ESTIMATE OF COSTS TO IMPLEMENT THE NEW BUILDING CODE FOR WINDSTORM RESISTANT CONSTRUCTION ALONG THE TEXAS COAST

FINAL REPORT

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INTRODUCTION

The overall project objective is to evaluate the cost-effectiveness of the New Code (Texas Department of Insurance, 1994). In order to evaluate the cost-effectiveness of the New Code we need an estimate of a "break-even" cost for the New Code cost-effectiveness, an estimate of the additional cost required to implement the New Code, and some criterion for cost-effectiveness. The concept of the break-even costs for code effectiveness and the criterion for cost-effectiveness are discussed in the accompanying report (Stubbs et al., 1995).

Several cost comparison studies of codes have been done previously. The NAHB National Research Center (1989) performed a cost comparison of the SBCCI Deemed-to-Comply Manual SSTD 10-90 (1990), the CABO One and Two Family Dwelling Code (1989) and current building practices in high winds areas. In their study, they utilized selected homes with specific designs and floor plans. The NCPI Cost Study (1994), Crandell (1994), and the All Industry Research Advisory Council (1989) all performed similar types of comparisons. Each of these studies involved the use of specific floor plans on which to base costs. The limitation of this type of cost comparison is that the costs cannot be easily applied to a large number of structures with varying designs. In order to increase the generalizability of this study, thereby increasing its applicability, we decided to calibrate the codes.

The objective of this report is to describe the procedures and results of our attempt to estimate the additional cost required to implement the New Code. This objective will be met by utilizing the following approach. First, we will discuss the principles guiding the

analysis. Second, we will outline the cost estimating methodology. Third, we will describe the quantity take-off procedures used. Fourth, we will describe the labor estimation procedures. Fifth, we will describe the cost analysis. Finally, we will perform cost analyses for selected structures. The six steps are discussed in the following sections.

PRINCIPLES GUIDING THE ANALYSIS

The four principles which guided the analysis were: 1) Selection of items affected by the codes, 2) Selection of cost estimating documents, 3) Incorporation of local labor rates and material costs, and 4) Incorporation of local building experts. We elaborate upon these items below:

Selection of Items Affected by Codes

In order to determine the costs to implement the Current Code (Texas Department of Insurance, 1989) and the New Code (Texas Department of Insurance 1994), it was necessary to first determine which items within the codes were impacted by the differences between the two codes. First, masonry construction was excluded from consideration, and second, areas which would not impact the structural integrity of the houses were excluded (e.g., porches, plumbing, etc.).

Selection of Cost Estimating Documents

The most efficient method of estimating costs of code implementation was determined by reviewing several different references on cost estimating (e.g., Cook, 1989; Foster, 1972; Goodacre and Crosbie-Hill, 1982; O'Brien, 1994; Petri, 1979; Thomas, 1983; and Wynne, 1973) as well as several reports on the cost to implement various codes (e.g., All-Industry Research Advisory Council, 1989; NAHB National Research Center, 1989; and NCPI Cost Study, 1994). The estimating documents selected were modified to accommodate the available information and consisted of 1) Quantity take-off forms, 2) Labor estimating forms, 3) Material cost forms, and 4) Summary forms.

Incorporation of Local Labor Rates and Materials Into Appropriate Subsystems

Due to the fact that the code will impact only the first tier counties, efforts were made to obtain labor and material costs from the subject areas. In this regard, several building supply firms and building contractors were contacted in the Galveston and Corpus Christi areas to determine material costs and local labor rates. Although ten building supply firms were contacted in Galveston, Corpus Christi, and Texas City, only three firms responded with prices lists.

Incorporation of Local Building Expertise

Local building contractors, architects, and building supply managers were interviewed to obtain their input regarding current building practices and the amount of labor which would be involved in implementing the changes in the New Code. A total of six interviews

were completed to obtain this information. Appendix A contains a copy of the interview form.

COST ESTIMATING METHODOLOGY

The cost estimating methodology used here can be broken down into two major steps. In the first step, we effectively "calibrate" the Current Code and New Code, both Inland and Seaward, by determining the unit costs to build the various building subsystems. In the second step, we use the unit costs developed in the first step to estimate the cost of arbitrary buildings. To calibrate the codes we perform the following seven steps:

1. Subdivision of houses into appropriate subsystems,
2. Interpretation of Current and New Code for each subsystem,
3. Selection of appropriate units for each subsystem,
4. Quantity take-offs by subsystem,
5. Labor estimates by subsystem,
6. Material costs by subsystem, and
7. Determination of total cost per unit of each subsystem.

We elaborate upon these steps below.

CODE CALIBRATION

Subdivision of Houses into Appropriate Subsystems

In order to calibrate the code, the following seventeen subdivisions were selected:

1. Foundation-Footings,
2. Foundation-Slab,
3. Exterior Framing,
4. Anchor Bolts,

5. Top Plate Splices,
6. Lateral Bracing, Exterior,
7. Roof Framing,
8. Anchorages, Exterior,
9. Holddowns,
10. Roof Decking,
11. Roof Covering,
12. Doors (Regular and Impact Resistant)
13. Windows (Regular and Impact Resistant)
14. Door Protection,
15. Window Protection,
16. Garage Doors, and
17. Floor Diaphragms.

Having defined the subdivisions, the objective here is to find the unit costs to construct each subdivision. The units associated with these subsystems are listed in Table 1.

Interpretation of Code for Each Subsystem

The Current and New Codes were analyzed and interpreted for each subsystem to determine the changes, if any, between the two codes. Each code was analyzed to determine if there were any changes in at least the following categories: 1) Lumber sizes, 2) Nailing patterns, 3) Anchorages, and 4) Lumber grades, thickness, span ratings, and so forth. Only areas which changed between the codes were included in the calculations. A summary of the changes between the codes is found in Appendix B.

Once the areas of major change were determined, the codes were applied to the design of the particular subsystem. A 759 square foot house was used as a model to calibrate each of the codes. The interpretation of the codes for the model structure is summarized in Tables 2 and 3. From the information provided in Tables 2 and 3, actual structures were designed in detail for both one and two story buildings.

Quantity Take-offs by Subsystem

Quantity take-offs were performed for the house for four different conditions: Current Code Inland, Current Code Seaward, New Code Inland, and New Code Seaward. If the applicable code did not specify requirements for a specific item or items (e.g., amount of rebar required and thickness of slab in the Current Code) the specifications were taken from either the CABO One and Two Family Dwelling Code (1994) or other references (Allen, 1985; SBCCI Deemed-To-Comply Standard, 1990; Spence, 1993).

An example of the quantity take-off forms for the foundation for both the Current and New Codes is shown in Tables 4 and 5. The required quantities for each code (excluding nails) are provided in Appendix C.

Labor Estimates by Subsystem

Standard labor estimates including costs for each subsystem of the Current Code involving carpentry, concrete, and roofing were determined using the *1994 National Construction Estimator* (Kiley and Moselle, 1993). The *National Construction Estimator* was chosen over Means (1994) and *Residential Construction Costs* (Saylor, 1992) due to the fact that only the *National Construction Estimator* provided labor hours which could be assigned to the appropriate subsystems. Means provided costs per square foot for specified units of construction such as framing with 2x4's, 16" o.c., 1x4 let-in bracing, but did not specify separate labor hours. While Saylor provided costs broken down by item (e.g., reinforcing, slab on grade 4", complete) it failed to specify labor hours or crew size for different types of reinforcing. Only the *National Construction Estimator* provided different labor rates for

the different materials for each subsystem (e.g., #4 and #5 rebar). Finally, the *National Construction Estimator* also provided crew sizes. This detail was necessary to accurately determine the labor costs for each subsystem.

In order to determine the labor estimates for the New Code interviews were conducted with local construction companies, an architect, and a building supply manager, as previously discussed. The resultant percentage estimates for labor increases (or decreases) for each subsystem, as well as the mean change in labor for each subsystem, are shown in Table 6. The mean increase was calculated by deleting the high and low estimates and averaging the remaining values. If there were four or fewer values, initially all values were used in the calculation of the mean. Estimates for the amount of time required to install the anchorages, holddowns, and provide window protection were obtained in minutes or hours. These values are also shown in Table 6. Although estimates were obtained for each subsystem, labor changes could be calculated from the *National Construction Estimator* for changes to lateral bracing, roof framing, and floor diaphragms. These values were used in the calculations instead of the estimates obtained in the interviews. Additionally, the changes for top splice nailings were not used as calculations could be more accurately made using a cost/nail figure. Labor estimates for holddowns and anchorages were obtained from the Simpson Installed Cost Guide (1994a). Finally, the estimates for the two story house, in general, were not used as the individual areas were evaluated instead.

Material Costs by Subsystem

Due to the fact that material prices differ significantly between the Galveston and Corpus Christi areas, calculations were performed separately for each city using costs obtained from responding local suppliers. Table 7 shows some typical prices and a complete list of applicable prices are provided in Appendix D. These calculations were performed for the inland and seaward sections of the Current and New Codes. The total for all materials required for each subsystem under the above conditions was then calculated. In some cases the specified materials were not available in one or both cities. Estimated costs for these materials were then determined in order to calculate the material costs.

In some cases, although there were changes between the Current and New Code, the cost to implement the changes was considered negligible and those cases were omitted from the calculations. For example, the nails required for attaching the rafter to the ceiling joist were changed from 12d to 16d. Due to the fact that both nails sell for the same price, the main difference occurs in the number of nails per pound (65 nails and 50 nails, respectively). The total increase in cost would be only \$0.16-\$0.21 per pound, or less than \$2.00 for a roof 40 feet in length. Additionally, if the code changed but the material costs and labor were unaffected (e.g., changing from Type M to Type S Mortar) the costs were disregarded.

