



Special Research Study:

Comparison of Pipeline Installation Lengths and Costs in Two Cities

Client: American Chemistry Council

**BCC Research
49 Walnut Park
Wellesley, Massachusetts
USA**

February 15, 2016

INTRODUCTION

The American Chemistry Council (ACC) is interested in an analysis of municipal pipeline markets in moderate to large U.S. cities, many of which use mainly or only ductile iron, cement, and other non-plastic materials. These long-standing actions remain in spite of significantly lower cost of plastic pipe, in part because suppliers of plastic pipe are not currently permitted to bid on many municipal projects. ACC seeks to remedy this situation through focused legislation that would open up municipal bidding processes to all forms of viable pipe materials, including plastics.

PURPOSE

The primary objective of this study was to provide a comparison of water transmission (pressurized) pipeline installation and costs between two Ohio communities: one allowing open bidding for pipeline materials, and one that excludes plastic pipelines from their bidding process. Data gathered will help the Client to better understand:

- How much pipe is installed each year
- Pipe sizing
- Pipe material, where data are available
- Pipe cost and cost differential between communities that do and do not allow open bidding

METHODOLOGY

Information collected in support of this study was collected through a combination of primary and secondary research methods. Primary data sources included phone based interviews with City staff, and with one regional pipeline supplier, in order to acquire and verify/benchmark pipeline data. Due to the potentially sensitive nature of the requested data, BCC initiated its data search using secondary sources. Much of the data collected was based on secondary sources including bid and bid award notices, council meeting minutes, contracts, planning documents, water master plans, and other available documentation that may contain information on pipe installation lengths, sizes, and schedules.

BCC collected public data that included pipeline lengths, materials, diameter, and published costs. However, most data sources also included extraneous information and costs, above and beyond simple pipeline cost. For example, most pipeline projects are bid out as a cost for construction and completion of the entire project, including pipelines as well as appurtenances (valves, fire hydrants) and also roadwork and earthwork (pavement, fill, sidewalks, etc.). Extracting pipeline costs from overall bid costs presented a challenge for much of the data that we collected, because in some cases, pipeline costs were not broken out explicitly. For these projects, we developed an estimation tool to help evaluate pipeline costs based on total construction. The tool compares pipeline costs to total installation costs, assuming in-road construction in an

urban area, based on pipeline diameter, using data collected in support of the project as well as available engineering and cost estimation data (Figure 1).

