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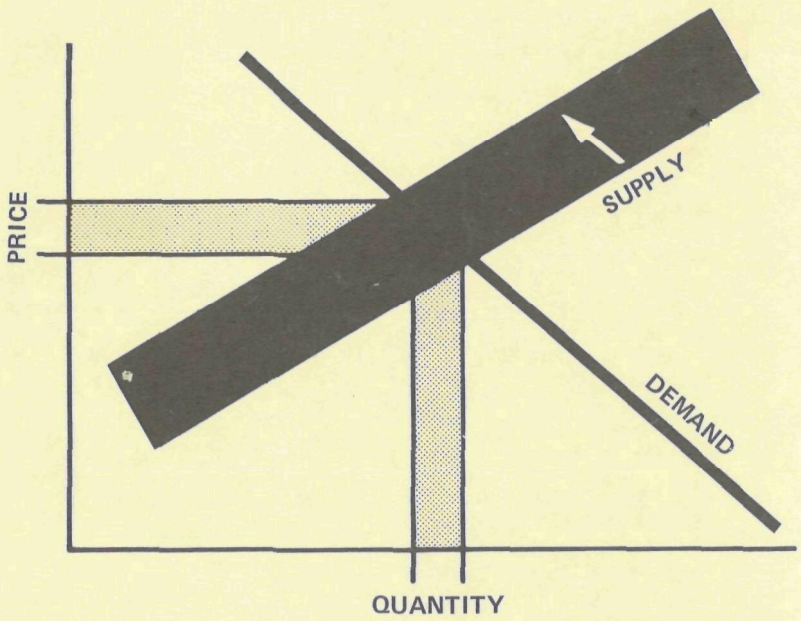
GUIDANCE ECONOMIC ANALYSIS FOR THE CONCRETE PRODUCTS INDUSTRIES



U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Analysis and Evaluation
Office of Water and Hazardous Material
Washington, D.C. 20460

EPA-440/2-77-016

GUIDANCE ECONOMIC ANALYSIS FOR THE CONCRETE PRODUCTS INDUSTRIES

Report to

U.S. Environmental Protection Agency
Office of Analysis and Evaluation
Office of Water Planning and Standards
Washington, D.C. 20460

July, 1977

Contract No. 68-01-1541

PREFACE

The attached document is a contractors' study prepared for the Office of Water Planning and Standards of the Environmental Protection Agency ("EPA"). The purpose of the study is to analyze the economic impact which could result from the application of alternative effluent limitation guidelines and standards of performance to be established under sections 304(b) and 306 of the Federal Water Pollution Control Act, as amended.

The study supplements the technical study ("EPA Guidance Document") supporting the issuance of proposed guidelines under sections 304(b) and 306. The Guidance Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports proposal of certain effluent limitation guidelines and standards of performance based upon an analysis of the feasibility of these guidelines and standards in accordance with the requirements of sections 304(b) and 306 of the Act. Presented in the Guidance Document are the investment and operating costs associated with various alternative control and treatment technologies. The attached document supplements this analysis by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

The study has been prepared with the supervision and review of the Office of Water Planning and Standards of the EPA. This report was submitted in fulfillment of Contract No. BOA 68-01-1541. Task Order No. 40. This report reflects work substantially completed as of November 1976, but also includes supplementary analysis based on additional and modified data offered in March/April 1977.

The study has not been reviewed by EPA and is not an official EPA publication. The accompanying study shall have standing in any EPA proceeding or court proceeding only to the extent that it represents the views of the contractor who studied the subject industry. It cannot be cited, referenced, or represented in any respect in any such proceeding as a statement of EPA's views regarding the subject industry.

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EXECUTIVE SUMMARY

A. SCOPE OF WORK

The U.S. Environmental Protection Agency (EPA) is in the process of issuing interim final effluent Guidelines for the concrete products industries and therefore has contracted with Arthur D. Little, Inc., to analyze the economic impact of these Guidelines for various levels of treatment. The Guidelines, appropriate technologies, and their related costs are contained in the *Technical Guidance Document for Effluent Limitations Guidelines and Standards of Performance, the Concrete Products Industries* (known as the "Guidance Document") prepared by Versar Inc. of Springfield, Virginia.

The economic impact analysis, conducted between October 1975 and November 1976 and later supplemented on the basis of additional and modified data offered in March/April 1977, covers the following industries:

Concrete Block and Brick	— SIC 3271
Concrete Products, N.E.C.	— SIC 3272
Ready-Mixed Concrete	— SIC 3273

It evaluates what price or financial effects could result from the implementation of these Guidelines, how many plants would be shut down rather than be brought into compliance, and the resultant production, employment, and community effects; and what investments would be required by the operators to meet the regulations. It does not evaluate the capability of the assumed treatment technology to meet the effluent Guidelines, or the reasonableness of the investment and operating costs. All costs of treatment have been restated in 1974 dollars by applying appropriate factors.

B. FINDINGS

1. Concrete Block and Brick — SIC 3271

The concrete block and brick industry has been subdivided into plants that use an autoclave curing process (125 establishments) and those that cure their product with low-pressure steam (1263 establishments).

About 90% of the autoclave curing segment treats the suspended solids, although no plant adjusts the pH of the effluent. The total capital cost for this segment to achieve Guideline Level C is estimated to be $170,000 (Table 1), or 4.7% of the average annual investment. The capital requirements are about the same for Level D technology but increase substantially to $9.6 million for Level E, equivalent to 262.7% of the average annual investment. The annualized cost for this segment, including capital charges, is about 0.1% of sales for Levels C and D and 2.8% for Level E.

The expected price increase due to pollution control ranges from 0.2% for Level C to 4% for Level E. No closures are anticipated for either Level C or Level D but up to 25 plants, representing 20% of the autoclave curing segment's capacity, may close. Under those conditions, 500 employees might be affected and community effects are possible.

TABLE 1

INDUSTRY SUMMARY
CONCRETE BLOCK AND BRICK: HIGH PRESSURE AUTOCLAVE CURING

SIC Code:	3271		
Plants in Segment:	125		
Percent Total Plants in Industry:	9%		
Percent of Segment with Level C Treatment in Place:	0 (90% treat suspended solids)		
	C	**D**	**E**
Cost of Pollution Abatement			
Capital Cost for Segment			
Total Capital Cost	$170,000	$156,000	$9.6 million
Total Capital Expenditures as % of Average Annual Investment	4.7	4.3	262.7
Total Capital Expenditures as % of Gross Book Value of Fixed Assets	0.2	0.2	14.8
Annualized Costs for Segment			
Total Incremental Increase Including Capital Charges	$180,000	$125,000	$4.2 million
Total Incremental Increase Excluding Capital Charges	$162,000	$107,000	$2.6 million
Total Incremental Increase including Capital Charges as % of Sales	0.1	0.1	2.8
Expected Price Increase			
Expected % Increase Due to Pollution Control	0.2	0.3	4.0
Plant Closures			
Total Closures Anticipated	None	None	25
% Reduction of Segment Capacity Due to Closures			20
Employment			
Total Employees Affected	None	None	500
% of Total Employees in Segment	None	None	20
Community Effects	None	None	Possible
Impact on Industry Growth	None	None	None
Balance of Trade Effects	None	None	None

As with the autoclave curing segment, 90% of the plants in the low-pressure steam curing segment treat suspended solids but no plants are known to modify the pH of the effluent. The total capital cost of pollution abatement under Level C is estimated to be $4.7 million (Table 2), equivalent to 18.4% of average annual investment. The capital expenditures under Level D are equivalent to 6.7%. The segment would have to expend $50 million to satisfy pollution abatement Guidelines under Level E, equivalent to 196% of the average annual investment and 15% of gross book value of fixed assets.

The total incremental increase in annualized costs, including capital charges, ranges up to 1.2% of sales for Level E, and could result in a 1.7% price increase. No plant closures or other effects are anticipated under Levels C or D, but the capital investment requirements of Level E could cause up to 10% of industry capacity (about 225 plants) to close. These closures would impact 2,000 employees and produce some community effects, but only have a limited impact on industry growth.

2. Concrete Products, N.E.C. — SIC 3272

This industry has been subdivided into those plants that manufacture concrete pipe (457 establishments) and those that manufacture precast and prestressed concrete (about 3200 establishments). The concrete pipe category has been further segmented into those facilities (436), that primarily produce non-pressure pipe and have small wastewater volumes, and those (21) that produce concrete pressure pipe and have large wastewater volumes.

The total capital cost of pollution abatement for the non-pressure segment of the concrete pipe industry (Table 3) is estimated to be $3 million under Level B, or 11.7% of average annual investment. This amount increases to about $30 million under Level C (117%). The total incremental increase in annualized costs for the segment, including capital charges, is 0.3% of sales for Level B and 1.9% (7.6 million) for Level C.

A price increase of up to 1.5% could occur under Level C for the non-pressure segment. Capital requirements could result in the closure of 10-20 plants, equivalent to only about 2% of industry capacity and employment. Community effects are unlikely.

In the pressure pipe segment 85% of the plant have Level B technology in place and thus the segment as a whole must incur a total capital cost of only $0.3 million to achieve that Guideline level — 4.1% of average annual investment (Table 4). Capital requirements increase to $1.7 million for Level C, equivalent to 23.3% of average annual investment, and $7.4 million (102.8%) for Level D. The total incremental increase in annualized costs, including capital charges for the segment, is up to 0.3% of sales for Level C, and 2.5% for Level D. The expected price increase is 2.3% for Level D. Plant closures are unlikely and thus probably no employees or communities will be affected.

About 50% of the plants in the precast and prestressed concrete segment have Level B treatment in place (Table 5). The segment as a whole must incur a total capital cost for pollution abatement of $6.4 million under Level B and about the same amount for Level C. Capital costs increase sharply to $108 million under Level D, equivalent to 138.2% of the average annual investment and 8.3% of the gross book value of fixed assets.

TABLE 2

INDUSTRY SUMMARY
CONCRETE BLOCK AND BRICK: LOW-PRESSURE STEAM CURING

SIC Code:	3271
Plants in Segment:	1263
Percent Total Plants in Industry:	91
Percent of Segment with Level C Treatment in Place:	0 (90% treat suspended solids)

	C	D	E
Cost of Pollution Abatement			
Capital Cost for Segment			
Total Capital Cost	$4.7 million	$0.9 million	$50.0 million
Total Capital Expenditures as % of Average Annual Investment	18.4	6.7	196.1
Total Capital Expenditures as % of Gross Book Value of Fixed Assets	1.4	0.3	14.9
Annualized Costs for Segment			
Total Incremental Increase Including Capital Charges	$1.6 million	$1.1 million	$11.2 million
Total Incremental Increase Excluding Capital Charges	$1.1 million	$1.0 million	$3.4 million
Total Incremental Increase including Capital Charges as % of Sales	0.2	0.1	1.2
Expected Price Increase			
Expected % Increase Due to Pollution Control	0.3	0.4	1.7
Plant Closures			
Total Closures Anticipated	None	None	about 225
% Reduction of Segment Capacity Due to Closures			10
Employment			
Total Employees Affected	None	None	2000
% of Total Employees in Segment			10
Community Effects	None	None	Some
Impact on Industry Growth	None	None	Limited
Balance of Trade Effects	None	None	None

TABLE 3

INDUSTRY SUMMARY
CONCRETE PRODUCTS N.E.C.:
CONCRETE PIPE (SMALL WASTEWATER, NON-PRESSURE)

SIC Code:	3272
Plants in Segment:	436
Percent Total Plants in Industry:	95.4
Percent of Semgment with Level B Treatment in Place:	0

	B	C
Cost of Pollution Abatement		
Capital Cost for Segment		
Total Capital Cost	$3.0 million	$29.9 million
Total Capital Expenditures as % of Average Annual Investment	11.7	117.3
Total Capital Expenditures as % of Gross Book Value of Fixed Assets	0.4	4.0
Annualized Costs for Segment		
Total Incremental Increase Including Capital Charges	$1.7 million	$7.6 million
Total Incremental Increase Excluding Capital Charges	$1.3 million	$2.8 million
Total Incremental Increase including Capital Charges as % of Sales	0.3	1.9
Expected Price Increase		
Expected % Increase Due to Pollution Control	0.3	1.5
Plant Closures		
Total Closures Anticipated	None	10-20
% Reduction of Segment Capacity Due to Closures		2
Employment		
Total Employees Affected	None	250
% of Total Employees in Segment		2
Community Effects	None	Unlikely
Impact on Industry Growth	None	None
Balance of Trade Effects	None	None

TABLE 4

INDUSTRY SUMMARY
CONCRETE PRODUCTS, N.E.C.: CONCRETE PIPE
(LARGE WASTEWATER, PRESSURE)

SIC Code:	3272
Plants in Segment:	21
Percent Total Plants in Industry:	4.6
Percent of Segment with Level B Treatment in Place:	85

	B	C	D
Cost of Pollution Abatement			
Capital Cost for Segment			
Total Capital Cost	$0.3 million	$1.7 million	$7.4 million
Total Capital Expenditures as % of Average Annual Investment	4.1	23.3	102.8
Total Capital Expenditures as % of Gross Book Value of Fixed Assets	0.2	1.1	4.8
Annualized Costs for Segment			
Total Incremental Increase Including Capital Charges	$50,000	$444,000	$3.3 million
Total Incremental Increase Excluding Capital Charges	$20,000	$235,000	$2.6 million
Total Incremental Increase including Capital Charges as % of Sales	Negligible	0.3	2.5
Expected Price Increase			
Expected % Increase Due to Pollution Control	0.2	0.3	2.3
Plant Closures			
Total Closures Anticipated	None	None	Unlikely
% Reduction of Segment Capacity Due to Closures			
Employment			
Total Employees Affected	None	None	Probably None
% of Total Employees in Segment			
Community Effects	None	None	None
Impact on Industry Growth	None	None	None
Balance of Trade Effects	None	None	None

TABLE 5

INDUSTRY SUMMARY
CONCRETE PRODUCTS, N.E.C.: PRECAST AND PRESTRESSED CONCRETE

SIC Code:	3272
Plants in Segment:	About 3200
Percent Total Plants in Industry:	100
Percent of Segment with Level B Treatment in Place:	50

	B	C	D
Cost of Pollution Abatement			
Capital Cost for Segment			
Total Capital Cost	$6.4 million	$6.8 million	$107.9 million
Total Capital Expenditures as % of Average Annual Investment	8.1	8.6	138.2
Total Capital Expenditures as % of Gross Book Value of Fixed Assets	0.5	0.5	8.3
Annualized Costs for Segment			
Total Incremental Increase Including Capital Charges	$3.2 million	$8.1 million	$43.3 million
Total Incremental Increase Excluding Capital Charges	$2.5 million	$7.3 million	$27.3 million
Total Incremental Increase including Capital Charges as % of Sales	0.2	0.6	3.0
Expected Price Increase			
Expected % Increase Due to Pollution Control	0.4	0.9	3.2
Plant Closures			
Total Closures Anticipated	None	None	Numerous
% Reduction of Segment Capacity Due to Closures			Unknown
Employment			
Total Employees Affected	None	None	Unknown
% of Total Employees in Segment			
Community Effects	None	None	Some
Impact on Industry Growth	None	None	Some
Balance of Trade Effects	None	None	None

The total incremental increase in annualized cost, including capital charges, for the segment is up to 0.6% for Level C and 3% for Level D. Price increases could amount to less than 1% for Levels B or C and more than 3% for Level D. Because of the considerable capital cost requirements for Level D, however, numerous but unknown numbers of closures can be anticipated, with consequent impact on employment and communities. It is also likely that industry growth would be affected.

3. Ready-Mixed Concrete — SIC 3273

The ready-mixed concrete industry has been segmented into those establishments that operate stationary, portable and mobile plants. Mobile ready-mixed concrete plants have no process effluent. The technology of those in the portable segment is similar to that of the stationary operations but little data are available on their economic characteristics. The analysis therefore focused on the 4,896 stationary plants. The Technical Guidance Document offers a complex combination of alternative treatment levels for the permanent ready-mixed concrete segment. These options are summarized as four different alternatives:

- **Alternative 1:** A minimum of treatment Level B (pond settling of suspended solids) plus pH adjustments for all plants. Plants with no treatment (Level A) would be required to construct settling ponds and incorporate pH adjustment (go from Level A to Level C). All other plants, except those with runoff systems, would be required to add pH adjustment to the treatment stream. Those at Level B would then go to treatment Level C, those at Level D would go to treatment Level E, and those at Level F would go to treatment Level G.
- **Alternative 2:** A minimum of treatment Level D (sloped slab system; recovery of aggregate; partial recycle of process wastewater; no recovery of cement fines; and no pH adjustment). Plants with no treatment (Level A) and plants at Level B (a total of 1,584 plants) are affected; the remaining 3,312 plants are unaffected.
- **Alternative 3:** A minimum of treatment Level F (mechanical clarification system; recovery of aggregate; partial recycle of process wastewater; no recovery of cement fines; no pH adjustment). Plants currently with no treatment (Level A), plants at Level B, and plants at Level D (a total of 2,352 plants out of 4,896) will be affected.
- **Alternative 4:** Total recycle of process wastewater, with reuse of aggregate and cement fines (Level I). A total of 2,496 plants will be affected, because only those 2,400 plants with runoff systems are currently in compliance.

The total capital cost of pollution abatement for this segment ranges from $15 million for Alternative 1 to $140 million for Alternative 4 and from 7.5% to 70% of average annual investment (Table 6). The total incremental increase in annualized cost, including capital charges, for the segment as a percentage of sales ranges from

TABLE 6

INDUSTRY SUMMARY
READY-MIXED CONCRETE

SIC Code:	3273
Plants in Segment:	4896 (stationary)
Percent Total Plants in Industry:	Unknown (100% of stationary)
Percent of Segment with Alternative 1 Treatment in Place:	49

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Cost of Pollution Abatement				
Capital Cost for Segment				
Total Capital Cost	$15.0 million	$27.4 million	$86.8 million	$139.3 million
Total Capital Expenditures as % of Average Annual Investment	7.5%	13.7%	43.4%	70.0%
Total Capital Expenditures as % of Gross Book Value of Fixed Assets	0.9	1.6	5.1	8.2
Annualized Costs for Segment				
Total Incremental Increase Including Capital Charges	$6.4 million	$7.8 million	$16.3 million	$120.9 million
Total Incremental Increase Excluding Capital Charges	$4.6 million	$4.6 million	$1.0 million	$92.4 million
Total Incremental Increase including Capital Charges as % of Sales	0.15	0.19	0.39	2.9
Expected Price Increase				
Expected % Increase Due to Pollution Control	0.1% to 0.5	0.1% to 0.7	0.2% to 1.1	1.4% to 4.8
Plant Closures				
Total Closures Anticipated	None	Up to 120	Up to 1,032	Up to 2,040
% Reduction of Segment Capacity Due to Closures		0.9%	16.1%	37.6%
Employment				
Total Employees Affected	None	Up to 252	Up to 12,300	Up to 33,500
% of Total Employees in Segment		3	14	38
Community Effects	None	60-120	500-1000	1000-2000
Impact on Industry Growth*	None	None	None	None
Balance of Trade Effects	None	None	None	None

*Note: This industry is not expanding.

0.2% to 2.9%, equivalent to $121 million for Alternative 4. Price increases due to pollution control requirements are 1% or less for Alternatives 1 through 3, but could be as high as 4.8% for Alternative 4 for specific plants under certain assumptions.

Plant closures are anticipated for each of the Alternatives 2 through 4 but are equivalent to only 1% of segment capacity for Alternative 2 and as much as 38% for Alternative 4. As the result of the closures under Alternative 4, up to 33,500 employees might be affected in 1,000 to 2,000 communities. As it is not anticipated that the industry will need to expand the number of facilities in operation in order to satisfy future demand, no impact on industry growth is expected.

I. CONCRETE BLOCK AND BRICK (SIC 3271)

A. PRODUCTS, MARKETS AND SHIPMENTS

Concrete block and brick, as well as other decorative precast cementitious units, are manufactured by semi-automated processes using cement, sand, and other construction aggregates. The principal products include:

1. Lightweight aggregate structural block, using cinder, expanded slag or other lightweight aggregates as an ingredient.
2. Heavyweight aggregate structural block, using conventional quarried sand or gravel.
3. Decorative block.
4. Concrete brick.

