DURALINE PIPES NEWSLETTER

October – December 2004 **Q4/2004**

This issue of the newsletter features the Karnataka coastal project, water distribution network for Udupi, and abrasion resistance – another outstanding property of HDPE (high density polyethylene) pipes that makes them uniquely suited for slurry transport in mining and other industrial applications.

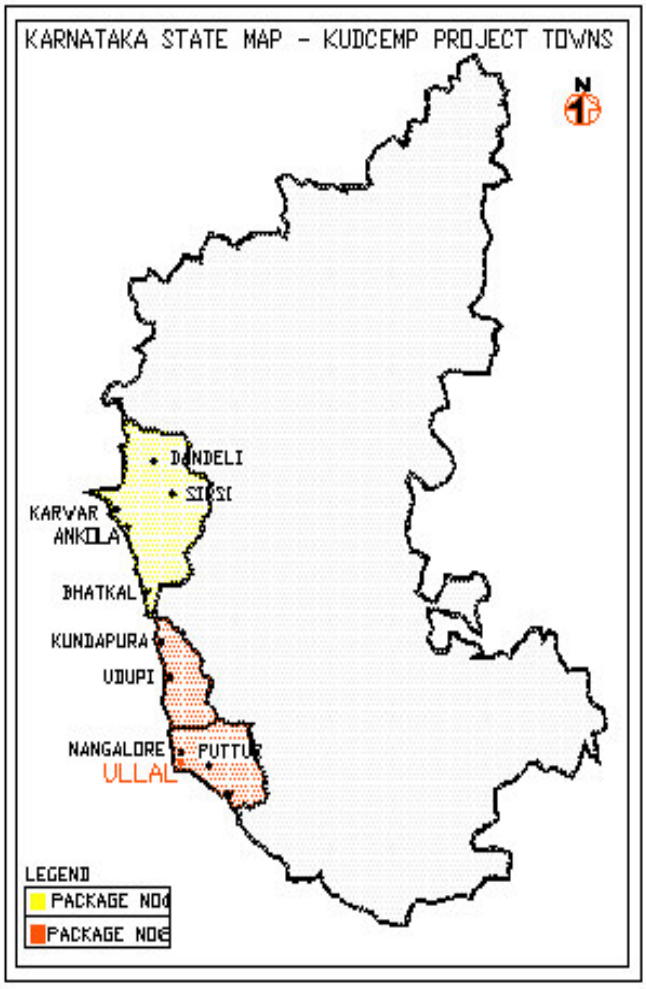
KARNATAKA COASTAL PROJECT

The coastal towns of Karnataka are undergoing a major transformation. Significant improvements in infrastructure are underway through the Karnataka Urban Development and Coastal Environmental Management (KUDCEM) Project. The nodal agency spearheading these developmental activities is the Karnataka Urban Infrastructure Development Finance Corporation.

The coastal areas of Karnataka present quite a contrast. Dakshin Kannada is the affluent region bustling with entrepreneurial energy. Mangalore and more recently Manipal are major centers of education and medical care that have made a name for themselves well beyond our borders. Udupi and Sringeri are flourishing religious centers from the time of Sankaracharya and even earlier. Uttara Kannada on the other hand is not as developed. However this is changing fast. The catalyst was the Konkan Railway project first conceptualized by the British in 1894 and finally implemented a 100 years later under the leadership of the great Indian Railways engineer E. Sreedharan. Project Seabird of the Navy is also contributing to the rapid development of the Karwar area. .

Two KUDCEM project teams are at work. The one based at Mangalore is addressing the requirements of the towns of Mangalore, Udupi, Kundapura, Ullal and Puttur. The other team based at Karwar is working on the requirements of Karwar, Dandeli, Sirsi, Ankola and Bhatkal.

Dura-Line is proud to be associated with the KUDCEM Project through the supply and installation of PE 100 HDPE pipes in the towns of Udupi, Ullal, Kundapura, and Sirsi.



Water Supply for Mangalore

Water supply source for Mangalore is the Nethravati River. Raw water is drawn from the river at Thumbe, some 14 km from Mangalore. Some 80 MLD (million liters per day) water is pumped to Ramalkatte, 1.5 km away through an existing 1000 mm mild steel (MS) pipeline.

