

Case Study

Time and Materials Comparison-Hotel

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Executive Summary

With advancements in plumbing materials technology, the importance of remaining price competitive is ever increasing. However, material costs are only one part of a larger puzzle. Many of the materials offered today also claim to reduce labor times for installation, resulting in reduced installation costs for the installing contractor.

The purpose of this case study is to examine a project's overall plumbing piping cost, including labor and materials, and determine where trade-offs in lower cost materials may affect the overall cost, both positively and negatively.

Project Information

The project used for this comparison is a 53,700 sq. ft. hotel with four-stories, and 91 units. The main trunk piping is routed in the ground-floor ceiling space, and is distributed up to the remaining three floors via risers.

The per-floor breakdown of unit quantities is as follows:

- Ground floor: 7 units
- Second floor: 28 units
- Third floor: 28 units
- Fourth floor: 28 units

Basic assumptions

The scope of this project is to compare project costs, both material and labor based, of five systems:

- PEX Logic
- CPVC Trunk & Branch
- Copper Sweat Trunk & Branch
- Copper Press Trunk & Branch
- Polypropylene (PP-r) Trunk & Branch

Materials

Although the project uses pipe and fittings larger than two-inch, this study will only look at costs for pipe, fittings, and valves two-inches and smaller. For the PEX system where materials larger than two-inches are not readily available, it is assumed that the larger materials will be copper. Therefore, where applicable, adapters are included for conversion to larger pipe sizes. Project costs, both material and labor based, do not include materials over two-inches.

For pipe and fittings larger than two-inch, each system will convert to:

- Copper will convert to copper
- CPVC will convert to Schedule 80 CPVC
- PEX will convert to copper

Material costs are calculated at 2014 trade pricing information received from various parts of the United States. It is to the best of our knowledge accurate and current.

For each system type, the following materials are included in the project material costs:

PEX Systems

For PEX Logic systems, bill of materials will include:

- 1/2"- 2" pipe and fittings
- 1"- 2" PEX-a Pipe Support w/ cable ties
- 1"- 2" elbows
- Multiport Tees (where applicable) for unit piping
- 1/2"- 1" PEX ball valves
- 1-1/4"- 2" Milwaukee Commercial ball valves with sweat adapters
- Sweat adapters to transition to larger diameter copper pipe (where required)

- Plugs at fixture terminations

CPVC Systems

For CPVC systems, bill of materials will include:

- 1/2"- 2" pipe and fittings
 - o Pipe to be SDR-11 CTS
 - o 1/2"-2" elbows
 - o Fittings to be solvent-cement
- 1/2"- 2" Milwaukee Commercial ball valves with threaded adapters
- Caps at fixture terminations

Polypropylene Systems

For polypropylene systems, bill of materials will include:

- 1/2"- 2" pipe and fittings
 - o CW pipe to be SDR-11
 - o HW pipe to be SDR-7.4 MF
- 1/2"-2" elbows
- Fittings to be socket type
- 1/2"- 2" Milwaukee Commercial ball valves with threaded adapters
- Caps at fixture terminations

Copper Systems

For **copper sweat** systems, bill of materials will include:

- 1/2"- 2" pipe and fittings
- 1/2"- 2" elbows
- 1/2"- 2" Milwaukee Commercial sweat ball valves
- Caps at fixture terminations

For **copper press** systems, bill of materials will include:

- 1/2"- 2" pipe and press fittings (type L)
- 1/2"- 2" press elbows
- 1/2"- 2" Milwaukee Commercial press ball valves
- Caps at fixture terminations

Labor has been calculated using the Mechanical Contractors Association of America (MCAA) Component Method approach. According to MCAA, *"The Component Method is based on the use of labor units that represent all activities necessary for the installation of one component (such as a 90° elbow or a tee). For piping, the unit is in manhours per foot and for components such as fittings, the unit is represented by each."*

From MCAA:

"A labor unit is expressed in terms of manhours to install a unit of material (such as a foot of pipe), an individual item (such as a fitting or valve), or perform a specific task (such as welding a joint). In developing the labor units set forth on this website, MCAA reviewed the many elements that make up installation labor."

