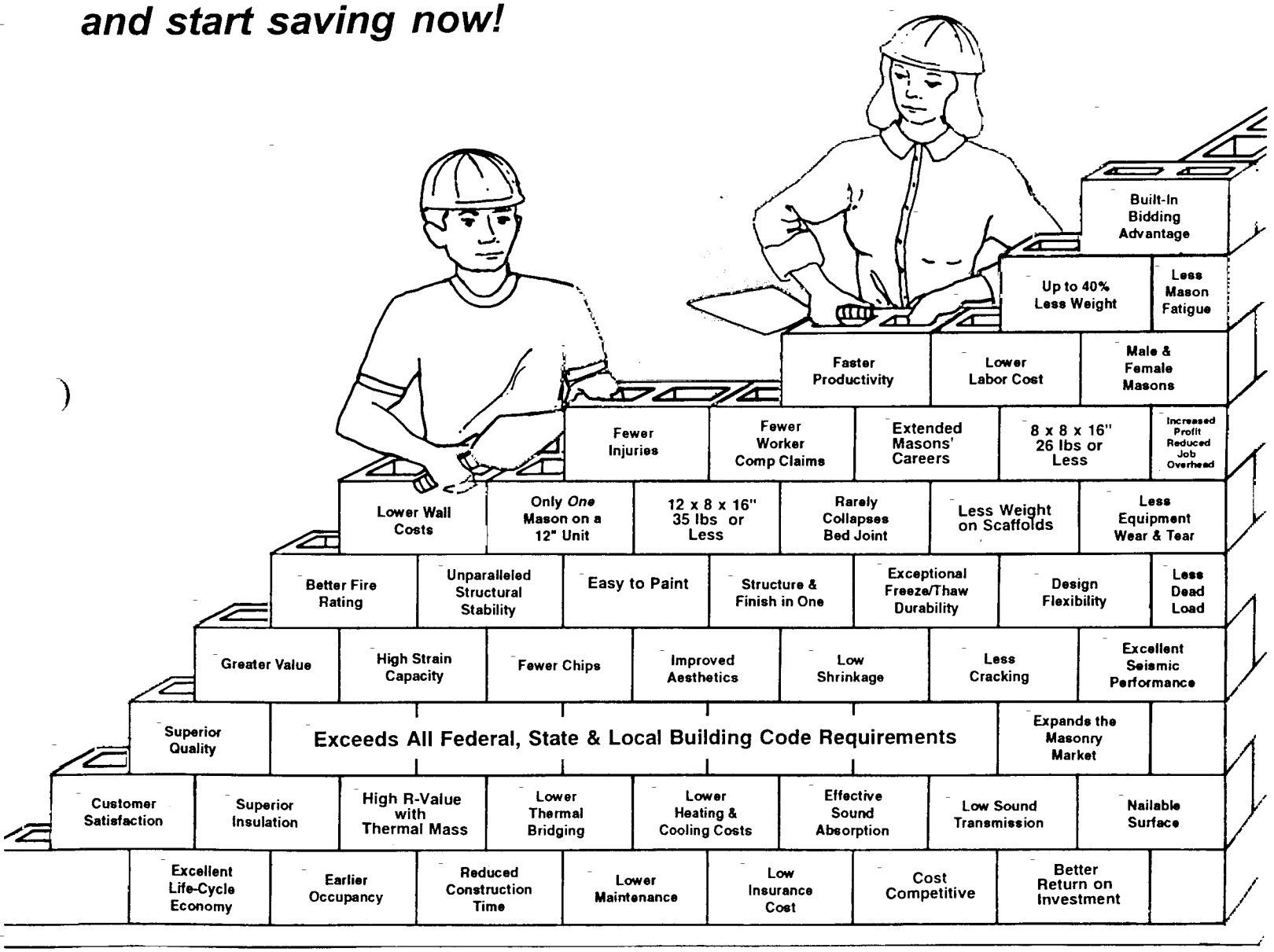
ESCSI

Expanded Shale Clay & Slate Institute

Information Sheet 3650.3
for **Mason Contractors**

High-Performance Concrete Masonry

Join the high-performance team and start saving now!



The Building Blocks of Profitability and Customer Satisfaction

Built on the foundation that there is something *special* inside. High-performance concrete masonry is made with expanded shale, clay, and slate (ESCS) ceramic-lightweight aggregates. ESCS is prepared by expanding select minerals in a rotary kiln at temperatures over 1000°C. The ESCS manufacturing and raw-material selection are strictly controlled to insure a uniform, high-quality structural aggregate that is strong, stable, durable, and inert, yet also lightweight and insulative.