While the sizes of both bricks and blocks can vary considerably, depending upon the use to which they are put, most block units have an 8" x 16" face and are between 4" and 12" thick. They usually are manufactured with cavities to reduce the weight and improve various other properties, but may be solid. Lightweight aggregate blocks weigh 20 to 35 lb per 8" x 8" x 16" equivalent, while heavyweight units weigh from 33 to 45 lb. Concrete bricks are smaller than block and generally are approximately 8" x 3-⅝" x 2-¼".

The total value of shipments of concrete brick and block by all manufacturing establishments (Table I-1) increased from $513 million in 1965 to $795.7 million in 1972 and to $892 million in 1973, a rate of growth (current dollars) greater than 7% per year. Of the 1972 shipments 85% ($676.3 million) was accounted for by firms classified under SIC 3271, while the remaining $119.4 million were shipped by firms operating primarily in such other industry sectors as ready-mixed concrete, sand and gravel, and precast concrete. Total shipments within SIC 3271 amounted to $855.7 million in that Census year, the balance of non-block shipments ($179.4 million) coming from similar products.

Table I-2 indicates the quantity and value of concrete block and brick shipments for 1967 and 1972. Shipments of lightweight aggregate structural block appear to be greater in 1972 than those using heavyweight aggregates. However, industry sources suggest that a large proportion of the undistributed value of shipments ($168.7 million) was in the heavyweight category and that shipments of the two types of block were roughly the same.

Industry estimates of block shipments totalled 3.75 billion units in 1973, up at an average rate of about 3.7% per year from 1965, but then dropped in each of the two most recent years because of the considerable slowdown in construction activity. Block and brick are used almost exclusively as structural or non-structural walls in buildings

TABLE I-1

VALUE OF SHIPMENTS BY ALL MANUFACTURING ESTABLISHMENTS–CONCRETE BRICK & BLOCK 1965-1976

Year	$ Million
1965	513.2
1966	521.8
1967	502.1
1968	553.3
1969	581.2
1970	568.0
1971	649.1
1972	795.7
1973	892.4
1974	820.6
1975	700.0 (estimate)
1976	860.0 (projection)

Sources: U.S. Bureau of Census, Annual Surveys; and Census of Manufactures.

as part of the foundation, as a finished load-bearing wall and as the backup for a brick veneer. Decorative units are employed as self-supporting walls, patio screens and in miscellaneous other architectural uses. Consequently, although concrete block and brick do compete with a wide range of cementitious and non-cementitious products, including clay brick, the principal influence on the health and growth of the industry is the level of construction activity. The block industry can thus expect an average real rate of growth of 2.5% to 3% per year to 1980 — a little slower than that experienced in the past decade.

Because most concrete block and brick are used in standard applications, little or no technical promotion or marketing is required on the part of the manufacturer. Exceptions to this generalization are the multi-story, load-bearing building and specialty units that feature certain styles, shapes or colors requested by the architect or builder. In those cases, technical assistance is provided bv the manufacturer or his representative.

Block is normally shipped direct from the manufacturer to the job site and is sold on the basis of unit cost either f.o.b. the plant or delivered. A certain amount of product is also distributed through building materials dealers and lumberyards and the block manufacturer may also sell complementary products, such as sand, gravel, masonry cement, or reinforcing steel to the mason contractor installing the block. The industry is quite active on a national, and sometimes regional, level in general promotion of its product to the architect, developer or contractor.

TABLE I-2

QUANTITY AND VALUE OF SHIPMENTS BY ALL PRODUCERS
CONCRETE BLOCK AND BRICK 1972 AND 1967

Product	Unit of Measure	Total Product Shipments Including Interplant Transfers			
		1972		1967	
		Quantity	Value ($MM)	Quantity	Value ($MM)
Concrete Block and Brick, Total		(X)	795.7	(X)	502.1
Structural block:					
Lightweight aggregate (cinder, expanded slag, pumice, etc.)	Million blocks 8"x8"x16" equiv.	1,814.7[1]	354.4	(S)	265.0
Heavyweight aggregate	do	833.1	220.4	567.0	114.6
Decorative block (such as screen block, split block, slump block, shadowal block, etc.)	do	90.2[1]	29.9	63.6	14.6
Concrete brick	Million bricks	420.7[1]	22.3	479.7	15.4
Concrete block and brick, n.s.k., for companies with 10 employees or more.		(X)	107.0	(X)	57.1
Concrete block and brick, n.s.k., for companies with less than 10 employees.		(X)	61.7	(X)	35.4

(X) – Not Available
(S) – Statistically Unreliable
n.s.k. – Not Specifically Known

Source: Bureau of Census, *Census of Manufactures, 1972,* MC 72(2)-32D

B. INDUSTRY STRUCTURE

1. Types of Firms

According to the 1972 Census (Table I-3), approximately 1300 companies operate about 1388 manufacturing establishments in the concrete brick and block industry. The National Concrete Masonry Association believes that about the same number of plants are operating today. The table also shows a decline in the number of establishments over the 1958-1972 period, resulting from larger average units as smaller ones become uneconomic.

With a few exceptions, the majority of the firms are small, single-plant operations that are located near metropolitan or urban areas, have modest sales, and have a low total capitalization. The few exceptions include companies who have multiple locations or who are horizontally diversified into related industries, such as precast concrete, ready-mixed concrete or clay brick. Little or no integration exists beyond that.

Although most block manufacturers also sell complementary products, as noted above, 79% of the value of shipments of this industry is in the form of concrete brick and block.

2. Types of Plants

Only about 30% of the manufacturing establishments in this industry employ 20 or more people, so the typical operation is small. In fact, the average gross value of fixed assets is only about $19,000 per employee and the average establishment would employ about 16 employees. The average value of shipments of all plants in 1972 was about $643,000, of which 89% was concrete brick and block. Table I-4 reviews this industry by employment size of establishment for 1972; note that nearly half of all plants employ less than 10 people, but only 5% employ 50 or more.

Block plants are located throughout the United States (Table 1-5), with the greatest concentration being in the populated North Central states and in the South. Most plants have been built since World War II and use a fairly automated manufacturing process that includes: batch mixing of cement, water and aggregates; forming the block in a machine which presses, rams or vibrates the moist mix into blocks; and then curing the block with low-pressure steam in a kiln, or with high-pressure steam in an autoclave. (See Section B-3 below.)

Both curing methods are reasonably efficient; loss rates from manufacturing errors or process breakdowns are low for each. However, only about 8% of the plants in this industry utilize the autoclaving process and those plants tend to be more heavily capitalized. Although plants based on either curing process may have an annual capacity of as much as 15 million equivalent units on a single-shift, 250-day year, plants based on autoclave curing generally have larger capacities than kiln-based plants.

TABLE I-3

GENERAL STATISTICS, 1958 TO 1972
CONCRETE BRICK AND BLOCK

	Number of Establishments		All Employees		Production Workers			Value Added by Manufacture ($MM)	Cost of Materials, fuels, etc. ($MM)	Value of Industry Shipments ($MM)	Capital Expenditures, New ($MM)	Gross Value of Fixed Assets ($MM)	End-of Year Inventories ($MM)	Specialization Ratio (%)	Coverage Ratio (%)
	Total	With 20 Employees of More	Number (1,000)	Payroll ($MM)	Number (1,000)	Man-hours (MM)	Wages ($MM)								
1972 Census	1,388	416	22.8	196.0	15.2	31.5	115.0	438.5	421.8	855.7	46.2	(NA)	88.6	93	85
1971 ASM	(NA)	(NA)	21.3	159.9	14.4	29.0	96.6	392.5	383.5	778.4	40.9	396.8	83.7	(NA)	(NA)
1970 ASM	(NA)	(NA)	21.9	151.8	15.1	31.5	94.2	338.2	319.9	653.1	36.9*	385.9	86.0	(NA)	(NA)
1969 ASM	(NA)	(NA)	21.0	152.1	14.2	29.3	90.1	317.7	327.9	644.0	45.7*	364.5	67.0	(NA)	(NA)
1968 ASM	(NA)	(NA)	21.2	146.1	14.6	29.3	86.5	310.9	310.3	621.3	36.5	332.1	60.5	(NA)	(NA)
1967 Census	1,599	349	21.1	130.1	14.6	30.6	77.0	274.2	276.1	550.1	30.5	307.2	60.8	92	86
1966 ASM	(NA)	(NA)	24.4	137.7	17.0	35.7	82.5	296.7	294.9	585.9	33.3	(NA)	66.3	(NA)	(NA)
1965 ASM	(NA)	(NA)	24.7	133.8	17.5	37.5	80.3	284.8	294.9	578.4	28.0	(NA)	62.1	(NA)	(NA)
1964 ASM	(NA)	(NA)	23.5	121.0	16.2	36.3	73.4	258.5	271.6	530.0	24.3	284.5	60.5	(NA)	(NA)
1963 Census	1,841	367	23.8	119.5	16.7	36.1	72.7	245.5	262.8	505.2	31.1	269.0	58.0	92	84
1962 ASM	(NA)	(NA)	22.3	110.7	16.2	37.4	67.4	215.3	243.6	459.1	20.5	248.8	50.0	(NA)	(NA)
1961 ASM	(NA)	(NA)	23.2	110.6	17.0	37.7	67.0	214.4	247.7	460.7	21.2	(NA)	49.3	(NA)	(NA)
1960 ASM	(NA)	(NA)	23.9	111.8	17.6	38.1	68.1	212.4	246.8	457.4	24.8	(NA)	49.8	(NA)	(NA)
1959 ASM	(NA)	(NA)	23.5	106.1	17.4	37.4	66.4	221.4	240.2	458.8	22.9	(NA)	48.7	(NA)	(NA)
1958 Census	1,796	336	22.8	98.1	16.4	32.9	61.3	190.4	224.3	413.7	22.8	(NA)	46.6	90	83

N.A. – Not Available

ASM – Annual Survey of Manufactures

* – Data of Limited Reliability

Source: Bureau of Census, *Census of Manufactures, 1972,* MC 72(2)-32D

TABLE I-4

GENERAL STATISTICS, BY EMPLOYMENT SIZE OF ESTABLISHMENT: 1972

	No. of Establishments	All Employees		Production Workers			Value Added by Manufacture ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures, ($MM)	End-of-Year Inventories ($MM)
		Number (1,000)	Payroll ($MM)	Number (1,000)	Man-hours (MM)	Wages ($MM)					
3271- Concrete Block and Brick											
Establishments, Total	**1,388**	**22.8**	**196.0**	**15.2**	**31.5**	**115.0**	**438.5**	**421.8**	**855.7**	**46.2**	**88.6**
Establishments with an Average of-											
1 to 4 Employees	340	0.6	4.2	0.5	0.9	2.6	13.5	12.2	25.6	1.2	3.4
5 to 9 Employees	265	1.8	14.3	1.3	2.6	8.9	38.0	33.7	71.4	3.5	9.2
10 to 19 Employees	367	5.1	44.4	3.3	7.1	25.5	102.1	102.6	203.3	10.0	21.4
20 to 49 Employees	348	10.2	88.9	6.7	14.3	50.7	191.6	189.0	378.1	20.5	38.4
50 to 99 Employees	58	3.8	31.4	2.5	5.0	18.6	66.8	61.4	128.0	6.2	11.5
100 to 249 Employees	10	1.3	12.7	0.9	1.7	8.6	26.6	23.0	49.2	4.8	4.8
Estabs, Covered by Admin. Record	460	1.7	11.3	1.2	2.3	7.1	32.3	29.3	61.7	2.8	8.1

Source: Bureau of Census, *Census of Manufactures, 1972*, MC 72(2)-32D

TABLE I-5

SHIPMENTS BY CLASS BY GEOGRAPHIC AREA

	1972			1967		
	Number of Plants	Shipment Value ($ MM)	Average Value per Plant ($ MM)	Number of Plants	Shipment Value ($ MM)	Average Value per Plant ($ MM)
Concrete Block and Brick:						
United States	1,388	855.7	0.62	1,599	550.1	0.34
Northeast	291	197.5	0.68	346	130.8	0.38
North Central	474	243.8	0.51	557	185.8	0.33
South	450	290.3	0.65	494	170.5	0.35
West	173	124.0	0.72	202	63.0	0.31

Source: U.S. Bureau of Census, *Census of Manufactures, 1972,* MC 72(2)-32D.

3. Industry Segmentation

The Guidance Document has segmented the concrete brick and block industry according to the method of curing used in the production process: low-pressure steam and high-pressure autoclave. The conventional low-pressure steam curing plants account for 1263 of all the block plants in operation in the United States today. Industry sources estimate that the number of autoclave plants increased from about 85 in 1960 to approximately 185 by 1969 and then declined to about 150 in 1972 and to 125 currently. However, autoclave plants tend to be larger than kiln plants (about 3 million units each versus about 2.4 million for the conventional process). Consequently, they represent about 9% of the manufacturing establishments and approximately 12% of U.S. production and 14% of revenues. The 125 plants also employed an estimated 2500 people in 1975, as indicated below:

Segment	No. of Plants	Millions of Blocks	No. of Employees	1975 Revenues ($MM)
Low pressure steam curing	1,263	2,640	20,500	930
Autoclave	125	360	2,500	152
	1,388	3,000	23,000	1,082

Source: Arthur D. Little, Inc., estimates.

C. FINANCIAL PROFILES

1. Industry Data

The concrete brick and block industry increased its gross value of fixed assets from $332 million in 1968 to about $410 million in 1972, averaging over $40 million in new capital expenditures in each of those years.

Table I-6 shows typical financial ratios from 1972 through 1974 derived from an analysis by Robert Morris Associates of the financial statements of a number of concrete brick and block manufacturers. The firms in question account for a high proportion of the total industry. For example, the 168 statements studied for 1974 account for over 70% of all sales by firms in this industry. An examination of these data shows:

- A wide range in returns on net worth and on total assets between the top and bottom quartiles.
- Before-tax profits on sales of 5.5% in 1974, but higher than this in prior years.
- Average assets of $3.2 million and average sales of $4.8 million for the 168 units studied in 1974, but a wide range that is very heavily skewed to the lower end.

As fewer companies account for a larger proportion of total sales volume, the average size of the typical plant will increase and profit margins (barring cyclical construction industry slowdowns) should generally improve. Also, the industry is becoming more capital intensive, rather than labor intensive; this trend should help it to maintain better margins when the plant is fully utilized but exposes the operator to the risk of poorer margins in an economic downturn.

2. Financial Profile for Representative Plants

In Tables I-7 through I-10, we have constructed typical balance sheets and income statements for the representative low-pressure steam curing and high-pressure autoclave curing plants, as defined in the Guidance Document for the cost-benefit analysis. The representative high-pressure curing plant has an annual production of 170,000 metric tons (10 million blocks) and sales of about $3.2 million. The after-tax profit is equivalent to about 3.3% of sales and 14.9% on equity. The ratio of long-term debt to total capital is approximately 36%; the gross profit margin is 26.9% and annual cash flow about $400,000.

The annual production for the low-pressure steam curing plant is 60,000 metric tons (3.5 million blocks), equivalent to a net sales volume of $1.1 million in 1974. This representative plant had a gross profit of 31.8%, and an after-tax profit of 3.7% on net sales and 16.7% on equity. The ratio of long-term debt to total capital is about 30%, and the cash flow $150,000.

TABLE I-6

TYPICAL FINANCIAL RATIOS

Asset Size ($Million)	1974			1973			1972		
	0.25–1.0	1 to 10	All Sizes	0.25–1.0	1 to 10	All Sizes	0.25–1.0	1 to 10	All Sizes
Number of Statements	78	61	168	82	53	164	75	59	165
(1) Profit Before Tax as % of Sales	4.6	5.2	5.5	4.1	5.6	6.2	4.8	6.0	6.4
(2) % PBT/Worth	29.4	28.0	32.2	28.3	35.8	33.2	27.9	32.4	28.5
	15.0	16.5	15.7	15.1	19.8	18.7	15.4	17.8	16.7
	7.1	5.7	5.8	7.0	6.8	8.0	6.7	4.4	6.3
(3) % PBT/Assets	13.5	13.6	15.0	13.1	14.8	14.6	13.6	17.1	14.3
	5.7	6.6	6.3	7.5	7.6	8.2	7.1	7.7	7.4
	1.4	2.2	1.7	2.8	2.4	3.0	2.8	1.5	2.6

Source: Robert Morris Associates' *Annual Statement Studies*. These data represent the aggregation of the financial statements for companies with varying asset sizes in the Concrete Brick and Block Industries. The ranges shown for items (2) and (3) represents the first, middle two and fourth quartile distributions.

TABLE I-7

BALANCE SHEET FOR REPRESENTATIVE PLANT
CONCRETE BRICK AND BLOCK (HIGH-PRESSURE AUTOCLAVE CURING)
1974

Annual Production	–	170,000 metric tons – 10 million block equivalent units
Net Sales Volume	–	$3.2 Million (@ 32¢/unit)
Total Assets	–	$1.6 Million
Ratio of Gross Fixed Assets to Sales	–	0.63

Assets		$000's
Current Assets		800
Gross Fixed Assets	2,000	
Less Depreciation	1,300	700
Other		100
Total Assets		**1,600**
Liabilities		
Current Liabilities		550
Long-Term Debt		380
Equity		670
Total Liabilities		**1,600**

Sources: Robert Morris Associates' Annual Statements and Arthur D. Little, Inc., estimates.

TABLE I-8

INCOME STATEMENT FOR REPRESENTATIVE PLANT
CONCRETE BRICK & BLOCK (HIGH-PRESSURE AUTOCLAVE CURING), 1974

		$000's	%
Net Sales (excluding delivery costs and discounts)		3,200	100.0
Less Cost of Labor	580		
Cost of Materials, etc.	1,600		
Repairs, Maintenance, etc.	160	2,340	73.1
Gross Profit		**860**	**26.9**
Less Depreciation	290		
Interest	100		
Sales, General & Administration	300	690	21.6
Profit Before Tax		**170**	**5.2**
Income Tax		70	1.9
Profit After Tax		**100**	**3.3**

Source: Robert Morris Associates' Annual Statements and Arthur D. Little, Inc., estimates.

TABLE I-9

BALANCE SHEET FOR REPRESENTATIVE PLANT
CONCRETE BRICK AND BLOCK (LOW-PRESSURE STEAM CURING)
1974

Annual Production	–	60,000 metric tons
	–	3.5 million block equivalent units
Net Sales Volume	–	$1.1 million (@ 31¢/unit)
Total Assets	–	$0.55 Million
Ratio of Gross Fixed Assets to Sales	–	0.73

Assets		$000's
Current Assets		300
Gross Fixed Assets	400	
Less Depreciation	170	230
Other		20
Total Assets		**550**
Liabilities		
Current Liabilities		210
Long-Term Debt		100
Equity		240
Total Liabilities		**550**

Sources: Robert Morris Associates' Annual Statements and Arthur D. Little, Inc., estimates.

TABLE I-10

INCOME STATEMENT FOR REPRESENTATIVE PLANT
CONCRETE BRICK & BLOCK (LOW-PRESSURE STEAM CURING), 1974

		$000's	%
Net Sales (excluding delivery costs and discounts)		1,100	100.0
Less Cost of Labor	200		
Cost of Materials, etc.	500		
Repairs, Maintenance, etc.	50	750	68.2
Gross Profit		**350**	**31.8**
Less Depreciation	110		
Interest	50		
Sales, General & Administration	140	300	27.3
Profit Before Tax		**50**	**4.5**
Income Tax		10	0.8
Profit After Tax		**40**	**3.7**

Source: Robert Morris Associates' Annual Statements and Arthur D. Little, Inc., estimates.

3. Financing

While the concrete brick and block industry is generally healthy, most capital financing comes from internally generated funds or from privately arranged bank loans. The cost of capital from these principal sources ranges from 7% to 10%, depending on the credit worthiness of the borrower. Neither source should represent a significant constraint on the financing of additional capital.

