



March 25, 2019

**Submitted to:**

Brian Skinner  
353 N, Claremont St.  
San Mateo, CA  
94401

Dear Mr. Skinner,

It was good to meet you the other day and we are honored you have considered us to protect your family and your greatest investment. We take this very seriously and will do the best job we possibly can. You might want to know who we are. You are in good hands.

Your house has a lot going for it. The entire cripple wall is covered with plywood, the foundation was replaced after July 1 of 1999, and the bolting exceeds modern code requirements.

On the other hand, the back cripple wall has no bracing whatsoever, the addition has no plywood, and the floor joists can roll over as I explained to you while there.

This proposal has three formats. The most instructive one is this video, the other way to read it is to print it and follow the relevant links to our website, and the final way is just to read it. It just depends on how much detail you want.

When there is a webpage associated with your proposal, you will see a thread to the relevant page. Here is an example: [www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → Proposals → CRIPPLE WALL RETROFITS

This means go to our homepage at

1. Bayarearetrofit.com
2. Go to the "Proposals" tab,
3. Drop down and open CRIPPLE WALL RETROFITS

This video contains information on every aspect of your retrofit.

Sincerely,

*Howard Cook*

Howard Cook M.A.  
Founder/Owner Bay Area Retrofit  
Office-510-548-1111  
Mobile-408-664-6355  
Retrofitting Homes for 25 years and still counting



## BACKGROUND INFORMATION FOR YOUR EARTHQUAKE (SEISMIC) RETROFIT

The type of hardware and retrofit methods required differ from house to house. What you see here may not be exactly what we do for your home. I personally train our technicians in seismic engineering principles so they know what to do no matter what they find.

### Engineering a Cripple Wall Retrofit

[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → [Proposals](#) → [Cripple Wall Procedures](#) → [Engineering a Cripple Wall Retrofit](#)

### General principles

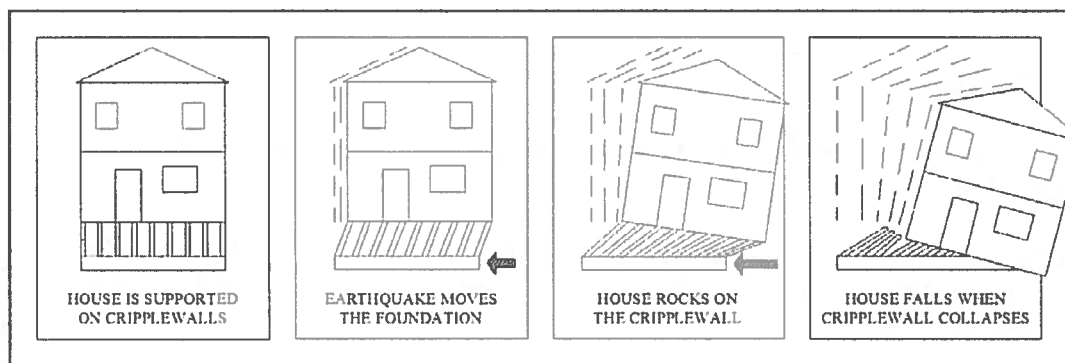
[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → [Proposals](#) → [CRIPPLE WALL RETROFITS](#)

This webpage describes almost everything you need to know about a cripple wall retrofit.

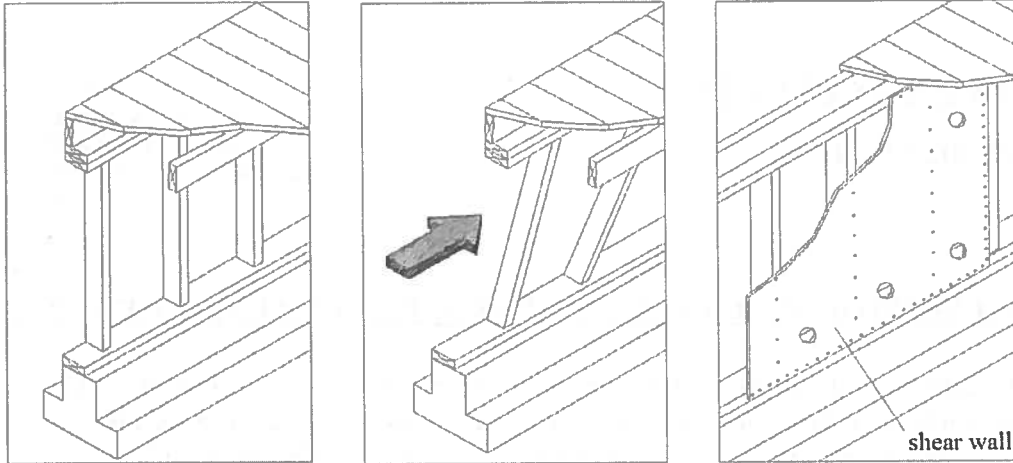
The type of hardware and retrofit techniques we use vary considerably from house to house and what you see here may not be exactly what we do. We train our technician's carefully in seismic engineering and they know what to do no matter what they find.

