



# THE HOBAS

# PIPELINE

A PUBLICATION HIGHLIGHTING THE TECHNICAL AND PRACTICAL USES OF HOBAS PIPE

## HOBAS Pipe USA, Inc.

## November 2002

### LOWEST LIFE CYCLE COST

The Milwaukee Metropolitan Sewerage District (MMSD) services 28 municipal customers throughout metropolitan Milwaukee, Wisconsin. With the completion of the Deep Tunnel System in the mid 1990's, the MMSD was able to implement the Central Metropolitan Interceptor Sewer (MIS) Improvement Project, which consists of rehabilitating or replacing about 51-miles of MIS in the downtown area of the City of Milwaukee. The MMSD required that the method of rehabilitation achieve an additional fifty-year service life for the Central MIS.

The MMSD stated there is no cookie-cutter solution to rehabilitating sewer segments. The general condition of the sewer segment, the material it is made of, its pitch, location and capacity all play critical roles in determining the best method of rehabilitating a sewer segment. Therefore, in rehabilitating the Central MIS, sliplining, shotcrete, discrete pipe segments, epoxy coating, cured-in-place pipe liner and open-cut replacement were evaluated.

The Preliminary Engineering Report (PER) to rehabilitate the eighty-year-old Clybourn Street MIS recommended two different methods for the rehabilitation of the 72-inch diameter monolithically cast concrete sewer. A structural liner for the pipe segments that were evaluated as structurally failed and a spray-on epoxy resin liner for the pipe segments that were evaluated as structurally sound but showing deterioration by hydrogen sulfide to the point that future corrosion needed to be halted.

The engineering firm of Alvord, Burdick & Howson (AB&H) was hired to evaluate the rehabilitation options recommended in the PER and perform the final design. AB&H evaluated the different methods of rehabilitation including several pipe liners for the



Lightweight segmental sections are strong enough to handle 70 foot depths.

structural segments and various spray on coatings for the nonstructural segments. The concept of rehabilitating an eighty-year-old concrete sewer to last an additional fifty years using a spray-on epoxy had been a matter of concern for AB&H from the start of the project. AB&H performed a 50-year life cycle cost analysis of the different types of nonstructural rehabilitation methods and concluded that the cost of an epoxy coating could be more than two times the cost of other methods of rehabilitation such as sliplining.

AB&H met with representatives of Hobas Pipe USA, Inc. to determine if HOBAS pipe could meet the design requirements. Mr. Frank Lin, structural engineer with AB&H, after reviewing the design of the HOBAS pipe, visit-

*(continued on page 7)*

### INSIDE



### THE HOBAS PIPELINE

#### PRODUCT PROFILE

Improve Sewer Hydraulics with HOBAS Sliplining	2
Sole Source in Los Angeles	4
HOBAS under Houston Bayou	6

# IMPROVE SEWER HYDRAULICS WITH HOBAS SLIPLINING

## INTRODUCTION

Hydraulics is typically an important consideration when planning pipeline rehabilitation. When sliplining is the chosen method, a slight diameter decrease will result. However, because of the much better flow characteristics of Hobas liner pipe, normally the rehabilitated line's hydraulics are improved relative to its existing condition.

## PARAMETERS

The parameters that effect the changed hydraulics are the host and liner pipes' Manning's "n", diameter, and slope. Since the slope is unchanged, the relative flow capacity is computed as follows:

$$\left( \frac{Q \text{ Hobas}}{Q \text{ Existing}} \right) = \left( \frac{n \text{ Existing}}{n \text{ Hobas}} \right) \left( \frac{D \text{ Hobas}}{D \text{ Existing}} \right)^{\{8/3\}}$$

## CHARACTERISTICS

The n value of existing sewers varies widely, perhaps from 0.013 to 0.024 or higher. Due to corrosion, off-set joints, sliming, and other deterioration, a likely value for aged sewers is at least 0.018. The n value for new Hobas pipes has been measured at 0.009. After several years of service (sliming, etc.), one agency determined an n value of 0.011.

## CHART

The chart on the following page shows the ratios of flow capacity of the Hobas liner (Q Hobas) to the host pipe (Q existing) for various diameter combinations and ranges of Manning's "n". A ratio of greater than one indicates improved flow capacity after lining with Hobas, while a value below one means a reduced flow capacity after the rehabilitation. A 1.1 ratio is a 10% flow capacity increase. A 0.9 ratio is a 10% flow capacity decrease.

