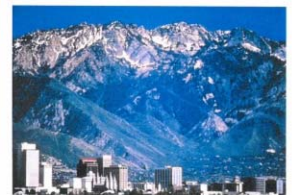


The Utah Guide For The Seismic Improvement Of Unreinforced Masonry Dwellings

2015

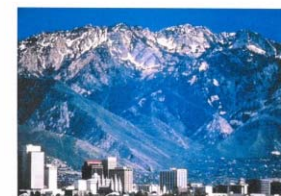
THE UTAH GUIDE FOR THE SEISMIC IMPROVEMENT OF
UNREINFORCED MASONRY DWELLINGS





We Want Utah to Know How Important Seismic Safety Is!

THE UTAH GUIDE FOR THE SEISMIC IMPROVEMENT OF UNREINFORCED MASONRY DWELLINGS

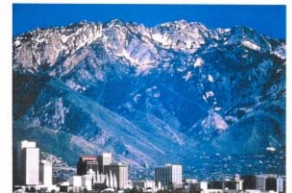


**We Want
This Book
to Cause
Owners to
Question;**

**How Safe
Is Your
Home?**



THE UTAH GUIDE FOR THE SEISMIC IMPROVEMENT OF
UNREINFORCED MASONRY DWELLINGS



**And then get
the Owners to
Improve the
Earthquake
Safety of their
Home!**

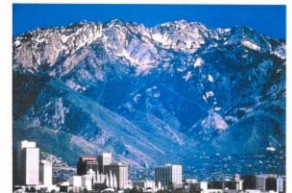


Before the Big Event!!!

Work Scope Objectives:

- This work was to be a fully Revised and Updated edition of the “Utah Guide”.
- A major objective was to better target the intended audience of Home Owners and smaller Remodel Contractors.
- It has been a major volunteer effort in coordination between SEAU and USSC in the joint “Existing Buildings” Committee.

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Chapter 1 is an “Introduction” to help the explain the basic concepts to the target audience.

- This helps to explain older home construction in Utah, and the potential impact of seismic activity on such homes.
- It helps to explain and illustrate the effects of weak older homes during earthquake action in Utah.
- This helps to explain & illustrate the importance of such risks for URM dwellings.

THE UTAH GUIDE FOR THE SEISMIC IMPROVEMENT OF
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How to Use This Guide

This guide was developed on the premise that the wide range of URM homes in Utah can be represented by a smaller number of URM models. It was determined that the vast majority of URM single-family homes along the Wasatch Front could be described in terms of seven different models. Each model has distinct architectural styles, variations in construction, and different configurations.

The details in this document are referenced using a consecutive numbering system, with each detail listing the model type referenced and the general purpose of the basic detail shown. These details are included in Chapters 5 and 6.

The process presented in this guide to evaluate and improve the seismic resistance of a home, is shown in the flow chart on the following page, and will be translated in four consecutive steps:

STEP 1 (a).

From the seven model homes described in Chapter 5, determine which one has the architecture features, configuration, and specific materials most closely resembling the home that is to be improved.

STEP 1 (b).

It is possible that several wall sections in this guide will apply to a single structure, and each potential similar element should be identified for consideration during the seismic improvement process. A contractor or repair specialist can assist in determining which wall sections apply to a specific structure.

Chapter 2 explains how to use the “Utah Guide”, giving basic simple steps to follow for upgrading URM homes.

Chapter 2 explains how to use the “Utah Guide”

STEP 2.

From the list of deficiencies and exterior wall sections in Chapter 5, select corrective measures which appear to be appropriate for the URM home that is to be improved using the improvement details in Chapter 6. The deficiencies are listed according to, and in order of, the approximate overall importance of safety related to each deficiency. It is recommended that they be corrected in the same sequence. As an example, the first and most important corrective measure for most URM homes is to provide a positive connection between the wood roof structure and the exterior walls.

STEP 3.

For some deficiencies, there are a number of alternative seismic improvement details which may be used to achieve the same result. There are advantages and disadvantages for each of the alternatives. Some methods are much more disruptive and would only be practical if a major renovation is being undertaken. The intended procedure is to select the method that is best suited for the circumstances of the specific dwelling. In most instances, the corrective measures will require some modification from the detail as provided. The method selected will be dictated by several factors which may include the following:

- a. Should the entire home or just a portion of a home be seismically improved?
This may be related to remodeling or other construction projects planned for the home.
- b. Can the architectural and/or historical appearance be altered?
- c. How much money is available for the project? This may require the work to be completed in stages.

Each alternative approach should generally provide the same basic result; however, some are based on constraints in the desired appearance or construction methods. Where multiple seismic improvement details are provided, alternative approaches may show different methods of construction or may show differing ways to achieve a different final appearance. Often a particular owner may feel the need to minimize

Chapter 2 explains how to use the “Utah Guide”

the risk of damage that may be possible with the various methods of construction, or they may not want to alter the basic brick look of their home. Because some of the alternatives shown do not always consider the final impact on appearance, owners need to be aware that major alterations in the architectural appearance could be the result.

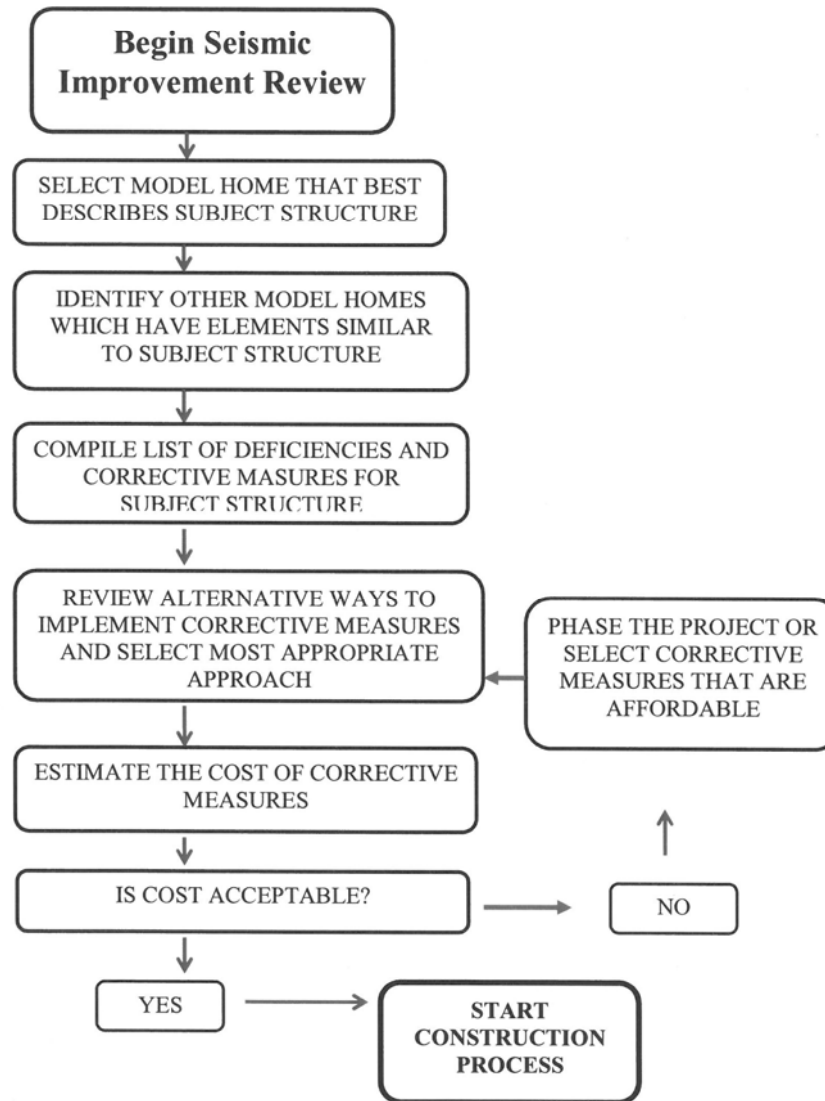
STEP 4.

The cost associated with each task should be estimated for the complete list of corrective measures selected then added up to determine an overall total. The budget for the project can then be used to determine how far the seismic improvement process can be taken. Each task should ideally be placed in the ranked priority shown in Table 1, Chapter 5. This priority list can also be readjusted to better meet the homeowners' specific needs considering budget or phasing options.

Each corrective measure that is implemented should improve the seismic performance of the home. If a task is done out of the suggested order, the desired improvement may not be achieved because of the failure of another element. Some measures are much more cost effective than others and this is generally reflected in the suggested order of corrective work. In areas where high levels of ground shaking are probable (IBC Seismic Design Category C through F), seismic improvements that address the top three deficiencies listed in Table 1 in Chapter 5 are recommended as the minimum amount of seismic rehabilitation work. In areas where the level of expected ground shaking is moderate to low (IBC Seismic Design Category A and B) the top two deficiencies listed in Table 1 in Chapter 5 should be addressed as a minimum. Corrective work beyond these minimum recommended levels will improve the seismic performance of the structure and should be considered. It is generally assumed that the best-case seismic zones in the Salt Lake valley are design category C, and therefore it is recommended that the maximum number of seismic deficiencies be addressed.