### Add Plywood to Cripple Walls to Prevent Cripple Wall Collapse

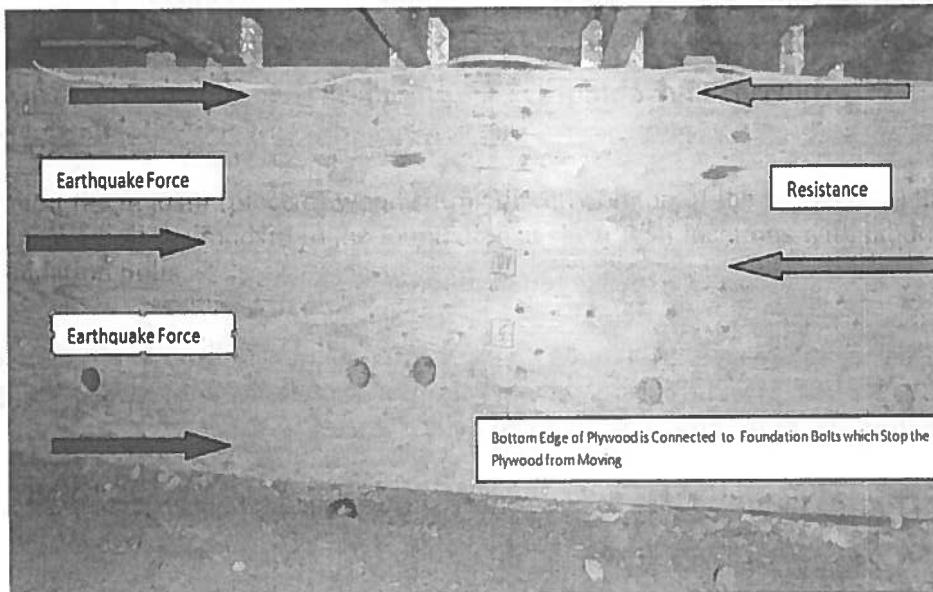
As part of a retrofit, we must address the potential of cripple wall collapse when an earthquake strikes. The diagrams below show what happens when a cripple wall collapses:



*Diagram: Cripple wall collapse.*



Movement prevented by plywood shear panels.

