



Product Evaluation

RC21 | 0815

Engineering Services Program

The following product has been evaluated for compliance with the wind loads specified in the International Residential Code (IRC) and the International Building Code (IBC).

This product evaluation is not an endorsement of this product or a recommendation that this product be used. The Texas Department of Insurance has not authorized the use of any information contained in the product evaluation for advertising, or other commercial or promotional purpose.

This product evaluation is intended for use by those individuals who are following the design wind load criteria in Chapter 3 of the IRC and Section 1609 of the IBC. The design loads determined for the building or structure shall not exceed the design load rating specified for the products shown in the limitations section of this product evaluation. This product evaluation does not relieve a Texas licensed engineer of his responsibilities as outlined in the Texas Insurance Code, the Texas Administrative Code, and the Texas Engineering Practice Act.

For more information, contact TDI Engineering Services Program at (800) 248-6032.

Evaluation ID: RC-21

Effective Date: August 1, 2015

Reevaluation Date: August 2019

Product Name: Clay Roof Tiles

Manufacturer: M.C.A. Clay Roof Tile
1985 Sampson Avenue
Corona, CA 92878
(951) 736-9590

General Description:

MCA Clay Roof Tiles are acceptable for use in designated catastrophe areas along the Texas Gulf Coast when installed in accordance with this product evaluation report, the building specifications adopted by the TDI, and the manufacturer's installation instructions as referenced in the document entitled "*Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions*" April 2010, except for the attachment methods, which are specified in Tables 3 through 4 of this evaluation report.

Product Description:

MCA Roof Tiles are clay tiles that are machine formed from natural clay and are kiln-fired to various degrees to obtain required strength. The tiles have a natural glazed or spray-flash finish. The spray-flash finish consists of a spray-on mixture of natural clay materials, which is baked on the surface of the tile. Accessory tiles, such as ridge, gable, hip, birdstop, and turret tiles are available.

Attachment: Install the MCA clay roof tiles specified in this report using a mechanical fastening system. Secure the tiles directly to the roof deck over the underlayment.

Adhesive fastening systems must comply with ICC-ES AC152, **Acceptance Criteria for Adhesive Fastening of Concrete or Clay Roof Tiles**. Refer to the adhesive fastening system manufacturer product evaluation for the allowable aerodynamic uplift moment and the installation method to develop a resistance equal to or greater than the code required aerodynamic uplift moment. Installation of roof tiles using an adhesive fastening

system must be done by technicians trained and having a current certification by the adhesive fastening system manufacturer.

Roof Tile Profile Classifications: Roof tile profiles are classified as one of the following:

- **Flat/Low profile:** Flat/Low profile tiles are tiles having a rise equal to or less than 1/2".
- **Medium profile:** Medium profile tiles are defined as tiles having a rise greater than 1/2" and a rise to width ratio of less than or equal to 1.5.
- **High/Barrel profile:** High/Barrel profile tiles are those tiles having a rise to width ratio greater than 1.5.

Roof Tile Designations, Profile Classifications, and Dimensions: Table 1 specifies the roof tile designations, profile classifications, and dimensions for the clay roof tiles that apply to this product evaluation report. Tile profiles and dimensions are shown in Figure 1.

Table 1
Roof Tile Designations, Profile, Dimensions, Factor, and Factor Ratio

Tile Name	Tile Profile	Tile				
		Length (in.)	Width		Factor (ft³)	Factor Ratio
			Total (in.)	On Center (in)		
1 Pc "S"	High	19.00	14.50	12.00	1.91	1.35
Classic S	High	19.00	12.00	10.00	1.59	1.13
Corona Tapered 2 Piece	High	19.00	8.71	12.00	1.38	0.98
Classic Tapered 2 Piece	High	19.00	7.50	10.00	1.19	0.85
8" Straight Mission	High	19.00	8.00	11.00	1.27	0.90
10" Straight Mission	High	19.00	10.00	13.50	1.59	1.13
Roman Pan	Medium	19.00	10.00	12.00 or 13.50	1.27	0.90
MF108 Flat	Flat/Low	13.75	13.75	12.00	1.00	0.71
Improved "S"	Flat/Low	12.00	12.25	10.50	0.67	0.47
Oriental	Flat/Low	12.0	12.00	10.50	0.60	0.43

Mechanical Installation: 1 Pc "S", Classic S, MF108 Flat, Improved "S" and Oriental.