They are:

- Receiving
- Unloading
- Stockpiling
- Distribution
- Handling and erection
- Fitting and joining
- Pressure testing

Labor rates are calculated at \$75/hr. This rate is based on extensive research of varying labor rates across the United States, and is not intended to cover all instances.

Study Results

To properly examine the various costs within a building's piping system, the materials and labor were broken up into three sections: main piping, units, and risers.

Main piping includes all pipe, fittings, and valves two-inches and smaller, on the ground floor. This includes public restrooms, laundry, valves and valve adapters for risers. For PEX systems, the main piping also includes required adapters for conversion to larger pipe diameters.

Unit piping includes all pipe and fittings within the unit, after the riser-branch. Units are not individually valved.

Riser piping includes all vertical piping, starting on ground floor, up to the fourth floor units. Risers are valved on ground floor.

Labor

Using the MCAA Component Method to estimate labor hours, the individual building sections were estimated and totalled, as shown in **Table 1**.

Table 1- Labor Hours by Building Section

Building Section	Labor Hours by Building Section				
	PEX Logic	CPVC	Copper Press	Copper Sweat	PP-r
Main Floor	131.03	158.08	142.50	272.40	336.13
Units	678.17	844.97	699.72	1293.27	1516.54
Risers	77.36	156.54	149.37	272.78	297.01
Total	886.56	1159.59	991.59	1838.45	2149.68

It can be seen that the PEX Logic system requires 23% less labor than the CPVC system, and 51% less than the Copper sweat system.

Material Costs

The material costs were then determined for each building section and totalled. **Table 2** highlights the overall material costs by building section. As stated previously, these prices are calculated using average trade pricing.

Table 2- Material Cost per Building Section (USD)

Building Section	Material Costs by Building Section (USD)				
	PEX Logic	CPVC	Copper Press	Copper Sweat	PP-r
Main Floor	\$13,467.86	\$6,012.94	\$17,061.60	\$11,860.70	\$11,262.75
Units	\$5,264.40	\$2,779.11	\$25,783.33	\$14,236.70	\$12,383.67
Risers	\$2,141.12	\$1,344.66	\$8,922.42	\$5,381.43	\$3,396.05
Total Material Cost	\$20,873.37	\$10,136.72	\$51,767.35	\$31,478.82	\$27,042.47

It can be seen that in terms of material costs, CPVC comes in at the lowest, with PEX Logic coming in second. However, lower material costs do not necessarily equate to lower installation costs as evidenced in **Table 3**.

Table 3- Total Costs with Building Sections

Building Section	Total Cost with Building Sections (USD)				
	PEX Logic	CPVC	Copper Press	Copper Sweat	PP-r
Main Floor	\$13,467.86	\$6,012.94	\$17,061.60	\$11,860.70	\$11,262.75
Units	\$5,264.40	\$2,779.11	\$25,783.33	\$14,236.70	\$12,383.67
Risers	\$2,141.12	\$1,344.66	\$8,922.42	\$5,381.43	\$3,396.05
Total Material Cost	\$20,873.37	\$10,136.72	\$51,767.35	\$31,478.82	\$27,042.47
Labor Cost @ \$75/hr	\$66,492.00	\$86,969.25	\$74,369.25	\$137,883.75	\$161,226.00
Total Project Cost	\$87,365.37	\$97,105.97	\$126,136.60	\$169,362.57	\$188,268.47

Once labor is factored into each project, it can be seen that the PEX Logic system comes in at the lowest total cost.

Individual Unit Comparison

As shown in **Table 1**, labor required for piping the units accounts for 65-76% of the total time required for the project. To examine the costs at an individual unit level, the materials and labor were broken down. **Table 4** shows the labor hours required to pipe each unit.

Table 4- Unit Comparison- Labor Hours

Unit 3-3P01	Unit Comparison-Labor Hours				
	PEX Logic	CPVC	Copper Press	Copper Sweat	PP-r
Labor Hours	13.32	17.90	14.84	27.42	32.10

Notes:

1. PEX Logic unit calculated as one set of back-to-back units with a central riser. **See Figure 1.**
2. All other units are calculated as two units. **See Figure 2.**

As shown by **Table 4**, the PEX Logic unit required 25% less labor than the CPVC unit, and 58% less than the PP-r unit.

Table 5 shows the total cost of the unit.

