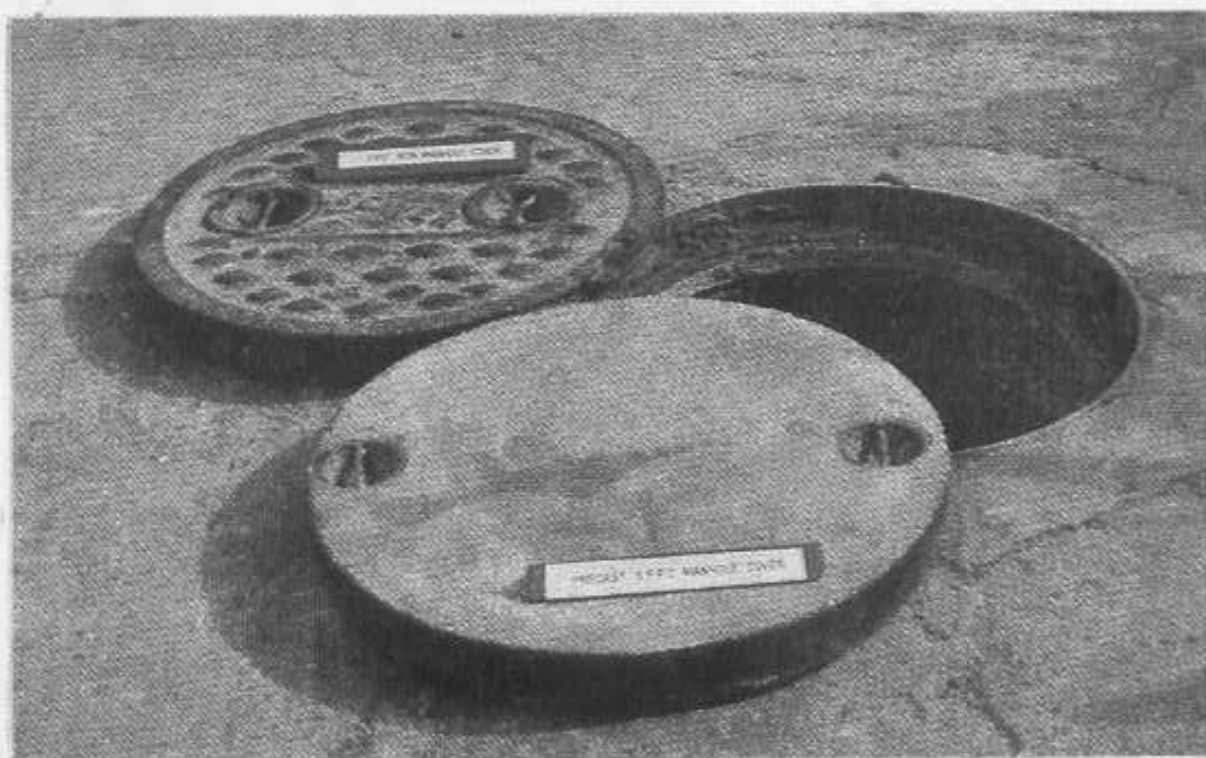




National Council for Cement and Building Materials

PRECAST STEEL FIBRE REINFORCED CONCRETE MANHOLE COVERS



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NCB

TECHNOLOGY

DIGEST

PRECAST STEEL FIBRE REINFORCED CONCRETE MANHOLE COVERS

INTRODUCTION

THE inspection chambers of storm water drains, sewage lines and post and telegraph ducts are covered with manhole covers generally made of cast iron. These covers are not only expensive, but also liable to pilferage. A sizeable number of cast iron manhole covers require replacement as a part of routine maintenance and repair measures, thereby further adding to their cost. As an alternative to cast iron covers, NCB has tried reinforced concrete covers and found these to be a viable proposition, particularly for heavy duty (HD) categories.

This Technology Digest describes the technology for the manufacture of Steel Fibre Reinforced Concrete (SFRC) manhole covers and frames.