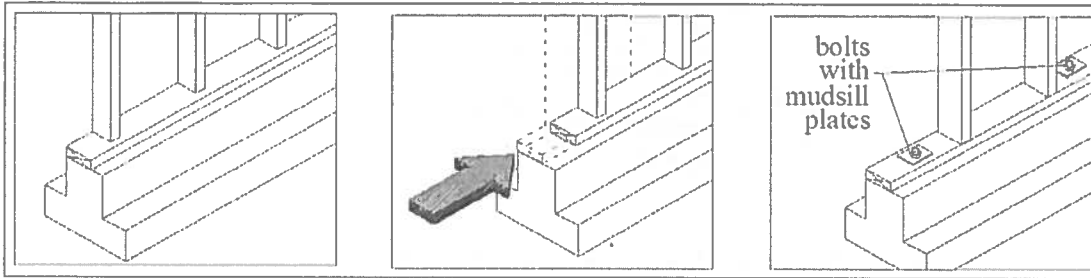


*Photo: Bolts at base of plywood resist earthquake force.*

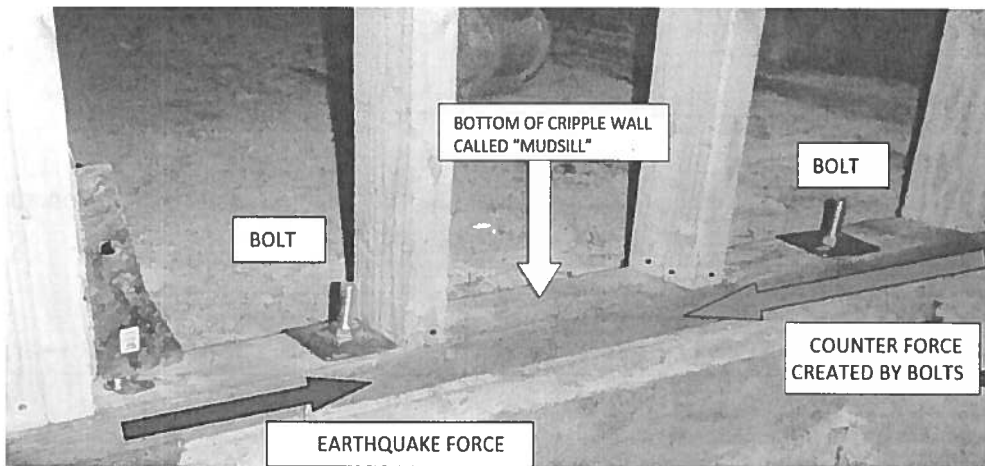
## Foundation Bolts

[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → Proposals → Cripple Wall Procedures → Foundation Bolts

We must bolt the mudsill (piece of wood sitting directly on top of the foundation) to the foundation. We bolt the mudsill to the foundation at shear wall locations with laboratory tested foundation bolts.



*Diagram: Bolts prevent the bottom of the cripple wall from sliding off the mudsill.*

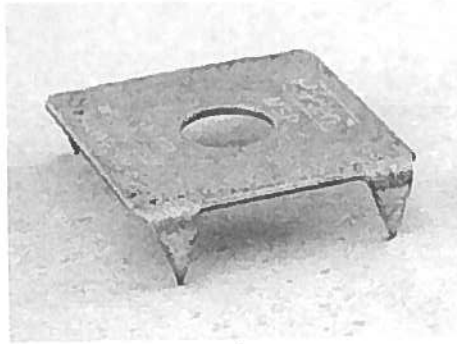


*Photo: Cripple wall resists movement because of bolt counterforce.*

## Mudsill Plates

[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → [Proposals](#) → [Cripple Wall Procedures](#) → [Mudsill Plates](#)

To my knowledge, you are the only company in the San Francisco Bay area who uses this highly specialized type of hardware. Tests have shown Mudsill Plates can increase the strength of a bolt by 59%. Your retrofit includes installation of mudsill plates on all new bolts.

