants to:

- *” Have a construction industry free of accidents. Our vision is zero accidents in the construction industry.*
- *Have a sustainable working life. An injury-free work environment that makes it possible to work for an entire working life and be physically and mentally healthy upon retirement.*
- *Increase risk awareness and strengthen a culture of safety”.*

8.2 Consulting

The federation offers member companies advice on occupational safety and health issues, mainly with a focus on prevention.

8.3 Education

The Federation conducts various educational activities.

8.3.1 Safe Construction Training

On July 1st 2021 the Safe Construction Training became compulsory for everyone who is active on a construction site. The online course is available in ten different languages. It is free of charge and open for everyone. The results are valid for 5 years and are registered in the identifying system ID06. The course works equally well with all devices – desktop, tablet and mobile. The estimated number of completed courses in 2022 is 100,000.

8.3.2 BUC, education company

BUC conducts training in the following areas:

- Work environment – more than 30 different courses, such as silica dust, excavation, road work, scaffolding and the coordinators CPD and CE.
- Construction.
- Construction law.
- Environment and sustainability.

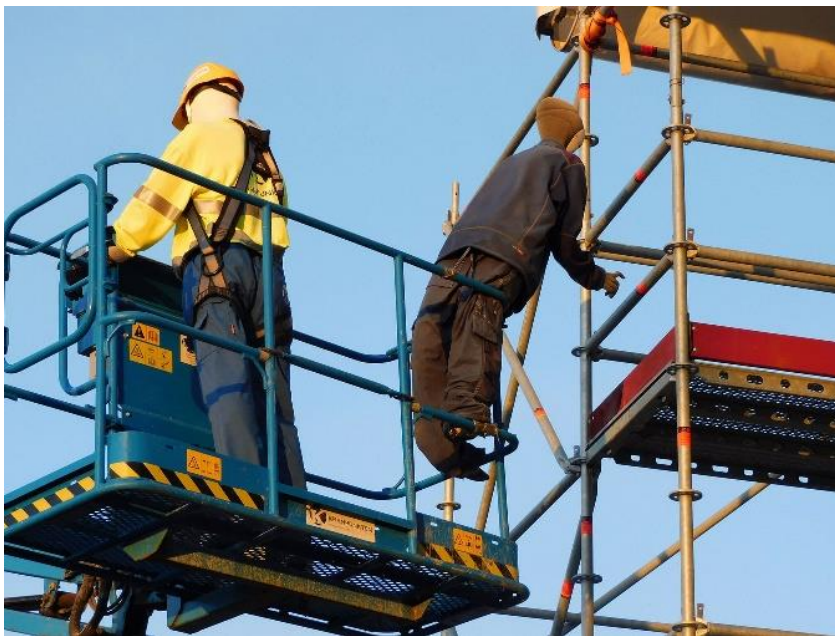
- Instructor training.
- Collective agreements and labor law.
- Leadership and corporate governance.

The number of completed trainings in 2021:

- 780 training sessions.
- 522 open (67%) & 258 (33%) internal.
- 445 classrooms (57%) & 335 remote/online (43%).
- 10 400 participants.
- More than 50% of the courses are about work environment.

8.3.3 Safety park

The safety park is today a facility of 15,000 m² where people who work in the construction process are given the opportunity to practice safety in groups and reflect on behavior and attitudes. The park creates opportunities for increased understanding of how behaviors affect the decisions made in the workplace, individually and in groups. By reflecting on behaviors in built-up stations and scenarios, a good insight into one's own behavior is created.



Skylift



Scaffold

Figure 7. Examples from the Safety Park

8.4 Management system

The Builder's Federation has developed a management system for small and medium-sized construction companies. The system is adapted to the industry's special conditions and is based on ISO 9001 (quality), ISO 14001 (environment) and ISO 45001 (working environment). Companies get help in the management system to formulate routines and, for example, define environmental aspects. Today, about 300 companies are certified. The goal is that 25% of all members by 2026 will be affiliated with BKMA Certification, that is about 1,000 converted into today's number of members.

Larger companies have normally chosen to certify themselves according to ISO 45001.

See also section 7!

8.5 Work environment plan-guide

The work environment plan, see clause 3.2.1, is an important and comprehensive document for work environment management in the planning process and at the construction site and a policy instrument for safe and secure work. To simplify the development of a work environment plan, a template document has been prepared, the so-called Work Environment Plan-Guide. For more information in English, see References!

8.6 ID06, Identifying system

ID06 is a system for easily identifying people in the workplace and linking each person to an employer. ID06 was launched by the Swedish Construction Federation in 2006 to promote healthy competition and safe workplaces in the construction industry. Today, the business is conducted in a separate company.

A very active industry association concerning work environment.

- Safe Construction Training, mandatory for all employees.
- Comprehensive work environment training with different focuses.
- An integrated management system, (quality, environment, work environment) adapted for the industry.
- Safety Park.

9. Statistics.

9.1 General on the Swedish labor market

This section refers to statistics for 2019. This is because the statistics for 2020 and 2021 are strongly influenced by COVID-19 and thus less relevant.

Fatal accidents at work mainly affect men. In 2019, 36 fatal accidents at work occurred in the Swedish workforce, 34 among employees (of which five women) and 2 among self-employed. *This means 0.9 fatal accidents at work per 100 000 employed persons.* Another 10 fatal occupational accidents occurred during the year among foreign citizens in connection with work in Sweden and people in labor market measures and the like.

When it comes to accidents at work, the relative frequency is lower in Sweden than in general in the European Union. Notably, the number of fatal occupational accidents per 100,000 workers has decreased by 95% between 1955 and 2019. The distribution of accidents is fairly evenly distributed across the country, with slightly lower numbers in the Stockholm area (more administrative work sites).

In 2019, approximately 34,700 accidents at work involving sick leave were reported among employees and self-employed, which is 1,500 more than in the previous year.

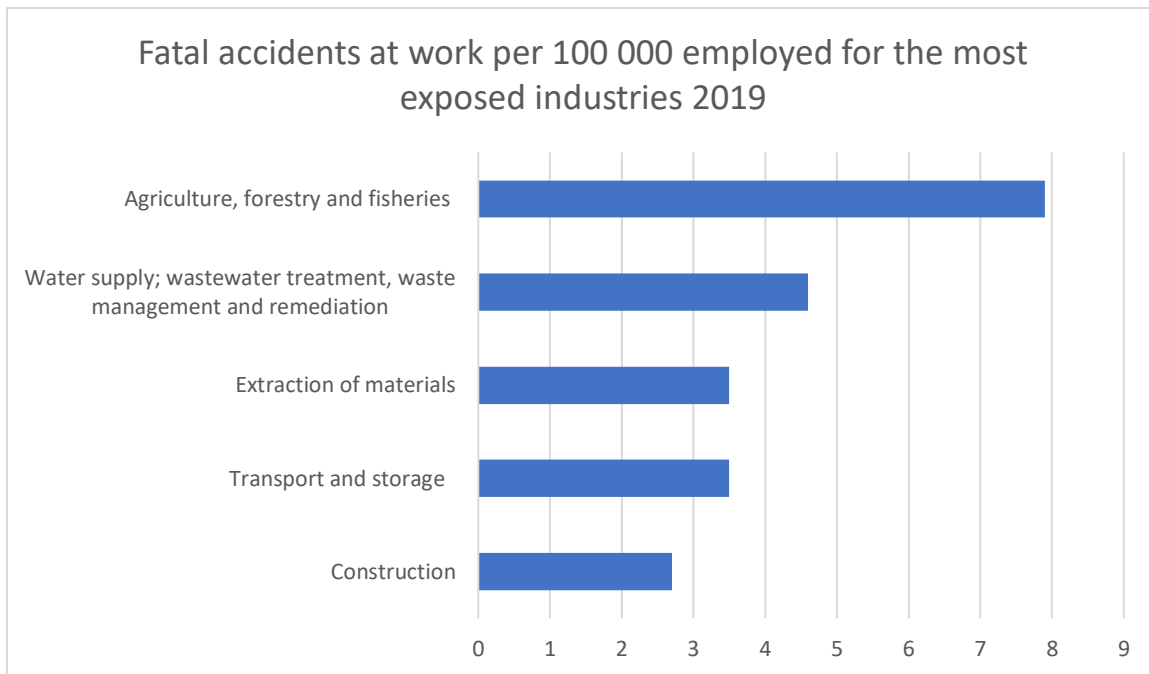


Figure 8. Fatal accidents, Sweden

The number of reports of occupational disease among workers and self-employed increased by approximately 1,700 notifications in 2019. More women than men have reported occupational disease (approximately 6,700 and 3,800 reports, respectively). This corresponds to approximately 2.8 notifications per 1,000 employed women and approximately 1.5 notifications per 1,000 employed men. The most common causes of reported occupational diseases were organizational and social causes, 40 percent, followed by ergonomic musculoskeletal disorders, 33 percent. It is mainly women who report occupational diseases for organizational and social reasons, and among women it has been the most common cause since 2014. Among men, ergonomic musculoskeletal disorders were the most common cause of reported occupational diseases in 2019.