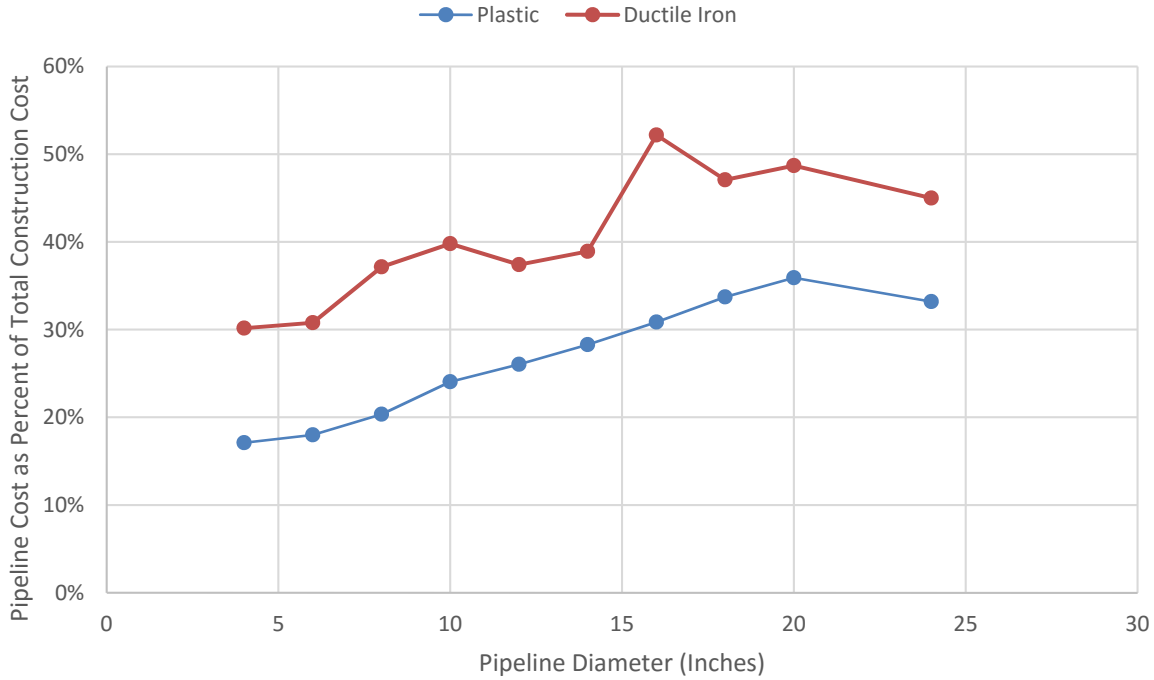


Figure 1: Percentage of Total Construction Cost Required for Pipeline Capital Cost.

Pipeline diameter data were available for approximately 40 to 65% of all projects identified, depending on the city. Where no data were available, pipeline diameter was estimated based on average available diameter data for that city.

TASK 1: CITY OF COLUMBUS PIPELINE INSTALLATION AND COST DATA

This task provides an assessment pipeline installation and cost data for the City of Columbus, OH, a city that does not offer open bidding for pipeline projects. Based on data and other information collected in support of this project, Columbus relies on ductile iron piping for all of its major water supply pipeline projects. Data for the City were collected primarily based on bid response and awarded contracts for City pipeline projects, which were readily publicly available in City Council meeting packages, through contract documentation, and as data made available to BCC research. Note that pipeline costs for the 4” to 6” category were not available for 2015, and therefore were estimated assuming a 3% cost escalation.

Table 1 summarizes the length and diameter of pipelines installed in Columbus during 2013, 2014, and 2015. Note that 2015 data were partially estimated due to lack of available data for a portion of the year. Similarly, Table 2 summarizes total pipeline costs by diameter and year, while Table 3 summarizes pipeline cost per foot, and Table 4 summarizes pipeline materials by length of pipeline installed. Finally, we estimated typical pipeline costs for Columbus over the study period as a function of diameter. These are shown in Table 5.

Data show that all major pressure-main pipeline installations of at least 4” in diameter in Columbus were ductile iron during the study period. Additional data are available showing very small installations (on the order of hundreds of feet or less) which include plastic pipe. However, these data are not considered here because the economics of such small scale installations were not readily comparable to the larger scale installations, and because they represented a very small proportion of annual pipeline installation (<1%).

Table 1: Columbus, OH: Linear Feet of Pipelines Installed, 2013-2015

Pipeline Diameter (Inches)	Pipeline Length Installed per Year (feet)		
	2013	2014	2015 (est.)
4" to 6"	13,100	18,240	18,605
6" to 12"	25,010	36,000	36,720
Over 12"	44,010	24,800	25,296
Total	82,120	79,040	80,621

Source: BCC Research.

Table 2: Columbus, OH: Pipeline Cost, 2013-2015

Pipeline Diameter (Inches)	Pipeline Cost, Total per Year		
	2013	2014	2015 (est.)
4" to 6"	\$282,567	\$473,328	\$497,278
6" to 12"	\$1,454,081	\$1,866,000	\$1,960,420
Over 12"	\$3,424,467	\$2,057,789	\$2,161,913
Total	\$5,161,116	\$4,397,117	\$4,619,611

Source: BCC Research.