D. PRICES AND PRICING

F.o.b. concrete brick and block prices normally are set on the basis of a required margin on the manufacturing cost but the block manufacturer frequently will quote a delivered zone price which varies with the distance from his plant. Block normally is not shipped more than 50 or 100 miles, because it has a high weight-to-value ratio and the average delivery costs are 4-5 cents for a unit selling at 32 cents, f.o.b. the plant in 1974. Prices vary by region, with the lowest priced regions being in the South Atlantic and in the Southwest.

Table I-11 reviews recent price movements. Wholesale prices for concrete block were 51% higher in 1974 than 1967 levels, representing an average price increase of about 7% per year. Block prices increased faster than the All-Commodities Price Index from 1967 to 1972 but currently is about 6% below that norm.

TABLE I-11

WHOLESALE PRICE INDEXES FOR CONCRETE BLOCK AND BRICK

(1967 = 100)

Year	Actual	Relative*
1967	100.0	100.0
1968	104.2	101.7
1969	107.9	101.3
1970	113.2	102.5
1971	118.3	103.9
1972	123.7	103.9
1973	134.0	98.9
1974	151.4	94.5

*Relative wholesale price indexes obtained by dividing the actual annual price index by the all-commodity W.P.I.

Source: U.S. Department of Labor, Bureau of Statistics, *U.S. Industrial Outlook, 1974.*

Future price changes are going to depend very much on the rate and extent of a recovery in construction activity. Under normal circumstances, cost increases in such basic ingredients as fuel, cement and aggregates will result in corresponding price increases, assuming that the competitive environment facing a particular manufacturer will allow him to recover such cost increments to maintain desirable margins. Competition is largely intra-industry, and uniform price increases tend to have very few secondary effects. A degree of inter-industry competition exists between the clay brick/concrete block walls, gypsum and wood, and metal sandwich panel systems for warehouse and light industrial or commercial construction. Significant price increases for the total installed system could cause block to lose market share.

E. REPRESENTATIVE PLANT CHARACTERISTICS

The representative concrete brick and block plant that uses high-pressure autoclave curing is assumed to have an output of 170,000 metric tons per year and no effluent treatment, discharging untreated effluent to municipal sewer systems or to surface water. The Guideline levels are identified below:

A — No treatment
B — Pond settling of suspended solids
C — B plus pH adjustment with sulfuric acid
D — C plus recycle to aggregate piles and/or convection autoclaves, or total containments
E — Mechanical evaporation of wastewater

It is estimated that 90% of the autoclave curing plants in this industry currently achieve the level of effluent discharge with respect to suspended solids (level B) but no plants satisfy the pH limitation required by level C or higher. The financial impact of the Guidelines on these plants is summarized in Table I-12.

The representative low-pressure plant has an output of 60,000 metric tons per year. The Guidelines, recommended technologies and present levels of treatment in the low pressure steam curing subcategory of the concrete brick and block industry are directly equivalent to those for the high-pressure autoclave curing subcategory. The financial impact of Guidelines is summarized in Table I-13.

F. ECONOMIC IMPACT ON EXISTING FACILITIES DUE TO GUIDELINES

1. High-Pressure Autoclave Curing

a. Price Effects

The total annual effluent control cost for those representative high-pressure autoclave plants that do not presently meet the Guidelines for either suspended solids or pH control ranges from 0.3 to 5.2% of manufacturing costs. If those plants are to maintain their after-tax returns on sales, they must increase selling prices by 0.2%, 0.3% and 4.0% for Levels C, D, and E, respectively. It is anticipated that the price increases required under Levels C and D would be implemented by the industry and

TABLE I-12

FINANCIAL IMPACT OF GUIDELINES ON

REPRESENTATIVE HIGH PRESSURE CONCRETE BRICK & BLOCK PLANT, 1974

Plant Characteristics

Annual Production	170,000 MT/yr
Manufacturing Cost	$13.76/MT
Sales Revenue	$18.82/MT
Average Annual Capital Investment	$101,500
Average Annual Cash Flow	$390,000

Financial Impact

Guideline Level	A	C	D	E
Total Capital Investment for Effluent Control ($)	0	8,232	12,348	274,400
Total Annual Effluent Control Cost ($/MT)	0	0.04	0.06	0.72
Increase in Manufacturing Cost (%)	0	0.3	0.4	5.2
Increase in Price (%)	0	0.2	0.3	4.0
Total Investment as % of Average Annual Cash Flow	0	2.1	3.2	70.4
Total Investment as % of Average Annual Capital Investment	0	8.1	12.2	270.3
After-tax Return on Sales* (%)	3.4	3.3	3.3	0.9
After-tax Return on Equity* (%)	14.9	14.4	14.1	4.2
After-tax Return on Assets* (%)	6.3	6.0	5.9	1.8

*If price increases are not achieved

Source: Arthur D. Little, Inc., estimates, based on Guidance Document.

that they will have no effect on the supply curve or on the supply/demand equilibrium. The 4% price increase that might be required under Level E is considerable and its relative cost-effectiveness questionable as no change in the raw waste load parameters is obtained. The extent to which it could be achieved would depend on the competitive environment in which specific plants operate.

b. Financial Effects

The capital requirements needed by the individual representative plant that has no effluent treatment, to achieve Levels C or D, are not expected to have any financial impact. According to the Guidance Document, approximately 65% of the plants in this subcategory already achieve Level D.

TABLE I-13

FINANCIAL IMPACT OF GUIDELINES ON
REPRESENTATIVE LOW PRESSURE CONCRETE BRICK & BLOCK PLANT, 1974

Plant Characteristics

Annual Production	60,000 MT/yr
Manufacturing Cost	$12.50/MT
Sales Revenue	$18.33/MT
Average Annual Capital Investment	$33,800
Average Annual Cash Flow	$140,000

Financial Impact

Guideline Level	A	C	D	E
Total Capital Investment for Effluent Control ($)	0	8,232	3,430	68,600
Total Annual Effluent Control Cost ($/MT)	0	0.06	0.07	0.30
Increase in Manufacturing Cost (%)	0	0.5	0.6	2.4
Increase in Price (%)	0	0.3	0.4	1.7
Total Investment as % of Average Annual Cash Flow	0	5.9	2.5	49.0
Total Investment as % of Average Annual Capital Investment	0	24.4	10.2	203.0
After-tax Return on Sales* (%)	3.7	3.4	3.3	2.3
After-tax Return on Equity* (%)	16.7	15.5	15.3	10.7
After-tax Return on Assets* (%)	7.3	6.8	6.7	4.7

*If price increases are not achieved

Source: Arthur D. Little, Inc., estimates, based on Guidance Document.

The total capital investment required for the representative plant not presently achieving this level of effluent control is estimated to be $12,400. This investment is approximately 3.2% of the average annual cash flow and 12.2% of the average capital investment.

No capital availability problems are anticipated. Assuming the remote possibility that an individual plant is not able to increase price to cover the additional manufacturing costs, its after-tax return on equity under Level D would decline to 14.1% from the present 14.9% — only a small reduction.

The investment required by the representative plant to achieve Level E is considerably higher ($274,000) and represents 70% of the average annual cash flow and 270% of the average annual capital investment for the representative plant. It is likely that many of the 125 autoclave plants in the United States would be unable or unwilling to raise such an amount and possibly as many as 25 could be forced to close. Those plants that are required to implement Level E, and do so, but who cannot obtain price increases to cover the 5.2% increase in manufacturing cost would face an unacceptable reduction in their profitability; the after-tax return on equity would decline from 14.9% to 4.2%.

Total investment by the high-pressure autoclave block sector would be $170,000 under Level C, $156,000 under Level D, and nearly $10 million under Level E.

c. Other Effects

Assuming that 25 plants, or 20% of the autoclave curing plants in the United States, ceased production rather than implement Level E effluent controls, about 500 persons would become unemployed and some community impact could occur. The potential loss in production under these conditions would be equivalent to only about 2.5% of the block industry's output; local shortages could occur, however.

2. Low-Pressure Steam Curing

a. Price Effects

The maximum price increase that would be required by a representative plant in this subcategory to meet Level E of the Guidelines is 1.7%. Assuming that capital is available to implement this level of technology, no price effects are anticipated.

b. Financial Effects

The total investment required by this subcategory would be only $4.7 million to achieve Level C and $0.9 million to achieve Level D. However, the industry would need to expend $50.0 million to achieve Level E, almost as much as the total annual capital investment made by the block industry. The cost-effectiveness of this requirement, in terms of effluent quality improvements, is questionable. No further reduction in the pH or the amount of suspended solids is achieved. The capital investment required for the representative plant represents 49% of the average annual cash flow for that plant, and more than twice its annual capital investment. It is thus highly unlikely that the industry would achieve Level E without some financial impact and possible 15-20% of the low-pressure steam curing facilities would choose to close.

c. *Other Effects*

This level of closure could cause about 2,000 people to be unemployed and reduce the productive capacity of the industry by about 10%. Supply shortages, and direct and indirect community impacts would thus occur.

G. ECONOMIC IMPACT ON NEW SOURCES DUE TO GUIDELINES

The capital investment required for effluent control Level D is about 0.5% of the total investment needed for a new high-pressure autoclave curing plant and 0.4% for a low-pressure steam curing plant. Level D effluent control is thus not expected to have an impact on the ability of the industry to add capacity or on the likelihood that it will do so. The incremental capital investment required under Level E, however, would be equivalent to 8% to 10% of the initial investment required for either plant process and would probably have a significant impact on the economic feasibility of a new facility. It is possible that the effluent control requirements of Level E would deter investment in new capacity by the industry.

II. CONCRETE PRODUCTS N.E.C (SIC 3272)

SIC 3272 (Concrete Products, not elsewhere classified) includes a wide range of companies that manufacture diverse concrete products:

- Precast pressure and non-pressure concrete pipe,
- Precast concrete,
- Prestressed concrete, and
- Miscellaneous other products.

It is extremely difficult to characterize these sectors as one group. Each category contains a wide variety of products; for example, precast concrete products include roof and floor units, architectural wall panels, septic tanks, burial vaults, miscellaneous garden furniture, laundry trays, etc. Moreover, few companies operate across the spectrum, because the market environments, business methods, operating characteristics and end uses are completely different.

The Guidance Document has chosen to segment this industry according to waste-load parameters into concrete pipe, and precast and prestressed concrete. The industry characterization that follows adopts this format but Census data presented in Tables II-1 through II-5 apply generally for all segments of SIC 3272; these tables will first be reviewed.

The 1972 Census of Manufactures indicates SIC 3272 includes 3,199 firms that operate 3,595 establishments. The total value of industry shipments (Table II-1) increased from $1.15 billion in 1967 to $2.2 billion in 1974 and totalled $1.86 billion in 1972. Shipments of primary precast and prestressed concrete products by this and other industries is shown below in millions of dollars for 1972:

	SIC 3272	Other Industries	Total
Primary Products	1775.5	89.2	1864.7
Other Products, Receipts	185.9	n.a.	n.a.
Total	1961.4	n.a.	n.a.

The principal secondary products shipped by industry SIC 3272 were concrete block and brick ($24.8 million) and ready-mixed concrete ($23.9 million). The major other industries that ship primarily precast and prestressed concrete products are those whose main products are block and ready-mixed concrete.

Sewer and water pipes are highly engineered products but operating conditions play a large part in what materials are preferred by the specifying engineer. The criteria that might benefit or limit the use of concrete pipe against other materials (ductile iron, plastic, asbestos cement, etc.) include: soil conditions, type of fluid to be carried, depth of lay, pressures incurred, need for cathodic protection, pipe size required, cost, availability and personal biases.

The concrete pipe manufacturer, however, must also contend with intra-industry competition by establishing himself in the eyes of the contractor both as a competitively-priced supplier and as one who can provide the required delivery and service throughout the project. Once a contract has been let and the order for shipment given, the pipe manufacturer will arrange a convenient schedule that matches the anticipated progress of the project and will normally deliver by truck up to 150 miles and by rail beyond that distance. Freight costs obviously are significant, especially for the non-reinforced pipe which was a lower value per unit weight, but pipes of unusual diameter or specifications have been known to be shipped more than 1000 miles.

The value of concrete pipe shipments by all manufacturing establishments grew from $400.5 million in 1967 to $599.4 million in 1973, at an average annual rate of 7% (Table II-1). However, if the apparent effects of inflation are removed, the real growth was less than 4% per year. Table II-2 details the quantity and value of shipments by all producers from 1967 and 1972. It is evident from this table that reinforced pipe has a predominant share of the total market, which is estimated to have been 12.8 million tons in 1972 for both pressure and non-pressure pipe. In fact, the American Concrete Pipe Association (ACPA), which represents about 70% of all U.S. non-pressure pipe production, estimates that reinforced pipe represented 74% of all 1974 production of non-pressure pipe (13.55 million tons), non-reinforced round pipe accounted for less than 7%, irrigation and drain tile for less than 4%, and manhole and other similar products for about 16%. Similar estimates by the ACPA (based on a survey of its member companies only) suggest the following proportionate production of non-pressure pipe by type of pipe:

Type of Pipe	Reinforced	Non-Reinforced	Total
Sanitary Sewer	29	39	30
Storm Sewer	50	42	49
Culvert	21	19	21
Total	100%	100%	100%

Prospects look bright for the concrete and other pipe manufacturing industries because the nation must make considerable investments in effluent pollution control and in fresh water supply in the near term. Consequently, it is anticipated that the average rate of tonnage growth will be about 6% per year from 1975 to 1980 and continue strong beyond this decade.

TABLE II-1

VALUE OF SHIPMENTS BY ALL MANUFACTURING ESTABLISHMENTS-CONCRETE PRODUCTS, N.E.C. 1967-1974

($ Million)

Year	Concrete Pipe	Precast	Prestressed	Other	Total
1967	400.5	341.5	217.7	187.8	1147.5
1968	438.8	428.8	262.4	123.1	1253.1
1969	499.2	445.2	283.8	127.4	1355.6
1970	490.2	557.5	275.6	134.1	1457.4
1971	530.9	622.7	337.8	147.7	1639.1
1972	565.3	536.8	414.1	348.5	1864.7
1973	599.4	678.6	510.4	309.2	2097.6
1974	713.0	774.1	553.3	115.6*	2156.0
Average Growth/Year	**7.5%**	12.5%	**14.3%**	**N/R**	**9.4%**

*Data Unreliable

Sources: U.S. Bureau of Census, Annual Surveys and Census of Manufactures.

Total employment and the average employment per establishment have been growing steadily since at least 1958 (Table II-3) and amounted to 67,600 and 19, respectively, in 1972. Only about one-quarter of the establishments employ 20 or more people. The value added by manufacture amounted to over 60% of industry shipments. The average annual new capital expenditures between 1968 and 1972 were $74.4 million, or about 10% of the gross value of fixed assets. The industry is geographically dispersed throughout the United States but it is notable that the average revenues per establishment are highest in the West (Table II-4).

A. CONCRETE PIPE

1. Products, Markets and Shipments

The basic raw materials of concrete pipe are Portland cement, aggregate, and water. The pipe can be either reinforced or non-reinforced; for reinforced pipe, a steel wire cage is added or the pipe is prestressed with steel wire during manufacture.

Concrete pipe is generally produced by one of six methods, three of which are described in the Guidance Document. The diameter of non-reinforced pipe ranges from less than 12" to 36", but the diameter of reinforced pipe is limited only by transportation and freight costs. Pipe reinforced with conventional steel has been manufactured in diameters as large as 204" and prestressed steel-reinforced pipe, in even larger diameters.

TABLE II-2

QUANTITY AND VALUE OF SHIPMENTS
BY ALL PRODUCERS – CONCRETE PRODUCTS, N.E.C. 1972 and 1967

1972 Product Code		Product	Unit of Measure	Total Product Shipments Including Interplant Transfers			
				1972		1967	
				Quantity	Value $MM	Quantity	Value $MM
3272-	—	CONCRETE PRODUCTS, N.E.C., TOTAL		(X)	1,864.7	(X)	1,147.5
32721	—	Concrete Pipe		(X)	565.3	(X)	400.5
		Culvert pipe:					
		Reinforced:					
32721	12	36 inches or more	1,000 s. tons	1,689.2	59.5		
32721	14	Less than 36 inches	do	1,277.1	47.1		
32721	17	Nonreinforced	do	251.7	8.2		
		Storm sewer pipe:					
		Reinforced:					
32721	21	36 inches or more	do	1,626.7	62.0		
32721	24	Less than 36 inches	do	1,035.3	39.2		
32721	25	Nonreinforced	do	165.3	6.0	6,942.5	215.6
		Sanitary sewer pipe:					
		Reinforced:					
32721	26	24 inches or more	do	1,430.9	58.2		
32721	27	Less than 24 inches	do	484.3	18.4		
		Nonreinforced:					
32721	28	15 inches or more	do	71.0	3.4		
32721	29	Less than 15 inches	do	237.0	9.5		
		Pressure pipe:					
32721	31	Reinforced concrete pressure pipe	Mil. lin. ft.	1.3	33.4		
32721	32	Prestressed concrete cylinder pipe	do	2.3	80.9		
32721	36	Pretensioned concrete cylinder pipe	do	2.9	16.5	7.1	96.4
32721	39	Other pressure pipe, including reinforced concrete cylinder pipe and prestressed concrete non-cylinder pipe	do	(S)	0.8		
32721	51	Irrigation pipe and drain tile	1,000 s. tons.	492.2[2]	13.5	1,203.5	35.5
32721	98	Other concrete pipe (such as manholes and conduits)	do	2,058.3[1]	70.4		
32721	00	Concrete pipe, n.s.k.		(X)	38.3	(X)	52.7
32722	—	Precast Concrete Products		(X)	536.8	(X)	341.5
		Roof and floor units:					
32722	13	Slabs and title	Million sq. ft.	19.8	35.1	(NA)	47.0
32722	17	Joints and beams	Mil. Lin. ft.	0.6[1]	6.9	(NA)	6.9
32722	23	Architectural wall panels	Million sq. ft.	23.9[1]	108.2	(NA)	71.4
32722	25	Piling, posts and poles	Mil. lin. ft.	2.8[2]	7.1	(NA)	1.9
32722	27	Cast stone (products for architectural purposes, except architectural wall panels, such as window sills, ashlar, coping, lintels and other trim		(X)	18.2	(X)	19.8
32722	28	Prefabricated building systems, primarily concrete, sold as complete units, and shipped in panel or modular form	Million sq. ft. floor area	4.4[1]	15.7	(X)	29.2
32722	29	Other precast concrete construction or building products, including prefabricated housing components, reinforced columns, etc.		(X)	68.6		
		Burial vaults and boxes:					
32722	33	Vaults	1,000 units	637.3	64.8	534.0	44.1
32722	35	Boxes	do	140.0	8.5	175.1	7.4
32722	41	Silo staves	do	12,288.0	23.4	12,050.0	17.8
32722	61	Septic tanks	do	289.5	34.1	204.9	17.1
32722	71	Dry-mixed concrete materials, including prepackaged sand, gravel and cement, mortar and cement premixes	1,000 s. tons.	1,926.5[2]	51.1	1,452.7	27.1
32722	98	Other precast concrete products, except construction or building products, including garden furniture, storage tanks, laundry trays, etc.		(X)	38.9	(X)	21.2
32722	00	Precast concrete products, n.s.k.		(X)	56.2	(X)	30.6
32723	—	Prestressed Concrete Products	Million sq. ft.	(X)	414.1	(X)	217.7
32723	11	Single tees, double tees, and channels	Mil. lin. ft.	63.5	94.3	50.2	55.7
32723	23	Piling, bearing piles, and sheet piles	do	8.1	31.7	5.2	20.1
32723	25	Bridge beams	do	2.6[1]	51.8	2.8	35.9
32723	27	Joists, girders, and beams (other than bridge beams)	Million sq. ft.	6.9[1]	29.2	(NA)	8.4
32723	31	Solid and hollow cored slabs and panels	do	77.1[1]	118.1	(NA)	36.7
32723	98	Other prestressed concrete products (such as arches, columns, etc.)	1,000 s. tons.	815.4[2]	45.5	598.5	28.6
32723	00	Prestressed concrete products, n.s.k.		(X)	43.5	(X)	32.2
32720	00	Concrete products, n.s.k., for companies with 10 employees or more.		(X)	210.9	(X)	117.1
32720	02	Concrete products, n.s.k., for companies with less than 10 employees.		(X)	137.6	(X)	70.7

X – Not applicable n.s.k. – Not specified by kind
S – Withheld N.A. – Not available

(1) From 10 to 30 percent of this figure was estimated.