The number of reports of occupational injuries in 2019 was different depending on the size of the establishment in which the injured person worked. Larger companies reported more accidents at work involving sick leave and more occupational diseases than smaller companies. Companies of 20 to 199 employees reported the highest number of accidents at work involving sick leave, 8.5 notifications per 1,000 employed persons and establishments with more than 200 employees reported the most occupational diseases, 2.8 notifications per 1,000 employed persons. One explanation for the difference between establishments of different sizes may be that the propensity to report differs as, for example, routines for handling occupational injuries may be different depending on the size of the establishment.

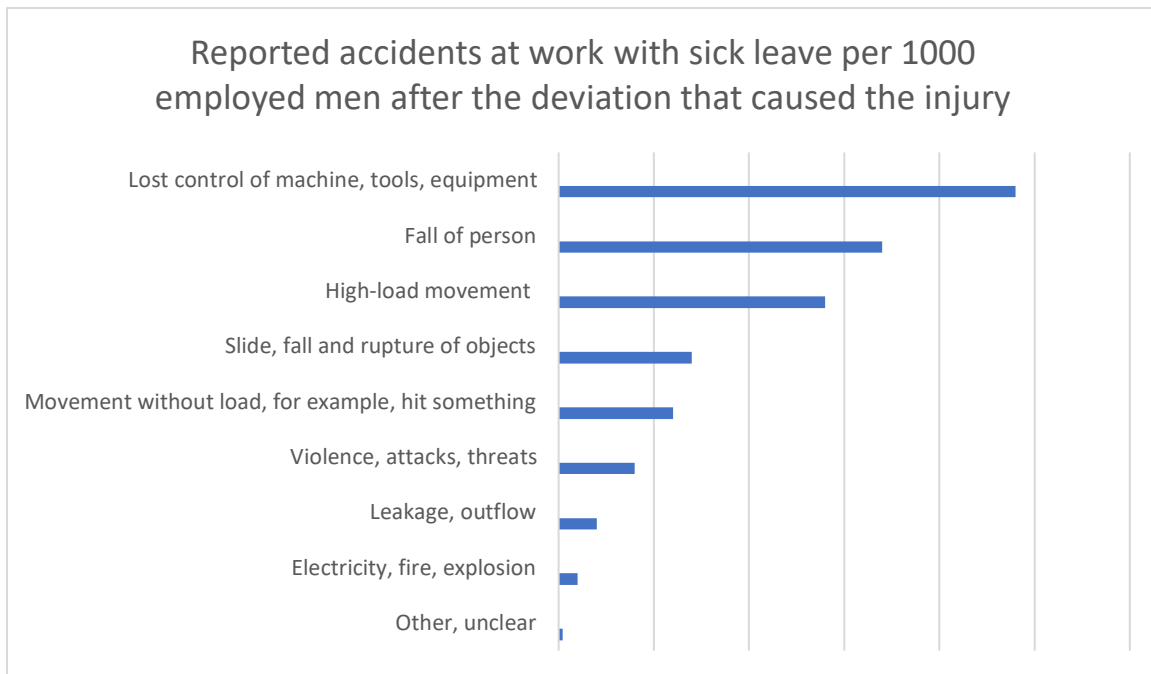


Figure 9. Reported accidents, Sweden

Over time, the decrease in occupational accidents, illnesses and deaths in the Swedish labor market is very noticeable.

The accidents are essentially evenly distributed across the country.

0,9 fatal accidents at work per 100 000 employed persons.

Construction is not the most affected industry in terms of accidents and fatal accidents.

The two most common types of accidents in construction industry are lost control of machine, tools, equipment and fall of person.

9.2 Building and Civil Engineering Work

The number of employees in the Swedish construction industry approximately 300,000.

9.2.1 Reported accidents in building and construction

This compilation includes reported work accidents to the Swedish Work Environment Authority and the Swedish Social Insurance Agency in private companies active in construction and civil engineering. All accidents resulting in at least one day's sick leave are included in the statistics

The long-term trend in accident rates has leveled off in recent years from being largely steadily declining for a long time.

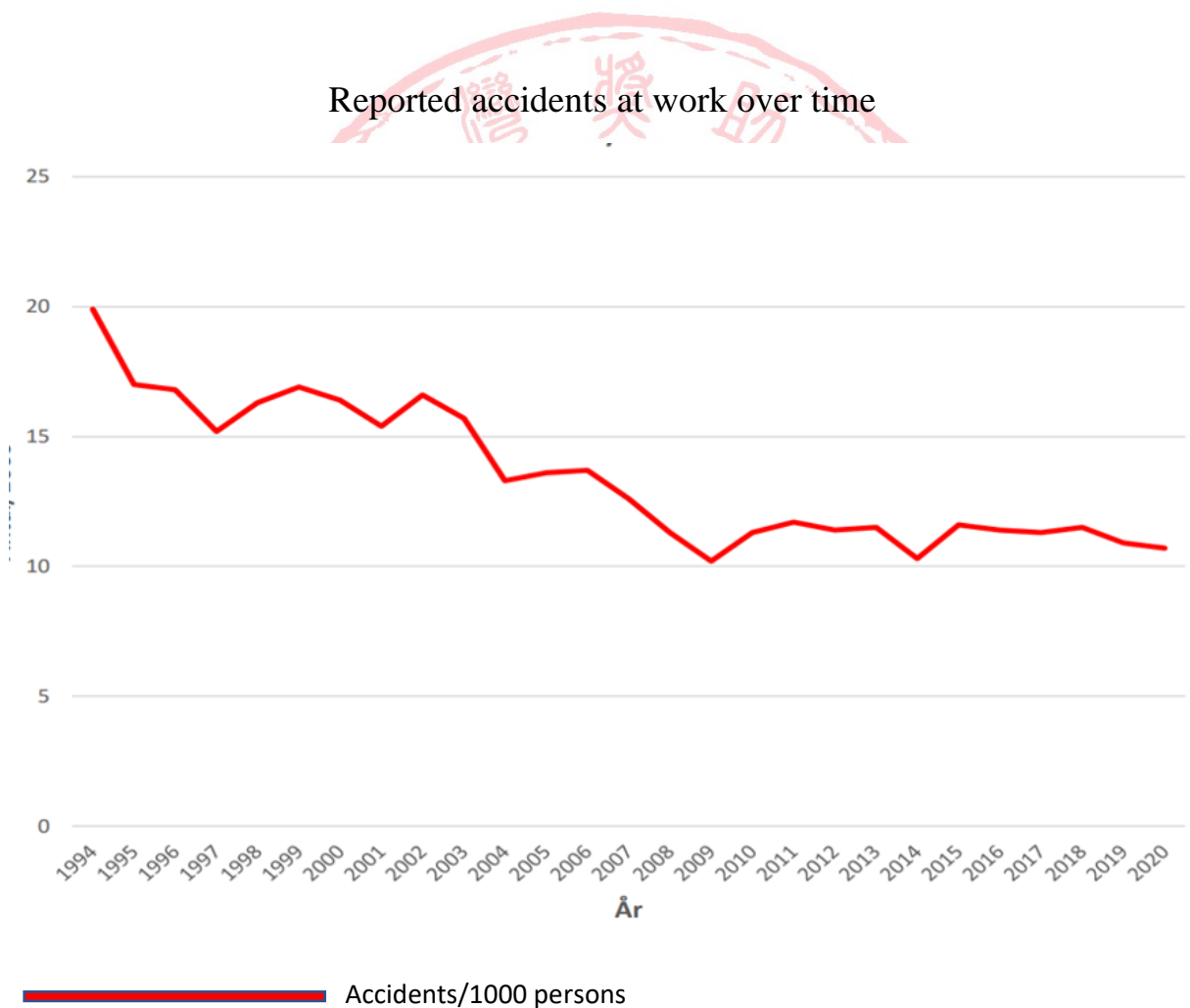


Figure 10. Reported accidents in the building and construction sector per year.

