Cost Effectiveness of Different Canal Lining Materials

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Abstract—The purpose of this study is to produce a comparative study of irrigation canal lining by the use of existing materials. This study reveals why irrigation canal lining and describes a number of various lining and there analysis. There are variable materials which are adopting concrete lining, brick lining, stone masonry lining, and polyethylene film with concrete cover and geo membranes lining. However in our country as per environmental condition mostly cement concrete lining is popular. Cost of each lining is different than others

Index Terms— Reduce cost, cost comparison, saving in water, lining materials, lining cost, canal lining.

I. INTRODUCTION

The irrigation has been from the time immemorial and so has been building of irrigation canals, but is not only since last century that canals have been designed on more or less scientific substructure. A canal may be rigid boundary or a mobile boundary canal .Irrigation system should be built in such a way that they operate in maximum efficiency. The efficiency of the conveyance and distribution system, that is convey of water at minimum cost and with minimum seepage and evaporation loss, essentially affects the economy of an irrigation project. Now many irrigation project constructed in Maharashtra, especially in West Maharashtra including Satara, Sangli, Kolhapupur, Pune.

The many canal constructed in this area are unlined canal, concrete canal, stone masonry canal. Design of canals are being carried out in accordance with Circular No MIS 1094/ (156/94) MP (A), dated 18-2-1995 by Irrigation Department, Government of Maharashtra. For this paper case study of concrete canal lining no-6 of Khatav canal, Urmodi Dam Division, Satara. Regional Schedule of Rates of Pune Region used for the estimation of canal lining.

II. DIFFERENT CANAL LINING

Lining Systems

As per IS 10430:2000 "CRITERIA FOR DESIGN OF LINED CANAKS AND GUIDANCE FOR CULL OF TYPE OF LINING" following are different lining systems.

a) Rigid Lining

1. Stone pitched lining,

2. Brick lining,

3. Pulverized fuel ash-lime bricks lining,

4. Precast cement concrete /stone slab lining,

5. Cement concrete tile lining,

6. In situ cement /lime concrete lining,

7. Stone masonry lining,

8. Soil cement lining,

9. Shotcrete lining

10. Ferrocement lining.

b) Geomembrane lining

High Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Low Density Polyethylene (LDPE) with cover comprising layer of betonies with adequate earth/burnt clay tile brick or pulverized fuel ash-lime brick or burnt clay fly ash building brick/precast cement concrete.

Functions of Lining

The function of lining are:

1. Seepage control,

2. Prevention of water logging,

3. Increased hydraulic efficiency,

4. Increased resistance to erosion,

5. Reduction in cross section area,

6. Low operation and maintenance cost.
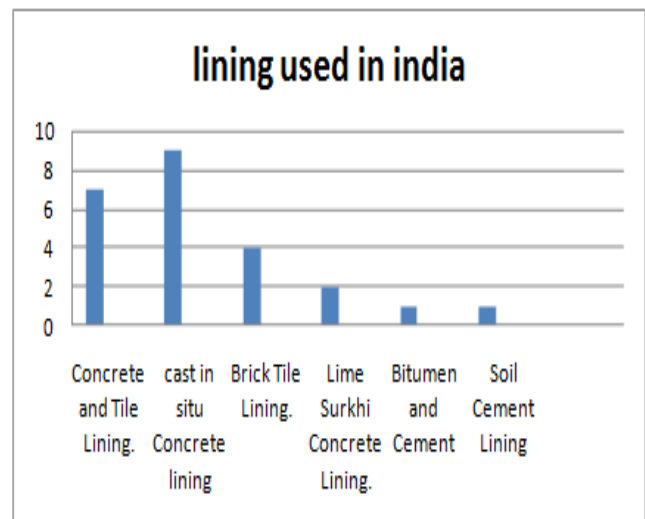
Fig. 1 shows the various linings used in India so far.

FIG. 1 LINING TYPES UTILIZED IN INDIA.

III. DESIGN & MEASUREMENT OF CANAL LINING

The basic parameter to design the canal is discharge, and as per case study the discharge is 20 cumecs.

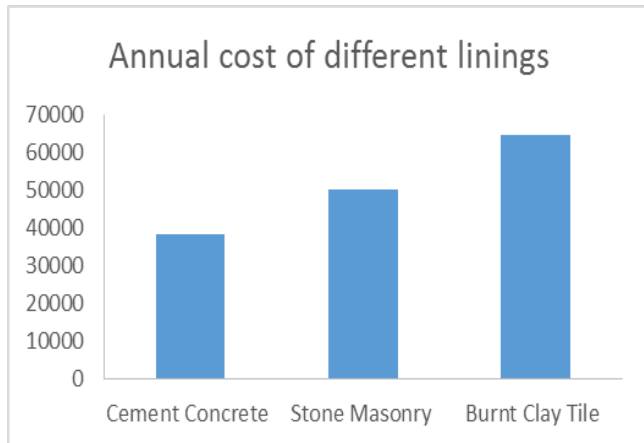**Mr. Amrut Namdev Sangale**, M.E.II (Civil - CM) Dept. Of Civil Engineering, Government College of Engineering, Karad, Maharashtra, India, 9595964194.
Dr. S. S. Valunjkar, Professor& Head of Dept. Of Civil Engineering, Government College of Engineering, Karad, Maharashtra, India.