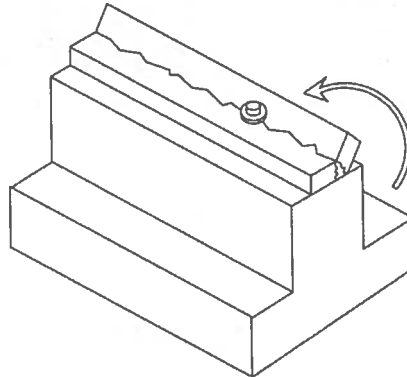


*Photo: Teeth on mudsill plate prevent mudsill from splitting.*

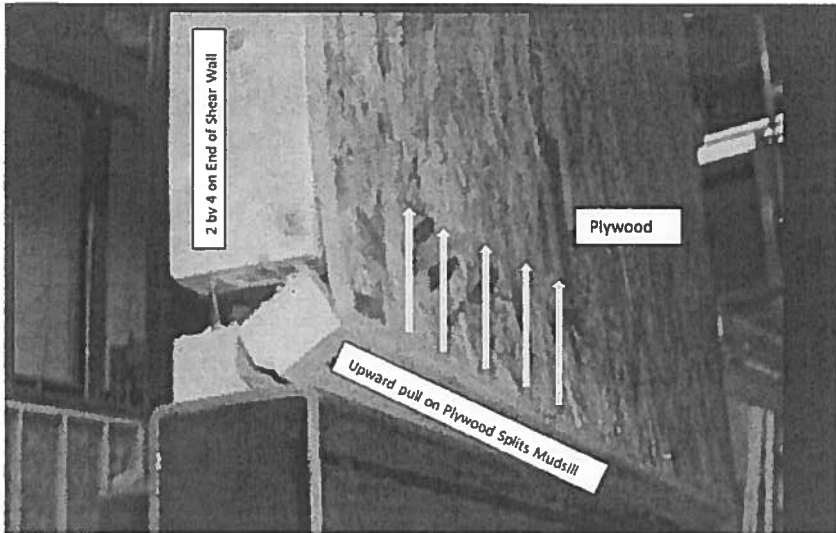
## **Plate Washers**

**[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → Proposals → Cripple Wall Procedures → Plate Washers**

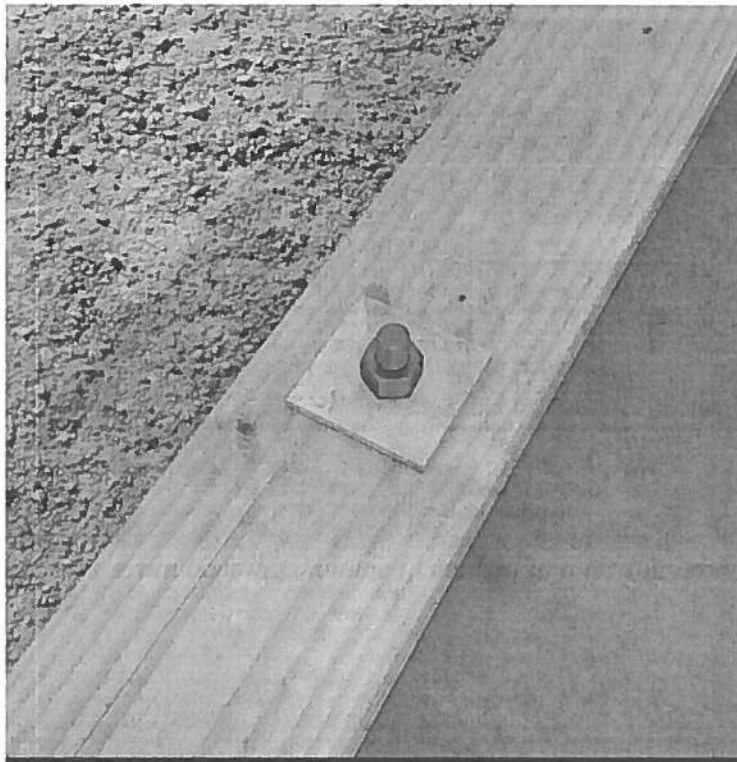
Plate washers prevent damage called “cross-grain bending.” We install plate washers on all new bolts.



*Figure: Cross-grain bending (splitting). Wood has practically no ability to resist cross grain bending.*