Chapter 2
explains how
to use the
“Utah Guide”,
giving basic
simple steps to
follow for
upgrading
URM homes.

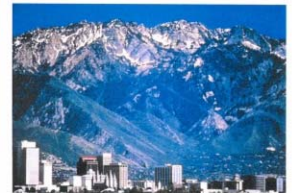
Figure 14 Seismic Improvement Flowchart



Chapter 3 describes how earthquake forces act upon, and are resisted by, dwellings.

- Gives some history and details of Utah's seismic activity.
- It helps explain how older URM homes were designed different that newer homes.
- Describes the structural elements of a home that resist earthquake forces.

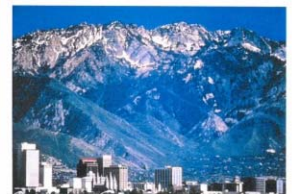
THE UTAH GUIDE FOR THE SEISMIC IMPROVEMENT OF
UNREINFORCED MASONRY DWELLINGS



Chapter 4 describes some of the notable features of UnReinforced Masonry (URM) construction for dwellings.

- Gives some history and details of Utah's seismic activity.
- It helps explain how older URM homes were designed different that newer homes.
- Describes the structural elements of a home that resist earthquake forces.

THE UTAH GUIDE FOR THE SEISMIC IMPROVEMENT OF
UNREINFORCED MASONRY DWELLINGS



Chapter 5 describes some of the notable features of UnReinforced Masonry (URM) construction for dwellings.

- Describes several “Model” types that are typical of URM dwellings.
- Describes deficiencies in each type of URM dwelling.
- Provides a description and photos of examples of each “Model” type.
- Provides a ranking list of deficiencies in order of priority for improvement.

THE UTAH GUIDE FOR THE SEISMIC IMPROVEMENT OF
UNREINFORCED MASONRY DWELLINGS



Chapter 5 provides photos of examples of each “Model” type.



Model A



Model B



Model C



Model D



Model E



Model F

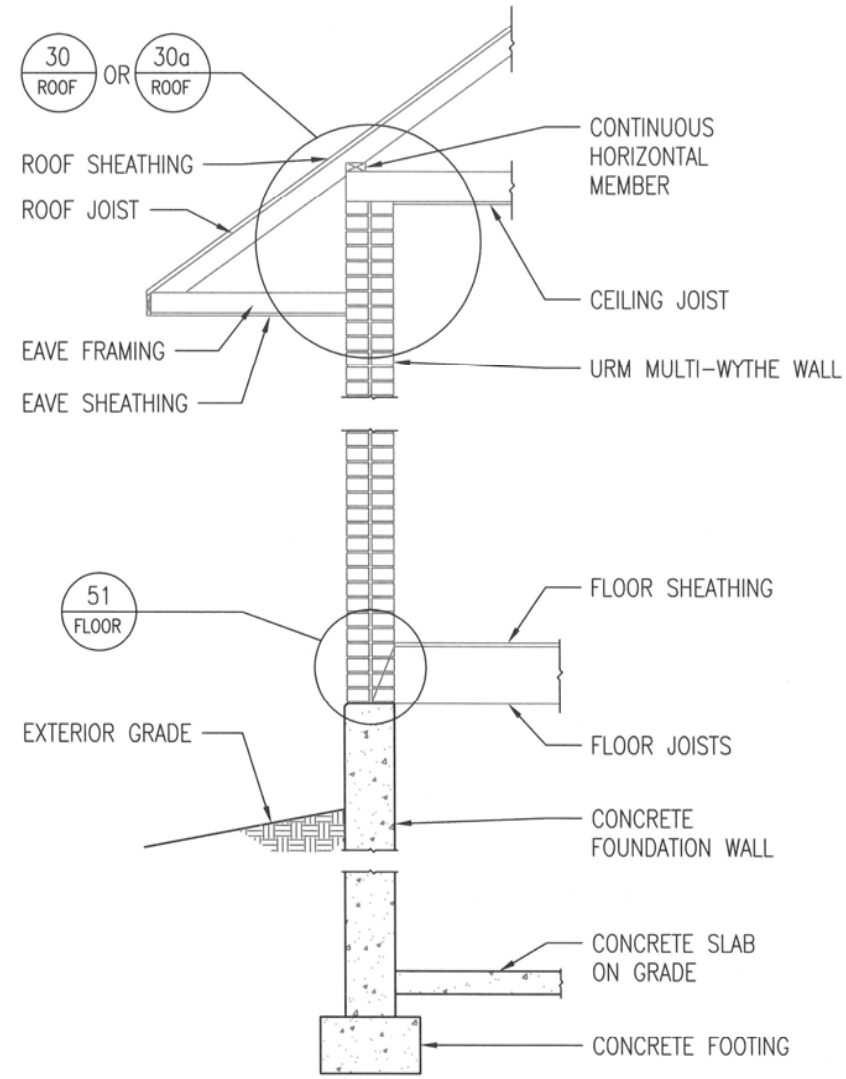
Figure 25 Representative Model Home Types

Chapter 5 also provides a list with a ranking of the deficiencies in order of priority for improvement, along with a list of helpful details for each model type.

TABLE 1:
MODEL HOME DEFICIENCIES UPGRADE DETAILS

DEFICIENCIES (In order of highest priority to lowest priority)	TYPICAL SEISMIC IMPROVEMENT DETAILS						
	MODEL A	MODEL B	MODEL C	MODEL D	MODEL E	MODEL F	MODEL G
ROOF TO URM WALL ANCHORAGE	DETAIL 30 DETAIL 30a DETAIL 35 DETAIL 35a	DETAIL 31 DETAIL 31a DETAIL 36 DETAIL 36a	DETAIL 32 DETAIL 32a DETAIL 32b DETAIL 37 DETAIL 37a	DETAIL 32 DETAIL 32a DETAIL 32b DETAIL 37 DETAIL 37a	DETAIL 33 DETAIL 38	DETAIL 34	DETAIL 32a SIM. DETAIL 32c DETAIL 36b
FLOOR TO URM WALL AND FOUNDATION WALL ANCHORAGE	DETAIL 51 DETAIL 53 DETAIL 54	DETAIL 51 DETAIL 53 DETAIL 54	DETAIL 50 DETAIL 51 DETAIL 53 DETAIL 54 DETAIL 56	DETAIL 50 DETAIL 51 DETAIL 53 DETAIL 54 DETAIL 56	DETAIL 52 DETAIL 55	DETAIL 51	DETAIL 51 SIM. DETAIL 54 SIM.
STRENGTHENING & BRACING OF SPECIAL FEATURES	DETAIL 20 THROUGH DETAIL 26	DETAIL 20 THROUGH DETAIL 26	DETAIL 20 THROUGH DETAIL 26	DETAIL 20 THROUGH DETAIL 26	DETAIL 20 THROUGH DETAIL 26	DETAIL 20 THROUGH DETAIL 26	DETAIL 20 THROUGH DETAIL 26
ROOF DIAPHRAGM STRENGTHENING	DETAIL 39 THROUGH DETAIL 42	DETAIL 39 THROUGH DETAIL 42	DETAIL 41 THROUGH DETAIL 42	DETAIL 41 THROUGH DETAIL 42	DETAIL 41 THROUGH DETAIL 42	DETAIL 41 THROUGH DETAIL 42	DETAIL 41 THROUGH DETAIL 42
FOUNDATION WALL STRENGTHENING	DETAIL 90	DETAIL 90	DETAIL 90	DETAIL 90	DETAIL 90	DETAIL 90	DETAIL 90
FLOOR DIAPHRAGM STRENGTHENING	DETAIL 57	DETAIL 57	DETAIL 57	DETAIL 57	DETAIL 57	DETAIL 57	DETAIL 57
URM WALL STRENGTHENING	DETAIL 70 DETAIL 74	DETAIL 70 DETAIL 74	DETAIL 70 DETAIL 74	DETAIL 70 DETAIL 74	DETAIL 70 DETAIL 74	DETAIL 75 DETAIL 76	DETAIL 70 DETAIL 76
STRENGTHENING OF MAJOR INTERIOR BEARING ELEMENTS	DETAIL 77 THROUGH DETAIL 82	DETAIL 77 THROUGH DETAIL 82	DETAIL 77 THROUGH DETAIL 82	DETAIL 77 THROUGH DETAIL 82	DETAIL 77 THROUGH DETAIL 82	DETAIL 77 THROUGH DETAIL 82	DETAIL 77 THROUGH DETAIL 82
NON-STRUCTURAL BRACING & ANCHORAGE	FOR BRACING & ANCHORAGE OF NON-STRUCTURAL ITEMS INCLUDING WATER HEATERS, FURNISHINGS, CABINETS, EQUIPMENT, ETC. SEE DETAIL NUMBERS 100 AND HIGHER						

Chapter 5
includes a
table of
contents of
details at the
end, followed
by details to
show the
typical
construction
for each
“Model” type.

