

TILE COUNCIL OF AMERICA HANDBOOK FOR TILE INSTALLATION

by Robert J. Kleinhans (U. S. A.)

- Executive Director of the Tile Council of America
- Member of the Board of Governors of the International Tile Exposition
- Chairman of the ISO Technical Committee for Tiles.
- Named "Man of the Year" by the NTCA in 1986.
- Received the TCAA Award in 1987.
- During his 35 years with the Tile Council of America, he has acted as Secretary for the Manual Editing Committee, as Secretary for the A108 A.N.S.I. Committee on ceramic Tiles, and on the Technical Committee of the NTCA.

The Tile Council of America, Inc. is a trade association of United States ceramic tile manufacturers whose purpose is to promote the use of ceramic tile in the U.S. One of the ways to accomplish this is to take steps to insure properly installed ceramic tile. To that end U.S. ceramic tile manufacturers have been involved in product and installation standards and specifications since the early 1920's. At that time, Tile Council's predecessor, the Associated Tile Manufacturers published a document entitled "Publication K-300, Basic Specification for Tilework and Related Documents." This specification dealt solely with the portland cement mortar installation method for walls and floors. Because the mortar method or "mud method", as it was called by the contractors, was the only ceramic tile installation method used, K-300 remained in use, and unchanged, for over twenty years.

The records are not clear on when the Associated Tile Manufacturers dissolved but industry leaders saw a need for a new trade association in the early 1940's and in 1945 the Tile Council of America was formed. One of the first orders of business was to establish uniform methods and standards for the installation of tile over the new types of building constructions and materials that were rapidly appearing. A prominent architect, Don Graf, was commissioned by TCA to do the work which resulted in the 1951 publication of the first "Tile Handbook" which superseded K-300.

In 1952 "K-400 Thin Setting Bed Methods and Materials" was published as a complement to the Tile Handbook. These documents served as both material and installation specifications and general industry recommendations. At about that same time the American Standards Association (ASA) emerged as the recognized standards body in the United States. Tile Council joined ASA and began the development of individual material and installation specifications according to ASA guidelines. As these standards were promulgated the role of the Tile Handbook and K-400 began to change from standards and specifications to reliable guides to the proper use of the newer ASA standards, however, with new building construction techniques and new backing materials that ceramic tile had to be installed over appearing almost monthly, these documents became obsolete.

In 1962 Tile Council's staff architect, Mr. Lamar Brown, was charged with the task of updating the Handbook and in 1963 the "New Handbook for Ceramic Tile Installation" was published.

It was decided that in order to keep the Handbook current with changes in building technology it would become a yearly publication and become part of Sweet's Architectural Files, a yearly compilation of building material manufacturers' catalogs. The sixteen page 1963 edition contained twenty five recommended ceramic tile installation methods for interior and exterior walls and floors. Each detail contained a cross sectional drawing of the installation method, the recommended uses of the method, its limitations, requirements for special preparation by other trades such as concrete, plumbing or carpentry, material requirements, special installation, grouting and other workmanship requirements for the tile contractors and a reference to any existing ASA or American Society for Testing and Materials (ASTM) specifications or standards. This format proved to be easy to follow and informative and remains basically the same in the 1992 edition of the Handbook.

The first major Handbook change occurred in 1964 with the addition of four new installation methods dealing with swimming pools, tiled bath tubs, refrigerator rooms and steam rooms. The Handbook, except for minor additions and corrections in the text, remained unchanged for the next four years.

In 1967 various contractor groups from throughout the United States complained to Tile Council about the information in the Handbook which was now widely used and referenced by architects and specifiers. Some methods were simply not suitable for the climatic conditions in some parts of the country, some were not in agreement with local trade practices while others were contrary to local building codes all of which vary throughout the country. As a result of these complaints, representatives of the major contractor groups were invited to a meeting to resolve the problems and make the Handbook a more useful tool for all. As a result of that meeting two more details were added to the Handbook, the information in the Handbook was modified to acknowledge the various geographical trade practices and conditions and, most importantly, a yearly ceramic tile industry Handbook Conference was begun. Thirteen organizations each with a vital interest in ceramic tile installation, were represented at that meeting. Each organization had one vote. Today the Conference size has grown to twenty-one organizations. The makeup of the Conference is diverse enough so that anyone in the United States whose work or product is affected by the contents of the Handbook can have a voice at the meeting through a Conference member. This has allowed us to keep the Conference at a workable size yet allow the maximum technical input.