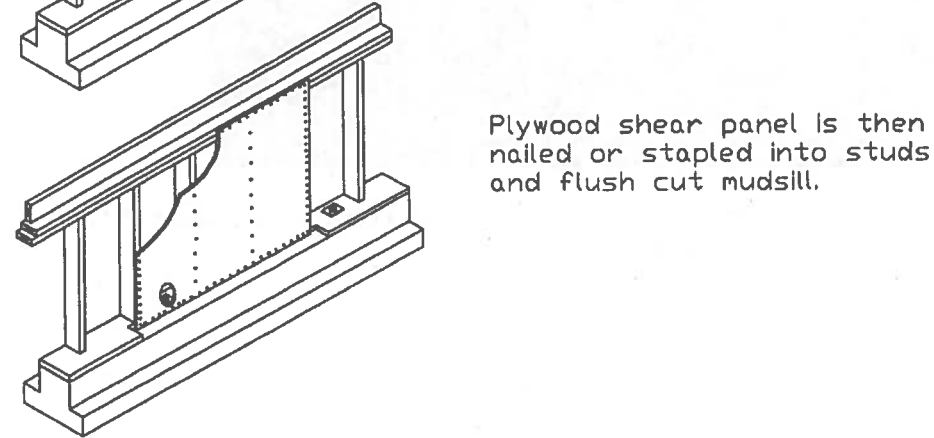
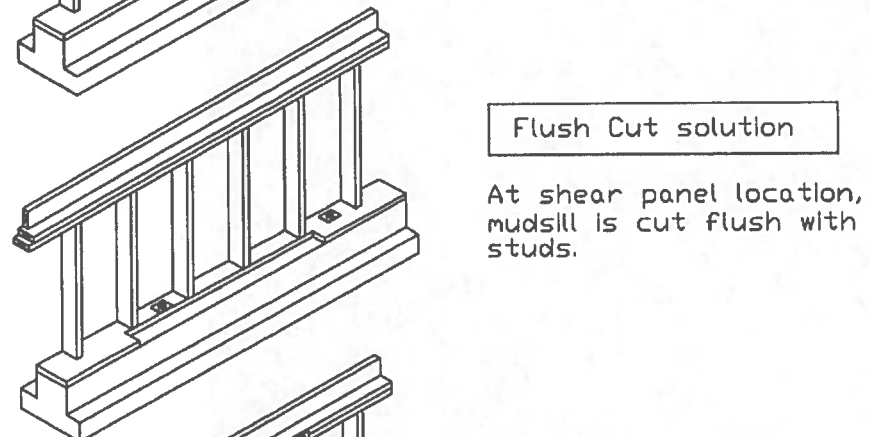
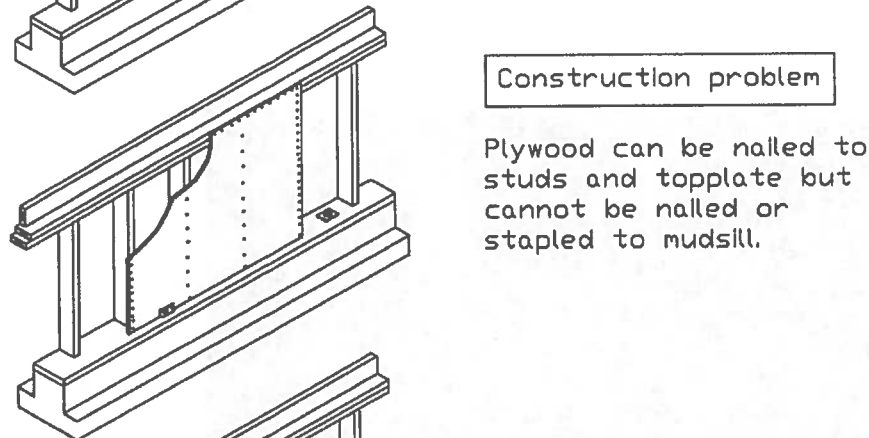
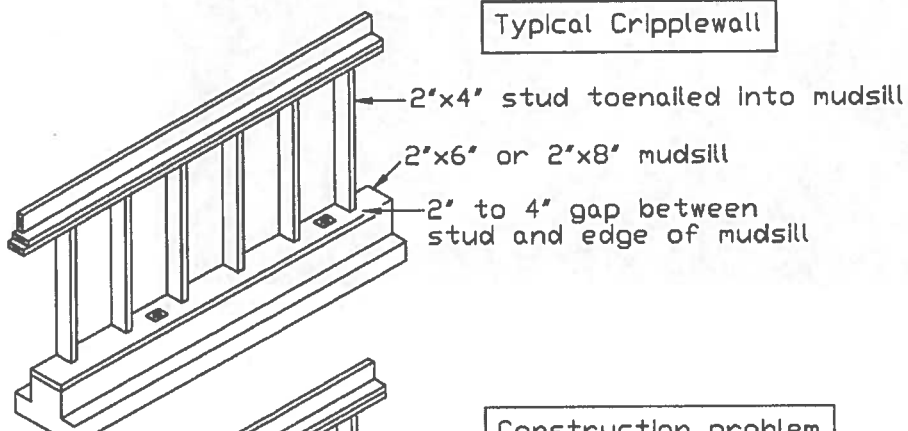
*Photo: Cross-grain bending damage to mudsill in a testing laboratory.*



*Photo: A square washer absorbs movement (converting it into an upward pull on the plate) and acts to prevent splitting of the mudsill.*

# The Most Vital Cripple Wall Connection

[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → Proposals → Cripple Wall Procedures → Plywood Connection



PH: Copyright - Fair use - flush cut



The “Flush Cut Solution” allows us to nail the plywood into very strong old growth redwood with closely spaced growth rings. Closely spaced growth rings firmly hold the nails in place, which improves plywood performance. The nail-blocking method, which we avoid whenever possible, uses low quality tree-farm wood with widely spaced growth rings.



*Photo: Comparison between old-growth redwood and modern tree farm*

## Making the Strongest Plywood Connection Possible

[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → Proposals → Cripple Wall Procedures → Plywood

The combination of plywood grade, thickness, nail size and nail spacing determine how strong the plywood shear wall will be. We make sure the plywood on your house uses the optimal combination of these factors.