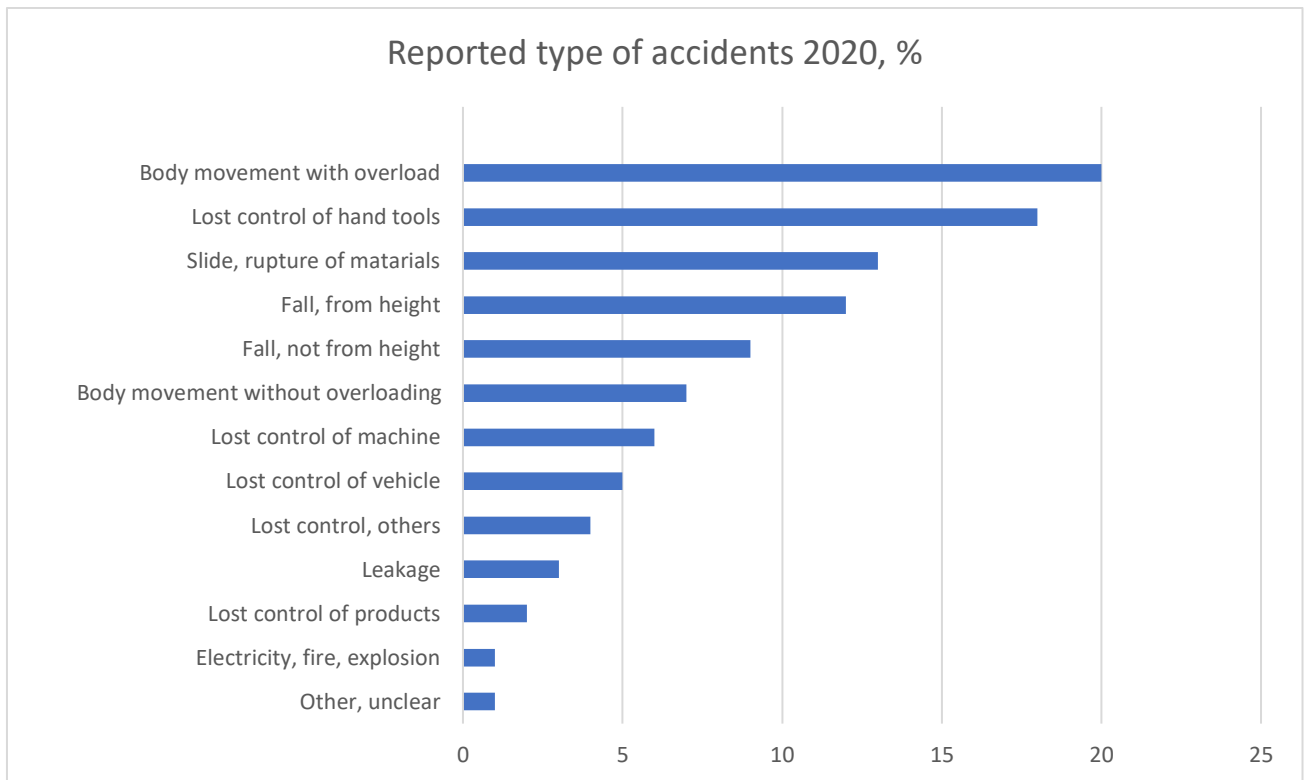


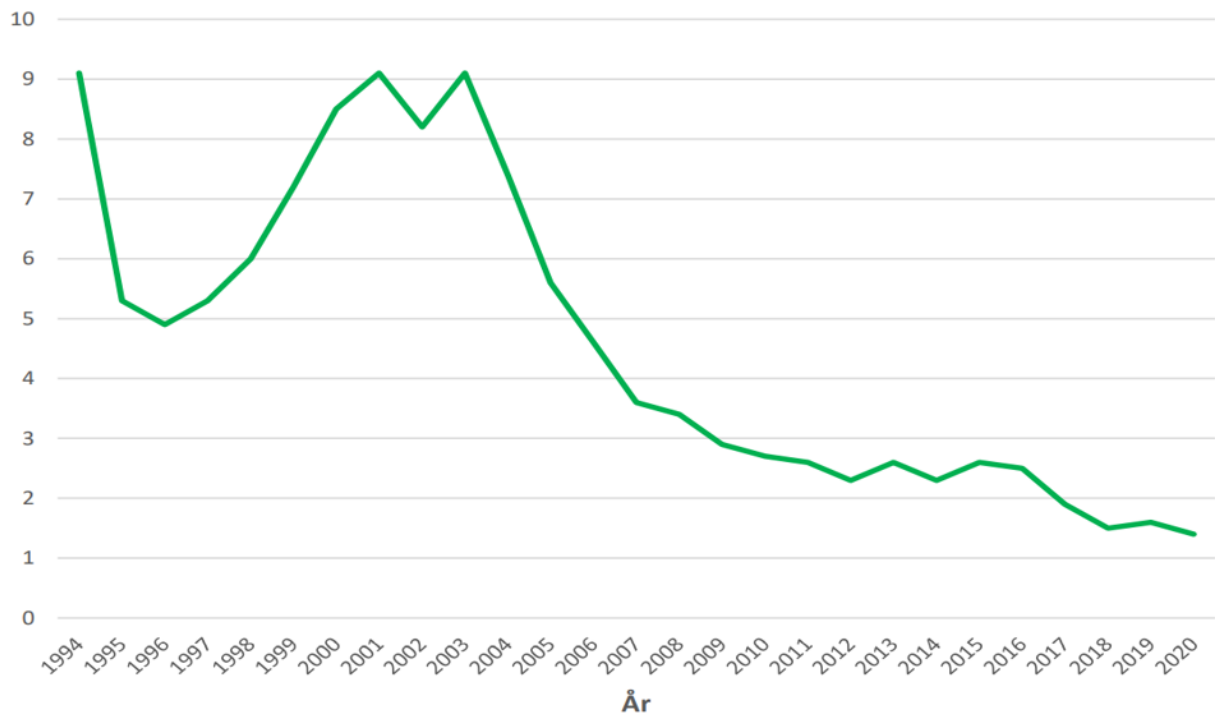
Figure 11. Reported type of accident in the building and construction sector.

9.2.2 Reported occupational diseases

This compilation includes to the Swedish Work Environment Authority and the Swedish Social Insurance Agency reported occupational diseases in the private construction industry in companies active in construction and civil engineering.

In the 2000s, the trend of rapidly declining frequency had almost levelled off, but after 2017 the declining trend has once again been noted. The year 2020 saw a significant drop to an all-time low.

Reported occupational diseases over time



— Number of occupational diseases/1000 persons

Comment: The "hump" between 1988-2006, can be explained by changes in the regulatory framework.

Figure 12. Reported occupational diseases in the building and construction sector.

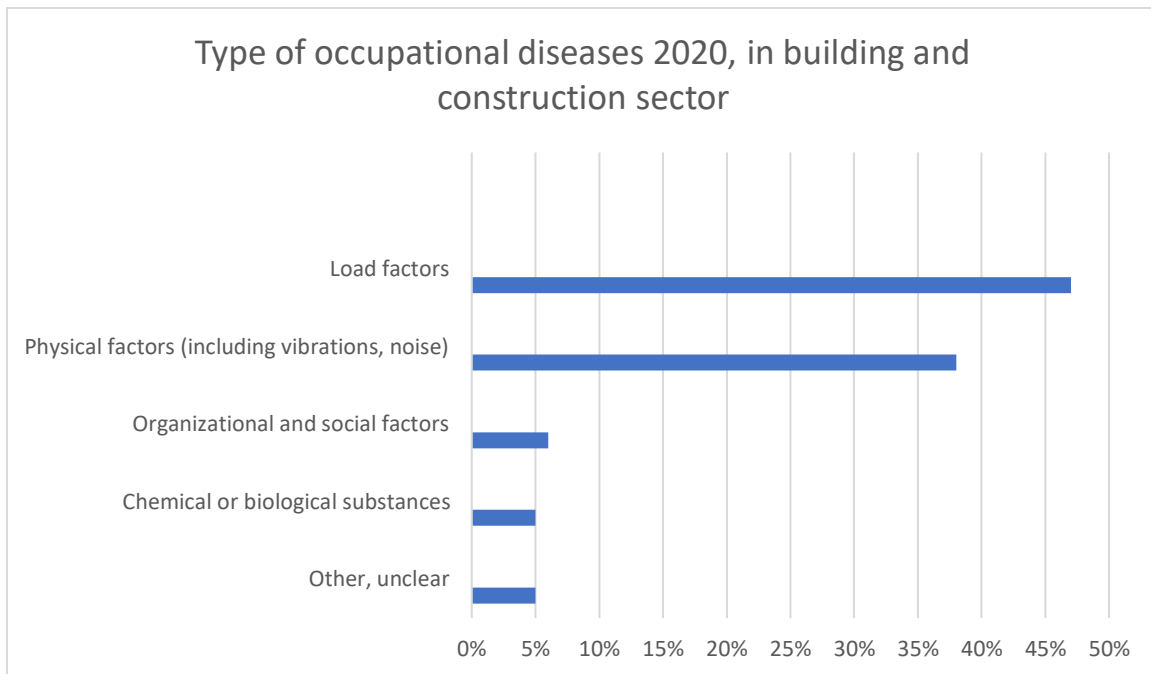
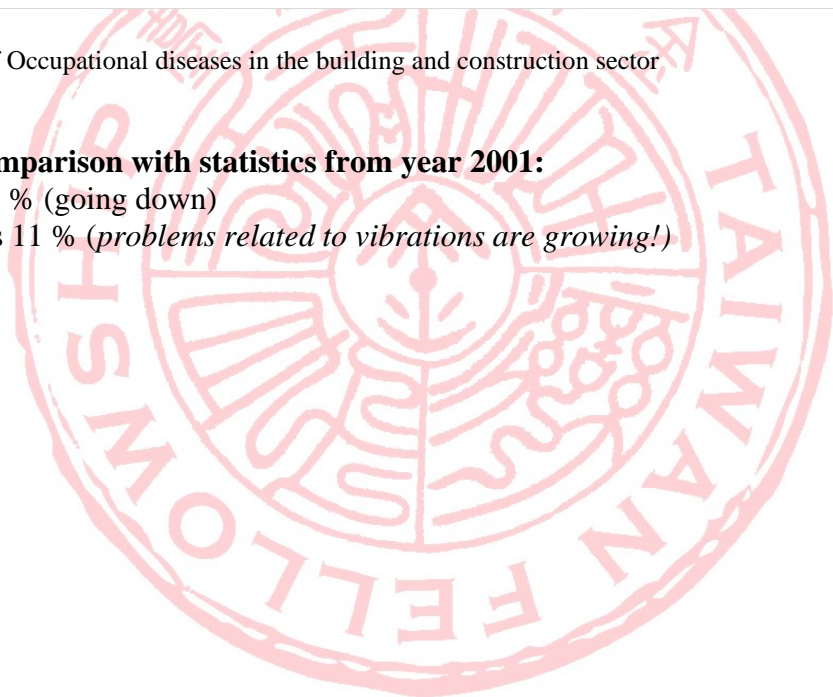