The Handbook continues to be published by the Tile Council as a service to the industry but the information in the Handbook is from everyone involved. It represents the recommendations of the entire industry, not the Tile Council alone. New installation material, techniques and methods must be capable of being successfully used in every location in the United States before they become a Handbook recommendation. For example, a technique for installing ceramic tile over wood subfloors with polymer modified thin-set mortar, although used with success in some sections of the country is not included in the Handbook recommendations because some contractor groups have not had complete success with the method in their areas. Generally, any installation technique or installation product that is not covered by an American National Standards Institute (ANSI, is the successor of American Standards Association, ASA, and USA Standards), undergoes very close scrutiny by the Handbook Conference before being included. This process can sometimes take years. On the other hand the Handbook, because of its yearly publication, is positioned to acknowledge important new techniques and materials much more quickly than the ANSI standards which are only reviewed on a five year schedule.

Today eighty-five to one hundred thousand copies of the Handbook are distributed each year in the United States to architects, designers, specifiers, builders and contractors. It has become one of the most highly regarded references in the United States building industry. The 1992 edition is the thirtieth consecutive year of publication. During that time the Handbook has more than doubled in size from 16 to 36 pages.

I would now like to take you through a page-by-page review of the Handbook, explain exactly what is in it and how it is used by the industry in the United States. On page 2, the left hand column lists the current Handbook Conference Roster. Please note the diversity of the organizations represented which includes an architectural consultant and two Industry Liaisons that represent anyone who is not affiliated with any of the other groups on the roster. Page 3 contains the table of contents and a highlighted note which encourages a user to seek the advice of someone technically qualified in ceramic tilework before specifying or installing ceramic tile using an unfamiliar method.

The Handbook is divided into three major sections; Installation Materials, Installation Guides and Recommended Installation Methods.

The first section runs from page 4 through page 8 and contains sub-sections on Setting Materials, Grouting Materials and Special Installation Products with a complete list of all the standards and specifications referenced in the document. In the setting materials section we have included descriptions of eight different products, how they are used and a reference to the proper ANSI installation and material specifications. The grouting materials section contains descriptions of seven products and their ANSI specifications.

The Special Products sub-section was added to the Handbook in 1974 as an aid to architects and specifiers. Any new product that appears on the market will be included in this section to assist the architect, designer or specifier to better understand what new materials or techniques may be available to him. For example, Cementitious Backer Units are described on page 7 along with the ANSI material and installation specifications. However, there is a note included which acknowledges other backing and underlayment materials which the architect may prefer to use. Because they are not presently covered by ANSI standards, the note cautions the user that he must rely on the manufacturers instructions. Another example is the description of Exterior Ceramic Tile Panels which are custom made for each job. This is a popular building technique used in the United States which provides an economical, rapid building enclosure system which is light weight, durable and decorative. The Special Products section concludes on page 8 where the Handbook user's attention is drawn to the note on expansion joint design and substrate limitations by the use of heavy borders and the word "Caution". I will be discussing both of these items later in this presentation. The column entitled "Notes" first appeared in 1988 and includes pertinent information that is not appropriate for the other main sections. For example, the affect of flat angle lighting on both floors and walls is outlined under "Lighting" in order to alert the designer to the possibility of undesirable effects that can be minimized or eliminated by pre-project planning.

There are five different guides in the next section of the Handbook. The Wall Tiling Installation Guide on page 9 was designed to assist the architect and specifier in selecting the proper ceramic tile wall installation for a given situation without overspecifying. The user first selects from the Service Requirement column for Commercial Construction or Residential & Light Construction and whether the area will be wet or, dry with limited water exposure. Next he selects the Wall Type (Masonry, Wood studs or Metal Studs). For example, if the architect is designing a laundry room framed with wood studs in a commercial building, he would refer to the second entry in the left hand column under "Services Requirements" and would move to the column entitled "Wood Studs" under "Wall Type" and find he had two recommended methods of ceramic tile installation to choose from - W231 & W244 on pages 22 and 23. The prefix W stands for Walls. The prefix B stands for Baths. If the architect was planning a shower in the same building construction he could choose from B411 on page 24 or B414 on page 25.