The New Code, Seaward includes a provision for window protection. This provision can be met by either 1) providing impact resistant windows, 2) providing permanently mounted approved shutters, or 3) at a minimum providing properly designed wood structural-use panels cut to fit in place with anchoring devices included. Due to the fact that shutters would need to be designed for each location, no attempt was made to provide

shutters, although prior estimates for shutters place the costs at several thousand dollars for a standard sized house. As a result, we decided to provide for two options only, structural-use panels for all windows and household doors, and impact resistant windows, doors, and garage doors. Several window and door manufactures were contacted. The window company selected was chosen because they could provide documentation on the manner in which their cost changes were obtained (Appendix E). The manufacturer (personal communication with Janet Wasserman, EXTECH, 1995) indicated there would be an increase in cost for the basic window assemblage (reflected in Appendix E), but there would be no change in the nailing schedule for attaching the window to the trimmer studs, header, and sill. There would, however, be an increase in cost for the anchorage required for the framing around the openings, as set forth in Section 412.9 of the New Code. Similarly for the doors, the manufacturer (personal communication with Bend Door Company, 1995) indicated that the schedule for attaching the doors to the trimmer studs would be unchanged, however there would be an increase in cost for the door assemblage itself. Again, there was an increase in cost reflecting the anchorage requirements for framing around the openings (Section 412.9 of the New Code). Finally, the cost to purchase an impact resistant garage door was found to me minimal based on personal communication with Atlas Roll-Lite Door Corp. (1995). For this reason, no garage door protection was calculated. There was an increase in cost associated with the anchorage requirements set forth in the New Code (Section 412.9). The increase in time required to install the new impact resistant door was stated to be 30 minutes. All required materials are provided with the door. The quantity take-offs were included in the New Code, Seaward calculations.

Labor Cost Estimates by Subsystem

Prior to calculating labor costs two changes were made. Due to the fact that the *National Construction Estimator*'s Average Cost per Manhour included taxes, insurance, fringe benefits and so forth, the base wage per hour was used initially. However, after the interviews it was determined that the base wages were significantly lower in the areas of concern. Therefore, the base wage was adjusted by a factor of 0.75 and this lower value was used to determine the "book rate". The "book rate" was then adjusted by the area modification factor of 0.92 and 0.84, respectively, for Galveston and Corpus Christi.

To determine the labor costs involved in installing anchorages for both the Current Code and the New Code, and for holddowns in the New Code, the Simpson Strong-Tie® Installed Cost Guide (1994a), the Simpson Strong-Tie® Texas Windstorm Requirements Approved Product Application Guide (1989), and the Simpson Strong-Tie® Connectors for Wood Construction Product & Instruction Manual (1993) were used. Simpson Strong-Tie® anchorages and holddowns were selected as labor costs could be determined. Only the Simpson Strong-Tie® Company was able to provide us with this information. Again, the cost per manhour was adjusted by a factor of 0.75 and the area modification factors from the *National Construction Estimator* were applied to the final values.

Labor estimates for each subsystem for the Current Code were obtained for the generic house using the hours and costs obtained from the *National Construction Estimator* or from the Simpson Strong-Tie® literature as noted above. Labor estimates for the New Code were obtained by multiplying the original labor value by the adjustment factor obtained from the interviews (Table 6). An example of the labor calculations for the

foundation for both the Current and New Codes is provided in Tables 8 and 9. Note that only the manhours for the footings for the New Code were adjusted. The New Code specifies anchor bolts at 4 feet o.c. while the Current Code specifies anchor bolts at 6 feet o.c. The increase in manhours was obtained by multiplying the cost from the *National Construction Estimator* by the increase in time for placing anchor bolts obtained from the interviews. The values used for the old code were obtained directly from the *National Construction Estimator*. Appendix F includes example calculations of the labor costs for the Current Code per the *National Construction Estimator*.

Cost Analysis for Subsystems

The cost analysis for the subsystems was completed in two steps. First, the material costs and the labor costs (adjusted for the appropriate area, e.g., Galveston or Corpus Christi) were combined. Second, the total cost was divided by the appropriate units for the subsystem. The result is the cost per unit per building per location per code. These calculations were repeated for each subsystem and for each code at each location. Appendix G contains the total cost for each subsystem and the costs per unit per building per location per code for the calibration house. Tables 10 and 11 list the resulting values for Inland and Seaward, respectively, for each code. These values are used to obtain the cost per subsystem for the selected structures.

The cost analysis figures were estimated conservatively. Any lumber, rolls of felt or wire, and so forth were always increased to a full piece of lumber or a full roll for the cost calculations. Although it would have been possible to cut many of the smaller rafters from

other pieces of lumber, each size rafter was calculated separately in order to provide for waste. Cost calculations were done using the number of boards, number of rolls, and so forth, rather than the number of board feet or square feet. This method of calculating costs also increases the potential for waste and increases the conservative nature of the estimates. A complete list of the assumptions and criteria that forced the cost estimates to be conservative for each subsystem is given in Appendix H.

ADDITIONAL COSTS TO IMPLEMENT THE NEW CODE FOR SELECTED STRUCTURES

In this section, we estimate the additional cost to implement the New Code for a number of common structures. To achieve this objective, we performed the following tasks. First, we selected the structures to be studied. Next, we performed a quantity take-off for each and every structure using the format developed in the last section. Having determined the quantities, the unit costs developed in the code-calibration process were next used to compute the costs to implement the New Code.

Selection of Houses to be Analyzed

A total of four houses were selected for analysis under the Current and New Codes. The sizes were determined from the typical sizes of homes reported in the areas. For purposes of the calculations, a rectangular design was chosen. Additionally, the two story home had both stories of equal size. The interpretations of the Codes for the four houses are summarized in Tables 12-19.

Quantity Take-offs for Selected Structures

For each of the selected structures, we estimated the quantities of all of the items impacted by the code implementation. A summary of the quantities for the four houses is listed in Tables 20 and 21. For subsystems which vary continuously (e.g., anchorages, shear wall length, etc.) the cost per unit per location per building per code was recalculated for each house under each code. Again, this increases the conservative nature of the estimates.

Cost Analysis of Selected Houses

To obtain costs for the selected houses, the base costs for the calibrated code (Tables 10 and 11) or for the new calibration, if applicable, were multiplied by the quantities developed in Tables 20 and 21. The calculations were performed for each house for the Current and New Codes, Inland and Seaward, in Galveston and Corpus Christi. Additionally, for the New Code Seaward two options were calculated: first, using window and door protection with an impact resistant garage door, and second, with all openings being constructed of impact resistant materials. These costs are summarized in Tables 22-29.

Finally, the additional costs to implement the New Code were determined in four separate steps. First, the difference in cost between the Current Code and the New Code was obtained. These differences are recorded in Table 30. Second, the difference was increased by a factor of 0.30 to adjust the costs for overhead and profit as suggested by NAHB National Research Center (1989) (Table 31). Third, the difference was divided by the cost of the structure assuming construction costs of \$60/sf, \$75/sf, \$85/sf, and \$100/sf.

The answer was then expressed as a percentage. These results are summarized in Tables 32 to 35.

SUMMARY AND CONCLUSIONS

The objective of this study was to describe the procedures and results of an attempt to estimate additional costs to implement the New Code. Depending upon the size of the house and the number of stories, the cost to implement the New Code ranges from approximately $1,000 to $9,000. This cost range corresponds to a range of 2% to 5% of the cost of the structure designed using the Current Code.

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Table 1. Selected Units for Subsystems

Subsystem	Units
Foundation-Footing	linear foot (lf)
Foundation-Slab	square foot of footprint (sf of fp)
Exterior Framing	square foot of exterior wall
Anchor Bolts	anchor bolt
Top Plate Splices	nail
Lateral Bracing, Exterior	linear foot
Roof Framing	square foot of footprint
Anchorages, Exterior	linear foot
Holddowns	holddown
Roof Decking	square foot of footprint
Roof Covering	square foot of footprint
Doors (Regular and Impact Resistant)	door
Windows (Regular and Impact Resistant)	window
Door Protection	door
Window Protection	window
Garage Doors	garage door
Floor Diaphragm	square foot of footprint

Table 2. Components and Specifications Calibration House, Inland

Subsystem	Size	Current Code	New Code
Foundation-Footing	120 lf	2-#4 rebars, 1 ft overlap/20 ft 12" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 12" W footing
Foundation-Slab	759 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	984 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	per bolt	1/2" anchor bolts 1-3/8"x1/8" thick washers anchor bolts 6 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 4 ft o.c.
Top Plate Splices	per nail	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 142 lf; new: 48 lf	1x4 let-in, nailed with 2-8d nails to each stud, installed at a 45° angle; one brace at each corner and for each 18 ft of wall	15/32" structural use panels, length determined per code, 8d nails, 3-12 nailing pattern
Roof Framing	759 sf	Roof slope 4:12, 2x6 rafters, 2x8 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 2. Components and Specifications Calibration House, Inland (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	120 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	18	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	759 sf	1/2" sheathing, 24/16 index, 7d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-6, 4-12, and 6-12 nailing pattern, span rating 32/16, no blocking required
Roof Covering	759 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	Install per manufacturer	Meet wind load provisions
Windows	8	Install per manufacturer	Install per manufacturer
Door Protection		Not required	Not required
Window Protection		Not required	Not required
Garage Doors	0		

Table 3. Components and Specifications Calibration House, Seaward

Subsystem	Size	Current Code	New Code
Foundation-Footing	120 lf	2-#4 rebars, 1 ft overlap/20 ft 12" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 12" W footing
Foundation-Slab	759 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	984 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	per bolt	1/2" anchor bolts, galvanized 1-3/8"x1/8" thick washers anchor bolts 6 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 3.5 ft o.c.
Top Plate Splices	per nail	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 142 lf; new: 48 lf	1x4 let-in, nailed with 2-8d nails to each stud, installed at a 45° angle; one brace at each corner and for each 18 ft of wall	15/32" structural use panels, length determined per code, 10d nails, 4-12 nailing pattern
Roof Framing	759 sf	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 3. Components and Specifications Calibration House, Seaward (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	120 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	18	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	759 sf	5/8" sheathing, 40/20 index, non-veneer, 8d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-12 nailing pattern, span rating 32/16, no blocking required
Roof Covering	759 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	Install per manufacturer	Meet wind load provisions, impact resistant
Windows	8	Install per manufacturer	Install per manufacturer, impact resistant
Door Protection	2	Not required	Structural use panels
Window Protection	8	Not required	Structural use panels
Garage Doors	0		

Table 4. Quantity Take-offs for the Foundation-Footing Calibration House-Current Code