Figure 13. Type of Occupational diseases in the building and construction sector

Comments, comparison with statistics from year 2001:

Load factors 73 % (going down)

Physical factors 11 % (*problems related to vibrations are growing!*)



9.2.3 Deaths from accidents at work, building and construction (Swedish companies)

Number of deaths by year

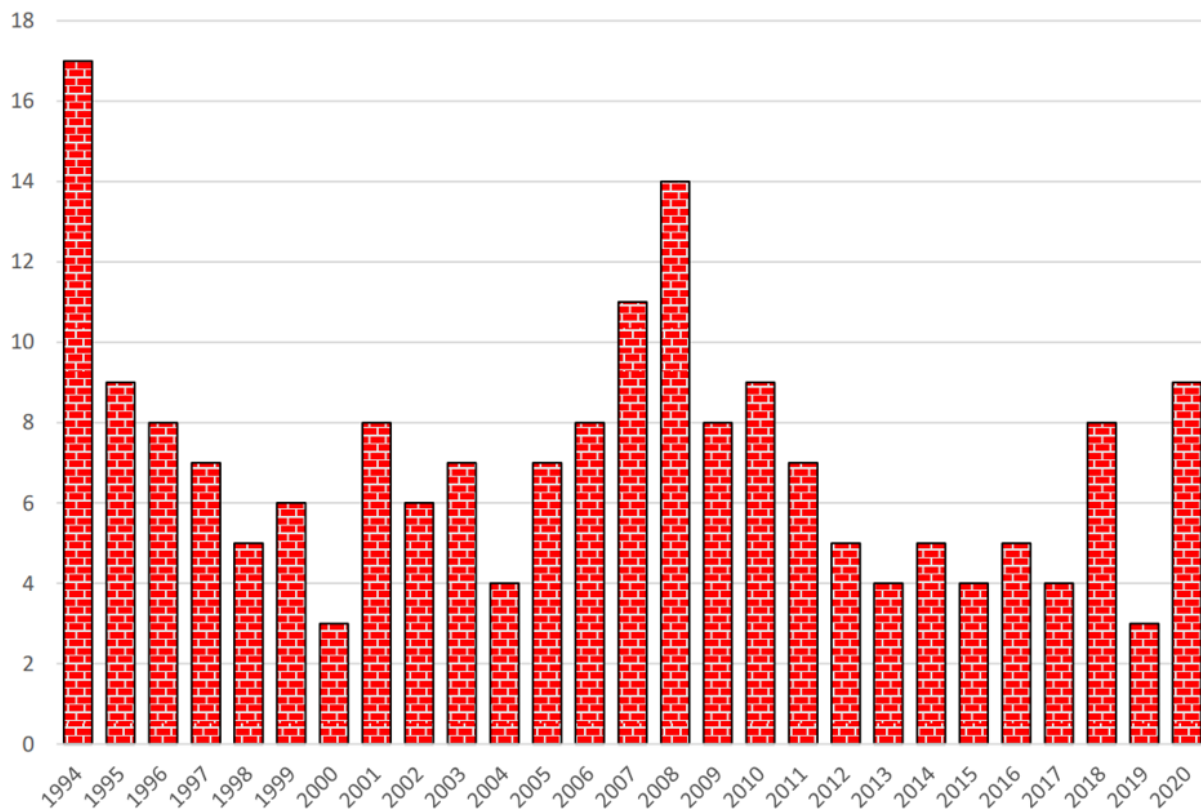


Figure 14. Fatal accidents in the building and construction sector.

In 2020, there were 9 deaths in workplace accidents that affected staff in private companies active in construction and civil engineering. That's six more cases than in 2019 and above the average for the past decade.

The sequence of events in the accidents was brief:

- Track worker hit by commuter train
- Crane truck driver hit by falling load
- Scaffolding builder fell from scaffolding
- Line fitter came into contact with live wire
- Excavator driver squeezed between wheel loaders and diesel tank
- Scaffolding builders fell from scaffolding
- Construction worker hit by falling equipment
- Wheel loader driver squeezed between concrete elements
- Construction worker clamped under wall blocks
- (In addition, one person died in the side industries, related to construction.)

Building and Civil Engineering:

11 reported accidents/1000 persons per year.

Body movement with overload and lost control of hand tools are the two most common causes of accidents.

1,5 reported occupational diseases/1000 persons per year.

Load factors represent approximately 50% of reported diseases.

10. Taiwan

The safety laws and regulations are separated into two different parts. Occupational Safety and Health Act with regulations, (OSHA). Building Act with regulations (Construction and Planning Agency Ministry of the Interior).

10.1 Legislation (OSHA)

Occupational Safety and Health Act, [occupational-safety-and-health-act.pdf \(osha.gov.tw\)](#).

The law is comprehensive and largely corresponds to the areas covered by the Swedish Work Environment Act. In quite a few respects, the legislation is more detailed than the Swedish legislation. For example, the use of safety data sheets for hazardous chemicals, *while in Sweden this is addressed in a special provision/regulation*. Another example is the use, control and certification of machines. There are other examples.

Risk assessments are to be carried out during designor construction planning phase.

The employers shall have the necessary safety and health equipment and measures (14 different risk works mentioned). One example - to prevent the risks of injuries posed by falling, falling objects or collapse at the job site.

“The employers shall adequately plan and adopt the necessary health and safety measures for the following items” , (4 types) “to prevent ailments induced by exceptional workload”.

General and special health examinations. *In Sweden, this is stated in provisions/regulations.*

The law, article 37, stipulates that fatal accidents and serious accidents must be reported to the relevant authorities. *Corresponds to Swedish rules, however, in Sweden serious incidents must also be reported.*

” Employers shall formulate a health and safety management plan based on the scale and characteristics of their business entities, and shall also establish safety and health organizations and personnel to implement health and safety management and self-inspections” *Similar to the Work Environment Plan for construction in Sweden, see section 3.2.1*

Areas of legislation, examples:

- Risk assessments must be carried out and reported.
- Appropriate safety equipment shall be provided:
- Protective measures to be taken.
- Clear employer responsibility.
- Machines must be safe and type-approved.
- Job site monitoring plan.
- All worksite building shall be designed by a registered, practicing architect in accordance with the law on architecture and safety and health provisions of the act.
- The employer must interrupt the work in case of serious danger
- Health examinations.
- Employers shall formulate a safe and health management plan based on the scale and characteristics of their business entities, and shall also establish health and safety organizations.
- Reporting of occupational accidents.
- Jobs not allowed for minors and pregnant women.