Adhesive Installation: Corona Tapered 2-Piece, Classic Tapered 2-Piece, 8" Straight Mission, 10" Straight Mission, Roman Pan.

Installation and Limitations:

Roof Framing and Roof Deck: Install roof framing members in accordance with either the IRC or the IBC. Do not space the roof framing members greater than 24" on center. The roof deck must be solidly sheathed with minimum 15/32" plywood. Fasten the roof deck to the roof framing members in accordance with either the IRC or the IBC.

If the existing roof deck is a spaced board roof deck, then either remove or cover the spaced boards with the minimum thickness of plywood deck specified in the IRC or the IBC. Install the plywood sheathing over the spaced boards in accordance with either the IRC or the IBC.

Metal drip edge: Install a metal drip edge as specified in the manufacturer's installation instructions as referenced in the *Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions*.

Roof underlayment:

3:12 roof slope to under 4:12 roof slope: Two layers of underlayment complying with ASTM D 226, Type II (No. 30 asphalt felt) or equivalent. Install the underlayment as specified in either the IRC or the IBC and in the manufacturer's installation instructions as referenced in the document entitled *Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions*.

4:12 roof slope and greater: One layer of underlayment complying with ASTM D 226, Type I (No. 30 asphalt felt) or equivalent. Lap the underlayment a minimum of 2" at the head laps and a minimum of 6" at the side laps. Install the underlayment as specified in either the IRC or the IBC and in the manufacturer's installation instructions as referenced in the document entitled *Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions*.

Self-Adhering Underlayment: Self-adhering underlayment must comply with ASTM D 1970 and ICC-ES acceptance criteria AC152 Section 3.4 Alternate Underlayments. Install the self-adhering underlayment in accordance with the self-adhering underlayment product evaluation report and the self-adhering underlayment manufacturer's installation instructions.

Roof Tile Installation: Follow the limitations on mean roof height and roof slope for installing the roof tiles:

Roof Slope Limitations: Install the roof tiles on buildings with a roof slope greater than or equal to 2-1/2:12. The MF108 Flat, the Improved "S", and the Oriental must be installed on a minimum 4:12 roof slope. The minimum roof slope is 3:12 unless installed on an approved waterproofing system. An installation on a roof with a roof slope greater than 7:12 requires a minimum of two fasteners per tile. When an adhesive fastening system is used, refer to the adhesive fastening system manufacturer's product evaluation for roof slope limitations.

Mean Roof Height Limitations: Table 3 and Table 4 specify the mean roof height limitations for the mechanical attachment systems listed in these tables. Install the roof tiles on structures with a mean roof height greater than 60' when installed using these tables. For heights greater than 60' or for other attachment systems, use the procedures described in **Required Aerodynamic Uplift Moment**.

General: Install the roof tiles in accordance with this product evaluation report and the manufacturer's installation instructions. The roof tiles and the underlayment system must be clean and dry at the time of their application.

Battens: Install Oriental, Improved "S", and MF108 Flat over battens. The roof deck must be solidly sheathed with minimum 15/32" plywood. Battens must be minimum 1x3 wood members. Space the battens to allow for the headlap required for the tile. Fasten the battens to the roof deck with minimum 8d corrosion resistant common wire nails, box nails, or equivalent diameter pneumatic gun nails. Space the fasteners a minimum of 24" on center. As an alternative, the battens may be fastened to the roof deck with 16-gauge by 7/16" crown by 1-1/2" long corrosion resistant staples. Space the staples a maximum of 12" on center.

Required Aerodynamic Uplift Moment: The required aerodynamic uplift moment may be calculated using Section 1609.5.3 of the IBC using the length and exposed width in Table 1. The allowable resistance to the required aerodynamic uplift moment is the sum of the ultimate attachment system resistance plus the restoring gravity moment from Table 2 divided by a safety factor of 2.

