STANDARDS TO FACILITATE METRIC CHANGEOVER IN THE ENGINEERING INDUSTRY IN SRI LANKA — PART II

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5.00 The Civil Engineering Industry

The Civil Engineering Industry uses a large number of building materials like steel, bricks, tiles, pipes and timber. The existing Sri Lanka Standards are being revised to the metric system. As in the previous cases in revising these standards the existing international and national practices are being taken into consideration. New codes for design, construction and testing of structures are being evolved. In the building industry schedule of rates and specifications is important. The rate of payment of work done is usually related to the weight or measure. The following standards with regards to the raw materials, basic and ancillary dimensional standards covering sizes of steel plates, sheets and rolled sections etc. are laid down by the Bureau. The standards which are in the Imperial System are being metricated.

CS 14 — 1968 "Ceylon Standard Specification for Mild Steel for General Structural Purposes".
CS 73 — 1969 "Ceylon Standard Specification for Dimensions and Properties or Steel Channels, Angles and Tee Bars".
CS 74 — 1969 "Ceylon Standard Specification for Dimensions of Round and Square Steel Bars for Structural and General Engineering Purposes (Metric Series)".
CS 75 — 1969 "Ceylon Standard Specification for Dimensions of Steel Flats for Structural and General Engineering Purposes".
CS 95 — 1975 "Ceylon Standard Specification for Welded Hard Drawn Steel Wire for Concrete Reinforcement".
CS 139 — 1972 "Ceylon Standard Specification for Mild Steel Wire for General Engineering Purposes".
CS 375 — 1976 "Ceylon Standard Specification for Cold Worked Deformed Steel Bars for the Reinforcement of Concrete".
CS 307 — 1974 "Ceylon Standard Specification for Slotted Sections"
CS 39 — 1968 "Ceylon Standard Specification for Common Burnt Clay Building Bricks".
CS 263 — 1974 "Ceylon Standard Specification for Building Timber"—
Pt. 1 — Recommendations on sizes.
Pt. 2 — Sp. for permissible defects.
CS 2 — 1967 "Ceylon Standard Specification for Clay Roofing Tiles".
CS 9 — 1967 "Ceylon Standard Specification for Asbestos Cement Corrugated and Flat Sheets".
CS 147 — 1972 "Ceylon Standard Specification for Rigid Unplasticized Polyvinyl Chloride Pipes for Potable Cold Water Supplies".
CS 229 — 1973 "Ceylon Standard Specification for Sanitary Appliances (Vitreous China)".
CS 377 — 1976 "Ceylon Standard Specification for Wash Basins".
CS 6 — 1967 "Ceylon Standard Specification for Wood Screws".
CS 8 — 1967 "Ceylon Standard Specification for Wire Nails".
CS 30 — 1968 "Ceylon Standard Specification for Steel Hinges".
CS 125 — 1977 "Ceylon Standard Specification for Architectural, Engineering and Survey Drawings".
CS 364 — "Ceylon Standard Specification for Building and Civil Engineering Drawing-symbols for Concrete Reinforcement".

The other Sri Lanka Standards which are under preparation are:—

(a) "Welded mesh, hexagonal mesh and square mesh for general purposes".
(b) "Cold worked deformed bars for reinforcement of concrete".
(c) "Plain, hard-drawn steel wire for pre-stressed concrete".
(d) "Method of measuring building works".
(e) "Earthenware pipes and fittings", etc.

5.10 With the changeover to metric, modular co-ordination has become a subject of importance in the building industry. Standardisation in the building industry aims to standardise all the construction components and materials on the basis of standard size modules. To facilitate the switchover and to persuade the industry to use modular co-ordination, the Bureau has issued the following Sri Lanka Standards:

CS 129 — 1972 "Basic modules to be used in the building industry".
CS 130 — 1972 "Horizontal multimodules to be used in the building industry".
CS 132 — 1972 "Classification of building components for dimensional co-ordination".
CS 365 — 1975 "Standard recommendation for modular co-ordination application of tolerances in the building industry".

5.20 The above standards connected with the Civil Engineering Industry are expected to be widely used by designers, architects and builders. It is essential for the designers to know the rationalized values of the permissible stresses for various mixes of concrete and various forms of steel. Some of the Codes which are under preparation to serve as a guide for this purpose are given below.

(a) C.P. for Architectural and Building drawing.
(b) C.P. for plain and reinforced concrete.
(c) C.P. for pre-stressed concrete.
(d) C.P. for laying concrete pipes.
(e) C.P. for basic requirements for water supply drainage and sanitation.
(f) C.P. for internal plastering.
(g) C.P. for brick laying.
(h) C.P. for stress grading timber.
(i) Schedule for unit weights of building materials.
(j) C.P. for stress grading of timber.
(k) C.P. for use of structural steel in general building construction.