10.2 Legislation (Construction and Planning Agency)

10.2.1 Building Act

[Building Act \(建築法\) | Construction and Planning Agency Ministry of the Interior \(cpami.gov.tw\).](#)

“This Act is enacted to implement building management to maintain the public security, traffic and health, and to improve the appearance of cities”

Administrative rules for construction of public buildings, such as Building Permit. Some clauses have some connection to competence and thus also responsibility for the management of the workplace. For example- Article 13, “The building designers and supervisors mentioned in this Code shall be the legally registered architects”.

Article 28: Building licenses are divided into four classes, which means a quality connection.

Article 67 specifies: Where the construction methods or equipment’s of a construction work cause severe vibration or noise and dusts, and thus encumber the safety or peace of the ambient areas, the competent authority of construction may require the constructor to take necessary measures or restrict the operating time.

Comment: The work environment plan, which is a requirement at Swedish construction sites, states that all disturbances that affect third parties must be taken into account and remedied.

Chapter 2 addresses the issue of Building Permit. No work environment aspects specified.

Chapter 6, Usage Management, Article 77-3:

3. Legally practicing professional technicians or architects, or inspection institutions or organizations designated by the central competent authority of construction shall be entrusted periodically to perform safety inspection.

Comment: The Act essentially lacks work environment aspects.

10.2.2 Other Acts and Regulations

Design Standards of Urban Roads and Accessory Works

Lacks information about safety and work environment.

Construction Industry Act

Article 4. Any construction enterprise that is not permitted and licensed with a registration certificate or doesn't join the association of construction industry may not do business. The association of construction industry may not reject any application for joining the association.

Article 9. A specialized construction enterprise shall meet the following conditions:

1. Full-time engineers who meet the requirements of the professional works.
2. At least a certain amount of capital; the higher of the capital amounts where two items of professional works are registered.

The qualifications and number of full-time engineers referred to in Subparagraph 1 and the certain amount in Subparagraph 2 shall be determined by the central competent authority separately according to each item of the professional works.

Article 10. A civil engineering contractor shall meet the following conditions:

A principal of three years of civil construction experiences.

Article 31. The jobsite directors shall have any of the following qualifications, and shall be evaluated as qualified by the central competent authority or acquire certificates of technician Grade A of construction engineering management under technical evaluation legislations by the central labor authority and hold the practicing certificates granted by the central competent authority:

Article 32. The jobsite director of a construction enterprise shall take charge of the following affairs:

1. Construction according to construction plan and drawings.
2. Filling in daily construction logs.

3. Management of persons, machines, equipments and materials at the jobsite.
4. Supervision of labor safety and hygiene at the jobsite, maintenance of public environment and safety, as well as other jobsite administrative affairs.
5. Information of emergency and abnormality at the jobsite.

Comment: Procedures and quality requirements for functions in the construction industry.

Architects Act

Article 18. The architect accepting the client's commission to supervise building construction matters is obliged to observe the following regulations: Here references are made to construction documents and specifications.

Comment: Lacks clear information about safety and work environment.

10.3 Regulations, OSHA

Information from OSHA website:

10.3.1 Regulations Safety

Eleven regulations containing rules for installations, machinery, cranes and tools. Type certification, identification et cetera. *Corresponds to the Swedish regulations Machinery, section 3.2.5, Lifting devices, section 3.2.7 and Inspection of lifting devices, section 3.2.8*

10.3.2 Regulations Occupational Health

Five regulations containing chemical handling, use, labelling, risk assessment, prohibitions, hygienic limit values et cetera. *Corresponds to the Swedish regulations Chemical Hazards in the Working Environment section 3.2.12 and Occupational exposure limit values, section 3.2.13.*

Limit values:

Mineral dust containing equal to or more than 10% crystalline free silica *10 mg/m³*.

Mineral dust containing less than 10% crystalline free silica *1 mg/m³*.

Silica at workplaces in Sweden *0.1 mg/m³*, carcinogenic (exposure during a working day, normally 8 hours, the limit value shall not be exceeded).

Asbestos *0,15 ff/cc*.

Asbestos, Sweden and European Union *0,1 ff/cc*, carcinogenic.

10.3.3 Regulations others (Occupational Safety and Health Education and Training Rules)

Training requirements for designated functions, for example in construction:

"Safety and health education and trainings specified for the construction safety assessor and process safety assessor". As I understand it, there are safety assessors who focus on roofing/fall hazards and work in tunnels. See 10.4.2, below.

Comment: The functions CPD and CE in Sweden should have the training, competence and experience that is necessary for early stages respective execution of the construction work. Their competence must be verified by the developer.

10.3.4 Standard Building Safety, Civil Engineering

The regulation corresponds partly to the Swedish regulation "Building and Civil Engineering Work", see section 3.2.1! An important difference is that the Swedish regulation also contains a detailed description of responsible roles – developer, architect, designer, coordinator CPD and coordinator CE.

Below are areas that are also dealt with in the correspondent Swedish regulation (* = a work that in Sweden is designated as particularly risky and requires a work environment plan to be drawn up):

- Actions in the planning process.
- Measures to be taken by the employer and what the employer may require of the employees.
- Safety personnel shall be appointed.
- Delimitation and marking of the work site.
- Passing traffic. *
- Requirements for vehicles and machines
- Protective equipment
- Risk of slide, rupture should be taken into account. *
- Work near water. *
- Fall hazards (more than 2 meters). *
- Roofing work. *
- Safety net.
- Overlay of openings.
- Storage of materials.
- Information for workers.
- Ground work
- Transport routes in the workplace. *
- Caissons. *

Below are areas that are dealt with in specific regulations in Sweden:

- Tunnel work. *
- Lifting devices. *
- Demolition. *
- Painting. *
- Hygiene and sanitation.

Thus, there are rules for the most dangerous works, with a risk of fatal accidents, in the construction sector (marked with *).

10.4 Authority, OSHA

[Occupational Safety and Health Administration, Ministry Of Labor \(osha.gov.tw\)](http://osha.gov.tw)

10.4.1 Organization and inspections

The OSHA consists of four divisions mainly responsible for the planning, implementation and management of laws and regulations, policies, systems and projects.

- Planning Division
- Occupational Hygiene and Health Division
- Occupational Safety Division
- Occupational Accident Labor Protection Division

A total of 34,431 inspections of *working conditions* were conducted in 2021, and these inspections uncovered 5,939 violations; the penalty rate was 18.92%, and fines totalled NT\$ 312,020,000. By type of industry, the 45,379 enterprises in construction engineering accounted for 35.22% of the total.

A total of 164 585 inspections of *sanitation and safety* were conducted in 2021 (about 69 000 in construction).

Thus, OSHA with its regional office conducts a very extensive inspection work!

10.4.2 Education

The Administration publishes training materials, also aimed at construction activities.

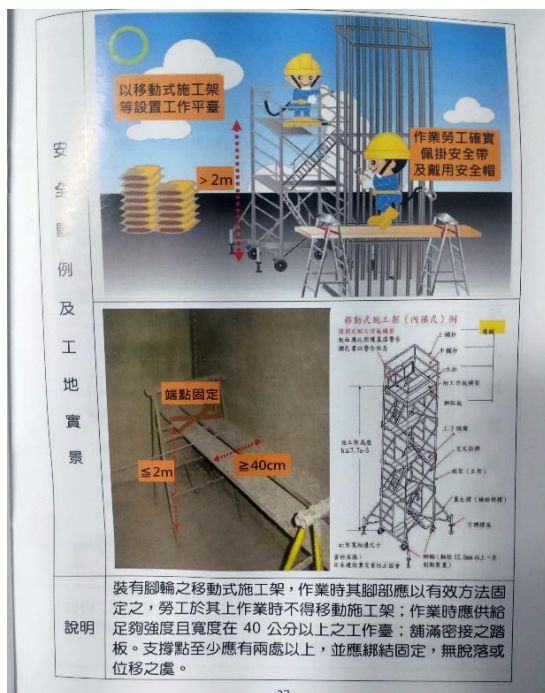


Figure 15. training material for construction

Quote from the survey: “Occupational Safety and Health Administration of the Ministry of Labor has posted activities (training/information) on their web site. In Taiwan, it is mandatory for a construction organization, especially a larger company, to conduct activities and training for its members in the field of occupational safety and health”

10.5 Taipei Labor Inspection Office

This is an example of a regional labor supervision authority. In addition to inspection activities, activities are conducted regarding general work environment information, service to the public and companies, FAQ's, information about education and training et cetera. The Administration also publishes training materials, aimed at construction activities.

10.6 Construction and Planning Agency, Ministry of Interior

Quote from the web page: “Upholding the philosophy of "innovation, responsibility, and continuous transformation", the CPA works to improve administrative management of construction and professional development of construction technology...”

One of the visions are - Safety: Integrate innovative construction management and quality construction technology to pursue a new paradigm for engineering and residential construction of utmost safety. In addition to the above, I have not found information on occupational safety and health issues in the construction sector. I have also not been able to get in touch with the authority.