As per Circular no. MIS 1094/ (156/94)

Slope of ground is 1:5000

Side slope 1 V: 1.5 H

B/d ratio 1.5 to 2

Assume that canal cross section is totally in cutting & strata is hard murum.

A) Cement Concrete Lining

As per IS code3873:1993 design of C.C lining

Velocity = 0.9 m/s,

Area req. = (20/0.9) =22.22 m^2

Provide, B = 4m,

d =3.65 m (with 0.9 m extra free board)

As per design provide 10 cm thick concrete bed & 8 cm side wall.

B) Stone Masonry Lining

As per IS code 11809:1994 for Stone Masonry

Velocity = 0.8 m/s,

Area raq. = 25 m^2,

Provide B = 4.2 m,

d = 3.80 m (with 0.9 m extra free board)

As per design provide 0.23 m thick stone masonry with 15 mm CM on prepared sub-grade.

C)Brick/ Burnt Clay Tile Lining

As per IS code 9698:1995 design of C.C lining

Velocity = 0.9 m/s,

Area req. = (20/0.9) =22.22 m^2

Provide, B = 4m,

d =3.65 m (with 0.9 m extra free board)

As per design provide 10 mm thick CM on sub-grade, then provide two 50 mm thick coat of burnt clay tiles with separated by 15 mm sandwich plaster & 5 mm thick mortar.

IV ESTIMATION OF CANAL LINING

Estimation is carried by using Regional Schedule of Rates (RSR) Pune region 2013-14.

A) Cement Concrete Lining

Excavation of 3958.56 m^3 (rate 51.45 Rs per m^3) Cost = 200860.8

Dressing of side slope area 1835.14 m^2 (rate 1.85 Rs per m^2) Cost = 3395 Rs.

Cost Preparation of sub-grade = 40051.3 Rs.

Cost of M 15 concrete for bed & side lining =473272 Rs.

As per RSR Pune 2013-14,

Total design cost per 100 m = 717579.12 Rs.

B) Stone Masonry Lining

Excavation of 4174.4 m^3 (rate 51.45 Rs per m^3) Cost = 214772 Rs.

Dressing of side slope area 1874 m^2 (rate 1.85 Rs per m^2) Cost = 3467 Rs.

Cost of 15 mm thick 1:3 CM = 301343 Rs.

Cost of 230 mm thick UCR = 459388

As per RSR Pune 2013-14,

Total design cost per 100 m = 978970 Rs.

C)Brick /Burnt Clay Tiles Lining

Excavation of 3670 m^3 (rate 51.45 Rs per m^3) Cost = 188841 Rs.

Dressing of side slope area 1760.8 m^2 (rate 1.85 Rs per m^2) Cost = 3257 Rs.

Cost of 10 mm CM (1:5) = 156348 Rs.

Cost of two 50mm thick brick coat = 394394 Rs.

Cost of plaster (1:3) = 391175 Rs.

As per RSR Pune 2013-14,

Total design cost per 100 m = 993298 Rs.

V. RESULT AND DISCUSSION OF CANAL LINING

Comparison of the three different comparing estimated annual costs of types of lining cost show in the table 1.

The following work illustrates calculate and compare annual costs and additionally in graphical form show in fig 2.

Table.1 Comparing Estimated Annual Cost of Lining

Sr. No.	Type of work	Cost of Lined canal Per 100 m		
		Cement Concrete	Stone Masonry	Burnt Clay Tile
1	Total cost	717579	978970	993298
2	Life	50	50	30
3	Salvage value	179394	244742	148994
4	T. D. D L.	538184	734227	844303
5	A. D. C.	10763	14684	28143
6	A. I. C.	22424	30592	28557
7	A. M. C.	4981	4843	8009
8	Total Annual cost:5+6+7	38168	50119	64709

Nomenclature:
T. D. D. L. = Total depreciation during life,
A. D. C. = Annual depreciating charge,
A. I. C. = Annual interest charge,
A. M. C. = Annual maintenance charge.
B = Canal bed width.
D = Total height including free board.

In this study concrete lining, stone masonry lining & burnt brick clay lining are commonly utilized in Maharashtra and

discussed fairly and a compression with deference to durability and economically.

Fig. 2 Comparison of Annual Cost

VI. CONCLUSION

In this study mainly fixate on the detail of construction cost of variant of lining and its durability. Compare cement concrete, Stone masonry and Burnt clay tile lining. According to analysis of this topic cement concrete lining is more felicitous then other two types of lining. Cost analysis of the topic cement concrete lining more cost efficacious then other types of lining method.

ACKNOWLEDGEMENT

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