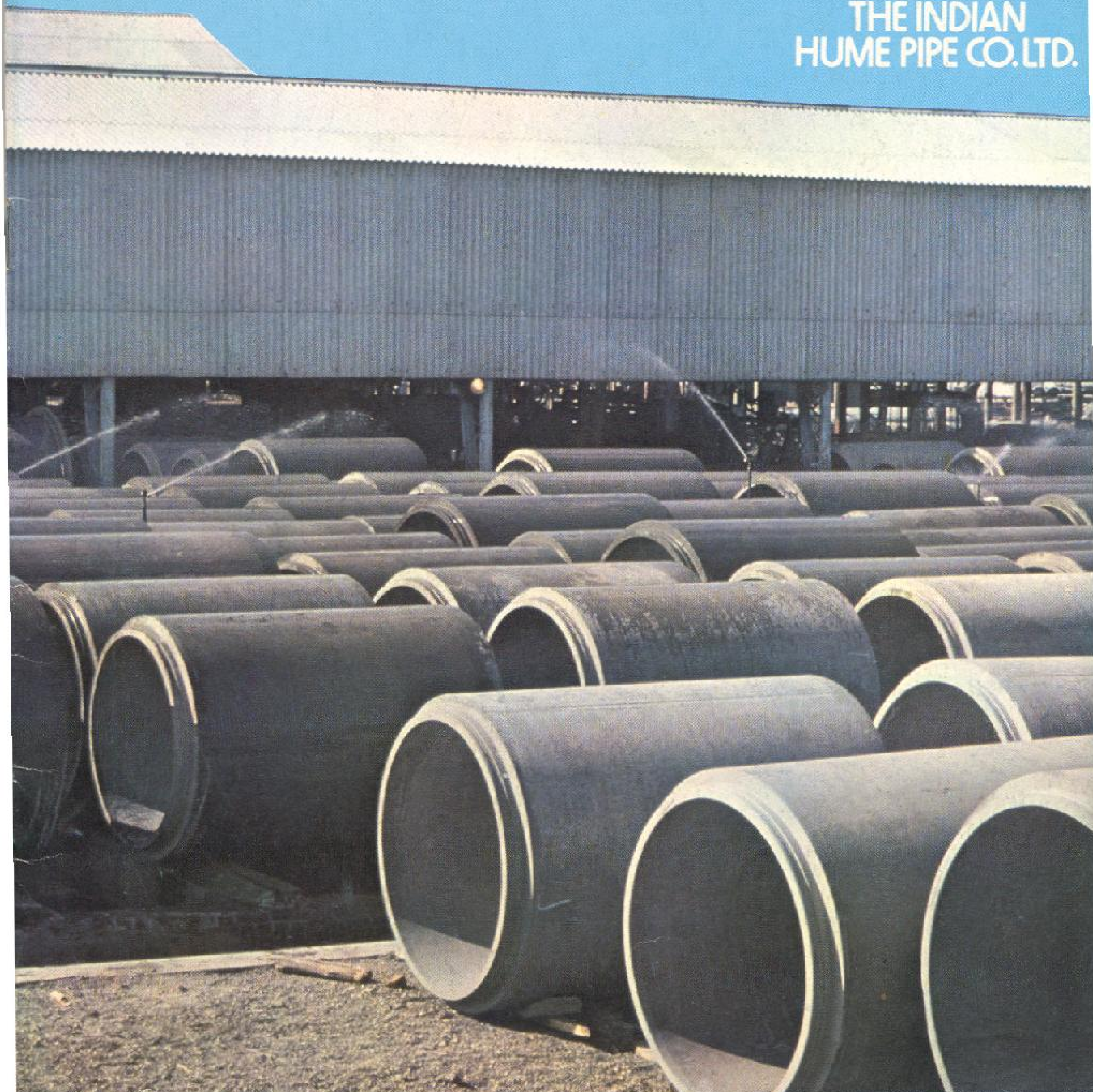
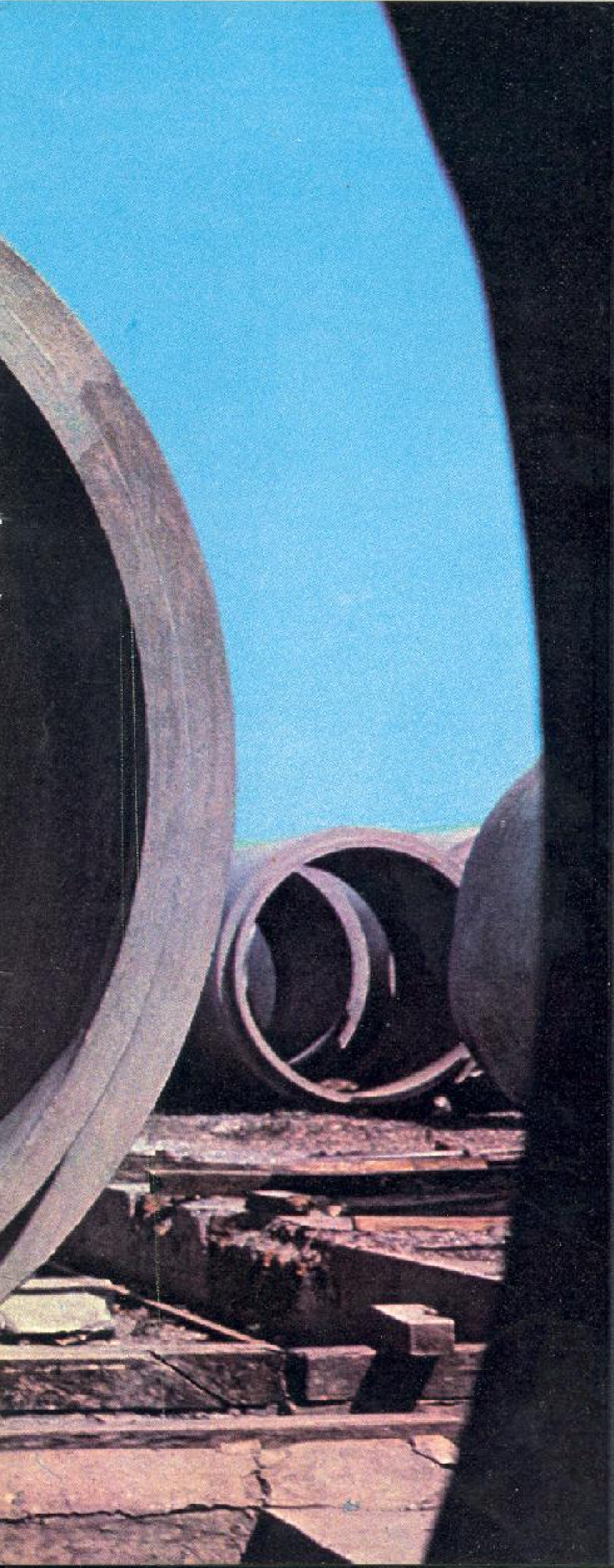
SPUN CONCRETE PIPES

THE INDIAN
HUME PIPE CO. LTD.





HISTORY...

Precast concrete pipes, popularly known as "Hume Pipes" were introduced in this country by The Indian Hume Pipe Co. Ltd., as early as 1926. This pipe material, because of its inherent qualities such as durability, strength, economy etc. soon found acceptance and still enjoys the confidence of Public Health and Highway Engineers.
For 50 years, the pipes supplied through over 50 branches of the Company have been used for Water Supply, Drainage, Irrigation, Road Culverts, etc, etc. and are still giving trouble-free service.