Exterior Footings: 12" x 20"		
Perimeter:		120 lf
Volume of Footing:	(1)(20/12)(120 lf) =	200 cf
Concrete Required:	200 cf/27 cf/cy =	7.41 cy
cy to purchase:		8.00 cy
Rebar: 2-#4		
Include 1 ft overlap/20 ft		
Perimeter:		120 lf
Feet of Rebar:	2(120) + 2(240/20) =	264 lf
Pounds/lf:		0.67
Pounds of rebar required:	(264 lf) (0.67 lb/lf) =	176.88 lb
Pounds of rebar to purchase:		177 lb

Table 5. Quantity Take-offs for the Foundation-Footing Calibration House-New Code

Exterior Footings: 12" x 16"

Perimeter:		120 lf
Volume of Footing:	(1)(16/12)(120 lf) =	160 cf
Concrete Required:	160 cf/27 cf/cy =	5.93 cy
cy to purchase:		6.00 cy

Rebar: 2-#5

Include 1 ft overlap/20 ft

Perimeter:		120 lf
Feet of Rebar:	2(120) + 2(240/20) =	264 lf
Pounds/lf:		1.04
Pounds of rebar required:	(264 lf) (1.04 lb/lf) =	274.56 lb
Pounds of rebar to purchase:		275 lb

Table 6. Estimates of Changes in Labor Times for New Code from Interviews

	Respondents						
Subsystem	A	B	C	D	E	F	Mean (%)
Foundation, increased anchor bolts	5	83	5	40	5	0	13.75
Exterior Framing, additional studding	7.5	2.5	0	25	7.5	1	4.63
Exterior Framing, changes in top plate splicing	0	4	0	0	---*	1	0.33
Wall Bracing	---	15	---	0	-10	0	1.25
Roof Framing	50	22.5	0	100	6.5	75	38.50
Anchorages (min)	66.5	50	50	0	---	---	55.50
Holddowns (min)	17.5	30	5	5	120	75	31.88
Roof Decking	40	10	33	225	4	75	39.50
Underlayment	30	35	58	50	12.5	125	43.25
Shingles	36.5	33	2	50	100	10	32.38
Window Protection (hrs)	0.8	---	1.5	1.0	---	---	1.10
Floor Diaphragm	50	100	100	---	6.5	100	83.33
Two Story House	---	50	50	---	---	---	50.00
Doors (min)	17.5	60	30	17.5	---	---	31.25
Windows (single) (min)	---	35	30	5	---	---	23.33
Windows (double) (min)	13.5	35	30	5	---	---	20.88

*No value provided by respondent.
Code: Respondents A, B, C, and D are building contractors in Corpus Christi (A and B) and Galveston (C and D), Respondent E is an architect, and Respondent F is a building supply store manager.

Table 7. Typical Costs of Materials in Galveston and Corpus Christi

Material	Galveston	Corpus Christi
Lumber - 2x4x8	2.77	3.36
Lumber - 2x8x10	6.38	8.20
Lumber - 2x8x20	17.90	20.00
4x8, 1/2" CD	14.69	14.19
15# Roofing Felt	8.49	8.49
6"x6" #10/10 WWF	47.29	92.50
Simpson Clip H4	0.20	0.25
Simpson Clip H2.5	0.20	0.17
Simpson Holddown HD5A	11.93	15.92

Table 8. Labor Estimates for the Foundation-Footing Calibration House-Current Code

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Footing:

12" W x 20" T @ 0.117 mh/lf

0.117 mh/lf * 120 lf = 14.040 mh
14.040 mh * $12.60/mh = $176.90

Reinforcing Steel:

1/2" (0.67 lb/lf) @ .010 mh/lb

0.67 lb/lf * 264 lf = 176.88 lb steel

176.88 lb * 0.010 mh/lb = 1.769 mh
1.769 mh * $12.75/mh = $22.55

Totals:	Footings:	14.040 mh	$176.90
	Steel:	1.769 mh	22.55
		15.809 mh	$199.46

Table 9. Labor Estimates for the Foundation-Footing Calibration House-New Code

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Footing:

12" W x 16" T @ 0.107 mh/lf

0.107 mh/lf * 120 lf = 12.831 mh
12.831 mh * $12.60/mh = $161.67

Reinforcing Steel:

5/8" (1.04 lb/lf) @ .009 mh/lb

1.04 lb/lf * 264 lf = 274.56 lb steel

274.56 lb * 0.009 mh/lb = 2.471 mh
2.471 mh * $12.75/mh = $31.51

Totals:	Footings:	12.831 mh	$161.67
	Steel:	2.471 mh	31.51
		15.302 mh	$193.18

Table 10. Cost per Unit per Building per Location per Code, Inland, for Calibration House

		Galveston		Corpus Christi	
Subsystem	Units	Current	New	Current	New
Foundation-Footing	lf	$5.87	$5.03	$5.74	$4.86
Foundation-Slab	sf of fp	0.94	1.04	1.04	1.14
Wall Framing	sf framing	0.49	0.56	0.52	0.60
Anchor Bolts	anchor bolt	1.44	2.60	1.34	1.89
Top Plate Splices	nail	0.03	0.03	0.03	0.03
Lateral Bracing	lf	0.59	2.09	0.60	2.01
Roof Framing	sf of fp	1.04	1.33	1.05	1.47
Exterior Anchorage	lf	0.80	1.82	0.81	2.02
Holddowns	holddown		15.19		19.29
Roof Decking	sf of fp	0.97	1.07	0.93	1.03
Roof Deck, blocking	sf of fp		0.05		0.05
Roof Covering	sf of fp	0.47	0.76	0.44	0.73
Doors	door	102.55	102.55	102.07	102.07
Doors, Impact Resistant	door				
Windows	window	332.22	332.22	331.86	331.86
Windows, Impact Resistant	window				
Door Protection	door				
Window Protection	window				
Garage Door	gar. door	350.33	350.33	348.47	348.47

Table 11. Cost per Unit per Building per Location per Code, Seaward, for Calibration House

		Galveston		Corpus Christi	
Subsystem	Units	Current	New	Current	New
Foundation-Footing	lf	$5.87	$5.03	$5.74	$4.86
Foundation-Slab	sf of fp	0.94	1.04	1.04	1.14
Wall Framing	sf framing	0.49	0.56	0.52	0.60
Anchor Bolts	anchor bolt	2.26	2.60	2.16	1.89
Top Plate Splices	nail	0.03	0.03	0.03	0.03
Lateral Bracing	lf	0.59	2.10	0.60	2.02
Roof Framing	sf of fp	1.30	1.37	1.43	1.50
Exterior Anchorage	lf	0.80	2.04	0.81	2.26
Holddowns	holddown		16.03		19.54
Roof Decking	sf of fp	1.15	1.06	1.15	1.02
Roof Deck, blocking	sf of fp		0.05		0.05
Roof Covering	sf of fp	0.47	0.76	0.44	0.73
Doors	door	102.55	102.55	102.07	102.07
Doors, Impact Resistant	door		275.55		275.07
Windows	window	332.22	332.22	331.86	331.86
Windows, Impact Resistant	window		384.72		384.36
Door Protection	door		79.92		80.80
Window Protection	window		68.61		69.46
Garage Door	gar. door	350.33	434.65	348.47	432.33

Table 12. Components for 1,000 square foot House, Inland

Subsystem	Size	Current Code	New Code
Foundation-Footing	130 lf	2-#4 rebars, 1 ft overlap/20 ft 12" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 12" W footing
Foundation-Slab	1000 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	1040 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	current: 30; new: 44	1/2" anchor bolts 1-3/8"x1/8" thick washers anchor bolts 6 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 4 ft o.c.
Top Plate Splices	current: 88; new: 240	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 90.64 lf; new: 48 lf	1x4 let-in, nailed with 2-8d nails to each stud, installed at a 45° angle; one brace at each corner and for each 18 ft of wall	15/32" structural use panels, length determined per code, 8d nails, 3-12 nailing pattern
Roof Framing	1000 sf	Roof slope 4:12, 2x6 rafters, 2x8 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 12. Components for 1,000 square foot House, Inland (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	130 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	20	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	1000 sf	1/2" sheathing, 24/16 index, 7d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-6, 4-12, and 6-12 nailing pattern, span rating 32/16, no blocking required
Roof Covering	1000 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	Install per manufacturer	Meet wind load provisions
Windows	6	Install per manufacturer	Install per manufacturer
Door Protection		Not required	Not required
Window Protection		Not required	Not required
Garage Doors	0		

Table 13. Components for 1,000 square foot House, Seaward

Subsystem	Size	Current Code	New Code
Foundation-Footing	130 lf	2-#4 rebars, 1 ft overlap/20 ft 12" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 12" W footing
Foundation-Slab	1000 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	1040 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	current: 30; new: 50	1/2" anchor bolts, galvanized 1-3/8"x1/8" thick washers anchor bolts 6 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 3.5 ft o.c.
Top Plate Splices	current: 88; new: 240	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 90.64 lf; new: 48 lf	1x4 let-in, nailed with 2-8d nails to each stud, installed at a 45° angle; one brace at each corner and for each 18 ft of wall	15/32" structural use panels, length determined per code, 10d nails, 4-12 nailing pattern
Roof Framing	1000 sf	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 13. Components for 1,000 square foot House, Seaward (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	130 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	20	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	1000 sf	5/8" sheathing, 40/20 index, non-veneer, 8d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-12, nailing pattern, span rating 32/16, no blocking required
Roof Covering	1000 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	Install per manufacturer	Meet wind load provisions, impact resistant
Windows	6	Install per manufacturer	Install per manufacturer, impact resistant
Door Protection	2	Not required	Structural use panels
Window Protection	6	Not required	Structural use panels
Garage Doors	0		

