# **PROPERTY INSPECTION REPORT**

#### **Prepared For:**

Concerning:		Missouri City, Texas		
By: Fred Willcox		TREC License No. 160		
	File No.	713-461-0009		

The inspection of the property listed above must be performed in compliance with the rules of the Texas Real Estate Commission (TREC).

The inspection is of the conditions which are present and visible at the time of the inspection, and all of the equipment is operated in normal modes. The inspection must indicate which items are in need of repair or are not functioning and will report on all applicable items required by TREC rules.

This report is intended to provide you with information concerning the condition of the property at the time of the inspection. Please read the report carefully. If any item is unclear, you should request the inspector to provide clarification.

It is recommended that you obtain as much history as is available concerning this property. This historical information may include copies of seller's disclosures, previous inspection or engineering reports, reports performed for or by relocation companies, municipal inspection departments, lenders, insurers and appraisers. You should attempt to determine whether repairs, renovation, remodeling, additions or other such activities have taken place on this property.

Property conditions change with time and use. Since this report is provided for the specific benefit of the client(s), secondary readers of this information should hire a licensed inspector to perform an inspection to meet their specific needs and to obtain current information concerning this property.

#### ADDITIONAL INFORMATION PROVIDED BY INSPECTOR

## STRUCTURAL INSPECTION

#### PURPOSE:

The purpose of a structural inspection is to perform a visual inspection, in a limited period of time, of the structural components of the building and to express an opinion as to whether, in the sole opinion of the inspector, they are performing satisfactorily or are in need of immediate repair. The main objective of the inspection and of this report is to better appraise you, our client, of the conditions existing at the time of the inspection. We cannot and do not represent or warrant that the structure, or any of its parts or components, will continue to perform satisfactorily in a manner that will be acceptable to you or that they will continue to perform the function for which they were intended. We do not represent or warrant that the future life of any item will extend beyond the time of this inspection. It is the intention and purpose of the inspector, made on the day and at the time of the inspection, as to the condition and performance of the structure inspected. Use of this report by third parties is unauthorized and unintended. Opinions of the inspector are subjective based on his education and experience and should not be considered conclusive.

Promulgated by the Texas Real Estate Commission(TREC) P.O. Box 12188 Austin, TX 78711-2188, 1-800-250-8732 or (512) 459-6544 (http://www.trec.state.tx.us). REI 7A-0

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Estimates for repair, if included, are provided as a courtesy and should be considered approximate. These estimates should not be viewed as bids for the actual performance of the work or of the repair suggested. It is recommended that you confirm the actual need for repair, the scope of the work, and the approximate cost with a qualified, appropriate service company. A PRUDENT BUYER WILL SECURE FIRM ESTIMATES FROM A QUALIFIED REPAIR COMPANY BEFORE CLOSING.

THIS INSPECTION AND REPORT WERE PREPARED FOR YOUR EXCLUSIVE USE. USE OF THIS REPORT BY, OR LIABILITY TO THIRD PARTIES, PRESENT OR FUTURE OWNERS AND SUBSEQUENT BUYERS IS SPECIFICALLY EXCLUDED. RELIANCE ON THIS REPORT BY THIRD PARTIES, PRESENT OR FUTURE OWNERS AND SUBSEQUENT OWNERS IS AT THEIR PERIL. NO WARRANTIES OR GUARANTIES TO THIRD PARTIES, PRESENT OWNERS OR FUTURE OWNERS ARE IMPLIED OR SHOULD BE ASSUMED.

NOTE: THE TERM "REPAIR" AS USED IN THIS REPORT DOES NOT MEAN "REPAIR" IN THE NORMAL OR CONVENTIONAL SENSE OF THE WORD. ACCORDING TO MARK MOSELEY, FORMER GENERAL COUNSEL OF THE TEXAS REAL ESTATE COMMISSION, "REPAIR" AS USED IN AN INSPECTION REPORT ENTITLES THE BUYER TO ASK THE SELLER TO MAKE REPAIRS OF THE ITEM COMMENTED ON OR IT ALLOWS THE BUYER TO ASK FOR MONETARY OR OTHER CONSIDERATION FROM THE SELLER FOR THE ITEM NOTED. IT IS POSSIBLE THAT THE ITEM INSPECTED WILL CARRY A MARK IN THE "REPAIR" COLUMN BUT THE COMMENTS MADE ON THAT ITEM WILL BE NOTED AS INFORMATION. THIS MEANS THAT THE ITEM MAY NOT REQUIRE IMMEDIATE REPAIR IN THE OPINION OF THE INSPECTOR, BUT YOUR OPINION MAY DIFFER FROM THAT OF THE INSPECTOR. THE MARK IS MADE IN THE "REPAIR" COLUMN SO AS TO NOT WAIVE YOUR RIGHT TO ASK FOR REPAIRS OR OTHER COMPENSATION.

