

CONSTRUCTION SKILLS TRAINING INSTITUTE

SKILL STANDARDS

BAR BENDING & STEEL FIXING



**CONSTRUCTION GROUP
LARSEN & TOUBRO LIMITED**

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COMMITTEE

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FOREWORD

Larsen & Toubro Limited (L&T) wish to regulate and promote Construction Vocational Training in India. To this end, L&T have established a Memorandum of Understanding with Henry Boot Training Limited and the Construction Industry Training Board of U.K. This is to assist in the development of a Unified Modular Training System for Construction related trades, which will supply the Industry with significant numbers of workers, trained to limited but recognised skill levels, in the shortest possible time. The system will be tried and tested by L&T and thereafter be offered to the Construction Industry Development Council of India as a model approach. The framework of the system will be designed to enable both new entrants to the Industry and skilled workers in the Industry to progressively improve their levels of skills and knowledge competency in their respective occupation and award them a skill certificate level, which is nationally recognised.

As a pre-requisite to the above, it is necessary to establish the Occupational Skill Standards, which the Industry requires from its employees. An Occupational Skill Standard is defined as written specification setting out the requirements of knowledge and skills in respect of a particular occupation or trade. To develop Construction skill standards, different committees were constituted, consisting of Senior executives of L&T ECC Group. They worked in collaboration with M/s. Henry Boot Training Limited, U.K. and Construction Industry Training Board, U.K.

The committee has brought out this book, which defines the skill standards and gradation in the skill level. Stratification of skills into three different levels (starting from level III and progressing to level I) has been done. There is a clear definition of Knowledge & Skills at each level. This is to encourage a progressive career growth for the individual and also a climate for continuous improvement of Knowledge & Skills in the Industry.

These Standards are used as a basis in the development of training programmes and in the implementation of Trade Testing and Certification. Employers in the construction Industry can confirm that employees, who achieve these Skill Standards, will meet the needs of the Industry and this will result in :

1. Improved productivity of each person
2. Increased job satisfaction
3. An opportunity for progressive career growth for the individual
4. Reduced labour turnover
5. Improved industrial relations
6. Improved safety practice leading to fewer accidents
7. Improved workmanship resulting in timely and effective completion of the project
8. Improved performance of the firms

Skill standards are a dynamic means of improving the quality in Industry. Such standards may be modified and improved as necessary to meet the changing needs of the Industry. I am sure this will usher in a sea of change in the Industry and fulfil a long felt need for recognition of Construction trades, as an organized industrial sector in the nation building process.

Larsen & Toubro Limited wishes to acknowledge the support given by

Mr. David Hammond, Director

M/s. Henry Boot Training Limited, U.K.

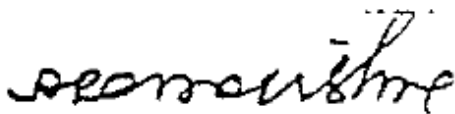
and

Mr. Terry Kivlin, Training Manager

M/s. Construction Industry Training Board, U.K.

for co-ordinating the efforts of the committee in drawing up these Construction Skill Standards.

I, on behalf of Larsen & Toubro Limited, wish to place on record my thanks to the committee, for their untiring efforts, in bringing about these excellent Skill Standards in the shortest time available at their disposal.



A. RAMAKRISHNA

MEMBER OF THE BOARD AND PRESIDENT (OPERATIONS)

LARSEN & TOUBRO LIMITED

Chennai

Feb. 1999

BAR BENDING AND STEEL FIXING

GENERAL:

A bar bender & fixer should be able to identify types of bars, read drawings and prepare schedules, fabricate using hand and power tools, store, transport and fix reinforcement in position in formwork in readiness for concrete pours. Should strictly practice safety norms and precautions.

SPECIFIC DUTIES:

1. Reads drawings and bending schedules
2. Identifies the types and grades of reinforcement available
3. Measures and sets out his work
4. Calculates from codes and standards the cut lengths, the weights of bars & the weights involved in the total job.
5. Computes the quantity of materials used in day to day work
6. Estimates the time requirement of a particular job.
7. Programmes and maintains progress of material and labour
8. Plans necessary workforce for the job
9. Plans cutting schedule so as to minimise scrap
10. Operates and maintains hand tools and power tools
11. Cuts and bends reinforcement exactly as per the requirement of the schedule.

12. Ensures that bent bars of the same type are bundled together and tagged for Identification.
13. Ties and fastens bundled bars to ensure they remain in position whether horizontal or vertical
14. Stacks and stores steel tidily and safely to ensure correct utilisation based on size and type
15. Keeps accurate and uniform spacing of bars, staggers laps and maintains correct cover
16. Recognises main bars and distributors
17. Correlates the sequence of reinforcement placing with fixing of inserts, sleeves, conduits & anchors.
18. Prefabricates mesh and cages including additional bars for lifting safely.
19. Identifies and uses correct ties on structures.
20. Works with mechanical connection systems used for extension of bars.
21. Protects the steel from corrosion and weathering action
22. Prepares reinforcement patterns for special structures.
23. Understands the basic terms commonly used in building trade
24. Works safely at heights using ladders, scaffolds and safety belts.