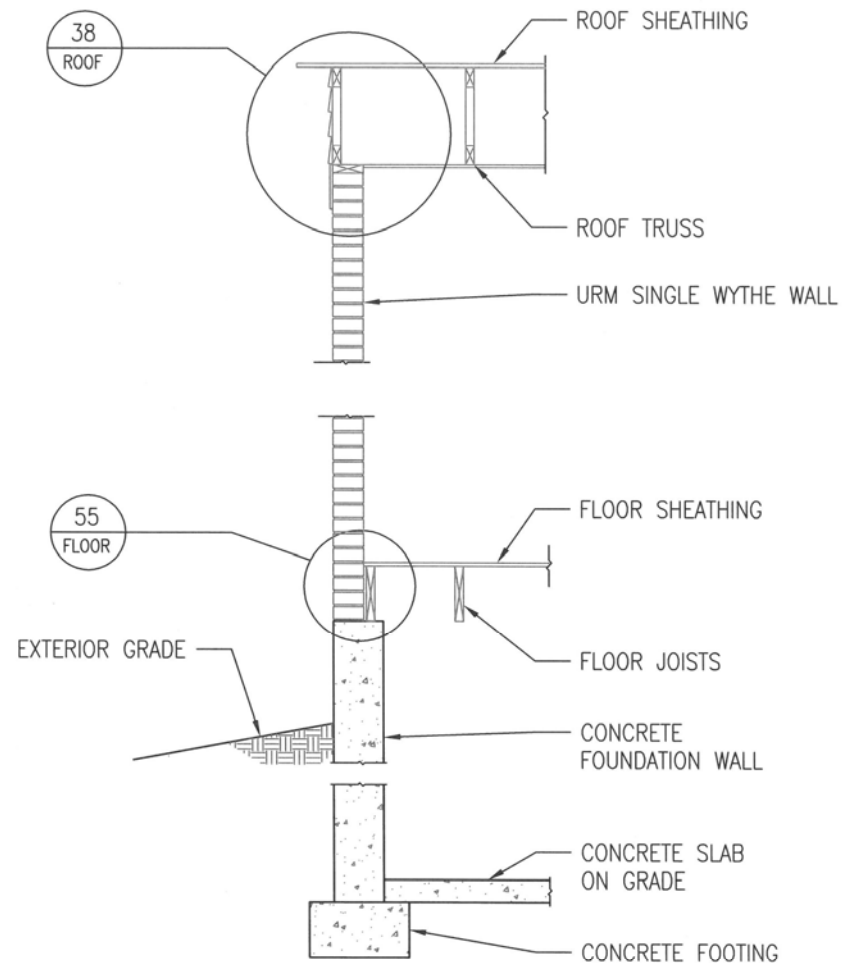


1 SECTION W/ JOIST FRAMING PERPENDICULAR TO WALL

Model Home Seismic Deficiencies	HOME TYPE: MODEL A	Exterior Wall Sections	DETAIL: 1
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Chapter 5

includes a table of contents of details at the end, followed by details to show the typical construction for each “Model” type.



10 SECTION W/ JOIST FRAMING
SECTION PARALLEL TO WALL

Model Home Seismic Deficiencies	HOME TYPE: MODEL E	Exterior Wall Sections	DETAIL: 10
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Chapter 6 provides seismic mitigation concepts and a lot of details for upgrade of URM homes.

Individual Structural Repair Details

Details for Seismic Mitigation of URM Structures (Details 20-99)*

Structural Bracing: Details 20 – 26a

Roof Anchorage and Strengthening: Details 30 – 41

Floor Anchorage and Strengthening: Details 50 – 57

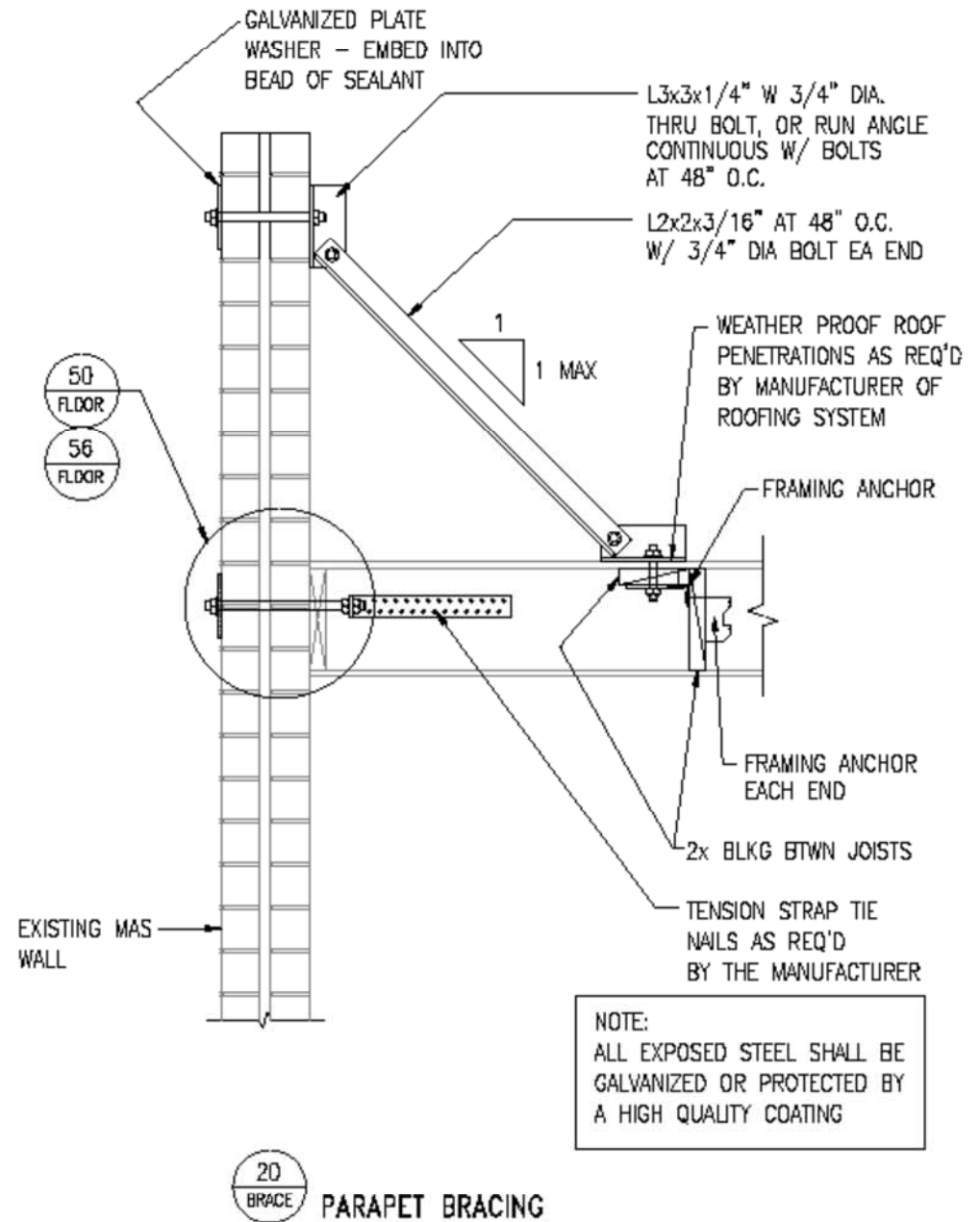
Wall Strengthening: Details 70 – 82

Foundation Anchorage and Strengthening: Details 90

*Unused detail numbers are intentionally left out for future printings.