The Grout Guide on page 9 works the same way. Let's say that a glazed wall tile will be used on the laundry room walls. The Grout Guide indicates that the architect can choose either a commercial portland cement, a dry-set grout or a latex portland cement grout. If stain resistance is not an important consideration he can use any of these materials, if it is important, the latex portland cement grout will be the best choice. The same applies to crack resistance which becomes an important consideration for long, high walls installed over backing materials which may bend or flex steel stud construction for example. Both guides on page 9 have been in the Handbook since 1974.

The Floor Tiling Installation Guide is based on testing of the various floor installations according to ASTM C627 "Standard Method for Evaluating Ceramic Floor Tile Installation Systems". This test method tests the entire system tile, grout, setting material and sub-floor. If any of these are changed the rating may also change. This guide is also designed to help avoid over specification of a particular installation. For example, any installation method can be used in residential construction but selecting a method from the Moderate to Extra Heavy service requirements would be more costly and not be required. On the other hand an installation method listed as Residential or Light simply will not perform in any of the higher service requirements. The F stands for Floor method, RF is a sound rated floor system and TR stands for Tile Renovation. All will be discussed later in this presentation. This guide first appeared in the 1969 Handbook.

The final guide in this section "How to Use Handbook When Writing Specifications", is the most important for architects and specifiers. The first paragraph states that "The Handbook is not a Specification" and goes on to point out that tile and installation materials must be specified and expansion joint locations must be detailed. A nine step process for developing a job specification from the information in the Handbook is illustrated and explained in the next two columns.

The third section of the Handbook begins on page 12 and includes a total of fifty-four industry recommendations for the installation of ceramic tile over vertical and horizontal surfaces both indoors and outdoors. There are twenty-one floor installation methods which include concrete and wood subfloors, stairs, roofdecks, waterproof membrane applications, chemical resistant floors and electrically conductive floors.

In order to get a good idea of the depth of the information in the Handbook we should make a detailed review of at least two of the pages starting with page 13. Here are three recommended installation methods for use over Interior, Concrete Floors. This is shown in the upper right corner of the page. The sequence of information is from the top of the page down, as shown in the How To Use the Handbook guide previously reviewed. All three methods are standard installations. If they were specialized methods such as Chemical Resistant or Waterproof floors that indication would be printed in the blank space between the headings, Floors, Interior and Concrete Subfloor. See page 16 for an example. The installation method title and member is printed above each detail. Notice that each number is followed by -92. This is done to make it easier to discuss the information by telephone and in correspondence. For example if the person calling makes reference to method F112-89 you know that he is looking at F112 in the 1989 Handbook: F112-92 identifies the 1992 Handbook. This practice began in the 1969 edition and has helped to eliminate communication difficulties because of year-to-year changes in Handbook content. Each cross sectional detail points out the features of the installation method from the complicated F-111 which requires a reinforced mortar bed over a cleavage membrane to a thin-set system bonded directly to the concrete. The information under Recommended Uses is the guide to where the method can be used but may be limited by the information under Limitations. For example both F-112 and F-113 are not suitable over concrete floors that bend and deflect. The user is referred to method F-111 which requires a reinforced mortar bed installed over a cleavage membrane that isolates the tilework from any movement in the slab. There may be special requirements for the subfloor to meet before the tile is installed as in F-113 where the user is cautioned that certain conditions may prevent a mortar bond or other damage to the tilework. A listing of the required materials and applicable standards is listed next. Any special Preparation by Other Trades follows. This is important for the architect to include in the appropriate sections of the project specification and also for the installer so that he can inspect the surface and report deficiencies before beginning his work. Under Expansion Joint requirements the architect is alerted to the fact that it is up to him, not the installer, to properly locate and design these joints in the tilework. Finally, the ANSI specification for the installation method is listed. In some cases another Handbook installation method will appear here. An example of this can be seen in Method F121-92 on page 15.