These superior quality pipes are produced by the centrifugal spinning process, discovered by Walter Hume of Australia.

While the basic spinning process is still used by the Company, many refinements have been made to meet specific needs. The Company attaches considerable importance to Research and Development in order to improve the product and production technology. Plant and product design also play a leading role in maintaining the reliability of concrete pipes. Considerable attention is paid to the quality of raw materials and finished products. The pipes produced today are of high density, which ensures long life, maximum strength, impermeability and good resistance in aggressive service conditions.

The Company's R. & D. Division is always engaged in the development of these products with the result that the pipes produced tomorrow are superior to the pipes made today. It has an Engineering Division, and the Company is thus in a position to undertake the design and production of any special type of pipes required.

With the development of controlled spinning technique, together with mix design, use of welded cage and rigid quality control at every stage of production, the IHP method of manufacture gives many advantages unobtainable by other manufacturers.

SPECIAL FEATURES OF IHP PIPES

Density

IHP's method of manufacture/ controlled spinning with vibration produces concrete of minimum water/cement ratio and maximum density.

- High strength
- Extreme impermeability
- Resistance to abrasion

Greater density means longer, more efficient working life.

Strength and Safety

The combination of

- Controlled spinning with vibration
- Higher quality materials
- Welded steel reinforcement
- Strict quality control produces concrete pipes of exceptional strength in Flexure – tension—shear and bond.

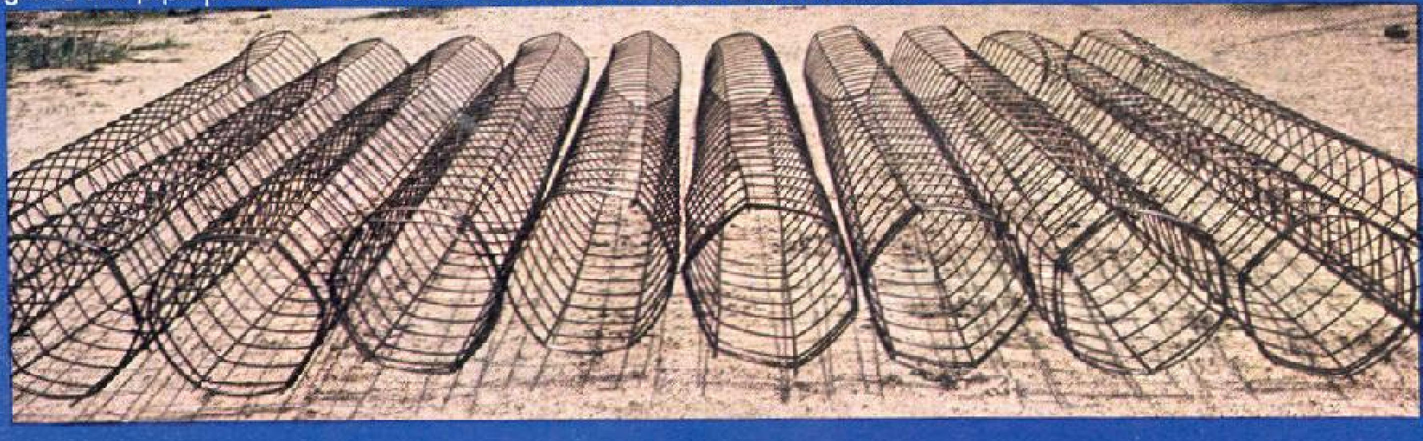
Unique Characteristics

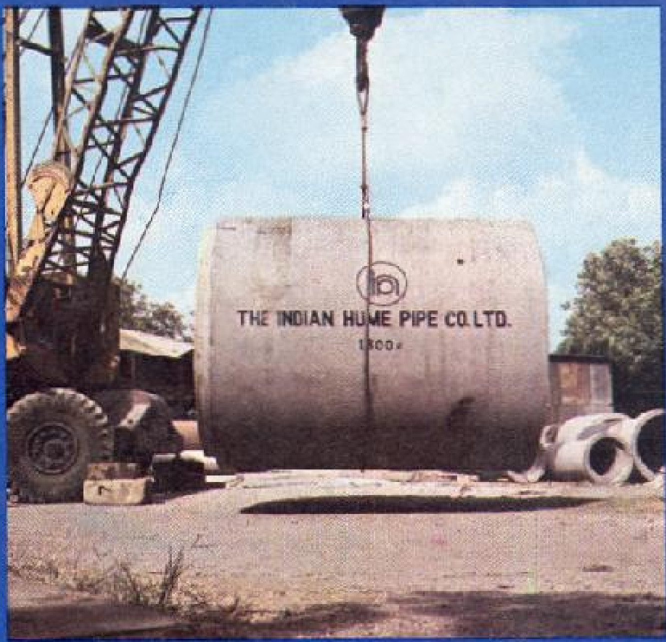
Pipes offer the unique characteristics of:

- Indefinite increase in strength in the presence of moisture.
- Autogenous healing of minor cracks resulting from incorrect handling or unanticipated shock loads. Aided by reinforcement, this provides maximum service life.

Welded cage

Spirals are electrically welded where they cross longitudinals forming rigid assembly. This assembly whose optimum position in the pipe wall is ensured by centering pieces gives the pipe perfect mechanical resistance to dead and live loads.



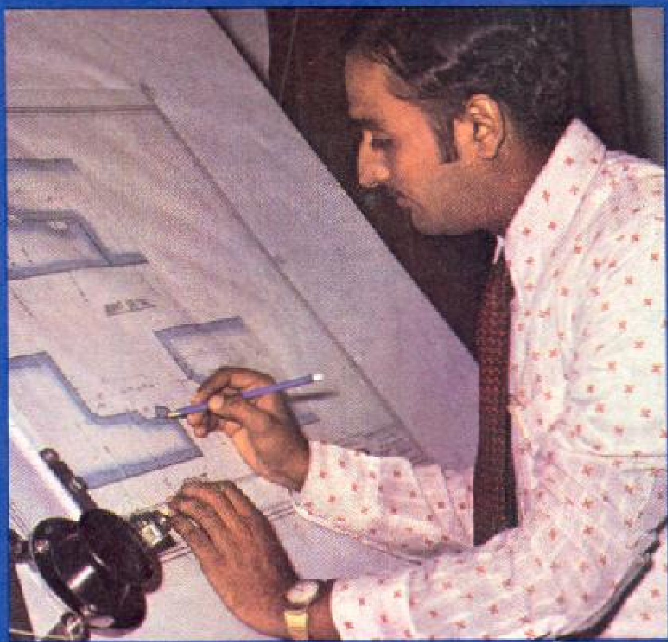


Beam Strength — Flexibility

The pipes are designed with a suitable length to diameter ratio.

- This ensures adequate beam strength.
- Rubber ring joints allow flexibility in pipelines.

These factors combine to maintain effective performance of pipelines in areas prone to ground movement.



Design Choice

Pipes are designed to meet the requirements of their inservice conditions; internal pressures and external loads.
(In pressure applications IHP pipes can be made in any test pressure increments required)

This results in

- Economical design
- Minimum cost
- Laying & handling advantages and IHP Design Engineers are always available to assist you.