SKILL STANDARDS

LEVEL III

1.0 KNOWLEDGE

- 1.1 Know and name all the steel fixing tools.
- 1.2 Appreciate care and use of tools
- 1.3 Be aware of the basic types and diameters of steel bar in regular use
- 1.4 Know how to use cover blocks
- 1.5 Be aware of all types of ties and their use on different structural elements
- 1.6. Be aware of correct sequence of steel fixing
- 1.7 Appreciate basic safety aspects.

2.0 SKILLS

- 2.1 Uses tools, correctly and safely, including hand and power benders for simple shapes, and pliers.
- 2.2. Identifies all diameters of steel bar and differentiates between mild and ribbed bars.
- 2.3. Carry out simple measurements using metric and imperial systems.
- 2.4 Fix steel, in given position, keeping accurate and uniform spacing of bars. (accuracy \pm 10 mm.)

- 2.5 Maintain correct cover to finished concrete. (Accuracy \pm 5mm).
- 2.6. Use slash, crown, ring and splice ties correctly.
- 2.7. Work safely with regard to self and others.

LEVEL II

1.0 KNOWLEDGE

- 1.1 Must have the knowledge for level III plus :
- 1.2 Understand use of schedules including code shapes and associated calculations.
- 1.3 Know simple maintenance methods for all tools and equipment.
- 1.4 Be aware of method of calculating weights of cut bars and of total job.
- 1.5 Interpret the principles involved in reading and understanding steel drawings.
- 1.6. Understand the basic terms commonly used in the building trade.
- 1.7 Know the reasons for selection of formers and rollers for different diameters of steel.
- 1.8 Be aware of mechanical connection systems used for extension of bars.

2.0 SKILLS

- 2.1 Must have the skills for level III plus.
- 2.2 Read drawings and schedules and set out for fixing steel reinforcement.
- 2.3 Work out from codes the cut length of bar to make a given shape of bend.
- 2.4 Bend bars to given specification on different types of bending machines, including hooks links and hob bars.
- 2.5 Stack and stores steel tidily and safely to ensure correct utilisation based on size and type.
- 2.6 Correlates the sequence of reinforcement placing with fixing of inserts, sleeves, conduits & anchors.
- 2.7 Prepare reinforcement patterns for special structures such as arches, cantilevers, and around openings.
- 2.8 Prefabricates mesh and cages including stability checks and additional bars for lifting safely.
- 2.9 Bundles together bent bars of the same type, and tags for identification.

LEVEL I

1.0 KNOWLEDGE

- 1.1 Must have the Knowledge for level III and level II Plus
- 1.2 Awareness of productivity
- 1.3 Be aware of methods of protecting steel from corrosion
- 1.4 Understand the need to schedule cutting and bending to maximise the use of material
- 1.5 Recognise different types of mesh to standard specifications
- 1.6 Have detailed knowledge of power tools including capacities

2.0 SKILLS

- 2.1. Must have the skills for level III and level II plus:
- 2.2. Computes the quantity of materials used in day to day work
- 2.3. Estimates the time requirement of a particular job.
- 2.4 Programmes and maintains progress of material and labour
- 2.5 Plans necessary workforce for the job.
- 2.6 Plans cutting schedule so as to minimize scrap.
- 2.7 Prepare schedules from given parts of a drawing, interpreting codes and key shapes and cut to correct lengths
- 2.8 Uses slings and chains in a safe manner for lifting steel reinforcement.
- 2.9. Set up hand power benders and select correct size formers and rollers to bend specified shapes to within a tolerance of $\pm 5\text{mm}$ to specified measurements including crank, shear and joggle bars in flat plane.

ACKNOWLEDGEMENTS

The Committee wishes to acknowledge the total support given by the following executives of L&T:

Mr. A. Ramakrishna	Member of the Board and President (Operations) L&T and Vice-Chairman-CIDC
Mr. K.V. Rangaswami	Vice President - Buildings & Infrastructure Projects
Mr. S. Chandrasekar	General Manager - Plant & HRD
Mr. V.B. Gadgil	Jt. Genl. Manager (Buildings & Factories)
Mr. K.P. Raghavan	Jt. Genl. Manager (Buildings & System Housing)
Mr. S.R. Kumar	Jt. Genl. Manager (Development - Buildings & Infrastructure)
Mr. M. Kalyanasundaram	Sr. Manager (Buildings & Factories)
Mr. M.G. Vasudevan	Manager (Building, & Factories)

The publications of the following organisations have been used for reference :

- Henry Boot Training Limited, U.K. (Training Standards)
- Construction Industry Training Board, U.K. (Training Manuals & Training Specifications)
- The Directorate General of Employment and Training of Ministry of Labour & Employment, Govt. of India
- Bureau of Indian Standards
- CIDC
- NICMAR

The following in-house documents of L&T ECC Construction Group have been used for reference

- Construction Group Work Procedures
- Construction Quality Assurance Manuals
- Construction Project Quality Plan Manuals