Reinforcing Steel Erector

Occupational Analysis Report

July 2010

Commission
de la construction
du Québec

The purpose of this report is to describe as accurately as possible the reinforcing steel erector trade as currently practiced in Québec's construction industry. It is a record of discussions held by a group of workers who met for the occasion after industry partners recommended them to the Commission de la construction du Québec for their expertise in the trade.

The occupational analysis is a first step in the definition of the competencies required for practicing the trade. This report becomes one of the reference and decision-making tools used by the Commission for teaching and learning purposes.

The present report does not bind the Commission in any way. It has no legal effect and is meant as a reflection of discussions held on the date of the analysis workshop.

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APPROVAL

This occupational analysis was read and approved by Commission de la construction du Québec decision-makers and the following persons on the dates mentioned below.

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INTRODUCTION

In early 2009, the Commission de la construction du Québec's (CCQ) Direction de la formation professionnelle launched a large-scale operation to review the occupational analyses[1] of all construction industry trades.

The CCQ undertook this operation for many reasons, particularly the following:

- the project to reform the construction workforce apprenticeship and management system, and the eventual design of qualitative apprenticeship booklets requiring a detailed description of each trade;
- the fact that most construction occupational analyses[2] had been conducted between 1987 and 1991 and had not been reviewed since;
- updates to vocational qualification examination question banks;
- implementation of Chapter 7 of the Agreement on Internal Trade (AIT) and of the Québec-France agreement on the Mutual Recognition of Professional Qualifications.

These factors demonstrate the necessity of updating the occupational analyses in order to obtain a current and complete profile of the various trades in Quebec.

The occupational analysis for reinforcing steel erectors belongs to this context[3]. Its purpose is to describe the trade as currently practiced by journeymen in the construction industry. The present report was written in order to collate and organize the information gathered during the occupational analysis workshop held in Laval on November 28 and 29, 2009.

This analysis aims to draw a portrait (tasks and operations) of the trade and its working conditions, and to identify the skills and behaviours required. The report of the occupational analysis workshop is an accurate reflection of the consensus reached by a group of reinforcing steel erectors. A special effort was made to include in this report all the data collected during the workshop and to ensure that the data accurately depict the realities of the trade analysed.

1. The terms "profession" and "trade" are considered synonymous.
2. Called "work situation analyses" at the time.
3. This occupational analysis was conducted according to the *Cadre de référence et instrumentation pour l'analyse d'une profession* produced in 2007 by the ministère de l'Éducation, du Loisir et du Sport (Direction générale de la formation professionnelle et technique) and the Commission des partenaires du marché du travail, ministère de l'Emploi et de la Solidarité sociale.

1. GENERAL CHARACTERISTICS OF THE TRADE

1.1 DEFINITION OF THE TRADE

According to the Regulation respecting the vocational training of workforce in the construction industry (Schedule A, article 10), the term “reinforcing steel erector” means:

> […] anyone who cuts, bends, fastens, installs and assembles rods and metal laths with wire, ties, or welding operations to strengthen concrete in the construction of forms, columns, beams, slabs or other similar work.
>
> Performance of the work described in the first paragraph includes trade-related handling for the purposes of immediate and permanent installation.

1.2 JOB TITLES

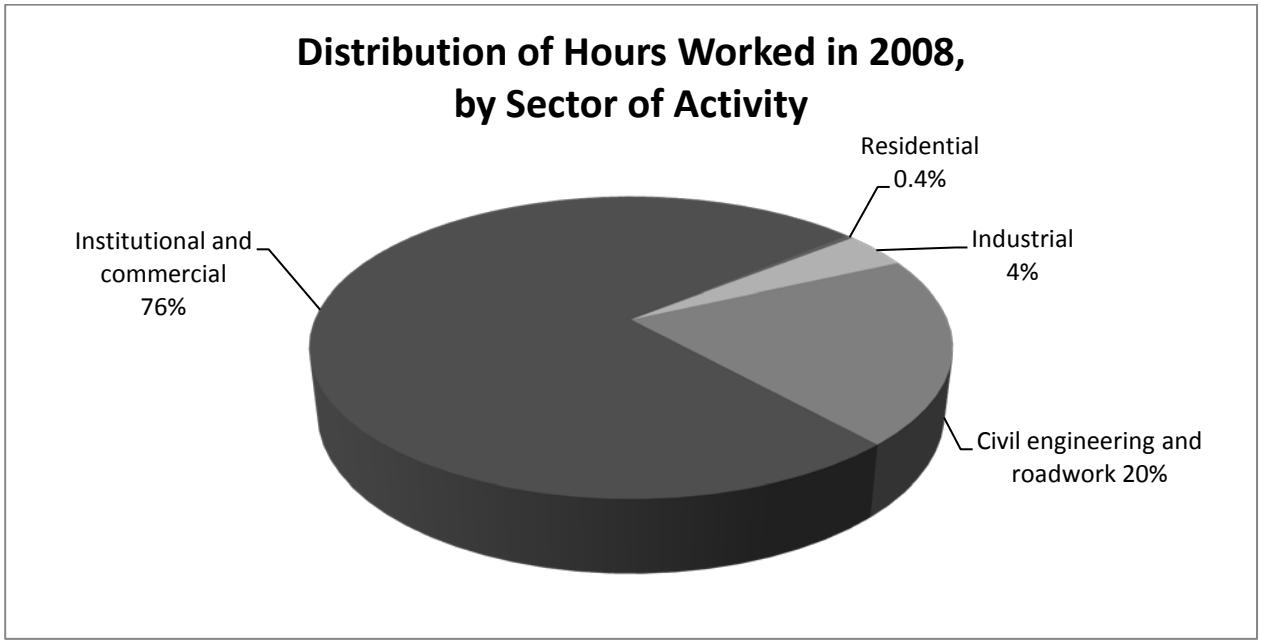
According to the participants consulted, the French title “ferrailleur” creates confusion between their trade and people who collect discarded scrap metal to resell it by weight. The participants prefer the French title “poseur d’acier d’armature” (reinforcing steel erector), which is more representative of their trade and corresponds to the title often used by other industry workers. Another French title used at times is “techniciens en pose d’acier d’armature”.

However, in the present French version of the report, the title retained is “ferrailleur”, since it is used in the Regulation respecting the vocational training of workforce in the construction industry (R-20, r.6.2). In the present English version of the report, the title “reinforcing steel erector” is used for the same reason.

1.3 SECTORS OF ACTIVITY

Most reinforcing steel erectors are active in three sectors of the construction industry, but to varying degrees; they rarely work in the residential sector (less than 0.5% of hours declared in 2008).

The chart below illustrates the work time distribution of all reinforcing steel erectors in Quebec for the year 2008[4]. The data show that the institutional and commercial sector accounts for most of the hours worked by reinforcing steel erectors.



This distribution may fluctuate substantially over time. Accordingly, the workshop participants have a different view of their workload distribution over the last year. In their view, the correct percentages are rather as follows:

- Institutional and commercial: 15%
- Civil engineering and roadwork: 80%
- Industrial: 5%

In addition, they think the preponderance of work in the civil engineering and road sector will likely be maintained, and will even grow in coming years.

4. Commission de la construction du Québec, *Carrières construction*, 2009-2010 edition.

1.4 FIELD OF PRACTICE

The trade's field of practice is the construction industry. The Act respecting labour relations, vocational training, and manpower management in the construction industry (R.S.Q., c. R-20) defines construction as follows:

> […] the foundation, erection, maintenance, renewal, repair, alteration and demolition work on buildings and civil engineering works carried out on the job site itself and vicinity including the previous preparatory work on the ground;
>
> In addition, the word "construction" includes the installation, repair and maintenance of machinery and equipment, work carried out in part on the job site itself and in part in the shop, moving of buildings, transportation of employees, dredging, turfing, cutting and pruning of trees and shrubs and laying out of golf courses, but solely in the cases determined by regulation.

1.5 LEGISLATION AND REGULATIONS

Reinforcing steel erectors working in the construction industry are subject to:

- the Act respecting Labour relations, vocational training and workforce management in the construction industry (R.S.Q., c. R-20);
- the Regulation respecting the vocational training of workforce in the construction industry (R-20, r.6.2);
- the Safety Code for the construction industry (R.Q. c. S-2.1, r.6);
- the four sector-based collective agreements for the construction industry;
- the Quebec Building Code, Chapter I – "Building";
- the National Building Code.

1.6 WORKING CONDITIONS[5]

The following information provides an overview of the conditions and context of the work of reinforcing steel erectors, as commented by the participants in the occupational analysis workshop. To obtain up-to-date and complete information that has legal effect, it is necessary to refer to the four collective agreements for the construction industry sectors.

Salary

A journeyman's hourly wage varies slightly according to the sector of activity. At April 4, 2009, the daytime hourly rate was as follows:

- Industrial, institutional and commercial: $32.87
- Civil engineering and roadwork: $32.82
- Residential (light): $29.48
- Residential (heavy): $32.80

Vacations and time off

Mandatory annual holidays of four weeks – two weeks in summer and two in winter at periods predetermined in collective agreements – are the general rule in the construction industry. To avoid penalizing employers and employees experiencing special constraints, the industry's four collective agreements allow certain possibilities for changing the vacation periods prescribed by the general rule.

To these vacation periods are added eight not worked statutory holidays, as well as a lump sum for sick leaves not otherwise paid.

5. The general data regarding working conditions are taken from the 2007-2010 collective agreements of the four construction industry sectors and from the document *Carrières construction*, 2008-2009 edition, published by the Commission de la construction du Québec.

Pension plan

Construction industry workers participate in a pension plan. They retain their eligibility for this pension plan throughout their career in construction, even if they change employer, trade or sector.

Insurance

The group insurance plan (medications, illness, disability, death) is fully paid by employers. Workers (and their families, as the case may be) are eligible for it so long as they remain active in the construction industry and work the required number of hours, whether or not they change employer.

Physical requirements

Reinforcing steel erectors must be in good physical shape to do their work. Their tasks require good endurance[6] and average physical strength. The shoulders and back are particularly active.

Work schedules

A 40-hour work week from Monday to Friday is the general rule in all construction industry sectors. The daily limit is 8 hours a day, except in the light residential sector, where it can be 10 hours within a 40-hour week.

To avoid penalizing employers and employees experiencing special constraints, the industry's four collective agreements allow many possibilities for changing the vacation periods prescribed by the general rule: compressed schedule, schedule shift, make-up time in light residential construction, etc. These special schedules confer flexibility to the work schedules in effect in the construction industry.

At certain times of the year, reinforcing steel erectors may be called upon to work overtime, for example in autumn, before winter weather, when contractors want to complete their work before winter in order to avoid the high cost of heating construction sites.

6. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 1.

