

LECTURE 3

BIDDING AND ESTIMATING



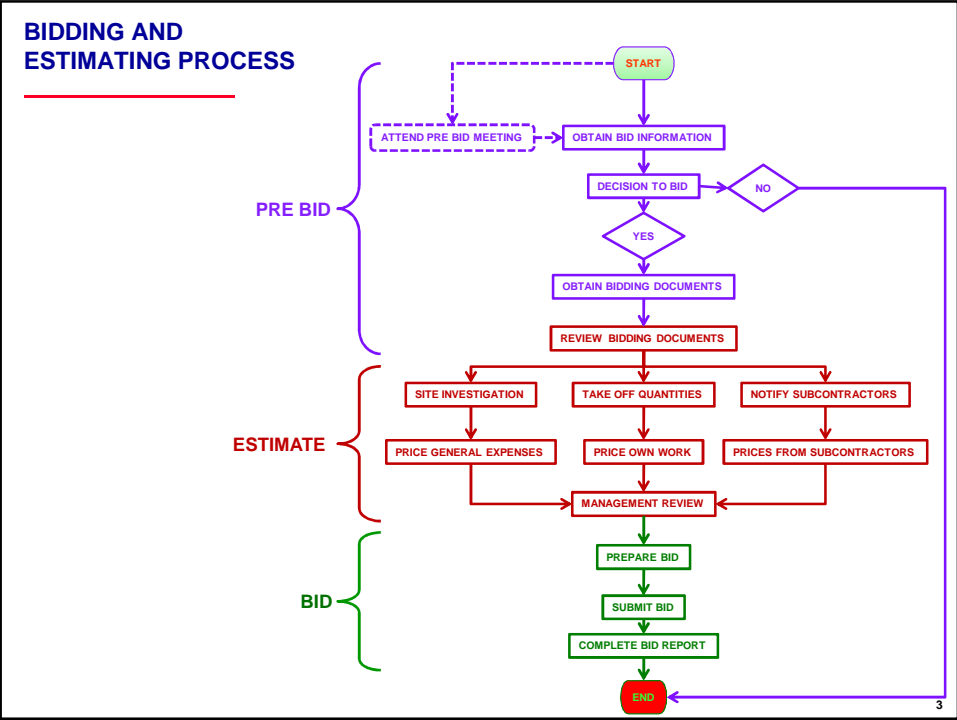
*CEEN 4812: Construction Management
Uzair (Sam) Shamsi, Ph.D., P.E.
Adjunct Professor
Department of Civil / Environmental & Chemical Engineering*

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OUTLINE

- ◆ Bidding and estimating process
- ◆ Bidding
- ◆ Estimating
 - ◆ *Ref.: Text Book Chapter 17:
Construction Economics*
- ◆ Homework No. 3 (Cost estimating spreadsheet)

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BIDDING

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BIDDING OUTLINE

- ◆ **Advertisement**
- ◆ **Bidding documents**
- ◆ **Site tour**
- ◆ **Pre-bid meeting**
- ◆ **Questions and clarifications**
- ◆ **Award of bids**
- ◆ **Bidding resources**
- ◆ **Sample bid document**

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ADVERTISEMENT (BY OWNER)

- ◆ **Newspapers, emails, online, RFP subscription services**
- ◆ **Bid date and time (deadline to submit)**
- ◆ **Project description**
- ◆ **Bidding documents**
- ◆ **Contract time (project start date to end date)**
- ◆ **Registration to bid (optional)**
 - ◆ **Fax, email, or online**
- ◆ **Letter of intent / interest (optional)**
 - ◆ **Allows owner to estimate number of potential bidders**
- ◆ **Contact information**

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BIDDING DOCUMENTS

- ◆ Request for Proposals (RFP)
 - ◆ Invitation for Bids (IFB), or
 - ◆ Invitation to Bid (ITB), or
 - ◆ Invitation to Tender (ITT)
 - ◆ Will be covered in Lecture 4 (Engineering Reports)
- ◆ RFPs generally include:
 - ◆ Front end documents
 - ◆ Specifications
 - ◆ Drawings
- ◆ Addenda (optional)
- ◆ Bidding documents may have to purchased

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FRONT END DOCUMENTS

- ◆ Part 1 “Administrative”
 - ◆ Instruction to bidder (site tour and pre-bid meeting, questions, clarifications & concerns, delivery of bids (time & location and number of copies)
 - ◆ Bid forms
 - ◆ Bid bond
 - ◆ Bidder qualifications
 - ◆ Agreement(s)
 - ◆ General conditions (Indirect cost, e.g. staging area, access roads, construction building access, temporary offices, daily/weekly and final clean up, temporary power and water utilities, safety, etc.)

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FRONT END DOCUMENTS

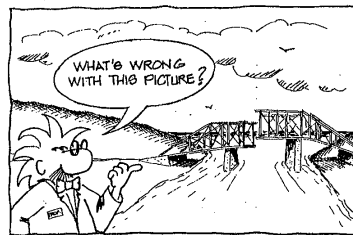
◆ Part 2 “General Requirements”

- ◆ Administrative provisions (scope of work, alternates, coordination, etc.)
- ◆ Progress meetings
- ◆ Construction schedules and procurement of equipment
- ◆ Submittals
- ◆ Quality Control (testing for soil, concrete, paving, etc.)
- ◆ Construction facilities and staging area
- ◆ O&M manuals and training

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SITE TOUR AND PRE-BID MEETING

- ◆ Site accessibility
- ◆ Temporary construction roads
- ◆ Staging area
- ◆ Storage area
- ◆ Security
- ◆ Site conditions and finishes
- ◆ Pre-bid meeting (pre-proposal conference)
 - ◆ Generally after the site tour
 - ◆ May be mandatory
 - ◆ May be recorded (audio or video)
 - ◆ Sign-up sheet
 - ◆ Presentation by the owner and owner’s representatives
 - ◆ Questions



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QUESTIONS AND CLARIFICATIONS

- ◆ Clarify any existing site condition that could affect the estimate (underground utilities not shown on documents, any dewatering and discharge, construction power, water needs, etc.)
- ◆ Any conflict between the drawings and specifications
- ◆ Ask for any missing detail or specification section.
- ◆ Must be asked before a deadline (1-2 weeks before the bid deadline)
 - ◆ No questions answered after this date (black-out period)
- ◆ Generally submitted in writing
- ◆ Answers distributed to all “registered” bidders via an addendum
- ◆ Addenda: Provide more info, Q&As, or clarifications
- ◆ Delivery of bid
 - ◆ Tip: Meet bid date and time deadline by
 - ◆ Knowing the Fedex pickup and delivery times
 - ◆ Online tracking and delivery confirmation

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AWARD OF BIDS

◆ Selection criteria

- ◆ Qualifications
- ◆ References
- ◆ Technical approach
- ◆ Schedule
- ◆ Price
 - ◆ New trend: price proposals received separately in sealed envelopes and reviewed only to compare top 3 most qualified bids.

BID TABULATION (COMPARISON)

CRITERIA	Weight	ALTERNATIVES					
		Option A		Option B		Option C	
		Rating	Score ⁽¹⁾	Rating	Score ⁽¹⁾	Rating	Score ⁽¹⁾
Criterion C1	1	3	3	3	3	3	3
Criterion C2	2	2	4	1	2	2	4
Criterion C3	3	1	3	3	9	2	6
Total	6	4	10	7	14	7	13

⁽¹⁾ Score = Rating * Weight

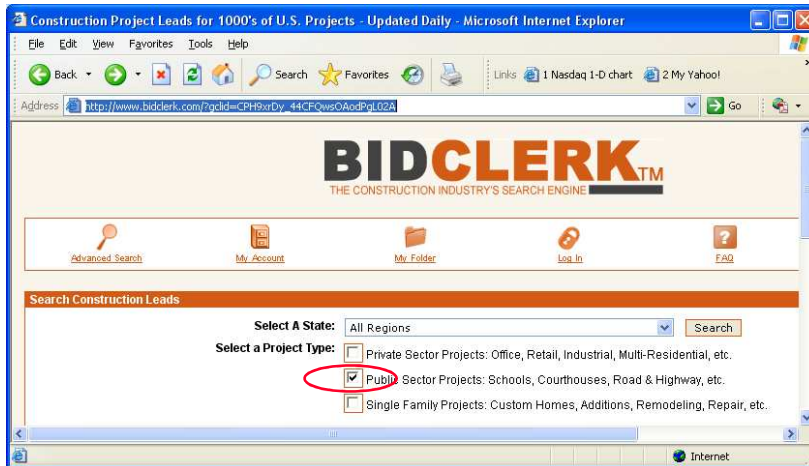
- When we sum up the ratings, both solutions B and C are equivalent (rating 7) and outperforming solution A.
- While similar globally, bidder B and C present different intrinsic strengths and weaknesses. Indeed, bidder B is better than bidder C for the criterion C3, but weaker on C2, while bidder C's qualifications are more evenly distributed.
- Therefore, Option B is usually called a *best-of-breed solution*.