Notwithstanding any provision in this agreement to the contrary, any dispute, controversy, or lawsuit between any of the parties to this agreement about any matter arising out of this agreement shall be resolved by mandatory and binding arbitration administered by the American Arbitration Association ("AAA") pursuant to the Texas General Arbitration Act and in accordance with this arbitration agreement and the Commercial Arbitration Rules of the AAA. To the extent that any inconsistency exists between this arbitration agreement and such statutes and rules, this arbitration agreement shall control. Judgment upon the award rendered by the arbitrators may be entered in, and enforced by, any court having jurisdiction and in accordance with the practice of such court.

In any dispute, controversy, or lawsuit arising from this agreement, the prevailing party shall be entitled to recover from the unsuccessful party, reasonable and necessary attorney's fees incurred in connection with such dispute, controversy, or lawsuit. This agreement is entered into in Harris County, Texas and shall be construed and interpreted in accordance with the laws of the State of Texas. Venue for any action brought to enforce this agreement shall lie in Harris County, Texas.

#### SCOPE:

This inspection is limited to observations of only those components of the structure and those portions of the roof framing and surface readily accessible and visible without moving or the removal of any item or object that would obstruct visual observation. The comment of "inspected" noted by any section of this report means that, at a minimum, all parts and components of that section listed in the Minimum Standards of Inspections as published by the Texas Real Estate Commission were inspected. These standards are treated as minimums and they do not limit the ability of the inspector to inspect or comment on the property as the inspector deems appropriate.

Any item not capable of being seen at the time of the inspection, that is concealed by objects, vegetation or the finishes of the structure is specifically excluded as being beyond the scope of this inspection. Conditions not readily and visually apparent at the time of the inspection, were not considered in reaching the conclusions or rendering the opinions contained in this report.

Specifically excluded from the inspection and this report are:

1) boring, digging or probing the soil or structure

2) location or effects of geological faults or of any underground structure or object

3) location of gas lines and/or systems

4) presence of asbestos and/or radon gas

5) lead based paint and/or products made from or containing lead

6) adequacy of site drainage

7) opinions relating to compliance with any specifications, legal and/or code requirements or restrictions of any kind, and

8) determination of the presence or health effects of molds, mildew, etc.

NOTE: No environmental inspections of any kind were performed during this inspection. Even if comments are made regarding certain aspects or issues, inspections and/or any determination of the presence or possible dangers of materials organisms or microbial organisms including, but not limited to asbestos, lead, formaldehyde, mildew, molds, fungi, etc. are specifically excluded from the inspection and from this report. If you have any concerns over the presence or possible future growth of any of these type items, you should, as part of your due diligence, have the environmental inspections of your choice performed on the house prior to closing.

Items not specifically noted as "inspected" in the following report are not cover by the report and should not be assumed to be good, bad, performing the function for which they were intended or in need of repair by the lack of notation. No verbal statements by the inspector are to be considered a part of the inspection or of this report. It is again emphasized that this is a limited visual inspection made in a limited amount of time. Some defects may not be apparent during the time of the inspection. This is not intended to be an exhaustive evaluation of the structure, nor is it intended to be a total list of defects, existing or potential. If the house is occupied at the time of the inspection, it is possible that visible defects may have been concealed or covered by furniture, fixtures, appliances and/or clothing, etc. Once the owner/occupant vacates the property, any visible defect that becomes apparent should be reported to you via an updated seller's disclosure form.

The photographs included in this report are intended to be used to illustrate some, but not all, of the defects and to clarify the text information in the report. All photographs taken at the subject property may not be included in the report. The photographs are not intended to be all inclusive or to describe all conditions noted on the property.