Mobility

Reinforcing steel erectors must often travel to various geographic areas, depending on the construction sites in operation. In fact, the proportion of reinforcing steel erectors called upon to travel from one region to another is 43% in 2008[7], whereas only 17% of workers from all construction industry trades and occupations have to do so. Several of the workshop participants have had to travel often during their career. However, they point out that this is also a personal choice and that it is entirely possible to work as a reinforcing steel erector while always remaining in the same region[8].

1.7 JOB MARKET ENTRY CONDITIONS[9]

To obtain the competency certificate-apprentice in a construction industry trade, candidates must first:

- supply proof that they are at least 16 years of age;
- supply their social insurance number and their home address;
- present their certificate for having passed the course *Santé et sécurité générale sur les chantiers de construction*;
- pay the required fees;
- designate the union association that they wish to join.

7. Commission de la construction du Québec, *Carrières construction*, 2009-2010 edition.
8. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 2.
9. Other conditions than those listed below may apply. For a complete list of conditions for entering the trade, see the Act respecting Labour relations, vocational training and workforce management in the construction industry (R.S.Q., c. R-20). The CCQ'S Internet site http://www.ccq.org/E_CertificatsCompetence.aspx?sc_lang=en&profil=Travailleur may also be consulted.

In addition, candidates who have obtained a diploma recognized by the CCQ (DEP in the installation of reinforced concrete) must:

- present the original version of an academic transcript or apprenticeship transcript attesting that they have passed the DEP;
- present a guarantee of employment from an employer registered with the CCQ for at least 150 hours within a period of not more than three consecutive months.

Candidates who meet these conditions then obtain a competency certificate-apprentice (CCA) in the reinforcing steel erector trade.

Although the construction industry favours graduates for access to the trade, labour shortages may at times make it necessary for the CCQ to admit candidates without a diploma. Thus, candidates without a diploma[10] are eligible to obtain a competency certificate-apprentice only during a labour shortage and must:

- supply proof that they have the academic prerequisites for the program leading to a vocational studies diploma (DEP) in the trade referred to in the application or pledge, by signing a consent letter, to take the necessary training to obtain those prerequisites;
- present a guarantee of employment registered during a labour-pool opening by an employer registered with the CCQ, for at least 150 hours over a period of at most three consecutive months.

The apprentice reinforcing steel erector must have completed an apprenticeship period of 2,000 hours in order to be eligible for the provincial qualification examination that leads to obtaining the competency certificate-journeyman for the trade.

A credit of 735 hours is paid into the apprenticeship record book of a reinforcing steel erector who has obtained his diploma, i.e., the duration of the training program leading to the DEP in the trade.

10. Of the 12 workshop participants, 8 entered their trade without training.

Moreover, certain qualities are sought by employers hiring new reinforcing steel erectors. The following list presents the main qualities[11], according to the participants consulted:

- being reliable and punctual (present on the site at the appointed time);
- having “guts”;
- being mobile (ready to work in various regions);
- being resourceful;
- being interested in and having the skills for physical and outdoor work;
- being able to manage the pressure of tight deadlines.

1.8 PLACE OF WOMEN IN THE TRADE

Section 126.0.1 of the Act respecting labour relations, vocational training, and manpower management in the construction industry pertains to women’s access to the construction industry: “The Commission, after consultation with the Commission des droits de la personne et des droits de la jeunesse, shall develop measures to favour the access of women to and their maintenance and greater representation on the labour market in the construction industry.”

According to the CCQ[12], the proportion of women active in the trade is 0.6% (7 women out of 1,173 reinforcing steel erectors in 2008).

The participants consulted do not really see any reasons for preventing a woman from practicing the trade, since the necessary physical strength is not excessive, and teamwork makes it possible to allocate more-physical tasks appropriately.

1.9 CAREER PROSPECTS

According to the participants, a reinforcing steel erector’s opportunities for promotion are interesting. After a few years, they may become foremen, and then superintendents. However, they point out that the job structure is relatively limited and that other options directly related to the trade are quite rare.

11. The qualities are presented in the order they were mentioned and not in order of importance.
12. Commission de la construction du Québec, *Carrières construction*, 2009-2010 edition.

1.10 DEVELOPMENT OF THE TRADE

In coming years, the industry is expected to use more and more prefabricated elements, which could have consequences on the nature of the work of reinforcing steel erectors.

The use of steel sheets for some types of work will accelerate installation. New materials (fibreglass, graphite) are already used, but their use is still very limited because they cost much more than steel. Finally, it was mentioned that new welding techniques are likely to be introduced soon in the trade, which could change part of the work of reinforcing steel erectors.

In recent years, the participants have noticed a few changes in their field, such as:

- more frequent use of lifting equipment in handling materials, which reduces the number of hours worked by labourers involved in this operation;

- self-inspection, which has become very widespread, mainly in the civil engineering and roads sector. Inspecting the work is no longer the foreman's sole responsibility; the reinforcing steel erector is also responsible for ensuring the quality of his work. According to the participants, this trend of recent years should become more and more important[13].

1.11 IMPACT OF ENVIRONMENTAL STANDARDS ON THE PRACTICE OF THE TRADE

The participants recognize that certain environmental standards have an impact on their work, particularly when work is done near a river. Generally, precautions to be taken and procedures to be followed are issued by the client and supervisors at the beginning of each construction site (job meetings), and then by the foreman as the work progresses.

13. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 3.

2. WORK DESCRIPTION

2.1 TASKS AND OPERATIONS

List of tasks

The following list presents the main tasks performed by reinforcing steel erectors. The order in which the tasks are presented does not necessarily reflect their importance in the trade.

Task 1 Unload materials

Task 2 Handle materials

Task 3 Install reinforcing steel[14]

Task 4 Build and put prefabricated elements in place

Task 5 Weld reinforcing steel

Task 6 Install mechanical joints

Task 7 Install anchors and studs

Task 8 Install wire meshes

Task 9 Put post-tensioning systems in place

Task 10 Build reinforcing parts on the site

Table of tasks and operations

During the workshop, a table of tasks and operations performed by reinforcing steel erectors was proposed to the participants. After discussions, modifications were made to the table. The final version is presented in the following pages.

14. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 4.

Table 2.1 Tasks and Operations

TASKS	OPERATIONS					
1. UNLOAD MATERIALS	1.1 Read work and safety instructions	1.2 Direct delivery truck movements on the site	1.3 Sling steel on the long-load truck	1.4 Put in place supports for the material on the ground	1.5 Rig and give signals to the crane operator so the load can be moved	1.6 Classify the reinforcing steel and other materials
2. HANDLE MATERIALS	2.1 Read work and safety instructions	2.2 Place scaffolds and platforms, if applicable	2.3 Choose the materials to be transported	2.4 Define the path to be followed	2.5 Clear the chosen path	2.6 Assess the load's weight
	2.7 Balance the load to make it easier to handle	2.8 Transport the load	2.9 Place the load at the designated location			
3. INSTALL REINFORCING STEEL[15]	3.1 Read work and safety instructions	3.2 Place scaffolds, platforms, aerial work platforms or lifts, if applicable	3.3 Find out about the lines, levels and templates	3.4 Choose the steel and mark the spacings	3.5 Place the supports	3.6 Place the bars
	3.7 Fasten the reinforcing steel	3.8 Check the assembly	3.9 Cut the bars, if applicable	3.10 Stabilize the elements	3.11 Before concrete is poured, replace steel and supports, if applicable	3.12 Collect rejects and put the work area in order

15. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 4.

TASKS	OPERATIONS					
4. **BUILD AND PUT PREFABRICATED ELEMENTS IN PLACE**	4.1 Read work and safety instructions	4.2 Check the weight of prefabricated elements and the distance to travel	4.3 Choose the work area and install sawhorses	4.4 Choose the steel and mark the spacings	4.5 Place the bars, stirrups and fasteners	4.6 Fasten the reinforcing steel
	4.7 Check the assembly	4.8 Cut the bars, if applicable	4.9 Read positioning instructions (levels, measurements and layout)	4.10 Check the presence of anchor points	4.11 Strengthen the reinforcing steel structure for rigging	4.12 Place scaffolds, platforms, aerial work platforms or lifts, if applicable
	4.13 Rig the prefabricated elements	4.14 Fasten and stabilize the prefabricated elements (spacers, steel wire tie, cable, steel)	4.15 Collect rejects and put the work area in order			
5. **WELD REINFORCING STEEL**	5.1 Read work and safety instructions	5.2 Place scaffolds, platforms, aerial work platforms or lifts, if applicable	5.3 Identify the weldable bars	5.4 Choose the electrodes	5.5 Install the bar folders and adjust the welding machine	5.6 Move the bar folders closer together or locate the anchors
	5.7 Fit	5.8 Put the work area back in order				
6. **INSTALL MECHANICAL JOINTS**	6A.1 Read work and safety instructions	6A.2 Place platforms, if applicable	6A.3 Cut the bars, if applicable	6A.4 Place the ring	6A.5 Screw, tighten or compress the ring	6A.6 Check positioning compliance
6A. **Lenton, Dayton and Barlock types and malleable sleeves**	6A.7 Put the work area back in order					

TASKS	OPERATIONS					
6B. **Caldwell type**	6B.1 Read work and safety instructions	6B.2 Delimit a safety perimeter	6B.3 Place scaffolds, aerial work platforms or lifts, if applicable	6B.4 Cut the bars, if applicable	6B.5 Clean the bars	6B.6 Heat and dry to remove moisture
	6B.7 Place the separator	6B.8 Install the furnace	6B.9 Place the metal powder and primer	6B.10 Ignite the powder	6B.11 Remove the furnace	6B.12 Put the work area back in order
7. **INSTALL ANCHORS AND STUDS** **7A.** **Diwydag anchors**	7A.1 Read work and safety instructions	7A.2 Place scaffolds, platforms, aerial work platforms or lifts, if applicable	7A.3 Identify the Diwydag bars	7A.4 Put the Diwydag bars in place	7A.5 Adjust the bar levels	7A.6 Place the anchor plates
	7A.7 Adjust the plate levels	7A.8 Inject concrete grout	7A.9 Put the work area back in order			
7B. **Studs with adhesive or grout**	7B.1 Read work and safety instructions	7B.2 Place scaffolds, aerial work platforms or lifts, if applicable	7B.3 Mark the spacing of holes[16]	7B.4 Choose the drill, install the depth gauge, drill holes	7B.5 Clean and brush the holes	7B.6 Choose the reinforcing steel bars and cut them, if applicable
	7B.7 Inject the adhesive or grout	7B.8 Insert and stabilize the studs	7B.9 Put the work area back in order			

16. The CCQ's Direction de l'application des conventions collectives has issued a notice to the effect that operations 7B.3, 7B.4 and 7B.5 are not exclusive to the reinforcing steel erector trade.