<http://www.rfp-templates.com/What-is-a-Decision-Matrix.html>

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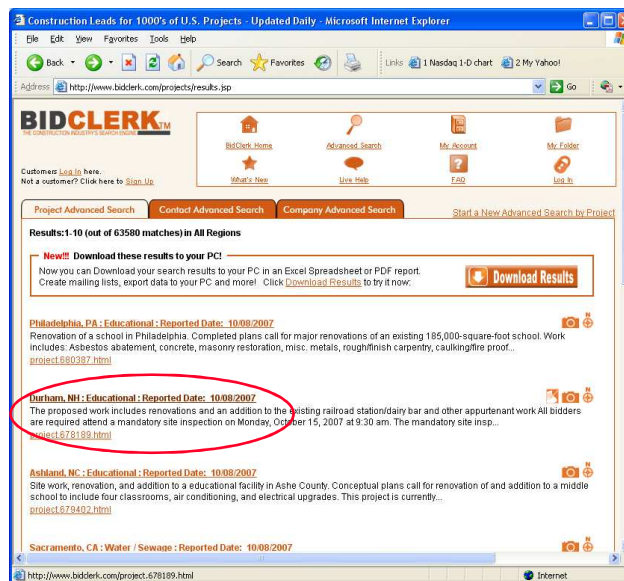
BIDDING RESOURCES RFP SUBSCRIPTIONS

- ◆ Bid Clerk
- ◆ www.bidclerk.com (9/7/10)



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BIDDING RESOURCES RFP SUBSCRIPTIONS



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BIDDING RESOURCES RFP SUBSCRIPTIONS

The screenshot shows a web browser window displaying a project page on BidClerk.com. The project details are as follows:

- Project ID:** 678189
- Project Name:** Available to subscribers only. [Sign Up Now!](#)
- Project Type:** Addition
- Building Use:** Educational
- Reported:** 10/08/2007
- Status:** GC Bidding
- Private / Public:** Public
- Location:** Durham, NH
- Project Address:** Available to subscribers only. [Sign Up Now!](#)
- Map:** [Map icon]
- Aerial Photo:** [Aerial photo icon]
- Project Documents (3):** Available to subscribers only. [Sign Up Now!](#)
- Map:** [Map icon]
- Aerial Photo:** [Aerial photo icon]

The text "Available to subscribers only. Sign Up Now!" is circled in red in the original image. The browser address bar shows <http://www.bidclerk.com/project.678189.html>.

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BIDDING RESOURCES RFP SUBSCRIPTIONS

The screenshot shows the "Premium Access Sign Up Form" on BidClerk.com. It lists three subscription plans:

Subscription	Discount	Description
<input type="checkbox"/> Silver Plan Month-To-Month		Get UNLIMITED access for just \$39.95 a month . Cancel your subscription at any time for any reason.
<input type="checkbox"/> Gold Plan 3 Month	5% OFF	Get UNLIMITED access to all project information for just \$113.85 every 3 months . Save \$24.00 Annually
<input type="checkbox"/> Platinum Plan Annual	20% OFF	Get UNLIMITED access to all project information for just \$383.50 every 12 months . Save \$95.90 Annually

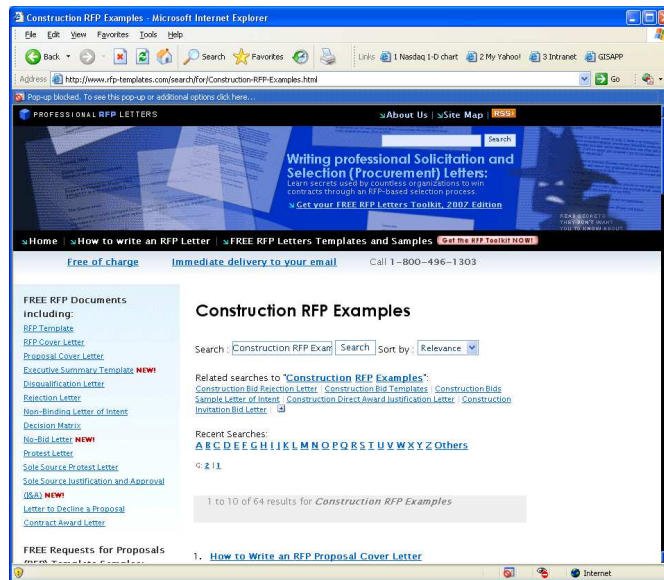
The browser address bar shows <https://www.bidclerk.com/projects/signup.jsp>.

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BIDDING RESOURCES

HOW TO PREPARE A REQUEST FOR PROPOSALS (RFP)

www.rfp-templates.com (9/7/10)



BIDDING RESOURCES

SAMPLE RFP

- ◆ City of New Haven, CT
- ◆ Construction of new drainage structures and piping, sanitary sewer manholes, concrete walls and pads.

<http://www.cityofnewhaven.com/Purchasing/index.asp> (9/7/10)

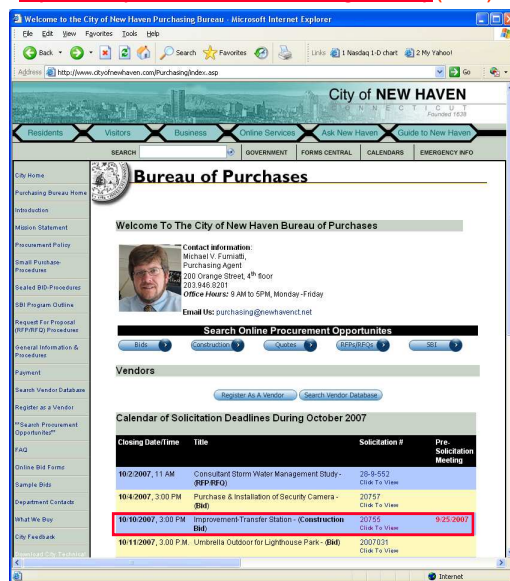
City of New Haven
Bureau of Purchases
Bid Documents

**NEW HAVEN TRANSFER STATION
IMPROVEMENTS**
Project #: 07-161-05
Contract # 20755

**Download from "Sample RFP"
Link From the Course Web site**

Honorable John DeStefano, Jr
Mayor
Richard H. Miller, P.E., L.S.
Director of Engineering

City of New Haven Bureau of Purchases Website
www.cityofnewhaven.com/Purchasing



BIDDING RESOURCES SAMPLE RFP

Bureau of Purchases

Construction Bid: Improvement-Transfer Station

Construction Bid Title: Improvement-Transfer Station
 Construction Bid Number: 29755
 Closing Date: 10/10/2007
 Closing Time (EST): 3:00 PM
 Pre-Proposal Meeting Date: 9/25/2007

Estimated Budget: \$1,382,520
Posting Date: 9/6/2007
Addendum Posted: 7
Tab Results Sheet Posted: N

Overview: Mandatory Pre-bid meeting to be held on September 25th, 2007 at 11:00am in the Engineering Dept Conference Room (Room 503), 200 Orange Street, New Haven, CT

The work shall include, but is not limited to: Construction of new drainage structures and piping, sanitary manhole, concrete walls and pads. The work also includes the removal of existing pavement, re-grading, bituminous concrete paving and the demolition of two existing truck scales and scaffolding and the installation of two new truck scales and a tarping station.

Download Available Construction Bid:

Download Construction Bid File now
 Download Construction Bid File now
 Download Construction Bid File now
 Download Construction Bid File now
 Download Construction Bid File now

Download Available Addendum(s):

Download Addendum File now
 Download Addendum File now
 Download Addendum File now

Download Available Tab or Submission Result Sheet:

Purchasing Feedback: Please click here if you have any questions about this website.

BIDDING RESOURCES CALCULATION SHEET (EXCEL FILE)

CITY OF NEW HAVEN
Bureau of Purchases

John DeStefano, Jr.
 Mayor
 Michael V. Furniatti
 Purchasing Agent

200 Orange Street
 Room 401
 New Haven, CT, 06510
 Tel. (203) 946-8281
 Fax (203) 946-8286

CALCULATION SHEET-New Haven Transfer Station Improvements

Project # 07-161-66
 Bid # 29755

1. The City reserves the right to award separate items to separate bidders. Bidders may indicate exceptions to this.
 2. All Quantities are estimated. Award of contract will depend upon availability of funds.
 3. Prices shall not include sales tax, excise taxes, or any other taxes for which the City is not liable. The City will execute any necessary exemption certificates.
 4. Total base bid must indicated on Bid form.
 5. Do not alter or amend this calculation sheet in any way, (including but not limited to footnotes, asterisks, or any other commentary). Complete the form as it is presented, if after your bid will be rejected. If you have need to make a change you must contact the Bureau of Purchases prior to submittal and we will evaluate the need and if warranted will issue an addendum.

Item No.	Description	Estimated Quantity	Unit of Measure	Unit Price	Total Price
Per bid specifications:					
1	Maintenance & Protection of Traffic	1	LS		0.00
2	Construction Staking	1	LS		0.00
3	Additional Trench Excavation	50	CY		0.00
4	Rock in Trench Excavation	40	CY		0.00
5	Additional Bedding Material	75	CY		0.00
6	Test Pit	2	EA		0.00
7	Additional Structure Excavation	25	CY		0.00
8	Rock in Structure Excavation	25	CY		0.00
9	Borrow	400	CY		0.00
10	Formation of Subgrade	5800	SY		0.00
11	Removal of Pavement	3650	SY		0.00
12	Earth Excavation	1600	CY		0.00
13	Cut Bituminous Concrete Pavement	940	LF		0.00
14	Rock Excavation	100	CY		0.00
15	Truck Scale Demolition	2	Each		0.00
16	Tarping Station Demolition	1	Each		0.00
17	6" PVC Pipe	40	LF		0.00
18	6" HDPE Pipe	80	LF		0.00
19	8" HDPE Pipe	180	LF		0.00
20	6" Perforated HDPE Pipe	75	LF		0.00
21	Pipe Connection to Existing Drain in Building	1	LS		0.00
22	Special Sanitary Manhole	1	EA		0.00
23	Manhole Drops	8	LF		0.00
24	Catch Basin - Type 'CL'	4	EA		0.00

ESTIMATING

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ESTIMATING OUTLINE

- ◆ Definition
- ◆ Types of costs and estimates
- ◆ Cost estimating resources
 - ◆ R.S. Means
 - ◆ ENR
 - ◆ Software
- ◆ Construction economics
- ◆ Four cost estimating examples
- ◆ Homework No. 3

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COST ESTIMATING DEFINITION

- ◆ The process of determining the price to bid for goods and services.
- ◆ An ***approximation*** that defines the **cost** of construction **activity** or activities prior to commencement of work vs. the cost of work during and after construction, which is the actual cost.
- ◆ Activity cost in general is basically the cost of material, labor and equipment.
- ◆ Estimating is a combination of art and science.
 - ◆ The more you know about construction methods, sequencing of work, resource estimates, and bidding strategies, the more you will excel in estimating.