## BENEFITS

Sliplining rehabilitation of sewers with Hobas pipes provides many benefits. Not only is the flow capacity frequently increased, but the host pipe is structurally reinforced, corrosion is stopped, and leakage is eliminated.

## CONCLUSION

To enjoy the many benefits of sliplining rehabilitation, specify and use Hobas pipes on your next project.

*(continued on next page)*

## PLAY HOBAS TRIVIA

A world record pipe jack was completed with 60 inch diameter HOBAS pipes on Staten Island, NY. What was the length of this jack? Please send your reply to [trivia@hobaspipeusa.com](mailto:trivia@hobaspipeusa.com). A winner will be selected from all correct answers received via email, on or before December 1, 2002. First prize is a HOBAS Chronograph Citizen Watch!

*Hint: details of this and other case histories may be found on our web site at [www.hobaspipeusa.com](http://www.hobaspipeusa.com)*



# Q HOBAS / Q EXISTING

		HOST PIPE EXISTING FLOW COEFFICIENT, n													
		0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.020	0.021	0.022	0.023	0.024		
<b>HOBAS RELINING PIPE FLOW COEFFICIENT, n</b>	20" into 24"	0.009 0.010 0.011	0.961 0.865 0.786	1.035 0.932 0.847	1.109 0.998 0.907	1.183 1.065 0.968	1.257 1.131 1.028	1.331 1.198 1.089	1.405 1.264 1.149	1.479 1.331 1.210	1.553 1.397 1.270	1.627 1.464 1.331	1.700 1.530 1.391	1.774 1.597 1.452	20" into 24"
	24" into 30"	0.009 0.010 0.011	0.851 0.766 0.696	0.916 0.825 0.750	0.982 0.884 0.803	1.047 0.943 0.857	1.113 1.001 0.910	1.178 1.060 0.964	1.244 1.119 1.017	1.309 1.178 1.071	1.375 1.237 1.125	1.440 1.296 1.178	1.505 1.355 1.232	1.571 1.414 1.285	24" into 30"
	30" into 36"	0.009 0.010 0.011	0.936 0.843 0.766	1.008 0.908 0.825	1.081 0.972 0.884	1.153 1.037 0.943	1.225 1.102 1.002	1.297 1.167 1.061	1.369 1.232 1.120	1.441 1.297 1.179	1.513 1.361 1.238	1.585 1.426 1.297	1.657 1.491 1.356	1.729 1.556 1.414	30" into 36"
	36" into 42"	0.009 0.010 0.011	1.001 0.901 0.819	1.078 0.970 0.882	1.155 1.039 0.945	1.232 1.109 1.008	1.309 1.178 1.071	1.386 1.247 1.134	1.463 1.316 1.197	1.540 1.386 1.260	1.617 1.455 1.323	1.694 1.524 1.386	1.771 1.593 1.449	1.848 1.663 1.512	36" into 42"
	42" into 48"	0.009 0.010 0.011	1.051 0.946 0.860	1.132 1.018 0.926	1.212 1.091 0.992	1.293 1.164 1.058	1.374 1.237 1.124	1.455 1.309 1.190	1.536 1.382 1.256	1.616 1.455 1.323	1.697 1.528 1.389	1.778 1.600 1.455	1.859 1.673 1.521	1.940 1.746 1.587	42" into 48"
	48" into 54"	0.009 0.010 0.011	1.097 0.987 0.897	1.181 1.063 0.966	1.265 1.139 1.035	1.350 1.215 1.104	1.434 1.291 1.173	1.518 1.367 1.242	1.603 1.442 1.311	1.687 1.518 1.380	1.771 1.594 1.449	1.856 1.670 1.518	1.940 1.746 1.587	2.025 1.822 1.656	48" into 54"
	54" into 60"	0.009 0.010 0.011	1.129 1.016 0.924	1.216 1.094 0.995	1.302 1.172 1.066	1.389 1.250 1.137	1.476 1.328 1.208	1.563 1.407 1.279	1.650 1.485 1.350	1.737 1.563 1.421	1.823 1.641 1.492	1.910 1.719 1.563	1.997 1.797 1.634	2.084 1.875 1.705	54" into 60"
	60" into 66"	0.009 0.010 0.011	1.135 1.022 0.929	1.223 1.100 1.000	1.310 1.179 1.072	1.397 1.258 1.143	1.485 1.336 1.215	1.572 1.415 1.286	1.659 1.493 1.358	1.747 1.572 1.429	1.834 1.650 1.500	1.921 1.729 1.572	2.009 1.808 1.643	2.096 1.886 1.715	60" into 66"
	66" into 72"	0.009 0.010 0.011	1.164 1.048 0.952	1.253 1.128 1.026	1.343 1.209 1.099	1.433 1.289 1.172	1.522 1.370 1.245	1.612 1.450 1.319	1.701 1.531 1.392	1.791 1.612 1.465	1.880 1.692 1.538	1.970 1.773 1.612	2.059 1.853 1.685	2.149 1.934 1.758	66" into 72"
	72" into 78"	0.009 0.010 0.011	1.184 1.066 0.969	1.275 1.148 1.043	1.366 1.230 1.118	1.457 1.312 1.192	1.549 1.394 1.267	1.640 1.476 1.342	1.731 1.558 1.416	1.822 1.640 1.491	1.913 1.722 1.565	2.004 1.804 1.640	2.095 1.886 1.714	2.186 1.968 1.789	72" into 78"
	72" into 84"	0.009 0.010 0.011	0.972 0.875 0.795	1.047 0.942 0.856	1.121 1.009 0.917	1.196 1.076 0.979	1.271 1.144 1.040	1.346 1.211 1.101	1.420 1.278 1.162	1.495 1.346 1.223	1.570 1.413 1.284	1.645 1.480 1.346	1.719 1.547 1.407	1.794 1.615 1.468	72" into 84"
	84"FL into 90"	0.009 0.010 0.011	1.183 1.064 0.968	1.274 1.146 1.042	1.365 1.228 1.117	1.456 1.310 1.191	1.547 1.392 1.265	1.638 1.474 1.340	1.729 1.556 1.414	1.820 1.638 1.489	1.911 1.720 1.563	2.002 1.801 1.638	2.093 1.883 1.712	2.183 1.965 1.786	84"FL into 90"
	84" into 96"	0.009 0.010 0.011	0.996 0.896 0.815	1.072 0.965 0.877	1.149 1.034 0.940	1.226 1.103 1.003	1.302 1.172 1.065	1.379 1.241 1.128	1.455 1.310 1.191	1.532 1.379 1.253	1.608 1.448 1.316	1.685 1.517 1.379	1.762 1.586 1.441	1.838 1.654 1.504	84" into 96"
	96" into 102"	0.009 0.010 0.011	1.215 1.094 0.994	1.309 1.178 1.071	1.402 1.262 1.147	1.496 1.346 1.224	1.589 1.430 1.300	1.683 1.514 1.377	1.776 1.598 1.453	1.870 1.683 1.530	1.963 1.767 1.606	2.057 1.851 1.683	2.150 1.935 1.759	2.243 2.019 1.836	96" into 102"
	96" into 108"	0.009 0.010 0.011	1.043 0.939 0.854	1.124 1.011 0.919	1.204 1.084 0.985	1.284 1.156 1.051	1.364 1.228 1.116	1.445 1.300 1.182	1.525 1.372 1.248	1.605 1.445 1.313	1.686 1.517 1.379	1.766 1.589 1.445	1.846 1.661 1.510	1.926 1.734 1.576	96" into 108"