High-Performance Concrete Masonry Units (HPCMUs)

HPCMUs can reduce costs while adding value to all building phases: design, construction, and occupancy. HPCMUs are designed to increase job site productivity while providing superior structural performance, design flexibility, and ongoing energy savings.

The high-performance movement links specifiers, block producers, contractors, and occupants in a "value chain" of quality by delivering superior building products, competitive up-front construction costs, and user-cost benefits that will last the lifetime of the building.

Let HPCMUs expand the concrete masonry market by making masonry a more competitive alternative to wood, glass, metal, concrete, or tilt-up wall systems.

Mason Contractor Benefits

HPCMUs are up to 40% lighter than traditional concrete masonry units. CMUs that weigh less will increase mason productivity up to 21% on 8x8x16" units, and 55% on 12x8x16" units. [1, 4] Increased productivity means increased profits, earlier completion, lower overhead costs, and significant bidding advantages.

Less weight also minimizes the physical demands on masons and equipment, resulting in fewer injuries and workers' compensation claims. Repeatedly lifting less weight also extends a mason's career, and allows women and men to work efficiently. Equipment and scaffolding last longer and are safer to use because less overall weight is being handled.

High-Performance Concrete Masonry Will

- ❑ Help keep mason contractors profitable.
- ❑ Give the contractor a built-in bidding advantage.
- ❑ Lower labor costs through increased productivity.
- ❑ Allow male and female masons to perform efficiently.
- ❑ Extend the mason's career because, even though a mason will lay approximately 20% more wall area in a year, the mason still lifts 15% less weight (about 94 tons less/year).
- ❑ Allow one mason to lay a 12" unit because it weighs only 35 lbs—not 52 lbs.
- ❑ Shorten construction time and reduce job overhead costs.
- ❑ Extend equipment life because lighter loads mean less wear and tear.
- ❑ Help insure safer scaffolding and worker platforms. Less weight means it is easier to meet OSHA weight requirements.
- ❑ Make it easier to lay a true and uniform wall. HPCMUs rarely collapse the bed joint.
- ❑ Improve aesthetics and customer satisfaction by reducing chipping and shrinkage cracks.
- ❑ Provide the architect and engineer with more reasons to specify concrete masonry over other wall systems like wood, steel, tilt-up, etc.
- ❑ Expand the masonry industry.

Productivity

The productivity of a mason is primarily determined by the weight of the concrete masonry unit (CMU). Productivity is crucial because labor is usually 60% of the total wall cost. [1,3,4] The contractors need to establish their own productivity rates based on good records of past performance. The production curves (Figures 1 & 2) provide an excellent tool and reference for estimating production.

CMU Weights in pounds (lbs)

Size (in.)	HPCMU 85-90 lbs/cf	ASTM 105 lbs/cf	Heavyweight (HW) 135 lbs/cf
8x8x16"	23 - 26	29	37
12x8x16"	32 - 35	41	52
8x8x24"	32 - 35	40	52

"Generally speaking, productivity increased as the weight of the units decreased and the length of the units increased." [11]

CMU Productivity Curves [1]