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TYPES OF COST ESTIMATES

- ◆ **Feasibility / conceptual estimate: order of magnitude estimates**
 - ◆ Planning level cost estimation for budgeting purpose
 - ◆ Will it cost more than a million dollars?
- ◆ **Preliminary Design: preliminary cost by area (square foot or SF) or component**
 - ◆ For consultant selection
- ◆ **Detailed Design: detailed estimate using unit prices, crews and production rates**
 - ◆ For construction bidding

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TYPES OF COST ESTIMATES

- ◆ **Guaranteed Maximum Price**
 - ◆ Time and material (T&M)
 - ◆ Not-to-exceed
- ◆ **Lump sum**
- ◆ **Unit prices**
- ◆ **Design build**

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TYPES OF COSTS

- ◆ **Direct cost: cost of doing the project work**
 - ◆ Labor + material + equipment
- ◆ **Indirect cost:**
 - ◆ General Condition (field cost, travel cost, safety, permits, clean up, printing, plotting, copying, postage, etc.)
 - ◆ Insurance
 - ◆ Bond cost
 - ◆ Overhead: cost of doing the business (150 to 200% of direct cost)
 - ◆ Administrative staff (secretaries, accountants, legal, etc.)
 - ◆ Office rental, supplies, and utility bills
 - ◆ Profit (10-20%)

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ESTIMATING RESOURCES MEASUREMENT UNITS

Examples of Typical Estimate Unit of measure

	Unit of measure
1. Division 2 Earth work	
• Mass Excavation	CY
• Trench Excavation	LF
• Backfilling	CY
• Paving	LF
• Asphalt Paving	sq. yd. SF
• Concrete Paving	SF
• Gravel Paving	CY
• Water and Sewer Lines	LF
• Manholes	EA
• Sewing	SF
2. Concrete work	CY
3. Masonry	
• CMU Units	EA, SQ. SF
• Face Brick	per 1,100 (7' per SF)
• Limestone	SF
4. Steel work	Tons
5. Carpentry	
• Wood nailers	LF
• Casings	LF
6. Waterproofing	SF
7. Roofing	SF
8. Scaffolding	LF
9. Follow Metal Frames and Doors	EA
10. Aluminum Doors	EA
11. Aluminum / Fiberglass Windows	SF
12. Easement	EA
13. Operated Doors	EA
14. Finishes	
• Hard Tile	SF
• Ceilings	SF
• Wood Flooring	SF
• Painting	SF
15. Toilet Partitions and Accessories	PC
16. Floor Mats	EA
17. Metal Lockers	per door
18. Duct Hangers	EA
19. Mechanical	
• Plumbing	L & M
• HVAC	L & M
20. Electrical	L & M

- ◆ CY: Cubic yards
- ◆ LF: Linear feet
- ◆ SF: Square feet
- ◆ EA: Each
- ◆ L&M: Labor & Material

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ESTIMATING RESOURCES R.S. MEANS CONSTRUCTION COST DATA

- ◆ Unit-cost data for estimating construction costs
- ◆ www.rsmeans.com
- ◆ Three versions:
 - ◆ Books
 - ◆ CostWorks CD-ROM
 - ◆ CostWorks Online: Web-based software
- ◆ Online tools: QuickCost Estimator
 - ◆ Calculate an estimated value of total project cost localized to your selected area.
 - ◆ The calculations include add-on costs itemizing low, medium & high estimates for Architectural Fees & Contractor's Overhead & Profit.



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ESTIMATING RESOURCES ENR CONSTRUCTION ECONOMICS

JANUARY 15, 2007

Construction Economics

enr.com

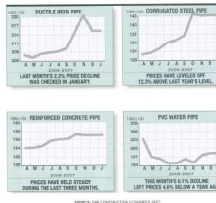
Construction Economics

PVC Pipe Prices Start 2007 on a Down Note

Prices for PVC pipe had a lackluster start to 2007 compared to double-digit gains posted during the first month of 2006. For example, prices for 6-in. PVC water pipe fell 0.1% in January compared to a sharp 0.6% increase in January 2006. The result was a sharp drop in year-to-year escalation from a plus 4% last December to a negative 4.6% this month. Copper pipe prices are still rising from year-over-year gains and in-copper water pricing begins this year at 2% above January 2006's level.



ENR's Materials Price Indexes



20-City Average

ITEM	UNIT	PRICE	% CHG.
REINFORCED CONCRETE PIPE (RCP)			
18"	ft	11.06	-0.1
24"	ft	26.37	-0.1
30"	ft	36.59	-0.1
36"	ft	47.41	-0.1
42"	ft	58.23	-0.1
48"	ft	69.05	-0.1
54"	ft	79.87	-0.1
60"	ft	90.69	-0.1
66"	ft	101.51	-0.1
72"	ft	112.33	-0.1
78"	ft	123.15	-0.1
84"	ft	133.97	-0.1
90"	ft	144.79	-0.1
96"	ft	155.61	-0.1
102"	ft	166.43	-0.1
108"	ft	177.25	-0.1
114"	ft	188.07	-0.1
120"	ft	198.89	-0.1
126"	ft	209.71	-0.1
132"	ft	220.53	-0.1
138"	ft	231.35	-0.1
144"	ft	242.17	-0.1
150"	ft	252.99	-0.1
156"	ft	263.81	-0.1
162"	ft	274.63	-0.1
168"	ft	285.45	-0.1
174"	ft	296.27	-0.1
180"	ft	307.09	-0.1
186"	ft	317.91	-0.1
192"	ft	328.73	-0.1
198"	ft	339.55	-0.1
204"	ft	350.37	-0.1
210"	ft	361.19	-0.1
216"	ft	372.01	-0.1
222"	ft	382.83	-0.1
228"	ft	393.65	-0.1
234"	ft	404.47	-0.1
240"	ft	415.29	-0.1
246"	ft	426.11	-0.1
252"	ft	436.93	-0.1
258"	ft	447.75	-0.1
264"	ft	458.57	-0.1
270"	ft	469.39	-0.1
276"	ft	480.21	-0.1
282"	ft	491.03	-0.1
288"	ft	501.85	-0.1
294"	ft	512.67	-0.1
300"	ft	523.49	-0.1
306"	ft	534.31	-0.1
312"	ft	545.13	-0.1
318"	ft	555.95	-0.1
324"	ft	566.77	-0.1
330"	ft	577.59	-0.1
336"	ft	588.41	-0.1
342"	ft	599.23	-0.1
348"	ft	610.05	-0.1
354"	ft	620.87	-0.1
360"	ft	631.69	-0.1
366"	ft	642.51	-0.1
372"	ft	653.33	-0.1
378"	ft	664.15	-0.1
384"	ft	674.97	-0.1
390"	ft	685.79	-0.1
396"	ft	696.61	-0.1
402"	ft	707.43	-0.1
408"	ft	718.25	-0.1
414"	ft	729.07	-0.1
420"	ft	739.89	-0.1
426"	ft	750.71	-0.1
432"	ft	761.53	-0.1
438"	ft	772.35	-0.1
444"	ft	783.17	-0.1
450"	ft	793.99	-0.1
456"	ft	804.81	-0.1
462"	ft	815.63	-0.1
468"	ft	826.45	-0.1
474"	ft	837.27	-0.1
480"	ft	848.09	-0.1
486"	ft	858.91	-0.1
492"	ft	869.73	-0.1
498"	ft	880.55	-0.1
504"	ft	891.37	-0.1
510"	ft	902.19	-0.1
516"	ft	913.01	-0.1
522"	ft	923.83	-0.1
528"	ft	934.65	-0.1
534"	ft	945.47	-0.1
540"	ft	956.29	-0.1
546"	ft	967.11	-0.1
552"	ft	977.93	-0.1
558"	ft	988.75	-0.1
564"	ft	999.57	-0.1
570"	ft	1010.39	-0.1
576"	ft	1021.21	-0.1
582"	ft	1032.03	-0.1
588"	ft	1042.85	-0.1
594"	ft	1053.67	-0.1
600"	ft	1064.49	-0.1
606"	ft	1075.31	-0.1
612"	ft	1086.13	-0.1
618"	ft	1096.95	-0.1
624"	ft	1107.77	-0.1
630"	ft	1118.59	-0.1
636"	ft	1129.41	-0.1
642"	ft	1140.23	-0.1
648"	ft	1151.05	-0.1
654"	ft	1161.87	-0.1
660"	ft	1172.69	-0.1
666"	ft	1183.51	-0.1
672"	ft	1194.33	-0.1
678"	ft	1205.15	-0.1
684"	ft	1215.97	-0.1
690"	ft	1226.79	-0.1
696"	ft	1237.61	-0.1
702"	ft	1248.43	-0.1
708"	ft	1259.25	-0.1
714"	ft	1270.07	-0.1
720"	ft	1280.89	-0.1
726"	ft	1291.71	-0.1
732"	ft	1302.53	-0.1
738"	ft	1313.35	-0.1
744"	ft	1324.17	-0.1
750"	ft	1334.99	-0.1
756"	ft	1345.81	-0.1
762"	ft	1356.63	-0.1
768"	ft	1367.45	-0.1
774"	ft	1378.27	-0.1
780"	ft	1389.09	-0.1
786"	ft	1400.00	-0.1
792"	ft	1410.82	-0.1
798"	ft	1421.64	-0.1
804"	ft	1432.46	-0.1
810"	ft	1443.28	-0.1
816"	ft	1454.10	-0.1
822"	ft	1464.92	-0.1
828"	ft	1475.74	-0.1
834"	ft	1486.56	-0.1
840"	ft	1497.38	-0.1
846"	ft	1508.20	-0.1
852"	ft	1519.02	-0.1
858"	ft	1529.84	-0.1
864"	ft	1540.66	-0.1
870"	ft	1551.48	-0.1
876"	ft	1562.30	-0.1
882"	ft	1573.12	-0.1
888"	ft	1583.94	-0.1
894"	ft	1594.76	-0.1
900"	ft	1605.58	-0.1
906"	ft	1616.40	-0.1
912"	ft	1627.22	-0.1
918"	ft	1638.04	-0.1
924"	ft	1648.86	-0.1
930"	ft	1659.68	-0.1
936"	ft	1670.50	-0.1
942"	ft	1681.32	-0.1
948"	ft	1692.14	-0.1
954"	ft	1702.96	-0.1
960"	ft	1713.78	-0.1
966"	ft	1724.60	-0.1
972"	ft	1735.42	-0.1
978"	ft	1746.24	-0.1
984"	ft	1757.06	-0.1
990"	ft	1767.88	-0.1
996"	ft	1778.70	-0.1
1002"	ft	1789.52	-0.1
1008"	ft	1800.34	-0.1
1014"	ft	1811.16	-0.1
1020"	ft	1821.98	-0.1
1026"	ft	1832.80	-0.1
1032"	ft	1843.62	-0.1
1038"	ft	1854.44	-0.1
1044"	ft	1865.26	-0.1
1050"	ft	1876.08	-0.1
1056"	ft	1886.90	-0.1
1062"	ft	1897.72	-0.1
1068"	ft	1908.54	-0.1
1074"	ft	1919.36	-0.1
1080"	ft	1930.18	-0.1
1086"	ft	1941.00	-0.1
1092"	ft	1951.82	-0.1
1098"	ft	1962.64	-0.1
1104"	ft	1973.46	-0.1
1110"	ft	1984.28	-0.1
1116"	ft	1995.10	-0.1
1122"	ft	2005.92	-0.1
1128"	ft	2016.74	-0.1
1134"	ft	2027.56	-0.1
1140"	ft	2038.38	-0.1
1146"	ft	2049.20	-0.1
1152"	ft	2059.99	-0.1