Economy

The economy of a pipeline can be expressed as its "Cost per year of operation"

This can be calculated by the following formula :-

(Cost of pipes delivered to site
+ Cost of installation
+ Maintenance cost)
÷ Total life of the pipeline

IHP pipes provide the most economical alternative available.

IHP's Expertise

IHP is the leading manufacturer of custom designed concrete pipe systems. Backed by highly skilled engineering and with specialised equipment of its own design and manufacture, IHP produces quality controlled pipes from 100 mm to 2100 mm dia.

IHP manufactures custom designed concrete pipes with full involvement of its R.& D. Department and efficiently handles any problem associated with pipe engineering.

- Hydraulic design of pipeline.
- Structural design of pipeline.
- Installation of pipes
- Maintenance of pipelines.

DIFFERENT TYPES OF IHP PIPES

Reinforced concrete culvert and drainage pipes:

These pipes are manufactured in accordance with IS 458—1971 in class NP2, NP3 and NP4.

NP2, NP3 and NP4 class pipes upto 1200 mm dia. are normally available in all the major factories. Larger diameter pipes are made for specific jobs.

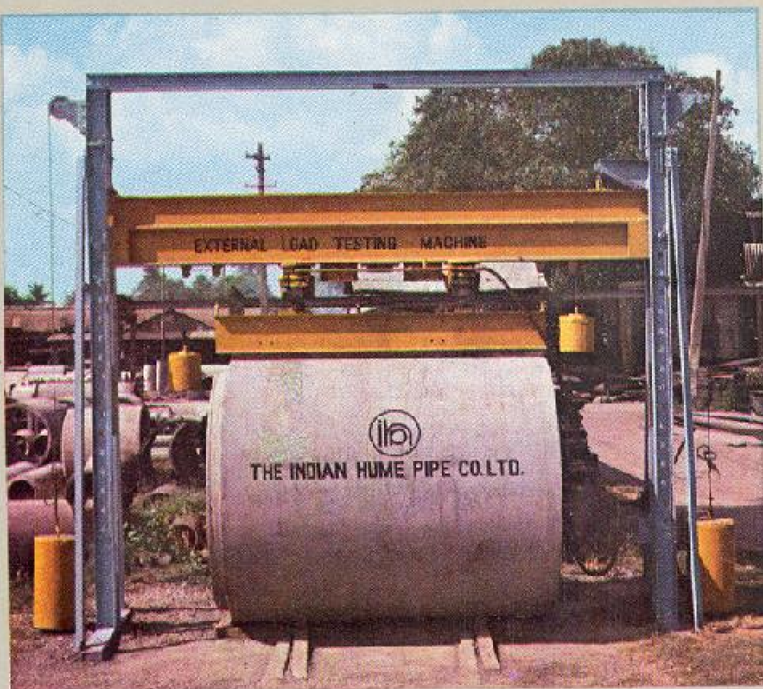
These pipes are supplied with collar joints or rubber ring joints.

Pipes required to withstand loads in excess of NP4 class can also be supplied. Enquiries may be directed to the nearest IHP factory.

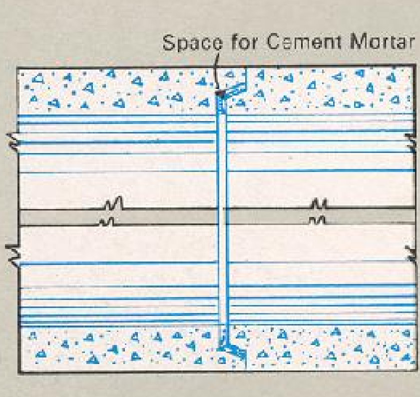
IHP design engineers are available to advise on all aspects of the safe and economic use of appropriate classes of pipes.

Testing:

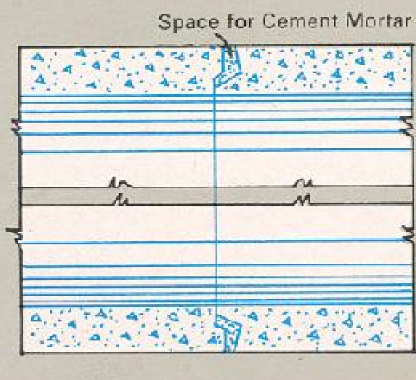
Reinforced concrete culvert and drainage pipes are subject to load and other tests at IHP factories in accordance with the procedure laid down in I.S. 3597, 1966, or as specified by the purchaser or as suggested by IHP



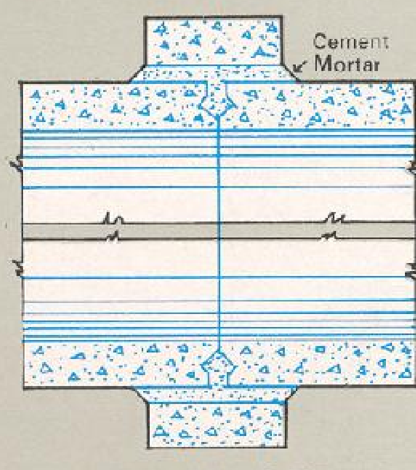
IHP REINFORCED CONCRETE CULVERT



INTERNAL FLUSH



EXTERNAL FLUSH



COLLAR JOINT

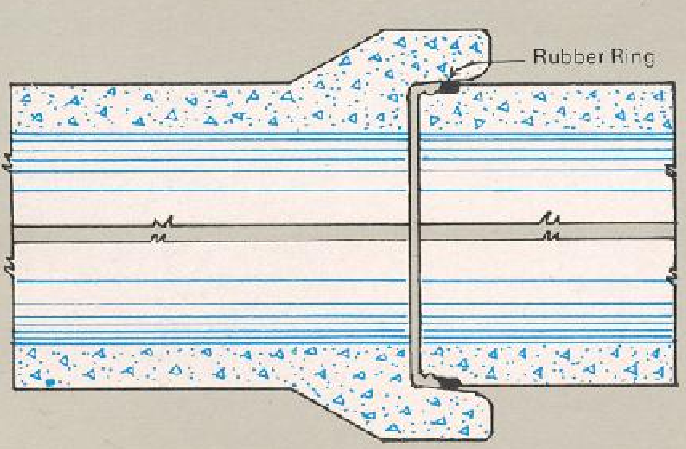
REINFORCED CONCRETE CULVERT AND DRAINAGE PIPES

