A Cost Comparison Between Standard Plan A and P-1100 Retrofits.

This study is a cost comparison between the Standard Plan A design system and the FEMA P-1100 design system. See Appendix A for Standard Plan A calculations.

The following pages contain tabulated price and design comparisons between the two design systems when applied to the exact same house i.e. the weight classification, square footage, seismic design category and the number of stories are exactly the same.

The pricing per piece of hardware and per linear foot of plywood shown below is based on Bay Area Retrofit's current price schedule.

Pricing

5/8" Bolts	$77 each
Type A Connector URFP	$135 each
Type B Connector FRFP	$135 each
12" Rip Cut Shim	$50 each
24" Cross Cut Shim	$90 each
48" Rip Cut Runner	$175 each
Type E Connector (L90)	$39 each
Plywood < 4 feet	$90 plf
Plywood > 4 feet	$165 plf
Tie Downs	$215 each

Rip cut shims are shims that cut parallel to the grain. Cross cut shims are cut perpendicular to the grain. Rip cut shims are much more labor intensive which is why they cost more. A 48" rip cut runner is a 48" shim that is part of Detail 3, Sheet D2.

Hardware and plywood capacities are rated according to the SDPWS, NDS, and the Simpson StrongTie catalog.

Capacities

5/8" Bolts in 2" Close Grain Redwood	1400#
Type A Connector (URFP)	1530#
Type B Connector (FRFP)	960#
Type E Connector (L90)	925#
Light Construction Rated Plywood	380plf
Medium Construction Rated Plywood	490plf
Standard Plan A 3" o.c. Structural 1 Plywood	550plf
Heavy Construction Rated Plywood	640plf

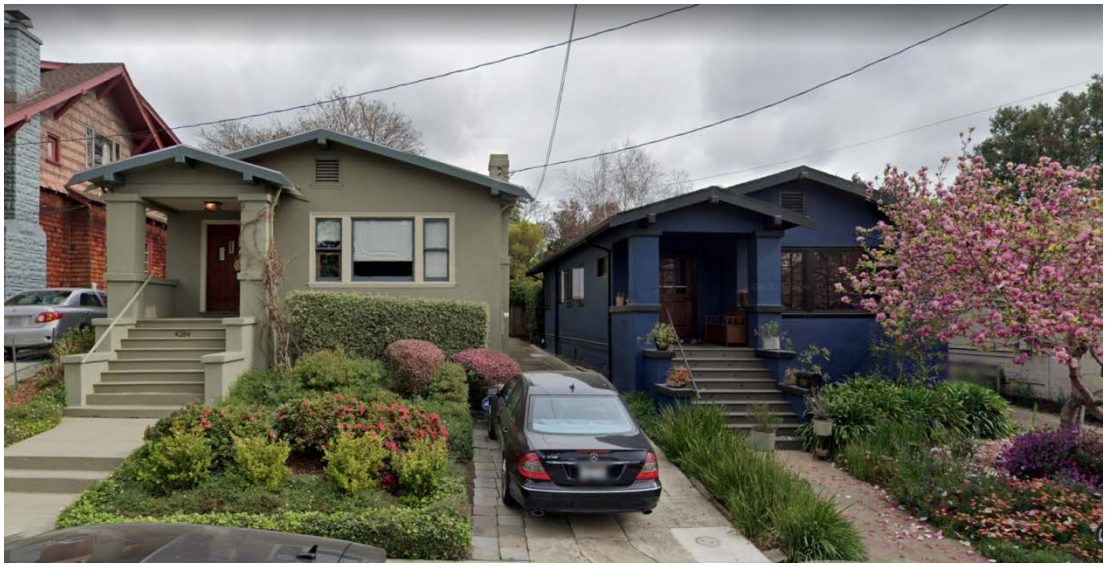
Seismic Design Coefficient in Standard Plan A is 0.186.

All house weights derived from Standard Plan A Calculations. See Appendix B

P-1100 Seismic Design Coefficient for mudsill connectors and framing anchors = 0.393 ((0.562 x .7)

Seismic Design Coefficient in P-1100 for plywood = 0.262 (0.375 x 0.7)

The Bay Area's Housing Stock.



EARTHQUAKE RETROFIT SCHEDULE

Weight Category	Total Area in Square Feet	☒ Mark row that applies	Length Each of Two Braced Wall Segments Along Each Perimeter Wall — Wood Structural Panel — Cripple Wall Height					
			up to 1'	1'-1" to 2'	2'-1" to 4'-0"		4'-1" to 6'-0"	
			Without Tie-downs	Without Tie-downs	Without Tie-downs	With Tie-downs	Without Tie-downs	With Tie-downs
1-Story Light Construction	up to 800		8.0'	8.0'	10.7'	8.0'	12.0'	8.0'
	801 to 1000		9.3'	9.3'	12.0'	9.3'	13.3'	9.3'
	1001 to 1200		10.7'	10.7'	13.3'	10.7'	16.0'	10.7'
	1201 to 1500		12.0'	12.0'	14.7'	12.0'	17.3'	12.0'
	1501 to 2000		14.7'	14.7'	17.3'	14.7'	21.3'	16.0'
	2001 to 2500		18.7'	18.7'	20.0'	18.7'	24.0'	18.7'
	2501 to 3000		21.3'	21.3'	22.7'	21.3'	26.7'	21.3'

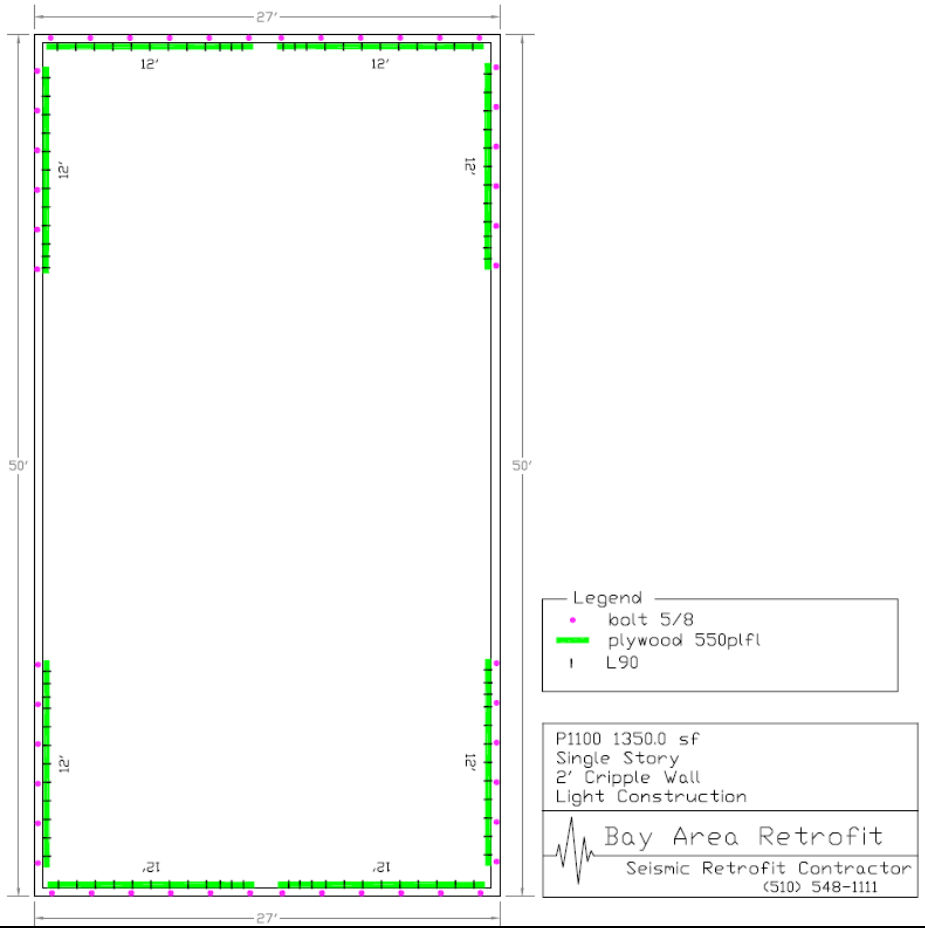
The cripple wall of this home appears to be slightly less than 4 feet tall. Applying P-1100's earthquake retrofit schedule, 29' 3" (without tie downs) or 24'(with tie downs) of shear walling is required. There is not enough available foundation to do this. This is one of the problems with FEMA P-1100. (Remember TWO lengths of structural panel are required on each will line)

The Comparison Process

In the following pages the FEMA P-1100 applications are identified by “P-1100” at the beginning of the house description.

Standard Plan A retrofits are identified by “Standard Plan A” at the beginning of the house description.