Table 3: Columbus, OH: Pipeline Cost per Foot

Pipeline Diameter (Inches)	Pipeline Cost, Average per Foot		
	2013	2014	2015 (est.)
4" to 6"	\$21.57	\$25.95	\$26.73
6" to 12"	\$58.14	\$51.83	\$53.39
Over 12"	\$77.81	\$82.98	\$85.46

Source: BCC Research.

Table 4: Columbus, OH: Pipeline Materials

Pipeline Materials	Pipeline Length Installed		
	2013	2014	2015
Ductile Iron	82,120	79,040	80,621
Concrete or vitrified clay	0	0	0
Plastics	0	0	0
Total	82,120	79,040	80,621

Source: BCC Research.

Table 5: Columbus: Estimated Average Pipeline Cost, by Pipeline Diameter

Diameter (Inches)	Estimated Average Cost per Foot
4	\$29.07
6	\$32.97
8	\$51.71
10	\$63.91
12	\$72.10
14	\$85.43
16	\$128.53
18	\$128.53
20	\$140.78

Source: BCC Research.

TASK 2: DELAWARE COUNTY PIPELINE INSTALLATION AND COST DATA

This task provides an assessment pipeline installation and cost data for outlying areas located north of the City of Columbus, in Delaware County, including the County as well as Delaware, Dublin, Westerville, and Powell. No explicit limitations on pipeline materials were identified in the area. Data for the area were collected primarily based on bid response and awarded contracts for pipeline projects, in addition to information collected from city staff.

Table 6 summarizes the length and diameter of pipelines installed in Delaware County during 2013, 2014, and 2015. Note that 2013 data were partially estimated due to lack of available data for a portion of the year. Similarly, Table 7 summarizes total pipeline costs by diameter and year, while Table 8 summarizes pipeline cost per foot, and Table 9 summarizes pipeline materials by length of pipeline installed. Note that pipeline costs for the 4" to 6" category were not available for 2015, and therefore were estimated assuming a 3% cost escalation. Finally, we estimated typical pipeline costs for the region over the study period as a function of diameter. These are shown in Table 10.

Data show a mix of plastic and iron pipeline installation in the region. Also, 2015 includes a very large project located in Westerville, which brought up the pipeline installation numbers during that year.

Table 6: Delaware County: Linear Feet of Pipelines Installed, 2013-2015

Pipeline Diameter (Inches)	Pipeline Length Installed per Year (feet)		
	2013 (est.)	2014	2015
4" to 6"	17,000	18,900	32,000
6" to 12"	20,500	22,500	46,300
Over 12"	2,500	1,500	72,400
Total	40,000	42,900	150,700

Source: BCC Research.

Table 7: Delaware County: Pipeline Cost, 2013-2015

Pipeline Diameter (Inches)	Pipeline Cost, Total per Year		
	2013	2014	2015 (est.)
4" to 6"	\$411,060	\$279,484	\$487,396
6" to 12"	\$957,350	\$749,821	\$1,557,995
Over 12"	\$225,375	\$157,995	\$5,852,092
Total	\$1,593,785	\$1,187,300	\$7,897,483

Source: BCC Research.

Table 8: Delaware County: Pipeline Cost per Foot

Pipeline Diameter (Inches)	Pipeline Cost, Average per Foot		
	2013	2014	2015 (est.)
4" to 6"	\$ 24.18	\$ 14.79	\$ 15.23
6" to 12"	\$ 46.70	\$ 33.33	\$ 33.65
Over 12"	\$ 90.15	\$ 105.33	\$ 80.83

Source: BCC Research.

Table 9: Delaware County: Pipeline Materials

Pipeline Materials	Pipeline Length Installed		
	2013	2014	2015
Ductile Iron	7,450	3,200	66,500
Concrete or vitrified clay	-	-	-
Plastics	32,550	41,400	84,200
Total	40,000	44,600	150,700

Source: BCC Research.