6.00 The Electrical Engineering Industry

In the field of Electrical Engineering, the metric system has been followed from inception with the use of the basic units such as current, voltage, charge and magnetic/electrostatic field. However in the cable industry, the sizes of conductors were expressed in inches and square inches. The metrication in the Electrical Engineering field in this respect has provided an opportunity for a general survey and innovation in design and utility of different materials to cables, by critically studying the

functional requirements, construction, quality and reliability in performance. It is very true to say that metrication of the electrical/electronic industry is largely dependent on the metrication of the mechanical engineering industry; while rationalising the material content consideration is also given to the fact that any change in the cross-sectional area means a change in the resistance and consequently in the current-carrying capacity. It was also noted that the sizes influence the design of the accessories of electrical equipment, such as terminal boxes on motors, transformers, fuse boxes etc. In the case of winding wires, apart from the current-carrying capacity being altered as a result of changes in the dimensions, the diameter influences the space factor which affects the magnetic and electrical currents. This has to be kept in mind while designing electrical equipment. The standards issued by the Bureau in this respect are:

CS 40 — 1977 "The Ceylon Standard Specification for Pre-Insulated Electric Cables and Flexible Cords with Copper Conductors (for voltages upto 1100v)" (1st Revision).
CS 162 — 1972 "The Ceylon Standard Specification for PVC Insulated Cables for Motor Vehicles". (1st Revision).
CS* "Rubber Insulated Cables".

While metricating in the case of cables, the Bureau is being guided by the Renard numbers in addition to the functional requirements like diameter, cross-section which are a function of the current carrying capacity.

A Sri Lanka Standard Specification on 'metric sizes of copper wires and conductors for electrical purposes is also under preparation. This standard is intended to specify cross-sectional areas of conductors for overhead lines, non-flexible cables, flexible cables, and flexible cords. The wire diameters specified in the standard will primarily be from R-40 series with a few additions from the R-8 series to accommodate the need of specialized consumers on the basis of their requirement at that time.

6.10 In the case of electrical accessories the following standards have been issued. To facilitate the changeover it was decided to give both inch and metric values, as a guidance.

CS 138 — 1972 "The Ceylon Standard Specification for Insulated Bayonet Lampholders".
CS 164 — 1972 "The Ceylon Standard Specification for Bayonet Cap Adaptors (Lamp Holder Plugs).
CS 163 — 1972 "The Ceylon Standard Specification for Electrical Ceiling Type Fans and Regulators".
CS 220 — 1973 "The Ceylon Standard Specification for Electrical Table Type Fans and Regulators".
CS 85 — 1969 "Ceylon Standard Specification for Lead Acid Starter Batteries for Motor Vehicles".
CS 362 — 1975 "The Ceylon Standard Specification for Switches for Domestic and Similar Purposes".
CS 352 — 1975 "Ceylon Standard Specification for Fuse Bases Used in Rewireable Type Electric Fuse upto 660 volts".
CS 361 — 1975 "Ceylon Standard Specification for Porcelain Insulation for Telegraph and Telephone Lines".

The other Sri Lanka Standards which are under preparation are plugs and socket inlets, electric kettles, hotplates etc.

6.20 It appears from the foregoing discussion that the two components, wires and screws, which are used widely in the electrical industry may to some extent control the progress of metrication in the Electrical Engineering Industry. In the case of accessories, it is very unlikely that there will be a major change in design: virtually it will be direct translation of dimensions to metric units with slight divergencies to harmonise with any international standards.

7.00 Concluding Remarks

It is thus seen that the introduction of the Metric System in a developing country like Sri Lanka would require manifold and varied tasks to be undertaken on the scientific, engineering and industrial fronts. While carrying out these tasks the Bureau in addition to promoting standards consciousness and safeguarding consumer interest, provides also, the requisite metric standards to meet the demands of the industry and to facilitate the changeover.

It is very encouraging to note that the Bureau is very successfully performing its tasks in formulating national standards to facilitate the metric changeover in Sri Lanka in various branches of industry and commerce. In this respect the Bureau's primary task had been to:

(i) make available metric standards or dual standards in all branches of Technology and Commerce as a guidance to the trade.
(ii) review all published standards for incorporating the metric units.

During the changeover period in the engineering industry, many practical problems are being experienced e.g. conversion of drawings already in the inch units to metric units; provision for interchangeability of parts manufactured and inspected in imperial units with parts manufactured and inspected in metric units; and manufacture and inspection of parts using calibrated machines using drawings detailed in imperial units. The basic engineering standards so far issued by the Bureau will be of immense help in solving these problems and in assisting the changeover.

Metric standards in connection with paper sizes, textiles, road signs and symbols, doors and windows and numerous other items are also under preparation by the Bureau and rapid progress has been made in this. However this paper is restricted to the engineering industry.

References

1. Rasa Rajeswaran, "*Going Metric in the Engineering Industry*", Part I and Part II, "The Engineer", Institution of Engineers (Ceylon), June 1973 and Sept. 1973.
2. "*The Adoption of the Metric System in Ceylon*", The Bureau of Ceylon Standards Report to the Minister of Industries and Fisheries, June 1969.
3. "*The National Metrication Board Report*" to the Ministry of Industries and Scientific Affairs, June 1972.
4. T. A. Prestidge, "*Production Problems in the Move to Metric*", B.S.I. News, June 1969.
5. "*Weights and Measures Ordinance*" (Sri Lanka) No. 37 of 1946.
6. "*Weights and Measures (Amendment) Law*", No. 24, 1974.
7. "*The Metric Conversion Law*", No. 17, 1976.