(2) From 30 to 50 percent of this figure was estimated.

Source: Bureau of Census, *Census of Manufacture, 1972,* MC 72(2)-32D.

TABLE II-3

GENERAL STATISTICS, 1958-1972
CONCRETE PRODUCTS, N.E.C.

	Number of Establishments		All Employees		Production Workers			Value Added by Manufacture ($MM)	Cost of Materials, fuels, etc. ($MM)	Value of Industry Shipments ($MM)	Capital Expenditures, New ($MM)	Gross Value of Fixed Assets ($MM)	End-of Year Inventories ($MM)	Specialization Ratio (%)	Coverage Ratio (%)
	Total	With 20 Employees of More	Number (1,000)	Payroll ($MM)	Number (1,000)	Man-hours (MM)	Wages ($MM)								
1972 Census	3,595	923	67.6	570.2	53.5	109.9	401.0	1,190.1	768.4	1,961.4	96.2	(NA)	260.3	96	95
1971 ASM	(NA)	(NA)	65.2	512.7	51.9	106.4	365.8	1,058.1	700.1	1,748.8	66.3	722.2	230.0	(NA)	(NA)
1970 ASM	(NA)	(NA)	62.7	457.6	50.3	106.3	327.8	924.6	604.9	1,522.8	75.7	760.5	209.1	(NA)	(NA)
1969 ASM	(NA)	(NA)	58.6	416.5	46.8	100.3	294.7	848.6	558.8	1,407.8	71.8	618.7	180.2	(NA)	(NA)
1968 ASM	(NA)	(NA)	56.6	383.7	45.2	96.0	273.0	816.5	525.1	1,330.6	62.1	575.0	171.0	(NA)	(NA)
1967 Census	3,412	802	56.8	351.1	45.4	94.2	247.9	722.6	487.9	1,201.1	73.8	538.3	159.1	96	94
1966 ASM	(NA)	(NA)	60.5	338.5	46.7	95.2	238.1	691.9	485.0	1,189.7	67.9	(NA)	153.7	(NA)	(NA)
1965 ASM	(NA)	(NA)	58.3	314.2	45.8	95.2	223.8	636.3	454.4	1,083.1	60.5	(NA)	152.1	(NA)	(NA)
1964 ASM	(NA)	(NA)	54.4	283.5	42.5	89.7	201.7	591.8	407.4	977.5	50.8	438.1	144.8	(NA)	(NA)
1963 Census	3,451	716	52.3	266.7	41.1	87.3	190.9	540.0	387.4	925.7	43.5	402.2	126.1	94	94
1962 ASM	(NA)	(NA)	49.3	241.8	39.3	85.6	173.4	499.5	373.5	871.6	36.8	379.4	123.7	(NA)	(NA)
1961 ASM	(NA)	(NA)	47.9	222.9	38.1	83.1	156.3	470.9	354.9	822.4	36.3*	(NA)	123.5	(NA)	(NA)
1960 ASM	(NA)	(NA)	48.6	222.4	39.0	85.6	157.5	460.2	366.6	822.5	32.3	(NA)	118.5	(NA)	(NA)
1959 ASM	(NA)	(NA)	47.2	211.8	38.0	79.3	150.9	438.3	358.6	795.2	38.9	(NA)	117.7	(NA)	(NA)
1958 Census	3,461	619	46.3	200.2	36.3	73.6	141.6	391.4	322.2	720.1	44.3	(NA)	110.2	94	94

N.A. – Not Available

ASM – Annual Census of Manufactures

*Data of Limited Reliability

Source: Bureau of Census, *Census of Manufactures, 1972,* MC 72(2)-32D

TABLE II-4

SHIPMENTS BY CLASS BY GEOGRAPHIC AREA

	1972			1967		
	Number of Plants	Shipment Value ($ MM)	Average Value per Plant ($ MM)	Number of Plants	Shipment Value ($ MM)	Average Value per Plant ($ MM)
Concrete Products, N.E.C.						
United States	3,595	1,961.4	0.55	3,412	1,201.1	0.35
Northeast	671	384.3	0.57	622	203.3	0.33
North Central	1,148	546.1	0.48	1,131	372.7	0.33
South	1,236	638.0	0.52	1,148	396.2	0.35
West	540	393.0	0.73	511	228.9	0.45

Source: U.S. Bureau of Census, *Census of Manufactures, 1972,* MC 72(2)-32D.

The principal uses of pipe include water pressure, sanitary sewer, storm sewer and culvert pipes. In these applications, concrete pipe competes against a variety of materials, including ductile iron, steel, clay, plastic and asbestos-cement pipe. Manufacturers of concrete pipe also produce complementary products such as manholes, elliptical and arch pipes, irrigation pipe and drain tile. This last product is manufactured by many small companies that do not make pipe.

The principal customers for concrete pipe are the federal, state and municipal public works agencies, and utilities. Typically, a drainage or water supply project is designed by qualified engineers who also select and specify the materials to be used. The contract is then put out to bid and general contractors interested in making a quotation will seek materials cost estimates from selected pipe manufacturers in the area. The contractor will incorporate these quotations into his overall bid submission and, if successful, will normally negotiate the precise terms of purchase from the pipe manufacturer and arrange for orderly shipments.

The prevalence and importance of material specifications imply that a great deal of prespecification promotion and technical sales must take place at all levels. Pressure-pipe manufacturers usually have sales engineers who contact the design engineers (employed internally or externally by the public agencies) and discuss the performance, merits and cost-effectiveness of their particular products. All concrete pipe must be manufactured to established national standards so the preliminary promotion required to obtain the specification is normally against competing materials — exclusive specifications are uncommon.

TABLE II-5

GENERAL STATISTICS, BY EMPLOYMENT SIZE OF ESTABLISHMENT: 1972

	No. of Establishments	All Employees		Production Workers			Value Added by Manufacture ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures, ($MM)	End-of-Year Inventories ($MM)
		Number (1,000)	Payroll ($MM)	Number (1,000)	Man-hours (MM)	Wages ($MM)					
3272- Concrete Products, NEC											
Establishments, Total	**3,595**	**67.6**	**570.2**	**53.5**	**109.9**	**401.0**	**1,190.1**	**786.4**	**1,961.4**	**96.2**	**260.3**
Establishments with an Average of-											
1 to 4 Employees	1,479	2.6	19.2	2.6	4.5	14.0	51.6	34.6	86.8	4.5	11.6
5 to 9 Employees	658	4.4	34.2	3.5	7.4	24.2	76.1	48.0	123.8	14.7	14.9
10 to 19 Employees	535	7.4	57.9	5.7	11.3	38.8	122.8	71.0	191.6	9.6	21.9
20 to 49 Employees	570	17.7	146.8	13.5	28.0	99.0	302.4	198.7	495.1	26.7	65.0
50 to 99 Employees	235	16.3	140.5	12.9	26.8	99.4	296.6	197.3	488.8	13.5	66.4
100 to 249 Employees	105	14.6	130.4	11.5	24.5	92.7	257.0	177.2	432.2	19.4	59.5
250 to 499 Employees	11	4.6	41.1	3.8	7.5	32.8	83.7	59.6	143.0	7.6	21.1
500 to 999 Employees	2	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Estabs, Covered by Admin. Record	1,586	4.6	33.5	4.2	7.9	24.3	80.9	53.9	134.8	7.0	18.8

D — Withheld; included with previous item underscored.

Source: Bureau of Census, *Census of Manufactures, 1972*, MC 72(2)-32D.

2. Industry Structure

a. Types of Firms

The data presented in Tables II-3 through II-5 apply broadly to SIC 3272, but no breakdown is available for precast or prestressed concrete pipe. The ACPA, however, estimates that 234 companies, operating 436 plants, manufacture a non-pressure concrete pipe. The American Concrete Pressure Pipe Association estimates that 6 other companies, operating 21 plants, also produce a pressure pipe. While all these companies specialize in the manufacture of concrete pipe, a number of them are also diversified horizontally into other businesses, mostly prestressed and precast concrete. In addition, many small firms in rural areas concentrate on the production of concrete drain tile. Little vertical integration exists.

Firms operating in this industry vary greatly in size but include about 12 public corporations. Four of these — Ameron, Interpace, U.S. Pipe and Foundry, and the Hydro-Conduit Division of Marcor — are nationally-based and have corporate revenues exceeding $100 million. These larger companies operate a number of pipe plants and, either through their parents or directly, are diversified into a wide range of businesses. Other, privately-held pipe firms, such as Price Brothers, frequently also operate more than one facility.

b. Types of Plants

Concrete pipe plants are located throughout the United States. They range in age from 2 to 40 years, and in capacity from 5,000 to nearly 200,000 tons per year. The technologies vary, depending on whether the pipe is reinforced or non-reinforced, and whether the production method is vertical packerhead, vertical wet cast, drycast, tamped, roller suspension, or centrifugal. Manufacturers purchase practically all of their raw materials and little or no integrated operations exist except those within the plant.

c. Industry Segmentation

The Guidance Document has segmented the concrete pipe industry according to the quantity of wastewater volume, the non-pressure pipe plants having small wastewater volumes and the pressure pipe plants having larger wastewater volumes. The following characteristics profile each segment:

Segment	Number of Plants	Number of Employees	1972 Shipments $ Million	1972 Shipments Metric Tons (000's)
Small wastewater (non-pressure pipe and other)	436	12,000	434	10,600
Large wastewater (pressure pipe)	21	2,200	131	1,025
	457	14,200	565	11,625

By far the most predominant segment is that producing non-pressure pipe largely for sewer use. The 436 plants employ 85% of the workers and produce 92% of the tonnage, but only 77% of the value of shipments. The average output per sewer pipe plant is 24,300 metric tons. In contrast, the average output for the 21 pressure-pipe plants, whose product is used mostly for water transmission, is 50,000 metric tons. Total employment averages 31 per plant.

3. Financial Profiles

a. Financial Profiles for Representative Plants

The Guidance Document has selected two representative plants for the concrete pipe industry; balance sheets and income statements for each plant are presented in Tables II-6 through II-9. The smaller of the two plants has an annual non-pressure (sewer) pipe production of 25,000 metric tons and a 1974 net sales volume of $1.25 million; the larger pressure-pipe plant has an annual production of 90,000 metric tons and net revenues of $14 million.

The concrete sewer pipe plant represents total assets of $1.2 million and an after-tax profit of 5.1% on sales. The return on equity is about 10.5%. The ratio of long-term debt to total capital is about 32% and the annual cash flow, $163,000. For the representative pressure-pipe plant, total assets are about $16.2 million, and after-tax profits are 5.0% on sales. The return on equity is about 11.3%. The ratio of long-term debt to total capital is about 28% and the annual cash flow, $1.65 million. These profiles are fairly representative of typical plants in each subcategory.

b. Financing

The larger companies in the concrete pipe industry typically finance growth through internal cash flow generation but will go to the bond or equity market for their overall corporate capital needs. The cost of capital thus depends greatly on the current corporate bond rating or on what internal capital charges are made on the operating divisions. The latter tend to be about 2% above the corporate bond rate.

The smaller firms will also rely to some extent on their internal cash-generation capabilities but will also utilize normal commercial banking channels to satisfy their capital needs. In recent years, the delay of projects by the EPA has threatened the economic viability of manufacturers with low capitalization. However, because the future of the industry appears bright, most manufacturers should find themselves in a competitive position in assuring their future capital needs and no significant capital constraints are anticipated.

4. Pricing

The wholesale price index for reinforced concrete culvert pipe is shown in Table II-10. While prices increased by 46% from 1967 to 1974, much of that increase was in 1973-1974 and prices have actually declined relative to the all-commodities index. Until the last two to three years, pipe demand has grown at about the rate of GNP growth. As government financing for water supply and effluent treatment increased, demand and product prices strengthened.

TABLE II-6

BALANCE SHEET FOR REPRESENTATIVE CONCRETE SEWER PIPE PLANT, 1974

Annual Production	–	25,000 metric tons
Net Sales Volume	–	$1.25 million (@ $50/metric ton)
Total Assets	–	$1.20 million
Ratio of Gross Fixed Assets to Sales	–	1.4

Assets		**$000's**
Current Assets		700
Gross Fixed Assets	1,800	
Less Depreciation	1,300	500
Total Assets		**1,200**
Liabilities		
Current Liabilities		320
Long-Term Debt		280
Equity		600
Total Liabilities		**1,200**

Source: Arthur D. Little, Inc., estimates based on industry data.

TABLE II-7

INCOME STATEMENT FOR REPRESENTATIVE CONCRETE SEWER PIPE PLANT, 1974

		$000's	**%**
Net Sales		1,250	100.0
Less Cost of Labor	410		
Cost of Materials, etc.	380		
Repairs, Maintenance, etc.	93	883	70.6
Gross Profit		**367**	**29.4**
Less Depreciation	100		
Interest	35		
Sales, General & Administration	145	280	22.4
Profit Before Tax		**87**	**7.0**
Income Tax		24	1.9
Profit After Tax		**63**	**5.1**

Source: Arthur D. Little, Inc., estimates based on industry data.

TABLE II-8

BALANCE SHEET FOR REPRESENTATIVE CONCRETE PRESSURE PIPE PLANT, 1974

Annual Production	–	90,000 metric tons
Net Sales Volume	–	$14.0 million (@$155/metric ton)
Total Assets	–	$16.2 million
Ratio of Gross Fixed Assets to Sales	–	1.0

Assets		**$000's**
Current Assets		7,800
Gross Fixed Assets	14,000	
Less Depreciation	7,000	7,000
Other		1,400
Total Assets		**16,200**
Liabilities		
Current Liabilities		3,800
Long-Term Debt		3,500
Equity		8,900
Total Liabilities		**16,200**

Source: Arthur D. Little, Inc., estimates based on industry data.

TABLE II-9

INCOME STATEMENT FOR REPRESENTATIVE CONCRETE PRESSURE PIPE PLANT, 1974

		$000's	**%**
Net Sales		14,000	100.0
Less Cost of Labor	5,000		
Cost of Materials, etc.	4,000		
Repairs, Maintenance, etc.	800	9,800	67.0
Gross Profit		**4,200**	**33.0**
Less Depreciation	950		
Interest	550		
Sales, General & Administration	1,500	3,000	24.4
Profit Before Tax		**1,200**	**8.6**
Income Tax		500	3.6
Profit After Tax		**700**	**5.0**

Source: Arthur D. Little, Inc., estimates based on industry data.

TABLE II-10

WHOLESALE PRICE INDEXES FOR REINFORCED CONCRETE CULVERT PIPE

(1967 = 100)

Year	Actual	Relative*
1967	100.0	100.0
1968	100.3	97.3
1969	101.6	95.4
1970	103.5	93.8
1971	112.0	98.3
1972	116.0	97.4
1973	119.0	87.8
1974	143.6	89.6

*Relative wholesale price indexes obtained by dividing the actual annual price index by the all commodity W.P.I.

Source: U.S. Department of Labor, Bureau of Statistics, *U.S. Industrial Outlook, 1974.*

Because much of pipe is sold through contract bidding, prices are quoted only for the smaller diameters. One bellwether product, a 12" concrete sewer pipe, is regularly quoted on a delivered basis in *Engineering News Record.* In July 1975, for example, this pipe was selling for $3.92/linear foot, up from $3.39 in 1974; a similar vitrified clay pipe was quoted at $3.42, up from $2.89/linear foot. These prices represent a 20-city average and prices can vary considerably by region. Also, prices for the larger diameters are set on the basis of manufacturing costs, required margins, order size, current capacity utilization and the competitive environment. For custom pipes, special prices may be developed.

5. Representative Plant Characteristics

The representative concrete sewer plant has an annual production of 25,000 metric tons. The effluent control Guideline Levels are identified below for this plant:

A — No treatment
B — Settling pits to remove suspended solids, oil and grease pit and skimmer, and manual pH adjustment with acid
C — Mechanical evaporation of wastewater

TABLE II-11

FINANCIAL IMPACT OF GUIDELINES ON REPRESENTATIVE CONCRETE SEWER PIPE PLANT, 1974

Plant Characteristics

Annual Production	25,000 MT/yr
Manufacturing Cost	$35.32/MT
Sales Revenue	$50.00/MT
Average Annual Capital Investment	$58,500
Average Annual Cash Flow	$150,000

Financial Impact

Guideline Level	A	B	C
Total Capital Investment for Effluent Control ($)	0	6,860	68,600
Total Annual Effluent Control Cost ($/MT)	0	0.16	0.70
Increase in Manufacturing Cost (%)	0	0.4	2.0
Increase in Price (%)	0	0.3	1.5
Total Investment as % of Average Annual Cash Flow	0	4.6	45.7
Total Investment as % of Average Annual Capital Investment	0	11.7	117.3
After-tax Return on Sales* (%)	5.1	4.8	4.1
After-tax Return on Equity* (%)	10.5	10.0	8.4
After-tax Return on Assets* (%)	5.3	5.0	4.2

*If price increases are not achieved

Source: Arthur D. Little, Inc., estimates, based on Guidance Document.

It is not known how many of the approximately 436 sewer pipe plants presently achieve Level B but the number is believed to be extremely low (5-10%). For the purposes of this analysis it is assumed that no plants currently achieve Levels B or C. The financial impact of the Guidelines is summarized in Table II-11.

The representative concrete pressure-pipe plant has an annual production of 90,000 metric tons and little or no effluent treatment. The Guideline Levels are:

A — No treatment
B — Settling ponds to reduce suspended solids, oil and grease pit and skimmer, instrumented pH control, and water quality monitoring
C — Level B plus partial recycle of wastewater
D — Mechanical evaporation of wastewater

It is anticipated that plants equivalent to 80-90% of the total production of this subcategory will have to implement Level B. The anticipated financial impact of the proposed Guidelines is summarized in Table II-12.

TABLE II-12

FINANCIAL IMPACT OF GUIDELINES ON

REPRESENTATIVE CONCRETE PRESSURE PIPE PLANT, 1974

Plant Characteristics

Annual Production	90,000 MT/yr
Manufacturing Cost	$108.89/MT
Sales Revenue	$155,00/MT
Average Annual Capital Investment	$653,500
Average Annual Cash Flow	$1,650,000

Financial Impact

Guideline Level	A	B	C	D
Total Capital Investment for Effluent Control ($)	0	137,200	171,500	686,000
Total Annual Effluent Control Cost ($/MT)	0	0.33	0.53	3.42
Increase in Manufacturing Cost (%)	0	0.3	0.5	3.1
Increase in Price (%)	0	0.2	0.3	2.3
Total Investment as % of Average Annual Cash Flow	0	8.3	10.4	41.6
Total Investment as % of Average Annual Capital Investment	0	21.0	26.2	105.1
After-tax Return on Sales* (%)	5.0	4.9	4.8	3.7
After-tax Return on Equity* (%)	7.9	7.7	7.6	5.8
After-tax Return on Assets* (%)	4.3	4.2	4.2	3.1

*If price increases are not achieved

Sources: Arthur D. Little, Inc., estimates, based on Guidance Document.

6. Economic Impact on Existing Facilities Due to Guidelines

a. Concrete Sewer Pipe (small wastewater volume)

(1) Price Effects. The total annual effluent control cost for those representative concrete sewer pipe plants that do not presently meet the Guidelines for Levels B or C is the equivalent of 0.4% and 2.0%, respectively, of their manufacturing costs (Table II-11). To maintain their after-tax returns on sales, these representative plants must increase selling prices by 0.3% and 1.5%, respectively. It is anticipated that such price increases would be implemented by the industry and that they would have no effect on the supply curve or on the supply/demand equilibrium.

(2) Financial Effects. The total capital investment required for their representative plant to achieve Level B effluent qualities is estimated at $6,860; the required amount for Level C is ten times as large. The total investment required by the sewer pipe subcategory, as few plants are believed to be presently achieving Level B technology, is estimated at $3,000,000. Level C technology would require $30,000,000.