MATERIALS

The materials for the manufacture of precast SFRC manhole covers shall comply with the provisions of IS : 456-1978 and the draft Indian Standard Specification for precast SFRC manhole covers.

Aggregates

The aggregates used shall be well graded. The maximum size of aggregate (MSA) shall not exceed 20 mm.

Reinforcement

Mild Steel (MS) or High Yield Strength Deformed (HYSD) bars shall conform to the relevant IS Codes.

Steel Fibres

Steel fibres shall be either made from mild steel drawn wires or manufactured by melt extract process. The percentage to be used depends on the shape, size and geometry of the fibres. In either case, the essential pre-requisite is that fibres shall be clean and free from rust.

Cement

Ordinary Portland Cement (OPC) or Portland Pozzolana Cement conforming to relevant Indian Standards shall be used. It is desirable to have cement strength around 37 N/sq mm to arrive at an economical mix proportion.

MIX PROPORTION

SFRC mix differs from conventional concrete in having higher paste content, lower size and lesser percentage of coarse aggregate. A paste content of 25 to 45% is needed depending upon fibre geometry and fibre volume. The type and quantity of fibres should be based on fibre handling and workability of the mix as well as strength requisites. The fine to coarse aggregate ratio generally varies from 1 : 1 to 3 : 1 and a ratio of 1 : 1 is often a good starting point for a trial mix.

The concrete should be dense without voids, honey combing, etc. The minimum grade of concrete recommended is M20-M25 for medium duty (MD) and M35 for heavy duty (HD) manhole covers.

DESIGN

The design is governed by punching shear capacity. The addition of fibres to the matrix improves punching shear capacity, resistance to cracking, and deformation characteristics of the composite.

METHOD OF CASTING

These covers and frames can be manufactured in the existing plants already producing precast concrete units or can be started afresh. In either case, the process requires the following facilities : (a) weighing and

batching system, (b) mixer, (c) vibrator, (d) moulds, and (e) curing yard, etc.

Steel fibres when added to concrete, influence the mixing procedure and mixing time. For mass production of SFRC, a pan type concrete mixer with steel fibre dispenser is recommended for use. For small scale production, an ordinary drum type mixer may be used taking necessary precautions to avoid balling or nesting of the fibre and take requisite safety measures for the workmen at the place of work.

In order to protect edges of the cover from possible damage during handling, the covers are cast with peripheral steel strips. These strips coated with anticorrosive paints ensure conformity to dimensional tolerances of covers.