TASKS	OPERATIONS					
8. **INSTALL WIRE MESHES**	8.1 Read work and safety instructions	8.2 Place scaffolds, platforms, aerial work platforms or lifts, if applicable	8.3 Determine and mark the spacing of supports	8.4 Install supports and spacers	8.5 Measure and cut the wire mesh	8.6 Stretch the wire mesh
	8.7 Attach the mesh	8.8 During the pour, put the mesh and supports back in place, if applicable	8.9 Put the work area back in order			
9. **PUT POST-TENSIONING SYSTEMS IN PLACE**	9.1 Read work and safety instructions	9.2 Place platforms, if applicable	9.3 Place anchors on the niche and the hooping steel	9.4 Measure and mark support locations	9.5 Install the supports	9.6 Place and fasten sheathes, check the curvature
	9.7 Screw the sleeves	9.8 Install a seal	9.9 Install vents at each end and at the highest points	9.10 Choose the cable and cut it, if applicable	9.11 Insert the bullet and the duct rod	9.12 Install the winch or threading equipment, if applicable
	9.13 Thread the cable	9.14 Install anchor blocks and wedges	9.15 Install the tensioning block	9.16 After the concrete is cured, use hydraulic jacks to tension the cables	9.17 Inject concrete grout	9.18 Put the work area back in order
10. **BUILD REINFORCING STEEL PARTS ON THE SITE**	10.1 Read the manufacturing delivery slips	10.2 Put the bending machine and the shearing machine in place	10.3 Calculate bending losses and gains	10.4 Measure the reinforcing steel bars and determine the necessary bars for the work	10.5 Cut the reinforcing steel bars	10.6 Bend the reinforcing steel bars
	10.7 Label the reinforcing steel bars and stack the prefabricated parts	10.8 Store the reinforcing steel bars	10.9 Put the work area back in order			

2.2 OPERATIONS, SUB-OPERATIONS AND CLARIFICATIONS

In the following pages are presented the sub-operations related to each operation[17], as well as a few clarifications made by the participants.

Table 2.2 Operations, Sub-Operations and Clarifications

TASK 1 UNLOAD MATERIALS		
Operations	**Sub-Operations**	**Clarifications**
1.1 Read work and safety instructions		The foreman's instructions may pertain to: – the unloading area's location and features; – the presence of obstacles (electric wires, objects, machinery, etc.); – the unloading area's load capacity; – coordination with other trades.
1.2 Direct delivery truck movements on the site		
1.3 Sling steel on the long-load truck	1.3.1 Choose a working method 1.3.2 Determine an unloading sequence 1.3.3 Choose and check the slings	Slinging is generally done in teams of two reinforcing steel erectors.
1.4 Put in place supports for the material on the ground		
1.5 Rig and give signals to the crane operator so the load can be moved		Signals to the crane operator may be given by a reinforcing steel erector or another worker, depending on the danger of moving[18].
1.6 Classify the reinforcing steel and other materials	1.6.1 Open and arrange bundle contents 1.6.2 Group the bars according to types of steel, installation sequence, etc.	

17. The order of operations may vary.
18. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 5.

TASK 2 HANDLE MATERIALS		
This task is related to manual handling that the reinforcing steel erector has to do once materials have been unloaded.		
Operations	**Sub-Operations**	**Clarifications**
2.1 Read work and safety instructions		The foreman's instructions are related, for example, to the location where materials are to be placed and to the work distribution between reinforcing steel erectors.
2.2 Place scaffolds and platforms, if applicable[19]		
2.3 Choose the materials to be transported		The choice is based on label data.
2.4 Define the path to be followed	2.4.1 Ensure safety in the moving area (on the ground and overhead)	
2.5 Clear the chosen path		The path must be clear of any obstacle that could hinder moving the materials.
2.6 Assess the load's weight		The reinforcing steel erector must adapt the load's weight (for example, the number of steel bars) to his physical capacity and the obstacles to be crossed.
2.7 Balance the load to make it easier to handle		Given that transportation is often done by two workers, the load's weight must be balanced between the reinforcing steel erectors to avoid the recoil effect.
2.8 Transport the load		
2.9 Place the load at the designated location		

19. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 6.

TASK 3 INSTALL REINFORCING STEEL[20]		
Operations	**Sub-Operations**	**Clarifications**
3.1 Read work and safety instructions	3.1.1 Read the work order or delivery slip 3.1.2 Determine the installation sequence	
3.2 Place scaffolds, platforms, aerial work platforms or lifts, if applicable		
3.3 Find out about the lines, levels and templates	3.3.1 Check location points and elevations measured by the surveyor	
3.4 Choose the steel and mark the spacings		If applicable, marks may be made by the foreman or the reinforcing steel erector.
3.5 Place the supports	3.5.1 Observe the spacings	They are plastic, metal or concrete supports.
3.6 Place the bars		
3.7 Fasten the reinforcing steel		The reinforcing steel may be fastened by any of three methods:[21] – with steel wire ties (by means of pliers or a mechanical device); – with fasteners (manually or by means of a mechanical device); – by welding.
3.8 Check the assembly		The verification may be done by the reinforcing steel erector and the foreman.
3.9 Cut the bars, if applicable		The bars may be cut mechanically (e.g., using a gaz cut-off saw) or by metal oxygen cutting.
3.10 Stabilize the elements		The elements may be stabilized by various means: spacers, steel wire tie, cables, steel, welding and other means.
3.11 Before concrete is poured, replace steel and supports, if applicable		
3.12 Collect rejects and put the work area in order		

20. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 4.
21. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 7.

TASK 4 BUILD AND PUT PREFABRICATED ELEMENTS IN PLACE				
Operations		**Sub-Operations**		**Clarifications**
4.1	Read work and safety instructions	4.1.1 4.1.2	Read the sketch or the part of the plan concerned Choose the working method (quick assembly)	Among work instructions, the reinforcing steel erector must learn the prefabricated element's lifting procedures, written by an engineer in certain cases.
4.2	Check the weight of prefabricated elements and the distance to travel	4.2.1	Consult the work order or delivery slip	Consulting the work order or delivery slip for the distance to be travelled with the load and for the prefabricated elements' weight will make it possible to choose the appropriate lifting device.
4.3	Choose the work area and install sawhorses	4.3.1	Choose the sawhorses	The working area must be flat, cleared and solid, to make it possible to build the element. If no surface with these features is available, the reinforcing steel erector must notify the foreman, who will have one prepared. Sawhorses are chosen according to the structure's weight.
4.4	Choose the steel and mark the spacings	4.4.1 4.4.2 4.4.3	Check the bars' diameter Check the bars' length Check the type of steel (W, 400, 300, etc.)	The verification is done to ensure compliance with the foreman's instructions.
4.5	Place the bars, stirrups, fasteners	4.5.1 4.5.2 4.5.3 4.5.4	Check the number of bars Check the number of stirrups Check the number of fasteners Locate the marking	
4.6	Fasten the reinforcing steel	4.6.1 4.6.2	Choose the type of fasteners Determine the position and number of fasteners	
4.7	Check the assembly	4.7.1	Ensure that there is no lack of steel in the element	The points to be checked are the assembly's stability, observance of spacing, the bars' position and parallelism, observance of the concrete cover, the type and quality of fasteners, etc.

TASK 4 *BUILD AND PUT PREFABRICATED ELEMENTS IN PLACE*		
Operations	**Sub-Operations**	**Clarifications**
4.8 Cut the bars, if applicable		The bars may be cut mechanically (e.g., with a saw) or by oxygen cutting.
4.9 Read positioning instructions (levels, measurements and layout)	4.9.1 Follow the engineer's procedures 4.9.2 Ensure that the element's dimensions correspond to the forms' 4.9.3 Make sure of the concrete cover 4.9.4 Make sure to have the correct elevation and alignment	
4.10 Check the presence of anchor points		The anchor points serve to secure and stabilize the element.
4.11 Strengthen the reinforcing steel structure for rigging		
4.12 Place scaffolds, platforms, aerial work platforms or lifts, if applicable		
4.13 Rig the prefabricated elements	4.13.1 Choose the lifting device 4.13.2 Choose slings	
4.14 Fasten and stabilize the prefabricated elements (spacers, steel wire tie, cable, steel)		This operation is performed with steel cables, come-alongs (TirFor), studs, etc.
4.15 Collect rejects and put the work area in order		This operation is important for the safety of all workers on the site. In addition, it facilitates the work related to the following stages, particularly formwork.

TASK 5 WELD REINFORCING STEEL

This task is not performed by all reinforcing steel erectors. In many companies, a few reinforcing steel erectors "specialize" in welding, and they perform all welding work.

The most commonly used welding process is shielded metal arc welding (SMAW).

Operations	Sub-Operations	Clarifications
5.1 Read work and safety instructions		The foreman's instructions pertain to the elements to be welded, the dimensions (length, width) of the weld bead, its position, etc.
5.2 Place scaffolds, platforms, aerial work platforms or lifts, if applicable		
5.3 Identify the weldable bars		The reinforcing steel erector must ensure that the letter W (weldable) appears on the bars he is preparing to weld.
5.4 Choose the electrodes		The choice of electrodes (type, dimensions) must comply with the foreman's instructions, which are taken from the specifications.
5.5 Install the welding machine cables and adjust the welding machine	5.5.1 Adjust the heat 5.5.2 Check the grounding	It is necessary to install weld cables safely by clearing the path and ensuring electrical continuity. The welding machine is then adjusted according to the type of steel, the type of electrode, etc.
5.6 Move the bar folders closer together or locate the anchors	5.6.1 Use clamps and fasteners to stabilize the steel bars	
5.7 Fit	5.7.1 Turn the electrode on by rubbing lightly	
5.8 Put the work area back in order		

TASK 6 INSTALL MECHANICAL JOINTS ***6A LENTON, DAYTON AND BARLOCK TYPES AND MALLEABLE SLEEVES***		
Operations	**Sub-Operations**	**Clarifications**
6A.1 Read work and safety instructions	6A.1.1 Determine the pressure and tension to be applied	
6A.2 Place platforms, if applicable		
6A.3 Cut the bars, if applicable		The bars may be cut mechanically (e.g., with a saw) or by oxygen cutting.
6A.4 Place the ring		
6A.5 Screw, tighten or compress the ring		
6A.6 Check positioning compliance		
6A.7 Put the work area back in order		
TASK 6 INSTALL MECHANICAL JOINTS ***6B CADWELL TYPE***		
6B.1 Read work and safety instructions		Cadwell mechanical joints are used less and less. For this type of joins, it is very important that all materials are dry and moisture-free. Storage conditions must therefore be the object of special attention. In addition, the work cannot be done in the rain.
6B.2 Delimit a safety perimeter	6B.2.1 Install a vacuum cleaner 6B.2.2 Install a ribbon limiting access 6B.2.3 Have a fire extinguisher on hand	

TASK 6 INSTALL MECHANICAL JOINTS ***6B CADWELL TYPE***		
Operations	**Sub-Operations**	**Clarifications**
6B.3 Place scaffolds, aerial work platforms or lifts, if applicable		
6B.4 Cut the bars, if applicable		The bars may be cut mechanically (e.g., with a saw) or by oxygen cutting.
6B.5 Clean the bars		
6B.6 Heat and dry to remove moisture		
6B.7 Place the separator		
6B.8 Install the furnace		
6B.9 Place the metal powder and primer	6B.9.1 Determine the type and quantity of powder to be used 6B.9.2 Avoid spills	Instructions on the type and quantity of powder to be used are provided to the reinforcing steel erector by the foreman, who has taken them from the supplier's data.
6B.10 Ignite the powder	6B.10.1 Apply the ignition procedure 6B.10.2 Place the primer 6B.10.3 Use the lighter	
6B.11 Remove the furnace		
6B.12 Put the work area back in order		It is necessary to wait for the cooling.