TABLE 1.

### RECOMMENDED SHEAR (POUNDS PER FOOT) FOR APA PANEL SHEAR WALLS WITH FRAMING SOUTHERN PINE<sup>(a)</sup> FOR WIND OR SEISMIC LOADING<sup>(b)</sup>

Panel Grade	Minimum Nominal Panel Thickness (in.)	Minimum Nail Penetration in Framing (in.)	Nail Size (common or galvanized box)	Panels Applied Direct to Framing			
				Nail Spacing at Panel Edges (in.)			
				6	4	3	2 <sup>(a)</sup>
APA STRUCTURAL I grades	5/16	1-1/4	6d	200	300	390	510
	3/8			230 <sup>(d)</sup>	360 <sup>(d)</sup>	460 <sup>(d)</sup>	610 <sup>(d)</sup>
	7/16	1-1/2	8d	255 <sup>(d)</sup>	395 <sup>(d)</sup>	505 <sup>(d)</sup>	670 <sup>(d)</sup>
	15/32			280	430	550	730
	15/32	1-5/8	10d	<del>340</del>	<del>510</del>	<del>665<sup>(d)</sup></del>	870

**Table 1:** Earthquake resistance of plywood varies according nailing and type of plywood.

The purple boxes call attention to differing strengths in plywood based on plywood nailing and the type of plywood used. In one case, the plywood can resist 200 pounds of earthquake force per linear foot, and in the other 870 pounds per linear foot. The magenta boxes show differences in the nailing. To the far left is the difference in panel (plywood) grade.

We will use the variables that create the strongest plywood connection possible for your house.

## No Blocking Between Floor Joists

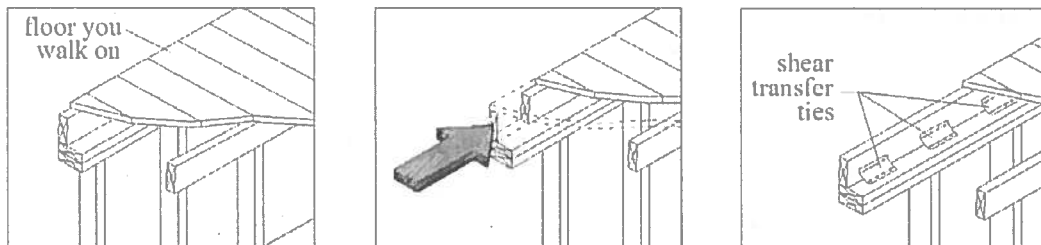
Install Lock Blocks between every other joist per California Existing Building Code which states:

A304.1.3 Floor joists not parallel to foundations. Floor joists framed perpendicular to perimeter foundations shall be restrained by solid or plywood blocking between alternate joists in one and two story buildings

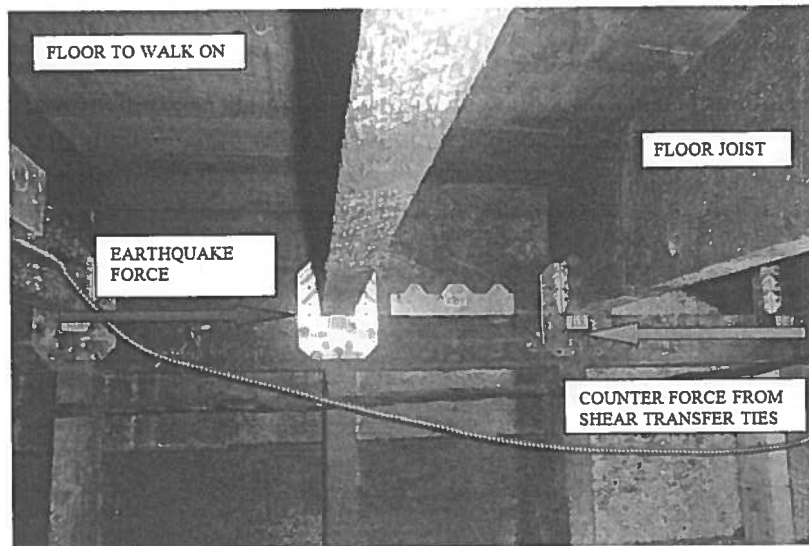
## Shear Transfer Ties

[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → Proposals → Cripple Wall Procedures → Shear Transfer Ties

In order to complete the cripple-wall-to-shear-wall conversion process, we will connect the bolted and plywooded cripple walls to the floor with steel known as shear transfer ties. We install laboratory tested shear transfer ties.