The following note appears on every page of the Handbook, "All specifications for ceramic tile installations must conform to local building codes, ordinances, trade practices and climatic conditions." This was done to satisfy the differences that sometimes occur in different sections of the United States.

Finally, there are pertinent notes that appear at the bottom of many pages. On this page under F113-92 the reader will find a reference to Method F122 if a waterproof membrane is required. In addition there is a reference to information on page 8 which recognizes the use of "other Installation Materials and Methods" which are not currently referenced in the Handbook. The user is alerted to the fact that he or she should depend on the manufacturers directions and recommendations which must be closely followed when using these materials.

On page 21 three typical interior wall installation recommendations are shown over solid backing which can be wood, plaster, masonry or gypsum based or cementitious backer units over wood or metal studs. The layout of the page is the same as described earlier. Each cross sectional drawing includes the basic requirements and the text below outlines the recommended uses, limitations, material requirements, etc. In some of the Handbook recommendations, there is not enough space to include all of the required information. In this case the user is referred to another section of the book. An example of this can be seen in the text of Method W223 where the user is referred to Methods W242 or W244 for the special requirements of metal stud wall construction. Just above the drawing in Method W223, is an asterisked caution note to See Page 8. Here the user is informed that certain substrate materials may be subject to deterioration from moisture penetration in wet areas and the performance and durability of the tile installation can be affected. This note appears in all methods where the tile is thin-set directly to surfaces that may be water sensitive backing materials such as gypsum board walls or plywood floors.

The One Coat Method W222, deserves special attention because it can be used for problem situations. For example it is ideal for remodeling or on surfaces that present bonding problems such as cracked or painted surfaces. If there is concern that the existing surface will be affected by moisture penetration, as indicated by the caution note in Method W223, the membrane in the one coat method will protect the surface while the tile installation takes only minimal additional space. This is all pointed out in the text under Recommended Uses.

There are eighteen wall installation methods which include masonry walls, with gypsum board, cementitious backer units and portland cement mortar facings and a recommendation for ceramic tile ceilings. Also included are three recommendations for bathtub walls and three recommendations for shower walls. Recommendations for ceramic tile tubs, fountains and swimming pools can be found on pages 26 and 28. There are three recommended installation methods for countertops and page 27. The remaining recommendations cover special types of installations such as thresholds, refrigerator and steam rooms, renovation work over existing ceramic tile and other surfacing materials and fire and sound rated walls and floors.

Many tile installation failures can be traced to the lack of or poor design of expansion joints. Because of their critical importance in successful tilework, page 19 is devoted entirely to expansion joint requirements, design and construction.

Recommendations for renovation work can be found on pages 30 and 31. Included are details for tiling over other surfacing materials such as paint, plastic laminates, and vinyl or asphalt tile floors. Tiling over tile on both walls and floors, a very popular method of remodeling, is also addressed.

In the United States, local building codes are requiring the wall and floor constructions in multiple family dwellings such as apartments and condominiums to meet sound and fire ratings. The ratings may vary from city to city. Method RW (Rated Wall) 800 on pages 32 and 33 shows the details of fifteen wall constructions that have been fire and sound tested by independent testing laboratories and rated according to recognized ASTM test standards. In order to meet the ratings shown in the chart, the walls must be constructed exactly as shown in the details.

Sound rated floor constructions, page 34, were also tested and rated by an independent laboratory according to ASTM standard test methods. There are eight methods of sound-rated tile installation presented. One of the major considerations facing the designer of sound-rated ceramic tile floor installations is the additional height that the rated floor will require. The chart provides that information plus a reference to recommended ceramic tile installation methods and sound transmission and impact insulation ratings.

CONCLUSION

This brief review of the Handbook has highlighted its history and its importance to the building industry in the United States. The contents of the Handbook, including a detailed look at typical recommendations for floors and walls, was also featured. The important points to remember are:

- 1. The Handbook information represents the consensus of the entire industry.**
- 2. The information is a guide to recommended installation procedures, it is not an installation specification.**
- 3. The information in the Handbook may change from year-to-year. It is important for the user to reference the current document and to be sure to thoroughly review all the text of each installation recommendation before developing a job specification or installing the tilework.**