TASK 7 INSTALL ANCHORS AND STUDS
7A DIWYDAG ANCHORS

Currently, the installation of Diwydag anchors is quite rare. However, according to the participants consulted, reinforcing steel erectors will have to install more and more of them in coming years.

During the installation of Diwydag anchors, rock drilling is generally done by specialized companies that may have reinforcing steel erectors intervene to do the work.

Operations	Sub-Operations	Clarifications
7A.1 Read work and safety instructions		The instructions pertain to the type and length of bars, the type of grout pipe, the grout injection procedure, the type of anchor heads, etc.
7A.2 Place scaffolds, platforms, aerial work platforms or lifts, if applicable		
7A.3 Identity the Diwydag bars		Identify the bars by their dimensions (diameter, shape and length).
7A.4 Put the Diwydag bars in place	7A.4.1 Install a sheath 7A.4.2 Install supports 7A.4.3 Choose a lifting device, if applicable	
7A.5 Adjust the bar levels		
7A.6 Place the anchor plates		
7A.7 Adjust the plate levels		
7A.8 Inject concrete grout[22]		It may be the case that grout injection is done by a specialized company[24].
7A.9 Put the work area back in order		

22. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 8.

TASK 7 INSTALL ANCHORS AND STUDS ***7B STUDS WITH ADHESIVE OR GROUT***		
Operations	**Sub-Operations**	**Clarifications**
7B.1 Read work and safety instructions	7B.1.1 Determine the holes' size, spacing and depth	
7B.2 Place scaffolds, aerial work platforms or lifts, if applicable		
7B.3 Mark hole locations[23]		
7B.4 Choose the drill, install the depth gauge, drill holes	7B.4.1 Determine the bit diameter 7B.4.2 Plan for the necessary energy source for the drill's operation (generator, extension cord, etc.)	
7B.5 Clean and brush the holes	7B.5.1 Install a vacuum cleaner or a compressed air system 7B.5.2 Eliminate residues before and after the work	
7B.6 Choose the reinforcing steel bars and cut them, if applicable		The bars may be cut mechanically (e.g., with a saw) or by oxygen cutting.
7B.7 Inject the adhesive or grout	7B.7.1 Choose the type of glue or grout	The choice is made according to the foreman's instructions.
7B.8 Insert and stabilize the studs		
7B.9 Put the work area back in order		

23. The CCQ's Direction de l'application des conventions collectives has issued a notice to the effect that operations 7B.3, 7B.4 and 7B.5 are not exclusive to the reinforcing steel erector trade.

TASK 8 INSTALL WIRE MESHES		
Operations	**Sub-Operations**	**Clarifications**
8.1 Read work and safety instructions	8.1.1 Check the quantities of wire meshes and supports	The foreman's instructions pertain to spacing, overlapping, etc.
8.2 Place scaffolds, platforms, aerial work platforms or lifts, if applicable		
8.3 Determine and mark the spacing of supports		
8.4 Install supports and spacers		
8.5 Measure and cut the wire mesh	8.5.1 Determine the position of obstacles	The mesh is cut with a cable cutter.
8.6 Stretch the wire mesh		
8.7 Attach the mesh		The mesh must be fastened to the four corners and the centre[24].
8.8 During the pour, put the mesh and supports back in place, if applicable	8.8.1 Check spacing	
8.9 Put the work area back in order		

24. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 9.

TASK 9 PUT POST-TENSIONING SYSTEMS IN PLACE

The participants mentioned that few reinforcing steel erectors perform this task. Indeed, work requiring post-tensioning systems to be put in place are not very common; they tend to be considered a specialty of the trade. Reinforcing steel erectors "specializing" in post-tensioning do not only do this type of work, since it is not frequent enough to occupy work teams full-time.[25]

Operations	Sub-Operations	Clarifications
9.1 Read work and safety instructions		The foreman's instructions concern: – sheath dimensions (width, length); – the sheath's position; – the type of anchors; – spacing between supports; – the number of cables in the sheath; – safety measures for cable tensioning.
9.2 Place platforms, if applicable		
9.3 Place anchors on the niche and the hooping steel	9.3.1 Determine the position of anchors on the formwork 9.3.2 Fasten the anchors with screws 9.3.3 Put a coil around the anchors, if applicable	
9.4 Measure and mark support locations	9.4.1 Mark the measurements (elevation) on the formwork	
9.5 Install the supports	9.5.1 Place the support at the necessary location for fastening the sheath to it	
9.6 Place and attach sheathes, check the curvature		
9.7 Screw the sleeves	9.7.1 Ensure that the sheaths are well abutted inside the sleeve	
9.8 Install a seal	9.8.1 Wrap the sleeves (tape) 9.8.2 Install a ring	The seal may be tape wrapped around the sleeves, or a ring shrinking in heat.

25. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 13.

TASK 9 PUT POST-TENSIONING SYSTEMS IN PLACE		
Operations	**Sub-Operations**	**Clarifications**
9.9 Install vents at each end and at the highest points	9.9.1 Ensure that the sheath exits the concrete 9.9.2 Ensure that the sheath is well fastened to the anchors	
9.10 Choose the cable and cut it, if applicable		
9.11 Insert the bullet and the duct rod		The bullet is inserted in the sheath tube to ensure that the latter is completely clean inside. For this reason, the bullet's diameter must be almost identical (slightly less) to the sheath's. Once inserted in the sheath, the bullet length is pushed to the entire length by means of an air jet.
9.12 Install the winch or threading equipment, if applicable		The cable may be threaded using a winch, threading equipment ("pusher"), or just manually.
9.13 Thread the cable		The threading procedure may vary according to the type of cable (single-strand or multi-strand).
9.14 Install anchor blocks and wedges		
9.15 Install the tensioning block		
9.16 After the concrete is cured, use hydraulic jacks to tension the cables	9.16.1 Connect the jack to the pump and a clock 9.16.2 Insert cables in the hydraulic jack 9.16.3 Lean the jack on the tensioning block 9.16.4 Check the elongations	
9.17 Inject concrete grout	9.17.1 Mix the concrete in the mixer 9.17.2 Pump the concrete in the sheath 9.17.3 Close the plugs at each end	
9.18 Put the work area back in order	9.18.1 Flush out excess grout and scrap it	

TASK 10 BUILD REINFORCING PARTS ON THE SITE

Reinforcing parts are usually built in-plant, but occasionally (particularly on sites in remote areas), due for example to a breakage, delivery error or plan modifications, the reinforcing steel erector has to build parts on the site.

The task as described in Table 2.1 assumes the production of several parts. However, the reinforcing steel erector may also have to build only one part on occasion. In such cases, operations 10.1, 10.7 and possibly 10.8 are reportedly not performed.

Operations	Sub-Operations	Clarifications
10.1 Read the manufacturing delivery slips		The delivery slip contains data on bending type, dimensions, type of bar, etc.
10.2 Put the bending machine and the shearing machine in place		
10.3 Calculate bending losses and gains	10.3.1 Check the dimensions 10.3.2 Consider the overlaps	
10.4 Measure the reinforcing steel bars and determine the necessary bars for the work		
10.5 Cut the reinforcing steel bars	10.5.1 Check the necessary lengths	The bars may be cut mechanically (e.g., with a saw) or by oxygen cutting.
10.6 Bend the reinforcing steel bars		
10.7 Label the reinforcing steel bars and stack the prefabricated parts		Labelling is used for distinguishing between reinforcing bars before putting them in place.
10.8 Store the reinforcing steel bars		
10.9 Put the work area back in order		This operation is important for the safety of all workers on the site. In addition, it facilitates work in later stages.

2.3 ACHIEVEMENT CONDITIONS

Data on achievement conditions were collected for the reinforcing steel erector trade as a whole. The data pertain to aspects such as work areas, work instructions, health and safety hazards, reference documents, and material resources used.

Table 2.3 Achievement Conditions[26]

ACHIEVEMENT CONDITIONS
Workplaces[27] Reinforcing steel erectors may be assigned to work on any building, new or existing, that includes reinforced concrete structures. Some bridge reinforcing work requires reinforcing steel erectors to work above water, in barges moored near the structures. They may also work in underground tunnels, in confined spaces, excavations, on roads, from heights in lifts, etc.
Instructions Reinforcing steel erectors always work according to instructions given by their foreman. Those instructions are taken from plans and specifications, which are not used by reinforcing steel erectors. However, the foreman occasionally gives an excerpt of the plans or a freehand sketch, to explain to them the work to be done.
References Reinforcing steel erectors do not have to consult specific documents. The only sources of information they must consult are the work orders, delivery slips and labels affixed to materials.
Tools and equipment In Annex 1 of the present report is a list of material resources used by reinforcing steel erectors in practicing their trade. Under the collective agreements, certain tools are provided by the reinforcing steel erector, and others by his employer.

26. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 10.
27. Non-exhaustive list.

ACHIEVEMENT CONDITIONS
Health and safety hazards In Annex 2 of the present report are a list of the main hazards involved in the tasks and operations of the reinforcing steel erector trade, and a list of applicable preventive measures.
Degree of autonomy Although reinforcing steel erectors have to work alone at times, generally they work within a team. The work teams often include four to six reinforcing steel erectors, but they may also include more. Reinforcing steel erectors generally work under the direct supervision of their foreman, particularly in small teams. In larger work teams, supervision is often less direct, since the foreman cannot be constantly present with each reinforcing steel erector.
Stress factors Tight deadlines can be somewhat stressful to reinforcing steel erectors, as well as the workload and a sustained pace of production. The participants consulted mention that the foreman's attitude can be a major stress factor for reinforcing steel erectors – some foremen put more pressure than others on workers. In addition, certain working conditions, for example working from heights or in confined spaces, may be stressful to persons who feel uneasy in this type of situation. However, the participants pointed out that teamwork makes it possible to distribute work according to each person's abilities.
Decision-making The trade does not require very complex decision-making, especially since the reinforcing steel erector is generally closely supervised by a foreman.