Table 10: Delaware County: Estimated Average Pipeline Cost, by Pipeline Diameter

Diameter (Inches)	Estimated Average Cost per Foot
4	\$ 18.92
6	\$ 21.46
8	\$ 33.65
10	\$ 41.59
12	\$ 46.92
14	\$ 55.60
16	\$ 83.64
18	\$ 83.64
20	\$ 91.61

Source: BCC Research.

SUPPLEMENTAL TASK: DAYTON PIPELINE INSTALLATION AND COST DATA

This supplemental task documents data that were collected for the City of Dayton. Based on discussions with the City engineer and staff in charge of writing requests for bids, the City currently maintains a portion of its water supply system as plastic, with most still as ductile iron. In order to ensure compatibility, the City’s typical process is to issue requests for proposals that specify the type of material allowable for a given project. Thus, while Dayton does not allow open bidding, it does provide for the installation of plastic water distribution pipe in a number of neighborhoods within the City, especially in newer areas. Data for the area were collected primarily based on bid response and awarded contracts for pipeline projects, in addition to information collected from city staff.

Table 11 summarizes the length and diameter of pipelines installed in Dayton during 2013, 2014, and 2015. Note that 2013 data were partially estimated due to lack of available data for a portion of the year. Similarly, Table 12 summarizes total pipeline costs by diameter and year, while Table 13 summarizes pipeline cost per foot, and Table 14 summarizes pipeline materials by length of pipeline installed. Finally, we estimated typical pipeline costs for the region over the study period as a function of diameter. These are shown in Table 15.

City engineers indicated that the City may more strongly transition to plastic pipelines in the future. Key hurdles identified included the cost of having to train staff and maintain repair/replacement supplies for plastic pipeline, in addition to ductile iron pipeline. However, City engineers expected that a transition might increase in intensity in the

coming years, given that a similar situation occurred in the 1990s as the City began installing plastic sewer lines as preferred over other materials.

Table 11: Dayton: Linear Feet of Pipelines Installed, 2013-2015

Pipeline Diameter (Inches)	Pipeline Length Installed per Year (feet)		
	2013 (est.)	2014	2015
4" to 6"	7,400	8,960	6,495
6" to 12"	32,200	38,992	30,518
Over 12"	-	-	20
Total	39,600	47,952	37,033

Source: BCC Research.

Table 12: Dayton: Pipeline Cost, 2013-2015

Pipeline Diameter (Inches)	Pipeline Cost, Total per Year		
	2013	2014	2015 (est.)
4" to 6"	\$229,770	\$282,139	\$204,519
6" to 12"	\$1,597,120	\$2,016,315	\$1,578,116
Over 12"	-	-	\$2,455
Total	\$1,826,890	\$2,298,453	\$1,785,089

Source: BCC Research.

Table 13: Dayton: Pipeline Cost per Foot

Pipeline Diameter (Inches)	Pipeline Cost, Average per Foot		
	2013	2014	2015 (est.)
4" to 6"	\$ 31.05	\$ 31.49	\$ 31.49
6" to 12"	\$ 49.60	\$ 51.71	\$ 51.71
Over 12"			\$ 122.73

Source: BCC Research.

Table 14: Dayton: Pipeline Materials

Pipeline Materials	Pipeline Length Installed		
	2013	2014	2015
Ductile Iron	35,640	43,157	33,330
Concrete or vitrified clay	-	-	-
Plastics	3,960	4,795	3,703
Total	39,600	47,952	37,033

Source: BCC Research.

Table 15: Dayton: Estimated Average Pipeline Cost, by Pipeline Diameter

Diameter (Inches)	Estimated Average Cost per Foot
4	\$ 27.76
6	\$ 31.49
8	\$ 49.38
10	\$ 61.03
12	\$ 68.86
14	\$ 81.58
16	\$ 122.73
18	\$ 122.73
20	\$ 134.44

Source: BCC Research.