Movement prevented by shear transfer ties.

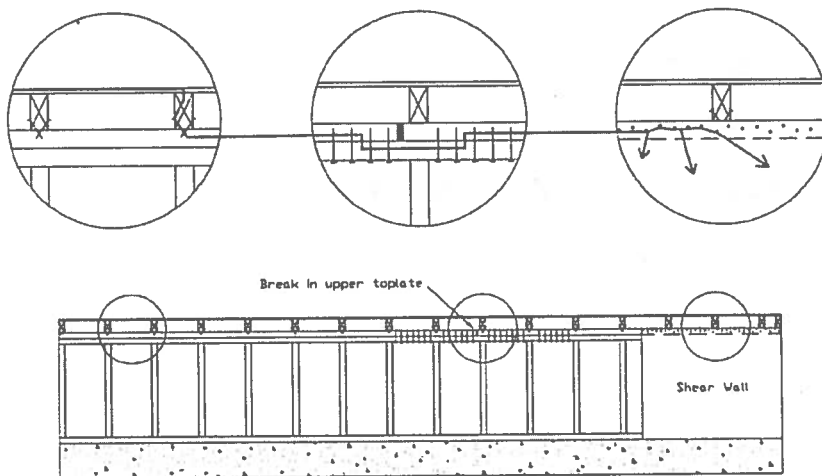


*Photo: Two of the many shear transfer ties we use.*

### Top Plates and Cripple Wall Retrofits

[www.Bayarearetrofit.com](http://www.Bayarearetrofit.com) → Proposals → Cripple Wall Procedures → Top Plates

The horizontal two by fours at the top of the cripple walls (known as top plates) are not connected. They tend to separate where not connected together. We will connect the top plates with either nails or steel.