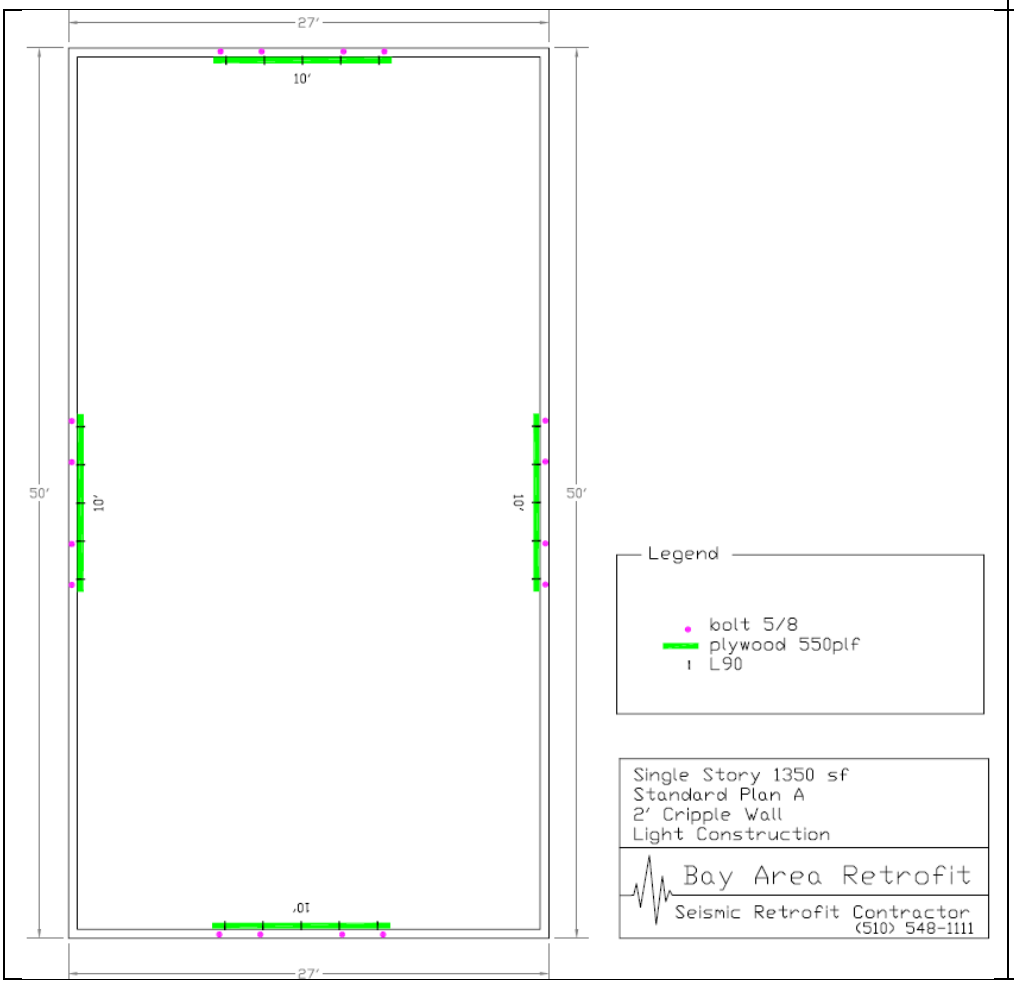
P-1100 - 1,350sf - One Story - 2’ Cripple Wall - Light Construction

	Total number of components and price.
	48 Bolts=$3,696 96 Linear feet plywood = $8,640 100 Type E Connectors=$3,900 Total $16,080.00

Shear resistance on each wall line.

5/8 Bolts- 1500#	18,000# each wall line
Plywood-380plf	9,120# each wall
L90s - 925#	23,125# each line

Standard Plan A - 1,350sf - One Story - 2’ Cripple Wall - Light Construction

	Total number of components and price
	16 Bolts = $1232 40 lf ply = $3,600 20 L90 $780 Total $5,622.00

.

Base shear = 4260#on each wall line. .

Component Capacities	Shear resistance on each wall line
5/8 Bolts- 1500#	6,000# each wall line
Plywood-550plf	5500# each wall line
L90s - 925#	4,625# each wall line

Design Comparison

P-1100 - 1,350sf - One Story - 2’ Cripple Wall - Light Construction - $16,080.00

Component Capacities	Shear resistance on each wall line
5/8 Bolts- 1500#	18,000# each wall line
Plywood-380plf	9,120# each wall
L90s - 925#	23,125# each line

Standard Plan A - 1,350sf - One Story - 2’ Cripple Wall - Light Construction- $5,622.00

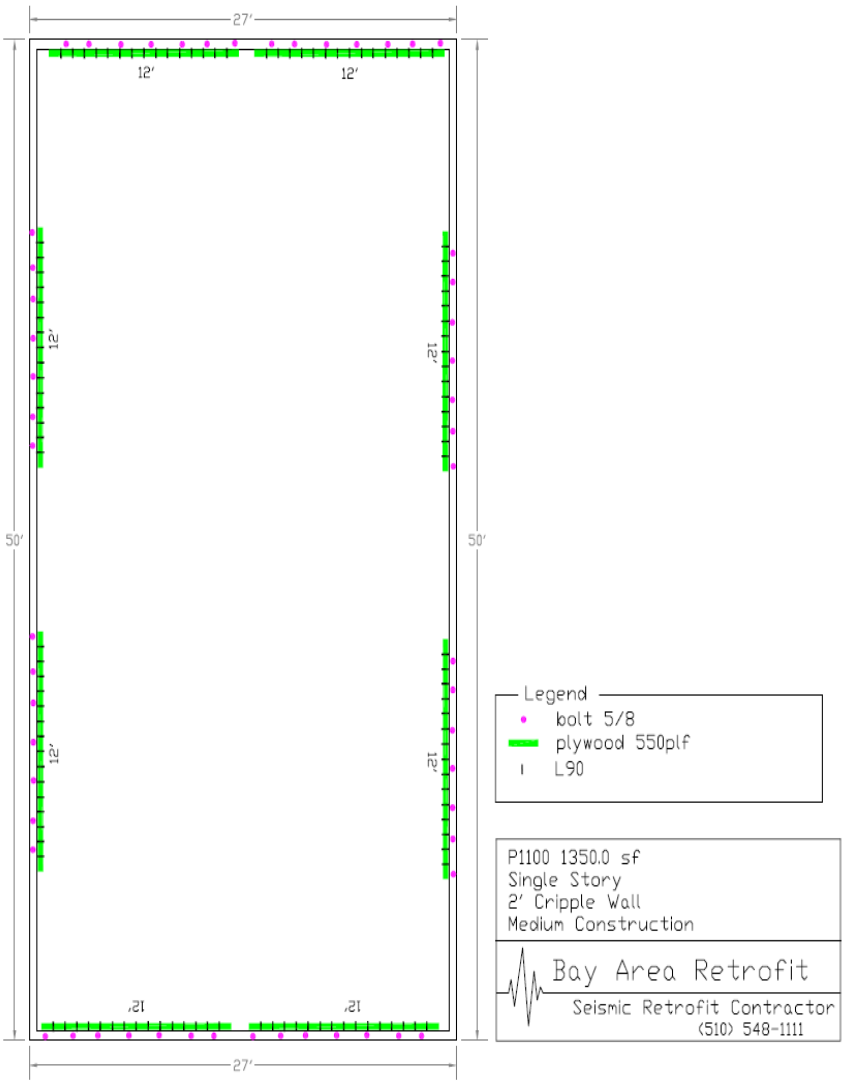
Base shear = 4260#on each wall line

Component Capacities	Shear resistance on each wall line
5/8 Bolts- 1500#	6,000# each wall line
Plywood-550plf	5500# each wall line
L90s - 925#	4,625# each wall line

Cost Comparison

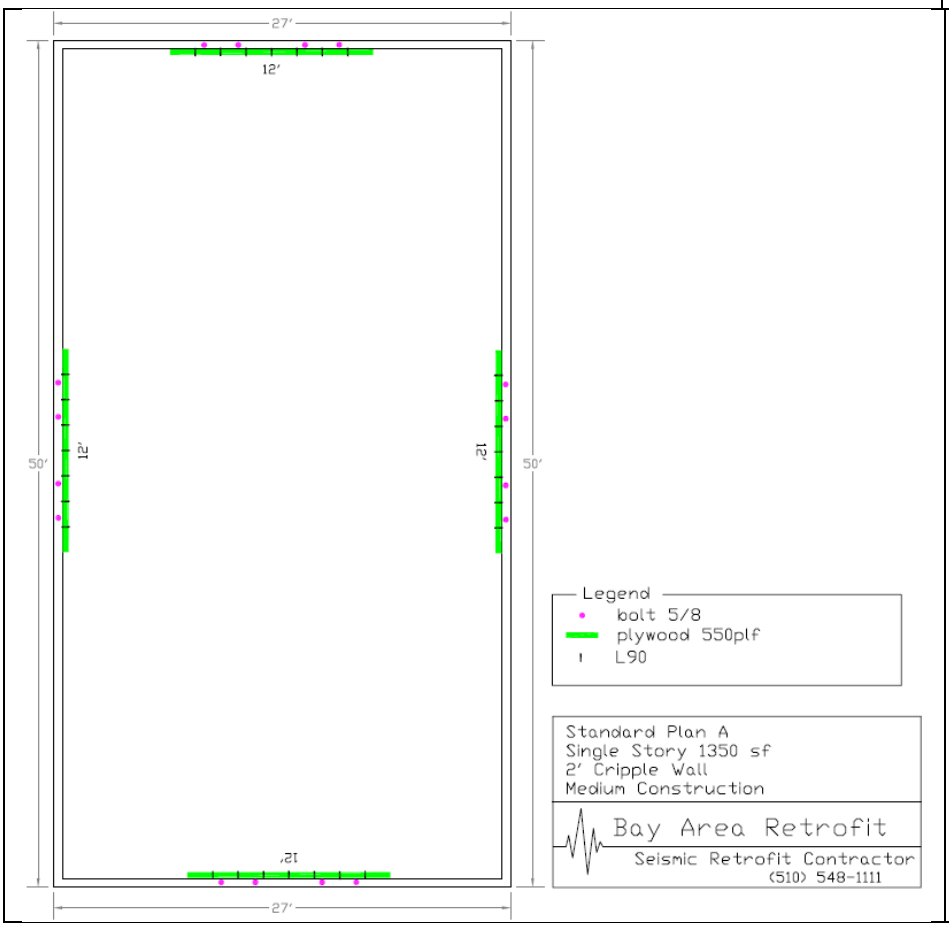
Item	P-1100	SPA	P-1100	SPA	P-1100	SPA	P-1100	SPA
Bolts	48	16					$3696	$1232
Plywood			96 lf	48lf			$8640	$4320
L90s					100	20	$3900	$780
Total Cost							$16,080	$5,622
V=								0.186 W

P-1100 - 1,350 One Story - 2’ Cripple Wall - Medium Construction

	Total number of components and price
	60 Bolts= $4620 96 lf ply = $8,640 116 L90s =$4,524 Total $17,784.00

5/8 Bolts – 1500#	22,500# each wall line
Plywood - 490plf	11,760# each wall line
L90 – 925#	26,825# each wall line

Standard Plan A – 1350sf - One Story - 2’ Cripple Wall - Medium Construction

	Total Number of Components and Price
	16 Bolts = $1232 48 lf ply = $4,320 28 L90s = $1092 Total $6,644.00

Base shear = 5649#on each wall line. .