Such a capital requirement for the typical concrete sewer pipe plant to achieve Level B represents only 4.6% of the average annual cash flow and 11.7% of average annual capital investment. These requirements are not expected to have any financial impact. A moderate impact could occur if sewer pipe plants were required to meet Level C effluent limitations as the capital investment is equivalent to 45.7% of the average annual cash flow for the representative plant and 117.3% of the average annual capital investment. A limited number (perhaps 10-20) of the 436 plants producing sewer pipe might choose to close rather than implement Level C technologies.

If local competitive pressures were such that plants were unable to make price increases to cover cost increases anticipated under Level C, the after-tax return on sales would decline from 5.1% to 4.1%, and that on equity, from 10.5% to 8.4%. The relative attractiveness of such a lower return would be marginal. Also, the cost-effectiveness of Level C technologies is questionable as the reduction in raw waste loads from Level B to Level C is almost not measurable.

(3) Other Effects. No other production, employment, community, or balance of payments, effects are anticipated unless Guideline Level C is required and a few (10-20) plants choose to close rather than implement the technologies. An average of about 28 employees would be effected for each sewer pipe plant that closes as a result of Level C Guidelines. Community and other effects are likely to be minimal, however.

b. Concrete Pressure Pipe (large wastewater volume)

(1) Price Effects. If the representative concrete pressure pipe plant is to recover its costs and maintain its after-tax return on sales, it must make price increases of 0.2%, 0.3% and 2.3% for Guideline Levels B, C and D respectively. (Table II-12) It is anticipated that the price increases required would be made by the industry and would not have any affect on supply curve or on the supply/demand equilibrium. In the event that one or more of the 21 concrete pressure pipe plants in the U.S. were unable to make the 2.3% price increase estimated under Level B for the representative plant, the cost absorption would result in a decline in the after-tax return on equity from 7.9% to 5.8% and would certainly make such facilities marginal.

(2) Financial Effects. The total investments required under each of these three Guideline levels range from $137,000 to $686,000 for the representative plant. Such capital requirements are up to 41.6% of the average annual cash flow, under Level D, and 105.1% of the average annual capital investment. The required investments for Level D are thus fairly significant and might cause selective impacts. The cost-effectiveness of Level D requirements, in terms of effluent quality improvements, is questionable, as raw waste load parameter reductions are minimal.

The total investment requirements for the pressure pipe subcategory are $237,000, $1.7 million and $7.5 million, for Levels B, C and D, respectively.

(3) Other Effects. No production, employment, community, balance of payments, or other effects are anticipated under Guideline Levels B or C. Should a plant consider Level D capital requirements beyond its capabilities and decide to close, significant employment, community and production effects could result. The average employment per pressure pipe plant is over 100 personnel; the 21 plants are sufficiently dispersed in the United States that the closing of one could cause product shortages of concrete pressure pipe in the locality that it serves.

7. Economic Impact On New Sources Due to Guidelines

a. Concrete Sewer Pipe (small wastewater volume)

In order to achieve Guideline Levels B and C, the firm building a new sewer pipe plant would have to increase its capital outlay by 0.4% and 4.0%, respectively. No economic impact is anticipated.

b. Concrete Pressure Pipe (large wastewater volume)

The total capital investment for Guideline Level C, $171,500, is equivalent to about 1.7% of the total capital required for a new pressure pipe plant. No economic impact is anticipated. However, Level D capital requirements are equivalent to nearly 7% of the total capital outlay and could have a significant impact on the profitability of a new facility. It is also possible that Level D effluent control requirements would deter investment in new capacity by the industry.

B. PRECAST AND PRESTRESSED CONCRETE

1. Products, Markets and Shipments

Precast and prestressed concrete products normally are manufactured by pouring unhardened concrete into a casting bed where reinforcing steel (conventional or prestressed) has been previously positioned. Precast concrete products include:

- Roof and floor units
- Architectural wall panels, frequently with exposed aggregate faces
- Piling
- Prefabricated building systems
- Burial vaults, septic tanks and miscellaneous products such as garden furniture, parking blocks, etc.

Prestressed concrete products usually are single or double tees and panels but include solid and hollow-core slabs, bridge beams and piling.

Precast and prestressed concrete products used in construction are highly engineered and precisely manufactured because they frequently must serve a structural function in a building or civil engineering structure where accuracy and safety are important considerations. Consequently, most manufacturers employ a design staff whose purpose it is to develop structural products to meet specific situations as well as to check continually on the design economies of the standard units. Standard, or "off the shelf " items are available from design handbooks and manufacturers' brochures and a number of proprietary systems are available through licensees. While architectural products are seldom used in a load-bearing capacity, design aesthetics are very important and quality control is required to maintain the conformity between one panel and the next.

Precast and prestressed concrete construction products compete against: ready-mixed concrete; structural steel; steel, glass and aluminum curtain walls; and clay brick and other masonry products. Despite this breadth of competition, the industry was extremely successful in achieving a healthy rate of growth through 1974 and increasing its share of the new-building and civil engineering structures markets. Since 1974, however, sales and profits have decreased because of the decline in construction market activity.

The design of a project is always carried out by architects and engineers, either independent firms or those employed by developers or building owners. Thus, concrete-products manufacturers must offer design assistance at the product selection and specification stage and a high level of service both during and after the construction stage. Many concrete-products manufacturers also operate contracting firms that install the units they manufacture although a few companies are backing off from this integrated responsibility and focusing on the production and marketing of their products.

The value of precast concrete shipments increased from $341.5 million in 1967 to $678.6 million in 1973 (Table II-1). Over the same period, prestressed concrete products enjoyed a faster rate of growth, from $217.7 million to $510.4 million. Future growth for both products will not be as spectacular, because the industry is reaching maturity and because overall construction activity will be at a lower level. However, real growth of precast concrete products could still be 6% per year or better, and that for prestressed concrete better than 10%.

2. Industry Structure

a. Types of Firms

The precise number of firms in the precast and prestressed concrete industry is not known but, according to Bureau of Census data, could total more than 3,000. The number of plants they operate is close to or exceeds that number. However, the majority of precasters are extremely small, local operations that manufacture miscellaneous non-construction products such as burial vaults, garden furniture, septic tanks, etc. Many of these latter products are not steel-reinforced.

Production of the more specialized structural and architectural products used in building and civil engineering construction is concentrated in the hands of far fewer companies; about 500 companies operate 600-700 prestressing and/or precasting plants. As previously mentioned, few of these companies are diversified outside their major businesses although a number do also operate ready-mixed concrete operations, pipe plants and block plants or are part of larger corporations that have other business interests.

Architectural precast/prestressed products normally are sold f.o.b. the plant with freight a trade-off item. In contrast, suppliers of structural products frequently operate their own transportation equipment and installation crews as profit centers. A few companies are vertically integrated into cement or aggregates manufacture and/or horizontally integrated into the production of other concrete products, but integration is generally low.

b. Types of Plants

Plants range in age up to 50 years and in capacity from 1,500 to over 500,000 tons per year, the largest of these being prestressing operations. The level of technology is extremely simple for some precast concrete products; it ranges in sophistication from simple hand casting to highly capital-intensive operations for prestressed concrete beams and columns. For example, a new plant with a capacity of about 100,000 tons, and plant sales of $6 million, would require a capital investment in excess of $6 million. However, many plants are built with provisions for a wide range of products that are not necessarily manufactured on a continuous basis; thus capacity utilization frequently is low. However, the manufacture of solid or cored floor and roof slabs can involve a continuous process, because these products tend to be more standardized, commodity units.

c. Industry Segmentation

The Guidance Document does not further segment the precast and prestressed concrete sector.

3. Financial Profiles

a. Financial Profile for Representative Plant

Tables II-13 and II-14 present average pro forma balance sheets and income statements for a prestressed and architectural precast concrete products plant with an annual production of 23,000 metric tons in 1974. The industry experienced significant variability in financial performance in the early 1970's, with excellent years in 1972 and 1973 followed by two unprofitable years. The financial statements presented average the three years ending mid-1975 and are based on industry association data.

Assuming an f.o.b. value of $88 per metric ton, the net revenues for this facility were about $2 million. It is estimated that freight and installation would account for 20-25% of the installed value for those companies providing the services; thus the gross sales volume was about $2.5 million. The representative plant had total assets of $1.77 million in 1974 and a ratio of gross fixed assets to net sales of 0.75. The plant operated on a gross margin of 33.8% and an after-tax profit of 3.6% in that year. The annual cash flow was about $250,000, while the return on total assets was about 4.0%, and that on equity, 14.2%.

TABLE II-13

BALANCE SHEET FOR REPRESENTATIVE PLANT
PRECAST AND PRESTRESSED CONCRETE PRODUCTS, 1974

Annual Production	–	23,000 metric tons
Net Sales Volume	–	$2.00 million (f.o.b. price @$88/metric ton)
Total Assets	–	$1.77 million
Ratio of Gross Fixed Assets to Net Sales	–	0.75

Assets		**$000's**
Current Assets		810
Gross Fixed Assets	1,500	
Less Depreciation	610	890
Other		70
Total Assets		**1,770**
Liabilities		
Current Liabilities		690
Long-Term Debt		580
Equity		500
Total Liabilities		**1,770**

Source: Arthur D. Little, Inc., estimates, based on industry data

Because of the wide range of products and company sizes in this industry, a complete spectrum of financial performance and capitalization exists. The financial statements presented for the representative plant are believed to be fairly typical for the average operation manufacturing precast and prestressed concrete building products.

b. Financing

With the exception of 1975, which was an extremely poor year for the industry, internally generated funds usually have been adequate to finance most routine capital needs. Privately held corporations and proprietorships would otherwise seek commercial bank financing at about 1% over the Prime Rate; public companies or their subsidiaries would rely exclusively on internal capital funding. Financing additional capital assets is not expected to present a constraint for this industry under normal conditions, because its prospects appear excellent once the anticipated construction recovery materializes in late 1976 and 1977.

TABLE II-14

INCOME STATEMENT FOR REPRESENTATIVE PLANT
PRECAST AND PRESTRESSED CONCRETE PRODUCTS, 1974

		$000's	%
Net Sales		2,000	100.0
Less Cost of Labor	550		
Cost of Materials, etc.	700		
Repairs, Maintenance, etc.	74	1,324	66.2
Gross Profit		**676**	**33.8**
Less Depreciation	180		
Interest	80		
Sales, General & Administration	320	580	29.0
Profit Before Tax		**96**	**4.8**
Income Tax		25	1.2
Profit After Tax		**71**	**3.6**

Source: Arthur D. Little, Inc., estimates, based on industry data.

4. Prices and Pricing

Precast and prestressed concrete products used in building or civil engineering construction normally are quoted on a delivered price basis and frequently are bid to the contractor. Thus, standard price lists do not exist and the manufacturer in essence becomes a construction subcontractor and prepares a quotation which takes into account the product customization required, the competitiveness of the marketplace, the level of activity in his plant, the distance of the project from his plant, and who his competitors are likely to be. He examines his costs, and allows for overhead expenses and a desired profit margin in arriving at a calculated price. He then must judge whether he will win the contract at the price and, if not, whether he is prepared to reduce his margin.

For standard products such as burial vaults, garden furniture, parking blocks, etc., standard prices exist and are listed by the manufacturer.

5. Representative Plant Characteristics

The representative plant manufacturing precast or prestressed concrete products has an annual production of 23,000 metric tons and has little or no effluent control treatment in place. Effluent control Guideline levels are identified below:

A — No treatment
B — Settling ponds for removal of suspended solids plus pH adjustment

C — Mechanical clarification systems plus additional settling tanks, plus pH adjustment prior to discharge
D — Mechanical evaporation of wastewater

In order to meet Level B, about half the plants in this segment would have to install settling ponds for the removal of solids and adjust pH. Table II-15 summarizes the anticipated financial impact of the Guidelines on the representative plant.

6. Economic Impact On Existing Facilities Due to Guidelines

a. Price Effects

The representative precast/prestressed concrete plant would have to make price increases ranging from 0.4% to 3.2% to cover the incremental annual effluent control costs of Guideline Levels B through D, respectively (Table II-15). It is anticipated that price increases required under Levels B and C would be made by the industry and would have no effect on the supply curve or the supply/demand equilibrium. However, a 3.2% price increase under Level D could be difficult to achieve for those plants already marginally profitable or in highly-competitive areas. Assuming that those plants are able to raise the capital but then are unable to achieve price increases to cover increased costs, their after-tax return on sales would decline from 3.6% to 1.3%, and after-tax return on equity, from 14.2% to 5.1%. These profitability levels would almost certainly be unacceptable to the individual investor.

b. Financial Effects

The capital requirements needed by the individual representative plant presently having no effluent treatment amounts to $15,000 to $16,000 to achieve Levels B or C. No financial impact is expected. However, the $137,000 required for Level D represents 68.6% of the average annual cash flow and 146.7% of the average annual capital investment. Both proportions will probably prove burdensome to a great number of the industry and many plants may close. Examination of the raw waste load reductions anticipated under Level D make questionable the cost-effectiveness of this level of technology over Levels B or C. It is thus unlikely that permit writers will require Level D technologies or effluent quality levels.

The total investment required by the industry for either Levels B or C is approximately $6.5 million. The capital outlay is considerably greater ($107.9 million) for Level D.

c. Other Effects

Unless Level D technologies are required, no production, employment, community, advance of payments or other effects are anticipated. These effects under Level D are unknown but would probably be considerable under normal economic conditions.

7. Economic Impact On New Sources Due to Guidelines

The total incremental capital investment for effluent control under Levels B and C is a maximum $16,000 for the representative plant. This is about 0.7% of total capital required for a new precast or prestressed concrete products facility. No economic impact is anticipated. The capital investment for effluent control needed under Level D, however, is approximately 6% of the total capital outlay required by a new source and might make marginal the economic feasibility of such an operation.

TABLE II-15

FINANCIAL IMPACT OF GUIDELINES ON REPRESENTATIVE PRECAST/PRESTRESSED CONCRETE PLANT, 1974

Plant Characteristics

Annual Production	23,000 MT/yr
Manufacturing Cost	$61.16/MT
Sales Revenue	$88.00/MT
Average Annual Capital Investment	$93,500
Average Annual Cash Flow	$200,000

Financial Impact

Guideline Level	A	B	C	D
Total Capital Investment for Effluent Control ($)	0	15,092	15,915	137,200
Total Annual Effluent Control Cost ($/MT)	0	0.33	0.83	2.68
Increase in Manufacturing Cost (%)	0	0.5	1.4	4.4
Increase in Price (%)	0	0.4	0.9	3.2
Total Investment as % of Average Annual Cash Flow	0	7.5	8.0	68.6
Total Investment as % of Average Annual Capital Investment	0	16.1	17.0	146.7
After-tax Return on Sales* (%)	3.6	3.3	2.9	1.3
After-tax Return on Equity* (%)	14.2	13.1	11.4	5.1
After-tax Return on Assets* (%)	4.0	3.7	3.2	1.4

*If price increases are not achieved

Source: Arthur D. Little, Inc., estimates, based on the Guidance Document.

III. READY-MIXED CONCRETE (SIC 3273)

A. PRODUCTS, MARKETS AND SHIPMENTS

The ready-mixed concrete industry (SIC 3273) consists of companies manufacturing a concrete batch and delivering it to the user in a plastic and unhardened state. The raw materials used for the ready-mixed concrete are similar to those used for all types of concrete — coarse and fine aggregate, cement and water. The following description of the various types of equipment and plants is reproduced from the Guidance Document:

> "The batching and mixing equipment used at ready-mixed concrete plants ranges in size and complexity from small portable mixers to automated permanent plants with central mixers capable of producing several hundred cubic meters of concrete per hour. The three general classifications of plants are:
>
> (1) *Permanent* — This type of plant uses ready-mixed trucks which deliver various types of concrete to numerous customers. The concrete may be mixed in central mixers and hauled in agitator trucks or may be dry batched into mixer trucks and mixed in the truck on the way to the job.
>
> (2) *Portable* — This is the type of plant used on large highway and airport paving jobs. The concrete may be produced in a central mixer and hauled in agitator trucks or it may be dry batched into trucks and hauled to a portable mixer at the construction site. The latter is the older method.
>
> (3) *Mobile* — The mobile concrete plant utilizes trucks capable of measuring and mixing the aggregate, cement, and water at the job site. The raw materials are transported separately on the mobile truck, proportioned and mixed in the truck-mounted mixer at the job site. Mobile ready-mixed concrete is primarily used for small jobs that can be economically serviced without returning to the base plant after each job.
>
> The permanent ready-mixed concrete plant may operate either as a dry batch plant or a central mixer plant. In a dry batch plant, the mix of aggregate and cement are weighed and transferred in a dry state to the ready-mixed trucks along with a proportioned amount of water, then mixed in the truck. This type of operation is found in approximately three-fourths of the plants in the permanent segment of the ready-mixed industry. The other one-fourth of these plants uses a central mixer with an average capacity of 4 cu m (5 cu yd)."

Purchasers and users of ready-mixed concrete favor the product because: it reduces the investment they would otherwise have to make in mixing and batching equipment; it eliminates the need to set aside valuable space at the construction site for such mixing; it adds convenience to the construction process, because the product can be ordered and received when needed without operating a mixing plant only part of the time; and it allows for mobile delivery to the exact point of use at the project without double handling.

According to the National Ready Mixed Concrete Association (NRMCA), whose members represent about one-quarter of the firms in the United States and 60-70% of the shipments, the end-use breakdown of ready-mixed concrete in 1970 was:

Residential, including apartments — 29%
Industrial and commercial building — 38%
Public works and transportation — 16%
Public buildings — 9%
Agricultural — 4%
Miscellaneous — 4%

These varied end uses require a wide variety of performance characteristics on the part of ready-mixed concrete. These characteristics can be achieved by: increasing the cement proportions to obtain higher ultimate strengths; using special cements to provide a sulfate-resisting concrete, a white concrete or other such features; adding chemical additives to reduce cement or water quantities; using lightweight, instead of regular density, aggregates to minimize the total weight of concrete in its hardened state; etc. Despite these variations, a standard concrete batch would be designed to achieve a 3000-psi strength and to use Type II Portland cement.

The physical distribution of ready-mixed concrete is severely limited both by its product characteristics (shipping radii are limited by the practical hardening time of the mix) and its high weight-to-value ratio. Consequently, permanent ready-mixed-concrete plants are located in or around urban and metropolitan areas, while the rural and more remote regions are mostly served by mobile units or portable equipment. The operator of a permanent plant will sometimes offer the potential user a limited amount of pre-sales service but usually also controls the quality of his product by frequently making and testing concrete cylinders.

A contractor or builder wishing to use concrete on a project first must decide whether it is more economic and convenient to purchase ready-mixed concrete or to batch his own on the site. If the decision is to purchase the concrete, he may opt for a mobile plant but he is very much more likely to select one or more of the local permanent plant operators to supply his needs for that project. His selection will depend on a number of factors, including: his past relationship with that operator; the quoted delivered price; and the capability of that operator to supply his needs in a timely fashion. If the user selects a mobile plant, he may set up and operate it himself or subcontract this task to another company. These other companies may or may not be operators of permanent plants.

The value of shipments of ready-mixed concrete by all manufacturing establishments, as reported by the Bureau of Census, increased from $2.33 billion in 1967 to $4.01 billion in 1974, at an annual rate of 8.0% (Table III-1). Eliminating the effects of inflation on the value of shipments, however, the apparent real rate of growth in this period was only 1.5% per year. The apparent volume of shipments increased from 124.5 million cubic meters (162.4 million cubic yards) in 1967 to about 159.4 million cubic meters (208.5 million cubic yards) in 1972 but has decreased steadily since then to 151.4 million cubic meters (198 million cubic yards) in 1973. Estimated shipments totalled $4.01 billion and $3.75 billion, respectively, in 1974 and 1975. The future long-term real growth in ready-mixed concrete sales will be about parallel to that of construction activity — approximately 2.5% per year from 1975 to 1980. The industry presently has excess practical capacity so capacity additions probably will not be required before 1980, except to replace obsolete plants or to satisfy regional growth.