Table 5-Unit Comparison-Cost Each

Unit 3-3P01	Unit Comparison-Cost Each (USD)				
	PEX Logic	CPVC	Copper Press	Copper Sweat	PP-r
Material Cost	\$109.73	\$59.93	\$546.17	\$503.91	\$264.44
Labor	\$999.00	\$1,342.50	\$1,113.00	\$2,056.50	\$2,407.50
Total Cost Each	\$1,108.73	\$1,402.43	\$1,659.17	\$2,560.41	\$2,671.94

Figure 1- PEX Logic Unit

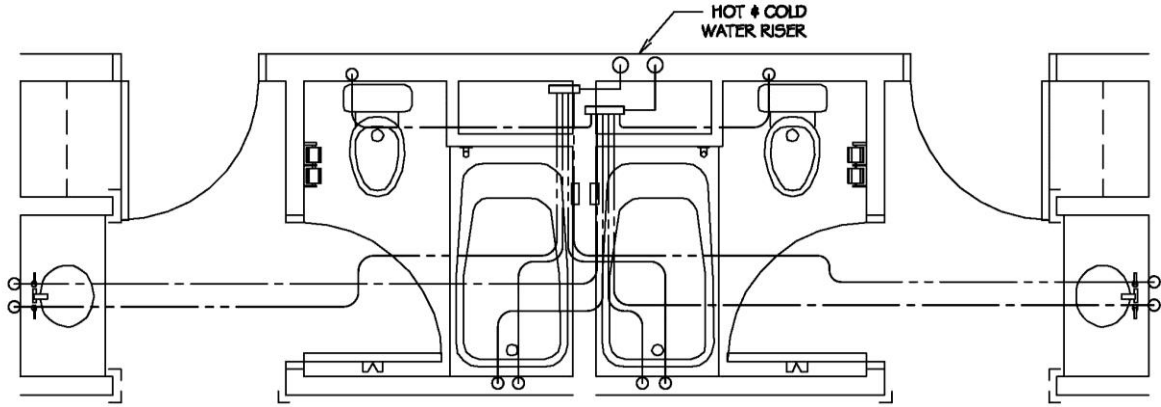
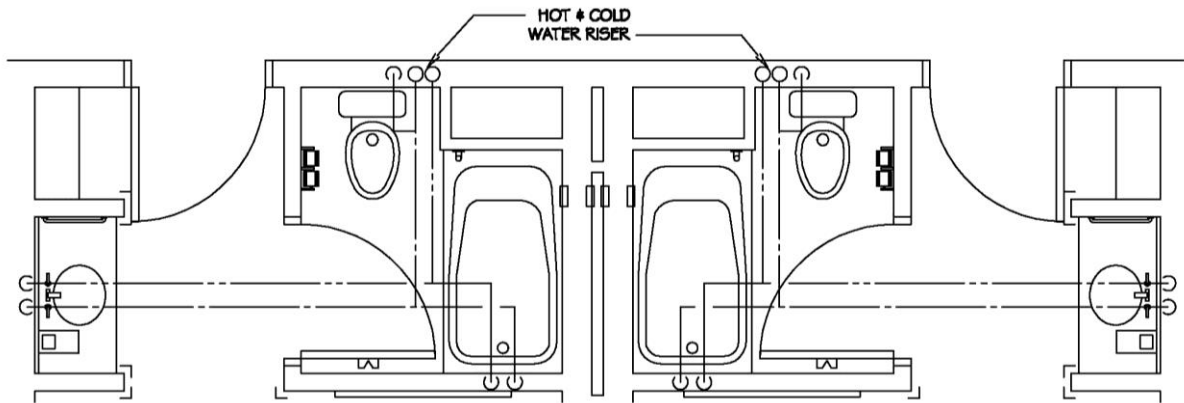


Figure 2- Trunk and Branch Units



Individual Riser Comparison

For this project, riser piping accounted for 8-15% of the total labor hours, depending on system type. **Table 6** highlights the labor hours required to pipe an individual common riser.

Table 6- Riser Comparison-Labor Hours

Riser 4-P502/5-P300	Riser Comparison-Labor Hours				
	PEX Logic	CPVC	Copper Press	Copper Sweat	PP-r
Labor Hours	4.45	10.72	10.24	18.44	20.08

Notes:

1. PEX Logic riser calculated as one larger diameter riser supplying back-to-back units. See **Figure 3**.
2. All other risers are calculated as the time required for two risers.