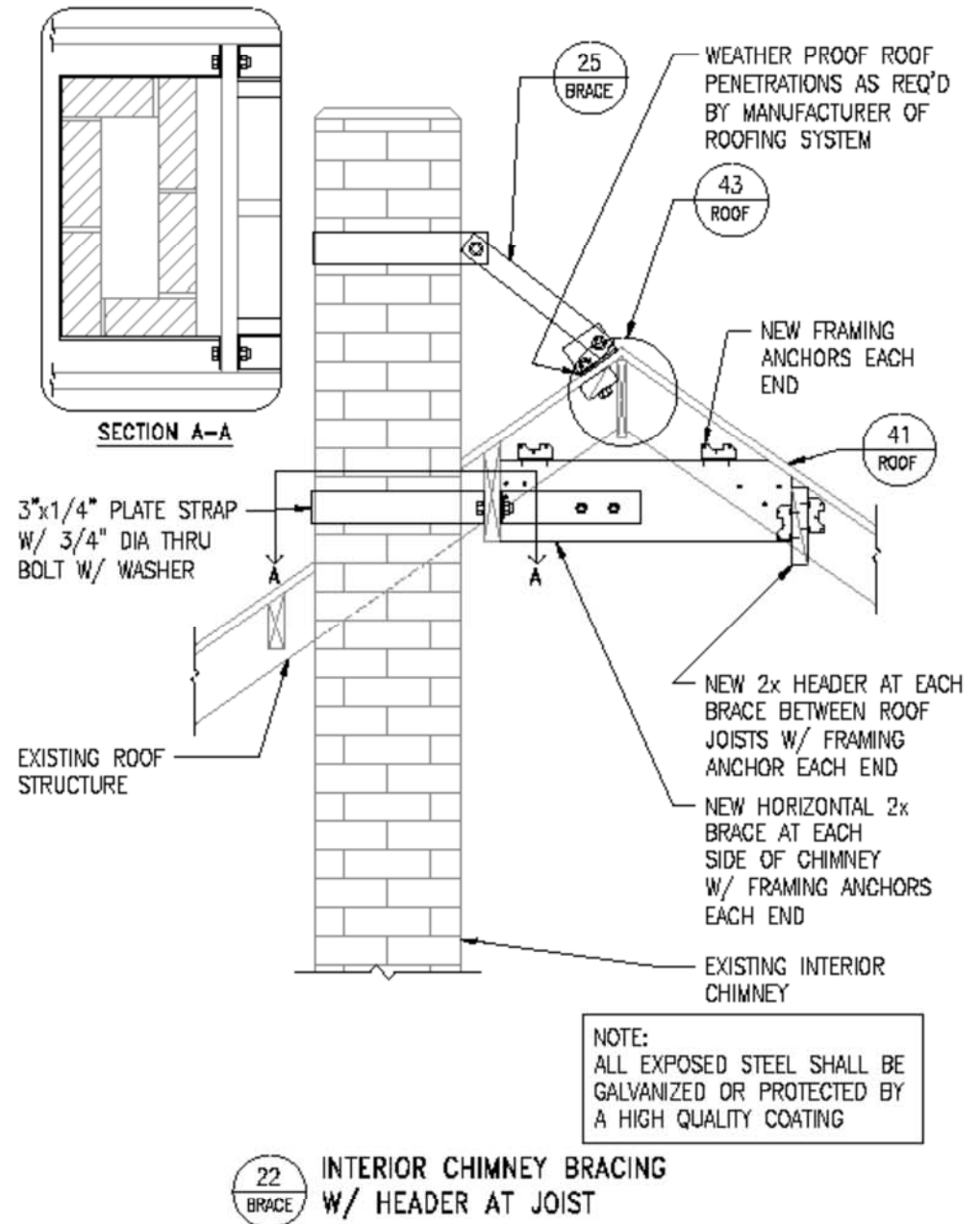
Chapter 6 Details

Take Down Or Brace URM Roof Parapets →



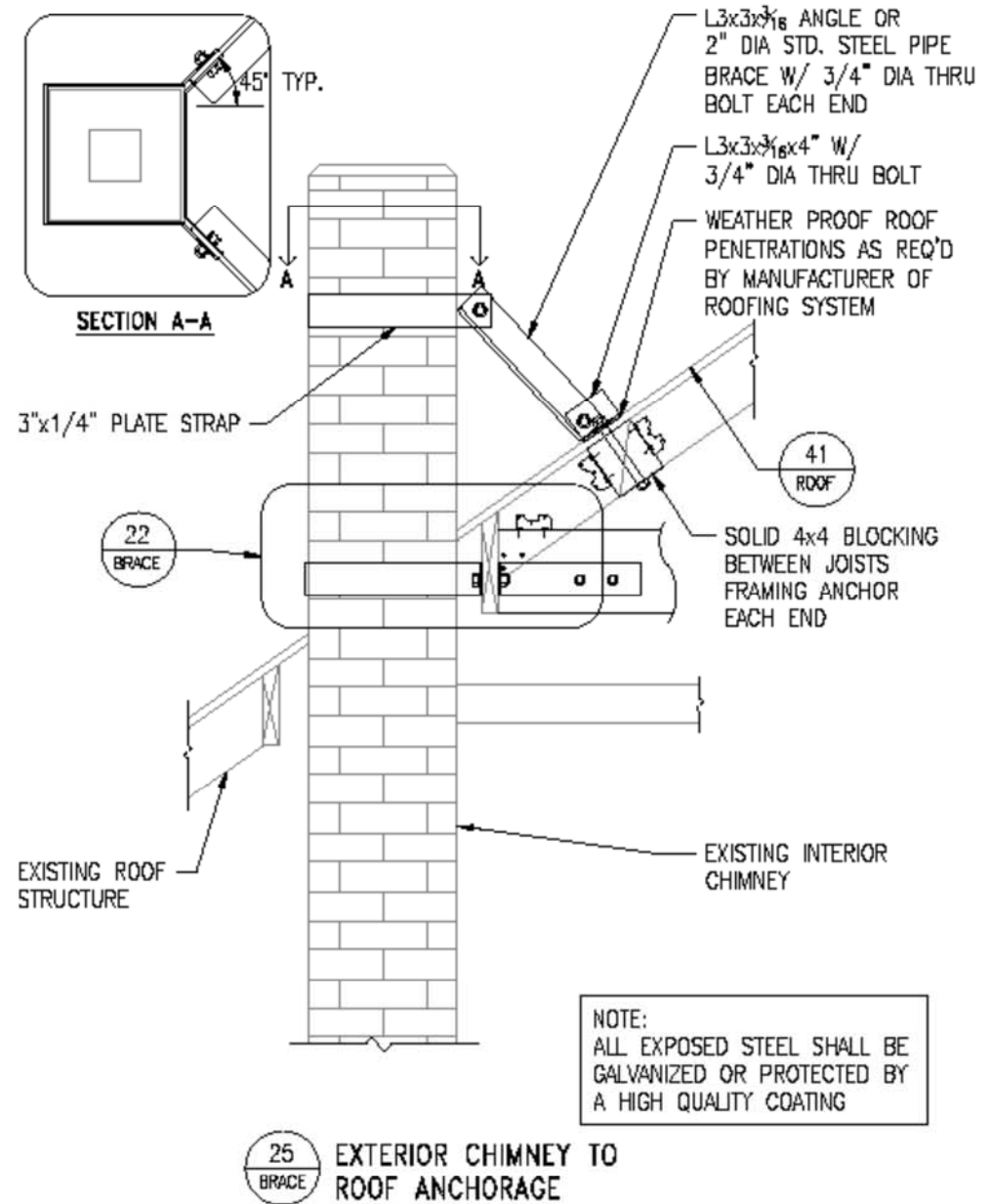
Chapter 6 Details

Brace URM Chimneys →



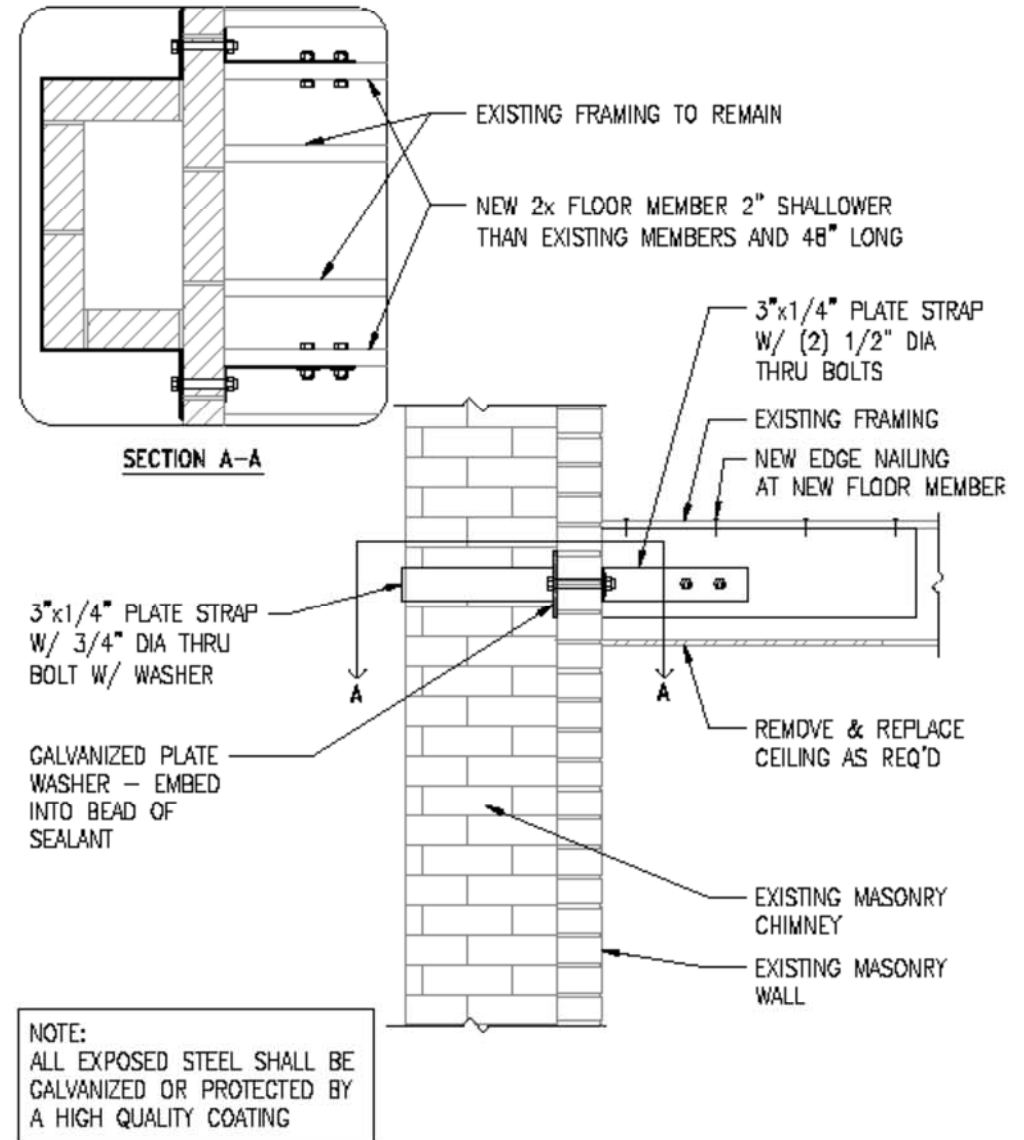
Chapter 6 Details

Brace URM Chimneys →