10.7 Education. “Builders Federation/Association”

In addition to government agencies, there are associations, companies and organizations that conduct educational activities in the field of occupational safety and health, including construction activities. Some examples are Yilan County Labor Education Association and Industrial Safety and Health Association.

10.7.1 Yilan County Labor Education Association

Is an association that conducts various types of work environment training. For the educational programs, there is financial support from the Ministry of Labor. Some examples of training:

- Create education and training materials for occupational safety and health business supervisors in the construction industry.
- Issues related to regulations and standards, related to work environment and fire protection.
- Risk management, occupational safety.
- Management of occupational safety and health.
- Ergonomic and behavioral sciences.
- Fixed cranes, mobile cranes, stackers, excavators pressure vessels.
- Head of work environment operations in the construction industry.
- Work Environment Administrator.
- Construction Industry Type A Occupational Safety and Health Business Supervisor.
- Construction work, vehicle construction machinery.

10.7.2 Industrial Safety and Health Association

The Association promotes the implementation of safety and health actions in order to achieve the purpose of preventing occupational disasters and improving the working environment.

The association conducts extensive educational activities, including in the construction industry. Teaching materials, stipulated by the law, for the construction industry:

- Create education and training materials for occupational safety and health business supervisors in the construction industry.
- Educational and training materials for the supervisor of occupational safety and health business in the construction industry.
- Education and training materials for construction safety assessors.
- Roofing supervisor education and training materials.
- Education and training materials for supervisors of excavation operations such as tunnels.
- Education and training materials for mobile crane operators with lifting loads of more than three metric tons.



Figure 16. Training materials for supervisors and managers in construction industry

10.8 Statistics

These statistics are taken from OSHA, Taiwan, and refer to all labor within the country. SOI = severe occupational injuries.

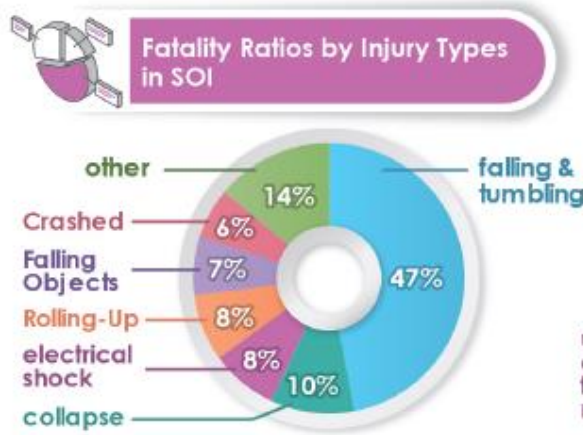


Figure 17

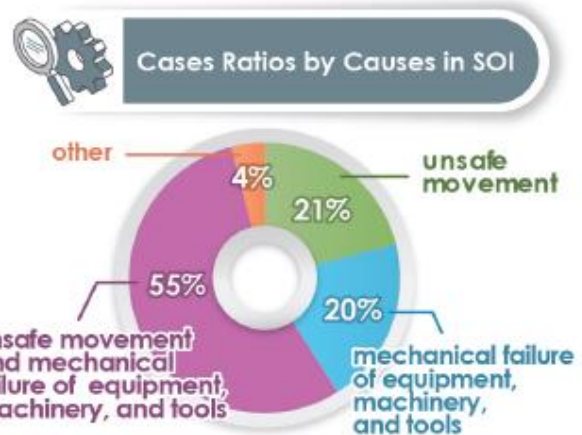


Figure 18

Another metric used in Taiwan is the Frequency of disabling injuries due to occupational accidents. Frequency of disabling injuries = Number of disabling injuries × 1000 000 / Total man-hours worked. The average frequency of disabling injuries due to occupational accidents in all industries was 1.55, year 2021. In construction the frequency was 1,86, not one of the highest values.



Number of Fatalities of the First Two Industries in SOI

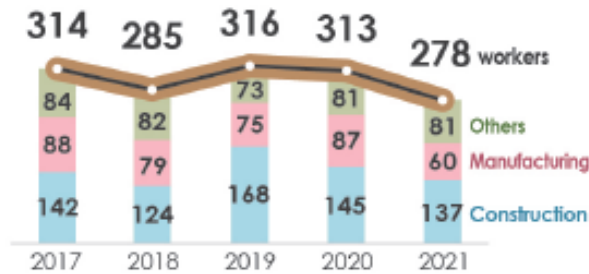


Figure 19

11. International outlook

European Union, fatal accidents at work, 2019, Incidence rates per 100 000 persons employed (Eurostat):

EU: 1,7

France 3,5

Sweden 0,7

Netherlands 0,5

Big differences!

Eurostat: In 2019, the highest incidence of non-fatal accidents at work in the EU was observed in construction, with 3 211 such accidents per 100 000 persons employed. (Transportation and storage 2 673, Manufacturing 1 859).

Eurostat: In 2020, more than a fifth of all fatal accidents at work in the EU took place within the construction sector (Sweden 25 %, Taiwan 50 %).

Number of work-related deaths in the construction industry in the United States about 1 100 in 2019 (www.statista.com). Taiwan 168, 2019, 15 % compared to US.

12. Comparisons

12.1 Overview

Area	Sweden	Taiwan
Traditions, awareness	Very long experience of safety thinking, <i>subjective opinion</i> .	Shorter experience than in Sweden, <i>subjective opinion. but confirmed by individuals I have spoken to and own personal observations.</i> But observe there are many certificates according to ISO 45001. Rising awareness?
Occupational Safety and Health Act, in general	Similarities. The Swedish Act is more of a framework used as a basis for detailed regulations. A framework legislation.	Similarities with regard to the overall objective of ensuring a good working environment.
Occupational Safety and Health Act, details	Is more general and comprehensive, except that the construction industry is addressed.	In addition to general issues, issues related to different types of work and work steps are also addressed
Reporting of serious accidents.	Is prescribed in the law. Even incidents (incident - that could have led to a serious accident) must be reported. This is important for evaluations and improvement work.	Is prescribed in the law.
Occupational Safety and Health Act, building and construction.	Building and construction is specifically mentioned and regulated. Four important functions and their responsibilities are defined – the developer, architects and designers and the coordinators for planning and design CPD/BAS-P and for execution of work, CE/BAS-U.	Building and construction is not highlighted as a special industry.
Provisions/regulations connected to the Occupational Safety and Health Act	Established by OSHA, about 80 provisions. They are quite different in nature – some regulations contain strict directives with fees, some are more descriptive and informative.	OSHA Regulations are available for three areas - Safety, Health and Other/Training and The Standard Building Safety, Civil Engineering.

<p>Taiwan: Building Act Construction Industry Act Architect Act.</p>	<p>Corresponding Swedish legislation exists.</p>	<p>Mainly lacks work environment aspects.</p>
<p>The Swedish Provision Building and Civil Engineering Work</p>	<p>A comprehensive provision describing administrative issues, risks and measures for different work situations. The regulation is an adaptation to the European "Construction Sites Directive" More than 20 other provisions also directly affect building and construction.</p>	<p>Some of the OSHA provision directly affect the construction industry, such as rules for cranes. The Standard Building Safety, Civil Engineering largely corresponds to the Swedish provision.</p>
<p>Coordinator for Planning and Design, CPD/BAS-P</p>	<p>Clearly described function that is defined both in the Work Environment Act and in the regulation Building and Construction. Requirements for approved education/competence and experience.</p>	<p>A corresponding function does not seem to exist in Taiwan.</p>
<p>Coordinator for Execution of Work, CE/BAS-U</p>	<p>Clearly described function that is defined both in the Work Environment Act and in the regulation Building and Construction. Requirements for approved education/competence.</p>	<p>There must be a construction safety assessor with approved training. The trainee needs to have the certificate with validation before working at the project with EHS concerns required by the mandatory regulations or project owner requirements. The role is similar to the function CE/BAS-U in Sweden.</p>
<p>Work Environment Plan</p>	<p>In principle, all construction projects must have a formal work environment plan. The developer is responsible. Sanction fees!</p>	<p>” Employers shall formulate a health and safety management plan...”). The Swedish work environmental plan is more clearly defined.</p>

Safety representative	Yes, with mandate to stop work.	Not with the same capacity as I understand. But workers, according to Article 18 of the law, may terminate the work in case of immediate danger.
OSHA, website	On the website there is information about the Work Environment Act, provisions, brochures, statistics, interactive training, theme pages, work environment issues in various industrial sectors, FAQ's in the construction sector.	Less information than in the Swedish one. Examples of headings: <ul style="list-style-type: none"> • Laws and Regulations • Statistics • Annual Report • News • Links There are also regional institutions, such as the Taipei Labor Inspection Office with extensive and detailed information on various OSHA issues. See section 10.5!
OSHA inspections	Employed inspectors: 278 Inspections (safety and working conditions) about 25 000 per year. Targeted inspections against construction are carried out on a recurring basis.	164 000 inspections (sanitation and safety) 34 000 inspections (working conditions). <i>A lot more inspections are made in Taiwan.</i>
Legal actions, sanctions	Sanction fees. A sanction fee is a <i>fee</i> and involves a simpler process, while fines are a <i>penalty</i> one is sentence to in a court of law. Earlier, several stipulations in the provisions carried a penalty and the employer could be sentenced to fines. From 1 July 2014, several regulations carry a sanction fee.	Fines are defined in Chapter V in the Act. I have not been made aware of how legal actions, in the form of sanction fees, are managed in Taiwan.