Table 14. Components for 1,664 square foot House, Inland

Subsystem	Size	Current Code	New Code
Foundation-Footing	168 lf	2-#4 rebars, 1 ft overlap/20 ft 12" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 12" W footing
Foundation-Slab	1664 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	1344 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	current: 38; new: 52	1/2" anchor bolts 1-3/8"x1/8" thick washers anchor bolts 6 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 4 ft o.c.
Top Plate Splices	current: 100; new: 368	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 113.3 lf; new: 64 lf	1x4 let-in, nailed with 2-8d nails to each stud, installed at a 45° angle; one brace at each corner and for each 18 ft of wall	15/32" structural use panels, length determined per code, 8d nails, 3-12 nailing pattern
Roof Framing	1664 sf	Roof slope 4:12, 2x6 rafters, 2x8 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 14. Components for 1,664 square foot House, Inland (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	168 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	20	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	1664 sf	1/2" sheathing, 24/16 index, 7d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-6, 4-12, and 6-12 nailing pattern, span rating 32/16, no blocking required
Roof Covering	1664 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	Install per manufacturer	Meet wind load provisions
Windows	10	Install per manufacturer	Install per manufacturer
Door Protection		Not required	Not required
Window Protection		Not required	Not required
Garage Doors	1	Install per manufacturer	Meet wind load provisions

Table 15. Components for 1,664 square foot House, Seaward

Subsystem	Size	Current Code	New Code
Foundation-Footing	168 lf	2-#4 rebars, 1 ft overlap/20 ft 12" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 12" W footing
Foundation-Slab	1664 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	1344 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	current: 38; new: 60	1/2" anchor bolts, galvanized 1-3/8"x1/8" thick washers anchor bolts 6 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 3.5 ft o.c.
Top Plate Splices	current: 100; new: 418	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 113.3 lf; new: 80 lf	1x4 let-in, nailed with 2-8d nails to each stud, installed at a 45° angle; one brace at each corner and for each 18 ft of wall	15/32" structural use panels, length determined per code, 10d nails, 4-12 nailing pattern
Roof Framing	1664 sf	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 15. Components for 1,664 square foot House, Seaward (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	168 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	20	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	1664 sf	5/8" sheathing, 40/20 index, non-veneer, 8d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-12 nailing pattern, span rating 32/16, block 4 ft
Roof Covering	1664 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	No special requirements	Meet wind load provisions, impact resistant
Windows	10	Nail per manufacturer	Nail per manufacturer, impact resistant
Door Protection	2	Not required	Structural use panels
Window Protection	10	Not required	Structural use panels
Garage Doors	1	Install per manufacturer	Meet wind load requirements, impact resistant

Table 16. Components for 2,040 square foot House, Inland

Subsystem	Size	Current Code	New Code
Foundation-Footing	188 lf	2-#4 rebars, 1 ft overlap/20 ft 12" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 12" W footing
Foundation-Slab	2040 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	1504 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	current: 44; new: 60	1/2" anchor bolts 1-3/8"x1/8" thick washers anchor bolts 6 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 4 ft o.c.
Top Plate Splices	current: 128; new: 664	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 113.3 lf; new: 80 lf	1x4 let-in, nailed with 2-8d nails to each stud, installed at a 45° angle; one brace at each corner and for each 18 ft of wall	15/32" structural use panels, length determined per code, 8d nails, 3-12 nailing pattern
Roof Framing	2040 sf	Roof slope 4:12, 2x6 rafters, 2x8 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 16. Components for 2,040 square foot House, Inland (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	188 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	20	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	2040 sf	1/2" sheathing, 24/16 index, 7d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-6, 4-12, and 6-12 nailing pattern, span rating 32/16, block 6 ft
Roof Covering	2040 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	Install per manufacturer	Meet wind load provisions
Windows	12	Install per manufacturer	Install per manufacturer
Door Protection		Not required	Not required
Window Protection		Not required	Not required
Garage Doors	2	Install per manufacturer	Meet wind load provisions

Table 17. Components for 2,040 square foot House, Seaward

Subsystem	Size	Current Code	New Code
Foundation-Footing	188 lf	2-#4 rebars, 1 ft overlap/20 ft 12" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 12" W footing
Foundation-Slab	2040 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	1504 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	current: 44; new: 66	1/2" anchor bolts, galvanized 1-3/8"x1/8" thick washers anchor bolts 6 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 3.5 ft o.c.
Top Plate Splices	current: 128; new: 784	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 113.3 lf; new: 96 lf	1x4 let-in, nailed with 2-8d nails to each stud, installed at a 45° angle; one brace at each corner and for each 18 ft of wall	15/32" structural use panels, length determined per code, 10d nails, 4-12 nailing pattern
Roof Framing	2040 sf	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 17. Components for 2,040 square foot House, Seaward (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	188 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	20	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	2040 sf	5/8" sheathing, 40/20 index, non-veneer, 8d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-12 nailing pattern, span rating 32/16, block 6 ft
Roof Covering	2040 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	No special requirements	Meet wind load provisions, impact resistant
Windows	12	Nail per manufacturer	Nail per manufacturer, impact resistant
Door Protection	2	Not required	Structural use panels
Window Protection	12	Not required	Structural use panels
Garage Doors	2	Install per manufacturer	Meet wind load requirements, impact resistant

Table 18. Components for 3,00 square foot House (Two Story), Inland

Subsystem	Size	Current Code	New Code
Foundation-Footing	160 lf	2-#4 rebars, 1 ft overlap/20 ft 15" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 16" W footing
Foundation-Slab	1500 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	2560 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	current: 48; new: 58	1/2" anchor bolts 1-3/8"x1/8" thick washers anchor bolts 4 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 3.5 ft o.c.
Top Plate Splices	current: 100; new: 368	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 320 lf; new: 192 lf	Sheath both floors completely, 8d nails, nail 4" for first 18-20" along plates, 6-12 for rest of wall, stagger the sheets	15/32" structural use panels, length determined per code, 8d nails, 3-12 nailing pattern
Roof Framing	1500 sf	Roof slope 4:12, 2x6 rafters, 2x8 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x10 rafters, 2x12 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 18. Components for 3,000 square foot House (Two Story), Inland (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	160 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers > 3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	56	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	1500 sf	1/2" sheathing, 24/16 index, 7d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-6, 4-12, and 6-12 nailing pattern, span rating 32/16, no blocking required
Roof Covering	1500 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	Install per manufacturer	Meet wind load provisions
Windows	20	Install per manufacturer	Install per manufacturer
Door Protection		Not required	Not required
Window Protection		Not required	Not required
Garage Doors	2	Install per manufacturer	Meet wind load provisions

Table 18. Components for 3,000 square foot House (Two Story), Inland (Continued)

Subsystem	Size	Current Code	New Code
Shear Transfer Plates	160 lf	Not required	Required to provide the shear capacity equivalent to the panel sheathing tables
Floor Straps	160 lf	Not required due to sheathing of entire house	Required to provide anchorage in accordance with tables
Floor Diaphragm	1500 sf	No specifications given, installed as for new code without the blocking	Joist spacing 24" o.c., floor sheathing thickness 19/32", fastened with 10d common nails 6-12, 2x4 blocking for first 4 ft at each end of the shear wall and spaced 4 ft o.c. beneath the floor sheathing panel edges

Table 19. Components for 3,000 square foot House (Two Story), Seaward

Subsystem	Size	Current Code	New Code
Foundation-Footing	160 lf	2-#4 rebars, 1 ft overlap/20 ft 15" x 20" footing	2-#5 rebars, 1 ft overlap/20 ft 16" T x 16" W footing
Foundation-Slab	1500 sf	WWF 6"x6" #10/10, No overlap 3-1/2" Slab	WWF 6"x6" #10/10 Double 3 ft at edge, 6" overlap 4" Slab
Exterior Framing	2560 sf	2x4x8 studs 16" o.c. Double studs at corners	2x4x8 studs 16" o.c. Triple studs at corners Double studs at end of shear wall
Anchor Bolts	current: 48; new: 64	1/2" anchor bolts, galvanized 1-3/8"x1/8" thick washers anchor bolts 4 ft o.c.	5/8" anchor bolts 2x2x1/8" washers anchor bolts 3 ft o.c.
Top Plate Splices	current: 100; new: 418	Double top plate with staggered joints, 2-16d nails/splice	Double top plate nailed at splices per table
Lateral Wall Bracing	current: 320 lf; new: 240 lf	Sheath both floors completely, 8d nails, nail 4" for first 18-20" along plates, 6-12 for rest of wall, stagger the sheets	15/32" structural use panels, length determined per code, 10d nails, 4-12 nailing pattern
Roof Framing	1500 sf	Roof slope 4:12, 2x8 rafters, 2x10 ridgeboards, hip and valley rafters, bracing installed for every 3rd rafter over span	Roof slope 4:12, 2x10 rafters, 2x12 ridgeboards, hip and valley rafters, bracing installed for each rafter over span

Table 19. Components for 3,000 square foot House (Two Story), Seaward (Continued)

Subsystem	Size	Current Code	New Code
Anchorages	160 lf	Anchor, 300# minimum attaching every other stud to double top plate Anchor, 300# minimum attaching every other stud to bottom plate Anchor, 300# minimum every 3rd rafter Headers >3 ft anchored for 300# minimum	Anchor every stud to double plate and rafter, anchorage per table Anchor every stud to sole plate, anchorage per table Anchor every rafter to double top plate, anchorage per table Anchor every header and cripple with same anchorage Trimmer stud anchored per table
Holddowns	60	Not required	Install at every corner and at the end of each shear wall, anchorage per table
Roof Decking	1500 sf	5/8" sheathing, 40/20 index, non-veneer, 8d nails, 6-12 nailing pattern	15/32" sheathing panels, 8d nails, 4-12 nailing pattern, span rating 32/16, no blocking required
Roof Covering	1500 sf	One layer of 15# felt, fastened with enough nails to hold in place until shingles applied; shingles nailed with 4 nails	One layer of 30# felt, fastened 9" o.c. first row and two rows staggered, 18" o.c.; shingles nailed with 6 nails; asphaltic cement to starter course and first row
Doors	2	No special requirements	Meet wind load provisions, impact resistant
Windows	20	Nail per manufacturer	Nail per manufacturer, impact resistant
Door Protection	2	Not required	Structural use panels
Window Protection	20	Not required	Structural use panels
Garage Doors	2	Install per manufacturer	Meet wind load requirements, impact resistant

Table 19. Components for 3,000 square foot House (Two Story), Seaward (Continued)