Figure 1

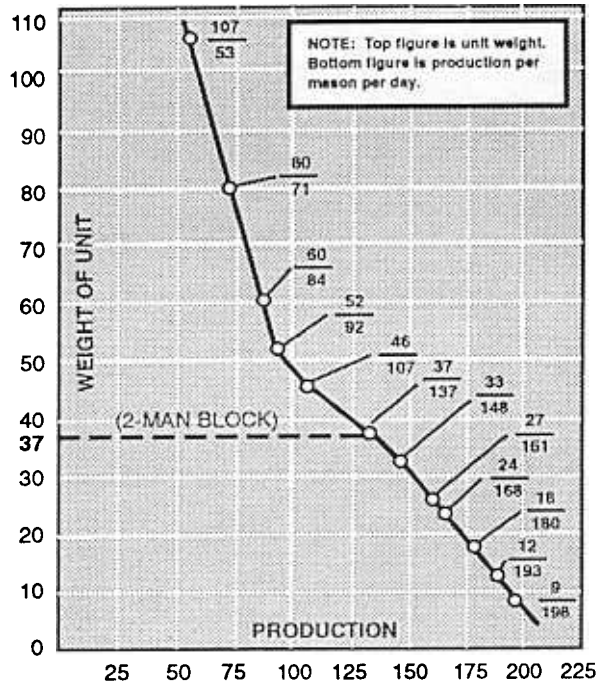
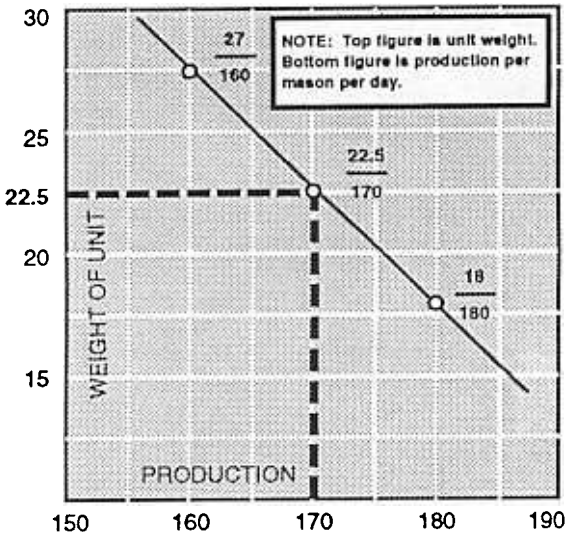


Figure 2.



Graph Reference: Rynold V. Kolkoski, *Masonry Estimating*, The Aberdeen Group, Addison IL 60601

Long-Term Problems Stem from Heavyweight CMUs. Center for Infrastructure Research, University of Nebraska at Lincoln. [4]

"Concrete masonry is a dominant material in wall construction. Over $10 billion worth of masonry walls are constructed in the United States every year. However, the industry is facing a shortage of qualified masons, and the average age of active masons has been gradually increasing due, in part, to the hard work they have to do in lifting heavy CMUs. . . The load of lifting these blocks, day after day, can make drudgery out of a day's work for a mason, especially after many years. **Some older masons must retire early due to the heavy lifting, and many masons experience crippling back and shoulder injuries before retirement."**

Concrete Masonry Wall Costs

	Increased Productivity [1, 3, 11]	Total Wall Costs [1, 2, 4, 5]
8x8x16" HW (37 lbs) to HPCMUs (24 lbs)	21%	2 to 7% less
12x8x16" HW (52 lbs) to HPCMUs (34 lbs)	55%	12 to 22% less
8x8x16" HW (37 lbs) to 8x8x24" HPCMUs (34 lbs)	53%	10 to 18% less*

* Additional savings: The 8x8x24" unit also requires less mortar because of fewer head joints.

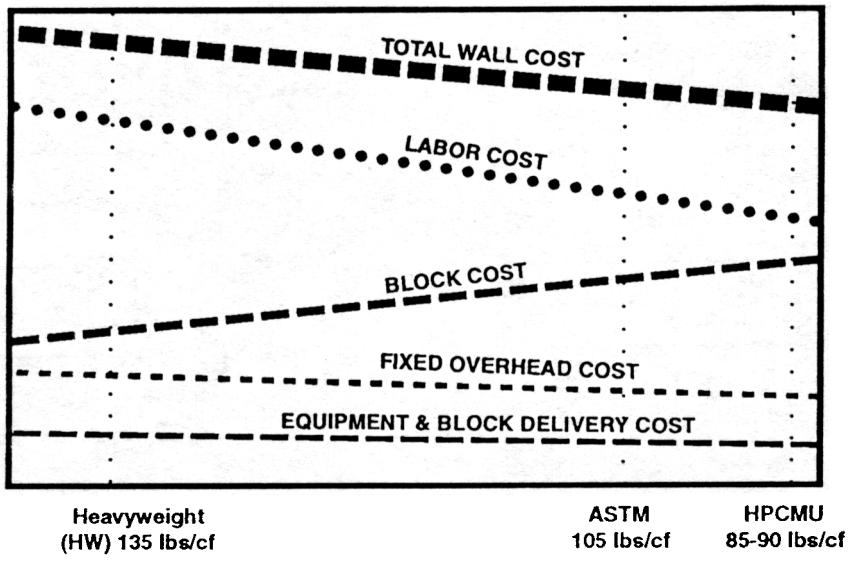


Figure 3. **Wall Cost Trends**

The mason contractor must:

- Keep good job records of mason productivity so that estimates are competitive, yet profitability is maintained.
- Provide quality workmanship. This will insure customer satisfaction and industry growth.
- Use HPCMUs. The future of the concrete masonry industry depends on a healthy labor force, customer satisfaction, and a competitive wall system—HPCMUs help to insure all three.
- Develop personal relationships with architects and engineers. They need your help in designing high-performance concrete masonry buildings that provide safety features, quiet comfort, and lower operating costs.