Table 2: Restoring Moment due to Gravity - M_g

Direct Deck Installation (ft-lbf)						
Tile	2-½:12	3:12	4:12	5:12	6:12	7:12 or Greater
1 Pc "S"	12.87	12.77	12.57	12.15	11.71	11.32
Classic S	10.73	10.64	10.47	10.12	9.76	9.43
Corona Tapered 2 Piece	8.58	8.51	8.38	8.10	7.81	7.55
Classic Tapered 2 Piece	6.87	6.81	6.70	6.48	6.25	6.04
8" Straight Mission	10.44	10.36	10.20	9.86	9.50	9.18
10" Straight Mission	11.03	10.94	10.77	10.41	10.04	9.70
Roman Pan	9.81	9.73	9.58	9.26	8.92	8.62
MF108 Flat	5.07	5.03	4.95	4.79	4.62	4.46
Improved "S"	3.55	3.52	3.46	3.35	3.23	3.12
Oriental	2.93	2.91	2.87	2.77	2.67	2.58

Table 3¹: Mean Roof Height Limitations

1 Pc "S" Tile and Classic "S" Tile						
Gable $7^\circ < \theta \leq 27^\circ$						
Hip $25^\circ < \theta \leq 27^\circ$						
Mechanical Fastener System	Mean Roof Height Limitation ²					
	Inland II		Inland I		Seaward	
	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³
2-10d ring shank nails (18-22 rings per inch)	60 ^{4,5}	45 ^{4,5}	60 ^{4,5}	20 ^{4,5}	40 ^{4,5}	NA
1-#8 screw	60 ^{4,5}	45 ^{4,5}	60 ^{4,5}	20 ^{4,5}	40 ^{4,5}	NA ^{4,5}
2-#8 screws	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
2-10d smooth or screw shank nails with clip	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
Hip Roof						
$7^\circ < \theta \leq 25^\circ$						
Mechanical Fastener System	Mean Roof Height Limitation ²					
	Inland II		Inland I		Seaward	
	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³
2-10d ring shank nails (18-22 rings per inch)	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	35 ^{4,5}
1-#8 screw	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	35 ^{4,5}
2-#8 screws	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
2-10d smooth or screw shank nails with clip	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
Gable Roof						
$27^\circ < \theta \leq 45^\circ$						
Mechanical Fastener System	Mean Roof Height Limitation ²					
	Inland II		Inland I		Seaward	
	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³
2-10d ring shank nails (18-22 rings per inch)	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
1-#8 screw	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
2-#8 screws	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
2-10d smooth or screw shank nails with clip	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
Monoslope Roof						
$10^\circ < \theta \leq 30^\circ$						
Mechanical Fastener System	Mean Roof Height Limitation ²					
	Inland II		Inland I		Seaward	
	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³
2-10d ring shank nails (18-22 rings per inch)	50 ^{4,5}	30 ^{4,5}	50 ^{4,5}	NA	30 ^{4,5}	NA
1-#8 screw	50 ^{4,5}	30 ^{4,5}	55 ^{4,5}	NA	30 ^{4,5}	45 ^{4,5}
2-#8 screws	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
2-10d smooth or screw shank nails with clip	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}

Table 4¹: Mean Roof Height Limitations

Improved "S" Tile ⁶ , Oriental Tile ^{6,7} , and MF108 Flat ⁸ (With Battens)						
Gable 7° < θ ≤ 27° Hip 25° < θ ≤ 27°						
Mechanical Fastener System	Mean Roof Height Limitation ²					
	Inland II		Inland I		Seaward	
	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³
2-10d ring shank nails (18-22 rings per inch)	60 ^{4,5}	20 ^{4,5}	60 ^{4,5}	NA ^{4,5}	NA	NA
1-#8 screw	60 ^{4,5}	25 ^{4,5}	45 ^{4,5}	NA ^{4,5}	NA ^{4,5}	NA ^{4,5}
2-#8 screws	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	25 ^{4,5}
2-10d smooth or screw shank nails with clip	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	30 ^{4,5}
Hip Roof 7° < θ ≤ 25°						
Mechanical Fastener System	Mean Roof Height Limitation ²					
	Inland II		Inland I		Seaward	
	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³
2-10d ring shank nails (18-22 rings per inch)	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	35 ^{4,5}	60 ^{4,5}	15 ^{4,5}
1-#8 screw	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	45 ^{4,5}	60 ^{4,5}	20 ^{4,5}
2-#8 screws	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
2-10d smooth or screw shank nails with clip	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
Gable Roof 27° < θ ≤ 45°						
Mechanical Fastener System	Mean Roof Height Limitation ²					
	Inland II		Inland I		Seaward	
	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³
2-10d ring shank nails (18-22 rings per inch)	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	45 ^{4,5}
1-#8 screw	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	55 ^{4,5}
2-#8 screws	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
2-10d smooth or screw shank nails with clip	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}
Monoslope Roof 10° < θ ≤ 30°						
Mechanical Fastener System	Mean Roof Height Limitation ²					
	Inland II		Inland I		Seaward	
	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³	Exposure B ³	Exposure C ³
2-10d ring shank nails (18-22 rings per inch)	50 ^{4,5}	15 ^{4,5}	30 ^{4,5}	NA ^{4,5}	NA ^{4,5}	NA ^{4,5}
1-#8 screw	50 ^{4,5}	15 ^{4,5}	35 ^{4,5}	NA ^{4,5}	NA ^{4,5}	NA ^{4,5}
2-#8 screws	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	40 ^{4,5}	60 ^{4,5}	15 ^{4,5}
2-10d smooth or screw shank nails with clip	60 ^{4,5}	60 ^{4,5}	60 ^{4,5}	50 ^{4,5}	60 ^{4,5}	20 ^{4,5}