Subsystem	Size	Current Code	New Code
Shear Transfer Plates	160 lf	Not required	Required to provide the shear capacity equivalent to the panel sheathing tables
Floor Straps	160 lf	Not required due to sheathing of entire house	Required to provide anchorage in accordance with tables
Floor Diaphragm	1500 sf	No specifications given, installed as for new code without the blocking	Joist spacing 24" o.c., floor sheathing thickness 19/32", fastened with 10d common nails 6-12, 2x4 blocking for first 4 ft at each end of the shear wall and spaced 4 ft o.c. beneath the floor sheathing panel edges

Table 20. Quantities for Selected Houses, Inland

Subsystem	Units	1000 sf	1664 sf	2040 sf	3000 sf*
Dimensions		25 x 40	32 x 52	34 x 60	30 x 50
Foundation-Footings	lf	130	168	188	160
Foundation-Slab	sf of fp	1000	1664	2040	1500
Wall Framing	sf framing	1040	1344	1504	2560
Anchor Bolts	anchor bolt	30, 44**	38, 52**	44, 60**	48, 58**
Top Plate Splices	nail	88, 240**	100, 368**	128, 664**	100, 368**
Lateral Bracing	lf	90.64,48**	113.3, 64**	113.3, 80**	320, 192**
Roof Framing	sf of fp	1000	1664	2040	1500
Anchorages	lf	130	168	188	160
Holddowns	holddown	20	20	20	56
Roof Decking	sf of fp	1000	1664	2040	1500
Roof Covering	sf of fp	1000	1664	2040	1500
Doors	door	2	2	2	2
Doors, Impact Resistant	door	2	2	2	2
Windows	windows	6	10	12	20
Windows, Impact Resistant	windows	6	10	12	20
Door Protection	door	2	2	2	2
Window Protection	window	6	10	12	20
Garage Doors	door	0	1	2	2
Shear Transfer Plates	lf	---	---	---	160
Floor Straps	lf	---	---	---	160
Floor Diaphragm	sf of fp	---	---	---	1500

*Two story.
**First number is for the Current Code, second number is for the New Code.

Table 21. Quantities for Selected Houses, Seaward

Subsystem	Units	1000 sf	1664 sf	2040 sf	3000 sf*
Dimensions		25 x 40	32 x 52	34 x 60	30 x 50
Foundation-Footings	lf	130	168	188	160
Foundation-Slab	sf of fp	1000	1664	2040	1500
Wall Framing	sf framing	1040	1344	1504	2560
Anchor Bolts	anchor bolt	30, 50**	38, 60**	44, 66**	48, 64**
Top Plate Splices	nail	88, 240**	100, 418**	128, 784**	100, 418**
Lateral Bracing	lf	90.64, 48**	113.3, 80**	113.3, 96**	320, 240**
Roof Framing	sf of fp	1000	1664	2040	1500
Anchorages	lf	130	168	188	160
Holddowns	holddown	20	20	20	60
Roof Decking	sf of fp	1000	1664	2040	1500
Roof Covering	sf of fp	1000	1664	2040	1500
Doors	door	2	2	2	2
Doors, Impact Resistant	door	2	2	2	2
Windows	windows	6	10	12	20
Windows, Impact Resistant	windows	6	10	12	20
Door Protection	door	2	2	2	2
Window Protection	window	6	10	12	20
Garage Doors	door	0	1	2	2
Shear Transfer Plates	lf	---	---	---	160
Floor Straps	lf	---	---	---	160
Floor Diaphragm	sf of fp	---	---	---	1500

*Two story.
**First number is for the Current Code, second number is for the New Code.

Table 22. Cost of Implementing the New Code per Subsystem for 1,000 square foot House, Inland

		Galveston		Corpus Christi	
Subsystem	Units	Current	New	Current	New
Foundation-Footings	lf	$763.10	$653.90	$746.20	$631.80
Foundation-Slab	sf of fp	940.00	1,040.00	1,040.00	1,140.00
Wall Framing	sf framing	509.60	582.40	540.80	624.00
Anchor Bolts	anchor bolt	43.20	114.40	40.20	83.16
Top Plate Splices	nail	2.64	7.20	2.64	7.20
Lateral Bracing	lf	29.91	100.32	30.82	96.48
Roof Framing	sf of fp	1,040.00	1,330.00	1,050.00	1,470.00
Anchorage	lf	104.00	232.70	105.30	258.70
Holddowns	holddown		303.80		385.80
Roof Decking	sf of fp	970.00	1,070.00	930.00	1,030.00
Blocking	sf of fp				
Roof Covering	sf of fp	470.00	760.00	440.00	730.00
Doors	door	205.10	205.10	204.14	204.14
Doors, Impact Resistant	door				
Windows	window	2,649.42	2,649.42	2,647.32	2,647.32
Windows, Impact Resistant	window				
Door Protection	door				
Window Protection	window				
Garage Doors	door				
Total		$7,726.97	$9,049.24	$7,777.42	$9,308.60

Table 23. Cost of Implementing the New Code per Subsystem for 1,000 square foot House, Seaward

		Galveston		Corpus Christi	
Subsystem	Units	Current	New*	Current	New*
Foundation-Footings	lf	$763.10	$653.90	$746.20	$631.80
Foundation-Slab	sf of fp	940.00	1,040.00	1,040.00	1,140.00
Wall Framing	sf framing	509.60	582.40	540.80	624.00
Anchor Bolts	anchor bolt	67.80	130.00	64.80	94.50
Top Plate Splices	nail	2.64	7.20	2.64	7.20
Lateral Bracing	lf	29.91	100.80	30.82	96.96
Roof Framing	sf of fp	1,300.00	1,370.00	1,430.00	1,500.00
Anchorage	lf	104.00	262.60	105.30	289.90
Holddowns	holddown		324.80		393.40
Roof Decking	sf of fp	1,150.00	1,060.00	1,150.00	1,020.00
Blocking	sf of fp				
Roof Covering	sf of fp	470.00	760.00	440.00	730.00
Doors	door	205.10	205.10	204.14	204.14
Doors, Impact Resistant	door		551.10		550.14
Windows	window	2,649.42	2,649.42	2,647.32	2,647.32
Windows, Impact Resistant	window		3,069.42		3,067.32
Door Protection	door		155.62		157.38
Window Protection	window		411.66		416.76
Garage Doors	door				
Total		$8,191.57	$9,713.50*	$8,402.02	$9,953.36*

*Total reflects increase in cost New Code with door and window protection.

Table 24. Cost of Implementing the New Code per Subsystem for 1,664 square foot House, Inland

		Galveston		Corpus Christi	
Subsystem	Units	Current	New	Current	New
Foundation-Footings	lf	$986.16	$845.04	$964.32	$816.48
Foundation-Slab	sf of fp	1,564.16	1,730.56	1,730.56	1,896.96
Wall Framing	sf framing	658.56	752.64	698.88	806.40
Anchor Bolts	anchor bolt	54.72	135.20	50.92	98.28
Top Plate Splices	nail	3.00	11.04	3.00	11.04
Lateral Bracing	lf	46.45	177.92	47.59	171.52
Roof Framing	sf of fp	1,730.56	2,213.12	1,747.20	2,446.08
Anchorage	lf	134.40	329.28	136.08	337.68
Holddowns	holddown		303.80		385.80
Roof Decking	sf of fp	1,614.08	1,780.48	1,547.52	1,713.92
Blocking	sf of fp				
Roof Covering	sf of fp	782.08	1,264.64	732.16	1,214.72
Doors	door	205.10	205.10	204.14	204.14
Doors, Impact Resistant	door				
Windows	window	2,666.00	2,666.00	2,662.50	2,662.50
Windows, Impact Resistant	window				
Door Protection	door				
Window Protection	window				
Garage Doors	door	350.33	350.33	348.47	348.47
Total		$10,795.60	$12,765.15	$10,873.34	$13,113.99

Table 25. Cost of Implementing the New Code per Subsystem for 1,664 square foot House, Seaward

		Galveston		Corpus Christi	
Subsystem	Units	Current	New*	Current	New*
Foundation-Footings	lf	$986.16	$845.04	$964.32	$816.48
Foundation-Slab	sf of fp	1,564.16	1,730.56	1,730.56	1,896.96
Wall Framing	sf framing	658.56	752.64	698.88	806.40
Anchor Bolts	anchor bolt	85.88	156.00	82.08	113.40
Top Plate Splices	nail	3.00	12.54	3.00	12.54
Lateral Bracing	lf	46.45	280.00	47.59	269.60
Roof Framing	sf of fp	2,163.20	2,279.68	2,379.52	2,496.00
Anchorage	lf	134.40	369.60	136.08	378.00
Holddowns	holddown		324.80		393.40
Roof Decking	sf of fp	1,913.60	1,763.84	1,913.60	1,697.28
Blocking	sf of fp		83.20		83.20
Roof Covering	sf of fp	782.08	1,264.64	732.16	1,214.72
Doors	door	205.10	205.10	204.14	204.14
Doors, Impact Resistant	door		551.10		550.14
Windows	window	2,666.00	2,666.00	2,662.50	2,662.50
Windows, Impact Resistant	window		3,086.00		3,082.50
Door Protection	door		159.84		161.60
Window Protection	window		628.20		635.90
Garage Doors	door	350.33	434.65	348.47	432.33
Total		$11,558.92	$13,956.33*	$11,902.90	$14,274.45*

*Total reflects cost for New Code with door and window protection.

