

# **Social sustainability through occupational health and safety prevention in the construction industry**

Constantin Tiberiu MANOLACHE<sup>1</sup>, Sylvie NADEAU<sup>1</sup>, Jean ARTEAU<sup>1</sup>

<sup>1</sup>*Mechanical Engineering Department, École de technologie supérieure,  
Montréal (Québec) H3C 1K3, Canada*

[sylvie.nadeau@etsmtl.ca](mailto:sylvie.nadeau@etsmtl.ca)

[jean.arteau@etsmtl.ca](mailto:jean.arteau@etsmtl.ca)

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## Social sustainability through occupational health and safety prevention in the construction industry

Constantin T. MANOLACHE, Sylvie NADEAU and Jean ARTEAU

*Mechanical Engineering Department, École de technologie supérieure,  
Montréal (Québec) H3C 1K3, Canada*

**Abstract:** The construction of reinforced concrete buildings and structures faces several challenges that aren't limited to the design of the structure and the pouring of concrete. Reinforcing steel bars must be assembled, installed in casing formworks and checked for quality purposes, in changing weather conditions, in a continuously changing building site and in lean construction environments and requirements. This article presents the documented material and technological parameters and activities (tasks, equipments, environment and variations) of rebar installers in Europe and North America. Many databases and websites have been consulted in French, in English and Rumanian: PubMed, Medline, Santé Canada, Centers for Disease Control and Prevention, Construction Safety Association of Ontario, European Agency for Safety and Health at Work, Occupational Safety and Health Administration, Fondation École Française du Béton, Classification Nationale des Postes, Métiers Sceau Rouge, Conseil Canadien des Normes, etc. Rebar installers must cut, shape and put in place steel components (notched rods, wreath steel wires and wire-mesh), that will be assembled in horizontal (concrete slabs, decks, beams and superstructures of bridges) or vertical (pillars and posts) formworks. Alternatively, the steel rebars could be assembled in a shop, moved to the construction site and installed in formworks (by crane). Rebar joints are spliced by a steel wire, welding or mechanical splices. These activities, work organization, environment and equipments are source of many occupational health and safety risks that will also be presented in this article.

**Keywords:** Workplace Health Protection, MSD Prevention, National Occupational Classification, steel fixers, Task Identification and Analysis.

### 1. Introduction

The economic development requires from nations and companies a demanding process of growth. When occupational health and safety are prioritized in an economic, political and social system, a plan for preventing diseases and injuries is enforced. The diseases and the injuries are caused by dangerous phenomena (physical, chemical and biological). These phenomena are harmful for the human body, but could also cause damage to technological equipment or work processes. The promotion of occupational health and safety is therefore essential in construction industry as well as throughout the lifetime of the structure.

The main objective of the construction industry is the design and the implementation of the basic infrastructure of buildings, roads or industrial construction. The



scientific literature and academic manuals on concrete (a material made of cement, water and aggregates) present design and calculations for the foundations of structures and look at the steel reinforcement of concrete from a design perspective only. However, the reinforcement of reinforced concrete structures is not only a section of a project to calculate and a shape to draw. It is also a product to be manufactured and put into a formwork.

In normal conditions (no load), the musculoskeletal system (MSS) has its biomechanical limits of mobility and driving forces. The tasks and working conditions require a repetition of movements that have a direct impact on physical recovery and MSS. Problems arise when a task requires the application of a driving force and a degree of mobility greater than the physical capacity of the worker or a repetition of gestures which has a negative impact on its physical recovery.

The musculoskeletal disorders (MSD) are defined as injuries and disorders of one or more components of the musculoskeletal system that may be caused or aggravated by risk factors in the workplace, during the execution of occupational activities (CSSTO, CRE-MSD 2007). The MSDs cause the main type of claims for work-related interruptions reported to the Commission de la Santé et de la Sécurité du Travail (Quebec Workplace Safety and Health Commission, the state agency for insurance and inspection).

As well, MSD:

- cause pain and suffering to thousands of workers each year;
- cost employers hundreds of millions of dollars due to absenteeism at work and lost productivity.

The objectives of this review of literature are:

- to describe the technological environment, materials, labor tasks specific to the occupation of rebar installers, as described in the literature (rebar is a contraction of reinforcing steel bar);
- To recall and clarify the regulations regarding this occupation;
- To identify the biomechanical risk factors of MSD as described in the literature.