Component Capacities	Shear resistance on each wall line
Bolts- 1500#	6,000# each wall line
Plywood-550plf	6600# each wall line
L90s - 925#	6475# each wall line

Design Comparison

P-1100 - 1,350 One Story - 2' Cripple Wall - Medium Constructions - $17,784.00

Component Capacities	Shear resistance on each wall line
5/8 Bolts – 1500#	22,500# each wall line
Plywood - 490plf	11,760# each wall line
L90 – 925#	26,825# each wall line

Standard Plan A – 1350sf - One Story - 2' Cripple Wall - Medium Construction $7,124.00___

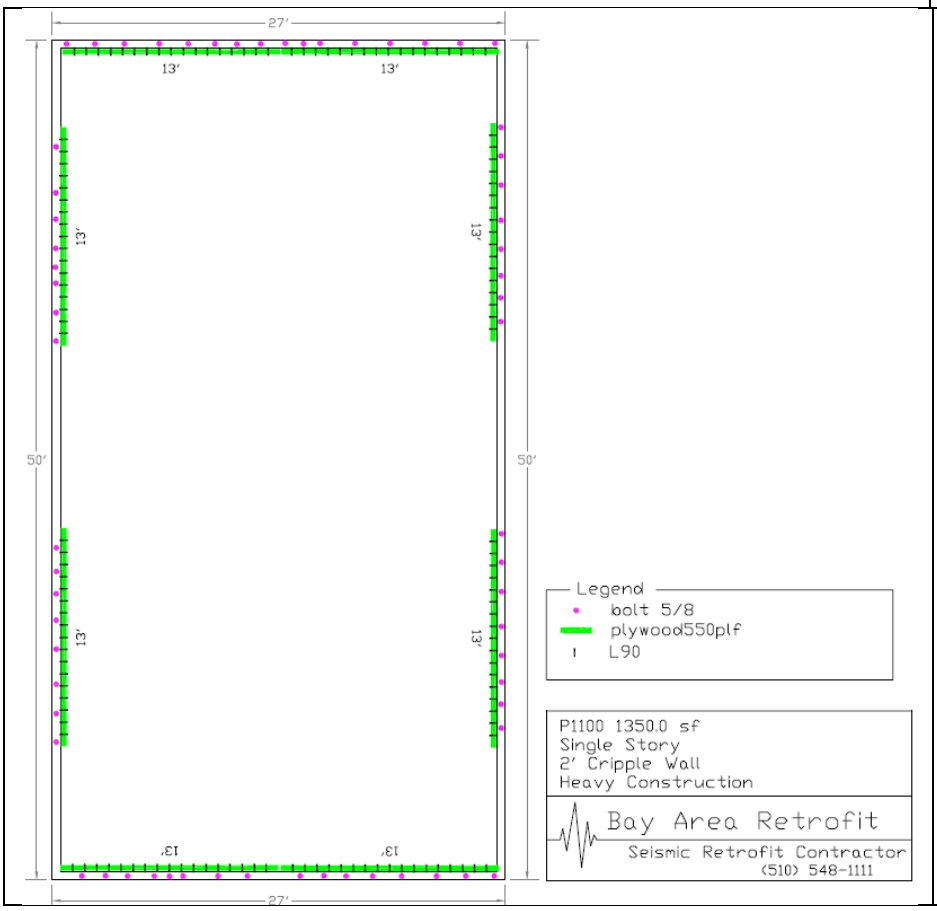
Base shear = 5649#on each wall line. .

Component Capacities	Shear resistance on each wall line
Bolts- 1500#	6,000# each wall line
Plywood-550plf	6600# each wall line
L90s - 925#	6475# each wall line

Cost Comparison

Item	P-1100	SPA	P-1100	SPA	P-1100	SPA	P-1100	SPA
Bolts	60	16					$4620	$1540
Plywood			96 lf	48lf			$8640	$4800
L90s					116	28	$4524	$1092
Total Cost							$17,784	$7,124
V=								0.186W

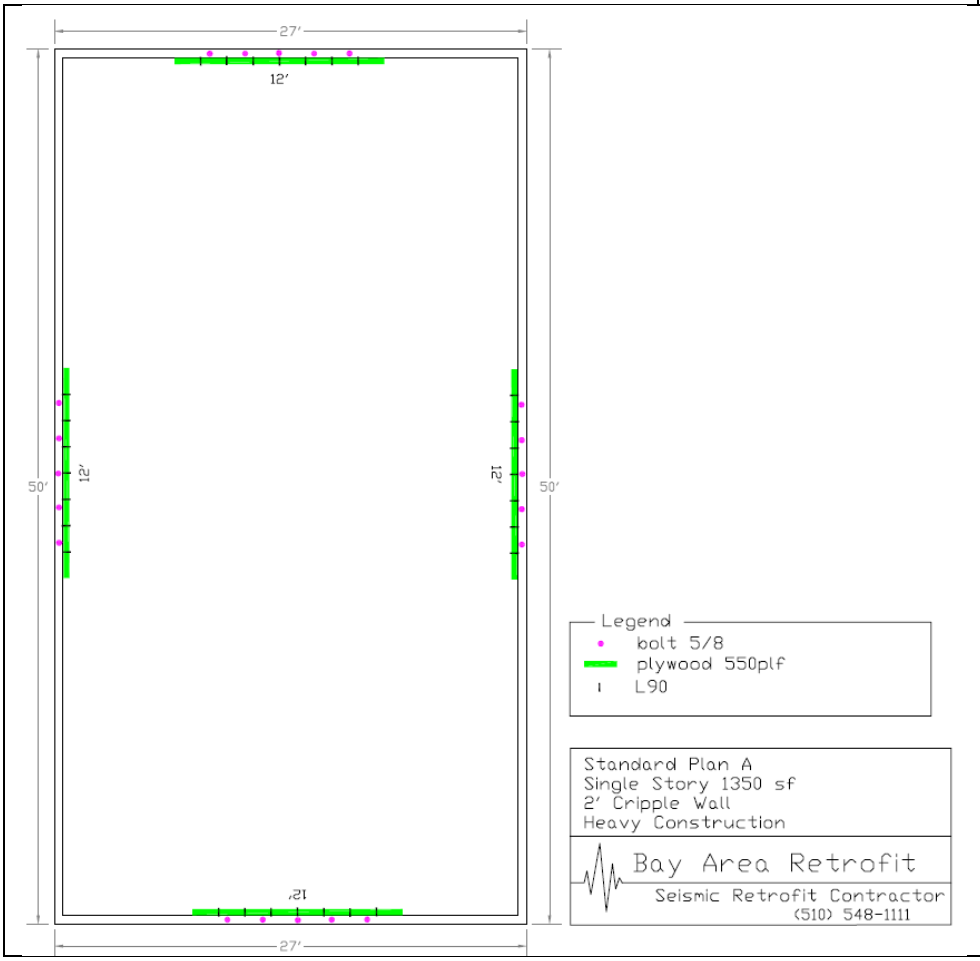
P-1100 - 1,350sf - One Story - 2'Cripple Wall - Heavy Construction

	Total Number of Component and Price
	64 Bolts=$4928 104 lf ply= $9,360 136 L90 = $5,304 Total $19,592.00

.

Component	Shear resistance on each wall line
5/8 Bolts	24,000# each wall line
640 plf Plywood	16,640# each wall line
L90s	31,912# each wall line

Standard Plan A - 1,350sf - One Story - 2’ Cripple Wall - Heavy Construction

	Total Number of Components and Price
	20 Bolts = $1540 48 lf ply = $4,800 28 L90 = $1092 Total $7,432.00

Base shear = 6277#on each wall line. .