- \* Hobas diameters are nominal for 36psi pipe stiffness
- \*\* Existing sewer assumed full sized, Nominal diameter = ID
- \*\*\* FL = Flush joint. In tight fit cases, it may be required to utilize a flush joint. The ID's of the flush joint are nominal for the typical minimum flush joint pipes
- \*\*\*\* Hobas 84" nominal size is based on the 87.0 OD mold



# SOLE SOURCE IN LOS ANGELES



Gasket sealed HOBAS Pipes do not require bypass pumping.



Buntich sliplined sections of sewer which traveled under homes and businesses.

**W**hen the City of Los Angeles grew, many of the existing underground utilities were further buried under roadways, down tight alleyways and in some cases, even directly under buildings or other new structures. As these utilities aged, the effects of hydrogen sulfide attack, root intrusion and other problems became apparent. The City now operates and maintains the largest wastewater collection system in the nation consisting of more than 6500 miles of sewers. The location, size, length and orientation of many of these utilities create unique challenges for engineers, owners and contractors to overcome.

## LIMITED ACCESS

On a recent project, NCOS - NOS Maze Phase 3 rehabilitation, approximately 60% of the 66 inch diameter project was inaccessible during the construction via traditional open cut methods. The access was required to be via small and isolated segments of the existing sanitary sewer which needed to remain under live flow conditions throughout the project. This mile long outfall, originally a 75" diameter clay-tile-lined RCP, ran

through neighborhoods, under residential homes and businesses, including a bank. For this extremely critical installation, the City of L.A. specified only one product, HOBAS CCFRPM pipes, to do the job.