Chapter 6 Details

Tie-Back URM Chimneys →

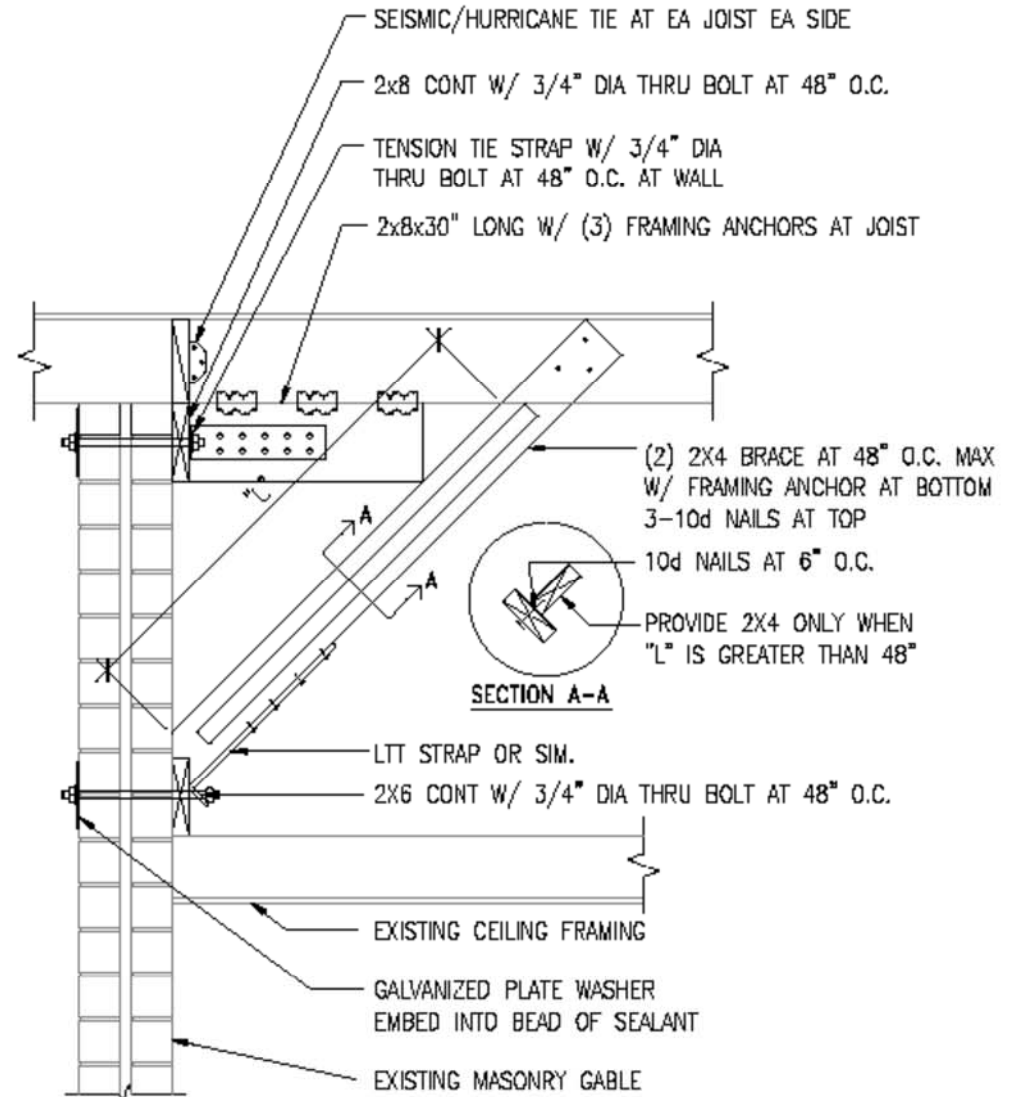


23
BRACE

EXTERIOR CHIMNEY TO FLOOR ANCHORAGE
⊗ JOISTS PERPENDICULAR TO WALL

Chapter 6 Details

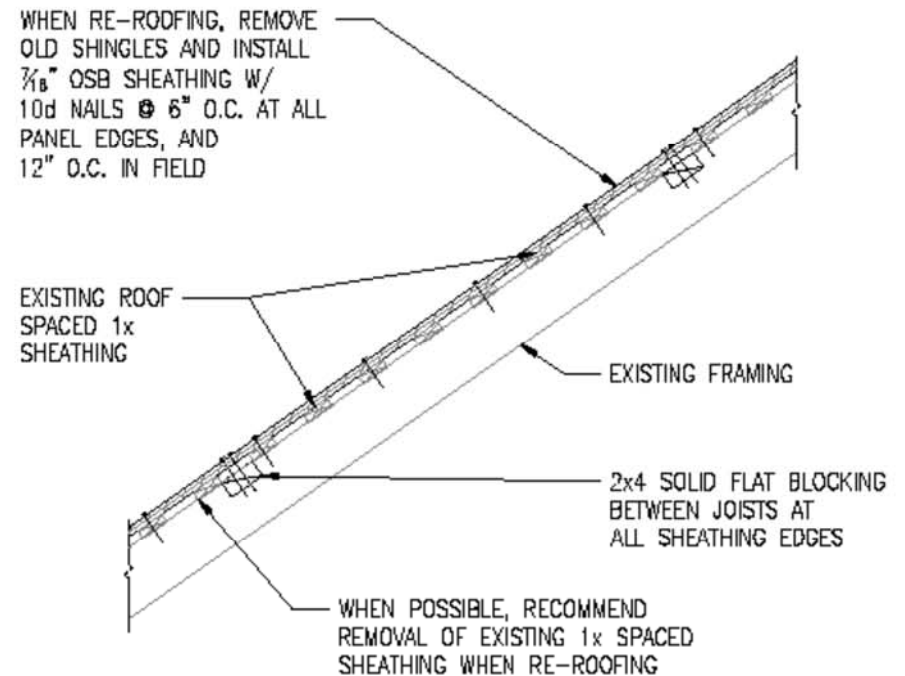
Brace Tall URM Walls & URM Gable End Walls →