# **MECHANICAL REPORT**

This limited visual inspection was performed, for the exclusive use of the client, with the intent of observing and reporting deficiencies apparent at the time of the inspection without disassembly of any unit or item inspected. This inspection was made of the physical condition of electrical switches, cover plates and convenience outlets that were accessible without moving furniture or fixtures. All functional equipment, in operable condition, was operated in at least one, but not necessarily every, mode to demonstrate its condition. Compliance with codes and/or adequacy of wiring and circuitry is beyond the scope of this inspection and report and is specifically excluded. If more in-depth information is desired or required on the electrical system or systems, it is recommended that a qualified electrician be consulted. It is emphasized that this is a limited visual inspection made in a limited amount of time. Some defects may not be apparent during the time of the inspection. This inspection is not intended to be an exhaustive evaluation of all the systems and appliances in the structure, nor is it intended to be a total list of defects, existing or potential. Items marked as "inspected" mean that, at a minimum, all parts and components of that section or item listed in the Minimum Standards of Inspections as published by the Texas Real Estate Commission were inspected. Items not noted as "inspected" in the following report are not covered by the report and should not be assumed to be good, bad, performing the function for which they were intended or in need of repair by lack of notation. The term "No Comments" indicates that the unit was performing the function for which it was intended without the apparent need of immediate repair at the time of the inspection. No verbal statements by the inspector are to be considered a part of the inspection or of this report.

INSPECTIONS OF GAS LINES AND/OR SYSTEMS OR FOR THE PRESENCE OF ASBESTOS, LEAD PAINT, PRODUCTS CONTAINING LEAD, RADON GAS OR OTHER ENVIRONMENTAL HAZARDS, INCLUDING MOLDS, MILDEWS OR FUNGI, ARE SPECIFICALLY EXCLUDED.

Additional pages may be attached to this report. Read them very carefully. This report may not be complete without the attachments. If an item is present in the property but is not inspected, the "NI" column will be checked and an explanation is necessary. The inspector may provide comments whether or not an item is deemed in need of repair.

#### I=Inspected NI=Not Inspected NP=Not Present R=Not Functioning or In Need of Repair I NI NP R Inspection Item 1. STRUCTURAL SYSTEMS

The inspection was of a two story, single frame dwelling under construction. The house was in the framing stage at the time of the inspection.



#### <u>REFERENCES TO THE BUILDING CODES ARE IN BOLD AND UNDERLINED TEXT AND ARE</u> <u>USED SOLELY FOR CLARIFICATION OF THE ITEM NOTED.</u>

**A. Foundations** (If all crawl space areas are not inspected, provide an explanation) *Comments* (*An opinion on performance is mandatory.*):

The foundation appeared to be performing without the obvious need of immediate remedial leveling at the time of the inspection, in my opinion.

				В.	Grading and	Drainage
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Comments:

The final grading and drainage will not be performed until the end of the construction process.

□ □ □ ■ C. Roof Covering (If the roof is inaccessible, report the method used to inspect.) *Comments:* 

NOTE: The surface of a roof begins to deteriorate as soon as it is placed into service and exposed to the elements. The degree of deterioration accelerates with the age of the roof and cannot be determined accurately by a visual inspection. Roof leaks can and may occur at anytime, regardless of the age of the roof, and cannot be accurately

predicted. If roof leaks do occur, their presence does not necessarily indicate the need for total replacement of the roof coverings. Responsibility for future performance of the roof is specifically excluded from this report.

All areas of the roof drip edges and rakes did not have drip edge flashing installed. Drip edge flashing should be properly installed on all drip edges and rakes.

The roofing felt did not extend to the rakes or bottom of the roof deck. This is an improper installation as the roof decking material may be exposed to water. The roofing felt should be extended to the rakes and bottom of the roof decking material and the felt should be properly terminated on top of the drip edge flashing at the drip edges of the roof. The drip edge flashing should be installed on top of the roofing felt at the rakes to help prevent the felt from being stripped from the roof deck in high winds.

Some of the roofing shingles were improperly fastened to the roof deck. All shingles are required to have a minimum of four fasteners per shingle, six fasteners in high wind zones. The fasteners are required to be located in the nailing strip so that the fastener penetrates the shingle in approximately the middle of the shingle and penetrates the underlying shingle along the top of that shingle. Fasteners are required to be located close to the rakes and ends of each shingle to reduce the chances of the shingle from being stripped in high winds. All shingles should be properly and correctly fastened to the roof deck to prevent the shingles from being stripped from the roof in high wind conditions.



## **HELP STOP BLOW-OFFS AND CALL-BACKS**

A minimum of four fasteners must be driven into the DOUBLE THICKNESS (laminated) area of the shingle. CAUTION: Do not use fastener line for shingle alignment.