Component Capacities	Shear resistance on each wall line
5/8 Bolts- 1500#	7,500# each wall line
Plywood-550plf	6600# each wall line
L90s - 925#	6475# each wall line

Design Comparison

P-1100 - 1,350sf - One Story - 2'Cripple Wall - Heavy Construction $19,592.00

Component	Shear resistance on each wall line
5/8 Bolts	24,000# each wall line
640 plf Plywood	16,640# each wall line
L90s	31,912# each wall line

Standard Plan A - 1,350sf - One Story - 2' Cripple Wall - Heavy Construction $7,432.00

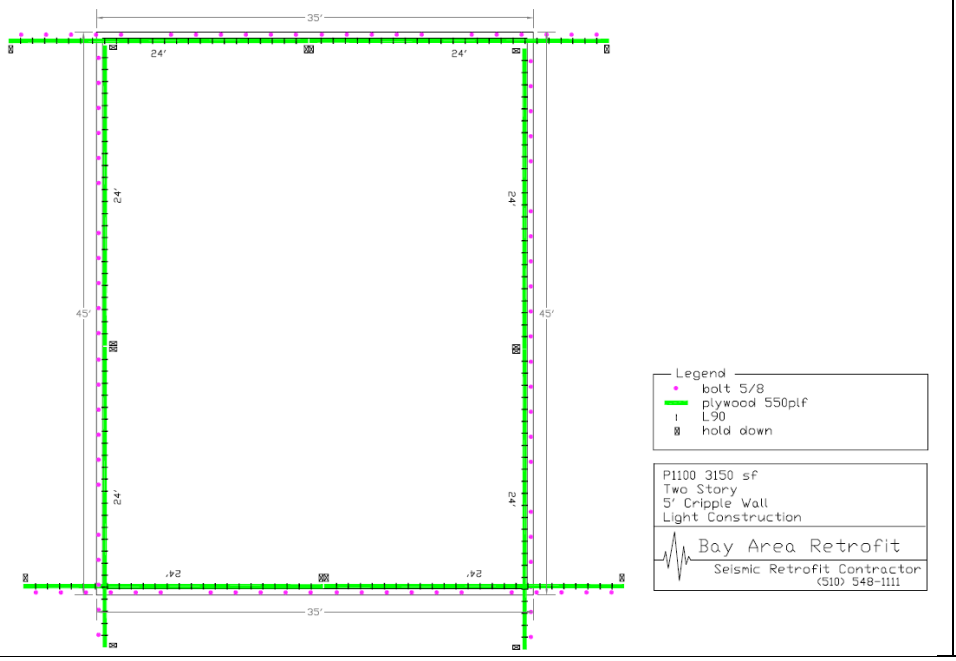
Base shear = 6277#on each wall line. .

Component Capacities	Shear resistance on each wall line
5/8 Bolts- 1500#	7,500# each wall line
Plywood-550plf	6600# each wall line
L90s - 925#	6475# each wall line

Cost Comparison

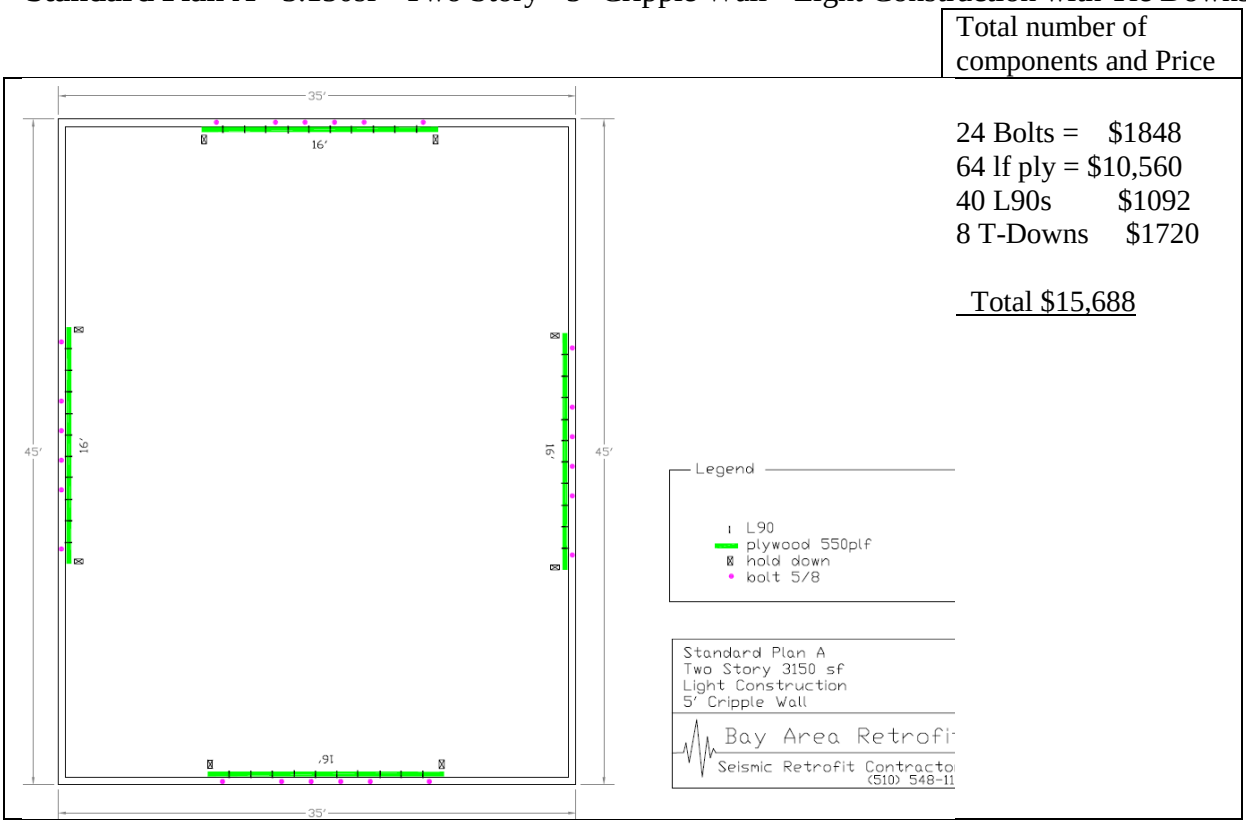
Item	P-1100	SPA	P-1100	SPA	P-1100	SPA	P-1100	SPA
Bolts	64	20					$4620	$1540
Plywood			104lf	48lf			$9360	$4800
L90s					136	28	$4524	$1092
Total Cost							$19,592	$7,432
V=								0.186 W

P-1100 - 3,150sf – Two Story - 5’ Cripple Wall - Light Construction - with Tie Downs

	Total Number of Components and Price
	88 Bolts= $6,776 192 lf ply = $31,680 192 L90s = $7,448 16 T-Downs = $3,440 Total $49,384.00

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	33,000# each side
Plywood-380plf	18,240# each side
L90s - 925#	44,400#each side

Standard Plan A - 3.150sf - Two Story - 5’ Cripple Wall - Light Construction with Tie Downs



Total number of components and Price

24 Bolts = $1848
64 lf ply = $10,560
40 L90s $1092
8 T-Downs $1720

Total $15,688

Base shear = 8642#on each wall line.

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	9,000# each side
Plywood-550plf	8.800# each side
L90s - 925#	9,250# each side

Design Comparison

TWO STORY

P-1100 - 3,150sf – Two Story - 5’ Cripple Wall - Light Construction - Tie Downs $49,384.00

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	33,000# each side
Plywood-380plf	18,240# each side
L90s - 925#	44,400#each side

Standard Plan A - 3.150sf - Two Story - 5’ Cripple Wall - Light Construction with Tie Downs
Total $15,688

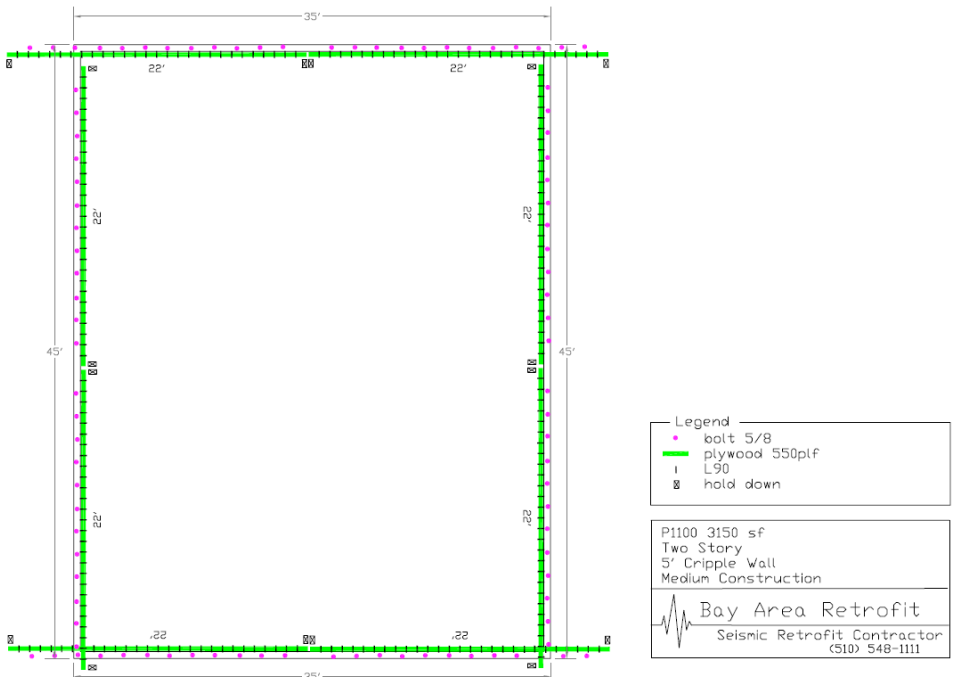
Base shear = 8642#on each wall line.

