

**Residential Masonry & Concrete  
Standards Summary Vol. I**

Submitted To:

**Home Builders Institute**

Washington, DC 20005

Prepared By:

**Wasdyke Associates LLC**

Stevensville, MD 21666

August 2006

***Wasdyke Associates LLC***  
**203 Romancoke Road Ste 507**  
**Stevensville, MD 21666**  
1-410-604-1840  
wasdyke@Verizon.net

Academy of Residential Construction  
National Association of Home Builders  
Home Builders Institute

Residential Masonry and Concrete Skill Standards  
Summary

### An Overview of HBI Framework for Skill Standards

We are pleased to present the sixth in a series of National Skill standards for the residential construction industry. The goal of this project is to establish national standards for the residential construction industry that reflect industry skill requirements. The standards will provide a basis for the certification and training of workers and provide employers with objective benchmarks for selecting employee and evaluating training needs. In addition, educators will find the standards useful for designing curriculum and evaluating individual training outcomes.

These standards in and by themselves do not represent a model-training program. These standards are designed to be a source for developing program and curriculum and evaluating the outcomes of residential masonry and concrete training programs.

Residential Masonry & Concrete standards have been developed and validated and incorporate Level I standards for semi-skilled masons and Level II standards for skilled masons. Forty-five (45) critical work functions or duty areas were identified. Critical work functions describe the major tasks and content areas of work within each specialty. Key activities or major tasks and knowledge involved in completing critical work functions are also provided.

Performance Indicators, which help determine when critical work functions and key activities are being performed competently and meet standards, are referenced to critical work functions. These indicators are found in *Residential Construction Performance*

*Guidelines for Professional Builders & Remodelers 2<sup>nd</sup> Edition* published by the National Association of Home Builders.<sup>1</sup>

In addition, applied academic skills required to perform key activities are provided. These include measurement, arithmetic, layout, geometry, communications and materials. Safety requirements involved in completing key activities have also been identified.

Committees of subject matter experts (SMEs) representing masonry contractors, trainers, and association representatives from different parts of the nation were used to establish and validate the standards. The final list of 43 critical work functions reflects and accommodates regional differences.

## **How the Standards Were Developed**

The project called for the formation of a committee of National Association of Home Builders (NAHB) industry leaders in the field of residential masonry and concrete including masonry contractors, representatives of the Portland Cement Association and Interlocking Concrete Pavement Institute, materials manufacturers as well as masonry instructors and trainers. In addition, the author and editor of Thompson Publishing masonry and concrete text were included in this committee. These leaders represented the following regions of the country: Northeast, Southeast, Southwest, Mid-Atlantic and Mid-Continent. Thus, industry leaders from different regions of the nation provided input with respect to masonry and concrete performance standards, building practices and materials unique to these various regions. The list of residential masonry and concrete critical work functions and key activities produced in this project is appropriate for all regions of the nation, according to these committee industry leaders.

The initial group of seven industry leaders participated in reviewing and rating critical work functions and key activities and applied academic skills. During a two and a half-day meeting the committee reviewed, commented on and rated the importance of more

---

<sup>1</sup> Residential Constructional Performance Guidelines for Professional Builders & Remodelers 2<sup>nd</sup> Edition, National Association of Home Builders, Washington, DC, 2000.

than 50 critical work functions and key activities. The committee also reviewed and referenced applied academic skills and safety requirements to each of these functions and activities.

A second group of ten industry leaders cross-validated the original list of critical work functions and key activities by reviewing and rating these functions and activities. This process allowed the project to develop a more robust set of standards than would have been possible if only one group of industry leaders was used.

### **Residential Masonry & Concrete Specialties**

The occupational category covered by this standards project was residential masons. This also includes masons who perform what is commonly referred to as flat-concrete work such as sidewalks, footings and aprons. Industry leaders further divided the occupational category into two specialties; masonry and concrete. This reflects the trend towards specialization in the home building industry. Industry leaders determined which of the 339 key activities (tasks) or required content was related to each specialty. The percent of all masonry & concrete tasks (231) performed by each of specialties is shown below.

**Table 1. What percent of all masonry & concrete activities are performed by each specialty?**

	<b>Specialty</b>	<b>Key Activities<sup>2</sup></b>	<b>Percent</b>
1	Masonry	226	67%
2	Concrete	113	33%

<sup>2</sup> The total number of residential masonry & concrete key activities and knowledge required to perform is 231.

**Core Activities.** Table 2 illustrates critical work functions that are common to masonry and concrete specialties.

**Table 2. What critical work functions are required by both masonry & concrete specialties?**

	<b>Percent</b>
Residential Masonry & Concrete As Careers	100%
Safety	100%
Reading Drawings & Plans	100%
Residential Materials	100%
Related Masonry Equipment	100%

### **Applied Academic Skills**

Committee members were asked to identify the applied academic skills required to perform each key activity. Applied academic skills include mathematics, communications, use of materials and safety. Table 5 indicates which academic skill goes with each key activity. Also, Table 5 reports safety requirements for each key activity. General statements describing academic skills were developed, reviewed and checked by industry committee members. The following is the list of applied academic skills and the coding structure used to align these skills with masonry and concrete critical areas and tasks.

### **Applied Mathematics Standards**

- 1= Measurement
- 2= Arithmetic
- 3= Layout
- 4= Applied geometry

### **Applied Communications Standards**

- 1= Follow verbal directions
- 2= Follow written directions
- 3= Give simple directions
- 4= Give complex directions

### **Applied Materials Standards**

- 1= Select appropriate materials
- 2= Apply as specified

### **Safety**

- 1= Fall protection
- 2= Silica & dust protection
- 3= Hazardous materials
- 4= Electrical protection
- 5= Power tool & equipment
- 6= Personal Protection Equipment (PPE)
- 7= Handling concrete/masonry materials
- 8= Ladders and scaffolding
- 9= Moving & lifting materials

Analysis of committee members ratings found in Table 5 indicate that more the 90% of the 43 critical work functions require following written and/or verbal direction. Almost 80%of all critical work functions require mathematics skills. Similarly, over 80% of all critical work functions require residential masons to know what materials to select and apply correctly

## Safety Skills

Industry committee members identified safety related skills for the 43 critical work functions as found in Table 5. The following is a list of safety-related skills and the percent of critical work functions that require these skills as displayed in Table 5 below. All skills-based masonry and concrete critical work functions require the proper use of personal protection equipment. In addition, knowledge of OSHA regulations that pertain to residential home building and masons is required.

**Table 3. What safety-related skills and knowledge are required to perform critical areas safely?**

	<b>Percent</b>
Personal Protection Equipment (PPE)	100%
Silica & dust protection	95%
Electrical protection	95%
Power tool & equipment	95%
Fall protection	95%
Handling concrete/masonry materials	95%
Ladders and scaffolding	95%
Moving & lifting materials	95%

## Tools

The industry committee identified standard hand tools and power tools required residential masonry and concrete workers as reported in Table 5. Masons who work with concrete products also require additional safety-related protective-equipment including rubber gloves and rubber work boots.

## **Skill Levels and Training**

Level I masonry and concrete standards can generally be met in a six months to one-year training program depending upon the student's prior educational background (especially in the area of measurement and applied mathematics), work experiences, interests and mechanical aptitude, as well as breadth, scope and sequence of the training program. Level I masons are commonly referred to as semi-skilled and usually perform work under the direction of a skilled or Level II mason. Level I standards are typically learned in a high school or community college vocational program, apprenticeship program, informal and formal builder-based training program, on-the-job training or some combination of these. Level II skilled masons typically perform work independently and may be required to supervise semi-skilled Level I mason. Level II standards typically require two years of training as well as two or more years of experience mastering skills learned in training. Incumbent workers with extensive experience in masonry may be able to demonstrate competence on standards with little or no additional structured training.