Table 26. Cost of Implementing the New Code per Subsystem for 2,040 square foot House, Inland

		Galveston		Corpus Christi	
Subsystem	Units	Current	New	Current	New
Foundation-Footings	lf	$1,103.56	$945.64	$1,079.12	$913.68
Foundation-Slab	sf of fp	1,917.60	2,121.60	2,121.60	2,325.60
Wall Framing	sf framing	736.96	842.24	782.08	902.40
Anchor Bolts	anchor bolt	63.36	156.00	58.96	113.40
Top Plate Splices	nail	3.84	19.92	3.84	19.92
Lateral Bracing	lf	46.45	278.40	47.59	267.20
Roof Framing	sf of fp	2,121.60	2,713.20	2,142.00	2,998.80
Anchorage	lf	150.40	381.64	152.28	392.92
Holddowns	holddown		303.80		385.80
Roof Decking	sf of fp	1,978.80	2,182.80	1,897.20	2,101.20
Blocking	sf of fp		102.00		102.00
Roof Covering	sf of fp	958.80	1,550.40	897.60	1,489.20
Doors	door	205.10	205.10	204.14	204.14
Doors, Impact Resistant	door				
Windows	window	2,674.32	2,674.32	2,670.00	2,670.00
Windows, Impact Resistant	window				
Door Protection	door				
Window Protection	window				
Garage Doors	door	700.66	700.66	696.94	696.94
Total		$12,661.45	$15,177.73	$12,753.35	$15,583.20

Table 27. Cost of Implementing the New Code per Subsystem for 2,040 square foot House, Seaward

		Galveston		Corpus Christi	
Subsystem	Units	Current	New*	Current	New*
Foundation-Footings	lf	$1,103.56	$945.64	$1,079.12	$913.68
Foundation-Slab	sf of fp	1,917.60	2,121.60	2,121.60	2,325.60
Wall Framing	sf framing	736.96	842.24	782.08	902.40
Anchor Bolts	anchor bolt	99.44	156.00	95.04	113.40
Top Plate Splices	nail	3.84	19.92	3.84	19.92
Lateral Bracing	lf	46.45	336.00	47.59	323.20
Roof Framing	sf of fp	2,652.00	2,794.80	2,917.20	3,060.00
Anchorage	lf	150.40	426.76	152.28	438.04
Holddowns**	holddown		640.20		660.40
Roof Decking	sf of fp	2,346.00	2,162.40	2,346.00	2,080.80
Blocking	sf of fp		102.00		102.00
Roof Covering	sf of fp	958.80	1,550.40	897.60	1,489.20
Doors	door	205.10	205.10	204.14	204.14
Doors, Impact Resistant	door		551.10		550.14
Windows	window	2,674.32	2,674.32	2,670.00	2,670.00
Windows, Impact Resistant	window		3,094.32		3,090.00
Door Protection	door		159.84		161.60
Window Protection	window		710.28		719.40
Garage Doors	door	700.66	869.30	696.94	864.66
Total		$13,595.13	$16,716.80*	$14,013.43	$17,048.44*

*Total reflects increase in cost for New Code with door and window protection.
**Increased cost reflects the increased size of holddowns due to double shear wall in the New Code.

Table 28. Cost of Implementing the New Code per Subsystem for 3,000 square foot House (Two Story), Inland

		Galveston		Corpus Christi	
Subsystem	Units	Current	New	Current	New
Foundation-Footings	lf	$1,152.00	$964.80	$1,126.40	$968.00
Foundation-Slab	sf of fp	1,410.00	1,560.00	1,560.00	1,710.00
Wall Framing	sf framing	1,254.40	1,433.60	1,331.20	1,536.00
Anchor Bolts	anchor bolt	69.12	150.80	64.32	109.62
Top Plate Splices	nail	3.00	11.04	3.00	11.04
Lateral Bracing	lf	1,660.80	1,603.20	1,596.80	1,541.76
Roof Framing	sf of fp	1,560.00	2,775.00	1,575.00	3,120.00
Anchorage	lf	128.00	368.00*	129.60	368.00*
Holddowns**	holddown		1,321.04		1,475.60
Roof Decking	sf of fp	1,455.00	1,605.00	1,395.00	1,545.00
Blocking	sf of fp				
Roof Covering	sf of fp	705.00	1,140.00	660.00	1,095.00
Doors	door	205.10	205.10	204.14	204.14
Doors, IR	door				
Windows	window	6,457.60	6,457.60	6,450.40	6,450.40
Windows, IR	window				
Door Protection	door				
Window Prot.	window				
Garage Doors	door	700.66	700.66	696.94	696.94
Shear Transfer Plates	lf		113.60		105.60
Floor Straps	lf		249.60		254.40
Floor Diaphragm	sf of fp		75.00		75.00
Total		$16,760.68	$20,734.04	$16,792.80	$21,266.50

*Increased cost for anchorages reflects the increase in lateral and uplift loads for a two story house for the New Code.

**Increased cost reflects the increased size of holddowns due to double shear wall in the New Code.

Table 29. Cost of Implementing the New Code per Subsystem for 3,000 square foot House (Two Story), Seaward

		Galveston		Corpus Christi	
Subsystem	Units	Current	New*	Current	New*
Foundation-Footings	lf	$1,152.00	$964.80	$1,126.40	$968.00
Foundation-Slab	sf of fp	1,410.00	1,560.00	1,560.00	1,710.00
Wall Framing	sf framing	1,254.40	1,433.60	1,331.20	1,536.00
Anchor Bolts	anchor bolt	108.48	166.40	103.68	120.96
Top Plate Splices	nail	3.00	12.54	3.00	12.54
Lateral Bracing	lf	1,660.80	2,520.00	1,596.80	2,426.40
Roof Framing	sf of fp	1,950.00	2,775.00	2,145.00	3,120.00
Anchorage	lf	128.00	614.40**	129.60	614.40**
Holddowns***	holddown		1,945.80		2,026.80
Roof Decking	sf of fp	1,725.00	1,590.00	1,725.00	1,530.00
Blocking	sf of fp				
Roof Covering	sf of fp	705.00	1,140.00	660.00	1,095.00
Doors	door	205.10	205.10	204.14	204.14
Doors, IR	door		551.10		550.14
Windows	window	6,457.60	6,457.60	6,450.40	6,450.40
Windows, IR	window		7,477.60		7,470.40
Door Protection	door		159.84		161.60
Window Prot.	window		1,038.40		1,053.60
Garage Doors	door	700.66	869.30	696.94	864.66
Shear Transfer Plates	lf		113.60		105.60
Floor Straps	lf		249.60		254.40
Floor Diaphragm	sf of fp		75.00		75.00
Total		$17,460.04	$23,890.98*	$17,732.16	$24,329.50*

*Total reflects increase in cost for New Code with door and window protection.
**Increased cost for anchorages reflects the increase in lateral and uplift loads of a two story house for the New Code.
***Increased cost reflects the increased size of holddowns due to double shear wall in the New Code.

Table 30. Price Difference Excluding Overhead and Profit Between Current Code and New Code

Location and Area	1,000 sf	1,664 sf	2,040 sf	3,000 sf*
Inland, Galveston	$1,322.27	$1,969.55	$2,516.27	$3,973.36
Inland, Corpus Christi	1,531.18	2,240.65	2,829.85	4473.70
Seaward, Galveston, Window and Door Protection	1,521.93	2,397.41	3,121.67	6,430.94
Seaward, Corpus Christ, Window and Door Protection	1,551.34	2,371.55	3,035.01	6,597.34
Seaward, Galveston, Impact Resistant Doors and Windows	1,720.65	2,375.37	3,017.55	6,598.70
Seaward, Corpus Christi, Impact Resistant Doors and Windows	1,743.20	2,340.05	2,920.01	6,748.14

*Two story.

Table 31. Price Difference Including Overhead and Profit Between Current Code and New Code (30% increase for Overhead and Profit)

Location and Area	1,000 sf	1,664 sf	2,040 sf	3,000 sf*
Inland, Galveston	$1,718.95	$2,560.41	$3,217.15	$5,165.37
Inland, Corpus Christi	1,990.54	2,912.85	3,678.81	5,815.81
Seaward, Galveston, Window and Door Protection	1,978.51	3,116.63	4,058.17	8,360.22
Seaward, Corpus Christi, Window and Door Protection	2,016.75	3,083.02	3,945.52	8,576.54
Seaward, Galveston, Impact Resistant Doors and Windows	2,236.84	3,087.98	3,922.81	8,578.31
Seaward, Corpus Christi, Impact Resistant Doors and Windows	2,266.16	3,042.07	3,796.02	8,772.58

*Two story.

Table 32. Percent Cost to Implement New Code, Inland, Galveston

	square feet			
Cost/sf	1,000	1,664	2,040	3,000*
$60	2.86	2.56	2.67	2.87
75	2.29	2.05	2.14	2.29
85	2.02	1.81	1.89	2.02
100	1.72	1.54	1.60	1.72

*Two story.

Table 33. Percent Cost to Implement New Code, Inland, Corpus Christi

	square feet			
Cost/sf	1,000	1,664	2,040	3,000*
$60	3.32	2.92	3.01	3.23
75	2.65	2.33	2.40	2.58
85	2.34	2.06	2.12	2.28
100	1.99	1.75	1.80	1.94

*Two story.

Table 34. Percent Cost to Implement New Code, Seaward*, Galveston

	square feet			
Cost/sf	1,000	1,664	2,040	3,000**
$60	3.29	3.12	3.32	4.64
75	2.64	2.50	2.65	3.72
85	2.33	2.20	2.34	3.28
100	1.98	1.87	2.00	2.79

*Value is for house with door and window protection.
**Two story.

Table 35. Percent Cost to Implement New Code, Seaward*, Corpus Christi

	square feet			
Cost/sf	1,000	1,664	2,040	3,000**
$60	3.36	3.09	3.22	4.76
75	2.69	2.47	2.58	3.81
85	2.37	2.18	2.28	3.36
100	2.02	1.85	1.93	2.86

*Value is for house with door and window protection.
*Two story.

APPENDIX A

INTERVIEW FORM FOR BUILDING CONTRACTORS

APPENDIX A

INTERVIEW FORM FOR BUILDING CONTRACTORS

Company: _____

Interviewee: _____

Interviewer: _____

1. What is an "average" sized one-story house? _____

2. What is an "average" sized two-story house? _____

3. What is the typical make-up of a framing/carpentry crew? _____
   Carpenter makes $_____/hr
   Laborer makes $ _____/hr

4. What is the typical make-up of a roofing crew?
   Roofer makes $_____/hr
   Laborer makes $_____/hr

5. What is the typical make-up of a foundation crew?
   _____ makes $_____/hr
   Laborer makes $ _____/hr

6. What is the typical make-up of a masonry crew?
   Mason makes $_____/hr
   Laborer makes $_____ /hr

7. Would the carpentry crew differ for installing windows, doors, and or hurricane clips and holddowns? If so, what is the typical make-up of the crew and the wages per hour?