Construction Federation	Very extensive work on health and safety issues, included courses/training.	No information available direct from a Federation But there are professional associations and private companies engaged in extensive and varying work environment training.
Training, competence		
Work environment courses/ training at universities	Occurs to a limited extent.	Occurs to a limited extent. Seems to be at the same level as in Sweden.
Lower level than universities.	Occurs normally	Hardly occurs at all (according to comments in the questionnaire).
Employees in general in the construction industry.	The Construction Federation offers a wide range of courses.	Associations of different types offers courses to a similar extent as in Sweden.
Workers	The Construction Federation offers a wide range of courses.	Foreign workers with skills shortages (according to comments in the questionnaire).
Certificates ISO 45001, 2021.	534.	1866, <i>impressive</i> .
Integrated Management System	The Builders Federation has developed a management system for small and medium-sized construction companies. The system is adapted to the industry's special conditions and is based on ISO 9001 (quality), ISO 14,000 (environment) and ISO 45,001 (working environment).	No corresponding system has been identified.
Size of working areas. In my opinion, this issue is of minor importance.	This problem also exists in Sweden.	Taiwan is very densely populated and many construction sites are therefore short of space. Causing more accidents. (according to comments in the questionnaire).

Fatal accidents, the entire labor market, per year	About 40 (Swedish OSHA)	About 300 (figure 19) A high figure in an international comparison (clause 11)
Fatal accidents in construction compared to the entire labor market.	25%	49% A very large percentage!
Fatal accidents in construction per year	About 10. Corresponds to 0,03 per 1000 employees and year	137, according to OSHA 2021 (figure 19). Corresponds to 0,16 per 1000 employees. <i>Is there data to evaluate on the distribution of accidents and fatal accidents between foreign and domestic workers?</i>
Serious accidents in construction	11 per 1000 employees per year (reported)	Frequency of disabling injuries 1.86 <i>Difficult to compare.</i>
Reported diseases in construction	1.5 per 1000 employees per year.	Have not found information.
Hygienic limit values	<i>0.1 mg/m³</i> , carcinogenic (exposure during a working day, normally 8 hours, the limit value shall not be exceeded). Asbestos, Sweden and European Union 0,1 ff/cc, carcinogenic.	10% crystalline free silica <i>10 mg/m³</i> . less than 10% crystalline free silica <i>1 mg/m³</i> . Asbestos 0,15 ff/cc.

12.2 Statistics

It has proved difficult to compare statistics on accidents and diseases. What is an accident or occupational disease, disabling injury, tendency to report, how is reporting classified and presented? I have studied the Annual Report of Labor Inspection, Statistics in 2021, but have failed to find relevant accident comparison figures.

A clear and important indicator is therefore the number of fatal accidents. This metric is clear and cannot be misunderstood and should also reflect the number of accidents and occupational diseases. According to Figure 19, the number of fatal accidents in building and construction in Taiwan is 137 in 2021. In Sweden, the number of fatal accidents amounts to about 10 (including foreign companies operating in Sweden), see section 9.2.3. Even considering that Taiwan has twice as many inhabitants and 2-3 times as many employees in the construction industry, this is an astonishingly large difference. According to OSHA

statistics, I find that the number of deaths in the construction sector is 0.16 per 1000 workers, compared to Sweden 0.03.

According to figure 19 in section 10.8, the construction sector accounts for about half of the fatal accidents that occur in Taiwan ($137/278 = 49\%$). The corresponding figure for Sweden will be about $40/10 = 25\%$ (clause 9.1 and 9.2.3). Fatal accidents in construction thus constitute a significantly larger proportion (a double) of the total fatal accidents than in Sweden. This fact makes visible in a clear way the relevance of this project.

If one compares figures 17 and 18 with the distribution of accidents in the Swedish construction industry, figure 10 in section 9.2.1, it can be concluded that there seem to be largely the same causes behind the accidents.

Statistics for Sweden in general (for men) are presented under section 9.1., figure 8. Notably, violence, attacks and threats are surprisingly the sixth most common cause of occupational injury in Sweden and that injuries by electrical shock seem to be more common in Taiwan.

12.3 Occupational Safety and Health Act

Both countries' legislation is comprehensive and comparable in level of ambition. In Taiwan, the Act is more data-oriented, while in Sweden most of the detailed issues are handled in separate regulations. The construction industry is the only industry specifically mentioned and regulated in the Swedish Act.

12.4 Legislation – Construction and Planning

Legislation such as the Building Act, the Construction Industry Act and the Architects Act essentially lacks rules and directions in the area of occupational safety and health. The same applies to corresponding legislation in Sweden.

12.5 Provisions

In Sweden, there are about eighty provisions/regulations issued, of which over twenty affect the construction sector. Some of the provisions cover work involving serious accident risks, while others deal with long-term health risks, such as Noise and Ergonomics..

In Taiwan, there are a standard for Building Safety, Civil Engineering and OSHA Provisins/regulations in three areas: Safety (eleven), Occupational Health (five) and "Others-Education and Training" (one).

12.6 Authorities OSHA

According to information on the websites, both authorities seem to be working in a similar way. The information on the Swedish website is richer in content and more informative. The website (English version). OSHA, Taiwan could be more informative with descriptions of issues such as the regulations, interactive training, work environment issues and FAQ's in different industry types, theme pages and more. Can be part of creating increased awareness.

12.7 Builders Federations

The Swedish Federation is very active concerning work environment:

- Safe Construction Training, mandatory for all employees.

- Comprehensive work environment training with different focuses.
- An integrated management system, (quality, environment, work environment) adapted for the industry
- Safety Park

No information has been found about similar activities in Taiwan.

12.8 Awareness

Without being able to point to anything concrete or be able to verify, I dare say that there is a longer tradition of health and safety thinking in Sweden. This has also been verified by people I have spoken to.

12.9 Questionnaire, quotes, and comments

A questionnaire with questions related to conditions in Taiwan has been sent out. Seven responses were received and evaluated. The survey contains nine multiple-choice questions and four supplementary general questions. The multiple-choice questions concern issues of responsibility and competence of the different actors, legislation and inspections.

Summary of the answers:

- Contractors take greater responsibility for the work environment than developers, architects and designers.
- The contractors have good knowledge.
- Workers' skills can be improved.
- Health and safety legislation and regulations are appropriately designed and strict enough.
- There are many courses/trainings available by government agencies and professional associations.

Some comments made in the questionnaire and in discussions:

"We have not worked as long with these issues as you in Sweden have done"

"The working force is poorly educated"

"A lot of immigrant workers with poor skills"

"The design of legislation and regulations has been influenced by American practice"

"Yes, technically and legally are adequate education in engineering schools."

"The trainee needs to have the certificate with validation before working at the project"

"HS concerns required by the mandatory regulations or project owner requirements".

"It is all about the execution and management rather than education or training."

"The owner requires completion and delivery, then the contractor takes into account the profit of the project, and neglects the protection of hazards in labor operations."

“Insufficient self-worth of workers: because blue-collar workers have a high tolerance for unsafe conditions or harm to the environment, a harm to the environment has become a major cause of occupational disasters.”



“ The smaller construction companies are more affected.” by

Figure 20. Comment from the working floor

“The economy comes first, security is neglected”

“Occupational Safety and Health Administration of the Ministry of Labor has posted activities (training/information) on their web site. In Taiwan, it is mandatory for a construction organization, especially a larger company, to conduct activities and training for its members in the field of occupational safety and health”

“A lot more accidents occur on the countryside, compared with Taipei”.

“Lack Occupational Safety and Health courses in schools”.

“Taiwan is very densely populated and many construction sites are therefore short of space. Causing more accidents”.

Observation from the author: Has passed workplaces with very high noise levels (carpentry, mechanical workshop, two road constructions and three street cleaning activities with noisy work tools), No one in these workplaces used hearing protection. *Lack of awareness?*

13. Conclusions

The construction sector in Taiwan accounts for about half (49%) of the fatal accidents that occur in Taiwan. The corresponding figure for Sweden is about 25% (clause 12.2). Fatal accidents in construction thus constitute a significantly larger proportion (a double) of the total fatal accidents than in Sweden.