21
BRACE URM GABLE BRACING

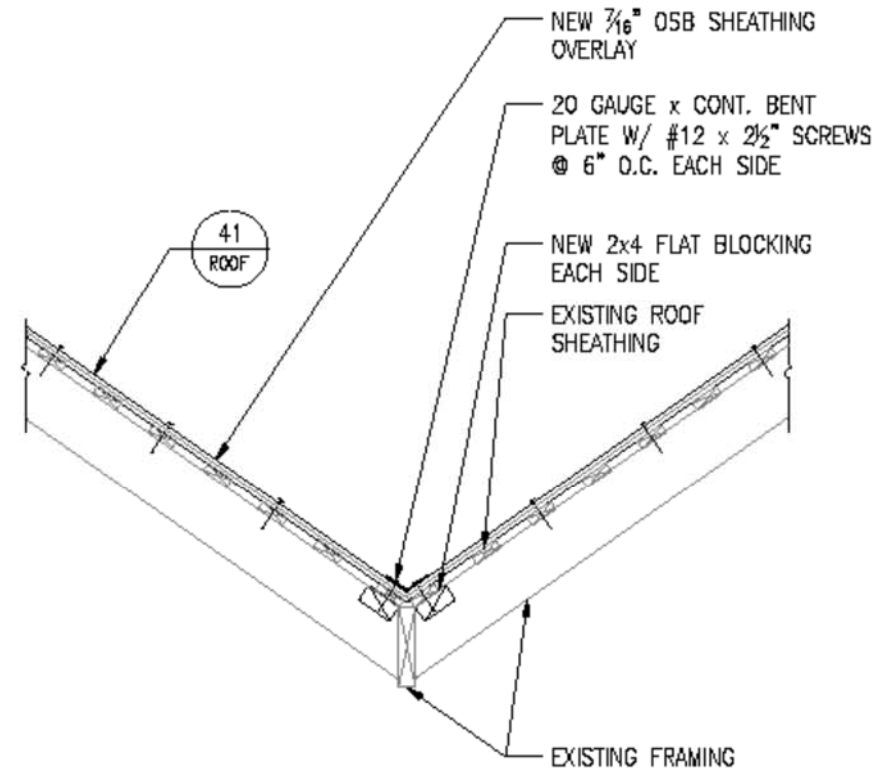
Chapter 6 Details

Tie Roof Sections Together →



Chapter 6 Details

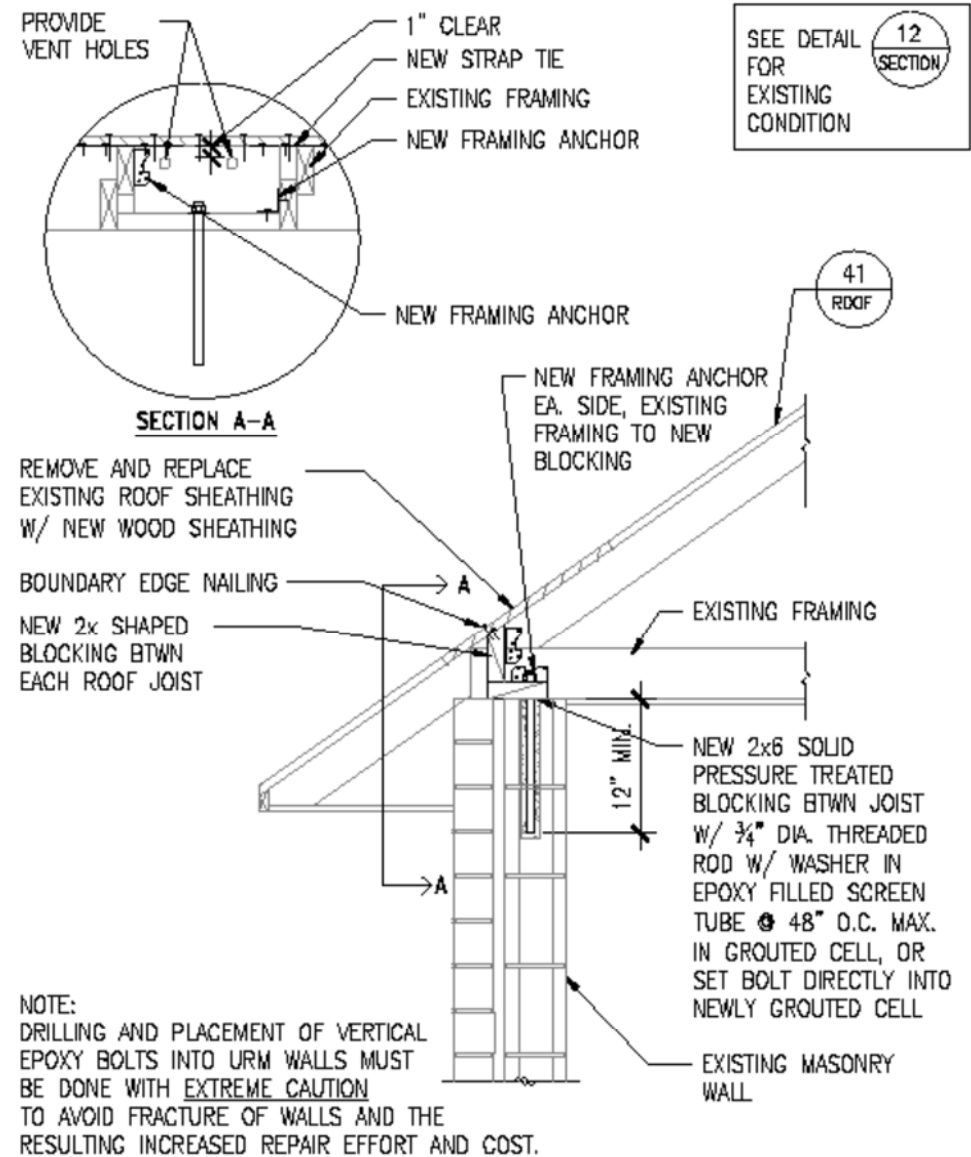
Tie Roof Sections Together →



42
ROOF SHEAR TRANSFER AT VALLEY

Chapter 6 Details

Roof-to-Wall Tie-In →



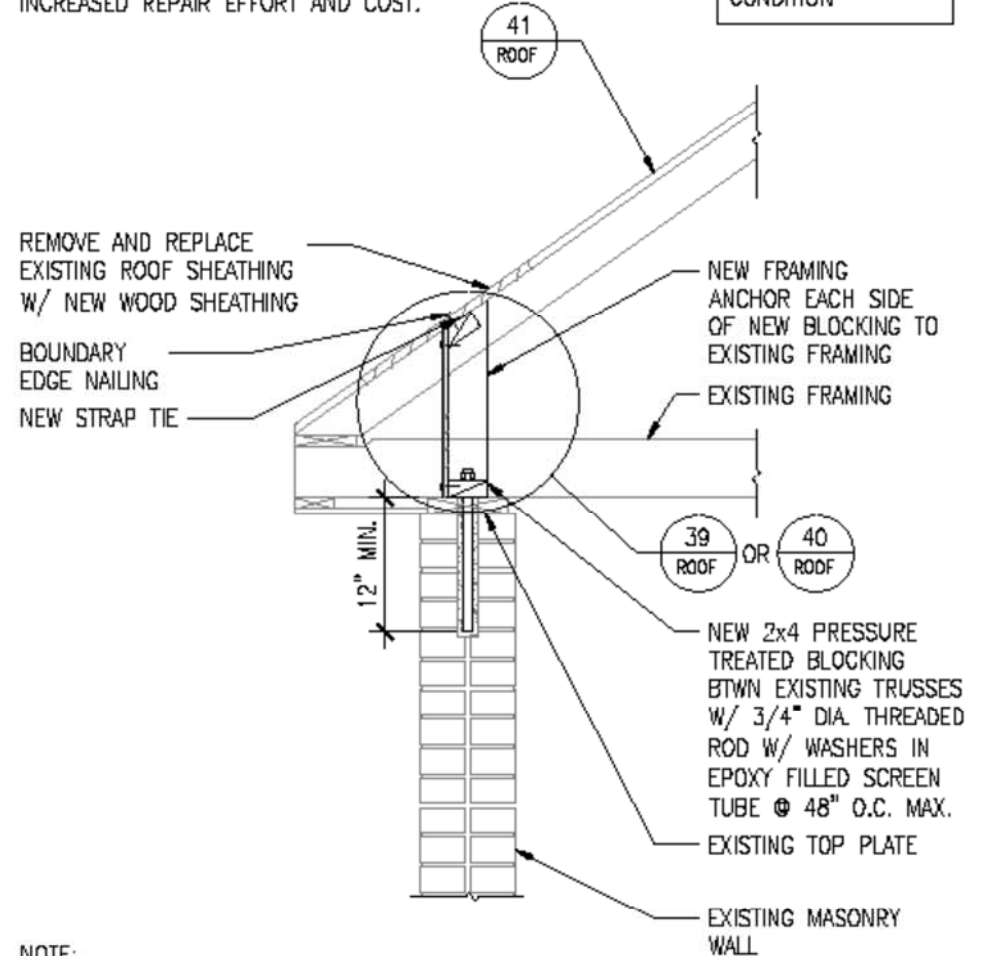
32c ROOF TO URM WALL ANCHORAGE W/ JOISTS PERPENDICULAR TO WALL

Chapter 6 Details

Roof-to-Wall Tie-In →

NOTE:
DRILLING AND PLACEMENT OF VERTICAL EPOXY BOLTS INTO URM WALLS MUST BE DONE WITH EXTREME CAUTION TO AVOID FRACTURE OF WALLS AND THE RESULTING INCREASED REPAIR EFFORT AND COST.