## SAVES MONEY

The contractor, Mladen Buntich of Sunland, is a veteran installer of HOBAS pipes. Buntich has utilized HOBAS on a dozen previous jobs in the L.A. area. Being very familiar with the HOBAS pipe and its capabilities, Buntich was able to reline many (otherwise risky) reaches without incident. "We knew using HOBAS could save us money" stated Lee Roesner, PE, Project Manager, since, the alternatives of devising means to accommodate traffic or bypass pumping were extremely costly if even possible. Other materials, even if allowed, would not have been up for the challenge of this demanding installation. The installation progressed rapidly and uneventfully despite the adverse conditions. HOBAS was installed at an insertion rate of one pipe every 5 minutes in the 2,000 foot run. These fast insertion rates were accomplished while averaging less than 40



Sliplining progressed rapidly achieving rates of 5 minutes per pipe.

tons of pushing load, well below the 200 ton capacity of the pipe.

## "DEPENDABLE PIPE"

In two separate areas, the contractor pushed 2,000 linear feet of HOBAS directly under residential

homes. With the access so limited, "We needed a dependable pipe" stated Roesner, the consequences of a pipe failure were too costly. The existing conditions and limited access prompted some creative installation methods which were only possible using HOBAS. One inaccessible area of the existing sewer had a 100 foot long 90 degree radius curve that was in need of repair. Buntich made several radius fittings with gasket sealed joints which were pushed into the curved sections to structurally reline the sewer without disrupting flow. "With our experience, we knew we could do this on site, it is easy, by cutting the pipe to length and laying it back up" stated Roesner. Manufacturing the radius fittings to match the existing curves also saved time, since the field measurements could immediately be relayed to onsite crews that could manufacture the exact configuration needed. Also, manufactured on site were 63 X 48 inch Tee sections fabricated by laminating 48 inch riser sections to the 63 inch main line. The riser sections could be placed in the correct location after sliplining was complete. One of the greatest benefits on this project was the ability to easily and cost effectively make field modifications to the pipe.



*A section of the existing sewer was removed and this area was utilized as an insertion pit for curved sections.*

## **CHALLENGES MET**

All involved are pleased with the outcome of the NCOS project and especially pleased with the pipe of choice. The project provided a series of challenges, all of which were met with the high strength and versatile polymer mortar pipe. HOBAS has been specified on many past and current projects for The City of L.A., several of them being sole source. HOBAS provides great advantages in sliplining including long-term corrosion resistance, structural reliability, superior long term hydraulics and the ability to maintain live flow without disruption to service or lateral connections. For all of these reasons and more, HOBAS is called the premier trenchless pipe.



*Radius fittings were manufactured on site to match existing sewer alignment.*



# HOBAS UNDER HOUSTON BAYOU



The pipe was installed adjacent to streets and buildings as well as directly below the bayou.

**HOBAS** pipes were utilized on a challenging siphon installation at depths of up to 110 feet, as part of the North Side Relief Tunnel system for The City of Houston. HOBAS was specified by the project engineer, Black and Veatch, and chosen by Boyer, Inc for the siphon section which passes directly under Buffalo Bayou.

## TUNNEL ADVANTAGE

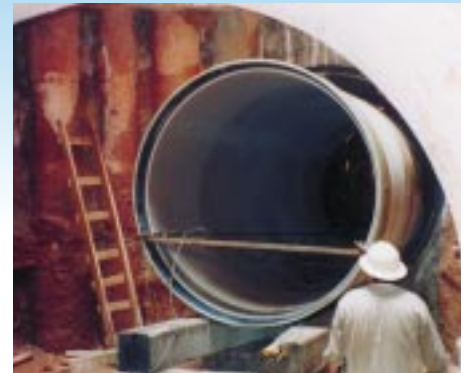
Deep depths and close proximity to downtown Houston streets and buildings made for a challenging installation for Boyer. This veteran installer of HOBAS chose the pipe on this installation for its light weight and lower installed cost. The 84 inch diameter HOBAS pipe was thinner walled relative to a comparable concrete pipe, which allowed for an oversized inside diameter with a relatively small outside diameter. One of the greatest benefits of using HOBAS in tunnels is the savings of 10-15% in primary tunnel liner and 20-30% less excavation and haul away both of which can be attributed to the smaller OD. The 84 inch nominal diameter pipe had an ID of over 85 inches with an OD of only 88.6 inches.



The high strength pipe wall allowed for a smaller primary tunnel.