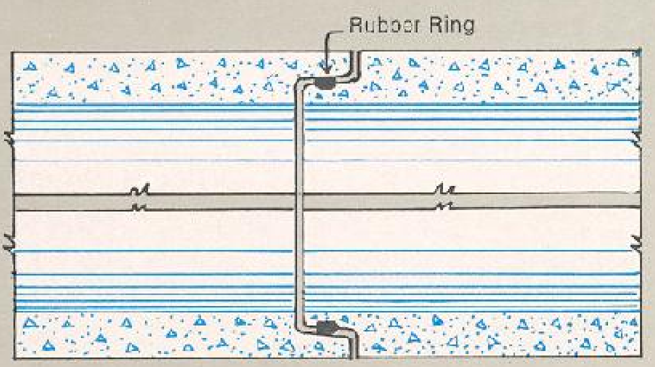
DIA.	LENGTH	COLLAR JOINT						R. R. JOINT					
		NP2		NP3		NP4		NP2		NP3		NP4	
mm	mm	WALL THK mm	PIPE WT kg	WALL THK mm	PIPE WT kg	WALL THK mm	PIPE WT kg	WALL THK mm	PIPE WT kg	WALL THK mm	PIPE WT kg	WALL THK mm	PIPE WT kg
100	2000	25	50	—	—	—	—	25	70	—	—	—	—
150	2000	25	70	—	—	—	—	25	90	—	—	—	—
250	2000	25	100	—	—	—	—	25	140	—	—	—	—
300	2500	30	190	—	—	—	—	30	210	—	—	—	—
350	2500	32	230	75	620	—	—	32	260	75	690	75	690
400	2500	32	260	75	670	75	670	32	290	75	830	75	830
450	2500	35	320	75	770	—	—	35	360	75	910	75	910
500	2500	35	350	75	810	75	810	35	390	75	990	75	990
600	2500	40	480	80	1060	85	1100	40	540	80	1290	85	1370
700	2500	40	560	80	1210	85	1260	40	630	80	1410	85	1500
800	2500	45	720	90	1450	95	1600	45	810	90	1890	95	1990
900	2500	50	900	100	1890	100	1890	50	1010	100	2260	100	2260
1000	2500	55	1090	100	2140	115	2420	55	1250	100	2140	115	2420
1100	2500	60	1310	115	2630	115	2630	60	1500	115	2630	115	2630
1200	2500	65	1650	115	2940	120	2990	65	1780	115	2940	120	2990
1400	2500	75	2090	135	3910	135	3910	75	2410	—	—	135	3910
1500	2500	—	—	—	—	—	—	—	—	—	—	140	4330
1600	2500	80	2530	—	—	140	4590	80	2970	—	—	140	4590
1800	2500	90	3210	—	—	150	5520	90	3780	—	—	150	5520
2000	2500	100	3960	—	—	—	—	100	4660	—	—	—	—
2200	2500	110	4790	—	—	—	—	110	5640	—	—	—	—

NOTE:

1) Special designs will be provided by IHP for loadings higher than NP3 or NP4 classes.
2) NP4 class pipes are also available in 1.25 Metres lengths as required by Indian Railways.
3) The weights of pipes are approximate.

AND DRAINAGE PIPE JOINTS





SOCKET SPIGOT R.R. JOINT

REINFORCED CONCRETE PRESSURE PIPES

General:

Reinforced concrete pressure pipes with collar or hydraulic rubber ring joints are used for water supply lines, irrigation schemes, sewer rising mains and similar projects. Indian Hume Pipe Co. Ltd., has over 50 years experience in the design and manufacture of reinforced concrete pressure pipes. Thousands of kilometers of reinforced concrete pressure pipes with these joints are in service throughout Australia, Europe, India and overseas countries. They testify to the efficiency and economy of this form of pressure pipeline.

Specifications:

Reinforced concrete pressure pipes are designed and manufactured in accordance with one of the following, as required :-

- I.S. 458—1971
- Clients'specifications
- IHP recommendations for specific jobs.

Nominal effective lengths:
Upto 250 mm diameter—2.0 M
300 mm diameter and above —2.5 M

Reinforced concrete pressure pipes are designed to withstand appropriate external loads, as well as internal pressures.

Design:

Pipes can be designed and manufactured to test pressures upto and including the maximum indicated in the table. For test pressures somewhat greater than shown, wall thickness may be increased with corresponding reduction of bore. Allowable test pressure for pipes over 600 mm diameter may be reduced by external loads. IHP engineering staff are available to assist with all aspects of pressure pipe design.

Testing:

All pressure pipes are subjected to a hydrostatic pressure test at IHP factory. The test pressure is directly related to the required working pressure for the pipe and in accordance with the requirements of the job. Pressure pipes are also subjected to other tests as specified in the standard.

Nominal diameter	Length of pipe	P1 Class tested to 2 kg/cm2		P2 Class tested to 4 kg/cm²		P3 Class tested to 6 kg/cm²	
		Wall thickness	Weight	Wall thickness	Weight	Wall thickness	Weight
mm	mm	mm	kg	mm	kg	mm	kg
100	2000	25	50	25	50	25	50
150	2000	25	70	25	70	25	70
250	2000	25	100	30	130	35	150
300	2500	30	190	40	260	45	290
350	2500	32	230	45	330	55	420
400	2500	32	260	50	430	60	520
450	2500	35	320	50	470	70	690
500	2500	35	350	55	580	75	810
600	2500	40	480	65	810	90	1170
700	2500	40	560	70	1020	105	1590
800	2500	45	720	80	1330	120	2080
900	2500	50	900	90	1680	—	—
1000	2500	55	1090	100	2070	—	—
1100	2500	60	1310	—	—	—	—
1200	2500	65	1560	—	—	—	—

Weights are approximate

RUBBER RINGS FOR CONCRETE PIPE JOINTS

General:

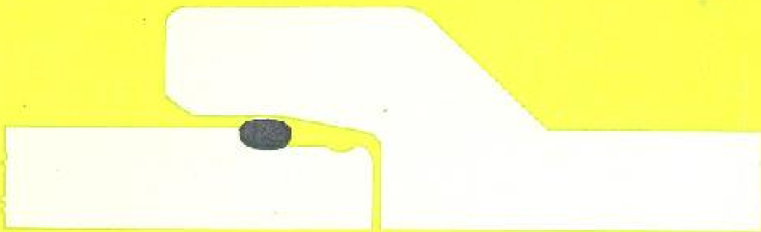
Rubber rings provide a quick, simple and effective means of jointing concrete pipes. When used with rigid concrete pipes the strength of the pipe combines with the flexibility of the joint to ensure the continued effective operation of the pipeline, even under adverse conditions caused by ground movement.

All rubber rings supplied with IHP pipes are manufactured in accordance with I.S. 5382—1969.

Natural rubber has compression set characteristics superior to synthetic rubber and is normally used. Natural rubber, however, has low resistance to hydrocarbons, and in situations where their presence is anticipated, polychloroprene (Neoprene) rubber rings are specified. Quality of rubber is not affected when it is protected from sun and light. In underground pipelines, in contact with water the life of rubber rings is as much as that of pipes.

Roll-on Rubber Ring Joint.

IHP manufactures socket and spigot concrete pipes with a roll-on-'o' ring joint in sizes from 100 mm to 1800 mm diameter. This joint developed by Cornilious in England, is in use for concrete pipes for over 45 years, giving satisfactory service.



ROLL ON JOINT

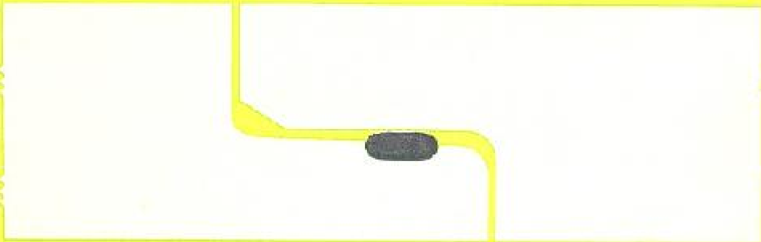
Confined 'O' Ring Joint:

A more recent development by IHP is the confined 'O' ring joint. The rubber ring remains in a fixed position on the pipe spigot. While jointing, the ring and the pipe socket are lubricated, and the joint is made.

The confined 'O' ring joint offers:-

- Easier closure in wet conditions.
- A more compact joint in large diameter pipes.