## **Residential Masonry & Concrete Occupational Standards**

Critical work functions (duty areas) and key activities (tasks) of a residential mason are listed in Table 4. Duty areas and tasks were determined through committee meetings with residential masonry and concrete industry leaders and review of authoritative texts and other references in the field of residential masonry and concrete. Industry leaders were drawn from different regions of the country and represented remodelers, custom builders, small volume and production builders as well as masonry and concrete instructors and trainers. A second group validated the preliminary results of an initial meeting with industry leaders and the results are shown in this table. The relative importance of each task for Level I semi-skilled and Level II residential masons is reported.

**Importance Rating.** The importance of each task or content area reported in the following table is the product of the proficiency or skill required to perform each task and the impact or risk to the mason, builder, and homeowner if the task is performed improperly. Impact or risk includes possible structural failure to the building, injury to the worker or homeowner, and financial exposure to the builder, to name but a few.

**Proficiency** was estimated by asking the industry experts the following: **What skill level is required of a semi-skilled and skilled residential mason?** This scale ranged from a rating of 1= Minimally Skilled to 4= Highly Skilled.

**Impact** on the building process was estimated by asking industry experts the question: **What is the impact of lack of knowledge or skills in this task or content area on building integrity, public confidence or safety?** The impact scale ranged from 1= Minimal to 4= Catastrophic.

**Overall Importance Rating.** The product of these two scales produced a 16-point importance scale that includes proficiency or skill in performing a task as well as impact on the building process if the task is performed improperly.

- 0-4 (L) Low Importance
- 5-8 (M) Moderate Importance
- 9-12 (V) Very Important
- 13-16 (E) Extremely Important

**Mason Concrete** column indicates whether this is masonry and/or concrete activity. A “Yes” indicates that the skill or knowledge is primarily a masonry or concrete activity.

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>1 Residential Masonry &amp; Concrete As Careers</b>					
A.	What Work Performed by Masons & Concrete Finishers	M	M	Yes	Yes
B.	Physical Qualifications	M	M	Yes	Yes
C.	Career Benefits in Residential Masonry & Concrete	M	M	Yes	Yes
D.	Career Pathways & Apprenticeship	M	M	Yes	Yes
E.	Employment Outlook and Opportunities	M	M	Yes	Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>2 Safety</b>				
A. Proper Dress & Protective Clothing	E	E	Yes	Yes
B. Personal Protection Equipment (Hard Hats, Masks, etc)	E	E	Yes	Yes
C. Fall Protection	E	E	Yes	Yes
D. Stacking Materials	E	E	Yes	Yes
E. Tool Safety	E	E	Yes	Yes
F. Lifting Safety	V	V	Yes	Yes
G. Safe Use of Materials	E	E	Yes	Yes
H. Hazardous Materials	E	E	Yes	Yes
I. OSHA Safety Rules & MSDS	E	E	Yes	Yes
J. Scaffolding & Ladders	E	E	Yes	Yes
K. Ventilation & Respiration Equipment	V	V	Yes	Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>3 Reading Drawings &amp; Plans</b>	L	V	Yes	Yes
A. The Use of Lines, Symbols & Abbreviations in Plans	L	V	Yes	Yes
B. Types of Plans and Drawings	L	V	Yes	Yes
C. Dimensions & Scales	L	V	Yes	Yes
D. Revisions to the Working Drawing	L	V	Yes	Yes
E. Care of the Working Drawing	L	V	Yes	Yes
<b>4 Residential Materials</b>	M	V	Yes	Yes
A. Specifications and Codes	M	V	Yes	Yes
B. Characteristics/Properties of CMUs & Clay Brick Materials	M	V	Yes	Yes
C. Sizes, Shapes, Types & Textures of Clay Brick & CMUs	M	V	Yes	Yes
D. Color & Finishes	M	V	Yes	Yes
E. Dry-Stacked, Surface-Bonded Masonry	M	V	Yes	Yes
F. Fundamentals of Concrete	M	E	Yes	Yes
G. Residential Applications of Concrete	M	V	Yes	Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>5 Use of Masonry Tools</b>				
A. Trowels	V	E	Yes	
B. Hammers	V	E	Yes	
C. Plumb Rule/Level	V	E	Yes	
D. Mason's Scale Rule	V	E	Yes	
E. Rotary Laser Levels	V	V	Yes	
F. Brick Set/Blocking Chisel	V	E	Yes	
G. Mason's Chisel	V	E	Yes	
H. Plugging/Joint Chisel	V	E	Yes	
I. Lines/Fastening	V	E	Yes	
J. Jointers	V	E	Yes	
K. Mason's Brush	V	E	Yes	
L. Steel Square	V	E	Yes	
M. Chalk Box	V	E	Yes	
N. Tool Bag	L	L	Yes	
O. Hard Hat & Safety Glasses	E	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>6 Related Masonry Equipment</b>					
A.	Manual Tools (wheelbarrows, shovels, )	V	V	Yes	Yes
B.	Power-driven Tools (mixers, saws & grinders, vibrators, prime mover, etc)	E	E	Yes	Yes
<b>7 Cutting with Masonry Saws</b>					
A.	Wet & Dry Cutting	E	E	Yes	
B.	Safety Practices	E	E	Yes	
C.	Care of Saw	V	V	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>8 Types and Characteristics of Mortar</b>				
A. Ingredients & Types of Mortar (water, admixtures)	E	E	Yes	
B. Recommended Uses of Mortar: Type M, S, N, O	E	E	Yes	
C. Recommended Mortar Joints in Historical Bldgs (tuckpointing)	E	E	Yes	
D. Potential Problems (discoloration, efflorescence, etc)	E	E	Yes	
<b>9 Mixing Mortar</b>				
A. Standard Proportions for Mortar Mixtures	V	E	Yes	
B. Mixing Mortar Manually	V	E	Yes	
C. Mixing Mortar w/Power Mixer	V	E	Yes	
D. Troubleshooting Mixing Mortar	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>8 Types and Characteristics of Mortar</b>				
A. Ingredients & Types of Mortar (water, admixtures)	E	E	Yes	
B. Recommended Uses of Mortar: Type M, S, N, O	E	E	Yes	
C. Recommended Mortar Joints in Historical Bldgs (tuckpointing)	E	E	Yes	
D. Potential Problems (discoloration, efflorescence, etc)	E	E	Yes	
<b>9 Mixing Mortar</b>				
A. Standard Proportions for Mortar Mixtures	V	E	Yes	
B. Mixing Mortar Manually	V	E	Yes	
C. Mixing Mortar w/Power Mixer	V	E	Yes	
D. Troubleshooting Mixing Mortar	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>10 Mixing Grout</b>				
A. Applications & Types of Grout	V	E	Yes	
B. Standard Proportions for Grout Mixtures	V	E	Yes	
C. Mixing Grout Manually	V	E	Yes	
D. Mixing Grout w/Power Mixer	V	E	Yes	
E. Troubleshooting Mixing & Placing Grout	V	E	Yes	
<b>11 Brick Bonds &amp; Patterns</b>				
A. Running/Stretcher Bond	V	V	Yes	
B. Stack Bond	V	V	Yes	
C. Common or American Bond	V	V	Yes	
D. Flemish Bond	V	V	Yes	
E. English Bond	V	V	Yes	
F. Garden Wall Bonds	V	V	Yes	