The statistics on accidents and illnesses in construction are difficult to compare – different classifications, reporting, classification and so on. On the other hand, the number of fatal accidents both generally and in the construction industry is clearly lower (5 times) in Sweden.

I have therefore concluded that the number of accidents and illnesses is also lower in Sweden. What factors, then, could be the reasons for this. I have made a priority order below from my perspective, but this I believe should be discussed and adjusted according to the conditions in Taiwan. What is reasonable? What has been misunderstood by me? What is possible to change? Priorities, etc.

Over the course of the project, *I have become more and more surprised that the situation is so different with much more accidents and fatal accidents in Taiwan.* There are many similarities between the countries in terms of legislation, regulations, the interests of those I have spoken to, authorities, inspections, training opportunities and more.



Figure 21. Seems to be a good site planning.

The best thing to get an answer to the question about the higher accident rate in Taiwan, in my opinion, would be for this report to form a basis for improvement work, evaluations, seminars and discussions.

Important factors, priority order from my perspective:

1. *Awareness and tradition* are important factors that can explain that there are fewer accidents and deaths in the Swedish construction industry. These factors are difficult to directly address, but can be built up through long-term work on the points below and on the issues mentioned in the overview in section 12.1.

But, many companies in Taiwan have chosen to certify themselves according to ISO 45001, which indicates an increasing awareness.

Hygienic limit values for hazardous substances appear to be higher in Taiwan. Also a sign of lower awareness?

2. In Sweden, there are one comprehensive provision focusing on the construction sector and just over twenty *detailed provisions* that have a direct impact also on the construction sector, see sections 3.2.1-3.2.21. Certain paragraphs in these are besides linked to sanction fines. I consider the Swedish provisions to be somewhat more extensive. Maybe some of these provisions may receive counterparts in Taiwan?

3. *Clearly identified work environment responsibilities.* In Sweden, well established and extensive responsibilities through the whole construction process are specified partly in the Work Environment Act/Occupational Safety and Health Act and partly in the regulation Building and Civil Engineering Work. This applies to the four functions, the developer, architects and designers and finally the two coordinators, CPD/BAS-P and CE/BAS-U. The coordinators have extensive responsibility for planning and design and execution of a construction project respectively. They need training, competence and experience, which must be verified and approved by the developer. The duties and responsibilities of the coordinators CPD and CE are also described in the European regulations.
4. *Responsibility for early stages* is clearly defined. This is already mentioned in point 3 above, but is worth to be emphasized. The **developer** and **CPD/BAS-P** are responsible for considering work environment aspects and doing the right thing from the start. Also architects and designers have a designated work environment responsibility within the framework of their assignments. Corresponds to similar rules in Europe.
5. *Informal governance* from the Swedish Construction Federation, such as consulting, training, Safe construction training, Safety Perk and requirements for entering a construction site (Id06). See section 8! I have not been able to obtain information about any similar activities in Taiwan. But there are Health and Safety extensive courses/trainings conducted by government, agencies, companies and professional associations.

This governance from the Swedish Construction Federation reflects naturally the awareness and ambitions of the member companies regarding the working environment. It is worth noting the large number of companies in Taiwan that have chosen to certify themselves according to ISO 45001, which indicates a growing commitment.

6. In principle, all construction projects must have a *formal and detailed work environment plan* in Sweden. This must be established by the developer and the coordinator CPD and then managed by the coordinator on the construction site CE/BAS-U. It is thus available throughout the construction process. The design of the plan is clearly regulated in the regulation Building and Civil Engineering Work. If it is not drawn up or if it is incorrectly designed, sanction fees may be imposed. This instrument has proven effective in drawing attention to and addressing occupational safety and health risks. Whether the plan regulated by the Taiwan Occupational Safety and Health Act fulfils the same function escapes the author's judgment ("Employers shall formulate a health and safety management plan...").
7. *Safety representatives* have existed in Sweden since 1912 and contributed to a secure working environment. The safety representative represents other employees and should collaborate with the employer to create a good working environment. In case of immediate or serious danger for the lives of the employees the Safety Representative can decide to stop work (a so-called *safety representative stop*) and wait for the Work Environment Authority to take a position in the matter. Is this effective instrument possible and desirable to introduce in Taiwan?

8. Skills, competence, training. Work environment courses/ training at universities and in the construction industry (supervisors, managers and the like) seem to be on the same level. At lower levels than universities it seems to be more work environment training conducted in Sweden. In Taiwan there are many foreign workers with skills shortages (according to several comments in the questionnaire and in discussions). Is there data to evaluate on the distribution of accidents and fatal accidents between foreign and domestic labor? In Sweden, all staff must undergo "Safe Construction Training", see clause 8.3.1.
9. Swedish trade unions have traditionally been strong and pursued work environment issues, not least in construction. What the situation looks like in this matter in Taiwan is beyond my area of knowledge.
10. Also the overview in section 12.1 contains issues that might be of importance and therefore should be taken into account, evaluated and discussed.

14. Final words

Finally, I would like to thank all those in Taiwan and in Sweden who have contributed with information, tips and information. Without you, it would not have been possible to carry out the project.

I hope that the project and the report will be followed up by relevant stakeholders in Taiwan. And that in the long run, the project can be part of a process that leads to fewer fatalities, injuries and occupational diseases in the construction sector.

15. References

Swedish

Swedish Work Environment Act, [Work Environment Act \(1977:1160\) Non-official translation \(government.se\)](#)

Swedish work environment authority, English. [Start - Arbetsmiljöverket \(av.se\)](#)

Regulations in Sweden, see section 3! Some regulations are also available in English, [Provisions - Arbetsmiljöverket \(av.se\)](#)

Work Environment plan-guide, English version. [Arbetsmiljoplanen_mall_eng.docx \(live.com\)](#)

Brochures from Swedish OSHA, in English:

Sanction fees. [Brochure, Information about sanction charges, ADI 687eng \(av.se\)](#)

Responsibilities [Who is responsible for what within building and construction? \(ADI 704\), brochure \(av.se\)](#)

Safer building and civil engineering work. [Säkrare bygg- och anläggningsarbete, Engelska, ADI 539Eng \(av.se\)](#)

[Safer Building \(ADI 659 Eng\), brochure - Arbetsmiljöverket \(av.se\)](#)

[Protect yourself against falls from height \(ADI 703\), brochure - Arbetsmiljöverket \(av.se\)](#)

Taiwan

Occupational Safety and Health Act, [occupational-safety-and-health-act.pdf \(osha.gov.tw\)](#)

Regulations Safety, [Regulations\(Safety\)-Occupational Safety and Health Administration, Ministry Of Labor \(osha.gov.tw\)](#)

Regulations Occupational Health, [Regulations\(Occupational Health\)-Occupational Safety and Health Administration, Ministry Of Labor \(osha.gov.tw\)](#)

Regulation other/Education and Training. [Occupational Safety and Health Education and Training Rules-Occupational Safety and Health Administration, Ministry Of Labor \(osha.gov.tw\)](#)

Standard, Building Safety, Civil Engineering
[file:///C:/Users/Asus/Documents/Sten/Taiwan/taiwan%20data/%E7%87%9F%E9%80%A0%E5%AE%89%E5%85%A8%E8%A1%9B%E7%94%9F%E8%A8%AD%E6%96%BD%E6%A8%99%E6%BA%96%20bygg%20o%20anl%20taiwan.pdf](#)

OSHA [Avdelningen för arbetarskydd, arbetsmarknadsministeriet \(osha.gov.tw\)](#)

OSHA Statistics [occupational-accident-statistics-in-2021.pdf \(osha.gov.tw\)](#)

OSHA Statistics [annual-report-of-labor-inspection-statistics-in-2021.pdf \(osha.gov.tw\)](#)

Construction and Planning Agency [Construction and Planning Agency Ministry of the Interior, R.O.C \(cpami.gov.tw\)](#)

Taipei Labor Inspection Office [Taipei City Labor Inspection Department \(gov.taipei\)](#)

Yilan Industrial Safety and Health Organization, <http://www.levtc.com/>

Industrial Safety and Health Association, <https://isha.org.tw>

Chienhua Bookstore, literature for examination training, for example Occupational Safety Management, <http://www.chienhua.com.tw>

Others

ISO (<https://isotc.iso.org>), the number of certificates according to ISO-certificates.

Olycksstatistik Europa, [Accidents at work statistics - Statistics Explained \(europa.eu\)](#)

<https://www.statista.com/statistics/525799/number-of-work-related-deaths-in-construction-us/>