## CORROSION RESISTANT

The entire 645 foot siphon was installed from one shaft using wooden skids and a winch system. The pipes were placed in the tunnel, descending at a grade of 8.25%, navigating under the bayou. Once the pipes were properly located within the tunnel, the pipes were blocked to maintain line and grade, and to facilitate grouting. Several (24) special short sections (6 1/2 foot) of HOBAS were supplied in order to accommodate curves in the 112 inch ID ring beam and wooden lag tunnel. Even though the installation was a tough one, the HOBAS siphon pipe was installed by this method in less than two weeks.




Lightweight pipes were easily pulled through ring beam and wooden lag tunnel.



Short sections were fabricated to fit easily into small but deep shafts.

Tommy Mazingo, of Boyer, was pleased with the HOBAS pipes performance, and especially liked the inherent corrosion resistance "Once the pipes were installed, that was it. There was no secondary lining to apply". With other material options on this project, such as PVC lined concrete pipes, the secondary lining required welding to provide the corrosion resistance already inherently present in the HOBAS pipes.

## HOBAS CHALLENGE

The pipe installation is now complete and Boyer has begun grouting preparations. The grouting will be accomplished by filling the siphon full of water, and pumping the annulus full of low density cellular concrete. Considering the size and complexity of this project, the HOBAS installation was relatively 'easy' and user friendly, proving again, that HOBAS pipes are ideal for challenging installations 

## LOWEST LIFE CYCLE COST

(continued from page 1)

ing the HOBAS pipe manufacturing facilities and witnessing the quality control procedures during manufacturing of the HOBAS pipe, determined HOBAS pipe could provide the structural reliability, corrosion resistance, and the flow characteristics required and wrote HOBAS pipe into the specifications for both the structural and nonstructural segments.

## CONTRACTOR CONFIDENCE

Two of the three low bidders chose sliplining with HOBAS for the straight sections and the low bidder, Super Excavators, Inc., of Menomonee Falls, WI, ultimately chose to use HOBAS for the entire project. Super Excavators chose a combination of low profile bell and flush joint pipes for sliplining. The stiffness classes of the pipes supplied to the project ranged from 36 to 68 stiffness for the deep (70 foot) depths. Super Excavators chose HOBAS pipe since it was a product which they were confident they could install easily, due to their prior experience with HOBAS pipe. The Contractor was able to install the pipe with an in-house designed pushing mechanism that utilized two 100 ton hydraulic rams, and a plate which backed to



Pipes were joined in the curve using a winch.

the existing sewer. The maximum push distance was 3,600 feet, "and we could have pushed more" stated Project Superintendent, Gregg Rehak. The long push was a requirement due to the presence of utilities that could not be easily relocated, limiting shaft locations. The HOBAS pipes were strong enough, light enough and smooth enough that pushing by this method was simple, requiring only 24

tons of force (well below the more than 200 ton design capacity of the HOBAS pipes).

## YES, YOU CAN SLIPLINE CURVES!

One of the greatest benefits of using HOBAS pipe was the ability to manufacture short sections which were made to order to custom fit this particular installation. The Contractor was required to slipline six separate curved sections of MIS with radii of 50-feet. Super Excavators took actual ID measurements and lengths of the deteriorated curved sections of the MIS and supplied that information to HOBAS engineers, who then designed a layout scheme. "I can't believe how well it went, all we did was the measuring and HOBAS took it from there. Perfect!" was the response from Rehak. HOBAS also manufactured short pipes for straight sections that were contained between curves and otherwise inaccessible. These shorts were pulled through the curves, and then installed with a winch. Even in this difficult installation area, Super Excavators was able to keep production rates up to 22-25 pipes per day.



The 66" pipe was pushed through the 72" deteriorated concrete line.

(continued on page 8)



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## LOWEST LIFE CYCLE COST

*(continued from page 7)*

## PERFORMANCE

The project has been progressing very smoothly; grouting the annular space between the HOBAS pipe and the host pipe has begun and has been uneventful. The HOBAS pipes are simply filled about half full of water and a lightweight foam grout is utilized to fill the annular space. The sections that have been grouted to date average about 500 feet in length.

## QUALITY AND SERVICE

The MMSD is satisfied since; sliplining with HOBAS ensures that the structural integrity of the line will be maintained for many years to come. AB&H is pleased with their choice to specify HOBAS pipes on this project and plan to include them on future projects as well. Super Excavators is not only delighted with the product, but with the quality of service they have received throughout the project. HOBAS' commitment to quality and service has again resulted in customer satisfaction.



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