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>12 CMU Bonds</b>					
A.	Running Bond	V	V	Yes	
B.	Stack Bond	V	V	Yes	
C.	Decorative Bonds (CMH p92-98)	M	M	Yes	
<b>13 Laying Brick to the Line</b>					
A.	Mortar Bonding Characteristics	V	V	Yes	
B.	Corner Pole	V	V	Yes	
C.	Line Block	V	V	Yes	
D.	Setting the trig	V	E	Yes	
E.	Laying the units	V	E	Yes	
F.	Pressing units into place	V	E	Yes	
G.	Laying the closure unit	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>14 Layout</b>				
A. Dry Bond First Course	V	V	Yes	
B. Modular Construction	V	V	Yes	
C. Building Layout -- Doors & Windows	V	V	Yes	
D. Masonry Openings for Ductwork, AC Units, etc.	V	V	Yes	
<b>15 Building Brick Corners</b>				
B. Building an Outside Corner	V	V	Yes	
C. Building an Inside Corner	V	V	Yes	
D. Rack-Back Lead	V	V	Yes	
E. Toothing the Corner and Openings	V	V	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>16 Laying Concrete Block to the Line</b>				
A. Spreading Mortar	V	V	Yes	
B. Laying the First Course	V	V	Yes	
C. Applying the Head Joint	V	V	Yes	
D. Positioning Block	V	V	Yes	
E. Adjusting Blocks	V	V	Yes	
F. Installing the Closure Block	V	V	Yes	
G. Reinforcing Bed Joints of Concrete Block	V	V	Yes	
H. Tooling Joints	V	V	Yes	
I. Cutting Concrete Block	V	V	Yes	
J. Safety Practices on the Job	V	E	Yes	
K. Repointing the Wall	V	V	Yes	
L. Bracing, Care and Protection of Work	V	V	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>17 Laying the Block Corner</b>				
A. Constructing the Block Corner	V	V	Yes	
B. Bonding Corners for 4, 6, 10 & 12-inch Block	V	V	Yes	
C. Building the Corner to the Specified Height	V	V	Yes	
D. Installing Wire Reinforcement in Joints	V	V	Yes	
E. Tooling Joints	V	V	Yes	
F. Using 3-4-5 Method	V	V	Yes	
<b>18 Wall Construction</b>				
A. Cavity & Veneer Walls	V	V	Yes	
B. Composite Walls (double-wythe walls) CMH Fig 4-18	V	V	Yes	
C. Minimizing Mortar Protrusions & Controlling Mortar Bridging	V	V	Yes	
D. Tying Wythes Together with Headers	V	V	Yes	
E. Using Metal Ties and Collar Joints	V	V	Yes	
F. Reinforced Walls with Rebar & Grout	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>19 Masonry Supports and Bearing Plates</b>				
A. Lintels	V	E	Yes	
B. Piers	V	E	Yes	
C. Steel Bearing Plates	V	E	Yes	
D. Pilasters	V	E	Yes	
E. Solid Masonry-Bearing Walls	V	E	Yes	
F. Laying Units Around Door and Window Frames	V	E	Yes	
<b>20 Movement Joints and Intersecting Walls</b>				
A. Control Joints (concrete masonry)	V	V	Yes	
B. Expansion Joints (clay masonry)	V	V	Yes	
C. Intersecting Walls	V	V	Yes	

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>21 Installation Details</b>					
A.	Setting Anchor Bolts	V	E	Yes	
B.	Masonry Fasteners during & after construction	V	E	Yes	
C.	Working with Electrical Wiring & Plumbing	V	E	Yes	
D.	Brick Corbeling & Quoine Corners	V	E	Yes	
E.	Columns, Piers & Pilasters	V	E	Yes	
F.	Wall Copings	V	E	Yes	
<b>22 Constructing Water-Resistant Walls</b>					
A.	Moisture Content of Brick	V	E	Yes	
B.	Mortar Joints	V	E	Yes	
C.	Air Cavity	V	E	Yes	
D.	Flashings, Vents & Weeps (holes, roping, vents)	V	E	Yes	
E.	Mortar Collection Devices	V	E	Yes	
F.	Origins & Prevention of Efflorescence	V	E	Yes	
G.	Water Repellants	V	E	Yes	
H.	Air Infiltration Barriers	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry Concrete</i>
<b>23 Constructing Water-Resistant Walls</b>	V	E	Yes
A. Proper Foundations & Supports	V	E	Yes
B. Parts of a Step	V	E	Yes
C. Rule of 25 (twice rise + depth of tread =25)	V	E	Yes
D. Determining Number of Treads & Risers	V	E	Yes
E. Constructing Steps	V	E	Yes
F. Perimeter Wall Construction	V	E	Yes
G. Reinforced Concrete Slabs	V	E	Yes
H. Paving Brick Surface	V	E	Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>24 Mortared Brick Pavers</b>	V	E	Yes	
A. Intended Use (light, medium of heavy traffic)	V	E	Yes	
B. Paving brick classifications	V	E	Yes	
C. Thickness Options	V	E	Yes	
D. Brick Density	V	E	Yes	
E. Types of Base (rigid, semi-rigid, flexible)	V	E	Yes	
F. Appearances & Sizes	V	E	Yes	
G. Pattern Bond	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry Concrete</i>
<b>25 Single Flue Chimney</b>				
A. The Chimney Base	V	E	Yes	
B. Mortar for the Chimney Flue Liners	V	E	Yes	
C. Units for the Chimney	V	E	Yes	
D. Installing the Cleanout Door	V	E	Yes	
E. Installing the Flue Lining	V	E	Yes	
F. Beginning Installation	V	E	Yes	
G. Installing Wood Framing Around Chimneys	V	E	Yes	
H. Installing Flashing at the Roof	V	E	Yes	
I. Capping the Chimney	V	E	Yes	
J. Checking for a Good Draft	V	E	Yes	
K. The Importance of Good Workmanship	V	E	Yes	
L. Building Code Requirements	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>26 Erecting and Using Ladders &amp; Scaffolding</b>				
A. Tubular Steel Sectional Scaffolding & Planking	V	E	Yes	
B. Avoiding Scaffolding Hazards	V	E	Yes	
C. General Precautions & Safety Rules	V	E	Yes	
D. OSHA Requirements	V	E	Yes	
<b>27 Cleaning Brick and Concrete Masonry</b>				
A. Safe Use of Cleaning Agents	V	E	Yes	
B. Cleaning Brickwork during Construction	V	E	Yes	
C. Cleaning Concrete Block during Construction	V	E	Yes	
D. Preventing Stains during Construction	V	E	Yes	
E. Removing Stains after Construction	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry Concrete</i>
<b>28 Applied Finishes for Concrete Masonry</b>			
A. Surface Applications (Paints, Stains & Clear Coatings)	L	L	Yes
B. Portland Cement Plaster Finishes (Stucco)	V	E	Yes
C. Furred and Other Finishes	L	L	Yes
D. Water Penetration Resistance	V	E	Yes
E. Parging (Below-Grade, Above-Grade Surfaces)	V	E	Yes
<b>29 Additional Applications of Concrete Masonry</b>			
A. Screen Walls	M	V	Yes
B. Garden Walls and Fences	M	V	Yes
C. Conventional Masonry Retaining Walls	V	E	Yes
D. SRW -- Segmental Retaining Walls	V	E	Yes
E. Interlocking Concrete Pavers	M	V	Yes
F. Manufactured Stone	V	E	Yes
G. Cast Stone	M	V	Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>30 Design and Construction of a Fireplace</b>				
A. Essentials of Fireplace Construction	V	E	Yes	
B. Mortar & Materials for Fireplace Construction	V	E	Yes	
C. Laying out the Foundation & Clearances	V	E	Yes	
D. Installing the Rough Hearth	V	E	Yes	
E. The Finished Hearth and Rough Opening	V	E	Yes	
F. Laying the Hearth	V	E	Yes	
G. Fireplace Openings	V	E	Yes	
H. Laying Out the Firebox	V	E	Yes	
I. Building the Walls of the Firebox	V	E	Yes	
J. The Smoke Shelf	V	E	Yes	
K. Fireplace Throat and Damper	V	E	Yes	
N. Installing the Damper	V	E	Yes	
M. Forming the Smoke Chamber	V	E	Yes	
O. Determining the Size of Flue Linings	V	E	Yes	
P. Installing Outside Combustion Air Intakes	V	E	Yes	
Q. Setting the Flue Lining Over the Smoke Chamber	V	E	Yes	