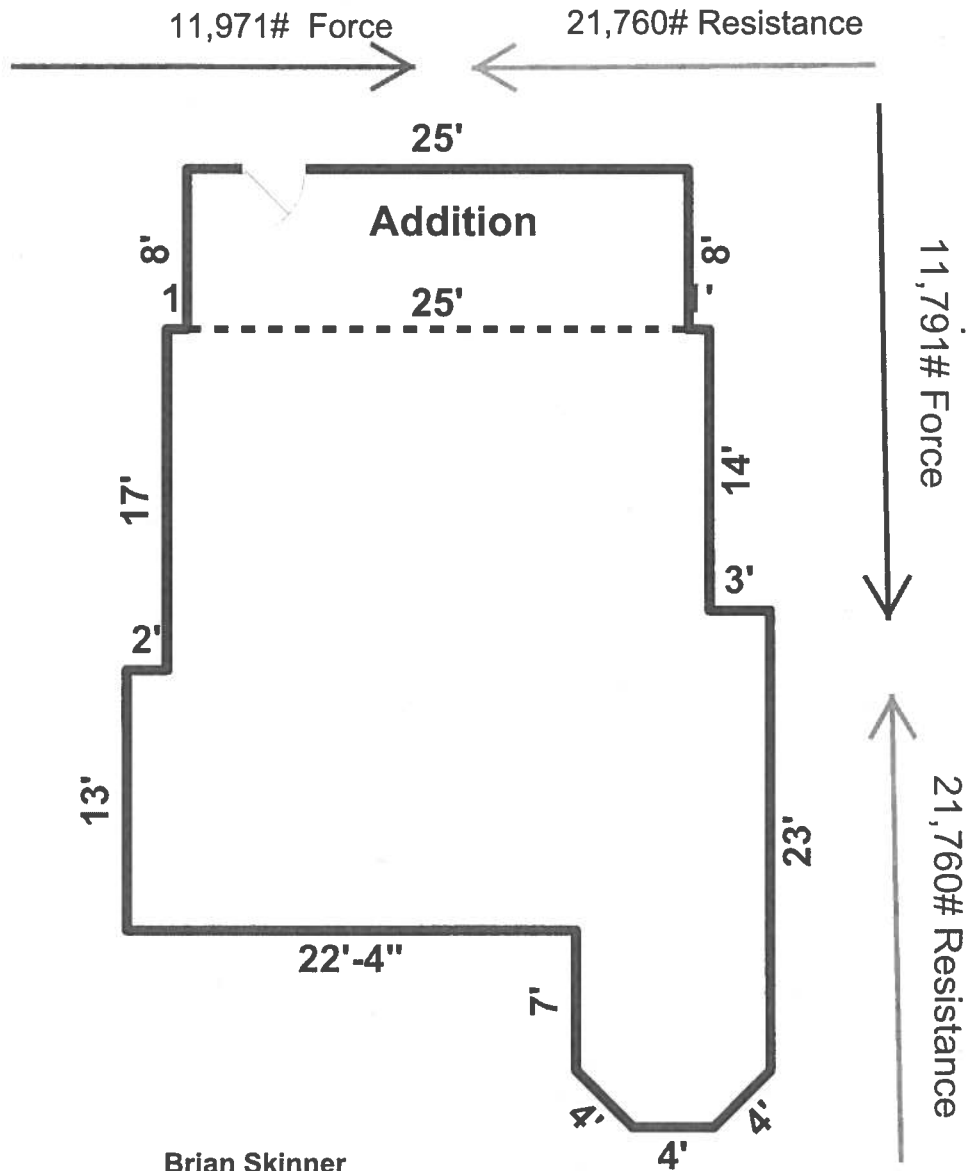


# BUILDING SKETCH

## Looking at foundation from above

According to engineering calculations your 1 1/2 story house needs to resist 11,971# of earthquake force in each direction

This retrofit provides 21,760# of resistance in each direction



Brian Skinner  
Email

Phone

Property Address  
353 N Claremont St  
San Mateo, CA 94401

# BUILDING SKETCH

## Looking at foundation from above

Engineering based on Calculations used in Standard Plan A

Anticipated Ground Acceleration = 0.186 Gs

The Standard Plan A calculations tell us this 1 1/2 story house weighs 55# per square foot

55# X 1171sf = 64,405# of House Weight

64,405# x 0.186 Gs = 11,971# Anticipated Pounds of Earthquake Force Striking From each Direction

11,971# divided by 2 = 5,985 # resistance needed each side

### **Bolts**

#### **Earthquake Resistance in lbs.**

1/2 Bolt 1340#

### **Plywood**

#### **Earthquake resistance in lbs.**

1 linear foot - 670 lbs.

### **Shear Transfer Ties**

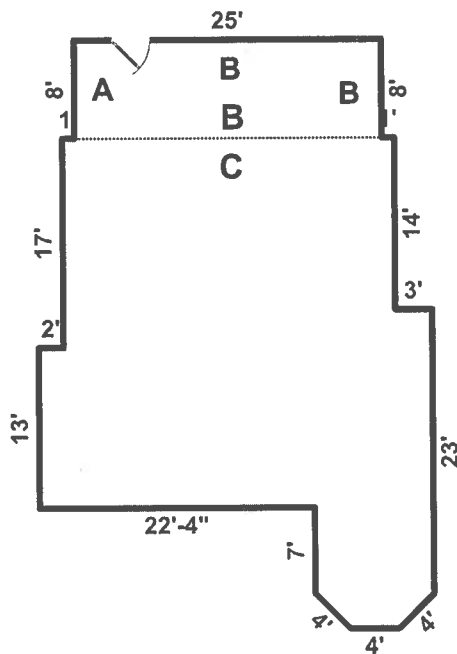
#### **Earthquake Resistance in lbs.**

L90 = 925#,

4LTP = 670#

23A = 565#

H10AR = 590#



Along Foundation A: 6' Plywood + Four Bolts (total) + Six L90 or Nine HT10AR or Eight LTP4 or Seven 23A

Along Foundation B: 6' Plywood + Four Bolts (total) + Six L90 or Nine HT10AR or Eight LTP4 or Seven 23A

Along Foundation C: 8' Plywood + Six Bolts (total) + Seven L90 or Twelve HT10AR or Eleven LTP4 or Thirteen 23A

**Foundation was replaced and house bolt after 7-1-1999**

**No additional bolting required**

**Assume plywood was nailed with 8d nails 6" apart**

**Rear addition does not have any plywood or shear transfer ties**

**Add as required**

**Right and left sides of the house do not have joist blocking**

**Add lock blocks every other joist bay**

**NOTE OR FOUNDATION A - use existing plywood stitch nail 2 top plates with 16d nails 2" o.c staggered**