Shingle Surface				T	
Deck	CORRECT	CROOKED		UNDERDRIVEN	
	Head flush to shingle. Tool head perpendic- ular to shingle during driving.	Decreased hol ing. Shingle to Prevents next shingle from sealing. See Repair Note 1.	ld- orn.	Decreased hold- ing. Prevents next shingle from seal- ing. See Repair Note 1.	Decreased hold- ing. Shingle torn. See Repair Note 2.
	REPAIR Note 1 Flatten nail head to pr interference with next Drive another nail nea	event shingle. arby.	REPAIR Note 2 Drive another nail nearby. Seal overdriven nail with asphalt plastic cement.		

J flashing was used to seal the junctions between the roof's surface and the walls. Section R905.2.8.4 of the International Residential Code (IRC) and the manufacturer of the shingles, per the instructions on the shingle bundles and on their websites, require that the junctions between the roof's surface and the side walls be flashed by the step flashing method. Step flashing creates redundancy in the metal sealing the roof/wall junctions. J flashing only provides a single layer of metal. Redundancy in water proofing materials on the surface of the roof is preferable.

#### 905.2.8.4 Sidewall flashing.

Flashing against a vertical sidewall shall be by the step-flashing method.

Step flashing must be used to flash along the intersection of a roof and a vertical sidewall. Commentary Figure R905.2.8.4 shows an example of flashing at a side wall. From the Commentary to the IRC.





Rafter ties were improperly installed in the attics of the house. Rafter ties are used to prevent the exterior walls parallel to the joists from spreading from the loads imposed by the hip roof when the joists are not installed parallel to the rafters. The rafter ties, in this case, were strong backs. The strong backs were not connected to the ends of the rafters or to the top of the exterior wall. There were gaps in the strong backs which reduce the strength of the strong backs. There were also an inadequate number of rafter ties installed per Section R802.3.1 of the IRC.

#### 802.3.1 Ceiling joist and rafter connections.

<u>Ceiling joists and rafters shall be nailed to each other in accordance with Tables R602.3(1) and R802.5.1(9),</u> and the assembly shall be nailed to the top wall plate in accordance with Table R602.3(1). Ceiling joists shall be continuous or securely joined where they meet over interior partitions and nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to the rafters.

Where ceiling joists are not parallel to rafters, subflooring or metal straps attached to the ends of the rafters shall be installed in a manner to provide a continuous tie across the building, or rafters shall be tied to 1-inch by 4-inch (25.4 mm by 102 mm) (nominal) minimum-size cross ties. The connections shall be in accordance with Table R602.3(1) or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top plate, the ridge formed by these rafters shall also be supported by a girder designed in accordance with accepted engineering practice.

#### Rafter ties shall be spaced not more than 4 feet (1219 mm) on center.

So that joists do not become accidentally displaced and so that they transfer thrust from the rafters to the ceiling joists, a mechanical connection to supporting members as shown in Commentary Figure 802.3.1(1) must be provided. To resist the horizontal thrust generated at the exterior walls by the loading of rafters, a continuous tie between the exterior walls is required. Commentary Figure R802.3.1(2) and R802.3.1(3) illustrate methods of accomplishing this. In Commentary Figure R802.3.1(3), the ceiling joists running parallel with the roof rafter framing provide the continuous tie. Where ceiling joists are not parallel with the roof rafters, separate cross ties (rafter ties) are to be provided, as shown in Commentary Figure R802.3.1(2). From the Commentary to the IRC.



Drawing from the Commentary to the International Residential Code



Several of the valley rafters and hip rafters were notched. Valley rafters are tension members, as defined by the code, and cannot be notched. The bottom of the valley rafter is in tension and the notch effectively removes the bottom section of the valley rafter from the board. This reduces the section of the board and may render the valley rafter inadequate. The notched valley rafters should be replaced. The notches in the hip rafters reduce the section of the hip rafters and decrease the hip rafter's ability to withstand separation. The notched hip rafters should be replaced.

#### 802.3 Framing details.

Rafters shall be framed to ridge board or to each other with a gusset plate as a tie. Ridge board shall be at least 1-inch (25.4 mm) nominal thickness and not less in depth than the cut end of the rafter. At all valleys and hips there shall be a valley or hip rafter not less than 2-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a

bearing partition or be designed to carry and distribute the specific load at that point. Where the roof pitch is less than three units vertical in 12 units horizontal (25-percent slope), structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams.







A brace on a valley was installed less than 45 degrees from the horizontal. This installation merely allows the strut or brace to rotate down when loaded by the roof. The strut or brace should be removed and replaced with a brace installed at the proper angle, which ideally should be perpendicular to the valley rafter.