2.4 PERFORMANCE CRITERIA

Performance criteria were gathered for each task. They are used for assessing whether the tasks were performed satisfactorily. The criteria pertain to aspects such as the quantity and quality of work done, the observance of a work procedure, the attitudes adopted, etc.

Table 2.4 Performance Criteria

TASK 1 UNLOAD MATERIALS

Performance Criteria

- Well positioned slings
- Correct interpretation of the work orders, delivery slips and labels
- Exact use of signals to the crane operator
- Observance of health and safety rules
- Appropriate arrangement of unloaded materials
- Appropriate classification of materials
- Observance of the foreman's instructions
- Correct determination of the total weight and volume of the load to be handled

TASK 2 HANDLE MATERIALS

Performance Criteria

- Good coordination between team members
- Appropriate load distribution
- Correct choice of materials to be transported
- Correct interpretation of the work orders, delivery slips and labels
- Choice of the shortest and safest path
- Complete clearing of the chosen path
- Regular alternation of the shoulders
- Observance of health and safety rules
- Following the foreman's instructions
- Load distributed to avoid the recoil effect while walking

TASK 3 INSTALL REINFORCING STEEL

Performance Criteria

- Bars well aligned and straight
- Observance of spacings and overlaps
- Observance of the marking
- Judicious choice of the type of fasteners and the technique to be used
- Well secured fasteners
- Good coordination between teams of reinforcing steel erectors
- Observance of the surveyor's instructions and data
- Observance of concrete covering dimensions
- Observance of health and safety rules
- Following the foreman's instructions

TASK 4 BUILD AND PUT PREFABRICATED ELEMENTS IN PLACE

Performance Criteria

- Choosing efficient working methods (quickness, controlled effort)
- Methodical work
- Securely fastened materials
- Appropriate scaffold assembly, if applicable
- Observance of the alignment and level
- Appropriate Immobilization of the structure during slinging
- Observance of health and safety rules
- Following the foreman's or engineer's instructions

TASK 5 WELD REINFORCING STEEL

Performance Criteria

- Solid assembly
- Clean and regular weld bead
- Appropriate weld penetration
- Choosing appropriate filling metal according to instructions
- Correct fitting
- Observance of health and safety rules
- Following the foreman's instructions
- Safe electrical installation (welding and return cables)

TASK 6 INSTALL MECHANICAL JOINTS

Performance Criteria

- Observance of prescribed lengths (rings)
- Solid assembly
- Appropriate screwing
- Observance of the work sequence
- Following procedures according to the jointing process used
- Observance of health and safety rules
- Following the foreman's instructions

TASK 7 INSTALL ANCHORS AND STUDS

Performance Criteria

- Appropriate drilling, at the right location and depth
- Correct hole diameter
- Complete cleaning of holes
- Judicious choice of the grout or glue according to instructions
- Following glue or grout preparation and injection procedures
- Gluing studs appropriately
- Observance of health and safety rules
- Following the foreman's instructions

TASK 8 INSTALL WIRE MESHES

Performance Criteria

- Observance of overlaps and spacings
- Correct determination of cuts to be made
- Precise cutting around obstacles
- Absence of damage to polyethylene
- Observance of health and safety rules
- Following the foreman's instructions

TASK 9 PUT POST-TENSIONING SYSTEMS IN PLACE

Performance Criteria

- Sheaths and sleeves well bonded
- Anchors securely fastened
- Observance of tolerances according to instructions
- Appropriate choice of cables according to instructions
- Efficient coordination between the teams responsible for the installation and the team responsible for post-tensioning
- Observance of health and safety rules
- Following the foreman's instructions
- Safe use of hydraulic jack systems

TASK 10 BUILD REINFORCING PARTS ON THE SITE

Performance Criteria

- Observance of dimensions and shapes
- Choosing the appropriate mandrel
- Observance of bending angles
- Correct application of bending and cutting techniques
- Appropriate use of tools and equipment
- Reduction of material losses
- Observance of health and safety rules
- Following the foreman's instructions

2.5 FUNCTIONS

Functions correspond to a set of related tasks. This set may be defined by the work's results or by a sequence of steps.

For the reinforcing steel erector trade, the participants agreed with the functions presented below. Thus, the reinforcing steel erector's work comprises:

- a function regarding **handling**, and grouping the following tasks:
  1 unload materials;
  2 handle materials;
- a function regarding the **building and installation**[28] of reinforcing steel, and grouping the following tasks:
  3 install reinforcing steel;
  4 build and put prefabricated elements in place;
  5 weld reinforcing steel;
  6 install mechanical joints;
  7 install anchors and studs;
  8 install wire mesh;
  9 build reinforcing steel parts on the site;
- a function regarding **post-tensioning**, and including the following task:
  10 put post-tensioning systems in place.

28. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 11.

3. QUANTITATIVE DATA ON TASKS

3.1 OCCURRENCE

Occurrence data concern the percentage of reinforcing steel erectors[29] who perform a task in the same workplace. The data presented in the tables below are the average results of the 12 workshop participants. However, they account for the use of time not only of the reinforcing steel erectors attending the workshop, but also of all reinforcing steel erectors working in the companies represented.

Table 3.1 Occurrence of Tasks[30]

Task	Occurrence
1. Unload materials	80.4%
2. Handle materials	93.8%
3. Install reinforcing steel	91.7%
4. Build and put prefabricated elements in place	72.5%
5. Weld reinforcing steel	6.5%
6. Install mechanical joints	35.1%
7. Install anchors and studs	52.5%
8. Install wire meshes	80.4%
9. Put post-tensioning systems in place	3.0%
10. Build reinforcing parts on the site	12.0%

29. The data include apprentices.
30. Read on this subject the comment by the Professional Subcommittee in Annex 3, Note No. 12.

3.2 WORK TIME

Work time, also expressed in percentages, represents the average time allocated to each task by the participants, on average and on an **annual** basis.

Table 3.2 Work Time Allocated to Each Task

Task	Work Time
1. Unload materials	7.4%
2. Handle materials	17.6%
3. Install reinforcing steel	46.6%
4. Build and put prefabricated elements in place	7.4%
5. Weld reinforcing steel	1.2%
6. Install mechanical joints	2.7%
7. Install anchors and studs	5.5%
8. Install wire meshes	7.0%
9. Put post-tensioning systems in place	3.3%
10. Build reinforcing parts on the site	1.3%
	100%

Thus, task 3, “Install reinforcing steel,” obtains the highest percentage, i.e., almost half of the workshop participants’ work time. The other tasks’ percentages vary between 17.6% (task 2, “Handle materials”) and 1.2% (task 5, “Weld reinforcing steel”).

Moreover, an examination of individual results reveals that:

- 6 participants never perform task 5, “Weld reinforcing steel”;
- 3 participants never perform task 9, “Put post-tensioning systems in place”;
- 4 participants never perform task 10, “Build reinforcing parts on the site”.

3.3 IMPORTANCE AND DIFFICULTY OF TASKS

The importance of a task is estimated according to the more or less harmful consequences of performing a task poorly or not at all. The importance is assessed according to the following scale:

1. Not important at all: Poor execution of the task has no consequences on the quality of the result, the costs, health and safety, etc.

2. Not very important: Poor execution of the task could result in minimal costs, an unsatisfactory result, injury or minor accident hazards, etc.

3. Important: Poor execution of the task could result in substantial additional costs, injuries, accidents, etc.

4. Very important: Poor execution of the task could have very substantial consequences in terms of costs, safety, etc.

A task's difficulty is assessed according to the following scale:

1. Very easy: The task involves little risk of error; it requires no notable physical or mental effort. Performing the task is less difficult than average.

2. Easy: The task involves a few risks of error; it requires minimal physical or mental effort.

3. Difficult: The task involves many risks of error; it requires a good physical or mental effort. Performing the task is more difficult than average.

4. Very difficult: The task involves a high risk of error; it requires substantial physical or mental effort. The task is among the most difficult in the trade.

The data presented in the table below are the average results for the reinforcing steel erectors who participated in the workshop.

Table 3.3 Importance and Difficulty of Tasks

Task	Importance	Difficulty
1. Unload materials	3.0	2.1
2. Handle materials	3.4	2.8
3. Install reinforcing steel	3.8	3.0
4. Build and put prefabricated elements in place	3.9	3.3
5. Weld reinforcing steel	3.7	3.0
6. Install mechanical joints	3.7	3.0
7. Install anchors and studs	3.6	2.6
8. Install wire meshes	3.1	1.9
9. Put post-tensioning systems in place	3.9	3.4
10. Build reinforcing parts on the site	3.4	3.3

4. KNOWLEDGE, SKILLS AND ATTITUDES

The occupational analysis enabled us to specify some of the knowledge, skills and attitudes necessary for performing the tasks. Those qualities are transferable, i.e., applicable to a variety of tasks and situations.

The following pages present the knowledge, skills and attitudes that, according to the participants, are considered essential for performing the tasks of the reinforcing steel erector.

4.1 KNOWLEDGE

Steel

The reinforcing steel erector must have a basic knowledge of the various types of steel (galvanized, black) and their grades, as well as the types of steel wire tie, bending, etc.

Construction

The reinforcing steel erector must know the most common expressions and terms in the construction industry (tools, equipment, installations, etc.), so as to be able to communicate easily with his reinforcing steel erector colleagues and workers in other trades.

Environment

A basic knowledge of the environmental impact of various practices related to the trade may be useful to the reinforcing steel erector. He must also know the precautions and preventive measures to take during certain types of work.

Mathematics

In the course of his work, the reinforcing steel erector must apply the four basic arithmetic operations (adding, subtracting, multiplying, subtracting), particularly in determining lengths and quantities. Calculations are done with fractions and decimals, in imperial and metric units. Knowledge of geometry may also be necessary; the reinforcing steel erector must particularly be able to distinguish between basic geometric figures.

Mechanics

Basic mechanical knowledge can be useful to the reinforcing steel erector, to enable him to troubleshoot in case of equipment failure. He may also be called upon to do regular maintenance on certain tools, for example mechanical saws (changing blades, lines, spark plugs, etc.).

Physics

A basic knowledge of physics is useful to the reinforcing steel erector, particularly concepts related to support points, prybars, range, load capacity, etc.

Occupational health and safety

The reinforcing steel erector must know the occupational health and safety rules, as well as precautions and preventive measures related to tasks, equipment, tools, installations and scaffolds.

Signalling

The reinforcing steel erector must know the necessary signals for guiding crane operators in moving various elements.