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry Concrete</i>
<b>31 Arches</b>			
A. Arch Construction & Terminology	M	E	Yes
B. Types & Classes of Arches	M	E	Yes
C. Laying out Arches From the Radial Center Point	M	E	Yes
D. Marking Off Spacing of the Arch Bricks	M	E	Yes
E. Laying the Arch in Mortar	M	E	Yes
<b>32 Masonry Construction in Extreme Weather Conditions</b>			
A. Hot-Weather Construction	V	V	Yes
B. Cold-Weather Construction	V	V	Yes

**Table 4. Residential Masonry & Concrete Standards**

Importance E=Extremely Important V=Very Important	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>33 Estimating Masonry Units</b>				
A. The Importance of Estimating	L	V	Yes	
B. The Wall Area Method	L	V	Yes	
C. Estimating Square Feet	L	V	Yes	
D. Estimating Masonry Cementitious Materials	L	V	Yes	
E. Estimating Sand	L	V	Yes	
F. Steel Reinforcements (rebar, joint reinforcement)	L	V	Yes	
G. Estimating Material Cost on the Job	L	V	Yes	
H. Estimating Labor Costs	L	V	Yes	

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry Concrete</i>
<b>34 Problem Prevention, Maintenance and Repair of Masonry</b>				
A. Inspection		L	V	Yes
B. Weathering and Frost Damage		L	V	Yes
C. Cracks and Spalls		L	V	Yes
D. Sealants		L	V	Yes
E. Water and Air Permeation		L	V	Yes
F. Efflorescence		L	V	Yes
G. Tuckpointing		L	V	Yes
H. Cleaning Concrete Masonry Surfaces		V	E	Yes
I. Stain Removal		V	V	Yes
J. Protective Surface Treatments		L	V	Yes

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>35 Use of Concrete Tools</b>					
A.	Personal Protection Equipment (Gloves, eye protection, etc)	E	E		Yes
B.	Trowels, Floats, Concrete Rakes & Screeds	V	E		Yes
C.	Hammers	V	E		Yes
D.	2- and 4-foot Levels	V	E		Yes
E.	Measuring Tape/Rule	V	E		Yes
F.	Edgers & Groovers	V	E		Yes
G.	Hand-held Rubbing Stone	V	E		Yes
H.	Hand Saws	V	E		Yes
I.	Lines/Fastening	V	E		Yes
J.	Brooms	V	E		Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>36 Use of Concrete Tools</b>				
A. Manual Tools (wheelbarrows, shovels, rakes)	V	E		Yes
B. Power-driven Tools (mixers, vibrators, power trowel, prime mover, plate compactor, concrete saws etc.)	V	E		Yes
<b>37 Cutting Control Joints with Concrete Saws</b>				
A. Wet & Dry cutting	V	E		Yes
B. Walk Behind, Hand-held & Soft Cut Saws	V	E		Yes
C. Safety Practices	V	E		Yes
D. Care of Saws	V	V		Yes

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>38 Concrete Forms and Placing Footings</b>					
A. Size of the Footings		L	V		Yes
B. Steel Reinforcement		V	E		Yes
C. Concrete for Footings		V	E		Yes
D. How to Estimate Concrete for a Footing		V	E		Yes
E. Types of Footings		V	E		Yes
F. Placing Concrete for Footings		V	E		Yes
G. Curing Time		V	E		Yes
H. Other Uses of Forms for Concrete		L	L		Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>39 Essentials of Concrete Work</b>				
A. Concrete Ingredients, Additives & Mix Proportioning	V	E		Yes
B. Controlling Water-Cement Ratio, Strength & Workability on the Job	V	E		Yes
C. Working Safely with Concrete	V	E		Yes
D. Preparation to Place Concrete	V	E		Yes
E. Placing Concrete (including conveyor belts & pumping)	V	E		Yes
F. Finishing Concrete	V	E		Yes
G. Finishes for Concrete	V	E		Yes
H. Curing	V	E		Yes
I. Troubleshooting Concrete Problems	V	E		Yes
J. Air Entrainment and Freeze-Thaw Resistance	V	E		Yes
K. Preventing Damage From Deicing Chemicals	V	E		Yes

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>40 Concrete Reinforcement</b>					
A.	Steel (rebar & wire mesh)	V	V		Yes
B.	Fiber reinforcement (polypropylene & steel)	V	V		Yes
<b>41 Concrete Construction in Extreme Weather Conditions</b>					
A.	Hot-Weather Construction	V	V		Yes
B.	Cold-Weather Construction	V	V		Yes
<b>42 Preconstruction Preparation Checklist</b>					
A.	Necessary Tools for the Job	V	E		Yes
B.	Subgrade Preparation	V	E		Yes
C.	Moisture Protection (vapor retarders)	V	E		Yes
D.	Formwork	V	E		Yes
E.	Reinforcement (primary & secondary)	V	E		Yes
F.	Joint Design	V	E		Yes
G.	Desired Finish	V	E		Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>43 Finishing concrete/flatwork- Step by Step</b>				
A. Step 1. Subgrade Preparation (Vapor Retarders)	V	E		Yes
B. Step 2: Setting Forms (place reinforcement)	V	E		Yes
C. Step 3: Placing Concrete	V	E		Yes
D. Step 4: Strike-off	V	E		Yes
E. Step 5: Darbying or Bullfloating	V	E		Yes
F. Step 6: Edging	V	E		Yes
G. Step 7: Jointing	V	E		Yes
H. Step 8: Waiting Period	V	E		Yes
I. Step 9: Floating	V	E		Yes
J. Step 10: Troweling	V	E		Yes
K. Step 11: Curing	V	E		Yes
L. Step 12: Protection	V	E		Yes
M. Precautions about Adding Water	V	E		Yes
N. Problems and Cures in Finishing Concrete	V	E		Yes

**Table 4. Residential Masonry & Concrete Standards**

<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>44 Building Concrete Steps</b>				
A. Step 1: Subgrade Preparation	V	E		Yes
B. Step 2: Layout	V	E		Yes
C. Step 3: Formwork	V	E		Yes
D. Step 4: Placement	V	E		Yes
E. Step 5: Strike-off	V	E		Yes
F. Step 6: Wait	V	E		Yes
G. Step 7: Floating and Edging	V	E		Yes
H. Step 8: Tread Finishing	V	E		Yes
I. Step 9: Riser Finishing	V	E		Yes
J. Step 10: Form Removal	V	E		Yes
K. Step 11: Curing	V	E		Yes
L. Precautions about Adding Water	V	E		Yes
M. Problems and Cures in Finishing Concrete	V	E		Yes