Some of the ceiling joists and/or roof rafters were offset more than 5 inches from the studs. The IRC, section R602.3.3 requires that all joists be located within 5 inches of the studs as the stud plates are not structural beams or headers and are not capable of transferring loads without deflecting.

## R602.3.3 Bearing studs.

Where joists, trusses or rafters are spaced more than 16 inches (406mm) on center and the bearing studs below are spaced 24 inches (610 mm) on center, such members shall bear within 5 inches (127 mm) of the studs beneath.

Plates are the horizontal elements of walls capping the top of walls and framing the bottom of stud walls. They are called plates because they are laid flat, with the deeper dimension horizontal. In building construction applications, top plates must be a nominal 2-inch (51 mm) thickness. Double top plates serve three major functions:

<u>1. They overlap at corners and interior wall intersections, providing a means of tying the building together.</u>

2. They serve as beams to support joists and rafters that are not located directly over the studs.

3. They serve as chords for floor and roof diaphragms.

Along with provisions for stud size and spacing limitations, this section requires the installation of double top plates to provide a continuous tie along the tops of the walls. With the advent of wider wall framing to accommodate increased thickness of insulation, a desire to save on material costs led to the allowance of a single top plate alternative. The exception permits the use of a single top plate in bearing and exterior walls as long as adequate top-plate ties are provided. In addition, joists or rafters framing into the wall must be placed more closely to the vertical stud below. This is necessary to limit the bending stress in the top plate. The single top plate exception is illustrated in Commentary Figure R602.3.2 The ends of the rafters and joists were not nailed together at the double plate. The ends of the joists and rafters are required to be nailed together to provide continuity to the framing as required by Section 802.3.1 of the IRC. The joists and rafters ends should be properly fastened together to provide continuity to the framing.

### 802.3.1 Ceiling joist and rafter connections.

<u>Ceiling joists and rafters shall be nailed to each other in accordance with Tables</u> <u>R602.3(1) and R802.5.1(9), and the assembly shall be nailed to the top wall plate in</u> <u>accordance with Table R602.3(1). Ceiling joists shall be continuous or securely joined</u> where they meet over interior partitions and nailed to adjacent rafters to provide a <u>continuous tie across the building when such joists are parallel to the rafters.</u>

Where ceiling joists are not parallel to rafters, subflooring or metal straps attached to the ends of the rafters shall be installed in a manner to provide a continuous tie across the building, or rafters shall be tied to 1-inch by 4-inch (25.4 mm by 102 mm) (nominal) minimum-size cross ties. The connections shall be in accordance with Table R602.3(1) or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top plate, the ridge formed by these rafters shall also be supported by a girder designed in accordance with accepted engineering practice.

Rafter ties shall be spaced not more than 4 feet (1219 mm) on center.



There were "lay down" valley rafters used to support the jack rafters on the rear of the house. A lay down rafter is improper for several reasons. The use of the lumber under this type framing is thought to be considerably weaker than the use of a valley rafter as the board is laid on its wide side and resists bending on its narrow side. The stiffness of a structural member is primarily determined by its depth, not its width. Section R802.3 of the International Residential Code (IRC) requires that all valley rafters be constructed as beams. Second, a common rafter cannot be used to support another common rafter, which is what happens with this type valley. Third, the system is structurally indeterminate. The forces cannot be resolved or their magnitude evaluated. Properly constructed valley rafters should be installed.



The ends of the jack rafters were square cut and were not cut to fit properly against header of the chimney chase. This does not allow for proper transfer of loads and the loads are transferred only through the shear strength of the nails. The jack rafters should be repaired.



There were only single headers at the opening for the chimney chase. The openings are required to be framed with doubled headers. The single headers should be replaced with double headers.

#### 802.9 Framing of openings.

Openings in roof and ceiling framing shall be framed with header and trimmer joists. When the header joist span does not exceed 4 feet (1219 mm), the header joist may be a single member the same size as the ceiling joist or rafter. Single trimmer joists may be used to carry a single header joist that is located within 3 feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds 4 feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the ceiling joist or rafter framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds 6 feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches(51 mm by 51 mm).

There were missing joist hangers and some of the joist hangers were undersized for the joists used. Joist hangers are required to be as deep as the joist. Joist hangers should be properly installed in all required areas.



□ □ □ ■ E. Walls (Interior and Exterior) Comments: Split studs should be replaced with sound new studs.