Welding

Basic welding knowledge is necessary to the reinforcing steel erector – particularly the rudiments of arc welding, oxygen cutting, and safety measures for handling gas cylinders.

Teamwork

Given that the reinforcing steel erector almost always works within a team, he should know the basic rules for good teamwork, communication between co-workers, work distribution, and coordination between team members. Knowing these rules should also facilitate communication with workers in other trades.

4.2 SKILLS

Skills are types of know-how. They are divided into three categories: cognitive, motor and perceptual.

Cognitive skills

Cognitive skills pertain to intellectual strategies applied in working. The main cognitive skills that reinforcing steel erectors need are the following:

- anticipation of the effects of their work on subsequent stages;
- ability to plan their work;
- overall vision of the work to be done.

Motor skills

Motor skills involve gestures and movements. The main motor skills that reinforcing steel erectors need are the following:

- ability to work from heights and in confined spaces;
- dexterity and coordination;
- endurance;
- balance;
- physical strength (to lift loads weighing 60 pounds on average).

Perceptual skills

Perceptual skills are sensory skills enabling a person to perceive by his senses what is happening in his environment. The main perceptual skills that reinforcing steel erectors need are the following:

- good vision;
- detecting gas odours, etc.

4.3 ATTITUDES

Attitudes are ways of acting, reacting and relating with others or with one's environment. They involve personal skills. A reinforcing steel erector should demonstrate the following attitudes:

- having a sense of order;
- being versatile;
- showing tact in his interactions with others;
- showing patience;
- working cleanly and methodically;
- being able to adapt to different situations, persons, etc.

5. TRAINING SUGGESTIONS

Initial training

The participants made the following suggestions about various aspects of initial training:

- Raise students' awareness of the reality of construction sites, which is very different from that of school, by insisting that the trade is physically demanding, which can deter certain students when they start working on construction sites. In addition, students should be well prepared for construction site production requirements.

- To the extent possible, the training should involve real situations likely to be encountered on construction sites.

- Make as many visits to construction sites as possible with students.

- One participant would like the apprenticeship to last 4,000 hours (instead of 2,000); another mentions that such an increase could discourage some new recruits.

Generally, the participants who took the training leading to the DEP are satisfied with its content and consider themselves to have been well prepared. However, it was mentioned that the number of hours allocated to welding could be reduced, as well as the number allocated to the "Science and Environment" module. In addition, it was recommended to add training in using aerial lifts and work platforms. Finally, given that the reinforcing steel erector does not have to read plans or specifications, the relevance of these subjects in initial training is questioned; reinforcing steel erectors who want to become foremen could learn to read plans and specifications in further training. That withdrawal of the subject from initial training would make it possible to allocate more time to practicing basic techniques[31].

31. On the subjects of plans and specifications and of training in post-tensioning, read the Professional Subcommittee's comment in Annex 3, Note No. 13.

Professional development and further training

The participants mentioned that they would be interested in further training in the following subjects:

- reading plans;
- new materials;
- post-tensioning;
- handling with a telescopic forklift[32];
- handling large prefabricated elements;
- using aerial lifts and aerial work platforms;
- slabs and ties.

32. The Direction de l'application des conventions collectives has issued a notice to the effect that there is currently a dispute (March 2010) over the use of telescopic forklifts, which is claimed exclusively by the heavy equipment operator trade.

Annexes

Annex 1
TOOLS AND EQUIPMENT

During the workshop, the participants were shown a list of tools and equipment from the 1989 occupational training specifications[33]. In the following pages is the list of tools and equipment that was validated by the participants.

Table A.1 Tools and Equipment

Hand Tools	
▪ hickey bar ▪ tool belt ▪ side/diagonal cutters ▪ knocker wrench ▪ pipe wrench ▪ adjustable wrench ▪ chalk line ▪ hydraulic jack ▪ reel ▪ combination wrench ▪ drill bits	▪ flashlight ▪ prybar ▪ hammers ▪ sledge hammer ▪ pliers ▪ cable cutters ▪ reel holder ▪ extension cord ▪ tie wire reel ▪ bolt bag ▪ bar clamps
Power Tools and Equipment	
▪ fixed bender ▪ portable bender ▪ electric shear ▪ compressor ▪ disk ▪ generator ▪ hammer drill ▪ grinder ▪ peening tool ▪ power drill	▪ tension control gun ▪ gas deck saw ▪ circular saw ▪ electric hacksaw ▪ band saw ▪ portable saw ▪ gas cut-off saw ▪ hydraulic jacks (pumps and accessories)
Measuring and Layout Equipment	
▪ string line ▪ chalk line ▪ vernier ▪ plumb line ▪ marker ▪ sprit level	▪ water level ▪ laser level ▪ builder's tripod level ▪ optical level ▪ magnetic torpedo level ▪ laser pointer ▪ straight edges ▪ measuring tape

33. Commission de la construction du Québec, *Ferrailleur : Devis de formation professionnelle*, 1989.

Safety Equipment	
▪ air movers (fans) ▪ portable lighting ▪ cables ▪ welding flash screens ▪ perimeter cables ▪ fire extinguishers ▪ stanchion posts ▪ guardrails ▪ ropes (fibre, wire)	▪ first aid equipment ▪ life lines ▪ anchor points ▪ fire blankets ▪ warning tape ▪ fume and toxic gas detectors ▪ signage ▪ eye wash facilities ▪ lock-out kit
Personal Protective Equipment	
▪ breathable air pack ▪ steel toe boots ▪ ear plugs and ear muffs ▪ life line ▪ hard hat ▪ safety belt ▪ coveralls (fire retardant) ▪ retractable lanyard ▪ rope grab ▪ safety hook ▪ fall arresters ▪ face shield ▪ gloves ▪ chain saw gloves	▪ rubber gloves ▪ welding gloves ▪ insulated gloves ▪ knee pads ▪ safety vest ▪ welding jacket ▪ full body harness ▪ safety glasses ▪ goggles ▪ respirator ▪ chin strap ▪ welding apron
Scaffolding and Access Equipment	
▪ end frames ▪ sawhorses ▪ ladder jack scaffold ▪ stationary scaffolds ▪ mechanical scaffolds ▪ rolling scaffolds ▪ swing stages ▪ extension ladder ▪ ladders ▪ stepladders	▪ boom lifts ▪ aerial lifts ▪ aluminium planks ▪ aerial work platforms ▪ electrical vertical lift ▪ ramps ▪ floats (angel's wings) ▪ tubes and clamps ▪ temporary access/freight elevator
Specialty Tools and Equipment (Welding, Cutting)	
▪ stud welding equipment ▪ cutting tools (oxygen, acetylene, propane) ▪ stud welding gun	▪ welding set ▪ oxygen cutting set ▪ bending table with pins ▪ ring compressor

Rigging Equipment	
▪ girder cleat rings and lines ▪ wire rope ▪ fibre rope ▪ ring and other chains ▪ simple roller ▪ thimbles ▪ hooks ▪ wedge socket ▪ dunnage ▪ wire rope slings ▪ multiple-leg bridle slings ▪ synthetic slings ▪ swivels ▪ shackles	▪ blocks ▪ tackle blocks ▪ chain falls ▪ ratchet hoist ▪ spreader beam or spreader ▪ multi-bearing rollers ▪ sheaves ▪ metal edges ▪ cable clamps ▪ turnbuckle ▪ winch ▪ mechanical/hydraulic jacks, pumps and accessories
Handling Equipment	
▪ boom truck ▪ roller ▪ forklift ▪ telescopic forklift[34] ▪ tugger	▪ chain falls ▪ come-alongs ▪ multi-bearing rollers ▪ pallet jack

34. The Direction de l'application des conventions collectives has issued a notice to the effect that there is currently a dispute (March 2010) over the use of telescopic forklifts, which is claimed exclusively by the heavy equipment operator trade.

Annex 2
GRIDS OF OCCUPATIONAL HEALTH AND SAFETY ELEMENTS

Produced by: **Gaston Dufour,** Inspector
Commission de la santé et de la sécurité du travail

Table A.2 Occupational Health and Safety Issues Involving the Reinforcing Steel Erector Trade

No.	*Hazards*	*Effects on Health and Safety*	*Means of Prevention*
1. FALL HAZARDS			
	a) Same-level fall hazard (sliding, tripping, etc.)	• Collisions, contusions, fractures, bruises	• Clear the workplace (pic up debris, tools, equipment). • Ensure that the workplace is not slippery. • Wear safety boots with anti-slip soles.
	b) Fall-from-height hazard: **1.** Using scaffolds **2.** Using ladders **3.** Using personal lifting devices	• Collisions, fractures, internal injuries, permanent physical and psychological after-effects, death	• Clear the workplace. • Ensure that the workplace is not slippery and is solid. • Wear a safety harness. • Make sure the ladder is solid and stable. • Install guardrails. • Secure the workplace. • Install and use scaffolds safely. ***When tasks involve the hazard of falling more than three metre (xxx high risk, see table A3, p. 56)***
2. EQUIPMENT-RELATED HAZARDS			
	a) Heavy equipment to be transported and handled	• Excessive effort • Back pain • Herniated disks	• Ensure the presence of adequate lifting equipment. • Make sure to have a colleague's assistance.
	b) Being caught by moving parts and transmission mechanisms	• Jamming • Crushing • Amputation • Fractures	• Wear adequate and well-fitted clothing. • Keep safe distance.
	c) Contact with a rotating tool	• Contusions • Hand injuries	• Make sure the tool stops before making any intervention. • Use safety equipment (wear gloves).
	d) Falling materials	• Crushing • Fractures • Death	• Wear safety footwear. • Wear a hard hat. • Do not stand under a load.
	e) Projection of various elements	• Eye and face injuries	• Wear safety glasses; • Wear a face shield.

No.	Hazards	Effects on Health and Safety	Means of Prevention
3. CHEMICAL HAZARDS			
	a) Presence of silica in materials b) Form oil c) Welding fumes d) Smoke e) Glue	• Silicosis and lung cancer (death in the long term) • Lung diseases	• Ensure that safe working methods for perforating or demolishing materials containing silica are put in place before doing work. • Wear appropriate respiratory protection equipment (silica, welding fumes). • Allow form oil to penetrate formwork.
4. ELECTRICAL HAZARDS			
	a) Electric tools b) Turned-on equipment c) Proximity of high-voltage lines	• Electric discharges • Electrification • Permanent physical and psychological after-effects • Death	• Use double insulation electric tools preferably. • Always use grounded extension cords, in good condition and sufficiently large for the tool. ***At all times, if work is done near an electric line. Application of safety rules during work near an electric line. Section 5 of the Safety Code for the Construction Industry (xxx high risk, see table A3, p. 56)***
5. ERGONOMIC HAZARDS			
	a) Postural constraints	• Musculoskeletal lesions	• Use handling assistance equipment.
	b) Handling, lifting, moving heavy loads	• Sprains	• Know handling techniques.
	c) Difficult tasks	• Hernias	• Have the right tools for the task to be performed.
	d) Cramped areas	• Fatigue, discomfort, pain • Permanent physical after-effects	• Request help for heavy loads. • Use the best possible working postures in cramped areas where the task is difficult.
6. PHYSICAL HAZARDS			
	a) Noise b) Moving particles	• Hearing loss, stress	• Wear hearing protection equipment. • Use less-noisy tools and equipment. • ***During outdoor work, workers may be exposed to heat and cold hazards.***

Table A.3 Risk Sources Related to the Tasks and Operations of the Reinforcing Steel Erector Trade

Legend

0	The risk is nil.
x	The risk is low.
xx	The risk is average.
xxx	The risk is high.

Risk levels are noted according to exposure to hazards, not according to the gravity of effects on personal health and safety.