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	9,000# each side
Plywood-550plf	8.800# each side
L90s - 925#	9,250# each side

Cost Comparison

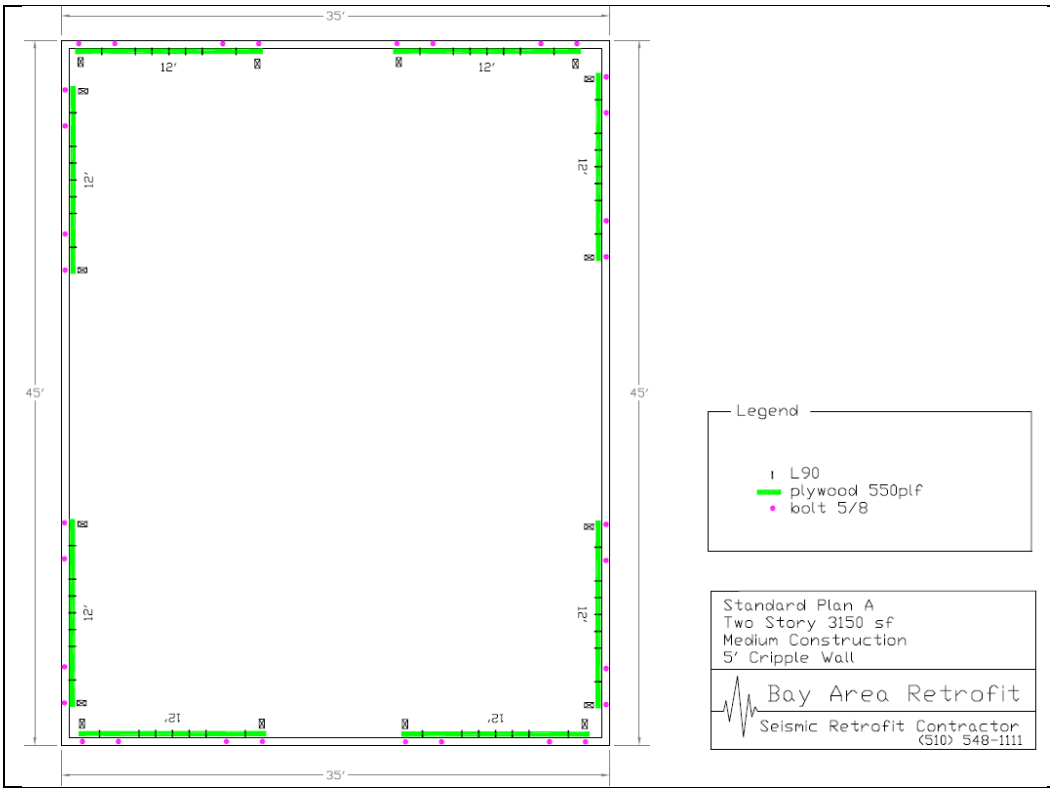
Item	P-1100	SPA	P-1100	SPA	P-1100	SPA	P-1100	SPA
Bolts	88	24					$4620	$1848
Plywood			192lf	64lf			$9360	$10,560
L90s					192	40	$4524	$1092
T-Downs					16	8	$3440	$1720
Total Cost							$49,384	$15,688,
V=								0.186 W

P-1100 3.150sf - Two Story - 5’ Cripple Wall - Medium Construction with Tie Downs

	Total number of components and Price
	100 Bolts = $7700 168 lf ply = $27,720 216 L90s $8424 16 T-Downs $3440 Total $47,284

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	37,500# each side
Plywood-490plf	20,580# each side
L90s -	49,950#each side

Standard Plan A - 3.150sf - Two Story - 5’ Cripple Wall - Medium Construction with Tie Downs

	Total number of components and Price
	32 Bolts = $2,465 96 lf ply = $15,840 56 L90s $2106 16 T-Downs $3440 Total $22,530

Base shear = 12010#on each wall line.

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	12,000# each wall line
Plywood-550plf	13,200# each wall line
L90s -	12,950#each wall line

Design Comparison

P-1100 3.150sf - Two Story - 5' Cripple Wall - Medium Construction with Tie Downs $47,284

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	37,500# each side
Plywood-490plf	20,580# each side
L90s -	49,950#each side

Standard Plan A - 3.150sf - Two Story - 5' Cripple Wall - Medium Construction with Tie Downs
Total $22,530

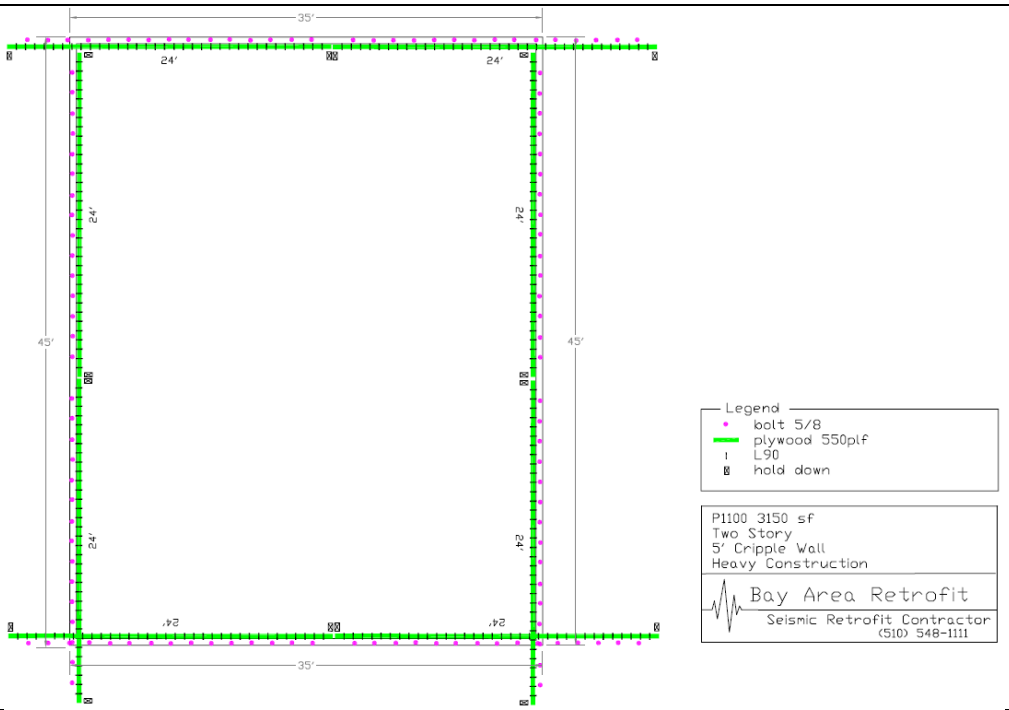
Base shear = 12010#on each wall line.

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	12,000# each wall line
Plywood-550plf	13,200# each wall line
L90s -	12,950#each wall line

Cost Comparison

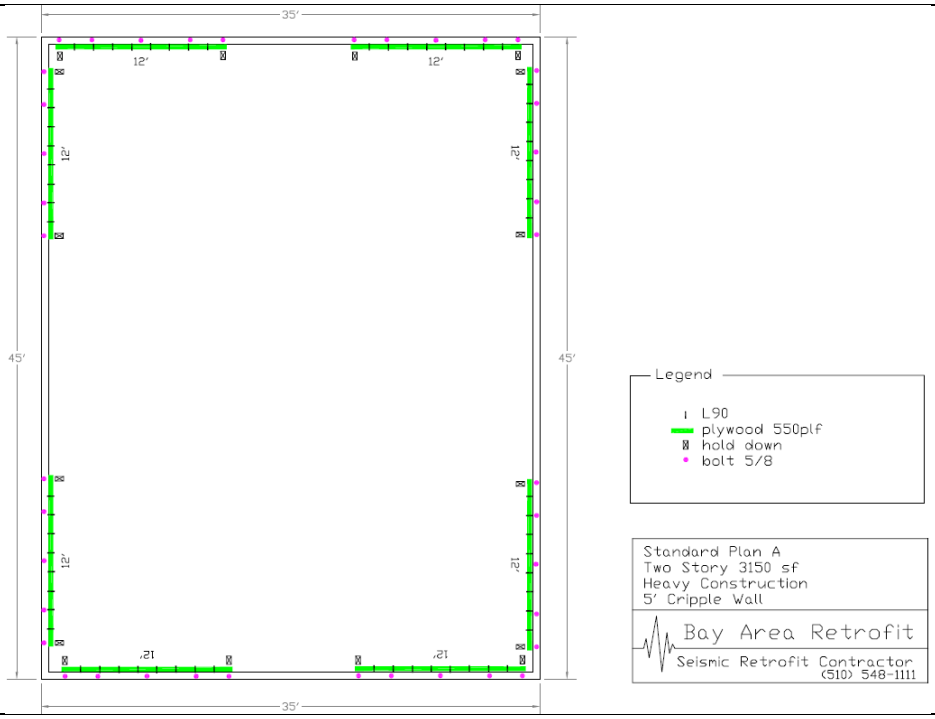
Item	P-1100	SPA	P-1100	SPA	P-1100	SPA	P-1100	SPA
Bolts	100	32					$4620	$1848
Plywood			168lf	96lf			$9360	$10,560
L90s					216	56	$4524	$1092
T-Downs					16	16	$3440	$1720
Total Cost							$47,284	$22,530,
V=								0.186

P-1100 - 3,150sf - Two Story - 5’ Cripple Wall - Heavy Construction with Tie Downs

	Total number of components and Price
	124 Bolts = $9548 192 lf ply = $31,680 272 L90s $10,608 16 T-Downs $3440 Total $55,276

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	46,500# each side
Plywood-640 plf	30,720# each side
L90s -	62,900# each side

Standard Plan A - 3.150sf - Two Story - 5’ Cripple Wall - Heavy Construction - Tie Downs

	Total number of components and Price
	40 Bolts = $3,080 96 lf ply = $15,840 64 L90s $2496 16 T-Downs $3440 Total $24,392

Base shear = 13,182#on each wall line.