   _____
   _____
   _____

8. **FOUNDATIONS:**

   A. **Old Code**: only specification was for interior load bearing walls to be anchored in an approved manner.

1. Anchor minimum of first 10 ft of load bearing interior walls with power-actuated fasteners every 2 ft (fasteners with .170"-.177" shank diameter). A load bearing wall is any wall perpendicular to the exterior wall and longer than 6 ft.
2. Anchor bolts minimum 1/2" diameter 6 ft o.c. and within 18" of ends or joints.
3. Anchor the first 10 ft of any interior wall perpendicular to the exterior wall.

B. **New Code: Footings** Exterior one story 16" H 12" W
Interior one story 8" H 12" W

1. Interior footing beneath every interior shear wall or load bearing wall.
2. Minimum 3" cover provided around all rebar.
3. Interior walls subject to uplift fastened to the slab to provide amount of anchorage required to resist uplift from rafter braces or trusses.
4. Bolts provided at wall corners in a location that will permit holddowns.
5. Minimum slab thickness 4".
6. Anchor bolts minimum 5/8" diameter, minimum 6" into footing, 2x2x1/8" square washers, spaced 4 ft o.c. roof slope ≤ 7:12 4 ft, > 7:12 3 ft Inland; roof slope ≤ 7:12 3.5 ft, > 7:12 2.5 ft Seaward.
7. Anchor bolts required on the interior footings supporting shear walls and walls subject to uplift.
8. Holddowns are required at each corner and at each end of the shear walls.

QUESTIONS ON FOUNDATIONS:

9. How long does it currently take to lay the foundation for a 750 sf house? _____ _____ Does this include using reinforcement? _____ What would the crew size and makeup be? _____

10. How much longer, if any, will it take to lay the foundation with larger footings and rebar added? _____

11. How much longer, if any, will it take to anchor exterior walls with the decreased spacing? _____

12. How much time will be saved, if any, by decreasing the anchorages on interior walls? (interior load bearing walls are no longer defined so only truly load bearing walls will have to be anchored in an approved manner.) _____

13. What type of anchorages would you use and how far apart would then be spaced? Non-load bearing and non-interior shear walls may be spaced 24" o.c.? _____ _____

14. Would there need to be any changes in the crew size? _____

15. Two story houses require 16" H and 16" W exterior footings and 8" H and 16" W interior footings and anchor bolts ever 3.5 ft for roof slopes ≤7:12 and 2 ft for roof slopes > 7:12. What would be the effects on crew size and time? _____
_____

16. **FRAMING**

A. **Old Code:**
1. 2x4 studs, 16" o.c.
2. At the corners 2 studs on one side and one on the other.
3. Header size based on size of opening: less than 3 ft requires no header anchorage if the king studs on each side are clipped to the sole plate and the top plate. Headers > 3 ft require clipping of King studs on each side of header, clipping of every other cripple to header and to top plate (or clipping of header to top plate).
4. Interior load bearing walls require corner bracing.

B. **New Code:**
1. 2x4 studs, 16" o.c.
2. At the corners 3 studs on the side which will have the holddown, one stud on the other.
3. Header size based on size of header, building width, and load supported by the header. Anchorages required regardless of header size.
4. Interior walls do not require corner bracing or anchors unless they are shear walls. Studs may be placed 24" o.c.
5. End joints that directly support the roof must be spaced a minimum of 4 ft apart within the middle 1/2 of the wall. Outside the middle 1/2 of the wall 2 ft apart.
6. Double top plate must overlap at corners and intersections with load bearing partitions.
7. Splice locations and amount of nails is specified. (Differ between inland and seaward).
8. Corner bracing is no longer allowed (to be discussed later) but double studs must be placed at the end of each shear wall (at a minimum the first 3 ft of each corner).

QUESTIONS ON FRAMING:

17. How long does it currently take do the exterior framing on a 750 sf house? _____
_____ What would the crew size be? _____

18. How much longer, if any, will it take to add the extra studs? _____

19. How much longer, if any, will it change the splices on the top plate? _____

20. Will changing the size of the headers require any more time? _____

21. Would there need to be any changes in the crew size? _____

22. How much time, if any, will be saved by the changing in the stud layout of interior walls? _____

23. How long does it currently take to frame an 8 ft interior wall without any openings? _____

24. How much less time would it take with out the need to prepare for bracing? _____

WALL BRACING

A. **Old Code:**
   1. 1x4 diagonal let-in wall bracing required at each corner.
   2. Metal let-in bracing is acceptable Inland only.

B. **New Code:**
   1. Solid panel sheathing required for at least the first 3 ft at each outside corner.
   2. Total length of sheathing required depends on width of building and distance between shear walls. This may differ between inland and seaward.
   3. Sheathing must be solid with no more than a small opening of no more than one square foot.
   4. Double sided shear walls may be used.
   5. Nailing pattern dependent on width of building, distance between shear walls, thickness of paneling and size of nails can be 6/12, 4/12 or 3/12.

QUESTIONS ON BRACING:

25. How long does it currently take to do the 1x4 let-in bracing for a 750 sf house? _____ If 1x4 bracing not used what method do you use and how long does it take? _____

26. How long will it take to install the shear walls with a 6/12 nailing pattern? _____ _____ 4/12? _____ 3/12? _____

27. What size crew do you currently use? _____ Will the crew size change? _____

ROOF FRAMING

A. **Old Code:**
   1. Sized and space for 31.25 psf uplift inland and 43.75 psf seaward.
   2. If span not meet at least every third rafter tied to joists or partitions directly below with a 1x6 or equivalent at midpoint of rafters 20 ft(16 ft) or less in length, or at third points of rafters > 20 ft (16 ft).
   3. Braces installed to resist uplift.
   4. Spaced maximum 24" o.c. and 2x6 minimum size, ridge beams at least one nominal size larger than rafters.
   5. No blocking required.
   6. Rafters on windward side of roofs with slopes > 30° sized and spaced to withstand inward force of 25 (35) psf.
   7. At eaves and overhangs size and space to resist 50 (70) psf uplift wind load if < 30 ft high.
   8. 1x6 collar beams or equivalent installed between every other pair of rafters.
   9. Each ceiling joist used to brace a rafter shall be anchored against uplift at each end. This may be accomplished by nailing in shear to a rafter which is fastened to the top plate with a framing anchor, or fastening the ceiling joist directly to the top plate with a framing anchor.
   10. When a strongback and/or purlin system is used:
      a. Purlins and strongbacks or ceiling joists tied together minimum 1x4 (1x6) or equivalent.
      b. Rafters, purlins, ties, strongbacks, ceiling joists, and load-bearing walls shall be anchored against uplift at a minimum spacing of every third rafter.
      c. Ceiling joists shall be anchored to a load-bearing wall or nailed in shear to rafters at both ends.

B. **New Code:**
   1. Rafters sized and spaced for loads as specified or per tables.
   2. If braces are used to reduce the effective span must brace every rafter.
   3. Anchorage must be provided as specified for the rafter to plate connections (to be discussed later).
   4. Valley and hip rafters have a minimum nominal thickness of 2" and a depth no less than the cut end of the rafters.
   5. Cathedral ceilings specified (to be discussed later).

6. Minimal nominal 2x4 blocking between rafters beneath all roof sheathing panel edges 4 ft o.c.
7. Rafters to be placed directly opposite each other.
8. Minimum 1x6 or 2x4 collar beams or equivalent installed between every other pair of rafters.
9. Span of rafters dependent on size of member, spacing of rafters, grade of stud, slope of roof, and number of stories.
10. Collar to rafter connections now require 3-16d or 4-12d nails.

QUESTIONS ON ROOF FRAMING

28. How long does it currently take to frame a 750 fp hip roof? _____ _____ What size crew would you use? _____

29. What will be the increase in time, if any, due to the changing in size of members, blocking being required (on larger homes), and bracing being required if effective span is decreased? _____

30. What is the time difference between framing hip roofs, gable roofs and other types of commonly used roofs? _____ _____ _____

ANCHORAGES:

A. **Old Code:**
1. Anchor every other stud to sole plate.
2. Anchor every other stud to double top plate or to rafter above (same stud as anchored to sole plate).
3. Anchor every other rafter to double top plate or to stud below.
4. All anchorage for minimum 300# uplift resistance.
5. If width of opening > 3 ft anchor every other cripple to double top plate and to header or anchor header to double top plate.
6. Anchor king stud on each side to double top plate and to sole plate (if king studs are not anchored on openings < 3 ft then every other cripple must be anchored.
7. Walls which are used to brace rafters which would be overspanned without the braces are classified as load bearing walls. Where rafter braces are tied to interior load bearing walls, the stud on each side of the brace shall be anchored to the top plate and to the sole plate with a framing anchor as specified above.
8. Each ceiling joist which is used to brace a rafter shall be anchored against uplift (unless strongback and/or purlin tie system used).

B. **New Code:**

1. Anchor every stud to double top plate.
2. Anchor every rafter to double top plate.
3. Anchor every stud to sole plate.
4. Anchor every cripple to double top plate or anchor header to top plate 16" o.c.
5. Anchor one king stud on each side of header to sole plate and to doubled top plate.
6. Anchorage rating depends on building width, roof slope and number of stories.
7. Anchor each end of header to trimmer stud and trimmer stud to sole plate.
8. Anchorage required for header is dependent on building width, width of opening, and number of stories.
9. Anchorage shall be provided at every stud between floors and is based on building width, roof slope and number of stories.
10. Must be installed per manufacturers recommendations.

QUESTIONS ON ANCHORAGES:

31. How long does it take currently to anchor a 750 sf house? _____ _____ What is the crew size? _____ Do you install the nails with a gun or by hand? _____ If by hand do you anticipate purchasing one of the new guns? _____ If so, what do you anticipate the saving in labor will be? _____

32. How long do you anticipate the new anchorages will take to install? _____ _____ Would you change the crew size? _____

HOLDDOWNS:

A. **Old Code:** None required

B. **New Code:**

1. At each corner and the ends of exterior and interior shear walls.
2. Capacity is dependent on the sheathing thickness, nail size for sheathing, and nailing pattern for sheathing. Must be fastened to the double studs and to other construction in accordance with manufacturer's recommendations.