Sewer, Water and Drain Pipes

ITEM	UNIT	PRICE	% CHG.
REINFORCED CONCRETE PIPE (RCP)			
18"	ft	10.98	-0.1
24"	ft	26.29	-0.1
30"	ft	36.50	-0.1
36"	ft	47.31	-0.1
42"	ft	58.12	-0.1
48"	ft	68.93	-0.1
54"	ft	79.74	-0.1
60"	ft	90.55	-0.1
66"	ft	101.36	-0.1
72"	ft	112.17	-0.1
78"	ft	122.98	-0.1
84"	ft	133.79	-0.1
90"	ft	144.60	-0.1
96"	ft	155.41	-0.1
102"	ft	166.22	-0.1
108"	ft	177.03	-0.1
114"	ft	187.84	-0.1
120"	ft	198.65	-0.1
126"	ft	209.46	-0.1
132"	ft	220.27	-0.1
138"	ft	231.08	-0.1
144"	ft	241.89	-0.1
150"	ft	252.70	-0.1
156"	ft	263.51	-0.1
162"	ft	274.32	-0.1
168"	ft	285.13	-0.1
174"	ft	295.94	-0.1
180"	ft	306.75	-0.1
186"	ft	317.56	-0.1
192"	ft	328.37	-0.1
198"	ft	339.18	-0.1
204"	ft	350.00	-0.1
210"	ft	360.81	-0.1
216"	ft	371.62	-0.1
222"	ft	382.43	-0.1
228"	ft	393.24	-0.1
234"	ft	404.05	-0.1
240"	ft	414.86	-0.1
246"	ft	425.67	-0.1
252"	ft	436.48	-0.1
258"	ft	447.29	-0.1
264"	ft	458.10	-0.1
270"	ft	468.91	-0.1
276"	ft	479.72	-0.1
282"	ft	490.53	-0.1
288"	ft	501.34	-0.1
294"	ft	512.15	-0.1
300"	ft	522.96	-0.1
306"	ft	533.77	-0.1
312"	ft	544.58	-0.1
318"	ft	555.39	-0.1
324"	ft	566.20	-0.1
330"	ft	577.01	-0.1
336"	ft	587.82	-0.1
342"	ft	598.63	-0.1
348"	ft	609.44	-0.1
354"	ft	620.25	-0.1
360"	ft	631.06	-0.1
366"	ft	641.87	-0.1
372"	ft	652.68	-0.1
378"	ft	663.49	-0.1
384"	ft	674.30	-0.1
390"	ft	685.11	-0.1
396"	ft	695.92	-0.1
402"	ft	706.73	-0.1
408"	ft	717.54	-0.1
414"	ft	728.35	-0.1
420"	ft	739.16</	

ESTIMATING RESOURCES ENR INDICES

- ◆ Five types:
 - ◆ Construction Cost Index (CCI)
 - ◆ Building Cost Index
 - ◆ Materials Cost Index
 - ◆ Skilled Labor Cost Index
 - ◆ Common Labor Cost Index
- ◆ National (20-city average) or local (for 20 U.S. and 2 Canadian cities)
- ◆ Based on local prices for:
 - ◆ Portland cement
 - ◆ 2 X 4 lumber
 - ◆ structural steel
 - ◆ union wages, plus fringes, for carpenters, bricklayers and iron workers.

Cost Indexes JANUARY 15, 2007

Construction Cost Index
The CCI begins 2007 with an annual escalation rate of 2.9%, down from 5% in January 2006 and 6.9% in 2005.

20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR
CONSTRUCTION COST	7879.58	-0.1	+2.9
COMMON LABOR	16920.53	0.0	+3.6
WAGE \$/HR.	31.90	0.0	+3.6

Building Cost Index
Inflation measured by the BCI starts 2007 at 2.3%, compared to rates of 5.4% in January 2006 and 9.2% in 2005.

20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR
BUILDING COST	4432.46	-0.2	+2.3
SKILLED LABOR	7458.80	0.0	+3.6
WAGE \$/HR.	41.40	0.0	+3.6

Materials Cost Index
An increase in cement prices was canceled out by falling steel and lumber prices, pulling the MCI down 0.5%.

20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR
MATERIALS	2583.52	-0.5	0.0
CEMENT \$/TON	95.90	+0.9	+6.5
STEEL \$/CWT	39.53	-0.7	+5.0
LUMBER \$/MBF	464.40	-0.5	-9.7