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	12,000# each wall line
Plywood-550plf	13,200# each wall line
L90s -	12,950#each wall line

Design Comparison

P-1100 - 3,150sf - Two Story - 5’ Cripple Wall - Heavy Construction - Tie Downs

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	46,500# each side
Plywood-640 plf	30,720# each side
L90s -	62,900# each side

Standard Plan A - 3.150sf - Two Story - 5’ Cripple Wall - Heavy Construction -Tie Downs

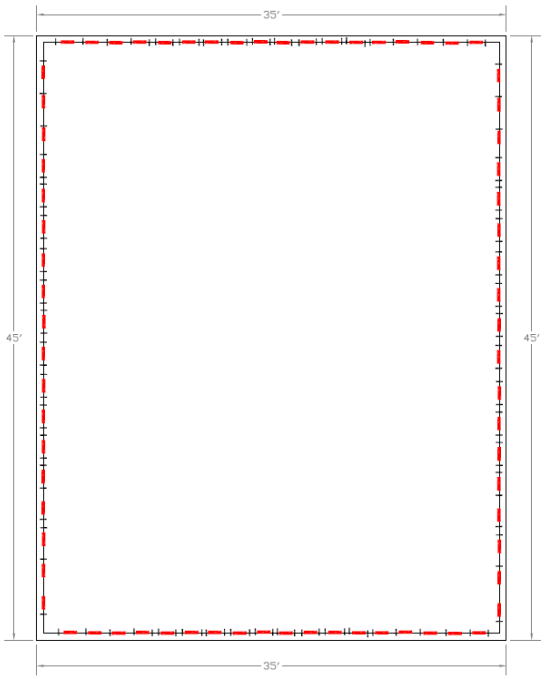
Base shear = 13,182#on each wall line.

Component	Shear resistance on each wall line
5/8 Bolts- 1500#	12,000# each wall line
Plywood-550plf	13,200# each wall line
L90s -	12,950#each wall line

Cost Comparison

Item	P-1100	SPA	P-1100	SPA	P-1100	SPA	P-1100	SPA
Bolts	124	40					$9548	$3080
Plywood			192lf	96lf			$31,680	$15,840
L90s					272	64	$10,608	$2496
T-Downs					16	16	$3440	$3,440
Total Cost							$55,276	$24,392,
V =								0.186

P-1100 - 1,350sf - No Cripple Wall - Light Construction - Type B Connectors



Each Type B Connector requires one 12 inch ripped

Legend

L90
Type B Connector

P1100
Single Story 1350 sf
Type B Connector
Medium Construction

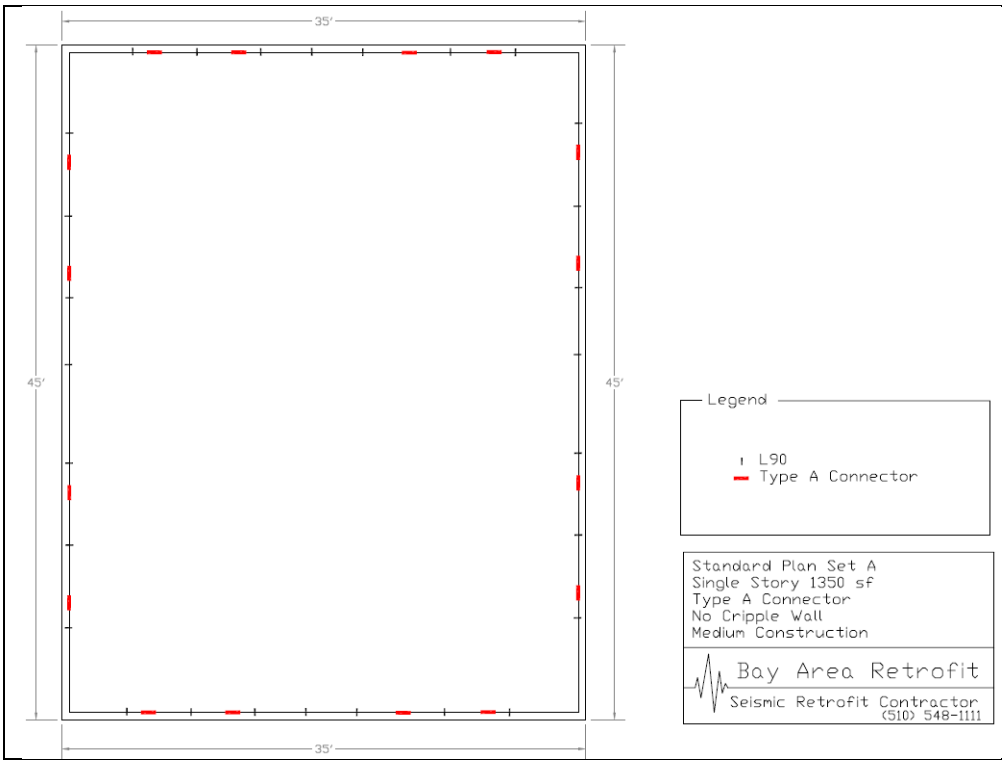
Bay Area Retrofit
Seismic Retrofit Contractor
(510) 548-1111

Total number of components and price

64 Type B Connectors $8,640
64 rip cut shims $3,200
100 L90s $3,900

Total $15,740

Standard Plan A - 1,350sf - No Cripple Wall - Light Construction - Type A Connector rather than a Type B Connector.

	Total number of components and price
	16 Type A Connectors = $2,160 No shims required 28 L90s $1,092 Total $3,252

Design Comparison

P-1100 - 1,350sf - No Cripple Wall – Single Story Light Construction - Type B Connectors
Total $15,740

Component	Shear resistance on each wall line
Type B Connector 960#	15,360# each wall line
12” rip cut shims	Shims do not require connection to sill
L90s – 925#	23,125# each side

P-1100 - 1,350sf - No Cripple Wall – Single Story-Light Construction - Type A Connectors

Base shear = 4,268#on each wall line.

Component	Shear resistance on each wall line
Type A Connector 1530#	6,120# each wall line
L90s – 925#	6,475# each wall line

Cost Comparison

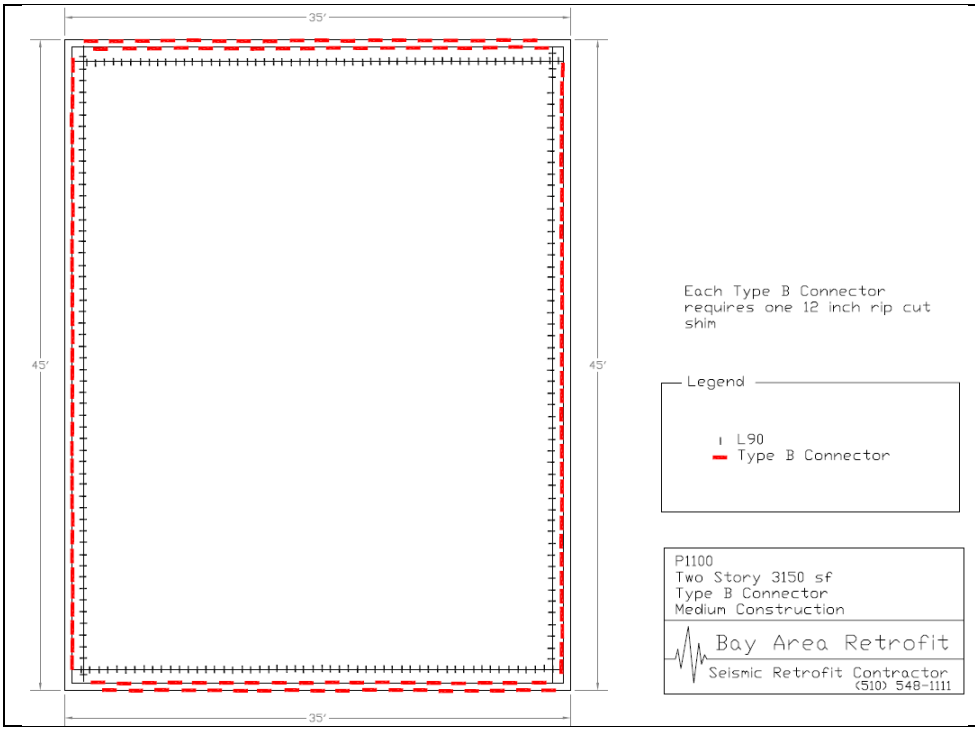
P-1100 Type B Connector

Type B Connector	64	$8640
12” Rip Cut Shims	64	$320
L90s	100	$3900
	Total	$15,740