Improperly bored studs in both bathrooms should be reinforced by the application of stud shoes. Section R602.6 of the International Residential Code, 2000 Edition (hereinafter, the IRC) requires that "any stud may be bored or drilled provided.... that the edge of the hole is no closer that 5/8 inch to the edge of the stud." Improperly bored studs may, according to the IRC, be reinforced by the installation of stud shoes at the site of the improper borings.

#### 602.6 Drilling and notching-studs.

Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing partitions may be notched to a depth not to exceed 40 percent of a single stud width. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no greater than 40 percent of the stud width, the edge of the hole is no closer than 5/8 inch (15.9 mm) to the edge of the stud, and the hole is not located in the same section as a cut or notch. See Figures R602.6(1) and R602.6(2). Exceptions:

 A stud may be bored to a diameter not exceeding 60 percent of its width, provided that such studs located in exterior walls or bearing partitions are doubled and that not more than two successive studs are bored.
 Approved stud shoes may be used when installed in accordance with the manufacturer's recommendation.

All high wind loading straps were not connected. All high wind loading straps should be properly fastened to the framing members.



The chimney chase was not properly fire stopped. The fire stop is required to completely seal the opening of the chimney chase between the vent pipe and the chimney chase at the floor of the attic and at the floor junctions. The fire stop was installed at the floor of the attic, but the firestop was not sealed to the vent pipe. The openings between the vent pipe and the firestop make the firestop ineffective. The openings should be sealed for safety.

#### 602.8 Fireblocking required.

<u>Fireblocking shall be provided to cut off all concealed draft openings (both vertical and horizontal) and to</u> <u>form an effective fire barrier between stories, and between a top story and the roof space. Fireblocking</u> <u>shall be provided in wood-frame construction in the following locations.</u>

**1.** In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs; as follows:

1.1. Vertically at the ceiling and floor levels.

1.2. Horizontally at intervals not exceeding 10 feet (3048 mm).

2. At all inter connections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.

3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R311.2.2.

4. At openings around vents, pipes, and ducts at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion.

#### 5. For the fireblocking of chimneys and fireplaces, see Section R1001.16. 6. Fireblocking of cornices of a two-family dwelling is required at the line of dwelling unit separation.

The stair risers and treads were not uniform in size. This condition creates a hazard to the user of the stairs. The brain adjusts your stride to the height and depth of stairs and one step that is a different size can cause you or another user of the staircase to trip and fall. The risers should be made uniform in height for safety.

## 311.5.3.1 Riser height.

The maximum riser height shall be 7 3/4 inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm).

The code establishes that the maximum riser height is 73/4 inches (197 mm). The International Residential Code does not provide a minimum riser height as does the International Building Code, where a 4-inch (102 mm) limit is specified. The provisions specify how the riser height is to be measured. See Commentary Figure R311.5.3.1(1). A significant safety factor relative to stairways is the uniformity of risers and treads in any flight of stairs. The section of a stairway leading from one landing to the next is defined as a flight of stairs. It is very important that any variation that would interfere with the rhythm of the stair user be avoided. While it is true that adequate attention to the use of the stair can compensate for substantial variations in risers and treads, too frequently the stair user does not give the necessary attention.

<u>To obtain the best uniformity possible in a flight of stairs, the maximum variation between the highest and lowest risers is limited to 3/8 inch (9.5 mm).</u> This tolerance is not to be used as a design variation, but its inclusion is in recognition that construction practices make it difficult to get exactly identical riser heights and tread dimensions in constructing a stairway in the field. Therefore, the code allows the variation indicated in Commentary Figure 311.5.3.1(2).

311.5.3.2 Tread depth.

The minimum tread depth shall be 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). Winder treads shall have a minimum tread depth of 10 inches (254 mm) measured as above at a point 12 inches (305) mm from the side where the treads are narrower. Winder treads shall have a minimum tread depth of 6 inches (152 mm) at any point. Within any flight of stairs, the greatest winder tread depth at the 12 inch (305 mm) walk line shall not exceed the smallest by more than 3/8 inch (9.5 mm).