ESTIMATING RESOURCES CCI LOCAL DATA

JANUARY 15, 2007

Construction Economics		Lower Lumber Prices Pull Back Denver Indexes																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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<td>7409.39</td> <td>+4.2</td> <td>3891.94</td> <td>-2.9</td> <td>15534.21</td> <td>+8.3</td> <td>6285.89</td> <td>+1.6</td> <td>2429.65</td> <td>-9.4</td> </tr> <tr> <td>CLEVELAND</td> <td>8150.03</td> <td>+3.6</td> <td>4262.67</td> <td>+3.4</td> <td>17368.42</td> <td>+2.8</td> <td>7147.75</td> <td>+1.4</td> <td>2500.05</td> <td>+7.1</td> </tr> <tr> <td>20-CITY: 1913=100</td> <td>JAN. 2007 INDEX VALUE</td> <td>% CHG. MONTH</td> <td>% CHG. YEAR</td> <td>20-CITY: 1913=100</td> <td>JAN. 2007 INDEX VALUE</td> <td>% CHG. MONTH</td> <td>% CHG. YEAR</td> <td>20-CITY: 1913=100</td> <td>JAN. 2007 INDEX VALUE</td> <td>% CHG. MONTH</td> <td>% CHG. 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<td>464.40</td> <td>-0.5</td> <td>-9.7</td> <td>LUMBER \$/MBF</td> <td>464.40</td> <td>-0.5</td> <td>-9.7</td> </tr> <tr> <td colspan="12">Sewer, Water and Drain Pipe</td> </tr> <tr> <td>ITEM</td> <td>UNIT</td> <td>ATLANTA</td> <td>BALTIMORE</td> <td>BIRMINGHAM</td> <td>BOSTON</td> <td>CHICAGO</td> <td>CINCINNATI</td> <td>CLEVELAND</td> <td colspan="3"></td> </tr> <tr> <td colspan="12">REINFORCED CONCRETE PIPE (RCP):</td> </tr> <tr> <td>12"</td> <td>ft</td> <td>10.72</td> <td>21.90</td> <td>10.25</td> <td>9.04</td> <td>10.15</td> <td>8.85</td> <td>8.70</td> <td colspan="3"></td> </tr> <tr> <td>24"</td> <td>ft</td> <td>28.24</td> <td>43.60</td> <td>23.97</td> <td>21.70</td> <td>21.62</td> <td>19.70</td> <td>21.50</td> <td colspan="3"></td> </tr> <tr> <td>36"</td> <td>ft</td> <td>48.03</td> <td>86.35</td> <td>46.40</td> <td>47.48</td> <td>42.65</td> <td>44.15</td> <td>44.70</td> <td colspan="3"></td> </tr> <tr> <td>48"</td> <td>ft</td> <td>78.05</td> <td>143.75</td> <td>76.95</td> <td>72.20</td> <td>68.30</td> <td>73.30</td> <td>72.00</td> <td colspan="3"></td> </tr> </tbody> </table>		1913=100	CONSTRUCTION COST	BUILDING COST	COMMON LABOR	SKILLED LABOR	MATERIALS	ALABAMA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	ALASKA	5887.73	-0.4	2888.02	-0.8	10158.26	+0.3	5238.40	-0.2	2462.79	-0.8	ARIZONA	5423.70	-2.3	3245.95	-1.8	10621.25	0.0	3677.42	0.0	2386.71	-0.2	ARKANSAS	5948.12	-0.3	3162.71	+0.2	30023.88	+0.8	9748.20	-0.6	2288.91	+0.2	CALIFORNIA	7589.36	+1.3	3867.84	-2.0	25521.21	-0.2	6088.00	-1.9	4629.00	-0.4	COLORADO	8150.03	+3.6	4262.67	+3.4	11127.19	-1.4	4022.00	-0.4	2500.00	-2.4	CONNECTICUT	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	DELAWARE	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	FLORIDA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	GEORGIA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	HAWAII	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	ILLINOIS	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	INDIANA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	IOWA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	KANSAS	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	KENTUCKY	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	LOUISIANA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	MAINE	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	MARYLAND	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	MASSACHUSETTS	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	MICHIGAN	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	MINNESOTA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	MISSISSIPPI	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	MISSOURI	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	MONTANA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	NEBRASKA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	NEVADA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	NEW HAMPSHIRE	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	NEW JERSEY	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	NEW MEXICO	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	NEW YORK	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	NORTH CAROLINA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	NORTH DAKOTA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	OHIO	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	OKLAHOMA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	OREGON	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	PENNSYLVANIA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	RHODE ISLAND	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	SOUTH CAROLINA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	SOUTH DAKOTA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	TENNESSEE	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	TEXAS	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	UTAH	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	Vermont	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	VIRGINIA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	WASHINGTON	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	WEST VIRGINIA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	WISCONSIN	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	WYOMING	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	Foreign	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8	U.S. Average	7879.58	-0.1	16920.53	0.0	31.90	0.0	4432.46	-0.2	2583.52	-0.5	Denver	8150.03	+3.6	4262.67	+3.4	11127.19	-1.4	4022.00	-0.4	2500.00	-2.4	CINCINNATI	7409.39	+4.2	3891.94	-2.9	15534.21	+8.3	6285.89	+1.6	2429.65	-9.4	CLEVELAND	8150.03	+3.6	4262.67	+3.4	17368.42	+2.8	7147.75	+1.4	2500.05	+7.1	20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR	20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR	20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR	CONSTRUCTION COST	7879.58	-0.1	+2.9	CONSTRUCTION COST	7879.58	-0.1	+2.9	CONSTRUCTION COST	7879.58	-0.1	+2.9	COMMON LABOR	16920.53	0.0	+3.6	COMMON LABOR	16920.53	0.0	+3.6	COMMON LABOR	16920.53	0.0	+3.6	WAGE \$/HR.	31.90	0.0	+3.6	WAGE \$/HR.	31.90	0.0	+3.6	WAGE \$/HR.	31.90	0.0	+3.6	BUILDING COST	4432.46	-0.2	+2.3	BUILDING COST	4432.46	-0.2	+2.3	BUILDING COST	4432.46	-0.2	+2.3	SKILLED LABOR	7458.80	0.0	+3.6	SKILLED LABOR	7458.80	0.0	+3.6	SKILLED LABOR	7458.80	0.0	+3.6	WAGE \$/HR.	41.40	0.0	+3.6	WAGE \$/HR.	41.40	0.0	+3.6	WAGE \$/HR.	41.40	0.0	+3.6	MATERIALS	2583.52	-0.5	0.0	MATERIALS	2583.52	-0.5	0.0	MATERIALS	2583.52	-0.5	0.0	CEMENT \$/TON	95.90	+0.9	+6.5	CEMENT \$/TON	95.90	+0.9	+6.5	CEMENT \$/TON	95.90	+0.9	+6.5	STEEL \$/CWT	39.53	-0.7	+5.0	STEEL \$/CWT	39.53	-0.7	+5.0	STEEL \$/CWT	39.53	-0.7	+5.0	LUMBER \$/MBF	464.40	-0.5	-9.7	LUMBER \$/MBF	464.40	-0.5	-9.7	LUMBER \$/MBF	464.40	-0.5	-9.7	Sewer, Water and Drain Pipe												ITEM	UNIT	ATLANTA	BALTIMORE	BIRMINGHAM	BOSTON	CHICAGO	CINCINNATI	CLEVELAND				REINFORCED CONCRETE PIPE (RCP):												12"	ft	10.72	21.90	10.25	9.04	10.15	8.85	8.70				24"	ft	28.24	43.60	23.97	21.70	21.62	19.70	21.50				36"	ft	48.03	86.35	46.40	47.48	42.65	44.15	44.70				48"	ft	78.05	143.75	76.95	72.20	68.30	73.30	72.00			
20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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ALABAMA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
ALASKA	5887.73	-0.4	2888.02	-0.8	10158.26	+0.3	5238.40	-0.2	2462.79	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
ARIZONA	5423.70	-2.3	3245.95	-1.8	10621.25	0.0	3677.42	0.0	2386.71	-0.2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
ARKANSAS	5948.12	-0.3	3162.71	+0.2	30023.88	+0.8	9748.20	-0.6	2288.91	+0.2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
CALIFORNIA	7589.36	+1.3	3867.84	-2.0	25521.21	-0.2	6088.00	-1.9	4629.00	-0.4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
COLORADO	8150.03	+3.6	4262.67	+3.4	11127.19	-1.4	4022.00	-0.4	2500.00	-2.4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
CONNECTICUT	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
DELAWARE	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
FLORIDA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
GEORGIA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
HAWAII	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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KANSAS	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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LOUISIANA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
MAINE	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
MARYLAND	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
MASSACHUSETTS	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
MICHIGAN	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
MINNESOTA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
MISSISSIPPI	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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NEW HAMPSHIRE	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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NORTH CAROLINA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
NORTH DAKOTA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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OKLAHOMA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
OREGON	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
PENNSYLVANIA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
RHODE ISLAND	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
SOUTH CAROLINA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
SOUTH DAKOTA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
TENNESSEE	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
TEXAS	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
UTAH	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Vermont	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
VIRGINIA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
WASHINGTON	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
WEST VIRGINIA	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
WISCONSIN	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
WYOMING	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Foreign	6060.79	-0.8	3011.98	-0.2	8866.42	+1.8	5238.24	+1.1	2559.24	-0.8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
U.S. Average	7879.58	-0.1	16920.53	0.0	31.90	0.0	4432.46	-0.2	2583.52	-0.5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Denver	8150.03	+3.6	4262.67	+3.4	11127.19	-1.4	4022.00	-0.4	2500.00	-2.4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
CINCINNATI	7409.39	+4.2	3891.94	-2.9	15534.21	+8.3	6285.89	+1.6	2429.65	-9.4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
CLEVELAND	8150.03	+3.6	4262.67	+3.4	17368.42	+2.8	7147.75	+1.4	2500.05	+7.1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR	20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR	20-CITY: 1913=100	JAN. 2007 INDEX VALUE	% CHG. MONTH	% CHG. YEAR																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
CONSTRUCTION COST	7879.58	-0.1	+2.9	CONSTRUCTION COST	7879.58	-0.1	+2.9	CONSTRUCTION COST	7879.58	-0.1	+2.9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
COMMON LABOR	16920.53	0.0	+3.6	COMMON LABOR	16920.53	0.0	+3.6	COMMON LABOR	16920.53	0.0	+3.6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
WAGE \$/HR.	31.90	0.0	+3.6	WAGE \$/HR.	31.90	0.0	+3.6	WAGE \$/HR.	31.90	0.0	+3.6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
BUILDING COST	4432.46	-0.2	+2.3	BUILDING COST	4432.46	-0.2	+2.3	BUILDING COST	4432.46	-0.2	+2.3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
SKILLED LABOR	7458.80	0.0	+3.6	SKILLED LABOR	7458.80	0.0	+3.6	SKILLED LABOR	7458.80	0.0	+3.6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
WAGE \$/HR.	41.40	0.0	+3.6	WAGE \$/HR.	41.40	0.0	+3.6	WAGE \$/HR.	41.40	0.0	+3.6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
MATERIALS	2583.52	-0.5	0.0	MATERIALS	2583.52	-0.5	0.0	MATERIALS	2583.52	-0.5	0.0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
CEMENT \$/TON	95.90	+0.9	+6.5	CEMENT \$/TON	95.90	+0.9	+6.5	CEMENT \$/TON	95.90	+0.9	+6.5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
STEEL \$/CWT	39.53	-0.7	+5.0	STEEL \$/CWT	39.53	-0.7	+5.0	STEEL \$/CWT	39.53	-0.7	+5.0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
LUMBER \$/MBF	464.40	-0.5	-9.7	LUMBER \$/MBF	464.40	-0.5	-9.7	LUMBER \$/MBF	464.40	-0.5	-9.7																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Sewer, Water and Drain Pipe																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
ITEM	UNIT	ATLANTA	BALTIMORE	BIRMINGHAM	BOSTON	CHICAGO	CINCINNATI	CLEVELAND																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
REINFORCED CONCRETE PIPE (RCP):																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
12"	ft	10.72	21.90	10.25	9.04	10.15	8.85	8.70																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
24"	ft	28.24	43.60	23.97	21.70	21.62	19.70	21.50																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
36"	ft	48.03	86.35	46.40	47.48	42.65	44.15	44.70																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
48"	ft	78.05	143.75	76.95	72.20	68.30	73.30	72.00																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

ESTIMATING RESOURCES PPI (PRODUCER PRICE INDEX) DATA

FOR DECEMBER 11, 2000



December's 1% increase left prices 6% above 1999. Prices have been stable since last September. Prices have been flat for most of the year. Despite a large correction, prices are 12% above 1999.