Notes for Tables 3 and 4:

1. Tables are based on an importance Factor of 1.00.
2. Mean roof height must be as defined in ASCE 7-05.
3. The Exposure category for the structure location must be as defined in ASCE 7-05.
4. Installation on a 15/32" roof deck.
5. Installation on a 19/32" roof deck.
6. Oriental Style and Improved S have a natural interlocking system at each corner.
7. Oriental Style has only one hole.
8. MF108 Flat has a built in wind lock.

Mechanical Fastening Systems:

Fasteners: Use fasteners for direct deck installations long enough to penetrate a minimum of 3/4" into or through the roof deck. Use fasteners for batten installations (when used) long enough to penetrate through the batten entirely and a minimum of 3/4" into or through the roof deck. The following types of fasteners may be required, depending on the installation method used as specified in ICC-ES ESR 2015P and *Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions*:

- No. 8 steel wood screws.
- 10d ring shank nails (0.283" flat head diameter, 0.131" ring shank diameter).
- 10d smooth or screw shank (0.283" flat head diameter, 0.131" smooth or screw shank diameter).
- Clips: When required, each tile is secured with a 0.060" thick and 0.50" wide corrosion resistant steel clip that is secured to the deck with one fastener per clip. The following fastener/clip combinations are permitted:
 - Aluminum alloy clip with hot dip galvanized roofing nail (0.128" smooth shank diameter)
 - Galvanized steel clip with hot dip galvanized roofing nail (0.128" smooth shank diameter)
 - Stainless steel clip with hot dip galvanized roofing nail (0.128" smooth shank diameter)

Rake Tiles: Rake tiles must be secured to minimum Spruce-Pine-Fir lumber framing with minimum two 10d box nails (3" long, 0.128" shank diameter).

Hip and Ridge Tiles: The hip and ridge tiles must be fastened to hip and ridge boards (dimensional lumber of sufficient height to support the hip and ridge tiles) in accordance with one of the following options:

- (1) Drill a 3/16" hole in the lower 1/3 of the starter tile. Use a fastener as specified in Table 5 and secure the starter tile at both the drilled hole in the lower 1/3 and at the head of the tile. Seal the head of the fastener with a UV resistant sealant.
- (2) Prior to installing the starter tile, apply a roof tile adhesive along the entire length of the starter tile. Secure the head of the starter tile with a fastener as specified in Table 8.

The remaining hip and ridge tiles are to be installed with a minimum 1" headlap. Place the toe of the tile into a 4" to 5" bead of roof tile adhesive along the head of the lower tile. The head of the hip or ridge tile is to be secured using a fastener as specified in Table 5.

Table 5
Hip and Ridge Tile Fastener Requirements

Lumber Species	Fasteners per Tile
Spruce-Pine-Fir	One No. 8 wood screw
Southern Pine	One No. 8 wood screw or one 10d box nail

Adhesive Fastening Systems:

Adhesive fastening systems must comply with ICC-ES AC152, **Acceptance Criteria for Adhesive Fastening of Concrete or Clay Roof Tiles**. Refer to the adhesive fastening system manufacturer product evaluation for the allowable aerodynamic uplift moment and the installation method to develop a resistance equal to or greater than the code required aerodynamic uplift moment. Installation of roof tiles using an adhesive fastening system must be done by technicians trained and having a current certification by the adhesive fastening system manufacturer.

Adhesive fastening systems must not be used with polyethylene or silicon surfaced underlayments.