SPA Type A Connector

Type B Connector	16	$2,160
12”Rip Cut Shims	NA	NA
L90s	28	$1092
	Total	$3252

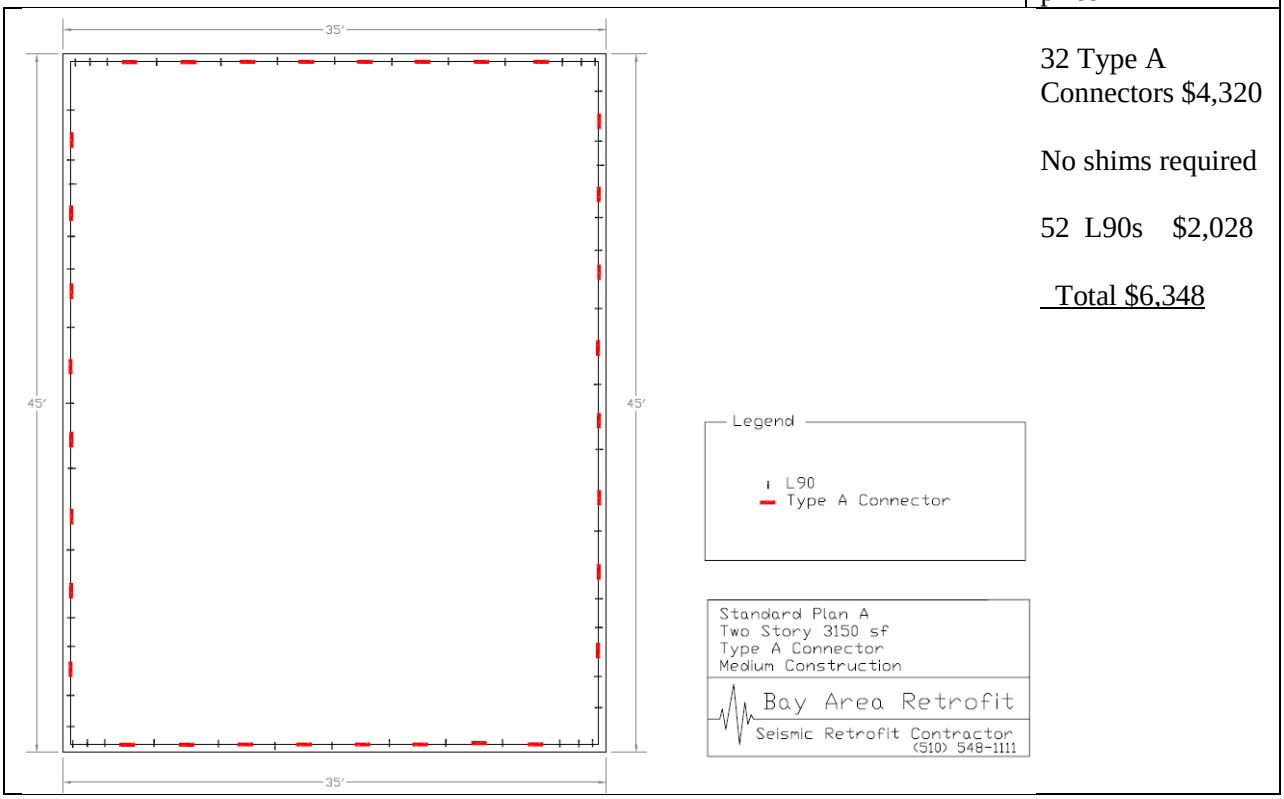
P-1100 - 3,150sf – Two Story - No Cripple Wall - Medium Construction - Type B Connectors



Total number of components and price
136 Type B Connectors $18,360
136 rip cut shims $6,800
216 L90s $8,424
Total $33,584

Standard Plan A - 3,150sf – Two Story No Cripple Wall - Medium Construction - Type A Connector.

Total number of components and price
32 Type A Connectors $4,320 No shims required 52 L90s $2,028 Total $6,348



Design Comparison

P-1100 - 3,150sf – Two Story - No Cripple Wall - Medium Construction - Type B Connectors

Component	Shear resistance on each wall line
Type B Connector 960#	32,640# each side
12”ripped shims	Shims do not require connection to sill
L90s	49,950# each side

Standard Plan A - 3,150sf - No Cripple Wall - Light Construction - Type A Connector.
Total $6,348

Base shear = 12.010# on each wall line.

Component	Shear resistance on each wall line
Type A Connector 1,530#	12,240# each wall line
L90s – 925#	12,025# each wall line

Cost Comparison

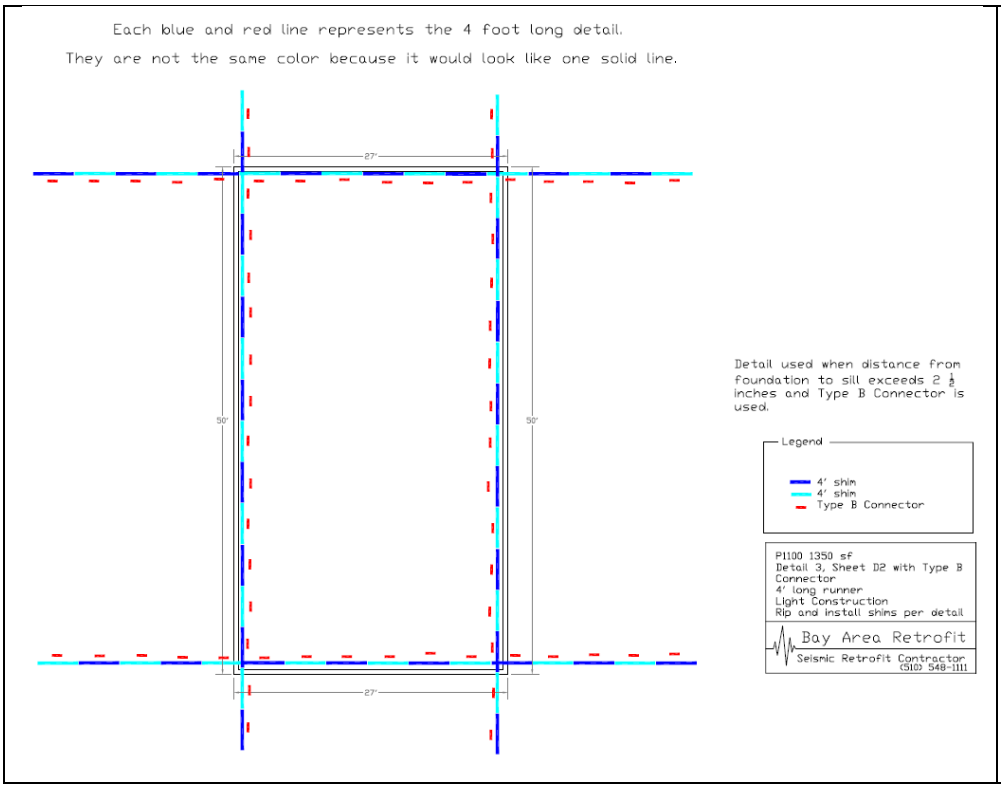
P-1100 Type B Connector

Type B Connector	136	$18,360
12” Rip Cut Shims	136	$6800
L90s	216	$8424
	Total	$33,584

SPA Type A Connector

Type B Connector	32	$4,320
12”Rip Cut Shims	NA	NA
L90s	52	$2,028
Total		$6348
V=		0.186 W

P-1100-1,350sf – No Cripple Wall - Light Construction – Detail 3, Sheet D2 with Type B Connectors



This detail contains a 4' long runner and is impossible to install because the runners will extend into the front, back and side yards.

IF it were possible, this is the cost breakdown.

64 Type B Connectors $8,640

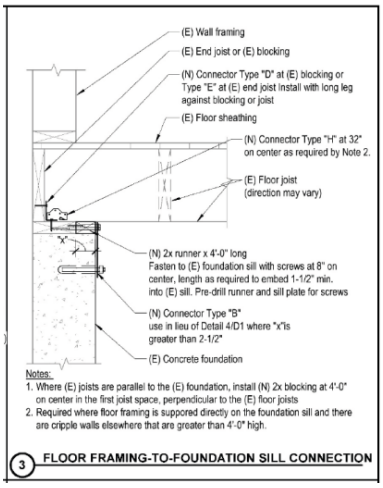
64 rip cut runners $11,200

100 L90s $8,424

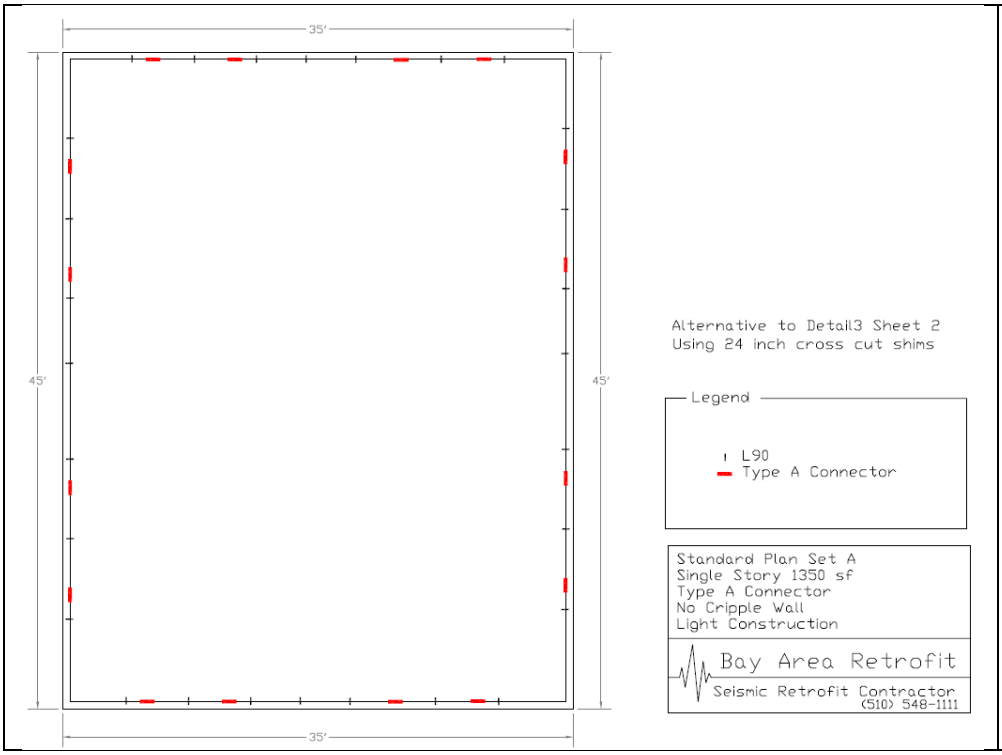
Total $28,264

Detail 3, Sheet D2

Component	Shear resistance on each wall line
Type B Connector 960#	15,360# each wall line
4' Rip Cut Runners. No load rating	Does not meet 2" min. penetration requirement
L90s -	23,125# each side



Standard Plan A - 1,350sf - No Cripple Wall - Light - Construction – 2’ Cross Cut Shims - Type A Connector.