Water from Ramalkatte is transmitted to Bendur (in Mangalore) Water Treatment Plant (WTP), a distance of 17 km by a 1000 mm MS pipeline. Part of this water is diverted through a 900 mm MS pipeline from Bendur to Panambur WTP at Suratkal, 9.6 km away. Existing capacity of WTPs are 40 MLD at Bendur and 27 MLD at Panambur. The distribution network then supplies this filtered water to users in Mangalore and Suratkal.

The current population of Mangalore is 4.2 lacs, projected to grow to 6.6 lacs in 2026. Present water supply in Mangalore is 95 lpcd (liters per capita per day). The KUDCEM Project is putting in place the facilities to meet a projected requirement of 135 lpcd. For this purpose a new 1100 mm MS/ DI (ductile iron) pipeline is being laid alongside the existing line to pump an additional 80 MLD water from Nethravati River at Thumbe to Ramalkatte. A new 80 MLD WTP is being built at Ramalkatte itself. An additional 23.5 MLD WTP capacity is being added at Panambur.

The filtered water will be pumped from Ramalkatte to a new 12 ML GLSR (ground level surface reservoir) at Padil, the highest elevation point in Mangalore, a distance of 14 km through a new 1100 mm MS pipeline along National Highway (NH) 48. The water storage capacity in Mangalore is being enhanced from the present 35 ML to 64 ML through the addition of new 29 ML capacity.

Some 875 km of new water distribution lines valued at Rs 34 crores are being installed. These lines range from 110 to 500 mm in diameter. The chosen materials are HDPE, 795 km line length in the 110 to 250 mm range, and DI, 80 km line length in 200 to 500 mm range.

Water Supply for Udupi

The water supply source for Udupi is the Swarna River. Population is 1.1 lacs projected to grow to 1.7 lacs by 2026. Present supply of 9.08 MLD works out to 70 lpcd. Raw water is lifted from the Swarna River at Baje and routed through a 450 mm CI (and RCC, gravity) pipeline to the WTP at Manipal. Water is then distributed to consumers in Udupi from this high elevation WTP.

This supply is being enhanced to 27.24 MLD based on 135 lpcd water requirement. A new WTP is being built at Baje itself. Water will be pumped from Baje through a 700 mm MS line to a new 5 ML GLSR at Manipal, 11.75 km away. A distribution network of additional 380 km of pipe ranging from 110 to 400 mm diameter is being laid throughout Udupi town. This network will be primarily of HDPE pipe. The distribution system contract is valued at Rs 24 crores.

Water Supply for Ullal

Ullal is a satellite town of Mangalore with a population of 50,000 people. The present water supply for Ullal is from open wells and tube wells. The water is supplied without treatment through 25 km of 63 to 110 mm PVC (polyvinyl chloride) distribution lines to 603 house connections and 665 stand post connections. Most of these existing PVC lines are damaged and are leaking. The supply works out to 27 lpcd.

The proposed supply plan for Ullal is a combined system with Mangalore. Ullal's share of the Mangalore water supply is 10 MLD with River Nethravati as the source. This is based on 135 lpcd requirement.

High water table at Ullal: not a problem

The distribution system in Ullal will cover 2,660 house service connections and 350 stand post connections. Distribution will be through 88 km of HDPE pipeline ranging from 90 to 250 mm in diameter.

Water Distribution Network for Udupi

The 380 km water distribution network under installation at **Udupi is one of the larger HDPE pipe networks within a town in the country.** The PE 100 pipes for this distribution system are being supplied by Dura-Line from its state-of-the-art plant at Goa. Dura-Line is also responsible for pipe jointing, laying, and pressure testing activity in much of Udupi town. Distribution pipe in Zone 7 of Udupi is exclusively some 70 km of Dura-Trac™ fully detectable pipe. The largest pipe under installation is 315 mm in diameter.

This distribution network is most complicated and difficult to install for these reasons:

- Congested city areas
- Dense public areas; local inconvenience
- Narrow roads; limited working space
- Utility crossings
- High quantity of fittings involved.

Udupi pipe installation in progress

Despite these challenges, work in Udupi is progressing rapidly. Eight installation teams are working seven days a week in different zones of the town to complete the distribution system that will cover 25,000 house connections. Work commenced in October 2003 and following the monsoon is again in full swing. The distribution system is projected for completion by December 2004.