Notes: A copy of ICC-ES ESR 2015P and *Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions* must be available at the job site. When a self-adhering underlayment is used, the self-adhering underlayment product evaluation and the self-adhering underlayment manufacturer's installation instructions must be available at the job site. When an adhesive fastening system is used, the adhesive fastening system product evaluation and the adhesive fastening system manufacturer's installation instructions must be available at the job site. Use corrosion resistant fasteners as specified in the IRC, the IBC, and the Texas Revisions.

Figure 1 - MCA Clay Roof Tile Profiles

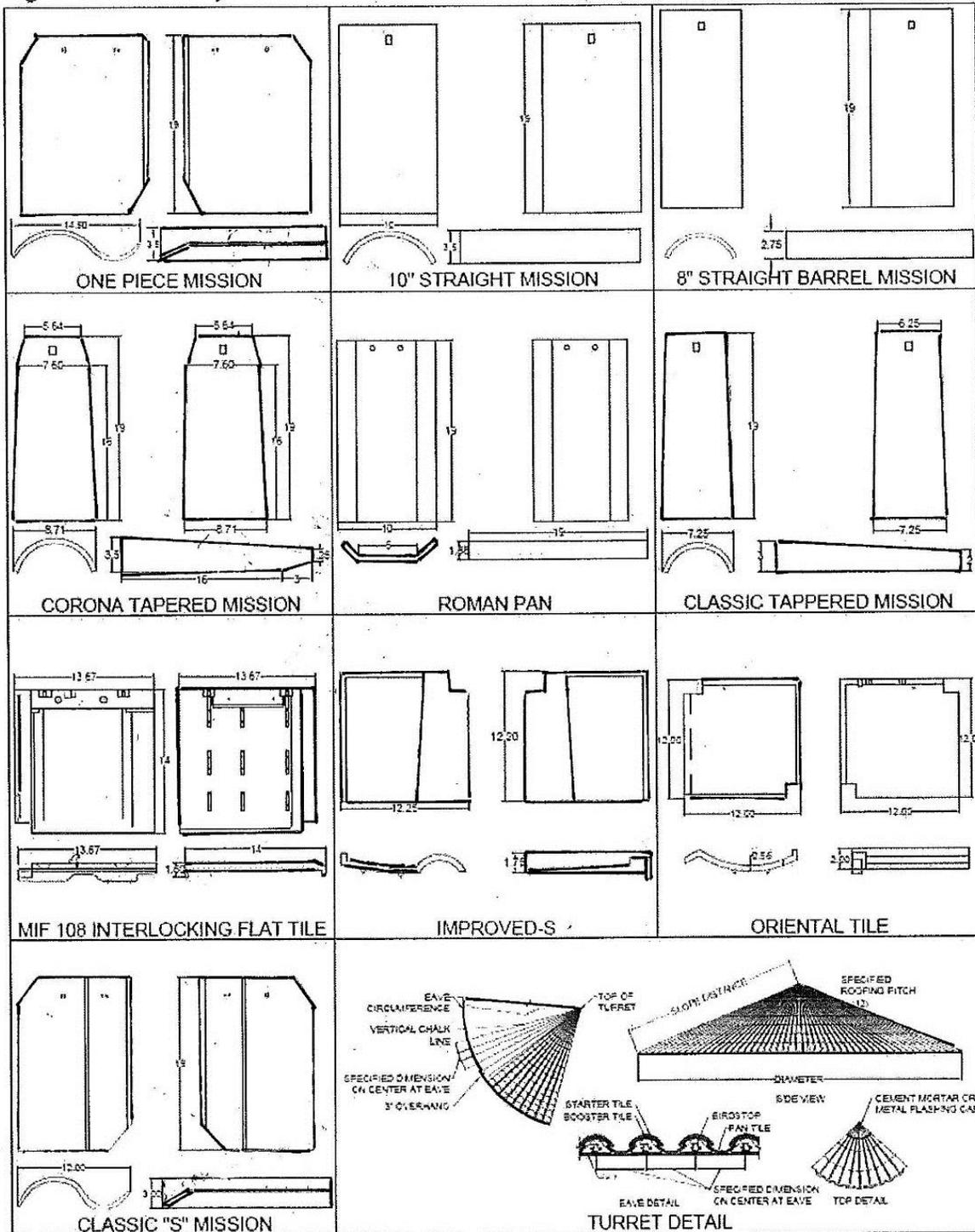


Figure 1. MCA Clay Roof Tile Profiles and Dimensions