PVC and DIP Prices Make Gains

Large price increases for PVC water and sewer pipe continue to provide opportunities for ductile iron pipe producers to raise their prices. In December, prices for 6-in.-dia PVC water pipe increased 1.8%, keeping prices 12% above last year's level. Ductile iron pipe producers responded with a 1% price hike for 6-in. DIP which is now priced 4% above a year ago. Larger diameter DIP made fewer gains, finishing the year 4% above 1999.

ITEM	UNIT	LOS ANGELES	MINNEAPOLIS	NEW ORLEANS	NEW YORK	PHILADELPHIA	PITTSBURGH
REINFORCED CONCRETE PIPE (RCP) 12"	ft	9.11	12.95	9.62	8.24	7.90	7.75
24"	ft	20.98	23.40	18.42	13.83	12.90	15.75
36"	ft	37.46	56.30	36.80	27.06	24.50	29.00
48"	ft	62.74	98.05	64.00	50.00	40.30	47.25
CORRUGATED STEEL PIPE 12"	ft	9.2	4.70	5.50	4.50	4.10	6.95
36"	ft	18.74	15.00	16.28	18.02	14.50	19.77
60"	ft	50.08	53.00	48.10	41.37	36.75	57.00
VITRIFIED CLAY PIPE (VCP), premium joint 12"	ft	10.42	8.93	---	12.19	12.10	8.66
24"	ft	42.91	41.11	---	---	48.13	43.36
POLYETHYLENE PIPE (PE), underdrain 4"	ft	0.43	0.37	0.50	0.30	0.30	0.25
POLYVINYLCHLORIDE PIPE (PVC), sewer 4"	ft	1.01	0.82	0.46	0.87	0.87	0.46
8"	ft	+3.02	2.80	1.68	3.62	3.62	1.68
water 6"	ft	+3.09	4.40	2.14	4.25	4.62	2.14
8"	ft	+5.81	7.40	3.17	7.00	8.02	3.71
12"	ft	+11.18	15.50	7.84	15.33	17.12	7.95

ESTIMATING RESOURCES PPI (PRODUCER PRICE INDEX) DATA

FOR JANUARY 15, 2007

Construction Economics enr.com
FOR A COMPLETE HISTORY OF COST INDICES, VISIT OUR WEBSITE: ENR.COM

PVC Pipe Prices Start 2007 on a Down Note
Prices for PVC pipe had a lackluster start to 2007 compared to double-digit gains posted during the first month of 2006. For 6-in. PVC water pipe, prices fell 0.1% in January compared to a sharp 8.8% increase in January 2006. The result was a 10% increase over last year's level.



Sharp drop in year-to-year escalation from a plus 4.7% last December to a negative 4.8% this month. Copper pipe prices are still rising from last year's record highs and 4-in. copper water tubing prices begin this year 45.3% above January 2006's level.

ITEM	UNIT	LOS ANGELES	MINNEAPOLIS	NEW ORLEANS	NEW YORK	PHILADELPHIA	PITTSBURGH
REINFORCED CONCRETE PIPE (RCP) 12"	ft	10.96	17.40	10.42	14.57	8.28	12.00
24"	ft	23.01	31.50	24.50	22.82	13.60	21.35
36"	ft	45.11	68.70	58.74	49.25	25.82	45.80
48"	ft	78.98	115.24	81.82	77.88	41.79	74.60
CORRUGATED STEEL PIPE 12"	ft	7.20	10.20	8.54	8.35	5.74	6.95
36"	ft	23.66	36.10	23.05	32.80	20.35	19.77
60"	ft	59.82	90.60	51.00	80.80	49.20	57.00
VITRIFIED CLAY PIPE (VCP): PREMIUM JOINT 12"	ft	13.03	8.93	---	21.28	29.32	8.66
24"	ft	50.22	41.11	---	---	62.70	43.35
POLYETHYLENE PIPE (PE): UNDERDRAIN 4"	ft	0.79	0.68	1.42	0.97	1.04	0.35
POLYVINYLCHLORIDE PIPE (PVC): SEWER 4"	ft	1.50	1.05	1.73	1.30	1.30	1.28
8"	ft	5.86	4.05	4.70	5.90	3.39	4.29
water 6"	ft	5.02	5.40	5.94	6.80	7.04	6.66
8"	ft	8.09	8.35	8.58	11.40	11.85	11.16
12"	ft	17.26	19.75	18.74	24.70	25.40	20.64

12" RCP pipe price is Pittsburgh jumped from \$7.75/ft to \$12/ft (+55%) in 7 years from 2000 to 2007.

ITEM	UNIT	LOS ANGELES	MINNEAPOLIS	NEW ORLEANS	NEW YORK	PHILADELPHIA	PITTSBURGH
REINFORCED CONCRETE PIPE (RCP) 12"	ft	10.96	17.40	10.42	14.57	8.28	12.00
24"	ft	23.01	31.50	24.50	22.82	13.60	21.35
36"	ft	45.11	68.70	58.74	49.25	25.82	45.80
48"	ft	78.98	115.24	81.82	77.88	41.79	74.60
CORRUGATED STEEL PIPE 12"	ft	7.20	10.20	8.54	8.35	5.74	6.95
36"	ft	23.66	36.10	23.05	32.80	20.35	19.77
60"	ft	59.82	90.60	51.00	80.80	49.20	57.00
VITRIFIED CLAY PIPE (VCP): PREMIUM JOINT 12"	ft	13.03	8.93	---	21.28	29.32	8.66
24"	ft	50.22	41.11	---	---	62.70	43.35
POLYETHYLENE PIPE (PE): UNDERDRAIN 4"	ft	0.79	0.68	1.42	0.97	1.04	0.35
POLYVINYLCHLORIDE PIPE (PVC): SEWER 4"	ft	1.50	1.05	1.73	1.30	1.30	1.28
8"	ft	5.86	4.05	4.70	5.90	3.39	4.29
water 6"	ft	5.02	5.40	5.94	6.80	7.04	6.66
8"	ft	8.09	8.35	8.58	11.40	11.85	11.16
12"	ft	17.26	19.75	18.74	24.70	25.40	20.64

ESTIMATING RESOURCES CCI HISTORICAL DATA SINCE 1908

MONTHLY DATA SINCE 1977

► Construction Cost Index History (1908-2000)

HOW ENR BUILDS THE INDEX: 200 hours of common labor at the 20-city average of common labor rates, plus 25 cwt of standard structural steel shapes at the mill price prior to 1996 and the fabricated 20-city price from 1996, plus 1.128 tons of portland cement at the 20-city price, plus 1,088 board-ft of 2 x 4 lumber at the 20-city price.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL AVG	
1977	2494	2505	2513	2514	2515	2541	2579	2611	2644	2675	2659	2660	2576
1978	2672	2681	2693	2698	2733	2753	2821	2829	2851	2851	2861	2869	2776
1979	2872	2877	2886	2886	2889	2984	3052	3071	3120	3122	3131	3140	3003
1980	3132	3134	3159	3143	3139	3198	3260	3304	3319	3327	3355	3376	3237
1981	3372	3373	3384	3450	3471	3496	3548	3616	3657	3660	3697	3695	3535
1982	3704	3728	3721	3731	3734	3815	3899	3899	3902	3901	3917	3950	3825
1983	3960	4001	4006	4001	4003	4073	4108	4132	4142	4127	4133	4110	4066
1984	4109	4113	4118	4132	4142	4161	4166	4169	4176	4161	4158	4144	4146
1985	4145	4153	4151	4150	4171	4201	4220	4230	4279	4228	4231	4228	4195
1986	4218	4230	4231	4242	4275	4303	4332	4334	4335	4344	4342	4351	4295
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL AVG	
1987	4354	4352	4359	4363	4369	4387	4404	4443	4450	4459	4453	4478	4406
1988	4470	4473	4484	4489	4493	4525	4552	4542	4535	4555	4567	4568	4519
1989	4580	4573	4571	4577	4578	4599	4608	4618	4658	4658	4668	4685	4615
1990	4680	4685	4691	4693	4707	4732	4734	4732	4774	4771	4787	4777	4732
1991	4777	4773	4772	4766	4801	4818	4854	4892	4891	4892	4896	4889	4835
1992	4888	4884	4927	4946	4965	4973	4992	5032	5042	5052	5058	5059	4985
1993	5071	5070	5106	5167	5262	5260	5252	5230	5255	5264	5278	5310	5210
1994	5336	5371	5381	5405	5405	5408	5409	5424	5437	5437	5430	5439	5408
1995	5443	5444	5435	5432	5433	5432	5484	5506	5491	5511	5519	5524	5471
1996	5523	5532	5537	5550	5572	5597	5617	5652	5683	5719	5740	5744	5620
1997	5765	5769	5759	5799	5837	5860	5863	5854	5851	5848	5838	5858	5825
1998	5852	5874	5875	5883	5881	5895	5921	5929	5963	5986	5995	5991	5920
1999	6000	5992	5986	6008	6006	6039	6076	6091	6128	6134	6127	6127	6060
2000	6130	6160	6202	6201	6233	6238	6225	6233	6224	6259	6266	6283	

Base: 1913=100. Indexes revised for March, April and May 2000

ANNUAL DATA FROM 1908 TO 1976

ANNUAL AVERAGE					
1908	97	1931	181	1954	628
1909	91	1932	157	1955	660
1910	96	1933	170	1956	692
1911	93	1934	198	1957	724
1912	91	1935	196	1958	759
1913	100	1936	206	1959	797
1914	89	1937	235	1960	824
1915	93	1938	236	1961	847
1916	130	1939	236	1962	872
1917	181	1940	242	1963	901
1918	189	1941	258	1964	936
1919	198	1942	276	1965	971
1920	251	1943	290	1966	1019
1921	202	1944	299	1967	1074
1922	174	1945	308	1968	1155
1923	214	1946	346	1969	1269
1924	215	1947	413	1970	1381
1925	207	1948	461	1971	1581
1926	208	1949	477	1972	1753
1927	206	1950	510	1973	1895
1928	207	1951	543	1974	2020
1929	207	1952	569	1975	2212
1930	203	1953	600	1976	2401