TABLE III-1

READY-MIXED CONCRETE PRODUCTION AND VALUE OF SHIPMENTS

Year	Quantity Consumed Millions Cu. Yds.	Value of Shipments Millions of Dollars	Price $ Per Cu. Yd.
1958	113.0	1466.8	12.99
1959	123.5	1645.8	13.32
1960	117.3	1645.8	14.03
1961	133.1	1702.9	12.79
1962	140.4	1755.8	12.50
1963	142.8	1970.7	13.79
1964	144.7	1981.2	13.69
1965	150.8	2154.9	13.99
1966	153.8	2165.9	14.08
1967	162.4	2330.5	14.35
1968	158.8*	2338.6	14.73
1969	160.6*	2470.7	15.38
1970	160.0*	2617.3	16.35
1971	160.0	2826.8	17.67
1972	208.5	3578.8	18.27**
1973	198.3**	3783.7	19.52**
1974	179.8**	4167.2	22.28**
1975 (estimate)	150.0	3748.8	25.00

Source: Census of Manufactures, 1972, Annual Survey of Manufactures, various years, except
*Derived by eliminating the effects of inflation
**Derived from National Ready Mixed Concrete Association, 1974 Industry Data Survey

B. INDUSTRY STRUCTURE

1. Types of Firms

The Bureau of Census reports in the 1972 Census of Manufactures that 3,978 firms operated 4,915 establishments classified under SIC 3273, ready-mixed concrete. The NRMCA, on the other hand, estimates that 5,122 companies are involved in the production of ready-mixed concrete and that these companies operated between 7500 and 9500 plants. There is no ready explanation for these apparent discrepancies. One possibility is that SIC 3273 may cover only stationary plants while the portable units are included as part of the operations of the highway and other contractors who principally own and operate them. However, the NRMCA also maintains that its data referred principally to stationary plants, although they may include a (limited) number of portable and mobile plants that are also owned by the stationary plant operators. Further discrepancies appear when one examines the average production per plant, the number of plants per company, and the apparent distribution of firm size.

It is not necessary, for this analysis, to attempt to resolve the discrepancies because of the nature of the markets served by each plant type and the low anticipated economic impact. Because the majority of all economic impact analyses rely heavily on the consistency, depth and coverage of Census data, this analysis does likewise. However, alternative data are utilized if these are clearly more accurate or if they supplement, and appear consistent with information published by the Bureau of Census.

In 1972, shipments of ready-mixed concrete by all industries totalled $3.58 billion of which $3.49 billion (98%) was by firms in SIC 3273. These latter firms also shipped an additional $557 million of secondary products — mainly sand, gravel, concrete block and other concrete products.

The typical firm supplying ready-mixed concrete will be a proprietorship operating one or more plants and a number of mixer trucks in an urban or metropolitan market. Firms range in size up to multi-million dollar operations and more than a few are part of widely diversified national corporations. While the level of integration is limited — only 280 of the 4,915 establishments are associated with a mine or quarry — the level of diversification can be fairly broad for those public companies. For example, some of the largest companies may operate stone quarries or sand and gravel pits, manufacture concrete block or precast units or even supply asphaltic concretes.

Table III-2 shows 1974 data supplied by the NRMCA on the production and value for 242 reporting member companies that represent approximately 25% of the membership and over 20% of U.S. shipments. This table indicates that:

- The 242 reporting companies operate an average of 3.84 plants, each of which, in turn, produces an average of 35,510 cubic meters (46,449 cubic yards) annually.
- The average sales volume for each company is $4 million.

- The average sales volume for each plant is slightly over $1 million.
- Half of the companies had a total production (all plants) of less than 75,000 cubic meters (100,000 cubic yards).

It should be pointed out, however, that the above data are not necessarily indicative of a statistical distribution of all plants in the industry or even of all companies belonging to the NRMCA. For example, it is believed that more than 50% of plants in the industry produce less than 19,000 cubic meters (25,000 cubic yards) per year. Thus net sales per plant would be less than $750,000 for more than half the operators; these are not fully represented in Table III-2.

TABLE III-2

PRODUCTION DATA FOR 242 REPORTING COMPANIES

1974 Production (Cu. Yds.)	No. of Reporting Companies	Cu. Yds. Sold by Reporting Companies	Total Net Sales of Reporting Companies ($)	Total Plants of Reporting Companies	Average Annual Production Per Plant (Cu. Yds.)
0 – 9,999	6	37,404	1,125,236	7	5,343
10,000 – 24,999	31	569,769	13,762,924	37	15,399
25,000 – 49,999	55	1,988,568	46,209,075	81	24,550
50,000 – 99,999	52	3,678,188	83,790,507	109	33,744
100,000 – 249,999	66	10,752,749	233,347,618	233	46,149
250,000 – 499,999	14	5,020,804	112,760,531	78	64,369
500,000 – 999,999	8	4,801,173	104,988,529	68	70,605
1,000,000 – and over	10	16,349,412	366,466,597	317	51,575
Total	**242**	**43,198,067**	**962,451,017**	**930**	**46,449**

Source: National Ready Mixed Concrete Association, 1974 Industry Data Survey

2. Types of Plants

Table III-3 presents general statistics for SIC 3273 for the years 1958 through 1972. In 1972, 73% of the establishments had fewer than 20 employees and the average establishment had: 17 employees, gross value of fixed assets of about $325,000, annual capital expenditures of $50,000, shipments of $825,000, and value-added of $357,000. (Note that new capital expenditures increased sharply in 1972, in response to a significant growth in demand.)

Table III-4 shows similar data by employment size of establishment for 1972 and whether the establishment is associated with a mine or quarry. Those that are so associated tend to be larger operations and with a higher value-added ratio. Stationary ready-mixed plants are distributed throughout the United States approximately according to population and level of construction activity (Table III-5). While a few plants date from the 1930's, most stationary units are considerably newer.

TABLE III-3

GENERAL STATISTICS, 1958 TO 1972

SIC 3273 – READY-MIXED CONCRETE

	Number of Establishments		All Employees		Production Workers			Value Added by Manufacture ($MM)	Cost of Materials, fuels, etc. ($MM)	Value of Industry Shipments ($MM)	Capital Expenditures, New ($MM)	Gross Value of Fixed Assets ($MM)	End-of Year Inventories ($MM)	Specialization Ratio (%)	Coverage Ratio (%)
	Total	With 20 Employees of More	Number (1,000)	Payroll ($MM)	Number (1,000)	Man-hours (MM)	Wages ($MM)								
1972 Census	4,915	1,328	85.7	809.3	56.9	114.4	497.4	1,756.7	2,291.8	4,050.9	247.8	(NA)	116.1	93	98
1971 ASM	(NA)	(NA)	76.7	655.3	54.8	106.1	426.2	1,422.7	1,849.9	3,279.8	135.4	1,590.4	103.2	(NA)	(NA)
1970 ASM	(NA)	(NA)	76.4	598.6	53.5	107.4	391.3	1,275.6	1,653.3	2,944.1	149.7	1,653.9	115.4	(NA)	(NA)
1969 ASM	(NA)	(NA)	74.9	562.3	49.0	102.7	352.6	1,320.6	1,613.8	2,925.3	140.4	1,526.7	107.2	(NA)	(NA)
1968 ASM	(NA)	(NA)	73.1	521.9	48.3	98.2	319.0	1,206.2	1,570.1	2,764.6	115.6	1,464.0	96.0	(NA)	(NA)
1967 Census	4,760	1,150	74.5	508.8	49.2	100.7	308.6	1,155.5	1,529.2	2,684.2	136.9	1,367.4	87.0	93	98
1966 ASM	(NA)	(NA)	75.4	487.9	49.9	101.4	295.4	1,051.3	1,483.8	2,527.8	143.8	(NA)	76.2	(NA)	(NA)
1965 ASM	(NA)	(NA)	76.2	465.6	50.2	102.4	279.2	1,066.7	1,447.4	2,511.5	135.6	(NA)	70.1	(NA)	(NA)
1964 ASM	(NA)	(NA)	72.3	431.8	46.8	97.4	259.0	996.6	1,319.7	2,310.3	105.7*	1,043.3	71.9	(NA)	(NA)
1963 Census	4,621	1,021	71.5	410.5	46.1	96.2	245.0	982.0	1,308.0	2,292.5	106.0	975.8	64.5	92	98
1962 ASM	(NA)	(NA)	66.7	381.7	48.0	99.2	245.3	786.5	1,160.3	1,953.7	91.5	895.7	60.8	(NA)	(NA)
1961 ASM	(NA)	(NA)	65.3	360.8	45.8	96.3	228.5	751.6	1,137.2	1,889.3	75.9	(NA)	62.6	(NA)	(NA)
1960 ASM	(NA)	(NA)	64.8	344.5	46.8	96.9	214.3	770.8	1,101.1	1,869.1	70.3	(NA)	63.7	(NA)	(NA)
1959 ASM	(NA)	(NA)	67.6	345.1	48.0	96.2	215.1	770.2	1,134.5	1,903.0	83.1	(NA)	63.5	(NA)	(NA)
1958 Census	3,657	949	62.1	303.1	44.2	88.4	202.0	679.4	1,008.8	1,687.2	71.6	(NA)	60.4	92	97

ASM – Annual Survey of Manufacture

N.A. – Not Available

*Date of limited reliability.

Source: Bureau of Census, *Census of Manufactures,* **1972**, MC 72(2)-32D.

TABLE III-4

GENERAL STATISTICS, BY EMPLOYMENT SIZE OF ESTABLISHMENT: 1972

	No. of Establishments	All Employees		Production Workers			Value Added by Manufacture ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures, ($MM)	End-of-Year Inventories ($MM)
		Number (1,000)	Payroll ($MM)	Number (1,000)	Man-hours (MM)	Wages ($MM)					
3273- Ready-Mixed Concrete											
Establishments, Total	**4,915**	**85.7**	**809.3**	**56.9**	**114.4**	**497.4**	**1,756.7**	**2,291.8**	**4,050.9**	**247.8**	**116.1**
Establishments with an Average of–											
1 to 4 Employees	1,397	2.9	24.3	2.4	4.1	16.1	91.8	126.0	217.7	8.1	5.8
5 to 9 Employees	1,027	6.9	58.5	4.7	9.2	37.2	149.0	209.1	358.1	17.2	9.2
10 to 19 Employees	1,163	16.0	146.3	10.8	21.4	90.5	335.5	433.3	768.9	47.2	18.1
20 to 49 Employees	1,030	30.7	298.1	19.6	39.7	174.8	620.3	823.0	1,442.6	90.3	36.7
50 to 99 Employees	213	14.3	137.2	9.6	19.8	87.3	286.1	363.4	649.5	37.3	19.0
100 to 249 Employees	73	10.3	97.7	6.8	13.8	61.1	183.4	231.9	416.6	29.6	20.5
250 to 499 Employees	10	4.7	47.3	3.0	6.3	30.4	90.6	105.1	197.5	18.2	6.9
500 to 999 Employees	2	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Estabs, Covered by Admin. Record	1,366	5.1	40.1	3.8	6.8	25.2	109.0	135.3	244.3	11.5	8.6
3273-02 Without a Mine or Quarry											
Establishments, Total	**4,635**	**74.3**	**686.1**	**48.8**	**98.0**	**414.3**	**1,508.6**	**2,073.8**	**3,584.6**	**206.8**	**101.2**
Establishments with an Average of–											
1 to 4 Employees	1,390	2.9	24.0	2.4	4.0	15.9	89.9	123.1	212.9	7.9	5.6
5 to 9 Employees	996	6.7	56.5	4.5	8.9	35.7	144.0	204.9	348.8	16.4	9.0
10 to 19 Employees	1,079	14.8	134.0	10.0	19.8	82.8	307.6	410.5	718.3	43.6	17.1
20 to 49 Employees	933	27.7	267.8	17.6	35.6	155.1	557.0	770.3	1,326.8	78.8	33.3
50 to 99 Employees	175	11.7	107.1	7.9	16.2	67.9	230.2	312.3	542.3	29.9	15.2
100 to 249 Employees	54	7.4	66.5	4.8	9.7	40.4	126.7	179.5	307.5	18.9	17.2
250 to 499 Employees	7	3.0	30.3	1.7	3.8	16.4	53.3	73.3	128.1	11.3	3.4
500 to 999 Employees	1	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Estabs, Covered by Admin. Record	1,366	5.1	40.1	3.8	6.8	25.2	109.0	135.3	244.3	11.5	8.6
3273-11 With a Mine or Quarry											
Establishments, Total	**280**	**11.4**	**123.2**	**8.1**	**16.4**	**83.1**	**248.1**	**218.0**	**466.3**	**41.0**	**14.9**
Establishments with an Average of–											
1 to 4 Employees	7	(Z)	0.2	(Z)	(Z)	0.2	1.9	2.9	4.9	0.1	0.2
5 to 9 Employees	31	0.2	2.0	0.2	0.3	1.4	5.1	4.2	9.3	0.8	0.2
10 to 19 Employees	84	1.2	12.3	0.8	1.6	7.7	27.9	22.8	50.7	3.6	1.0
20 to 49 Employees	97	2.9	30.2	2.0	4.1	19.8	63.3	52.7	115.8	11.5	3.4
50 to 99 Employees	38	2.5	30.1	1.8	3.5	19.4	55.9	51.2	107.2	7.4	3.8
100 to 249 Employees	19	2.9	31.2	2.0	4.2	20.7	56.7	52.3	109.1	10.7	3.3
250 to 499 Employees	3	1.6	17.0	1.2	2.6	14.1	37.4	31.8	69.4	6.9	3.0
500 to 999 Employees	1	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)

(D) – Withheld; included with previous underscored item

(Z) – Statistically insignificant

Source: Bureau of Census, *Census of Manufactures, 1972*; MC 72(2)-32D.

TABLE III-5

SHIPMENTS BY CLASS BY GEOGRAPHIC AREA

	1972			1967		
	Number of Plants	Shipment Value ($ MM)	Average Value per Plant ($ MM)	Number of Plants	Shipment Value ($ MM)	Average Value per Plant ($ MM)
Ready-Mixed Concrete:						
United States	4,915	4,050.9	0.82	4.760	2,684.2	0.56
Northeast	639	609.4	0.95	658	489.5	0.74
North Central	1,699	1,056.6	0.62	1,661	818.2	0.49
South	1,619	1,542.9	0.95	1,475	844.9	0.57
West	958	842.0	0.88	966	531.6	0.55

Source: U.S. Bureau of Census, *Census of Manufactures, 1972,* MC 72(2)-32D.

3. Industry Segmentation

The Guidance Document has segmented the ready-mixed concrete industry into five categories: 3 sizes of permanent plants; mobile plants; and portable plants. Because mobile plants have no wastewater, an economic impact analysis of effluent guidelines would be irrelevant. Permanent plants are used predominately in urban areas or where long-term market demand is sufficient to sustain a unit. Portable plants are basically similar in process technology and equipment but lack permanent foundations. Process effluents are also comparable, as are financial and operating characteristics. However, portable units tend to have a more protected market and operate more profitably. Hence, the analysis focuses on the three sizes of permanent plants.

C. FINANCIAL PROFILES

The ready-mixed concrete industry has a gross value of fixed assets of approximately $1.6 billion, up from $1.46 billion in 1968. New capital expenditures have averaged $158 million (about 10% of the gross value) annually over the same period.

Table III-6 shows typical financial ratios for 1972 to 1974 derived from an analysis undertaken by Robert Morris Associates of the financial statements of a number of ready-mixed concrete producers. The statements analyzed are exhibited by asset size. From these data it can be seen that before-tax profit as a percentage of sales is not too healthy and has declined considerably for those companies with assets between $0.25 million and $1 million. The returns on net worth and total assets are reasonably attractive but these, too, have declined since 1972 and are extremely low for all but the top quartile of the statements analyzed.

TABLE III-6

TYPICAL FINANCIAL RATIOS

Asset Size ($Million)	1974			1973			1972		
	0.25-1.0	1 to 10	All Sizes	0.25-1.0	1 to 10	All Sizes	0.25-1.0	1 to 10	All Sizes
Number of Statements	39	54	114	32	56	106	49	41	102
(1) Profit Before Tax as % of Sales	1.7	2.2	4.0	3.0	4.7	5.9	3.5	4.5	5.3
(2) % PBT/Worth	30.0	20.4	23.7	26.5	31.0	28.1	35.7	36.0	35.7
	12.4	11.2	13.4	14.4	16.8	16.8	16.2	19.4	19.1
	0.8	1.2	3.6	7.1	10.2	8.5	4.0	6.3	6.2
(3) % PBT/Assets	9.7	7.4	9.3	10.6	11.3	11.1	13.3	13.6	14.0
	3.5	3.5	4.2	6.2	7.7	7.4	4.8	5.6	5.9
	0.3	0.5	0.8	2.7	2.9	3.0	1.5	2.8	2.3

Source: Robert Morris Associates' *Annual Statement Studies*. These data represent the aggregation of the financial statements for companies with varying assets sizes in the Ready-Mixed Concrete Industry. The ranges shown for items (2) and (3) represent the first, middle two and fourth quartile distributions.

The fixed assets of the typical permanent plant have a market value of less than $0.5 million and a debt-to-equity ratio of about 0.40. Fixed costs are about 20-30% of net sales revenues, with variable costs of at least 70%. A new plant with a capacity of 39,300 cubic meters (52,000 cubic yards) would require an investment of $0.5 million.

Despite the occasional excellent year, the ready-mixed concrete industry cannot be considered as being generally profitable and many small plants are only marginal operations. Margins can be expected to improve as the construction industry comes out of the current recession but intra-industry price competition dampens the opportunity for stable profits.

1. Financial Profiles for Representative Plants

In Tables III-7 through III-12, we have constructed typical balance sheets and income statements as of 1974 for the representative permanent ready-mixed concrete plants selected by the technical contractor for the cost-benefit analysis.

For the smallest plant, annual production totals 18,900 cubic meters (25,000 cubic yards) and sales volume is $600,000. After-tax income is about 1.4% of net sales, and the annual cash flow is about $31,000. The return on total assets is 3.2%; on equity about 8%.

For the mid-sized permanent plant, annual production totals 39,300 cubic meters (52,000 cubic yards) and sales volume is $1.2 million. A plant of this size and type had a before-tax profit of about 1.7% of net sales and a tax liability of 0.3% in 1974. The annual cash flow is approximately $66,000, while the return on assets is 3.0% and return on equity is 8%. The largest representative plant selected has an annual production of 75,000 cubic meters (99,000 cubic yards) and net sales of $2.2 million. The annual cash flow totals $129,000 while the after-tax return on net sales is about 1.7%, that on total assets 3% and that on equity 8%.

It should be emphasized that, while extremely low, these returns reflect a poor year for the industry and that financial performance is typically stronger, as Table III-6 showed.

2. Financing

The majority of firms in this industry are proprietorships or closely held public companies. Therefore, external financing is limited to private placements, bank loans or the extension of credit by machinery suppliers. Many ready-mixed operators are thus undercapitalized and could have difficulty in raising sufficient funds for other than routine replacement investments. Since most firms also operate two or more plants within the same geographic area, non-productive investments, such as for effluent controls, might cause them to consolidate operations into fewer, larger facilities. This decision, however, will be made with many other factors in mind, such as the competitive environment, freight costs, land availability and the size and extent of the required investment at each location. The cost of capital for most operators would be approximately 1% over the Prime Rate.

TABLE III-7

BALANCE SHEET FOR REPRESENTATIVE PLANT
PERMANENT READY-MIXED CONCRETE, 1974

Annual Production	–	18,900 cubic meters
	–	25,000 cubic yards
Net Sales Volume	–	$600,000 @ $24/cubic yard, delivered, 3000 psi)
Total Assets	–	$250,000
Ratio of Gross Fixed Assets to Net Sales	–	0.35

Assets		**$000's**
Current Assets		110
Gross Fixed Assets	200	
Less Depreciation	80	120
Other		20
Total Assets		**250**
Liabilities		
Current Liabilities		80
Long-Term Debt		70
Equity		100
Total Liabilities		**250**

Sources: Robert Morris Associates' Annual Statement Studies and Arthur D. Little, Inc., estimates.