## 2. Methods

The review of literature has targeted all publications: magazines, newspapers, scientific articles, courses or technical work, research reports and scientific presentations, norms, standards and regulations (making a direct link with the environment, materials, work tasks of layers of reinforcing steel and equipment). It has been directed and conducted in two (2) steps:

- with an emphasis on occupational injuries and musculoskeletal disorders among workers in the area surrounding the construction site;
- with an emphasis on the job of rebar installers: the environment, its materials and occupational specific tasks, an overview of the organizational factors and operational risks.

The retrieval methodology began with a consultation of databases and websites that are intended for publications with medical connotations in the sense of prevention of occupational diseases or for promoting health and safety in the field of construction: PubMed, Medline, Health Canada, CDC, Centers for Disease Control and Prevention, Construction Safety Association of Ontario European Agency for Safety and Health at Work, Occupational Safety and Health Administration, HSE, INRS, CSST, OPPBTP, etc.



Then, the sites of businesses, professional associations, practitioners, government departments and agencies that have a direct link with the theme have been consulted: reinforced concrete, steel frame and concrete structure in Canada, the United States and Europe: French School Foundation Concrete, cement Info, site of the French cement industry (based documentary), National Post Classification (NOC), Canadian Council of Directors of Apprenticeship (CCDA) Red Seal Trades, Service Canada, Canada (Standards Council of Canada NCC), Quebec (Le Bureau de normalization du Quebec BNQ), ISO Standards.

### 3. Results

Rebar installers must cut, shape and put in place steel components (notched rods, wreath steel wires and wire-mesh), that will be assembled in horizontal (concrete slabs, decks, beams and superstructures of bridges) or vertical (pillars and posts) formworks. Alternatively, the steel rebars could be assembled in a shop, moved to the construction site and installed in formworks (by crane). Rebar joints are spliced by steel wire, welding or mechanical splices. The steels are in the form of bars often 12 m long.

The standards define and establish the required characteristics on the parameters of the reinforcing steel, as the nominal diameter 'd' (mm) which corresponds to the nominal area of the section (in mm<sup>2</sup>) and mass per unit length (kg / m).

Advanced technologies, global markets and deregulation all have served to foster profound change in organizations: systems of production have become more and more integrated and dynamic. The Council of Science and Technology in 2006 called for products meeting specific requirements of users, offering high value added from a technical and knowledge-based perspective that are turned out in significant quantities.

Construction building in Canada is becoming lean, with the same principles and requirements one knows for lean manufacturing: flexibility, control of variations (quality and dependability of equipments) autonomous and polyvalent work, privileged relationships with subcontractors, reactive management.

These activities, work organization, environment and equipments are source of many occupational health and safety risks. Among the tasks performed by rebar installers, tying the steel bars seems to be the most physically demanding. The environments of construction sites are characterized by a variety of variables (weather, continuously changing building sites, etc.). The steel bars are heavy and difficult to manipulate. The rebar installer's job requires often extreme biomechanical positions, repetitive efforts for tasks taking many hours.

### 4. Discussion and/or Conclusions

The construction of reinforced concrete buildings and structures faces several challenges that aren't limited to the design of the structure and the pouring of concrete. Reinforcing steel bars must be assembled, installed in formworks and checked for quality purposes, in changing weather conditions, in a continuously changing building site and in lean construction environments and requirements.

Sustainable development seeks to respond to the current needs of people worldwide without compromising the capacity of future generations. From a sustainable



development perspective, the International Labour Organization (ILO) supports the right to decent work which cannot be performed without efforts to prevent occupational accidents and illnesses. In order to offer a workable and socially and economic sustainable rebar installer occupation an ergonomic intervention of this job is crucial.

To complement our review of literature, we will study and analyze in the next six (6) months the learning activities leading to the occupation of steel fixers (skills necessary in the process of metal structures and location of rods bars, wire mesh and steel used to reinforce concrete).

The research protocol involves the study of this activity by the participation of twenty (20) students and two (2) teachers of the Training Center Trades Steel 'Centre de Formation des Métiers de l'acier (CFMA)', during the program development skills. The CFMA, through its programs of study, equipment and environment, offers a valid preliminary research field, a real source of information to accomplish the main goals of our project: identify and analyze the work of rebar installers.

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