No.	Operations and Sub-Operations	Fall Hazards	Equipment-Related Hazards	Chemical Hazards	Electrical Hazards	Ergonomic Hazards	Physical Hazards
TASK 1	**UNLOAD MATERIALS**						
1.1	**Read work and safety instructions**	0					
1.2	**Direct delivery truck movements on the site**	X	0	0	0	0	X
1.3	**Sling steel on the long-load truck**	X	XX	0	0	XX	X
1.3.1	Choose a working method		0	0	0	0	0
1.3.2	Determine an unloading sequence		0	0	0	0	0
1.3.3	Choose and check the slings		X	0	0	0	0
1.4	**Put in place supports for the material on the ground**	X	XX	0	0	X	0
1.5	**Rig and give signals to the crane operator so the load can be moved**	X	XXX	0	0	0	0
1.6	**Classify the reinforcing steel and other materials**	X	XX	0	0	0	0
1.6.1	Open and arrange bundle contents			0	0	0	0
1.6.2	Group the bars according to types of steel, installation sequence, etc.			0	0	XXX	0
TASK 2	**HANDLE MATERIALS**						
2.1	**Read work and safety instructions**	0					
2.2	**Place scaffolds and platforms, if applicable**	XXX	XXX	0	XXX	XXX	XX
2.3	**Choose the materials to be transported**	X	0	0	0	0	0
2.4	**Define the path to be followed**	X	0	0	0	0	0
2.4.1	Ensure safety in the moving area (on the ground and overhead)	X	0	0	0	0	0
2.5	**Clear the chosen path**	X	X	0	0	0	0

No.	Operations and Sub-Operations	Fall Hazards	Equipment-Related Hazards	Chemical Hazards	Electrical Hazards	Ergonomic Hazards	Physical Hazards
2.6	**Assess the load's weight**	0	0	0	0	0	0
2.7	**Balance the load to make it easier to handle**	0	XX	0	0	XXX	0
2.8	**Transport the load**	XX	XX	0	0	XXX	0
2.9	**Place the load at the designated location**	0	XX	0	0	XXX	X
TASK 3	**INSTALL REINFORCING STEEL**						
3.1	**Read work and safety instructions**	0					
3.1.1	Read the work order or delivery slip	0					
3.1.2	Determine the installation sequence	0					
3.2	**Place scaffolds, platforms, aerial work platforms or lifts, if applicable**	XXX	XXX	0	0	XXX	XX
3.3	**Find out about the lines, levels and templates**	0	0	0	0	0	0
3.3.1	Check location points and elevations measured by the surveyor	0	0	0	0	0	0
3.4	**Choose the steel and mark the spacings**	0	0	0	0	0	0
3.5	**Place the supports**	0	0	0	0	X	0
3.5.1	Observe the spacings	0	0	0	0	0	0
3.6	**Place the bars**	XX	XX	0	0	XXX	XX
3.7	**Fasten the reinforcing steel**	XX	0	0	0	XXX	0
3.8	**Check the assembly**	XX	0	0	0	X	0
3.9	**Cut the bars, if applicable**	XX	XX	XX	XX	XXX	XXX
3.10	**Stabilize the elements**	XX	0	0	0	0	0
3.11	**Before concrete is poured, replace steel and supports, if applicable**	XX	X	0	0	XXX	0
3.12	**Collect rejects and put the work area in order**	XX	X	0	0	XX	0
TASK 4	**BUILD AND PUT PREFABRICATED ELEMENTS IN PLACE**						
4.1	**Read work and safety instructions**	0					
4.1.1	Read the sketch or the part of the plan concerned	0					
4.1.2	Choose the working method (quick assembly)	0					
4.2	**Check the weight of prefabricated elements and the distance to travel**	0	0	0	0	0	0
4.2.1	Consult the work order or delivery slip	0	0	0	0	0	0
4.3	**Choose the work area and install sawhorses**	0	XX	0	0	XX	0
4.3.1	Choose the sawhorses	0	0	0	0	0	0

No.	Operations and Sub-Operations	Fall Hazards	Equipment-Related Hazards	Chemical Hazards	Electrical Hazards	Ergonomic Hazards	Physical Hazards
4.4	**Choose the steel and mark the spacings**	0	0	0	0	0	0
4.4.1	Check the bars' diameter	0	0	0	0	0	0
4.4.2	Check the bars' length	0	0	0	0	0	0
4.4.3	Check the type of steel (W, 400, 300, etc.)	0	0	0	0	0	0
4.5	**Place the bars, stirrups, fasteners**	XX	XX	0	0	XXX	X
4.5.1	Check the number of bars	0	0	0	0	0	0
4.5.2	Check the number of stirrups	0	0	0	0	0	0
4.5.3	Check the number of fasteners	0	0	0	0	0	0
4.5.4	Locate the marking	0	0	0	0	0	0
4.6	**Fasten the reinforcing steel**	XX	0	0	0	XXX	0
4.6.1	Choose the type of fasteners	0	0	0	0	0	0
4.6.2	Determine the position and number of fasteners	0	0	0	0	0	0
4.7	**Check the assembly**	0	0	0	0	0	0
4.7.1	Ensure that there is no lack of steel in the element	0	0	0	0	0	0
4.8	**Cut the bars, if applicable**	XX	XX	XX	XX	XX	XXX
4.9	**Read positioning instructions (levels, measurements and layout)**	0	0	0	0	0	0
4.9.1	Follow the engineer's procedures	0	0	0	0	0	0
4.9.2	Ensure that the element's dimensions correspond to the forms'	0	0	0	0	0	0
4.9.3	Make sure of the concrete cover	0	0	0	0	0	0
4.9.4	Make sure to have the correct elevation and alignment	0	0	0	0	0	0
4.10	**Check the presence of anchor points**	XX	0	0	0	0	0
4.11	**Strengthen the reinforcing steel structure for rigging**	XX	XX	0	0	XX	0
4.12	**Place scaffolds, platforms, aerial work platforms or lifts, if applicable**	XXX	XXX	0	0	XXX	XX
4.13	**Rig the prefabricated elements**	XX	XX	0	0	XX	0
4.13.1	Choose the lifting device	0	0	0	0	0	0
4.13.2	Choose slings	0	0	0	0	0	0
4.14	**Fasten and stabilize the prefabricated elements (spacers, steel wire tie, cable, steel)**	XX	0	0	0	XX	0
4.15	**Collect rejects and put the work area in order**	X	0	0	0	XX	0

No.	Operations and Sub-Operations	Fall Hazards	Equipment-Related Hazards	Chemical Hazards	Electrical Hazards	Ergonomic Hazards	Physical Hazards
TASK 5	**WELD REINFORCING STEEL**						
5.1	**Read work and safety instructions**	0					
5.2	**Place scaffolds, platforms, aerial work platforms or lifts, if applicable**	XXX	XXX	0	0	XXX	XX
5.3	**Identify the weldable bars**	0	0	0	0	0	0
5.4	**Choose the electrodes**	0	0	0	0	0	0
5.5	**Install the welding machine cables and adjust the welding machine**	0	0	0	0	0	0
5.5.1	Adjust the heat	0	0	0	0	0	0
5.5.2	Check the grounding	0	0	0	0	0	0
5.6	**Move the bar folders closer together or locate the anchors**	X	0	0	0	0	0
5.6.1	Use clamps and fasteners to stabilize the steel bars	X	0	0	0	0	0
5.7	**Fit**	0	0	0	0	X	0
5.7.1	Turn the electrode on by rubbing lightly	0	XX	XX	XX	X	0
5.8	**Put the work area back in order**	X	0	0	0	X	0
TASK 6	**INSTALL MECHANICAL JOINTS**						
6A	**LENTON, DAYTON AND BARLOCK TYPES AND MALLEABLE SLEEVES**						
6A.1	**Read work and safety instructions**	0					
6A.1.1	Determine the pressure and tension to be applied	0					
6A.2	**Place platforms, if applicable**	XXX	XXX	0	0	XXX	XX
6A.3	**Cut the bars, if applicable**	0	XX	XX	0	XXX	XXX
6A.4	**Place the ring**	0	0	0	0	0	0
6A.5	**Screw, tighten or compress the ring**	0	XX	0	XX	0	XXX
6A.6	**Check positioning compliance**	0	0	0	0	0	0
6A.7	**Put the work area back in order**	0	0	0	0	0	0
6B	**CADWELL TYPE**						
6B.1	**Read work and safety instructions**						
6B.2	**Delimit a safety perimeter**	0	0	0	0	0	0
6B.2.1	Install a vacuum cleaner			0	0	0	0
6B.2.2	Install a ribbon limiting access			0	0	0	0
6B.2.3	Have a fire extinguisher on hand			0	0	0	0

No.	Operations and Sub-Operations	Fall Hazards	Equipment-Related Hazards	Chemical Hazards	Electrical Hazards	Ergonomic Hazards	Physical Hazards
6B.3	**Place scaffolds, aerial work platforms or lifts, if applicable**	XXX	XXX	0	0	XXX	XX
6B.4	**Cut the bars, if applicable**	0	XX	XX	XX	XXX	XXX
6B.5	**Clean the bars**	0	0	0	0	X	0
6B.6	**Heat and dry to remove moisture**	0	0	0	0	0	0
6B.7	**Place the separator**	0	0	0	0	0	0
6B.8	**Install the furnace**	0	0	0	0	0	0
6B.9	**Place the metal powder and primer**	0	0	0	0	0	0
6B.9.1	Determine the type and quantity of powder to be used			0	0	0	0
6B.9.2	Avoid spills			0	0	0	0
6B.10	**Ignite the powder**	0	0	XXX	0	0	0
6B.10.1	Apply the ignition procedure			0	0	0	0
6B.10.2	Place the primer	0	0	0	0	0	0
6B.10.3	Use the lighter			0	0	0	0
6B.11	**Remove the furnace**		0	0	0	0	0
6B.12	**Put the work area back in order**	0	0	0	0	0	0
TASK 7	**INSTALL ANCHORS AND STUDS**						
7A	**DIWYDAG ANCHORS**						
7A.1	**Read work and safety instructions**	0					
7A.2	**Place scaffolds, platforms, aerial work platforms or lifts, if applicable**	XXX	XXX	0	0	XXX	XX
7A.3	**Identify the Diwydag bars**	0	0	0	0	0	0
7A.4	**Put the Diwydag bars in place**	0	0	0	0	XXX	0
7A.4.1	Install a sheath		0	0	0	0	0
7A.4.2	Install supports		0	0	0	0	0
7A.4.3	Choose a lifting device, if applicable		0	0	0	0	0
7A.5	**Adjust the bar levels**	0	0	0	0	X	0
7A.6	**Place the anchor plates**	0	0	0	0	0	0
7A.7	**Adjust the plate levels**	0	0	0	0	0	0
7A.8	**Inject concrete grout**	0	0	0	0	0	0
7A.9	**Put the work area back in order**	0	0	0	0	0	0