Customer Satisfaction

Improved customer satisfaction will ultimately expand any market. When you specify HPCMUs, you are selecting a wall system that will greatly exceed traditional building performance standards, thus improving customer satisfaction. HPCMUs will help expand the masonry industry because it has many advantages.

Better Fire Ratings [8]

When specifying rated fire walls, HPCMUs will give you an extra margin of safety that can save lives and dollars—two vital benefits we all value. HPCMUs exceed all UL and National Building Code requirements for equivalent thickness.

Unparalleled Structural Stability

ESCS has a coefficient of thermal expansion significantly lower than that of heavyweight aggregates. HPCMU walls can withstand extreme heat up to 1000°C, and the thermal shock of high-pressure fire-hose spray without cracking, caving in, or deforming. Time and time again, HPCMU walls will remain intact, ready for reuse after a fire.

Effective Noise Control [8]

The sound absorption and low sound transmission of HPCMU walls create a quiet, more peaceful living and working environment. A Noise Reduction Coefficient (NRC) of 0.50 is common—a real benefit in noise-filled rooms or for sound-barrier walls.

Unsurpassed Strength

HPCMUs are made with an optimum density mixture of ESCS aggregate and cement paste to give an improved particle interlock and consolidation. The result is a high strength-to-weight-ratio CMU that far exceeds current ASTM minimum strength standards by 65% to 250%. With net compressive strength commonly in the 3000 psi ranges, HPCMUs can meet the most stringent specification requirements.

Exceptional Freeze-Thaw Durability

Freeze-thaw testing programs at both the University of New Brunswick[6] and the University of Nebraska at Lincoln[4] show that properly designed mixes used in HPCMUs and ASTM lightweight CMUs perform as well as or better than heavyweight CMUs.

Improved Aesthetics

HPCMUs have a greater capability to flex prior to fracture. This improved strain capacity means the HPCMUs will be less subject to chipping and cracking. If you're committed to total quality and customer satisfaction, specify HPCMUs.

continued..

Choose a construction system that won't compromise quality or safety.

Tom Wallace, PE, Wallace Engineering Structural Consultants Inc., Tulsa, OK

"As structural engineers for Wal-Mart Corporation, it is our responsibility to help choose construction systems that are no compromise to quality or safety, and which lend themselves to rapid and economical construction. Concrete masonry units are attractive, economical, and provide fire safety, longevity, and lower insurance rates. They also have the structural capacity to carry gravity, wind, and earthquake loads without backup support.

"We specify lightweight concrete masonry units for all Wal-Mart stores because masons may handle many more units per day without fatigue. Lightweight units weigh about ⅓ less than heavyweight units, so productivity is naturally increased. Maximum productivity is an advantage that we desire in each store built."

Lower Energy Costs

Everyone benefits from HPCMUs, not just the mason contractor. The owners and occupants benefit for years from accrued energy savings. HPCMUs can lower heating and cooling costs by as much as 60%. [7] HPCMUs provide superior insulation by combining high R-values with thermal mass and low thermal bridging.

When comparing tilt-up walls to HPCMU walls of a Houston retail facility (50,000 - 12" CMUs), the HPCMU wall showed a 15% saving in total construction and operating costs over a five-year period. The energy savings alone netted the retailer $21,800 annually. [7]

Reduce Thermal Bridging

Metal frame and heavyweight CMU wall systems are notoriously bad thermal conductors that allow *thermal bridging*. Simply put, thermal bridges allow the funneling of outside temperatures (hot or cold) through the wall via the bridge. This effectively overpowers the R-values of the insulation.

The results are higher energy costs, and uncomfortable hot and cold spots. Metal and wood studs, metal fasteners, and the web in heavyweight CMUs are common high-conductive thermal bridges. The negative effect of the high thermal bridging for heavyweight CMUs and metal studs is clearly shown in the following tables. The superior insulating ability of HPCMUs is a direct result of the low thermal bridging through the web.