SEE DETAIL FOR EXISTING CONDITION 3 SECTION

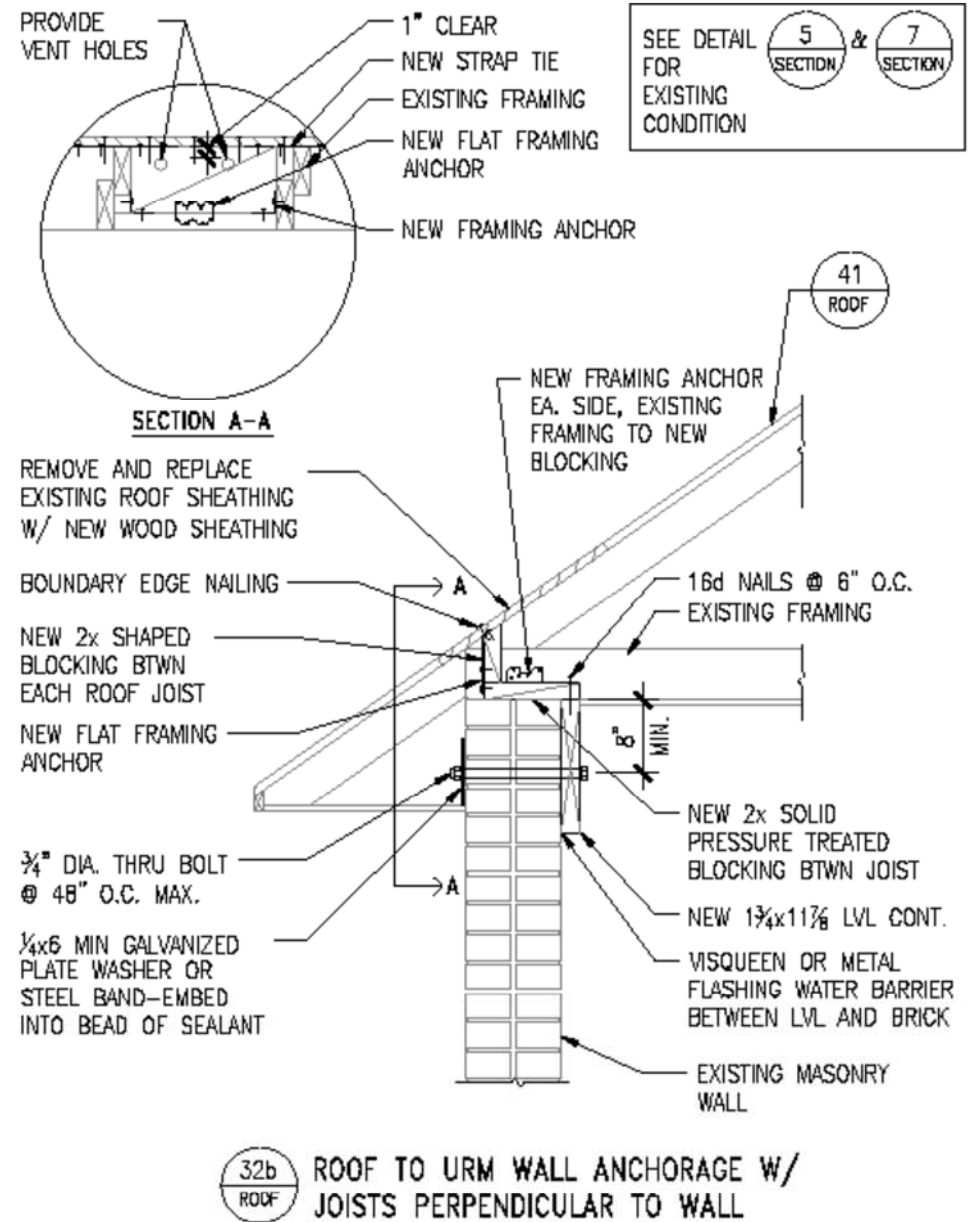


NOTE:
FOR EASE OF INSTALLATION THE NEW WOOD MEMBERS CAN BE ASSEMBLED ON THE GROUND, LIFTED INTO PLACE AND THEN ATTACHED TO THE EXISTING WALL AND FRAMING.