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ENR INDICES APPLICATION IN COST ESTIMATING

◆ Application: Convert old costs to new costs using:

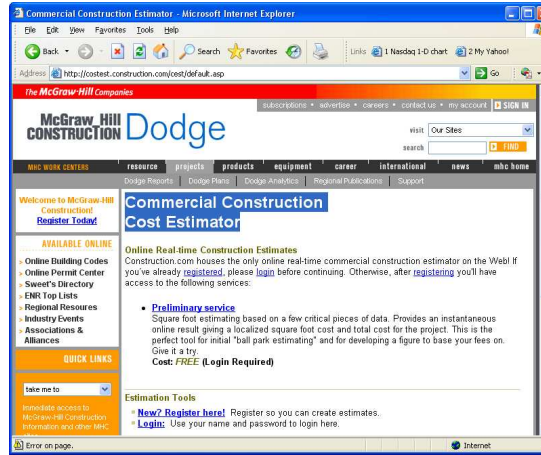
$$\frac{\text{Year O cost}}{\text{Year O ENRI}} = \frac{\text{Year N cost}}{\text{Year N ENRI}}$$

$$\text{Year N cost} = \text{Year O cost} \times \frac{\text{Year N ENRI}}{\text{Year O ENRI}}$$

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ESTIMATING RESOURCES COMMERCIAL CONSTRUCTION COST ESTIMATOR

- ◆ From McGraw-Hill
- ◆ costest.construction.com/cest/default.asp
- ◆ Basic preliminary design cost estimating is free (registration and login required)



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CONSTRUCTION ECONOMICS PRESENT WORTH CALCULATIONS

- ◆ The equivalence of any future amount to any present amount is called the present worth (F.E. Exam Manual).
- ◆ **Ref.: Text Book Chapter 17: Construction Economics**

Table 2.1
Discount Factors for Discrete Compounding

factor name	converts	symbol	formula	
single payment compound amount	P to F	$(F/P, i\%, n)$	$(1 + i)^n$	Future value factor (F/P) Compounded Future value of a Present amount
present worth	F to P	$(P/F, i\%, n)$	$(1 + i)^{-n}$	Single payment present worth factor (P/F) Present worth of a single Future cost (e.g. construction)
uniform series Sinking Fund	F to A	$(A/F, i\%, n)$	$\frac{i}{(1+i)^n - 1}$	
capital recovery	P to A	$(A/P, i\%, n)$	$\frac{i(1+i)^n}{(1+i)^n - 1}$	
compound amount	A to F	$(F/A, i\%, n)$	$\frac{(1+i)^n - 1}{i}$	Uniform series present worth factor (P/A) Present worth of recurring future Annual cost (e.g. maintenance)
equal series present worth	A to P	$(P/A, i\%, n)$	$\frac{(1+i)^n - 1}{i(1+i)^n}$	
uniform gradient	G to P	$(P/G, i\%, n)$	$\frac{(1+i)^n - 1}{i^2(1+i)^n} - \frac{n}{i(1+i)^n}$	

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i = interest rate per period
 n = number of periods

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CONSTRUCTION ECONOMICS F/P FACTOR

http://www.engineeringtoolbox.com/discrete-payments-compounding-formulas-d_1234.html

Single Payment
Compound Amount - Symbol (F/P, i%, n)
 Converts to a future value - F - given a present single payment or value - P - today.

$$F = P [(1 + i)^n] (1)$$

where
 F = future value
 P = single payment today
 i = interest rate per period
 n = number of periods

Compound Amount - Online Calculator

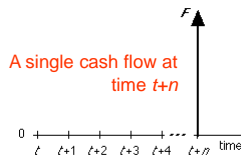
1 P - single payment today
 3 i - interest rate (%)
 20 n - number of periods

Convert

Future Value (F) : 1.81

CONSTRUCTION ECONOMICS P/F FACTOR

http://www.me.utexas.edu/~jensen/ORMM/omie/computation/unit/econ_add/functions.html



Present worth of a single Future cost (e.g. construction)

(P/F, i, n): Single payment present worth factor

E_{PF} (interest rate per period, number of periods)

You win the lottery and the government promises to pay you \$1,000,000 in ten years. Your minimum acceptable rate of return on investments is 10%. What is the prize worth to you now?

A	B	C	D	E	F	G
10	$P = 1000000(P/F, 0.1, 10) = 1000000 * 0.385543 = 385543$					
11						
12	Amount = \$1,000,000.00					
13	Interest = 10%					
14	Time = 10					
15						
16	Present value = \$ 385,543.29					
17						

With a minimum return of 10%, you should accept no less than \$385,543.29.

P/F = 0.385543

CONSTRUCTION ECONOMICS P/A FACTOR

http://www.me.utexas.edu/~jensen/ORMM/omie/computation/unit/econ_add/functions.html



A uniform series of n payments, starting at time t and ending at time $t+n$

Present worth of recurring future Annual cost (e.g. maintenance)

(P/A, i, n): Uniform Series Present Worth Factor

E_PA(interest rate per period, number of periods)

You can afford \$300 a month to purchase a car. If the interest rate is 6% a year and the loan is for 60 months, how much can you finance?

Since the payments are monthly, we use a monthly interest rate in the factor and express the number of periods in months.

A	B	C	D	E	F
41	P = 300(P/A, 0.005, 60) = 300*51.725 = 15517				
42					
43	Amount = \$	300.00			
44	Interest/yr. =	6%			
45	Time(yrs.) =	5			
46	Periods/yr. =	12			
47	Interest/per. =	0.5%			
48	Time(per.) =	60			
49					
50	Present value = \$	15,517.57			
51					

=C43*E_PA(C47,C48)

P/A = 51.725

The present value of the loan payments is the amount that you can borrow.

COST ESTIMATING EXAMPLE 1 SWIRL CONCENTRATOR

- Swirl Concentrators: A Combined Sewer Overflow (CSO) control technology
- Regulates flow and separates solids from wastewater
- Provides equivalent of primary treatment

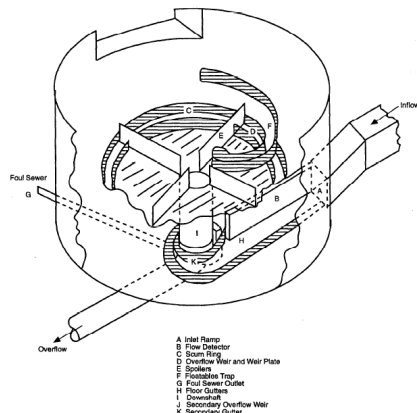


Figure 4-14. Example EPA swirl concentrator (U.S. EPA, 1982).



Saco's excess flow treatment systems at work.



A view of Saco's new CSO treatment system.

STORM KING VORTEX SEPARATOR, SACO, MAINE
 (Storm Water Solutions, July/August, 2007)

COST ESTIMATING EXAMPLE SWIRL CONCENTRATOR

- Alternative name: vortex separator
- Effective at removing heavy suspended solids and floatables
 - Total suspended solids removal \cong 80%
- Operation: Flow entering the unit is directed around the perimeter of a cylindrical shell, creating a swirling, vortex flow pattern. The swirling action throttles the influent flow, and causes solids to be concentrated at the bottom of the unit. The throttled underflow containing the concentrated solids passes out through a foul sewer outlet in the bottom of the unit, while the clarified water passes out through the top of the unit. The underflow is typically discharged to the downstream interceptor for treatment at the sewage treatment plant. Various baffle arrangements capture floatables in the clarified water on top. Once storm flows subside, the floatables are carried out in the underflow when the unit drains.
- Advantage: can operate unattended during a storm (do not need an operator)

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COST ESTIMATING EXAMPLE SWIRL CONCENTRATOR

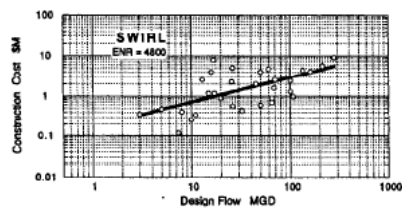
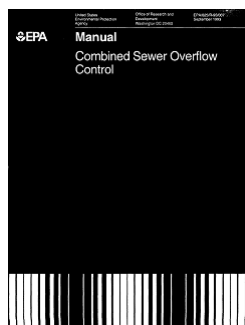


Table S-1. Cost Equations for CSO Control Technology

CSO Control Technology	Cost Equation*	Applicable Design Range	ENR Index
Storage basins	$3.637 V^{0.826}$	0.15 to 30 MG	4,800
Deep tunnels	$4.982 V^{0.795}$	1.8 to 2,000 MG	4,800
Swirl concentrators	$0.176 Q^{0.611}$	3 to 300 MG	4,800
Screens	$0.072 Q^{0.543}$	0.8 to 200 MG	4,800
Sedimentation	$0.211 Q^{0.568}$	1 to 500 MG	4,500
Disinfection	$0.121 Q^{0.484}$	1 to 200 MG	4,500

May 1991

* V = volume (MG); Q = flow rate (MGD).