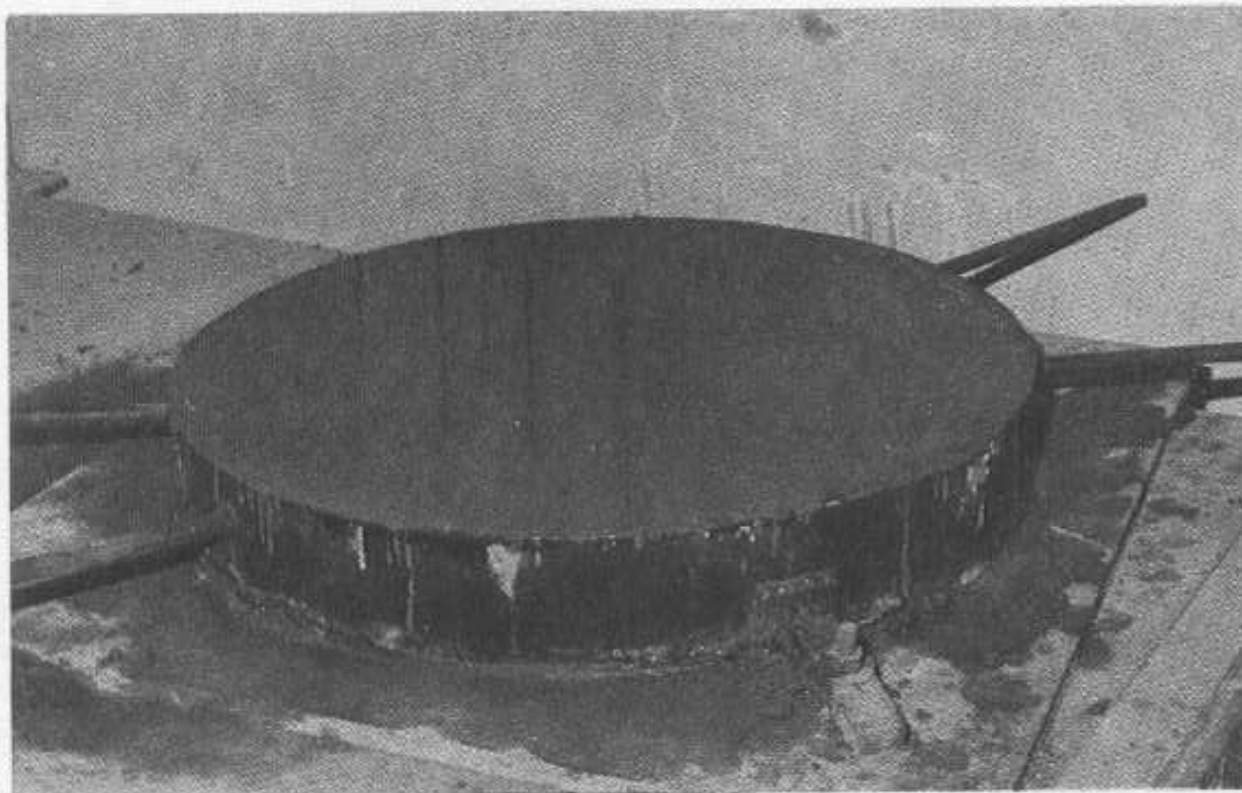


Fig 1 SFRC manhole cover after casting

ACCEPTANCE TEST

The precast SFRC Heavy Duty Manhole Covers manufactured as per NCB technology are found to withstand the static test load laid down in IS : 1726-1974. The units are also found to satisfy the performance tests specified in draft Indian Standard on "Methods of tests for precast concrete manhole covers BDC (3976)" (under print).

ADVANTAGES

The NCB technology for manufacture of precast SFRC manhole covers and frames offers the following advantages :

- a) The manhole covers are comparatively cheaper than those made of cast iron.
- b) These are less prone to pilferage, hence offer social benefits in the form of reduced number of accidents and less health hazards.
- c) These satisfy the stipulated functional and loading requirements.
- d) As shock absorbing capacity of SFRC is about six times more than that of conventional concrete, the chances of their failure under impact load are minimum.

ECONOMICS

The project projections for setting up a precast SFRC manhole covers and frames plant of 100 sets per day capacity are given in Table 1.

CURRENT STATUS

NCB's technology for manufacture of precast manhole covers and frames with steel fibre reinforced concrete is now a proven technology. A few entrepreneurs have already adopted this technology and started commercial production of precast SFRC manhole covers and frames of capacity up to 100 sets per day.

TABLE 1

ABSTRACT COST ESTIMATE*

1	Project	:	Manufacture of SFRC manhole covers and frames
2	Capacity	:	100 sets per day, 27000 sets per annum (90 % utilisation and 300 working days)
3	Project cost	:	Rs 16.08 lakhs
4	Working capital	:	Rs 6.58 lakhs
5	Manpower	:	49 Nos (Unskilled 31, Skilled 14, Managerial 4)
6	Land requirement	:	2 acres (cost not being included)
7	Power (connecting load)	:	20 kW
8	Production cost	:	Rs 455 per set

*Based on October 1989 prices.

Note — Working capital is based on one month's production cost



Fig 2 SFRC manhole cover in service

The covers and frames produced with this technology are superior in quality and cheaper than cast iron units. Consumers acceptability of these units is being established and will get a boost as soon as draft Indian Standard on these products is published (being processed by BIS).

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