IHP flexibly jointed NP4 class pipes of diameter 1000 mm and above have confined 'O' ring joints. This joint is accommodated in the wall thickness of the pipes; hence there is no projection of socket.



CONFINED 'O' RING JOINT

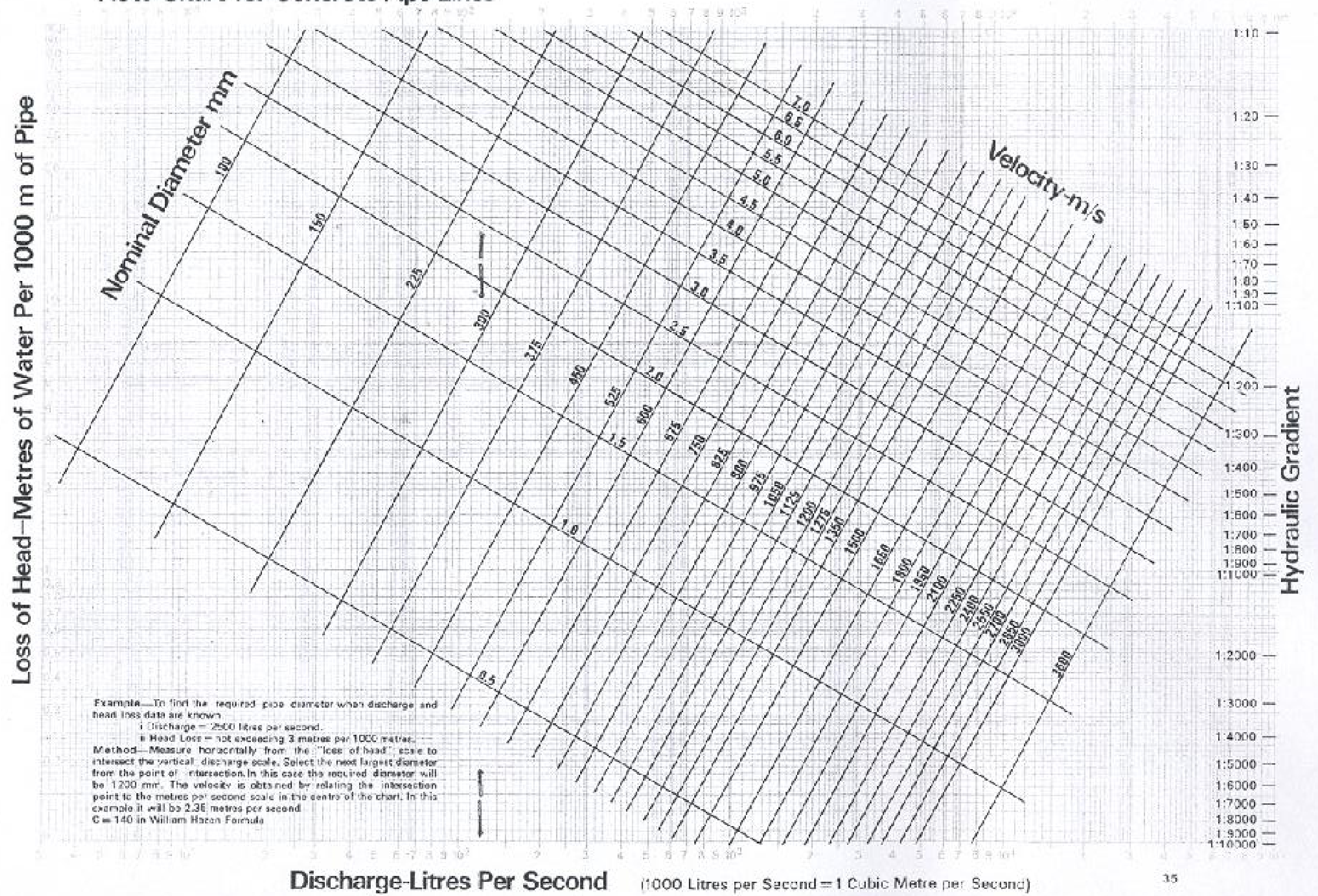
DESIGN OF PIPELINE

Hydraulic Design:

Hydraulic Engineers of IHP Engineering department have worked out the graphs making possible precise and quick calculation of head losses with the use of the usually used formula of William & Hazen.

Our engineers are at client's disposal to help them study the problems connected with large diameter pipelines, description of economical diameters, related pressures, eventual over pressures, provisions of various controlling devices (valves, airvents, surge tanks, etc). In some cases, the whole of the hydraulic study may be done including writing of the final calculation note.

Flow Chart for Concrete Pipe Lines



Structural Design.

During the last decade the designing of rigid underground pipes, their joints and technique of installation have been changing fundamentally from empirical and traditional methods to more rational methods based on the scientific principles of structural and soil mechanics. A buried pipeline is now recognised as a load bearing structure, and within the limits of present knowledge, is designed with growing confidence.

Condition of installation.

The magnitude of loads imposed upon a buried pipe, by the overlying soil and by any uniformly distributed or concentrated surface surcharge of large or infinite extent, depends first on the nature, density and depth of soil cover, the intensity of surcharge, the nature of the pipe—whether rigid or flexible and on the conditions in which it is installed—whether trench or embankment.

Reference is often made to the manufacturer's tabulated load carrying capacities to select the appropriate pipe class when the service load requirements are known. This procedure is satisfactory *provided* all factors are considered. However, prior to deciding the class of pipe required, the design engineer should consider in detail, how the pipe is to be laid, i.e. the depth of excavation, cover, backfill material type, trench width required for practical installation, minimum density of backfill and possible construction traffic loads.

Trench widths.

For pipes in trench conditions, the fill and surcharge loads depend upon the effective trench width and whether it is wide or narrow with respect to the outside diameter of the pipe and depth of soil cover. When installing a pipe, it is essential that the trench width be specified and excavated uniformly and not be permitted to "just happen" in a haphazard manner.

Back filling.

Another aspect of pipe installation that is neglected is backfilling. The ability of any pipe to support an embankment depends on adequate side support. It is essential that side filling be thoroughly compacted to at least 90% of the maximum dry density as assessed by the modified Proctor Test Method. If 90% compaction is not attained, the ability of the pipe to carry a given load is reduced significantly.

Failure to provide side support may cause failure of the pipeline at less than the designed loading and may also induce differential settlement when the fill above and beside the conduit does not settle uniformly.

Surcharge loads.

Pipes in service are subject to loads generated by earth pressures and superimposed surcharges, such as traffic loads for pipes under road ways. The actual loads vary according to the class of foundation material, depth of cover, compaction procedure and whether the pipe is beneath an embankment or in a trench.

A loading which is often overlooked and which may exceed the combined loads is traffic loading. The trend today is for larger and consequently heavy earthmoving equipment. When this equipment is used in conjunction with pipeline installation it is often allowed to pass over or alongside the pipe during the backfilling operation. Little concern is directed in the field to the permanent effect such transient traffic can have on the pipe.

Installation of Pipes.

The performance of the pipeline in service depends not only on the quality of pipe and joint but also on installation i.e. on the design and execution of bedding, jointing and backfilling. The following notes will help to design and execute installation properly.

Trench Preparation.

Trenches should be kept to the specified width since any excessive increase in trench width will increase both the load on the pipe, the quantity of excavation, and will also require more bedding material under the pipe. A trench narrower than that specified may impede the proper placing and consolidation of the bedding material and restrict working conditions in the trench during pipe laying. Recommended trench widths for various pipe diameters and installation conditions are indicated in tables enclosed.

