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ROLE OF ALUMINIUM IN CONSTRUCTIONAL ENGINEERING(*)

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As far as extant records indicate aluminium was first used in construction in 1884 in the capping of the Washington Monument, USA. Since then it has been extensively used in the roofs of churches and administrative office buildings in the West. In India aluminium began to be used in the early thirties of this century in the form of utensils for kitchenware. Since then the industry has assumed sizeable proportions. Today the total installed capacity is 108000 tonnes against which there is a demand of nearly 150000 tonnes.

While the applications of aluminium are increasing, an ironical situation has arisen in that the electrical industry has become the major user while the construction industry utilises the metal to the smallest extent. The total public and private sector outlay in the India in the Fourth Five Year Plan is placed at around Rs.23,000 crores, out of which the construction outlay will be Rs. 10,480 crores. Evidently therefore the fabulous construction industry should be the one to utilise aluminium to the maximum possible instead of minimum extent.

The manner in which this light metal can be used in various construction activities is examined with reference to the parameters of adaptability by indicating the typical characteristics of the metal which are brought into play. Aluminium is 1/3 weight of steel and other common metals, and has the same weight as marble and glass. It is slightly heavier than concrete and has three times the density of timber. It has excellent corrosion resistance, good thermal conductivity, high strength and good hygienic properties. Its high specific tenacity enables it to be used in stress carrying members like beams, columns, roof trusses and cantilevers with comparatively lower overall weight than steel. The metal has high reflectivity for white light and low emissivity.

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These characteristics can be advantageously utilised by incorporating aluminium in roofing systems or in the form of foils for insulation. Today aluminium competes favourably with conventional roofing materials like asbestos cement sheets and corrugated galvanised iron sheets, with the added advantage of exterme lightness and no risk of breakage, as in asbestos sheets. It is for this reason that corrugated aluminium sheets have been fairly widely used in the country in roofing over industrial structures. In large spans either in trussed roofs or in domes the economics in weight are very substantial. In bridges especially those of the bascule or lift type, aluminium is the material for construction. For other types of bridges it is found that the limiting spans in light metal are not comparatively high. Thus for example using an alloy of aluminium having an ultimate tensile strength of 44 kg/mm^2 it is found that a light metal bridge can compete with a steel bridge of identical span and loading at spans of 36 m and over for simple trusstype designs; 45m for continuous or cantilever trusses; and 76m for arch bridges. Among the modern trends, space frames are being vigorously studied and offer unlimited potentialities in aluminium. Constructional engineering does not limit itself to mere buildings and bridges but spreads its tentacles to other spheres like public works and municipal engineering, irrigation and sanitary technology. Here aluminium with its low density and good corrosion resistance finds use in such items as sewage disposal plant components, sprinkler irrigation systems, hydraulic pipes, storage bins and food silos. In piping systems, the weight of aluminium affects considerable economies in labour. Thus for instance a 3 m long pipe 100 mm in diameter can be easily handled by just one man; in steel this becomes a difficult proposition. The use of this light metal in concrete mixers offers advantages which require to be carefully considered in this country. Among other fields where aluminium can be utilised are pylone, booms of cranes, shuttering for concrete, and tubular scaffolding.

The cost of aluminium production is fairly high since its metallurgy is complex. This results in a fairly expensive product, made further costly by the higher cost of electric power and the unwarranted excise duty levied in this country. Nonetheless aluminium can be used beneficially provided its full properties are known and

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full advantage taken of them. At current prices it is found that under certain conditions of loading and stresses, aluminium is nearly two and a half times more expensive than steel. However when dead loads are taken into account as in large and long span structures, the economics tend to swing in favour of the light metal. It is felt that with extensive use of the metal in construction and with increasing production the overall price factor will not come in the way and aluminium will be able to compete on a direct cost basis. For this it is necessary to establish an independent organisation to disseminate information and create awareness amongst the masses - both lay and technical of the advantages and potentialities of aluminium.

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