The window frames, door frames and other wall penetrations installed in the brick veneer were not properly flashed or drained. The current building code, the 2000 and 2003 Editions of the International Residential Code, require the installation of through wall flashing above the window and door frames and below the window sill. The through wall flashing should extend from behind the wall sheathing and should terminate on the exterior of the veneer. Weep holes, for drainage of the wall cavity at the window frames, are required to be formed in the veneer above the window frames and below the sills. While weep holes had been formed in the veneer above the window and door frames, the lintels were used as the flashing. Lintels are structural support members for the veneer and are not intended for use as drains. For further information, see Sections R703.7.5, R703.7.6 and R703.8 of the IRC (International Residential Code) along with the referenced drawings in the code. For further information, go to bia.org on the World Wide Web, which is the website of the brick manufacturer's association. You can also go to the American Plywood Association's website. There are free sites, although they may require you to sign up for a password. Once you have gained access, go to the technical notes section from information on the requirements of the manufacturer's association for the drainage of the wall cavities.

#### 703.7.5 Flashing.

Flashing shall be located beneath the first course of masonry above finished ground level above the foundation wall or slab and at other points of support, including structural floors, shelf angles and lintels when masonry veneers are designed in accordance with Section R703.7. See Section R703.8 for additional requirements.

#### 703.7.6 Weepholes.

Weepholes shall be provided in the outside wythe of masonry walls at a maximum spacing of 33 inches (838 mm) on center. Weepholes shall not be less than 3/16 inch (4.8 mm) in diameter. Weepholes shall be located immediately above the flashing.

#### 703.8 Flashing.

Approved corrosion-resistive flashing shall be provided in the exterior wall envelope in such a manner as to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. The flashing shall extend to the surface of the exterior wall finish and shall be installed to prevent water from reentering the exterior wall envelope. Approved corrosion-resistant flashings shall be installed at all of the following locations:

**1.** At top of all exterior window and door openings in such a manner as to be leakproof, except that self-flashing windows having a continuous lap of not less than 1 1/8 inches (28 mm) over the sheathing material around the perimeter of the opening, including corners, do not require additional flashing; jamb flashing may also be omitted when specifically approved by the building official.

2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.

3. Under and at the ends of masonry, wood or metal copings and sills.

4. Continuously above all projecting wood trim.

5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.

6. At wall and roof intersections.

7. At built-in gutters.

The code requires that all points subject to the entry of moisture be appropriately flashed. Roof and wall intersections and parapets create significant challenges, as do exterior wall openings exposed to the weather. Where wind-driven rain is expected, the concerns are even greater. While the code identifies a number of locations where flashing is specifically required, the entire exterior envelope must be weather-tight to protect the interior from weather. Therefore, any location on the exterior envelope that provides a route for the admission of water or moisture into the building must be properly protected. Commentary Figure R703.8 illustrates examples of flashing. From the Commentary to the IRC



# Water Penetration Resistance - Design and Detailing

Abstract: Proper design, detailing and construction of brick masonry walls are necessary to minimize water penetration into or through a wall system. Many aspects of design, construction and maintenance can influence a wall's resistance to water penetration. The selection of the proper type of wall is of utmost importance in the design process as is the need for complete and accurate detailing. In addition to discussing various wall types, this *Technical Note* deals with proper design of brick masonry walls and illustrates suggested details which have been found to be resistant to water penetration.

Key Words: barrier, design, detailing, drainage, flashing, installation, rain, wall types, weeps.

# SUMMARY OF RECOMMENDATIONS:

#### Wall System Selection:

- Drainage walls provide maximum protection against water penetration
- Barrier walls are designed to provide a solid barrier to water penetration and provide good water penetration resistance
- Single wythe masonry walls require careful detailing and construction practices to provide adequate water penetration resistance

#### **Through Wall Flashing Locations:**

 Install at wall bases, window sills, heads of openings, shelf angles, tops of walls and roofs, parapets, above projections, such as bay windows, and at other discontinuities in the cavity

- Through-Wall Flashing Installation:
- Lap continuous flashing pieces at least 6 in. (152 mm) and seal laps
- Turn up the ends of discontinuous flashing to form end dams
- Extend flashing beyond the exterior wall face
- Terminate UV sensitive flashings with a drip edge

#### Weeps:

- Open head joint weeps spaced at no more than 24 in. (610 mm) o.c. recommended
- Most building codes permit weeps no less than <sup>3</sup>/<sub>16</sub> in. (4.8 mm) diameter and spaced no more than 33 in. (838 mm) o.c.
- Wick and tube weep spacing recommended at no more than 16 in. (406 mm) o.c.