Because the Logic system utilizes combined risers for multiple units, the labor hours required are 58% less than CPVC risers and 78% less than the PP-r risers.

After material and labor costs are added to the riser, the PEX Logic riser maintains its lead, showing that the decreased amount of labor required plays an important role in the overall costs. **Table 7** shows the individual riser costs.

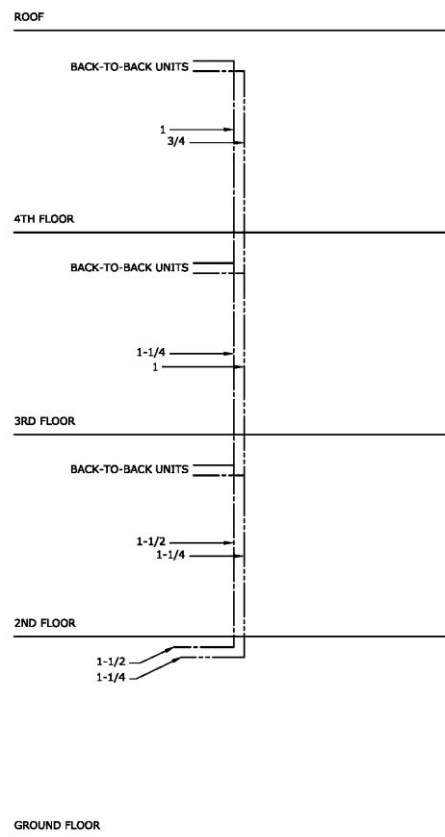
Table 7- Riser Comparison Cost

Riser 4-P502/5-P300	Riser Comparison-Cost Each (USD)				
	PEX Logic	CPVC	Copper Press	Copper Sweat	PP-r
Material Cost	\$142.31	\$88.77	\$613.80	\$617.05	\$235.92
Labor	\$333.75	\$804.00	\$768.00	\$1,383.00	\$1,506.00
Total Cost Each	\$476.06	\$892.77	\$1,381.80	\$2,000.05	\$1,741.92

Notes:

1. PEX Logic riser calculated as one larger diameter riser supplying back-to-back units. See **Figure 3**.
2. All other risers are calculated as the time and cost required for two risers.

Figure 3- PEX Logic Riser



Note the larger pipe sizes required for the PEX Logic riser. Because the PEX Logic system utilizes multiport tees, two separate units can share one common riser (as shown in **Figure 1**), reducing the overall number of risers by 39% (28 to 17).

Figure 4- Copper Riser for Trunk & Branch Units

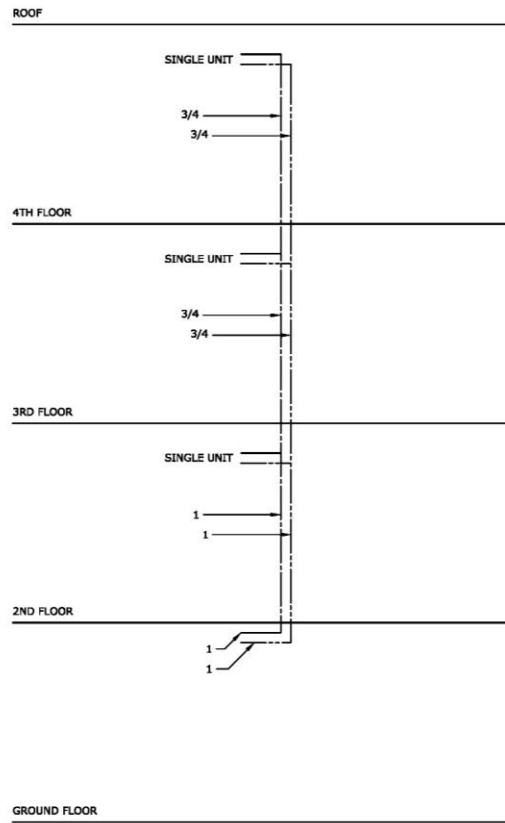


Figure 5- CPVC/PP-r Riser for Trunk & Branch Units