R-Values* for Concrete Masonry Walls (h-ft^2 °F/BTU) [9]

Exposed block, both sides	Concrete Density pcf	Cores empty	Cores filled with loose-fill Perlite
8x8x16"	85 135	2.5 1.9	7.1 3.3
12x8x16"	85 135	2.8 2.0	10.3 4.4

* R-values are mid-range.

Parallel Path Correction Factors - Metal Framed Walls with Studs 16 Ga. or Lighter [10]

Size of Member	Spacing of Framing in.	Cavity Insulation R-value	Correction Factor F_c	Equivalent Resistance R_e
2 x 4	16 O.C.	R - 11 R - 13 R - 15	0.50 0.46 0.43	R - 5.0 R - 6.0 R - 6.4
2 x 4	24 O.C.	R - 11 R - 13 R - 15	0.60 0.55 0.52	R - 6.6 R - 7.2 R - 7.8
2 x 6	16 O.C.	R - 19 R - 21	0.37 0.35	R - 7.1 R - 7.4
2 x 6	24 O.C.	R - 19 R - 21	0.45 0. 43	R - 8.6 R - 9.0
2 x 8	16 O.C.	R - 25	0.31	R - 7.8
2 x 8	24 O.C.	R - 25	0.38	R - 9.6

Mason Contractors' Comments

"Using High-Performance Concrete Masonry helped us increase our productivity almost 20%." William (Bill) Wagner, Founder, Tri-Masonry Co.

"I founded Tri-Masonry in 1965. At Tri-Masonry we do all types of masonry including brick, stone, and CMU exclusively on commercial projects. Our customers include Wal-Mart, Target, Hi/Lo Auto Supply, Albertson's, and the Arlington (Texas) and Coppell (Texas) Independent School Districts.

"Recently, we used HPCMUs on a Wal-Mart in Southlake, TX. Using HPCMUs helped us increase our productivity almost 20% versus the Wal-Mart stores we've constructed using heavyweight CMUs. One reason is the 12 in. HPCMU only requires one man while the heavyweight CMU needs two men. The men don't get as tired as fast, either. One man can go seven or eight hours with the HPCMU before he gets as tired. The HPCMU is just what the doctor ordered for us!" ♦

"We support the use of High-Performance Concrete Masonry Units on the jobs we do." David Knight, Owner and Mel Oller, Chief Estimator, D and H Masonry.

"D and H Masonry was established in 1985 in Houston, TX, and is committed to supplying the construction industry with the highest quality masonry jobs possible. We have successfully completed numerous schools for Fort Bend and Houston Independent School Districts, as well as the recently completed Museum of Fine Arts Junior School and Administration Building.

"We support the use of HPCMUs on the jobs we do. We expect better productivity and less chipping due to the lighter weight and higher compressive strength of each unit. As part of the total masonry system that includes quality masonry performed by D and H Masonry, the addition of yet another quality component only results in a winning combination!" ♦

Better attitudes, higher morale, and less breakage. Danny A. Batten, President, Consolidated Masonry Systems, Inc., Garner, NC.

"Using lightweight block, rather than heavyweight, has increased our production and quality of work, as well as created a better attitude and higher morale among our masonry crews. We also have less breakage with lightweight." ♦

Saves both time and money. Bill Merillat, Jayhawk Masonry, Topeka, KS.

"With 8x8x16" lightweight masonry units, we can see at least a 15% increase in mason productivity. With 12x8x16" lightweight units, the increase is more like 35-40%. Time is money, and lightweight saves both." ♦

"We are encouraging the specification of High-Performance Concrete Masonry Units." Robert V. (Buddy) Barnes Jr., President & CEO, Masonry Technology Inc.

"The Dee Brown Companies were formed during the past 40 years with a goal to provide our client with the highest quality masonry product, on time, and within the client's budget. We have provided this work on projects such as the Lew Sterrett Justice Center, Dallas; The Meyerson Symphony Center, Dallas; Burlington Northern Railroad, Ft. Worth; Brooke Army Medical Center, San Antonio; World Savings Corporate Offices, San Antonio.

"As a member of the ASTM-C15 Committee, I understand the HPCMU exceeds all existing ASTM standards, yet will weigh less than the existing CMUs. The lighter weight, along with a more uniform edge and texture, will increase the mason's productivity, thus allowing for a better quality product. We are encouraging the specification of HPCMUs, and we are excited about using this high-quality product to enhance the value and quality of the masonry wall systems we install." ♦

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