**Table 4. Residential Masonry & Concrete Standards**

	<b>Importance E=Extremely Important V=Very Important M= Modest Important L=Least Important</b>	<i>Level I</i>	<i>Level II</i>	<i>Masonry</i>	<i>Concrete</i>
<b>45 Building Concrete Steps</b>					
A. Dusting		V	E		Yes
B. Blisters		V	E		Yes
C. Delaminations		V	E		Yes
D. Scaling		V	E		Yes
E. Popouts		V	E		Yes
F. Crazing		V	E		Yes
G. Cracking		V	E		Yes
H. Discoloration		V	E		Yes

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>			
<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>

**1 Residential Concrete & Masonry As Careers**

- A. What Work Performed by Masons & Concrete Finishers
- B. Physical Qualifications
- C. Career Benefits in Residential Masonry & Concrete
- D. Career Pathways & Apprenticeship
- E. Employment Outlook and Opportunities

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>			
<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>

<b>2 Safety</b>	
A. Proper Dress & Protective Clothing	1,2
B. Personal Protection Equipment (Hard Hats, Masks, etc)	1,2
C. Fall Protection	1,2
D. Stacking Materials	1,2
E. Tool Safety	1,2
F. Lifting Safety	1,2
G. Safe Use of Materials	1,2
H. Hazardous Materials	1,2
I. OSHA Safety Rules & MSDS	1,2
J. Scaffolding & Ladders	1,2
K. Ventilation & Respiration Equipment	1,2

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>3 Reading Drawings &amp; Plans</b>				
A. The Use of Lines, Symbols & Abbreviations in Plans	1,2,3,4	1,2		
B. Types of Plans and Drawings		1,2		
C. Dimensions & Scales	1,2	1,2		
D. Revisions to the Working Drawing	1,2,3,4	1,2		
E. Care of the Working Drawing		1,2		
<b>4 Residential Materials</b>				
A. Specifications and Codes		1,2	1,2	
B. Characteristics/Properties of CMUs & Clay Brick Materials		1,2	1,2	
C. Sizes, Shapes, Types & Textures of Clay Brick & CMUs		1,2	1,2	
D. Color & Finishes		1,2	1,2	
E. Dry-Stacked, Surface-Bonded Masonry		1,2	1,2	
F. Fundamentals of Concrete		1,2	1,2	
G. Residential Applications of Concrete		1,2	1,2	

**Table 5. Applied Academics Masonry & Concrete**

					<b>Applied Academics</b>					
					<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>		
<b>5 Use of Masonry Tools</b>										
A.	Trowels					1,2				
B.	Hammers					1,2		6		
C.	Plumb Rule/Level					1,2				
D.	Mason's Scale Rule			1,2,3,4		1,2				
E.	Rotary Laser Levels					1,2		6		
F.	Brick Set/Blocking Chisel					1,2		6		
G.	Mason's Chisel					1,2		6		
H.	Plugging/Joint Chisel					1,2		6		
I.	Lines/Fastening					1,2				
J.	Jointers					1,2				
K.	Mason's Brush			1,2,3,4		1,2				
L.	Steel Square					1,2				
M.	Chalk Box					1,2				
N.	Tool Bag					1,2		6		
O.	Hard Hat & Safety Glasses									

**Table 5. Applied Academics Masonry & Concrete**

					<b>Applied Academics</b>					
					<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>		
<b>6 Related Masonry Equipment</b>										
A. Manual Tools (wheelbarrows, shovels, )						1,3		2,6,7,8,9		
B. Power-driven Tools (mixers, saws & grinders, vibrators, prime mover, etc)						1,2,4		2,4,5,6,7,8,9		
<b>7 Cutting with Masonry Saws</b>										
A. Wet & Dry Cutting					1	1,2,3,4		2,4,5,6,7,8,9		
B. Safety Practices						1,2,3,4		2,4,5,6,7,8,9		
C. Care of Saw						1,2,3,4		4,5		
<b>8 Types and Characteristics of Mortar</b>										
A. Ingredients & Types of Mortar (water, admixtures)						1,2		1		
B. Recommended Uses of Mortar: Type M, S, N, O						1,2		1		
C. Recommended Mortar Joints in Historical Bldgs (tuckpointing)						1,2		1		
D. Potential Problems (discoloration, efflorescence, etc)						1,2		1		

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>9 Mixing Mortar</b>				
A. Standard Proportions for Mortar Mixtures	1,2	1,2	1,2	2,6,7,9
B. Mixing Mortar Manually	1,2	1,2	1,2	2,6,7,9
C. Mixing Mortar w/Power Mixer	1,2	1,2	1,2	2,5,6,7,9
D. Troubleshooting Mixing Mortar	1,2	1,2	1,2	2,5,6,7,9
<b>10 Mixing Grout</b>				
A. Applications & Types of Grout	1,2	1,2	1,2	
B. Standard Proportions for Grout Mixtures	1,2	1,2	1,2	2,6,7,9
C. Mixing Grout Manually	1,2	1,2	1,2	2,6,7,9
D. Mixing Grout w/Power Mixer	1,2	1,2	1,2	2,5,6,7,9
E. Troubleshooting Mixing & Placing Grout	1,2	1,2	1,2	2,5,6,7,9

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>11 Brick Bonds &amp; Patterns</b>				
A. Running/Stretcher Bond	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Stack Bond	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Common or American Bond	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Flemish Bond	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. English Bond	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Garden Wall Bonds	1,2,3	1,2	1,2	1,2,5,6,7,8,9
<b>12 CMU Bonds</b>				
A. Running Bond	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Stack Bond	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Decorative Bonds (CMH p92-98)	1,2,3	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>13 Laying Brick to the Line</b>				
A. Mortar Bonding Characteristics		1,2	1,2	
B. Corner Pole	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Line Block	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Setting the trig	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Laying the units	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Pressing units into place	1,2,3	1,2	1,2	1,2,5,6,7,8,9
G. Laying the closure unit	1,2,3	1,2	1,2	1,2,5,6,7,8,9
<b>14 Layout</b>				
A. Dry Bond First Course	1,2,3,4	1,2	1,2	1,2,5,6,7,8,9
B. Modular Construction	1,2,3,4	1,2	1,2	1,2,5,6,7,8,9
C. Building Layout -- Doors & Windows	1,2,3,4	1,2	1,2	1,2,5,6,7,8,9
D. Masonry Openings for Ductwork, AC Units, etc.	1,2,3,4	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

					<b>Applied Academics</b>			
					<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>15</b>	<b>Building Brick Corners</b>							
B.	Building an Outside Corner				1,2,3	1,2	1,2	1,2,5,6,7,8,9
C.	Building an Inside Corner				1,2,3	1,2	1,2	1,2,5,6,7,8,9
D.	Rack-Back Lead				1,2,3	1,2	1,2	1,2,5,6,7,8,9
E.	Toothing the Corner and Openings				1,2,3	1,2	1,2	1,2,5,6,7,8,9
<b>16</b>	<b>Laying Concrete Block to the Line</b>							
A.	Spreading Mortar				1,2,3	1,2	1,2	1,2,5,6,7,8,9
B.	Laying the First Course				1,2,3	1,2	1,2	1,2,5,6,7,8,9
C.	Applying the Head Joint				1,2,3	1,2	1,2	1,2,5,6,7,8,9
D.	Positioning Block				1,2,3	1,2	1,2	1,2,5,6,7,8,9
E.	Adjusting Blocks				1,2,3	1,2	1,2	1,2,5,6,7,8,9
F.	Installing the Closure Block				1,2,3	1,2	1,2	1,2,5,6,7,8,9
G.	Reinforcing Bed Joints of Concrete Block				1,2,3	1,2	1,2	1,2,5,6,7,8,9
H.	Tooling Joints				1,2,3	1,2	1,2	1,2,5,6,7,8,9
I.	Cutting Concrete Block				1,2,3	1,2	1,2	1,2,5,6,7,8,9
J.	Safety Practices on the Job				1,2,3	1,2	1,2	1,2,5,6,7,8,9
K.	Repointing the Wall				1,2,3	1,2	1,2	1,2,5,6,7,8,9
L.	Bracing, Care and Protection of Work				1,2,3	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