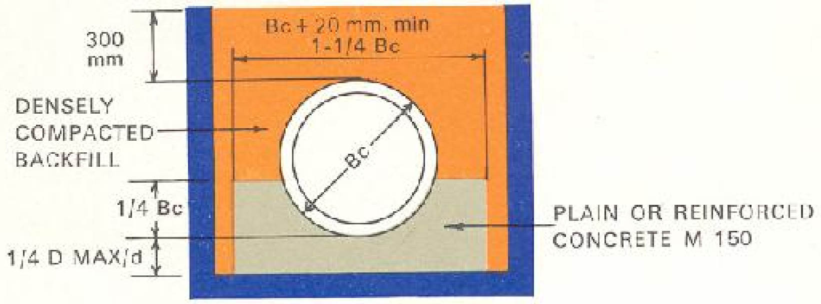
The foundation.

Uniform support along the pipeline is important. All hard spots and also soft zones which can cause differential settlement should be removed from the foundation. Boulders and soft patches should be dug out and replaced with well tamped selected back-fill. Disturbance by trampling of fine soils or coarse grain material in the trench bottom must be avoided. In water bearing ground sufficient waterstops should be provided to prevent passage of water along the trench. The water level should not be allowed to rise before backfilling is completed. Rock occuring in

TRENCH BEDDINGS

Concrete Cradle

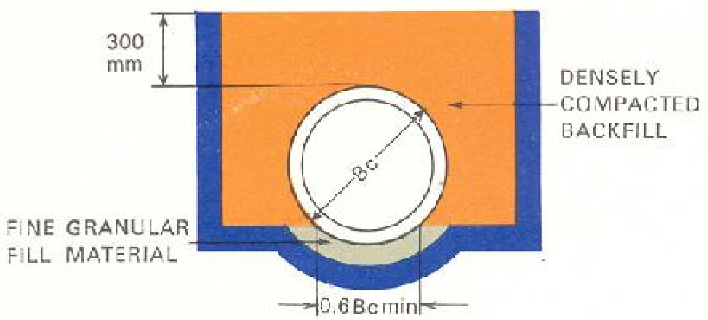
LF=2.25 to 3.4



CONTINUOUS CONCRETE CRADLE OF MONOLITHIC CROSS SECTION IF UN-REINFORCED

First Class

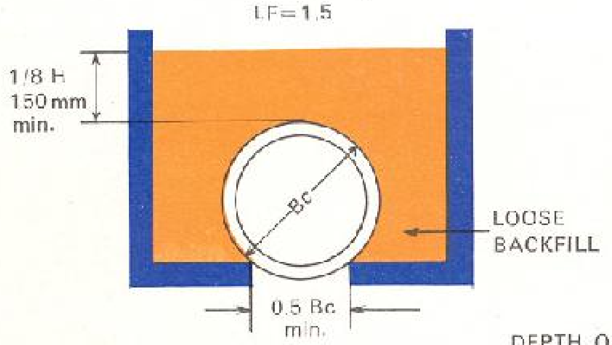
LF=1.9



SHAPED SUBGRADE WITH GRANULAR FOUNDATION

Ordinary

LF=1.5



SHAPED SUBGRADE

DEPTH OF BEDDING MAT. BELOW PIPE

D	d (MIN)
700 mm	75 mm
750 mm to 1500 mm	100 mm
1600 mm & LARGER	150 mm

Legend

Bc = OUTSIDE DIAMETER
H = BACKFILL COVER ABOVE TOP OF PIPE
D = INSIDE DIAMETER
d = DEPTH OF BEDDING MATERIAL BELOW PIPE

Note

FOR ROCK OR OTHER INCOMPRESSIBLE MATERIALS, THE TRENCH SHOULD BE OVEREXCAVATED A MINIMUM OF 150 mm AND REFILLED WITH GRANULAR MATERIAL.

the foundation should be generously overcut and replaced by a layer of granular material.

Ground water should be kept below the bottom of the trench wherever possible during pipe laying operations by the use of temporary drains, sumps, or other suitable means. Peat or boggy material at formation level should be removed and replaced by sand or other approved filling materials.
If the trench is excavated in clay it is important to try to maintain the water content of the clay during construction. The addition of water will cause swelling while excessive drying can cause shrinkage. Either swelling or shrinkage can cause an uneven trench bottom.
Where slips occur and the trench wall collapses immediate action should be taken to inform the Resident Engineer so that remedial work may be put in hand to take account of a trench width in excess of that specified.
Care must be taken when constructing a trench adjacent to a manhole. The trench should be backfilled as soon as possible after the pipes are laid to prevent any movement of the manhole causing an overload to the pipes.

Bedding Materials.

The types of bedding normally used with concrete pipes are concrete cradle bedding, 1st class bedding and ordinary bedding.

Concrete Cradle Bedding:

(Reinforced or plain concrete)

This type of bedding using good quality concrete, carefully placed to ensure adequate and uniform support does not unduly limit the flexibility of the joints, provided gaps—each not less than 12 mm wide, are made in the concrete at every second joint position or at every 5 Meters whichever is less. These gaps should be filled with a soft compressible material to prevent the entry of any stones, such other materials liable to restrict flexibility of the bed and consequently of the pipeline itself.

First Class Bedding:

(Granular material)

Free draining gravels or crushed stones, well graded and evenly compacted under supervision will ensure good joint performance. An excess of fines in the material may cause 'bulking' during progress of the work, with consequent variations in line, level and compaction.

The maximum particle size should generally not exceed 20 mm. The presence of an occasional particle between 20 mm and 25 mm is acceptable provided the total quantity of such particles is only a very small fraction of the whole. If particles over 25 mm are present the material should be rejected.

The use of material obtained from the trench during excavation should be permitted only after a grading analysis has been made and the material approved as suitable for the particular size of pipe being laid. When granular bedding is used in trenches dug in uniform coarse sands or gravel it is important to ensure that the bedding material is not compacted less than the natural trench bottom.

Ordinary Bedding:

(natural soil of trench)

The bedding of concrete pipes on natural soil of the trench bottom in these classes is generally only suitable for pipes up to 300 mm diameter. The natural soil should be uniform and fine grained; conditions relatively dry.

Bedding Procedure:

For concrete cradle bedding, precast cradles or other means of support for the pipes at the correct height above the trench bottom and which can be safely left in place, should be regularly placed by means of a distance gauge and then boned in to the correct level and gradient. A layer of compressible material should be placed between the pipe and cradle to prevent the creation of a hard spot at the cradle.

No supports should be used in 1st class bedding, the top of which should be trimmed to the correct gradient, slightly above the final level to allow for a small settlement of heavy pipes, as pre-determined by trial. Timbering or sheeting should, wherever possible, be withdrawn as work proceeds so that no voids are left in the bedding. The bedding should be properly compacted, preferably by mechanical means.

Care should be exercised to avoid disturbance of the bedding beneath the pipe and to make good any disturbance which may occur accidentally. The bedding must be dug out under the pipe sockets so that the pipes are supported along the whole length of their barrels, and not on their sockets only.