Abrasion Resistance – Slurry Transport

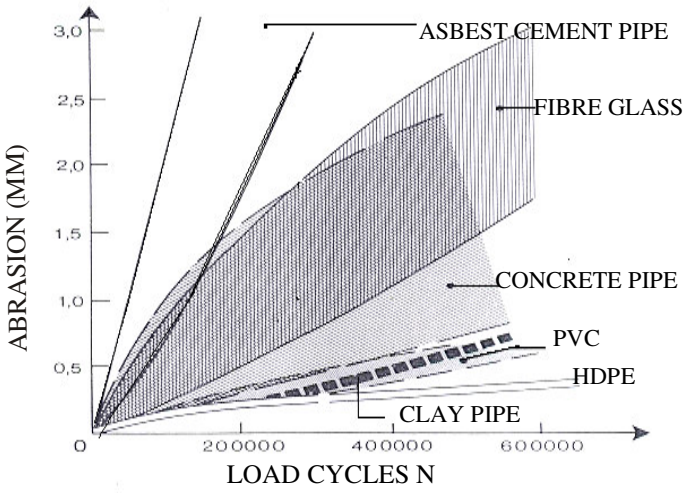
The growth in the hydraulic transportation of solids through hydraulic systems is increasing mainly due to the economic advantages of operating this type of system. More and more PE pipe is being used to transport liquid slurries in power plants, mining, dredging and similar applications. **The advantage of polyethylene in these applications is its wear resistance,** which has been shown in laboratory tests to be three to five times longer than normal or fine-grained steel pipe.

The problem of abrasion in slurry lines is particularly acute at bends. PE pipes offer excellent resistance against abrasion. In addition **because of the flexible nature of PE pipes they adapt to the contour of the route** obviating the need for special bends. The local abrasion effect at bends is thus marginal in PE pipes. The abrasion resistance of PE pipes improves with the density of the polyethylene.

The high impact strength, resilience, high molecular weight, and corrosion resistance of the HDPE pipe all contribute towards its success in slurry applications. **Extra-high molecular weight HDPE pipe resists impact and cutting abrasion from sharp particles making HDPE PE 100 pipe the most effective slurry transport medium.** The concentration, size and shape of the solid materials along with the velocity are the major parameters that will affect the wear resistance and thus affect the life of the pipeline. The angle of impingement of the particles is another important factor.

A comparison of the abrasion resistance performance of different pipe materials is shown in the graph on the following page. HDPE pipes perform the best with the least abrasion wear.

The excellent abrasion resistance is only one of the benefits of using PE pipe for slurry applications; it is also lighter in weight and easier to install in areas where slurry lines are required. In addition, PE pipe is easier to maintain and can be easily rotated once



Slurry Pipes Abrasion Resistance

wear has taken place. Periodic rotation of the slurry pipeline is recommended for its longer life.

Slurry Applications

Slurry is a mixture of a solid in a fluid where the two constituents do not react chemically but can be mechanically separated. There are two basic types of slurry. The first is the **non-settling slurry** in which all particles remain entrained in the liquid. In this type of flow, the slurry resembles characteristics of a viscous fluid and can be treated as such in the design of the system. The second and more typical flow regime for slurries is the **settling slurry.** In this condition, the particles, once suspended in the liquid, begin to settle on the lower portion of the pipe. The degree of settling is dependent upon the velocity of the system. Larger particles are harder to suspend and require higher velocities to remain in suspension, especially in horizontal pipes.

The **critical velocity** is the minimum velocity required for keeping the solids suspended in the slurry. The critical velocity is dependent on the following system variables:

- Solid size and shape
- Solid size distribution
- Solid density
- Fluid density
- Slurry concentration
- Size of the pipe

Homogenous flow, where all of the particles are evenly distributed and entrained in the fluid resulting in minimal contact between the solid and the pipe wall, is the least abrasive to the pipe material; therefore, the most desirable. Homogenous flow may be achieved with those types of material where the particle size is below `

- Boiler fly ash
- Fine sands
- Clays
- Scrubber solids
- Pulverized coal
- Materials that have been reduced to powder

In **heterogeneous flow** there is some tendency for the particles to settle toward the bottom of the pipe resulting in increased density of the slurry in the bottom half of the pipe. However, the solids are still not in full contact with the pipe wall while in transit; therefore, minimal abrasion occurs. This condition is the most economical since achieving homogenous flow requires more energy. Heterogeneous flow is the best situation for slurry materials containing particles larger than 200 microns in size. Typical slurry materials that are in this category include the following:

- Mine tailings
- Sand
- Mineral ores
- Crushed limestone
- Gravel
- Dredge materials

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