31a ROOF ROOF TO URM WALL ANCHORAGE W/ JOISTS PERPENDICULAR TO WALL

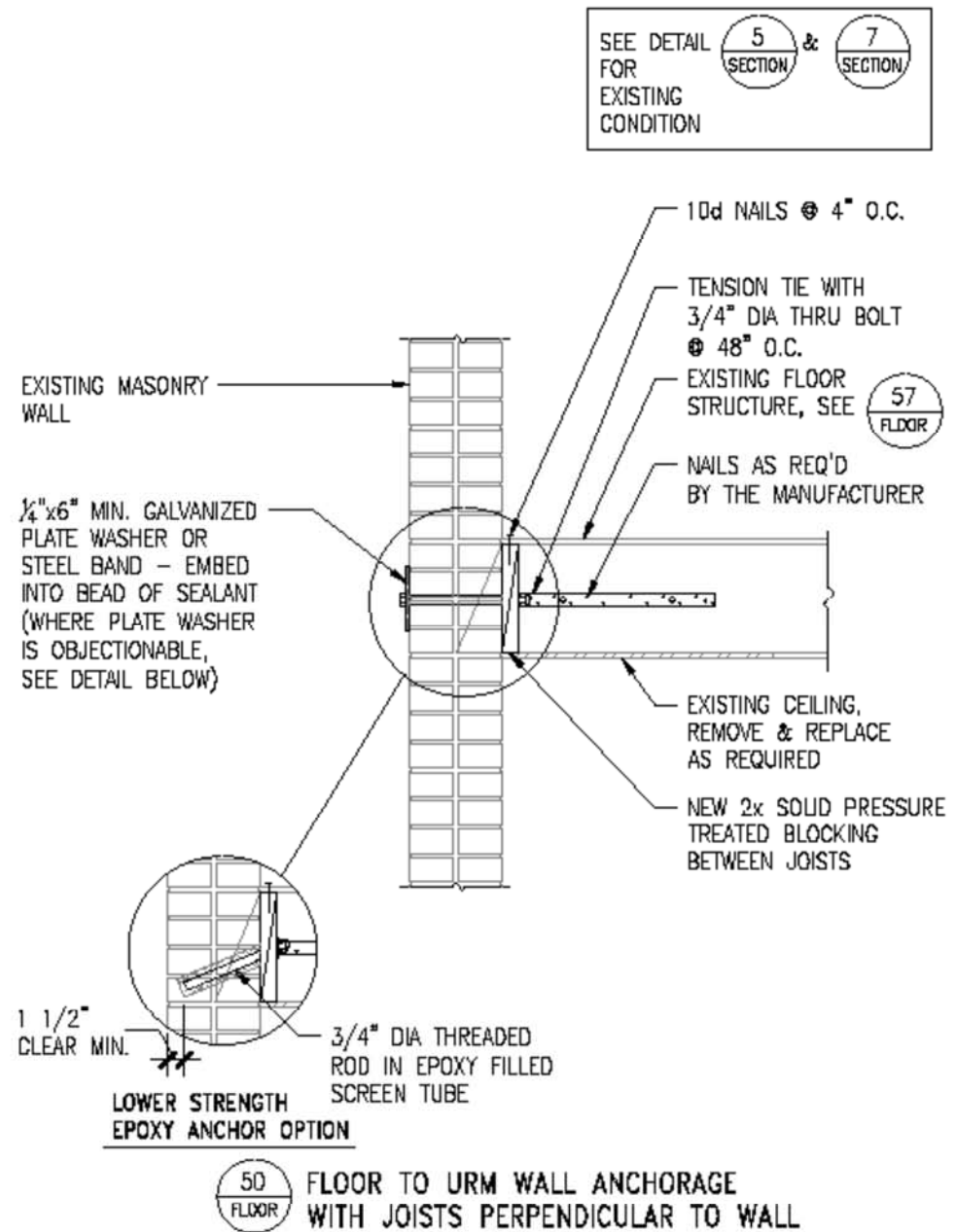
Chapter 6 Details

Roof-to-Wall Tie-In →



Chapter 6 Details

Floor-to-Wall Tie-In →

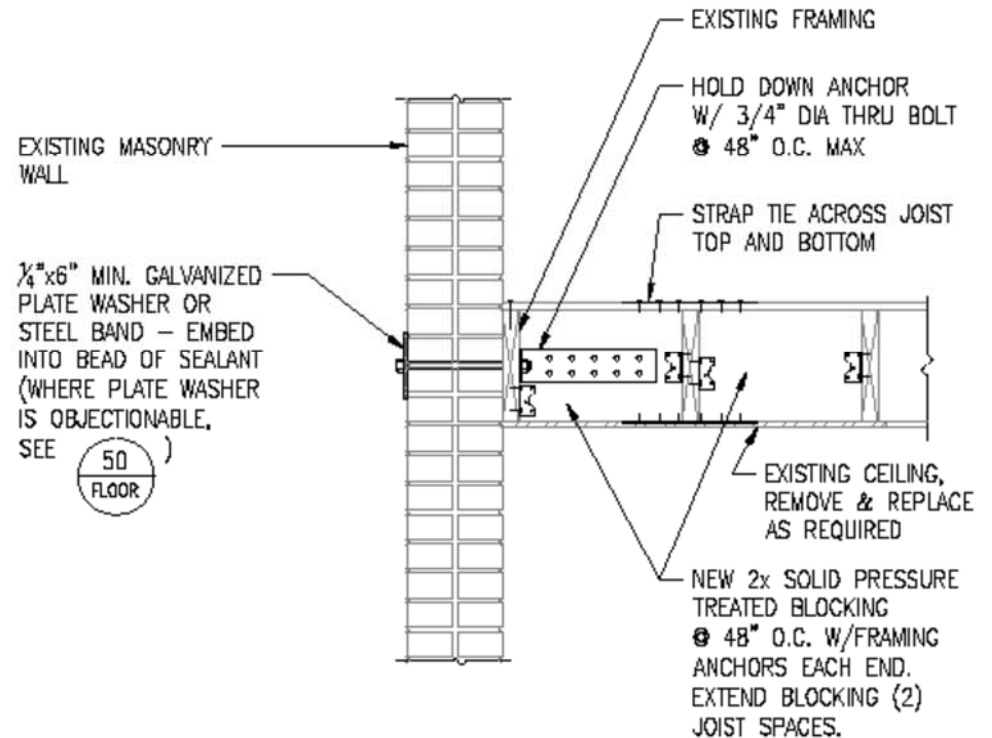


Chapter 6 Details

Floor-to-Wall Tie-In →

SEE DETAIL FOR EXISTING CONDITION

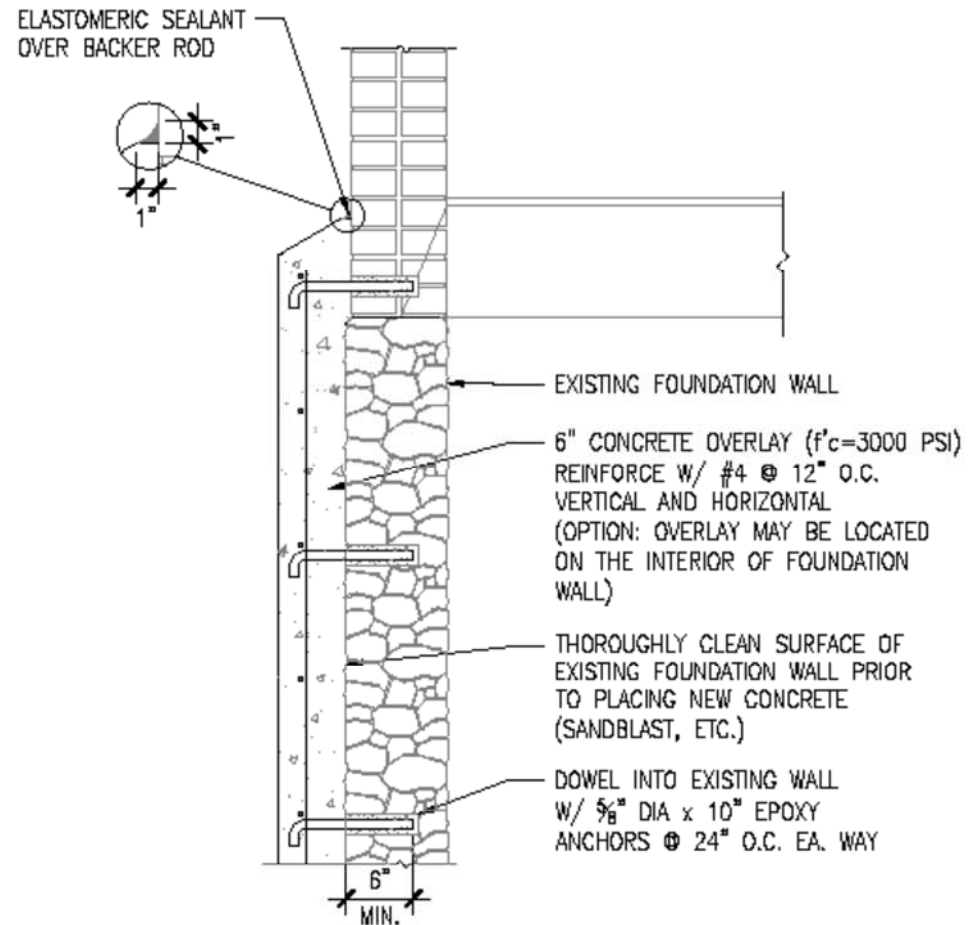
6 SECTION & 8 SECTION



56 FLOOR TO URM WALL ANCHORAGE WITH JOISTS PARALLEL TO WALL

Chapter 6 Details

Foundation Strengthening →



FOUNDATION WALL STRENGTHENING

Chapter 7; Anchorage of Non-Structural Items;

- Discusses the danger of unanchored items on shelves & on entertainment centers.
- Provides a few details for anchorage of bookshelves, tall furniture, water heaters, etc.

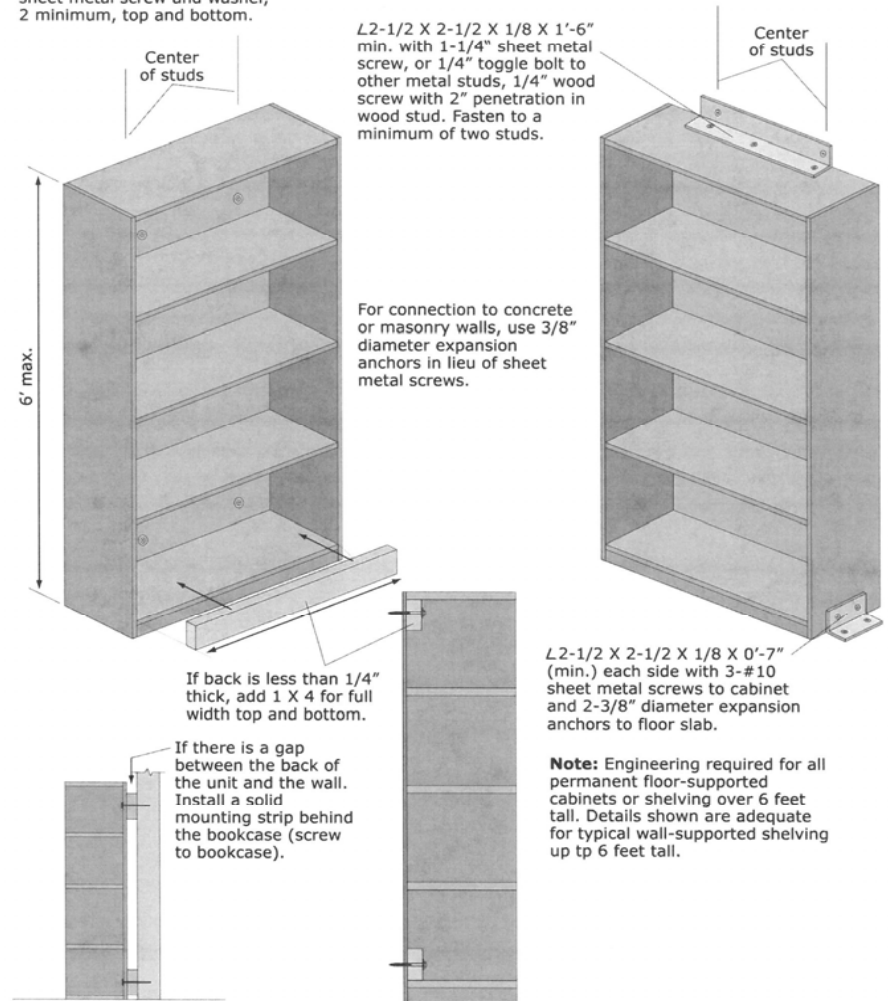


Chapter 7; Anchorage of Non-Structural Items;

- Discusses the danger of unanchored items on shelves & on entertainment centers.
- Provides a few details for anchorage of bookshelves, tall furniture, water heaters, etc.

Where rear wall of bookcase is wood or metal with mechanical connection to bookcase framing, unit may be fastened directly to wall studs with 1/4" sheet metal screw and washer, 2 minimum, top and bottom.

2 X 4 min. wood stud or 20 ga. min. metal stud @ 24" oc max. Verify that studs run full height to floor above or are adequately braced to structural framing



Seismic Improvement Non-Structural Detail	HOME TYPE: VARIES	Bookshelves Against Wall	DETAIL 104
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SUMMARY - The Utah Guide For The Seismic Improvement Of Unreinforced Masonry Dwellings

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