TABLE III-8

INCOME STATEMENT FOR REPRESENTATIVE PLANT
PERMANENT READY-MIXED CONCRETE, 1974

		$000's	%
Net Sales (18,900 cubic meters)		600	100.0
Less Cost of Labor	110		
Cost of Materials, etc.	300		
Repairs, Maintenance, etc.	25	435	72.5
Gross Profit		165	27.5
Less Depreciation	23		
Interest	17		
Sales, General & Administration	115	155	25.8
Profit Before Tax		10	**1.7**
Income Tax		2	0.3
Profit After Tax		8	**1.4**

Sources: Robert Morris Associates' Annual Statement Studies and Arthur D. Little, Inc., estimates.

TABLE III-9

BALANCE SHEET FOR REPRESENTATIVE PLANT
PERMANENT READY-MIXED CONCRETE, 1974

Annual Production	–	39,300 cubic meters
	–	52,000 cubic yards
Net Sales Volume	–	$1.2 Million (@$23/cubic yard, delivered, 3000 psi)
Total Assets	–	$0.53 Million
Ratio of Gross Fixed Assets to Net Sales	–	0.40

Assets		**$000's**
Current Assets		200
Gross Fixed Assets	470	
Less Depreciation	190	280
Other		50
Total Assets		**530**
Liabilities		
Current Liabilities		180
Long-Term Debt		150
Equity		200
Total Liabilities		**530**

Sources: Robert Morris Associates' Annual Statement Studies and Arthur D. Little, Inc., estimates.

TABLE III-10

INCOME STATEMENT FOR REPRESENTATIVE PLANT
PERMANENT READY-MIXED CONCRETE, 1974

		$000's	%
Net Sales (39,300 cubic meters)		1,200	100.0
Less Cost of Labor	230		
Cost of Materials, etc.	570		
Repairs, Maintenance, etc.	50	850	71.2
Gross Profit		**350**	**28.8**
Less Depreciation	50		
Interest	30		
Sales, General & Administration	240	330	27.1
Profit Before Tax		**20**	**1.7**
Income Tax		4	0.3
Profit After Tax		**16**	**1.4**

Sources: Robert Morris Associates' Annual Statement Studies and Arthur D. Little, Inc., estimates.

TABLE III-11

BALANCE SHEET FOR REPRESENTATIVE PLANT
PERMANENT READY-MIXED CONCRETE, 1974

Annual Production	–	75,000 cubic meters
	–	99,000 cubic yards
Net Sales Volume	–	$2.2 Million (@ $22/cubic yard, delivered 3000 psi)
Total Assets	–	$1.30 Million
Ratio of Gross Fixed Assets to Net Sales	–	0.50

Assets		**$000's**
Current Assets		530
Gross Fixed Assets	1,130	
Less Depreciation	500	630
Other		140
Total Assets		**1,300**
Liabilities		
Current Liabilities		500
Long-Term Debt		310
Equity		490
Total Liabilities		**1,300**

Sources: Robert Morris Associates' Annual Statement Studies and Arthur D. Little, Inc., estimates.

TABLE III-12

INCOME STATEMENT FOR REPRESENTATIVE PLANT
PERMANENT READY-MIXED CONCRETE, 1974

		$000's	%
Net Sales (75,000 cubic meters)		2,200	100.0
Less Cost of Labor	440		
Cost of Materials, etc.	1,150		
Repairs, Maintenance, etc.	110	1,700	77.3
Gross Profit		**500**	22.7
Less Depreciation	90		
Interest	90		
Sales, General & Administration	270	450	20.5
Profit Before Tax		**50**	**2.2**
Income Tax		11	0.5
Profit After Tax		**39**	**1.7**

Sources: Robert Morris Associates' Annual Statement Studies and
Arthur D. Little, Inc., estimates.

D. PRICES AND PRICING

1. Price Determination

Prices of ready-mixed concrete are quoted on a delivered basis and the cost and time of delivery from the producing plant to the construction site are significant factors in the service performance and competitiveness of the supplier. Thus, although each supplier attempts to achieve at least a target margin, price competition on a job-by-job basis frequently exists. However, this competition is somewhat lessened by the frequent personal supplier-purchaser relationships that are important in doing business in this industry.

2. Historic Prices

The average delivered price in the United States for 3,000 pounds per square inch ready-mixed concrete was $26.37 per cubic yard in mid-1975, up from about $23 at a similar period in 1974. The wholesale price index (Table III-13) increased from 100.0 in 1967 to 153.3 in 1974, at an average annual rate of 6.3%. Much of this increase took place between 1973 and 1974. However, the wholesale price of ready-mixed concrete dropped in each year from 1972 through 1974 relative to the All Commodities Wholesale Price Index and represented 95.7 of that index in 1974. This latter fact helps to explain the poor profitability discussed earlier, although the WPI increased, relatively, in 1975.

TABLE III-13

WHOLESALE PRICE INDICES
(1967 = 100)

	Ready-Mixed Concrete	
Year	Actual	Relative*
1967	100.0	100.0
1968	102.6	100.1
1969	107.2	100.7
1970	113.6	102.9
1971	122.7	107.7
1972	127.9	107.4
1973	133.0	98.2
1974	153.3	95.7
1975 (est.)	171.5	98.1

*Relative wholesale price indexes obtained by dividing the actual annual price index by the all commodity W.P.I.

Source: U.S. Department of Labor, Bureau of Statistics, *U.S. Industrial Outlook, 1974.*

E. ALTERNATIVE TREATMENT LEVELS

The Guidance Document describes the various current and potential treatment levels for three plant sizes — 18,900, 39,300, and 75,000 cubic meters per year, i.e.:

Level A: — No treatment.

Level B: — Pond settling of suspended solids; no aggregate recovery; no pH adjustment.

Level C: — Same as Level B plus pH adjustment.

Level D: — Sloped slab system; recovery of aggregate; partial recycle of processed wastewater; no recovery of cement fines; no pH adjustment

Level E: — Same as Level D plus pH adjustment.

Level F: — Mechanical clarification system (e.g., Jaddair Redi-Wash), recovery of aggregate; partial recycle of process wastewater; no recovery of cement fines; no pH adjustment.

Level G: — Same as Level F plus pH adjustment.

Level H: — Same as Level F plus mechanical evaporation of excess wastewater.

Level I: — Total recycle of wastewater with recovery and reuse of aggregates and cement.

The effluent Guidelines studied do not call for the control of runoff. Plants at Level A or B could implement Levels C through I; those at Level D could implement Levels E through I; plants at Level F could go to Levels G, H or I. All plants currently without runoff systems will incur costs to achieve Level I.

Table III-14 shows the treatment technology employed by the ready-mixed concrete industry as of 1974 as described in the Guidance Document.

TABLE III-14

READY-MIXED CONCRETE INDUSTRY TREATMENT TECHNOLOGY, 1974

Treatment Level	Number of Plants	Percent of Total
A	480	9.8
B	1,104	22.6
D	768	15.7
F	144	2.9
Runoff System	2,400	49.0
	4,896	100.0

Almost half of the ready-mixed concrete plants already have runoff systems in place. They would not incur any additional expense as a result of any treatment within each level studied. The distribution of treatment level size category was the same for each of the three sizes in the Guidance Document.

The alternative treatment levels analyzed in this study are as follows:

- **Alternative 1:** A minimum of treatment Level B (pond settling of suspended solids) plus pH adjustments for all plants. Plants with no treatment (Level A) would be required to construct settling ponds and incorporate pH adjustment (go from Level A to Level C). All other plants, except those with runoff systems, would be required to add pH adjustment to the treatment stream. Those at Level B would then go to treatment Level C, those at Level D would go to treatment Level E, and those at Level F would go to treatment Level G.
- **Alternative 2:** A minimum of treatment Level D (sloped slab system; recovery of aggregate; partial recycle of process wastewater; no recovery of cement fines; and no pH adjustment). Plants with no treatment (Level A) and plants at Level B (a total of 1,584 plants) are affected; the remaining 3,312 plants are unaffected.
- **Alternative 3:** A minimum of treatment Level F (mechanical clarification system; recovery of aggregate; partial recycle of process wastewater; no recovery of cement fines; no pH adjustment). Plants currently with no treatment (Level A), plants at Level B, and plants at Level D (a total of 2,352 plants out of 4,896) will be affected.
- **Alternative 4:** Total recycle of process wastewater, with reuse of aggregate and cement fines (Level I). A total of 2,496 plants will be affected, because only those 2,400 plants with runoff systems are currently in compliance.

F. ECONOMIC IMPACT ON EXISTING FACILITIES DUE TO GUIDELINES

1. Permanent Plants

a. Cost of Compliance

The cost of compliance escalates rapidly for progressively stringent treatment levels (Table III-15). The total annual cost for Alternative 2 is 20% higher than that of Alternative 1; the total for Alternative 3 is more than twice that of Alternative 1; and the total for Alternative 5 is 19 times more than that for Alternative 1.

For each alternative the cost of compliance varies significantly according to current plant size and current level of treatment (Appendix A, Tables A-1 through A-4). The increase in cost of production (change in average total cost) for each combination of plant size and current treatment is shown in Table III-16.

TABLE III-15

COST OF COMPLIANCE
ALTERNATIVE TREATMENT LEVELS
($000)

	Capital Expenditure		Operating Cost	Total Annual Cost
	Total	Annualized*		
Alternative 1	15,030	1,710	4,640	6,350
Alternative 2	27,420	3,280	4,550	7,830
Alternative 3	86,760	15,230	1,030	16,260
Alternative 4	139,290	28,450	92,440	120,880

*Based on the assumption of a 10% cost of capital to the industry.

Source: Derived from Appendix Tables A-1, A-2, A-3 and A-4.

b. Price and Output Effects

Prices in the ready-mixed concrete industry vary by size of plant. In 1974, according to industry data, the average price per cubic meter of concrete was $29.14 while the price was $32.07 for the 18,900 Cu.M. size category, $30.39 for the 39,300 Cu.M. size category and $29.03 for the 75,000 Cu.M. size category. The explanation for this could be that different size plants generally do not compete in the same markets. For purposes of this analysis, the assumption is made that the price differential by size will continue.

Water effluent treatment methods used by ready-mixed concrete plants differ considerably (Table III-14). Since as many as one-half of the plants in each size category currently have runoff systems, the price impact of any of the alternative Guidelines could be as low as zero; that is, no increase. In certain markets, where the supply/demand balance is tight, the price impact could be equal to the weighted average cost increase for each size category or the highest cost measure. This scenario would materialize if current treatment levels vary by market region and competing plants generally have the same treatment train in place.

Table III-17 depicts the potential long-run increases (in 1974 dollars) that could occur for each alternative treatment level. For Alternative 1, price impacts are minimal, at a maximum increase of 0.5%. The price impact of Alternative 2 is similar to Alternative 1, with a maximum level of 0.6% to 0.7% for each size category. Under Alternative 3, the price impact is still small, with the small plant price increase at a maximum level of 1.1%. Under Alternative 4, the price impact would be more substantial, at maximum levels of 4%-5% and an overall average level of 1%-2%.

In general, for each alternative treatment level, plants currently with no control (Level A) incur the greatest cost per size of plant and require the greatest increase in price to recover the cost of installing pollution control equipment and to finance the capital investment. If the plants currently with no water pollution control (Level A)

TABLE III-16

INCREASE IN AVERAGE TOTAL COST PER CUBIC METER
ALTERNATIVE TREATMENT LEVELS
($ 1974)

ALTERNATIVE 1

Effluent Level		Size Category (Cu.M.)			
Current	Proposed	18,900	39,300	75,000	Total
A	C	0.19	0.15	0.15	
B	C	0.08	0.03	0.03	
D	E	0.03	0.02	0.02	
F	G	0.03	0.03	0.02	
Runoff	Same	–	–	–	
Weighted Average		0.04	0.03	0.03	0.03

ALTERNATIVE 2

Effluent Level					
Current	Proposed				
A	D	0.22	0.18	0.17	
B	D	0.10	0.06	0.05	
Others	Same	–	–	–	
Weighted Average		0.04	0.03	0.03	0.03

ALTERNATIVE 3

Effluent Level					
Current	Proposed				
A	F	0.36	0.27	0.22	
B	F	0.25	0.15	0.10	
D	F	0.15	0.08	0.03	
Others	Same	–	–	–	
Weighted Average		0.12	0.08	0.05	0.06

ALTERNATIVE 4

Effluent Level					
Current	Proposed				
A	I	1.55	1.29	1.20	
B	I	1.43	1.16	0.88	
D	I	1.33	1.08	0.63	
F	I	1.19	0.98	0.56	
Others	Same	–	–	–	
Weighted Average		0.72	0.58	0.48	0.47

Source: Derived from Appendix Tables A-1, A-2, A-3, and A-4.

TABLE III-17

ESTIMATED LONG-RUN EQUILIBRIUM PRICE AND OUTPUT EFFECTS OF COMPLIANCE WITH WATER EFFLUENT CONTROLS

Plant Size[1]	1974 Price Cu.M. ($)	Alternative 1			Alternative 2			Alternative 3			Alternative 4		
		Compliance Cost		Decline in	Compliance Cost		Decline in	Compliance Cost		Decline in	Compliance Cost		Decline in
		$/Cu.M.	% of Price	Output/Plant[4]	$/Cu.M.	% of Price	Output/Plant[4]	$/Cu.M.	% of Price	Output/Plant[4]	$/Cu.M.	% of Price	Output/Plant[4]
18,900 Cu.M.	**32.07**												
Highest Cost[2]		0.19	0.5	95 Cu.M.	0.22	0.7	132 Cu.M.	0.36	1.1	208 Cu.M.	1.55	4.8	907 Cu.M.
Average Cost[3]		0.04	0.1	19	0.04	0.1	19	0.12	0.3	57	0.72	2.2	416
No. Plants = 1,224													
39,300 Cu.M.	**30.39**												
Highest Cost[2]		0.15	0.5	197 Cu.M.	0.18	0.6	235 Cu.M.	0.27	0.9	354 Cu.M.	1.29	4.2	1668 Cu.M.
Average Cost[3]		0.03	0.1	39	0.03	0.1	39	0.08	0.3	57	0.58	1.9	747
No. Plants = 1,224													
75,000 Cu.M.	**29.03**												
Highest Cost[2]		0.14	0.5	375 Cu.M.	0.17	0.6	450 Cu.M.	0.22	0.8	600 Cu.M.	1.20	4.1	3075 Cu.M.
Average Cost[2]		0.02	0.1	75	0.03	0.1	75	0.05	0.2	150	0.41	1.4	1050
No. Plants = 2,448													
Average – All Sizes	**29.14**	0.3	0.1		0.03	0.1		0.06	0.2		0.47	1.7	

1 Annual Production.

2. Change in long-run equilibrium price is equal to highest change in total cost within the subgroup.

3. Change in long-run equilibrium price is equal to the weighted average change in total cost for the entire category.

4. Based upon an estimated price elasticity of 1.00.

Source: Derived from Appendix Tables A-1, A-2, A-3 and A-4.

compete substantially with plants with higher levels of control, the former may not be able to increase prices to cover the cost of pollution control. Thus, the average impact for each size category may be more representative of the price impact that will prevail. As a result, some of the smaller plants with no pollution control equipment currently in place will incur a proportionately greater cost, given the magnitude of any price increase they can hope to attain, and will suffer reduced margins. The actual price impact that occurs — zero, average impact, or highest — will depend upon economic conditions and specifically on the demand for ready-mixed concrete at the local level.

A microeconomic model of the ready-mixed concrete industry indicates that the price elasticity of demand is such that a 1% increase in price will result in a corresponding reduction in the level of demand. This means that quantity demanded will decline in the same proportion as the price increase. An illustration of the output reduction for each plant that would have occurred had the price impacts taken place in 1974 is also shown in Table III-17. Note that what will occur as a result of a price increase will be a reduction in the demand level prevailing when the price increases occur.

c. *Financial Effects*

The potential price increases resulting from the alternative treatment levels range from no increase, to that equivalent to the change in average total cost for the high-impact plant category (plants currently with no treatment). Whether or not price increases occur, price increases in a competitive industry like ready-mixed concrete probably will follow cost increases. As a consequence, some plants may have difficulty generating sufficient funds to purchase the required capital equipment.

Ready-mixed concrete plants are relatively small business enterprises. It would be unlikely that all of them could obtain external financing for the cost of pollution control expenditures. It was important, therefore, to determine whether they can meet the capital investment outlays out of cash flow. Hence, the capital investment that must be made to comply with the Guidelines was compared to annual cash flow for each category of water effluent discharge for each size plant (Table III-18). Within each size of plant for each alternative studied, the producer with no treatment in place incurs the highest relative investment as a percentage of cash flow. As the treatment alternatives become more stringent, the required initial investment is a larger portion of cash flow. The cash flow requirements of Alternatives 1 and 2 do not appear very severe, at a maximum of 16% of cash flow for Alternative 1 and 33% for Alternative 2. Under Alternative 3, small and medium-sized plants and large plants with no treatment (Level A) may experience difficulty devoting 50% or more of annual cash flow to pollution control investment. Under Alternative 4, plants with treatment levels below Level F (partial recycle) could have difficulty paying for pollution control equipment out of cash flow.

Another way of examining the impact of alternative treatment levels is to examine the change in profitability that would occur under each alternative. If the price increase corresponds to the highest cost increase for any plant within a size category, then all plants will maintain or increase profitability. If price increases do not occur, profitability will decline for all ready-mixed concrete plants that must incur some

TABLE III-18

INITIAL CAPITAL EXPENDITURE FOR CONTROL ALTERNATIVES
COMPARED TO ANNUAL CASH FLOW

Effluent Level		Size Category Cu.M.					
		18,900		39,300		75,000	
Current	Proposed	($000)	% Cash Flow	($000)	% Cash Flow	($000)	% Cash Flow
				Alternative 1			
A	C	5.1	18	9.2	4	15.7	12
B	C	2.7	9	4.1	6	6.1	5
D	E	2.7	9	4.1	6	6.1	5
F	G	2.7	9	4.1	6	6.1	5
Runoff	Same	–	0	–	0	–	0
				Alternative 2			
A	D	10.1	35	17.3	26	30.3	23
B	D	7.6	26	12.2	18	20.6	16
Others	Same	–	–	–	–	–	0
				Alternative 3			
A	F	26.4	91	41.2	62	60.6	47
B	F	24.0	83	36.1	55	50.9	39
D	F	16.4	57	23.9	36	30.3	23
Others	Same	–	–	–	–	–	0
				Alternative 4			
A	I	37.1	128	55.5	84	84.8	66
B	I	34.6	119	52.4	79	75.1	58
D	I	27.0	93	40.2	61	60.6	47
F	I	10.7	37	16.3	25	24.2	19
Others	Same	–	–	–	–	–	0
Annual Cash Flow ($ 000)		29.0		66.0		129.0	

Source: Appendix Tables A-1 through A-4; Arthur D. Little, Inc., estimates.

costs to come into compliance. The average reduction in profitability for each plant size if no price increases occur is shown in Table III-19 part A.

Under each alternative, if the price increase is equal to the change in long-run average total cost, then some plants will face a reduction in profits while others will have an increase in profits. The factor which determines the impact on profits, under this scenario, is the current treatment in place. Plants with no treatment will have the highest costs and the incremental price increase will be less than the highest change in cost. These plants could face the profit reductions indicated in Table III-19 B. Plants with some treatment in place may enjoy price increases greater than their change in long-run average cost and thus their profits will increase. This does not necessarily mean that some firms will have lower profit *levels* than others as a result of the regulations because plants which will incur the lowest cost of compliance are already incurring costs associated with equipment in place. (In fact current market prices may reflect the cost of treatment in place.) In all cases, plants currently with runoff systems wll enjoy increased profits as a result of any price increase.

If no price increase occurs, all plants that are affected by an alternative will face a decrease in profits, and under Alternative 4, profitability would be substantially eliminated.

As mentioned above, the price increase scenario that materializes will differ by market area according to the supply/demand balance and the current treatment levels prevalent in an area.

d. Conclusions

Table III-20 summarizes the impact of different guideline effluent levels on the ready-mix concrete industry. On average, the impact of treatment Alternative 1 is small for each size group of ready-mixed plants. Price effects are small (0.1%-0.5%) and, in view of annual cash flow, capital investment costs are not overly burdensome.