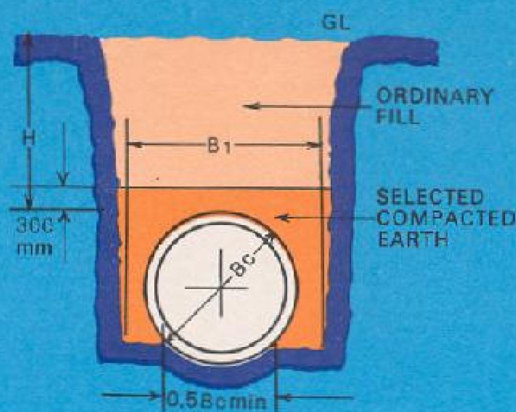
The pipe should be suspended during laying and jointing to avoid disturbance of the granular bed, and to prevent the whole weight of the pipe from bearing on the rubber ring during jointing for Rubber Ring Joints and allow uniform caulking space in the case of collar joint. After completion of jointing the sling should be carefully removed to prevent disturbance of the bedding.

Permissible depths of filling and types of bedding for NP4 class pipes

Trench Condition

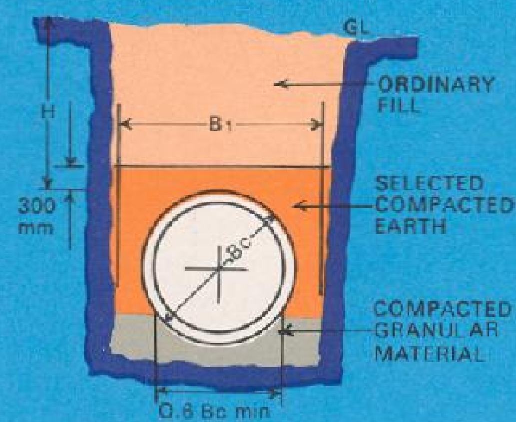
DEPTH OF FILL OVER TOP OF PIPE

DIA OF PIPE IN mm	METHOD OF BEDDING		
	ORDINARY BEDDING	FIRST CLASS BEDDING	CONCRETE CRADLE
350	UNLIMITED	UNLIMITED	UNLIMITED
400	"	"	"
450	"	"	"
500	"	"	"
600	10.92 M	13.83 M	21.84 M
700	9.61 M	12.05 M	19.02 M
800	8.57 M	10.86 M	17.14 M
900	7.89 M	9.99 M	15.78 M
1000	7.62 M	9.65 M	15.24 M
1100	7.31 M	9.26 M	14.62 M
1200	7.40 M	9.37 M	14.80 M
1400	6.27 M	7.94 M	12.54 M
1600	6.35 M	8.04 M	12.70 M
1800	6.38 M	8.08 M	12.76 M



Ordinary Bedding

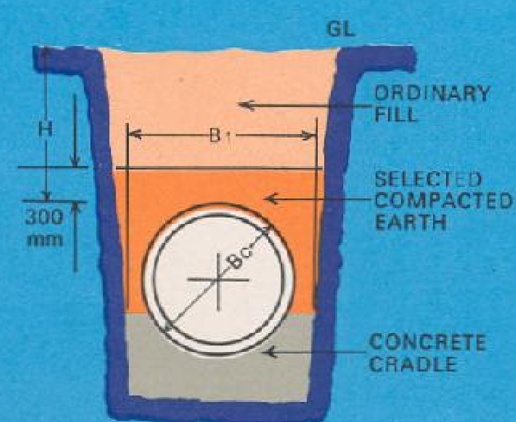
LOAD FACTOR 1.5



First Class Bedding

LOAD FACTOR 1.9

1. FILLING MATERIAL IS ORDINARY CLAY AS PER I.S. 783-1959 FIG. II (CURVE WITH $K\mu$ & $K\mu^1$ =.130)
2. FILL MATERIAL DENSITY=1750 KG/M^3
3. NO SUPERIMPOSED LOAD
4. WIDTH OF TRENCH
   UP TO 1200-O.D.+300 mm
   BEYOND 1200-O.D.+450 mm.



Concrete Cradle Bedding

LOAD FACTOR 3

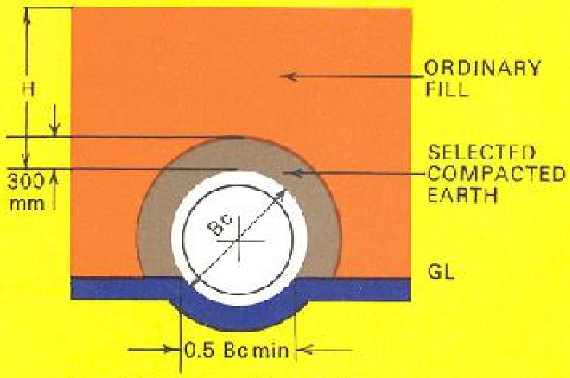
Permissible depths of filling and types of bedding for NP2 class pipes

Embankment (positive projection) condition

DEPTH TO INVERT OF THE PIPE

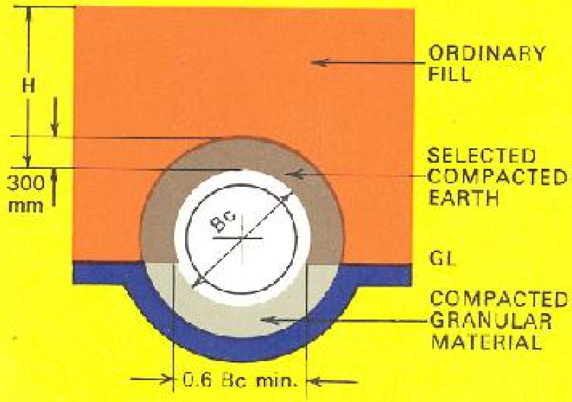
DIA.OF PIPE mm	METHOD OF BEDDING		
	ORDINARY BEDDING	FIRST CLASS BEDDING	CONCRETE CRADLE
100	UNLIMITED	UNLIMITED	UNLIMITED
150	"	"	"
250	2.88 M	3.47 M	4.87 M
300	2.48 M	2.99 M	4.20 M
350	2.32 M	2.80 M	3.93 M
400	2.23 M	2.69 M	3.77 M
450	2.16 M	2.60 M	3.66 M
500	2.22 M	2.68 M	3.76 M
600	2.11 M	2.54 M	3.57 M
700	2.03 M	2.45 M	3.44 M
800	1.96 M	2.36 M	3.32 M
900	1.90 M	2.29 M	3.22 M
1000	1.98 M	2.39 M	3.35 M
1100	1.83 M	2.21 M	3.10 M
1200	1.73 M	2.08 M	2.93 M
1400	1.55 M	1.87 M	2.62 M
1600	1.58 M	1.90 M	2.67 M
1800	1.39 M	1.68 M	2.35 M
1900	1.59 M	1.92 M	2.69 M
2000	1.52 M	1.83 M	2.57 M
2100	1.44 M	1.74 M	2.44 M

1) FILLING MATERIAL IS ORDINARY CLAY AS PER I.S. 783-1959 FIG. 11
2) FILL MATERIAL DENSITY=1750 KG/M^3
3) NO SUPERIMPOSED LOAD