	Applied Academics			
	Math	Comm.	Materials	Safety
<b>17 Laying the Block Corner</b>				
A. Constructing the Block Corner	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Bonding Corners for 4, 6, 10 & 12-inch Block	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Building the Corner to the Specified Height	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Installing Wire Reinforcement in Joints	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Tooling Joints	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Using 3-4-5 Method	1,2,3,4	1,2	1,2	1,2,5,6,7,8,9
<b>18 Wall Construction</b>				
A. Cavity & Veneer Walls	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Composite Walls (double-wythe walls) CMH Fig 4-18	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Minimizing Mortar Protrusions & Controlling Mortar Bridging	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Tying Wythes Together with Headers	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Using Metal Ties and Collar Joints	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Reinforced Walls with Rebar & Grout	1,2,3	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

	Applied Academics			
	Math	Comm.	Materials	Safety
<b>19 Masonry Supports and Bearing Plates</b>				
A. Lintels	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Piers	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Steel Bearing Plates	1,2,3,4	1,2	1,2	1,2,5,6,7,8,9
D. Pilasters	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Solid Masonry-Bearing Walls	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Laying Units Around Door and Window Frames	1,2,3	1,2	1,2	1,2,5,6,7,8,9
<b>20 Movement Joints and Intersecting Walls</b>				
A. Control Joints (concrete masonry)	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Expansion Joints (clay masonry)	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Intersecting Walls	1,2,3	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>21 Installation Details</b>				
A. Setting Anchor Bolts	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Masonry Fasteners during & after construction	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Working with Electrical Wiring & Plumbing	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Brick Corbeling & Quoine Corners	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Columns, Piers & Pilasters	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Wall Copings	1,2,3	1,2	1,2	1,2,5,6,7,8,9
<b>22 Constructing Water-Resistant Walls</b>				
A. Moisture Content of Brick	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Mortar Joints	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Air Cavity	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Flashings, Vents & Weeps (holes, roping, vents)	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Mortar Collection Devices	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Origins & Prevention of Efflorescence	1,2,3	1,2	1,2	1,2,5,6,7,8,9
G. Water Repellants	1,2,3	1,2	1,2	1,2,5,6,7,8,9
H. Air Infiltration Barriers	1,2,3	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>23 Brick Steps, Stoops &amp; Porches</b>	1,2,3	1,2	1,2	1,2,5,6,7,8,9
A. Proper Foundations & Supports	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Parts of a Step	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Rule of 25 (twice rise + depth of tread =25)	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Determining Number of Treads & Risers	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Constructing Steps	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Perimeter Wall Construction	1,2,3	1,2	1,2	1,2,5,6,7,8,9
G. Reinforced Concrete Slabs	1,2,3	1,2	1,2	1,2,5,6,7,8,9
H. Paving Brick Surface	1,2,3	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

	Applied Academics			
	Math	Comm.	Materials	Safety
<b>24 Mortared Brick Pavers</b>	1,2,3	1,2	1,2	1,2,5,6,7,8,9
A. Intended Use (light, medium of heavy traffic)	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Paving brick classifications	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Thickness Options	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Brick Density	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Types of Base (rigid, semi-rigid, flexible)	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Appearances & Sizes	1,2,3	1,2	1,2	1,2,5,6,7,8,9
G. Pattern Bond	1,2,3	1,2	1,2	1,2,5,6,7,8,9
H. Procedures for Laying Mortared Brick Paving	1,2,3	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

Applied Academics			
Math	Comm.	Materials	Safety

**25 Single-Flue Chimneys**

A. The Chimney Base	1,2,3	1,2	1,2	1,2,5,6,7,8,9
B. Mortar for the Chimney Flue Liners	1,2,3	1,2	1,2	1,2,5,6,7,8,9
C. Units for the Chimney	1,2,3	1,2	1,2	1,2,5,6,7,8,9
D. Installing the Cleanout Door	1,2,3	1,2	1,2	1,2,5,6,7,8,9
E. Installing the Flue Lining	1,2,3	1,2	1,2	1,2,5,6,7,8,9
F. Beginning Installation	1,2,3	1,2	1,2	1,2,5,6,7,8,9
G. Installing Wood Framing Around Chimneys	1,2,3	1,2	1,2	1,2,5,6,7,8,9
H. Installing Flashing at the Roof	1,2,3	1,2	1,2	1,2,5,6,7,8,9
I. Capping the Chimney	1,2,3	1,2	1,2	1,2,5,6,7,8,9
J. Checking for a Good Draft	1,2,3	1,2	1,2	1,2,5,6,7,8,9
K. The Importance of Good Workmanship	1,2,3	1,2	1,2	1,2,5,6,7,8,9
L. Building Code Requirements	1,2,3	1,2	1,2	1,2,5,6,7,8,9

<b>Applied Academics</b>			
<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>

**26 Erecting and Using Ladders & Scaffolding**

A. Tubular Steel Sectional Scaffolding & Planking	1,2,3	1,2		1,4,5,6,7,8,9
B. Avoiding Scaffolding Hazards	1,2,3	1,2		1,4,5,6,7,8,9
C. General Precautions & Safety Rules	1,2,3	1,2		1,4,5,6,7,8,9
D. OSHA Requirements	1,2,3	1,2		1,4,5,6,7,8,9

**27 Cleaning Brick and Concrete Masonry**

A. Safe Use of Cleaning Agents	1,2	1,2	1,2	1,3,4,5,6,8,9
B. Cleaning Brickwork during Construction		1,2	1,2	1,3,4,5,6,8,9
C. Cleaning Concrete Block during Construction		1,2	1,2	1,3,4,5,6,8,9
D. Preventing Stains during Construction		1,2	1,2	1,3,4,5,6,8,9
E. Removing Stains after Construction		1,2	1,2	1,3,4,5,6,8,9

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>28 Applied Finishes for Concrete Masonry</b>				
A. Surface Applications (Paints, Stains & Clear Coatings)	1,2	1,2	1,2	1,3,4,5,6,8,9
B. Portland Cement Plaster Finishes (Stucco)	1,2	1,2	1,2	1,3,4,5,6,8,9
C. Furred and Other Finishes	1,2	1,2	1,2	1,3,4,5,6,8,9
D. Water Penetration Resistance	1,2	1,2	1,2	1,3,4,5,6,8,9
E. Parging (Below-Grade, Above-Grade Surfaces)	1,2	1,2	1,2	1,3,4,5,6,8,9
<b>29 Additional Applications of Concrete Masonry</b>				
A. Screen Walls	1,2,3,4	1,2	1,2	1,2,6,7,8,9
B. Garden Walls and Fences	1,2,3,4	1,2	1,2	1,2,6,7,8,9
C. Conventional Masonry Retaining Walls	1,2,3,4	1,2	1,2	1,2,6,7,8,9
D. SRW -- Segmental Retaining Walls	1,2,3,4	1,2	1,2	1,2,5,6,7,8,9
E. Interlocking Concrete Pavers	1,2,3,4	1,2	1,2	2,5,6,7,8,9
F. Manufactured Stone	1,2,3,4	1,2	1,2	1,2,6,7,8,9
G. Cast Stone	1,2,3,4	1,2	1,2	1,2,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