The impact of treatment Alternative 2 is moderate. It would be associated with small prive increases (0.1%-0.7%), but capital investment would require up to one-third of a year's cash flow. Plant shutdowns would only be likely in an area where small, marginal plants without any treatment (up to 120 plants) compete with plants that have some treatment in place. Employment and community effects are minimal.

Although treatment Alternative 3 would be associated with small price increases (0.2%-1.1%), the capital investment required is sufficiently large to present problems to some ready-mixed plants. Plant closures could occur if plants currently with no treatment (Level A) or small and medium-sized plants are unable to obtain external financing for the pollution control equipment (up to 1032 plants). Employment effects could be significant (up to 12,300 persons, or 15% of the industry) and community supply effects could occur in up to 1000 communities when demand is strong.

Alternative 4 could bring about price increases of from 1.4% to 4.8%. Plants of all sizes currently with no treatment or at treatment Levels B or D could shut down if unable to obtain external financing. In addition, if price increases are equal to the average change in total cost for each size category, the reduced profitability for small

TABLE III-19

IMPACT OF GUIDELINES ON PROFITABILITY OF READY-MIXED CONCRETE PLANTS
(all dollars in thousands)

A. Without Price Increase (Average Decline in Profit)

Plant Size	Average Profit	Guidelines Control Level A	B	C	D
18,900 Cu.M.	$ 8.01				
$ Decline in Profit		$-0.4	$-0.4	$-1.1	$- 7.1
% of Average		-5%	-5%	-14%	-88%
39,300 Cu.M.	$16.0				
$ Decline in Profit		$-0.5	$-1.1	$-1.6	$-12.1
% of Average		-3%	-7%	-10%	-76%
75,000 Cu.M.	$39.0				
$ Decline in Profit		$-0.9	$-1.1	$-2.1	$-16.1
% of Average		-2%	-3%	-5%	-41%
Industry Average	$25.5				
$ Decline in Profit		$0.6	$0.8	$-1.7	$-12.8
% of Average		-3%	-3%	-7%	-50%

B. With Price Increase (Maximum Decline in Profit)*

Plant Size	Average Profit	Guidelines Control Level A	B	C	D
18,900 Cu.M.	$ 8.0				
$ Decline in Profit		$-1.5	$-1.8	$-2.3	$- 8.1
% of Average		-14%	-22%	-31%	-100%
39,300 Cu.M.	$16.0				
$ Decline in Profit		$-2.5	$-3.9	$-3.9	$-15.6
% of Average		-15%	-24%	-17%	-60%
75,000 Cu.M.	$39.0				
$ Decline in Profit		$-4.7	$-5.5	$-6.7	$-33.3
% of Average		-12%	-14%	-17%	-60%
Industry Average	$25.5				
$ Decline in Profit		$-3.4	$-4.2	$-4.9	$-22.6
% of Average		-13%	-16%	-19%	-89%

*Average decline in profit is zero.

TABLE III-20

FINANCIAL IMPACT OF GUIDELINES ON REPRESENTATIVE READY-MIXED CONCRETE PLANTS

Plant Characteristics

Average Production	52,050 MT
Mfg. Cost	$29.77 MT
Average Sales Revenue	$1.55 Million
Average Annual Capital Investment	$77,500
Average Annual Cash Flow	$88,300

	($ Millions)			
	A	B	C	D
Financial Impact of Effluent Control				
Capital Investment	$15.0	$27.4	$86.8	$139.3
Total Annualized Cost	6.4	7.8	16.3	120.9
Increase in Mfg. Cost	0.1	0.1	0.2	1.6
Increase in Price	0.1	0.1	0.2	1.7
Investment % Cash Flow	3.5%	6.3%	20.1%	32.2%
Investment % Annual Investment	4.0%	7.3%	4.3%	36.7%
After-tax Return on Sales* (%)	1.6%	1.6%	1.5%	0.8%
After-tax Return on Equity* (%)	7.8	7.7	7.4	4.0
After-tax Return on Assets* (%)	2.9	2.9	2.8	1.5

*If price increases are not achieved.

Source: Arthur D. Little, Inc., estimates, based on the Guidance Document.

and medium-sized firms will also cause plant closures. Up to 2,040 plants, representing 38% of capacity, could shut down either because the pollution control investment could not be recovered or because they cannot obtain external financing. Up to 38% of industry employment could be effected if these closures occur, and community impacts could be significant.

2. Portable Plants

As discussed previously, few data are available on the portable ready-mixed plant subcategory. It is not known how many plants are in operation, whether these plants are operated primarily as captive operations of highway and building contractors or are part of the services offered by a conventional ready-mixed concrete company, or what the financial profile would be. Portable operations can be used exclusively by one project or be located temporarily to serve many projects or customers. Such operations tend to be more profitable than permanent facilities, because they have protected markets and negotiated prices; they typically do not have to compete against other suppliers once they are established. On the other hand, they incur an additional capital requirement for each relocation and setup, which might occur every two to five years and may involve an additional $25,000. Selling prices are slightly higher than for permanent facilities because the operators will generally amortize these setup costs.

The economic tradeoff between permanent and portable facilities depends greatly on distance and travel time. A potential customer for the ready-mixed concrete will generally negotiate with the suppliers and establish a selling price, also involving cost escalation clauses. It is thus evident that the economic impact of Guidelines on the final user will be insignificant, because the purchased concrete will represent an extremely small part of the total construction cost for the project (e.g., highway, power station, dam, etc.).

However, the initial capital expenditures to meet Alternative 1 Guidelines (say $9,200 for a 39,300-cubic-meter plant) could represent as much as 40% of the relocation and setup costs, because these effluent control costs must be incurred after each move. The effect of a shorter amortization time would be to about triple the annualized capital expenditures but only increase the incremental cost per cubic meter by $0.06 for a portable plant with a 39,300-cubic-meter output. The price impact would be to increase manufacturing costs by 0.8%, as opposed to 0.5% for the permanent plant of the same size and current effluent control status. Such a differential impact is considered negligible.

G. ECONOMIC IMPACT ON NEW SOURCES DUE TO GUIDELINES

The incremental investment required for the ready-mixed concrete industry will be equivalent to less than 2% of the total capital expenditures for a new plant. Consequently, no economic impact is anticipated.

LIMITS OF THE ANALYSIS

A. AVAILABILITY AND ACCURACY OF DATA

Data on the industry sectors analyzed in this report are generally available only in a broad, descriptive format. Whatever detailed information is available tends to agglomerate the operations and characteristics of the full spectrum of types and sizes of firms and plants without differentiating among the specific characteristics of individual operations. For example, detailed data on the operations of plants in relation to their size, process technology, age, product mix, etc., are not available and had to be developed by making assumptions based on the specialized knowledge of analysts, industry contacts, available texts, and published data.

Financial information concerned with the investments, operating costs, and returns was not available for individual plants but was developed for "representative" plants from a variety of sources, including previous studies done by the contractor, information obtained from operating firms, published financial performance data such as that of the Internal Revenue Service, and of Robert Morris Associates. Throughout the study, an effort was made to evaluate these data and other information used and to update these materials wherever possible. Contacts with informed sources in both industry and government were continually made to help insure that data and information used were as reliable and as representative as possible.

Water pollution control costs were furnished by EPA, Effluent Guidelines Division. These data were developed for representative plants in each industry sector; in some cases, it was necessary to adapt these costs to the type and sizes of plants used in the analysis and to make adjustments to be consistent with the most recent financial data available. In addition, it was necessary to make specific assumptions regarding the current status of effluent disposal and treatment in each industry sector. These latter assumptions were mainly provided in the Guidance Document but were also supplied through individual contacts in the industry.

Our evaluation of control costs and technologies contained within the Guidance Document was limited to:

- the appropriateness of cost parameters (unit conversion factors, cost of capital, useful service life, and the like),
- tests of reasonableness for one of the subcategories (permanent-ready-mixed concrete) and,
- the general appropriateness of proposed treatment methods, taking into consideration the level of production technologies presently being employed.

We did not make a detailed analysis of capital or operating costs or whether the proposed technologies would achieve the degree of effluent control intended.

B. CRITICAL ASSUMPTIONS

The economic impact analysis required a series of assumptions where data either were not available or where the analysis had to be kept within reasonable limits. These assumptions fall into six general categories.

1. Industry Structure

The analysis relied heavily on the 1972 Census of Manufactures and subsequent Annual Surveys to provide the most recent and complete data on specific industry sectors. While the level of detail available in the census is considerably greater than in the Annual Surveys, the format and coverage are not directly useful for an economic impact analysis. Also, it can be expected that certain characteristics, especially cost and financial ratios, have changed in the intervening years. The concrete industry trade associations provide better-than average data on their respective industries, based on surveys of their memberships. These data supplemented our analysis.

2. Price Assumptions

Wherever possible, weighted average prices, reflecting an implied product mix in the industry, were used in the analysis. In addition, although product prices are generally available in historical series, considerable regional variation can occur, reflecting the competitive environment existing within an industry and among industries.

3. Current State of Wastewater Treatment

Data on wastewater treatment in the industry were obtained from the Guidance Document and were considered to be reasonably correct at the time they were prepared. However, many plants and companies undoubtedly have improved their own operating performance in the intervening period in response to state and local requirements or in anticipation of Federal legislation. We made contacts with individual companies where there were only a limited number of plants in an industry, but this was not possible (or necessary, given the anticipated low economic impact of the Guidelines) in non-concentrated industries.

4. Representative Model Plants

No single plant can be considered representative of the wide spectrum of types and sizes that constitutes most of the industry sectors analyzed. We believe, however, that the segmentation by product line and plant size adequately represented most of the plants in the industries.

5. "Shutdown" Decisions

The most difficult issue to analyze is the likelihood of plant closure. The general purpose of such an analysis is to examine the profitability of the representative plants before and after the imposition of effluent Guidelines, to determine the profitability of the forced closures that would result, and to calculate the price changes required to cover the added control costs.

Such an analysis requires assumptions about a number of factors, not the least of which are the characteristics of individual firms and the personalities of their management. Large, multi-industry, publicly-held firms such as those active in the concrete pipe industry tend to make shutdown decisions based on objective business analysis, such as effects on profitability or importance of a product line to overall corporate strategy. Such a firm would likely have specific criteria for each of its operating facilities. A private owner, however, tends to have a greater subjective commitment to staying in business, even if profitability is substantially reduced. This commitment may be sentimental, e.g., to a facility which has been operated by the family for generations, or specifically economic, e.g., the business may be a particular family's sole or primary source of income. Furthermore, the privately-held firm considers the magnitude of cash flow as the important issue, rather than profitability ratios. The management of such firms is not likely to perform a discounted cash flow analysis as part of its shutdown decision making. In addition, the costs and sources of financing and the alternatives available for the redeployment of assets enter into the equation.

C. RANGE OF ERROR ESTIMATES

The estimated data error ranges will vary by industry sector. In general, they will fall into the following ranges for the critical assumptions made:

Industry Structure	±10%
Price Assumptions	± 5%
Current Status of Treatment	±20%
Representative Model Plants	±10%
"Shutdown" Decisions	±20%

APPENDIX TO CHAPTER III
SUPPORTING DATA

TABLE A-1

COST OF COMPLIANCE WITH EFFLUENT CONTROL GUIDELINES FOR READY-MIXED CONCRETE PRODUCERS ($)

Alternative 1

Plant Type	Capital Expenditure		Operating Costs	Annual Cost*	Cost/Cubic Meter
	Total	Annualized			
18,900 Cu.M.					
A→C (120)	5,090	610	2,890	3,500	0.19
B→C (276)	2,660	320	1,180	1,500	0.08
D→E (192)	2,660	320	290	610	0.03
F→G (36)	2,660	320	320	640	0.03
Runoff (600) (1224)	—	—	—	—	—
Weighted Average	1,590	190	560	750	0.04
39,300 Cu.M.					
A→C (120)	9,200	1,090	4,960	6,050	0.15
B→C (276)	4,040	490	820	1,300	0.03
D→E (192)	4,120	490	300	780	0.02
F→G (35)	4,120	490	560	1,230	0.03
Runoff (600) (1224)	—	—	—	—	—
Weighted Average	2,600	310	730	1,010	0.03
75,000 Cu.M.					
A→C (240)	15,700	1,850	8,740	10,590	0.14
B→C (552)	6,100	720	1,170	1,890	0.03
D→E (384)	6,100	720	530	1,250	0.02
F→G (72)	6,100	720	650	1,370	0.02
Runoff (1200) (2448)	—	—	—	—	—
Weighted Average	4,050	450	1,220	1,690	0.02
Overall Weighted Average	3,070	350	940	1,290	0.03

*Includes a return on investment.

Source: Derived from the Guidelines Document, adjusted to mid-1974 prices.

TABLE A-2

COST OF COMPLIANCE WITH EFFLUENT CONTROL GUIDELINES
FOR READY-MIXED CONCRETE PRODUCERS
($)

Alternative 2

Plant Type	Capital Expenditure		Operating Costs	Annual Cost*	Cost/Cubic Meter
	Total	Annualized			
18,900 Cu.M.					
A → D (120)	10,050	1,200	2,950	4,150	0.22
B → D (276)	7,610	900	930	1,840	0.10
Other (828)	–	–	–	–	–
Weighted Average	2,700	320	500	820	0.04
39,300 Cu.M.					
A → D (120)	17,320	2,060	4,790	6,850	0.18
B → D (276)	12,230	1,440	1,090	2,530	0.06
Other (828)	–	–	–	–	–
Weighted Average	4,450	530	720	1,250	0.03
75,000 Cu.M.					
A → D (240)	30,270	3,630	9,100	12,730	0.17
B → D (522)	20,590	2,470	1,540	4,010	0.05
Other (1656)	–	–	–	–	–
Weighted Average	7,620	910	1,240	2,150	0.03
Overall Weighted Average	5,600	670	930	1,600	0.03

*Includes a return on investment.

Source: Derived from the Guidelines Document, adjusted to mid-1974 prices.

TABLE A-3

COST OF COMPLIANCE WITH EFFLUENT CONTROL GUIDELINES FOR READY-MIXED CONCRETE PRODUCERS ($)

Alternative 3

Plant Type	Capital Expenditure		Operating Costs	Annual Cost*	Cost/Cubic Meter
	Total	Annualized			
18,900 Cu.M.					
A → F (120)	26,400	4,300	2,660	6,960	0.36
B → F (276)	23,950	4,010	640	4,650	0.25
D → F (192)	16,350	3,110	-290	2,820	0.15
Other (636)	—	—	—	—	—
Weighted Average	10,570	1,820	360	2,180	0.12
39,300 Cu.M.					
A → F (120)	41,170	6,700	4,190	10,900	0.27
B → F (276)	36,090	6,090	50	6,140	0.15
D → F (192)	23,860	4,610	610	4,000	0.08
Other (636)	—	—	—	—	—
Weighted Average	15,940	2,760	320	3,090	0.08
75,000 Cu.M.					
A → F (240)	60,550	9,870	6,670	16,540	0.22
B → F (552)	50,860	8,720	-910	7,810	0.10
D → F (384)	30,280	6,300	-2,450	3,850	0.05
Other (636)	—	—	—	—	—
Weighted Average	22,182	3,930	60	3,990	0.05
Overall Weighted Average	17,720	3,110	210	3,320	0.06

*Includes a return on investment.

Source: Derived from the Guidelines Document, adjusted to mid-1974 prices.

TABLE A-4

COST OF COMPLIANCE WITH EFFLUENT CONTROL GUIDELINES
FOR READY-MIXED CONCRETE PRODUCERS
($)

Alternative 4

Plant Type	Capital Expenditure Total	Capital Expenditure Annualized	Operating Costs	Annual Cost*	Cost/Cubic Meter
18,900 Cu.M.					
A - ►| (120)	37,060	6,060	23,320	29,380	1.55
B —►| (276)	34,610	5,760	21,300	27,060	1.43
D —►| (192)	27,010	4,870	20,290	25,160	1.33
F —►| (36)	10,660	1,760	20,650	22,410	1.19
Other (600)	—	—	—	—	—
Weighted Average	16,000	2,710	10,880	13,590	0.72
39,300 Cu.M.					
A —►| (120)	55,520	11,010	39,270	50,280	1.29
B —►| (276)	52,440	10,790	35,130	45,920	1.16
D —►| (192)	40,200	9,320	34,470	43,790	1.08
F —►| (36)	16,350	4,710	35,080	39,790	0.98
Other (600)	—	—	—	—	—
Weighted Average	26,840	5,120	18,220	23,330	0.58
75,000 Cu.M.					
A —►| (240)	84,770	16,830	57,920	74,750	1.00
B —►| (552)	75,080	15,680	50,340	66,020	0.88
D —►| (384)	60,550	14,730	32,700	47,430	0.63
F —►| (72)	24,220	6,960	35,150	42,110	0.56
Other (1200)	—	—	—	—	—
Weighted Average	35,480	7,710	23,210	30,920	0.41
Overall Weighted Average	28,450	5,810	18,880	24,690	0.47

*Includes a return on investment.

Source: Derived from the Guidelines Document, adjusted to mid-1974 prices.

TABLE A-5

CHANGE IN PROFITABILITY* OF READY-MIXED CONCRETE PLANTS IF AVERAGE PRICE INCREASES OCCUR

Effluent Level		Size Category (Cu.M.)					
		18,900		39,300		75,000	
Current	Proposed	($000)	% Change**	($000)	% Change	($000)	% Change
A	C	-1.5	14	- 2.5	-15	- 4.7	-12
B	C	-0.4	5	0.0	0	0.3	- 1
D	E	-0.9	- 1	0.2	1	0.0	0
F	G	-0.9	1	0.0	0	0.0	0
Runoff	Same	0.4	5	0.6	4	0.3	1
A	D	-1.8	22	- 3.9	-24	- 4.5	-14
B	D	-0.6	7	- 0.6	- 4	- 0.8	- 2
Others	Same	0.4	5	0.6	4	0.8	2
A	F	-2.3	- 31	- 3.9	-24	6.7	-17
B	F	-1.3	- 16	- 1.4	9	- 2.0	- 5
D	F	-0.3	- 4	0.0	0	0.0	0
Others	Same	1.2	15	1.6	10	2.0	5
A	I	-8.1	-100	-14.6	-91	-33.3	-60
B	I	-6.9	- 86	-11.9	-74	-18.5	-47
D	I	-5.9	75	- 6.3	-64	- 8.7	-23
F	I	-5.5	- 57	- 4.2	-51	- 2.9	-15
Others	Same	7.0	88	11.9	74	16.2	41
1974 Annual Profit After Tax ($000)		8.0		16.0		39.0	

*Change in Profit After Tax, from an accounting standpoint, equal to 0.52 X (Change in Revenue – Change in Operating Costs), without deduction for interest charge.

**Percent change of average profit in plant size category.

Source: Appendix Tables A-1 through A-4 and Arthur D. Little, Inc., estimates.

TABLE A-6

DEMAND EQUATION USING THE EXOGENOUS VARIABLE GROSS NATIONAL PRODUCT

Variable	Coefficient	t-statistic
Est. Price	- 13.1359	2.55
GNP	0.192316	11.38
Constant	198.400	2.94

Statistics

R^2	0.93
Durbin-Watson Statistic	3.7
% Standard Error	5.3%
Number of Observations	14
F-statistic (2, 11)	73.6

Method:

Two-Stage Least Squares

Other exogenous variables used for estimated price:

Raw material cost

Wage rate

All statistics are significant at the 95% confidence interval.

Source: Arthur D. Little, Inc.

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This study is to analyze the econoomic impact which could result from the application of alternative effluent limitation guidelines and standards of performance to be established under sections 304(b) and 306 of the Federal Water Pollution Control Act, (FWPCA) as amended. The Guidance Document surveys existing and potential waste treatment control methods and technology within particular industrial sources categories and supports proposal of certain effluent limitation guidelines and standards of performance based upon an analysis of the feasibility of these guidelines and standards in accordance with the requirements of sections 304(b) and 306 of the Act. Presented are the investment and operating costs associated with various alternative control and treatment technologies. The document supplements this analysis by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade and other competitive effects.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

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