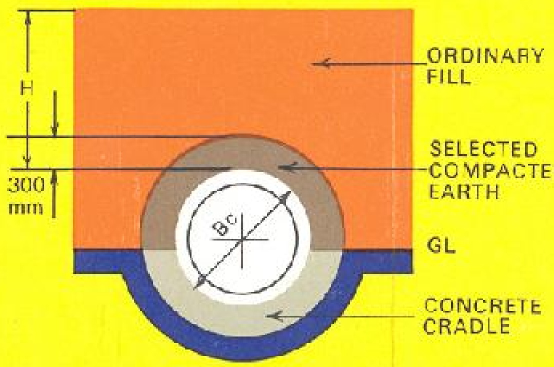
Ordinary Bedding

LOAD FACTOR 1.95



First Class Bedding

LOAD FACTOR 2.35



Concrete Cradle Bedding

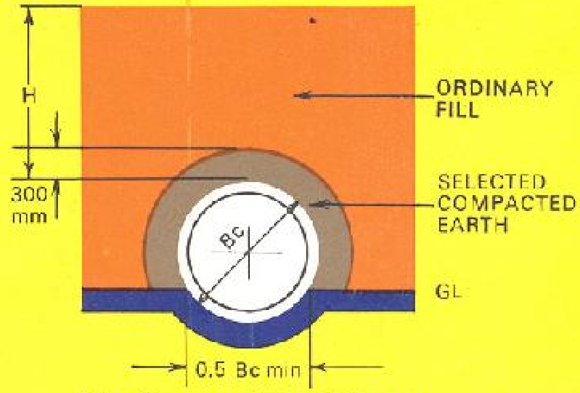
LOAD FACTOR 3.3

Permissible depths of filling and types of bedding for NP4 class pipes

Embankment(positive projection)condition

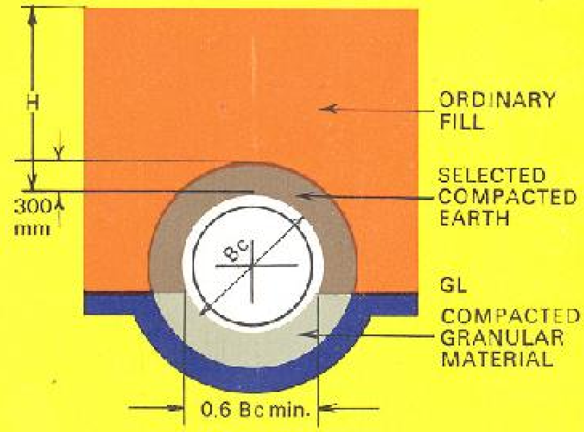
DEPTH TO INVERT OF THE PIPE

DIA.OF PIPE mm	METHOD OF BEDDING		
	ORDINARY BEDDING	FIRST CLASS BEDDING	CONCRETE CRADLE
350	4.93 M	5.94 M	8.34 M
400	5.12 M	6.17 M	8.66 M
450	5.07 M	6.11 M	8.58 M
500	5.20 M	6.27 M	8.80 M
600	5.09 M	6.13 M	8.61 M
700	4.99 M	6.01 M	8.44 M
800	5.10 M	6.15 M	8.63 M
900	5.17 M	6.23 M	8.75 M
1000	4.92 M	5.93 M	8.33 M
1100	4.99 M	6.01 M	8.44 M
1200	5.01 M	6.04 M	8.45 M
1400	5.25 M	6.33 M	8.88 M
1600	5.39 M	6.50 M	9.12 M
1800	5.62 M	6.77 M	9.51 M



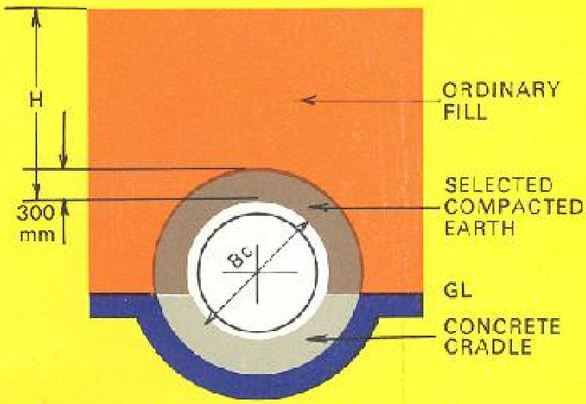
Ordinary Bedding

LOAD FACTOR 1.95



First Class Bedding

LOAD FACTOR 2.35



Concrete Cradle Bedding

LOAD FACTOR 3.3

1) FILLING MATERIAL IS ORDINARY CLAY AS PER I.S. 783-1959 FIG. 11
2) FILL MATERIAL DENSITY=1750 KG/M^3
3) NO SUPERIMPOSED LOAD

SOME MAJOR WATER SUPPLY AND DRAINAGE SCHEMES WHERE HUME PIPES ARE USED

Sl. No.	Name of the Scheme	Year	Size	Class or Test Pressure	Length in mtrs.
1.	Quetta Water supply	1930	12"	2.00 Kgs./cm²	16094
2.	Hambantata water supply in Ceylon	1930	8"	2.00 "	97000
3.	Municipal Drainage, Karachi	1931	6"-15"		45731
4.	Jamshedpur Drainage	1931	4"-27"	Non pressure	54000
5.	Warrangal Water Supply	1938	15"-24"	2.00 kgs/cm²	31000
6.	Mithapur Chemicals; water supply	1939	4"-18"	Non pressure	11000
7.	Tata Iron & Steel Jamshedpur drainage	1939	4"-18"	Non pressure	11200
8.	Delhi drainage	1940	4"-30"	Non pressure	28000
9.	Indus Water supply, Karachi	1941-42	33"-63"	2.00 Kgs/cm²	36000
10.	Tata Iron & Steel, water supply & drainage, Jamshedpur	1945	4"-36"	Non pressure	33650
11.	Water supply to Munirabad	1947	3"-9"	6.00	62474
12.	Aurangabad water supply	1952-55	6"-24"	1 to 2	72077
13.	Hyderabad water supply	1955	60"-66"	2 to 3	30570
14.	Municipal drainage, Lucknow	1955	6"-42"		81280
15.	Municipal drainage, Delhi	1959	78"-90"	Non pressure	17600
16.	Jabalpur water supply	1959	52"	2.00	16764
17.	Sabarmati water supply, Ahmedabad	1960	4"-18"	2.00	162017
18.	Gorakpur drainage	1961-62	6"-8"	Non pressure	46310
19.	Water supply to Gauhati	1961-62	24"-30"	2.00	16800
20.	Nasik drainage	1964	6"-27"	Non pressure	54075
21.	Dharwar water supply	1965	4"-9"	4 to 6	46372
22.	Madras water supply	1965	15"-18"	6.00	16337
23.	Improvement trust-Nagpur drainage	1967	10"-16"	Non pressure	17725
24.	Madurai water supply	1968	15"	4.00	29300
25.	Gulbarga water supply	1968	30"	2.00	42490
26.	Jaipur water supply	1969	24"	2.00	20120
27.	Osman saagar water supply, Hyderabad	1971	700 mm-800 mm.	4.00	14000
28.	Dharampur water supply, Madras	1972	15", 450-600 mm.	4 to 6	70000
29.	Rural water supply, Kanpur	1972	8"-41"	Non pressure	12500
30.	Gandhigarh lift irrigation	1974	381-457 mm	Non pressure	28000
31.	Augmentation to Yamuna Canal, Chandigarh.	1973	450—600 mm	2 kg/cm²	17250
32.	Bombay City and Suburbs Drainage*	1975	350—1800 mm	NP3, NP4 1.4 kg/cm²	25,000

* Project financed by the World Bank.