16 Type A Conn-ectors = $2,160

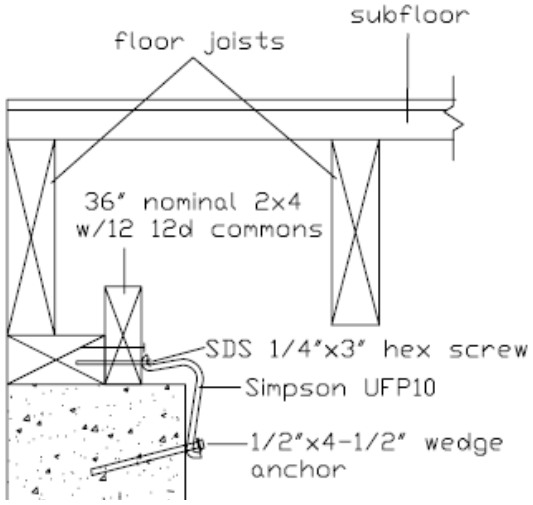
(16) 2 x 4 x 24” Cross Cut Shims $1,440

28 L90s $1,092

Total $4,692

Base shear = 4,268#on each wall line.

Component	Shear resistance on each wall line
Type A Connector 960#	6,120# each wall line
30” Cross Cut Shims with (4) ¼” SDS screws	6,400# each wall line
L90s -	6,475# each wall line



Comparison

P-1100-1,350sf – No Cripple Wall - Light Construction – Detail 3, Sheet D2 $26,264

Component	Shear resistance on each wall line
Type B Connector 960#	15,360# each wall line
4’ Rip Cut Runners. No load rating	Does not meet 2” min. penetration requirement
L90s -	23,125# each side

Standard Plan A - 1,350sf - No Cripple Wall - Light - Construction – 2’ $4,692

Base shear = 4,268#on each wall line.

Component	Shear resistance on each wall line
Type A Connector 960#	6,120# each wall line
30” Cross Cut Shims with (4) ¼” SDS screws	6,400# each wall line
L90s -	6,475# each wall line

COST COMPARISON

P-1100 Detail 3, Sheet D2

Type B Connector	64	$8,640
4’ Rip Cut Runners.	64	$6800
L90s	100	$3900
Total		$19,340

Alternate SPA Type A Connector

Type B Connector	16	$2,160
2’ Cross Cut Shims	16	$1,440
L90s	28	$1092
Total		$4692
V =		0.186 W

Conclusion

On average FEMA P-1100 retrofits cost three times as much as retrofits designed using Standard Plan A. Seismic retrofits are, and will continue to be, voluntary. This has been local jurisdiction policy all over the state for decades.

Homeowners must therefore be enticed by reasonable cost rather than discouraged by high cost retrofits. High cost is the number one disincentive homeowner face when deciding whether or not to improve the lateral force resisting system of their home.

The Seismic Design C0-efficent Impact on Cost

The seismic design Coefficient in FEMA P-1100 for plywood is 0.262.

The seismic design Coefficient in FEMA P-1100 for bolts and framing anchors is 0.393.

The seismic design Coefficient in Standard Plan A is 0.186 no matter which retrofit component is considered.

This is why bolt, plywood, and L90 capacities never match in P-1100. For example, in this P-1100 retrofit for a 3.150sf - Two Story - 5' Cripple Wall - Medium Construction home the difference in capacities and quantities vary greatly. This has an enormous impact on cost. .

Component	FEMA P-1100	Total capacity and cost
(100) 5/8 Bolts-	150,000# = $7,700	
(168lf) 490 plf Plywood-	82,320 # = $27.720	
(216) L90s	199,800# total = $8,424	
TOTAL COST	$43,844	

This is unaffordable for most homeowners.

On the other hand, the earthquake resistance of bolts, plywood, and L90s are practically the same when Standard Plan A's Seismic Design Coefficient of 0.186 is applied equally to all components. The matching of capacities reduces cost considerably.

Component	Standard Plan A	Total capacity and cost
(32) Bolts- 1500#	48,000# = $2,464	
(96lf) 550plf Plywood-	52,800# = $15,840	
(56) L90s -	51.800# = $2,184	
TOTAL COST	$20,488	

This is affordable for most homeowners.

Conclusion

The Seismic Design Coefficient in P-1100 drives the cost beyond what most homeowners can afford and will cause homeowners to revert to other design systems such as such as Standard Plan A or self-styled systems contractors have created themselves.

If this standard is not made more affordable it will never be used to reduce problems in found voluntary seismic

Appendix A

Standard Plan A's Engineering Background – By Jim Russell

Here are the complete calculations.

The following calculations determine the seismic load demand to cripple walls and foundation sill plates for conditions commonly found in existing wood-framed residential buildings located in the San Francisco Bay Area. These demands are the basis for the cripple wall bracing and foundation sill anchorage requirements contained in the East Bay and Peninsula Chapter of ICC Seismic Retrofit Provisions. Certain assumptions are made in the calculation of these demand loads. They include:

1. Wood structural panels are used to brace the cripple walls, and the buildings are limited to a maximum of two stories. Therefore, the R factor used is 5.5. (2001 CBC Table 16-N)

2. The Redundancy Factor rho (ρ) = 1.0, because the cripple wall bracing lengths along each exterior wall in each axis are equal, or are nearly equal. (2001 CBC Sec.1630.1.1)

3. The Near Source Factor (Na) = 1.3, to account for buildings that are located between 4 and 10 kilometers of a Type A fault. This value is less than the maximum Na = 1.5 specified for locations 2 kilometer or less from a Type A fault, but is greater than the Na = 1.1 value permitted for buildings that are, 1) located on soil classified not greater than type SD, 2) are not defined by the code as being irregular, and 3) have rho = 1.0. (CBC Sec.1629.4.2 and Tables 16-L, 16-M, and 16-S)

4. New resisting elements are located at the building perimeter only, therefore, one-half of the total seismic load in each axis is resisted by each of two parallel perimeter wall lines.

5. No reduction from current code force levels is being taken, as is permitted by Section 301.3 of the Guidelines for Seismic Retrofit of Existing Buildings. (ICBO, 2001)

Certain assumptions are made with respect to the capacities of the new materials added to strengthen the buildings. They include:

1. Allowable stresses are increased by a factor of 1.33 for short term seismic loads, or are based on tabular values already adjusted for seismic loading (2001 CBC Table 23-II-I-1).

The following assumptions have also been made regarding the construction of the houses:

1. The floor to ceiling wall height is 8 feet.

2. The roof slope is 4:12, with gable ends occurring on the short (transverse) side, and two foot eave overhangs on all sides.

3. Four Cases of exterior and interior wall finish and roofing are considered.

A) Lightweight roofing (5 psf) of wood shake, wood shingle, or composition shingle, exterior wood sheathing or board finish, and ½" gypsum wallboard interior finish.
B) Lightweight roofing, exterior wood sheathing or board finish, and gypsum lath and plaster interior finish. This is considered the definition of "Light Construction"
C) Lightweight roofing, cement plaster (stucco) exterior finish, and gypsum lath and plaster interior finish.
D) Lightweight roofing, cement plaster (stucco) exterior finish, and gypsum wall board interior finish.

Category D was missing from the original calculations and I added it based on the weights defined elsewhere in the calculations. These calculations look at 3 different footprint sizes:

- For one-story buildings the footprint sizes are: 1) 30 feet by 40 feet (1,200 square feet)
  2) 30 feet by 50 feet (1,500 square feet)
  3) 36 feet by 56 feet (2,016 square feet)
- For two-story buildings the footprint sizes are: 1) 30 feet by 30 feet (1,800 square feet)
  2) 30 feet by 40 feet (2,400 square feet)

3) 30 feet by 50 feet (3,000 square feet)

Appendix B

I averaged the weights of these footprints and created this table. These weights are used in determining Standard Plan A base shear.

Light Construction **ROOF: SHNGLES** **SIDING: WOOD** **WALLS: DRYWALL** **ONE STORY- 34 psf** **TWO STORY – 29.5 psf**	**Medium Construction** **ROOF: SHNGLES** **SIDING: STUCCO** **WALLS: DRYWALL** **ONE STORY- 41 psf** **TWO STORY-36.5 psf**
Medium Construction **ROOF: SHINGLES** **SIDING: WOOD** **WALLS: PLASTER** **ONE STORY-45psf** **TWO STORY-41 psf**	**Heavy Construction** **ROOF: SHNGLES** **SIDING: STUCCO** **WALLS: PLASTER** **ONE STORY-50psf** **TWO STORY-45psf**