# DETAILING

# Through-Wall Flashing

Through-wall flashing is a membrane, installed in a masonry wall system, that collects water that has penetrated the exterior wythe and facilitates its drainage back to the exterior. Such flashing is essential in a drainage wall system, and is required as a second line of defense in a barrier wall system. Proper design requires flashing at wall bases, window sills, heads of openings, shelf angles, projections, recesses, bay windows, chimneys, tops of walls and at roofs. Flashing should extend vertically up the backing a minimum of 8 in. (203 mm). The water-resistant barrier on the backing should lap the top of the flashing. Examples of water-resistant membranes include No. 15 asphalt felt, building paper, certain high-density polyethylene or polypropylene plastics (housewraps) and certain water-resistant sheathings. Various types of flashing materials which may be used in the design of brick masonry and composite walls are covered in *Technical Note* 7A.

In regard to flashing, the designer must also address the following considerations:

**Extension Through Wall.** When possible, flashing should extend beyond the face of the wall to form a drip as shown in Figure 7. When using a flashing that deteriorates with UV exposure, a metal or stainless steel drip edge can accomplish this. It is imperative that flashing be extended at least to the face of the brickwork.



Figure 14 Window Head in Brick Veneer/Frame Wall



The blocking for the upstairs bathroom air register was not properly fastened to the framing. The blocking should be properly fastened to the frame.



The torn or separated sheathing should be repaired or replaced.



Comments:

CONDITIONED AIR DISTRIBUTION SYSTEM: Pinched and misshapen flexible ducts were noted throughout the attic. It is well known that reducing or changing the shape of a pipe or channel causes turbulence which increases the pressure in the pipe or channel but reduces flow through the pipe, a phenomenon that you may have used in pinching a garden hose to reduce or eliminate water flow from the hose. For some reason, HVAC contractors contend that this well known and documented fact does not occur in flexible air ducts. It does. The ducts should be properly aligned and supported. The turns in the ducts should be gradual so that the duct is bent and distorted as little as possible. This will help increase the volume of air flowing into the house and may relieve the pressures on the air conditioning equipment.

Flexible Air Duct installation vs. Flexible Connector installation: There are distinct differences in the use and limitations between "air duct" and "connector," as defined by "Flexible Duct Performance & Installation Standards," Third Edition, published by the Air Diffusion Council. In accordance with NFPA 90A and 90B Standards, national building codes, and local building codes, there are specific limitations on the use and installation of these items.

Particular attention must be paid to the limitation for Connector (Anco System 3100). In all cases, the most stringent of codes must be met. The U.L. label for air duct is rectangular in shape; whereas, the U.L. label for Connector is round. This allows easy differentiation between them. For example, connector CANNOT be used in lengths exceeding 14 lineal feet as per NFPA standards.

Avoid installations where exposure to direct sunlight can occur. Prolonged exposure to sunlight could cause degradation to the vapor barrier.

Install duct fully extended, do NOT install in the compressed state or use excess lengths. This will noticeably increase friction losses.

If suspended, product shall be supported at no less then 4" intervals by hanger, saddle, or ceiling joist or other commonly used support of no less than 1-1/2" width at contact points with maximum permissible sag of 1/2" per lineal foot of spacing between supports.

Avoid bending ducts across sharp corners or incidental contact with metal fixtures, pipes or conduits. Radius at center line of bend shall NOT be less than one duct diameter. *Typical Flexible Duct Manufacturer's Installation Instructions.* 





Electrical conductors were used to support some of the ducting. Electrical conductors are not intended or designed to support ducting. The conductors can break or can be damaged by this use. The conductors should be completely separated from the ducting so that the conductors are not placed in tension.

The downstairs return air chase may be undersized. The sizing of the return air chases should be verified prior to the installation of the wall covering materials.

The PVC supply and drain pipes did not appear to be adequately supported in all areas. All sections of the PVC piping should be properly supported per section P2605.1 and Table 2605.1.

## P2605.1 General.

Support for piping shall be provided in accordance with the following:

 Piping shall be supported so as to ensure alignment and prevent sagging, and allow movement associated with the expansion and contraction of the piping system.
 Piping in the ground shall be laid on a firm bed for its entire length, except where support is otherwise provided.

3. Hangers and anchors shall be of sufficient strength to maintain their proportional share of the weight of pipe and contents and of sufficient width to prevent distortion to the pipe. Hangers and strapping shall be of approved material that will not promote galvanic action. Rigid support sway bracing shall be provided at changes in direction greater than 45 degrees (0.39 rad) for pipe sizes 4 inches (102 mm) and larger.
4. Piping shall be supported at distances not to exceed those indicated in Table P2605.1.