	Applied Academics			
	Math	Comm.	Materials	Safety
<b>30 Design and Construction of a Fireplace</b>				
A. Essentials of Fireplace Construction	1,2,3,4	1,2	1,2	1.2,6.7.8.9
B. Mortar & Materials for Fireplace Construction	1,2	1,2	1,2	2,4,5,6,,7,9
C. Laying out the Foundation & Clearances	1,2,3,4	1,2	1,2	1.2,6.7.8.9
D. Installing the Rough Hearth	1,2	1,2	1,2	2,4,5,6,,7,9
E. The Finished Hearth and Rough Opening	1,2	1,2	1,2	2,4,5,6,,7,9
F. Laying the Hearth	1,2,3,4	1,2	1,2	1.2,6.7.8.9
G. Fireplace Openings	1,2	1,2	1,2	2,4,5,6,,7,9
H. Laying Out the Firebox	1,2,3,4	1,2	1,2	1.2,6.7.8.9
I. Building the Walls of the Firebox	1,2	1,2	1,2	2,4,5,6,,7,9
J. The Smoke Shelf	1,2,3,4	1,2	1,2	1.2,6.7.8.9
K. Fireplace Throat and Damper	1,2,3,4	1,2	1,2	1.2,6.7.8.9
N. Installing the Damper	1,2,3,4	1,2	1,2	1.2,6.7.8.9
M. Forming the Smoke Chamber	1,2,3,4	1,2	1,2	2,4,5,6,,7,9
O. Determining the Size of Flue Linings	1,2	1,2	1,2	2,4,5,6,,7,9
P. Installing Outside Combustion Air Intakes	1,2	1,2	1,2	2,4,5,6,,7,9
Q. Setting the Flue Lining Over the Smoke Chamber	1,2	1,2	1,2	2,4,5,6,,7,9

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>31 Arches</b>				
A. Arch Construction & Terminology	1,2,3,4	1,2	1,2	1,2,4,5,6,7,8,9
B. Types & Classes of Arches		1,2		
C. Laying out Arches From the Radial Center Point	1,2,3,4	1,2	1,2	1,2,4,5,6,7,8,9
D. Marking Off Spacing of the Arch Bricks	1,2,3,4	1,2	1,2	1,2,4,5,6,7,8,9
E. Laying the Arch in Mortar	1,2,3,4	1,2	1,2	1,2,4,5,6,7,8,9
	1,2,3,4	1,2	1,2	1,2,4,5,6,7,8,9
<b>32 Masonry Construction in Extreme Weather Conditions</b>				
A. Hot-Weather Construction	1,2	1,2	1,2	1,2,5,6,7,8,9,
B. Cold-Weather Construction	1,2	1,2	1,2	1,2,4,5,6,7,8,9,

**Table 5. Applied Academics Masonry & Concrete**

Applied Academics			
Math	Comm.	Materials	Safety

**33 Estimating Masonry Units**

A. The Importance of Estimating		1,2		
B. The Wall Area Method	1,2,3,4	1,2		
C. Estimating Square Feet	1,2,3,4	1,2		
D. Estimating Masonry Cementitious Materials	1,2	1,2		
E. Estimating Sand	1,2	1,2		
F. Steel Reinforcements (rebar, joint reinforcement)	1,2,3,4	1,2		
G. Estimating Material Cost on the Job	1,2	1,2	1	
H. Estimating Labor Costs	1,2	1,2		

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>34 Problem Prevention, Maintenance and Repair of Masonry</b>				
A. Inspection		1,2		
B. Weathering and Frost Damage		1,2		
C. Cracks and Spalls	1,2	1,2	1,2	1,2,5,6,7,8,9
D. Sealants	1,2	1,2	1,2	1,2,5,6,7,8,9
E. Water and Air Permeation	1,2	1,2	1,2	1,2,5,6,7,8,9
F. Efflorescence	1,2	1,2	1,2	1,2,5,6,7,8,9
G. Tuckpointing	1,2	1,2	1,2	1,2,5,6,7,8,9
H. Cleaning Concrete Masonry Surfaces	1,2	1,2	1,2	1,2,5,6,7,8,9
I. Stain Removal	1,2	1,2	1,2	1,2,5,6,7,8,9
J. Protective Surface Treatments	1,2	1,2	1,2	1,2,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

					<b>Applied Academics</b>				
					<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>	
<b>35</b>	<b>Use of Concrete Tools</b>								
A.	Concrete Ingredients, Additives & Mix Proportioning Controlling Water-Cement Ratio, Strength & Workability on the				1,2	1,2	1,2		
B.	Job				1,2	1,2	1,2	6,7,9	
C.	Working Safely with Concrete					1,2	1,2		
D.	Preparation to Place Concrete					1,2	1,2		
E.	Placing Concrete (including conveyor belts & pumping)					1,2	1,2	1,2,4,5,6,7,9	
F.	Finishing Concrete					1,2	1,2	1,2,4,5,6,7,9	
G.	Finishes for Concrete					1,2	1,2		
H.	Curing					1,2	1,2	6,9	
I.	Troubleshooting Concrete Problems					1,2	1,2	1,2,4,5,6,7,8,9,	
J.	Air Entrainment and Freeze-Thaw Resistance				1,2	1,2	1,2	1,2,4,5,6,7,8,9	
K.	Preventing Damage From Deicing Chemicals				1,2	1,2	1,2	6,7,9	

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>			
<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>

**36 Use of Concrete Tools**

- A. Manual Tools (wheelbarrows, shovels, rakes)
- B. Power-driven Tools (mixers, vibrators, power trowel, prime mover, plate compactor, concrete saws etc.)

1,2	6
1,2	6

**37 Cutting Control Joints with Concrete Saws**

- A. Wet & Dry cutting
- B. Walk Behind, Hand-held & Soft Cut Saws
- C. Safety Practices
- D. Care of Saw

1	1,2,3,4	2,4,5,6,7,8,9
	1,2,3,4	2,4,5,6,7,8,9
	1,2,3,4	4,5
1	1,2,3,4	2,4,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

	Applied Academics			
	Math	Comm.	Materials	Safety
<b>38 Concrete Forms and Placing Footings</b>				
A. Size of the Footings	1,2,3,4	1,2	1,2	
B. Steel Reinforcement	1,2,3,4	1,2	1,2	1,4,5,6,7,8,9
C. Concrete for Footings	1,2	1,2	1,2	
D. How to Estimate Concrete for a Footing	1,2	1,2	1	
E. Types of Footings		1,2		
F. Placing Concrete for Footings	1,2,3,4	1,2	1,2	1,2,4,5,6,7,8,9
G. Curing Time	1,2	1,2	1,2	6,9
H. Other Uses of Forms for Concrete	1,2,3,4	1,2	1,2	1,2,4,5,6,7,8,9