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D7 $f_x = (0.176 * (C7)^{0.611}) * 1000000 * C\$3 / 4800$

Swirl Concentrator Cost Estimate

**COST ESTIMATING EXAMPLE 1
SWIRL CONCENTRATOR**

Unit No.	Peak Flow (cfs)	Peak Flow (MGD)	Construction Cost	O&M Cost
1	15.06	9.79	916,082	89,000
2	8.09	5.26	626,861	48,000
3	6.78	4.41	562,554	40,000
4	18.37	11.94	1,034,317	108,000
5	8.95	5.82	666,587	53,000
6	10.68	6.94	742,502	63,000
Total	67.93	44.156	4,548,902	401,000

◆ Planning level cost estimation
◆ EPA cost equation for CCI = 4800 (May 1991)
◆ December 2000 CCI for Pittsburgh = 6199

Support\Swirl Cost.xls

	User Input	Calculated Values
16 Construction Cost		4,549,000
17 Contingency	23%	1,138,000
18 Non-construction costs	13%	682,400
19 Total Capital Cost		6,370,000
PRESENT WORTH CALCULATIONS		
21 Salvage rate as an assumed % of capital cost	10%	
22 Land Value	200,000	
23 Design Life (Years) = n	20	
24 Interest Rate = i	8%	
25 Annual rate of increase in land value	3%	
26 Future value factor = (F/P)		1.8061
27 Uniform series present worth factor = (P/A)		9.8181
28 Single payment present worth factor = (P/F)		0.2145
29 Present Worth, Capital Cost		6,370,000
30 Present Worth, Annual O&M Cost		\$3,938,000
31 Salvage		
32 Land value after n years		\$362,000
33 Facility value based on assumed salvage rate		637,000
34 Total Salvage Value		\$999,000
35 Present Worth, salvage value		\$215,000
36 Total Present Worth (Capital + O&M - Salvage)		10,093,000

1. Calculate factors: F/P, P/A, P/F

2. Apply P/A

3. Apply F/P

4. Apply P/F

5. Sum the three present worth values

COST ESTIMATING EXAMPLE 2 STORM SEWER CONSTRUCTION

- ◆ Planning level cost estimation for budgeting purpose
- ◆ Date: November 2002
- ◆ Location: Western Pennsylvania / West Virginia

PROJECT COST FOR INSTALLATION OF NEW STORM SEWER
 CSO W30 and W31 - BANK STREET
 ENGINEER'S OPINION OF PROBABLE PROJECT COSTS

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
1	24" Diameter Sanitary Sewer	550	L.F.	\$130	\$71,500
2	18" Diameter Storm Sewer	450	L.F.	\$88	\$38,250
3	12" Diameter Storm Sewer	400	L.F.	\$70	\$28,000
4	6" Diameter Sanitary Sewer	1176	L.F.	\$55	\$64,625
5	4' Diameter Manhole Bottom	4	Each	\$800	\$3,200
6	5' Diameter Manhole Bottom	8	Each	\$1,000	\$8,000
7	4' Diameter Manhole Barrel	32	V.F.	\$120	\$3,840
8	5' Diameter Manhole Barrel	65	V.F.	\$180	\$11,700
9	Manhole Frames and Cover	12	Each	\$280	\$3,360
10	2' x 4' Inlet	6	Each	\$2,500	\$15,000
11	2' x 4' Inlet Frame and Grate	6	Each	\$700	\$4,200
12	Paving Restoration	2125	S.F.	\$25	\$53,125
13	Connection to Existing Manhole, Inlet or Sewer	6	Each	\$400	\$2,400
14	Abandon Existing CSO	2	Each	\$10,000	\$20,000
15	Bypass Pumping	1	Each	\$25,000	\$25,000
16	Traffic Control	1	Each	\$25,000	\$25,000
SUBTOTAL CONSTRUCTION					\$376,840
CONSTRUCTION CONTINGENCY (15%)					\$56,526
TOTAL CONSTRUCTION					\$433,366
ENGINEERING, LEGAL AND ADMINISTRATIVE (15%)					\$65,005
TOTAL PROJECT COST					\$498,371

COST ESTIMATING EXAMPLE 3 SANITARY SEWER CONSTRUCTION

Table 1
Comparable Parallel Force Main Construction Costs
San Francisco ENR CCI (1999) = 6850

Item	Qty.	Unit	14" DIP (\$ 1,000)	10" PVC (\$ 1,000)	14" PVC (\$ 1,000)
Sitework					
Excavation	6,883	CY	103	103	103
Backfill	3,737	CY	75	75	75
Agg. Base & Compaction	2,796	CY	98	98	98
Offhaul	3,776	CY	57	57	57
Trench Shield	61,950	SF	248	248	248
Bore & Jack, Road Crossing	200	LF	200	200	200
Pavement Restoration	1,700	LF	85	85	85
Utility Restoration	1	LS	30	30	30
Bore & Jack, Creek Crossing	200	LF	200	200	200
Equipment					
Air/vacuum Release Stations	5	EA	75	75	75
Blow-Off Stations	6	EA	45	45	45
Access Vaults & Isol. Valves	2	EA	30	30	30
Piping					
Furnish & Install	8,850	LF	978	177	207
Fittings	45	EA	115	55	70
Cathodic Protection	8,850	LF	150	0	0
SUBTOTAL			2,489	1,478	1,523
CONTINGENCY @ 25%			622	370	381
CONSTRUCTION COST			3,111	1,848	1,904
Engineering, Legal and Administration @ 20%			622	370	381
CAPITAL COST			3,733	2,218	2,285
ESCALATED 2006 COST			4,480	2,661	2,742

Table 2
Gravity Sewer Construction Costs
San Francisco ENR CCI (2006) = 8400

Item	Qty.	Unit	15" VCP (\$ 1,000)	24" VCP (\$ 1,000)
Sitework				
Excavation	6,300	CY	95	95
Backfill	3,500	CY	70	70
Agg. Base & Compact	2,500	CY	88	88
Offhaul	3,500	CY	52	52
Trench Shield	50,000	SF	225	225
Bore & Jack, Road Crossing	200	LF	200	200
Pavement Restoration	1,700	LF	80	80
Utility Restoration	1	LS	30	30
Bore & Jack, Creek Crossing	200	LF	200	200
Equipment				
Manholes	22	EA	110	110
Piping				
Furnish & Install	7,150	LF	143	179
SUBTOTAL			1,293	1,329
CONTINGENCY @ 25%			323	332
CONSTRUCTION COST			1,616	1,661
Engineering, Legal and Administration @ 20%			323	332
CAPITAL COST			1,939	1,993

COST ESTIMATING EXAMPLE 4: EXTRAPOLATION METHOD SEWAGE TREATMENT PLANT

1. MAJOR PROJECTS, Estimating By Percentage Extrapolation

This approach is to be used only on projects that will involve extensive use of all or most of the Master Specifications (CMS). The procedure utilizes the installed costs of "EQUIPMENT" as defined and the statistics generated from analysis of bids received on eleven previous projects to predict the total cost of the project under consideration.

The statistical data currently profiles a major project as follows:

PROCESS EQUIPMENT	=	37.58% of the Cost
CONCRETE	=	17.51% of the Cost
ELECTRICAL & INSTRUMENTATION	=	13.61% of the Cost
ARCHITECTURAL	=	20.56% of the Cost
SITE WORK	=	6.94% of the Cost
GENERAL REQUIREMENTS	=	3.80% of the Cost

a. To use this data you simply compile an equipment list and cost it as accurately as possible from vendor telephone or recently written quotes and/or data presented elsewhere in this document. Do not use numbers from previous estimates unless you know the source of the data on which those numbers are based and whether they are already adjusted for installation.

Once the base cost data is assembled, then use the Installation Multiples presented elsewhere in this document to extrapolate an installed cost on each

and every item of equipment. After all equipment has been costed and totalized, calculate pipe and valving costs at 30% of the installed equipment costs. Show piping and valves as a line item and add to the equipment costs. The resulting number is the total equipment costs as defined.

Step 3

Step 4

Step 5

Step 6

$$\frac{\text{Total Equipment Costs}}{\text{Mean Average Equip. Percentage}} = \text{Project Cost}$$

$$\text{Project Cost} \times \text{Category Percentage} = \text{Installed Cost for that Category}$$

$$\text{Totalized Category Dollars} + 25\% \text{ Contingency} = \text{Estimated Project Cost}$$

EXAMPLE: Assume we are working on a project on which the installed equipment cost before Piping and Valves is \$800,000. First, we must add Piping and Valves to complete "EQUIPMENT", as defined.

SO: $\$800,000 \text{ (equipment costs)} \times .30 \text{ (factor, piping)} = \$240,000 \text{ (piping costs)}$
 $\$800,000 + \$240,000 = \text{TOTAL EQUIPMENT COSTS OR } \$1,040,000$

THUS: $\frac{\$1,040,000 \text{ (Total Equipment)}}{.3758 \text{ (Mean Avg. Equip. \%)}} = \$2,767,429.48$ PROJECT COST

EXTRAPOLATED:

Equipment		\$1,040,000
Concrete (\$2,767,429 x .1751)		484,577
E & I (\$2,767,429 x .1361)		376,647
Architectural (\$2,767,429 x .2056)		568,083
Site Work (\$2,767,429 x .0694)		192,060
General Requirements (\$2,767,429 x .0380)		105,162
Projected Cost		\$2,767,429
Contingency 25%		691,937
TOTAL PROJECTED COST		\$3,459,366

Installation multiple = 25 - 50 %

Step 1

Step 2

HOMEWORK No. 3



- This is an individual homework
- Recreate Example 4 in an MS Excel spreadsheet
- Create cells for all given data (user input) including all factors.
- Calculate the total project cost with the data given in Example 4. Make sure it is \$3,459,286
- Submit a printout of the spreadsheet
- Recalculate the total project cost with the following data:
 - Installed equipment cost before piping and valves = \$1,100,000
 - Installed equipment factor for Step 3 = 20%
 - Contingency = 25%
 - You should be able to recalculate the total project cost simply by changing the given data in user input cells
- Submit a recalculation printout of the spreadsheet
- Due: Next class