No.	Operations and Sub-Operations	Fall Hazards	Equipment-Related Hazards	Chemical Hazards	Electrical Hazards	Ergonomic Hazards	Physical Hazards
7B	**STUDS WITH ADHESIVE OR GROUT**						
7B.1	**Read work and safety instructions**	0					
7B.1.1	Determine the holes' size, spacing and depth	0	0	0	0	0	0
7B.2	**Place scaffolds, aerial work platforms or lifts, if applicable**	XXX	XXX	0	0	XXX	XX
7B.3	**Mark hole locations**	0	0	0	0	0	0
7B.4	**Choose the drill, install the depth gauge, drill holes**	0	X	XX	XX	XXX	XXX
7B.4.1	Determine the bit diameter	0	0	0	0	0	0
7B.4.2	Plan for the necessary energy source for the drill's operation (generator, extension cord, etc.)			0	XX	0	0
7B.5	**Clean and brush the holes**	0	0	XX	0	0	0
7B.5.1	Install a vacuum cleaner or a compressed air system			0	0	0	0
7B.5.2	Eliminate residues before and after the work			0	0	XX	XX
7B.6	**Choose the reinforcing steel bars and cut them, if applicable**	0	XX	XX	XX	XX	XXX
7B.7	**Inject the adhesive or grout**	0	0	X	0	0	0
7B.7.1	Choose the type of glue or grout	0	0	0	0	0	0
7B.8	**Insert and stabilize the studs**	0	X	XX	0	0	0
7B.9	**Put the work area back in order**	0	0	0	0	0	0
TASK 8	**INSTALL WIRE MESHES**						
8.1	**Read work and safety instructions**	0					
8.1.1	Check the quantities of wire meshes and supports	0					
8.2	**Place scaffolds, platforms, aerial work platforms or lifts, if applicable**	XXX	XXX	0	0	XXX	XX
8.3	**Determine and mark the spacing of supports**	0	0	0	0	XX	0
8.4	**Install supports and spacers**	0	0	0	0	XX	0
8.5	**Measure and cut the wire mesh**	0	X	0	0	XX	
8.5.1	Determine the position of obstacles		0	0	0	0	0
8.6	**Stretch the wire mesh**	0	X	0	0	XXX	
8.7	**Attach the mesh**	0	0	0	0	XXX	0

No.	Operations and Sub-Operations	Fall Hazards	Equipment-Related Hazards	Chemical Hazards	Electrical Hazards	Ergonomic Hazards	Physical Hazards
8.8	**During the pour, put the mesh and supports back in place, if applicable**	0	X	0	0	XXX	
8.8.1	Check spacing			0	0	0	0
8.9	**Put the work area back in order**	0	X	0	0	0	0
TASK 9	**PUT POST-TENSIONING SYSTEMS IN PLACE**						
9.1	**Read work and safety instructions**	0					
9.2	**Place platforms, if applicable**	XXX	XXX	0	0	XX	XX
9.3	**Place anchors on the niche and the hooping steel**	0	0	0	0	X	0
9.3.1	Determine the position of anchors on the formwork		0	0	0	X	0
9.3.2	Fasten the anchors with screws		0	0	0	X	0
9.3.3	Put a coil around the anchors, if applicable		0	0	0	X	0
9.4	**Measure and mark support locations**	0	0	0	0	X	0
9.4.1	Mark the measurements (elevation) on the formwork			0	0	X	0
9.5	**Install the supports**	0	0	0	0	XX	0
9.5.1	Place the support at the necessary location for fastening the sheath to it		0	0	0	X	0
9.6	**Place and attach sheathes, check the curvature**	0	0	0	0	XX	0
9.7	**Screw the sleeves**	0	0	0	0	0	0
9.7.1	Ensure that the sheaths are well abutted inside the sleeve	0	0	0	0	0	0
9.8	**Install a seal**	0	0	0	0	X	0
9.8.1	Wrap the sleeves (tape)		0	0	0	X	0
9.8.2	Install a ring		0	0	0	X	0
9.9	**Install vents at each end and at the highest points**	0	0	0	0	X	0
9.9.1	Ensure that the sheath exits the concrete		0	0	0	X	0
9.9.2	Ensure that the sheath is well fastened to the anchors		0	0	0	X	0
9.10	**Choose the cable and cut it, if applicable**	0	0	XX	XX	XXX	0
9.11	**Insert the bullet and the duct rod**	0	X	0	0	X	0
9.12	**Install the winch or threading equipment, if applicable**	0	XX	0	0	X	0
9.13	**Thread the cable**	0	0	0	0	XXX	0

No.	Operations and Sub-Operations	Fall Hazards	Equipment-Related Hazards	Chemical Hazards	Electrical Hazards	Ergonomic Hazards	Physical Hazards
9.14	**Install anchor blocks and wedges**	0	0	0	0	XX	0
9.15	**Install the tensioning block**	0	0	0	0	X	0
9.16	**After the concrete is cured, use hydraulic jacks to tension the cables**	0	XXX	0	0	XXX	0
9.16.1	Connect the jack to the pump and a clock			0	0	0	0
9.16.2	Insert cables in the hydraulic jack			0	0	XXX	0
9.16.3	Lean the jack on the tensioning block			0	0	XXX	0
9.16.4	Check the elongations			0	0	0	0
9.17	**Inject concrete grout**	0	0	0	0	0	0
9.17.1	Mix the concrete in the mixer		XX	XX	0	XX	0
9.17.2	Pump the concrete in the sheath		0	0	0	0	0
9.17.3	Close the plugs at each end		0	0	0	0	0
9.18	**Put the work area back in order**	0	0	0	0	0	0
9.18.1	Flush out excess grout and scrap it		0	0	0	0	0
TASK 10	**BUILD REINFORCING PARTS ON THE SITE**						
10.1	**Read the manufacturing delivery slips**	0					
10.2	**Put the bending machine and the shearing machine in place**	X	XX	0	0	XXX	0
10.3	**Calculate bending losses and gains**	X	0	0	0	0	0
10.3.1	Check the dimensions			0	0	0	0
10.3.2	Consider the overlaps			0	0	0	0
10.4	**Measure the reinforcing steel bars and determine the necessary bars for the work**	X	0	0	0	0	0
10.5	**Cut the reinforcing steel bars**	X	XX	0	XX	XX	XXX
10.5.1	Check the necessary lengths		0	0	0	0	0
10.6	**Bend the reinforcing steel bars**	X	XX	0	0	0	XX
10.7	**Label the reinforcing steel bars and stack the prefabricated parts**	X	0	0	0	0	0
10.8	**Store the reinforcing steel bars**	X	X	0	0	XX	0
10.9	**Put the work area back in order**	X	XX	0	0	XXX	0

Annex 3

COMMENTS OF THE REINFORCING STEEL ERECTOR SUBCOMMITTEE

At the meeting of February 16, 2011 held in Longueuil, and further to the meeting of April 18, the members of the Reinforcing Steel Erector Professional Subcommittee made the following comments on the report:

1. Point 1.6 Working Conditions, on physical requirements, p.7

   Good physical endurance is important to reinforcing steel erectors, particularly because of changing and demanding weather conditions.

2. Point 1.6 Working Conditions, on mobility, p. 8

   The employment reality differs according to the regional situation. Thus, it may be possible for a reinforcing steel erector to work in the same region, but he risks having less employment opportunities.

3. Point 1.10 Development of the Trade, last paragraph, p. 11

   Self-inspection applies to all sectors. A conscientious worker demonstrates more rigour by making a self-inspection.

4. List of Tasks, pp. 13, 14, 20 and others

   Task 3 should read “Install steel and other materials for the concrete reinforcement.”

5. Clarification on operation 1.5, p. 18

   During this operation, signals to the crane operator should always be given by a reinforcing steel erector.

6. Clarification on operation 2.2, p. 19

   Ground level and solidity should be checked before placing scaffolds and platforms.

7. Clarification on operation 3.7, p. 20

   In addition to the three methods already mentioned, steel may also be fastened with an epoxy adhesive, concrete grout, or *tie-wrap* or other nylon fasteners.

8. Task 7A, “Install anchors and studs, Diwydag anchors”, p.26

   An operation should be added between 7A.7 and 7A.8 and read as follows: “Proceed to post-tensioning Diwydag bars, if applicable.”

   The clarification of operation 7A.8 should read “Occasionally the injection of concrete grout is done by reinforcing steel erectors from a specialized company.”

9. Clarification on operation 8.7, p. 28

   The mesh should be fastened at the four corners and at the centre midway between the corners.

10. Table 2.3 Achievement Conditions: Workplaces and References, p. 32

    In addition to the workplaces already specified in Table 2.3, dams should be mentioned. Moreover, reinforcing steel erectors have to refer to the plans in the course of their work.

11. Point 2.5 Functions, p. 37

    The second function should read as follows: a function related to building, assembling and installing reinforcing steel…

12. Table 3.1 Occurrence of Tasks, p. 39

    The Subcommittee members think these results do not reflect the realities of the trade.

13. Training Suggestions, p.47

    The Professional Subcommittee members point out that it is very important for the reinforcing steel erector to be able to read the plans and specifications.

    They also emphasize that the demand for putting post-tensioning systems in place (task 9) is evolving quickly, particularly for wind turbines. Accordingly, there is a need for adequate training in this regard.

Annex 4

APPROVAL OF THE REINFORCING STEEL ERECTOR SUBCOMMITTEE

This vocational analysis was approved by the Reinforcing Steel Erector Professional Subcommittee at its meeting held on June 21, 2011 in Longueuil. However, the Professional Subcommittee members expressed their disagreement with the notice by the Direction de l'application des conventions collectives, in footnote No. 18, regarding operation 7B.3.