SUMMARY FINDINGS AND CONCLUSIONS

Key findings of this project indicate that Delaware County, which does not restrict pipeline bidders to a particular material, enjoys the lowest cost, on average, for pipeline capital costs. Columbus, which restricts water pipeline materials to ductile iron, and Dayton, which restricts to either ductile iron or plastics on a project by project basis, both received bids having a higher average pipeline cost than those located in Delaware County. Total pipeline construction costs (including appurtenances, asphalt, etc.) using plastic pipelines were 13.6% lower, on average, than total pipeline construction costs using ductile iron pipelines. In order to easily compare costs among the regions, the following chart estimates pipeline cost by diameter, for each of the three areas considered under this project. On average, pipe capital cost (not including appurtenances, asphalt, etc.) were 32% to 35% lower for plastic pipe than for ductile iron.

Key hurdles in the way of a more significant transition to reliance on plastic pipelines include institutional inertia (political inertia, lack of familiarity with plastic systems), lack of trained maintenance staff, and lack of replacement supplies on-hand (i.e., acquiring

replacement and maintenance supplies would require additional costs for a given project). Also, based on discussions with water system engineers, transitioning from iron to plastic can in their opinion be difficult because meshing existing ductile iron pipelines with plastic pipelines can prove problematic and subject to increased failure rates.

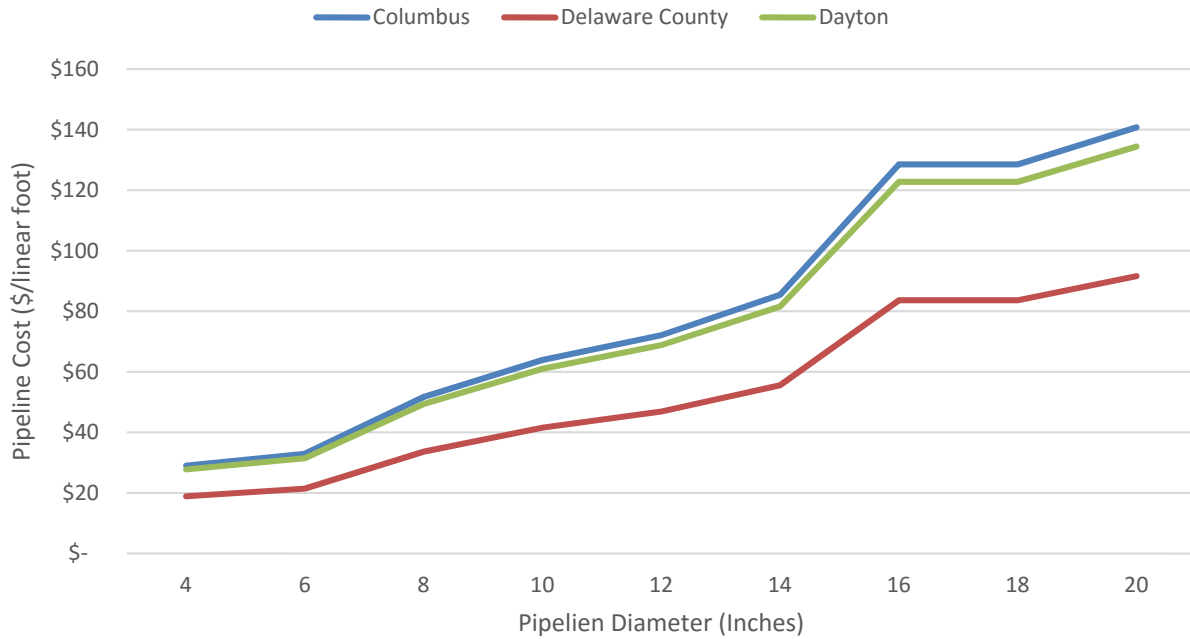


Figure 2: Estimated Pipeline Capital Costs by Pipeline Diameter, for the City of Columbus, Delaware County, and the City of Dayton.