**Table 5. Applied Academics Masonry & Concrete**

	Applied Academics			
	Math	Comm.	Materials	Safety
<b>39 Essentials of Concrete Work</b>				
A. Concrete Ingredients, Additives & Mix Proportioning Controlling Water-Cement Ratio, Strength & Workability on the	1,2	1,2	1,2	
B. Job	1,2	1,2	1,2	6,7,9
C. Working Safely with Concrete		1,2	1,2	
D. Preparation to Place Concrete		1,2	1,2	
E. Placing Concrete (including conveyor belts & pumping)		1,2	1,2	1,2,4,5,6,7,9
F. Finishing Concrete		1,2	1,2	1,2,4,5,6,7,9
G. Finishes for Concrete		1,2	1,2	
H. Curing		1,2	1,2	6,9
I. Troubleshooting Concrete Problems		1,2	1,2	1,2,4,5,6,7,8,9,
J. Air Entrainment and Freeze-Thaw Resistance	1,2	1,2	1,2	1,2,4,5,6,7,8,9
K. Preventing Damage From Deicing Chemicals	1,2	1,2	1,2	6,7,9

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>40 Concrete Reinforcement</b>				
A. Steel (rebar & wire mesh)	1,2	1,2	1,2	6,7,9
B. Fiber reinforcement (polypropylene & steel)	1,2	1,2	1,2	6,7,9
<b>41 Concrete Construction in Extreme Weather Conditions</b>				
A. Hot-Weather Construction	1,2	1,2	1,2	6,7,9
B. Cold-Weather Construction	1,2	1,2	1,2	6,7,9
<b>42 Preconstruction Preparation Checklist</b>				
A. Necessary Tools for the Job		1,2		
B. Subgrade Preparation		1,2		
C. Moisture Protection (vapor retarders)		1,2		
D. Formwork		1,2		
E. Reinforcement (primary & secondary)		1,2		
F. Joint Design		1,2		
G. Desired Finish		1,2		

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>40 Concrete Reinforcement</b>				
A. Steel (rebar & wire mesh)	1,2	1,2	1,2	6,7,9
B. Fiber reinforcement (polypropylene & steel)	1,2	1,2	1,2	6,7,9
<b>41 Concrete Construction in Extreme Weather Conditions</b>				
A. Hot-Weather Construction	1,2	1,2	1,2	6,7,9
B. Cold-Weather Construction	1,2	1,2	1,2	6,7,9
<b>42 Preconstruction Preparation Checklist</b>				
A. Necessary Tools for the Job		1,2		
B. Subgrade Preparation		1,2		
C. Moisture Protection (vapor retarders)		1,2		
D. Formwork		1,2		
E. Reinforcement (primary & secondary)		1,2		
F. Joint Design		1,2		
G. Desired Finish		1,2		

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>				
	<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>
<b>43 Finishing concrete/flatwork- Step by Step</b>				
A. Step 1. Subgrade Preparation (Vapor Retarders)	1,2	1,2	1,2	1,4,5,6,9
B. Step 2: Setting Forms (place reinforcement)	1,2,3,4	1,2	1,2	1,5,6,9
C. Step 3: Placing Concrete		1,2	1,2	1,2,4,5,6,7,9
D. Step 4: Strike-off		1,2		1,,4,5,6,9
E. Step 5: Darbying or Bullfloating		1,2		1,6,9
F. Step 6: Edging		1,2		1,6,9
G. Step 7: Jointing		1,2		1,6,9
H. Step 8: Waiting Period		1,2		
I. Step 9: Floating		1,2		1,,4,5,6,9
J. Step 10: Troweling		1,2		1,,4,5,6,9
K. Step 11: Curing		1,2		6,9
L. Step 12: Protection		1,2		1,8,9
M. Precautions about Adding Water		1,2		
N. Problems and Cures in Finishing Concrete		1,2		

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>			
<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>

**44 Building Concrete Steps**

A. Step 1: Subgrade Preparation	1,2	1,2	1,2	1,4,5,6,9
B. Step 2: Layout	1,2,3,4	1,2		
C. Step 3: Formwork	1,2,3,4	1,2	1,2	1,5,6,9
D. Step 4: Placement		1,2	1,2	1,2,4,5,6,7,9
E. Step 5: Strike-off		1,2		1,,4,5,6,9
F. Step 6: Wait		1,2		
G. Step 7: Floating and Edging		1,2		1,6,9
H. Step 8: Tread Finishing		1,2		1,6,9
I. Step 9: Riser Finishing		1,2		1,6,9
J. Step 10: Form Removal		1,2		1,6,9
K. Step 11: Curing		1,2		
L. Precautions about Adding Water		1,2		
M. Problems and Cures in Finishing Concrete		1,2		

**Table 5. Applied Academics Masonry & Concrete**

<b>Applied Academics</b>			
<b>Math</b>	<b>Comm.</b>	<b>Materials</b>	<b>Safety</b>

**45 Preventing Surface Defects**

A. Dusting		1,2	
B. Blisters		1,2	
C. Delaminations		1,2	
D. Scaling		1,2	
E. Popouts		1,2	
F. Cracking		1,2	
G. Cracking		1,2	
H. Discoloration		1,2	

**Table 6. Residential Masonry & Concrete Tools**

	<i>Masonry</i>	<i>Concrete</i>
<b>Masonry Tools-- From Kreh 5th Edition</b>		
Personal Protection Equipment (Gloves, eye protection, etc)	Yes	Yes
Hardhat, rubber gloves, protective eyewear, long pants, long sleeve shirt, rubber work boots	Yes	
Hammers-- (standard mason's hammer, tile hammer)	Yes	
2- and 4-foot Levels	Yes	
Measuring Tape/Rule--(folding mason's scale rules)	Yes	
Chisels--(brick set chisel, mason chisel and plugging/joint chisel)	Yes	
Jointers--(V-jointer, long and short convex jointers, grapevine jointer, slicker and rake out-jointer)	Yes	
Mason's brush	Yes	
Steel square	Yes	
Chalk box	Yes	
Tool bag	Yes	

**Table 6. Residential Masonry & Concrete Tools**

<b>Masonry Tools-- From Kreh 5th Edition</b>	<i>Masonry</i>	<i>Concrete</i>
Grout bag	Yes	
Edgers & Groovers	Yes	
Hand-held Rubbing Stone	Yes	
Hand Saws	Yes	
Lines/Fastening--(wood blocks, tempered nail, steel pin, metal trig)	Yes	
Brooms	Yes	
Manual Tools (wheelbarrows, shovels, rakes)	Yes	
Power-driven Tools (mixers, vibrators, power trowel, prime mover, plate compactor, concrete saws etc.)	Yes	

**Table 6. Residential Masonry & Concrete Tools**

	<i>Masonry</i>	<i>Concrete</i>
<b>Concrete Tools-- from PCA Concrete Finisher's Guide pp. 11-13</b>		
Shovel		Yes
Wide-blade pick-ax		Yes
Subgrade tamper		Yes
Stringline/chalk line		Yes
Tape measure		Yes
Claw hammer		Yes
Sledge hammer		Yes
Side cutters/pliers		Yes
Builder's level		Yes
Wheelbarrow or power buggy		Yes
Concrete rake/come-along		Yes
Screed		Yes
Internal vibrator		Yes
Bullfloat		Yes

**Table 6. Residential Masonry & Concrete Tools**

	<i>Masonry</i>	<i>Concrete</i>
<b>Concrete Tools-- from PCA Concrete Finisher's Guide pp. 11-13</b>		
Fresco trowel		Yes
Highway straight edge		Yes
Margin trowel		Yes
Darby		Yes
Hand float		Yes
Hand trowel		Yes
Edger		Yes
Groover/joiner		Yes
Sponge		Yes
Brush/Broom		Yes
Buckers		Yes
Fog Sprayer		Yes
Polyethylene sheeting		Yes
Waterproof paper		Yes
Liquid membrane-forming curing compound		Yes
Hand sprayer		Yes