QUESTIONS ON HOLDDOWNS:

33. How much time do you anticipate it taking to install a holddown? Minimum _____ _____ Maximum _____ What crew size and type would you use? _____

ROOF DECKING:

A. **Old Code:**
   1. Sheathing panels or 1" board decking may be used.
   2. Sheathing panels minimum 24/16 span, Inland; 5/8" minimum with veneer Seaward. If OSB is used Seaward the minimum is a 40/20 span.
   3. Support spacing 24" o.c. maximum
   4. Staples allowed (Inland).

B. **New Code:**
   1. Sheathing panel size dependent on building width, nailing pattern, nail size, roof slope, and required blocking.
   2. Board decking not allowed.
   3. Panel span 32/16.
   4. Nailing patterns are: inland: 4" o.c. at the dia. boundary (e.g., the boundary of the roof diaphragm, either at the exterior or interior shear walls, gable trusses and gable rafters), and 6" o.c. at the panel edges or seaward: 4" o.c. at the diameter boundary 12" o.c. on panel edges. Nails my be spaced a maximum of 12" o.c. along the interior rafters in inland and seaward.
   5. Staples not allowed.

QUESTIONS ON ROOF DECKING:

34. How long does it currently take to deck a 750 fp hip roof? _____ _____ What size crew would you use? _____

35. What time change, if any, would the code changes make? _____ _____ Would you change the makeup of the crew? _____ _____

ROOF COVERING:

UNDERLAYMENT:

A. **Old Code:**
   1. ≥ 4:12 slope 1 layer of 15# felt.
   2. < 4:12 slope 2 layers of 15# felt.
   3. Fasteners for felt and spacing of fasteners not specified.
   4. Staples allowed.
   5. If two layers of felt used felt is to be overlapped 18-19" along top and bottom and 4" along end.
   6. Overlap felt 2" top and bottom and 4" along end if one layer used.

7. Fasten with enough nails or staples to hold in place until shingles applied.

B. **New Code:**
1. ≥ 4:12 slope 1 layer of 30# felt.
2. < 4:12 slope 2 layers of 30# felt.
3. Felt fasteners must have 1.5" diameter caps and approved fasteners.
4. Nailing pattern is one row at 9" o.c., 2 rows staggered, spaced 18" o.c. and 9" o.c. at ridges & eaves.
5. Staples not allowed.
6. Minimum extra layer of felt in valleys.
7. Same specifications for overlapping of felt.

QUESTIONS ON UNDERLAYMENT:

36. Do you usually install underlayment by hand or by gun? _____
Do you anticipate changing this if the new code is enacted?

37. How long does it currently take to do the underlayment on a 750 fp house? _____
_____ Size of crew? _____

38. How much longer would you anticipate the changes will take? _____
_____ Any change in crew size? _____

COMPOSITION SHINGLES:

A. **Old Code:**
1. 4 Nails/shingle; follow manufacture's specs. for high wind shingle installation.
2. Staples allowed inland.

B. **New Code:**
1. Detailed installation instructions provided.
2. Only "Wind Resistant" shingles allowed.
3. Minimum length of nails 1-1/4".
4. Nails must be located on the correct fastener line.
5. Nails placed back 2-3" from rake.
6. Starter course requirements specified.
7. The starter and first course of shingles must be sealed with asphalt plastic cement. Sealing of gable ends also required.
8. If the cut valley method is used in the valley shingle layers must be sealed using asphalt plastic cement.
9. Maximum overhang for shingles 3/8" (Range 1/4" to 3/8").
10. No staples allowed.

QUESTIONS ON COMPOSITION SHINGLES:

39. How long does it currently take to lay shingles on a 750 fp house? _____ _____ What is the crew size and makeup? _____ _____

40. How much longer do you think the new nailing pattern will require? _____ _____ Sealing with the asphalt plastic cement? _____ _____ Would you change the crew size and makeup? _____ _____

SIDING: NO CHANGES

MASONRY:

A. **Old Code:**
   1. Brick ties nailed to every stud 16" o.c. vertically inland, and 12" o.c. to every stud seaward.
   2. Ties are to be a minimum 22 gauge corrugated sheet metal, minimum number 6 gauge wire, with a minimum of 2 inch hook embedded in mortar or other equivalent fastener.
   3. Mortar shall be placed on sheet metal ties.
   4. Staples may be substituted for nails on the wall sheathing (Inland only).

B. **New Code:**
   1. Brick ties to be spaced 16" o.c. vertically on each stud both inland and seaward.
   2. Ties are to be a minimum 22 gauge, 7/8" wide and 6 inch long corrugated sheet metal; minimum number 6 gauge wire with a minimum 2 inch hook embedded in mortar or other equivalent fastener.
   3. Type S mortar shall be used.
   4. Ties to be embedded minimum of 2 inches into bed joints of the veneer.
   5. Ties to be nailed as specified depending on type of lumber and type of sheathing used.

QUESTIONS ON MASONRY:

41. How long does it currently take to apply the brick veneer to a 750 sf house? _____ _____ What crew size and makeup would you use? _____ _____ Do you usually install brick veneer ties by hand or by gun? _____ _____

42. How much longer, if any do you anticipate the new code would take? _____ _____ Would you change the crew size or makeup? _____ _____

DOORS:

43. How long does it currently take for you to install a standard size door? _____ _____ Double doors? _____ Sliding glass doors? _____ _____ French doors? _____ Storm doors? _____

WINDOWS:

44. How long does it currently take you to install a double hung window? _____ _____ A single hung window? _____ Windows of larger sizes? _____ _____ _____

45. The current code specifies that windows are to be nailed with 4d nails at 12" o.c. The manufacturers will be specifying the new standards for their windows personally. How much increase in time might be required? How closely could a window be nailed? _____ ___

WINDOW PROTECTION:

A. **Old Code:**
   1. None

B. **New Code:**
   1. Applies to seaward only.
   2. Glazed openings must be protected with impact resistant glazing or
   3. Where glazing is not impact resistant it may be protected by permanently mounted approved shutters or other impact resistant devices. At a minimum protection shall consist of property designed wood structural-use panels, cut to fit in place and with anchoring devices included.

QUESTIONS ON WINDOW PROTECTION:

46. How long would it take to make the structural-use panels? _____ ___ What size and makeup of crew would you use? _____ _____

GABLE END WALLS

A. **Old Code:**

1. At gable ends at least every other gable stud shall be attached to the doubled top plate and the rafter with a framing anchor.

B. **New Code:**

1. Balloon framing should be used for all gable endwalls.
2. Balloon framing should be used on all gable endwalls which are not supported by ceiling framing, such as rooms with cathedral ceilings.
3. The full height of each stud shall be used (generally the stud table requires a #2 yellow pine or douglas fir 2x6 12" o.c. for a 16 ft stud).
4. Gable endwalls in which the studs do not extend completely from the sole plate to the roof line shall be supported laterally at the ceiling level.
5. Gable endwall support shall be accomplished by providing 2x4 braces having a minimum length of 8 ft, spaced a maximum of 6 ft o.c. Braces shall be installed directly over an endwall stud.
6. Gable braces shall be nailed to each ceiling joist they cross with a minimum of 2-10d nails.
7. Gable braces shall have a 2x4 block nailed to them to fit in the space between the last ceiling joist and the endwall. The block shall be nailed to the brace with a minimum of 4-10d nails.
8. The gable brace shall be nailed to the gable truss or an added framing member the thickness of the ceiling joists with a minimum of 2-10d nails.
9. A galvanized steel strap having a minimum thickness of 20 gauge shall be applied from the top of the brace to the top of the exterior of the gable wall stud. The strap shall be nailed to the brace and the stud with a minimum of 10-8d nails each (total of 20). If studs are 16" o.c. and braces are 64" o.c., each connection requires 9-8d nails.

QUESTIONS ON GABLE END WALLS:

47. How long does it take to frame and anchor a gable end wall under the current code? _____ Size and make up of crew? _____
_____

48. How long will it take to frame and anchor a gable end wall under the new code? _____ Any change in size or crew make-up? _____
_____

FLOOR DIAPHRAGMS:

A. **Old Code:** not discussed

B. **New Code:**

1. Floor joist spacing shall be a maximum of 24" o.c.
2. Floor sheathing shall have a minimum thickness of 19/32".
3. Floor sheathing shall be fastened with 10d common nails at 6" o.c. along panel edges and 12" o.c. along intermediate framing.
4. Nominal 2x4 blocking shall be provided perpendicular to the floor joists for the first 4 ft at the end of each shear wall and shall be spaced at 4 ft o.c., located beneath the floor sheathing panel edges.
5. For second and third story floor diaphragms with floor lengths between shear walls > 2.0 times their width, blocking is required along all panel edges and the sheathing shall be fastened with 10d common nails 4" o.c. along panel edges and 12" o.c. along intermediate framing.
6. For second and third story floor diaphragms with floor lengths between shear walls > 1.5 times their width, blocking shall be provided perpendicular to the floor joists at each end of the structure for a distance of 1/4 of the floor length. Floor sheathing shall be fastened with 10d common nails 4" o.c. along panel edges and 12" o.c. along intermediate framing.

QUESTIONS ON FLOOR DIAPHRAGMS:

49. How long does it take to install a floor diaphragm under the old code? _____ _____ Size and make-up of crew? _____ _____

50. How long will it take to install a floor diaphragm under the new code? _____ _____ Any change in size or make-up of crew? _____

CATHEDRAL CEILINGS:

A. **Old Code:** not discussed.

B. **New Code:**

1. Where there are no collar ties, the ridge beam or center beam must be designed to support the rafters. Rafters shall be fastened to the beam in such a manner as to provide one-half of the amount of anchorage required for the rafter to top plate connection. Anchorage shall be carried to the foundation.

QUESTIONS ON CATHEDRAL CEILINGS:

51. How long does it currently take to install a cathedral ceiling? _____ _____ Size and makeup of crew? _____

52. How long will it take to install a cathedral ceiling under the new code? _____ _____ Any change in size of make-up of crew? _____

TWO-STORY HOMES:

A. **Old Code:**

1. Continuous anchorage from the studs of the top floor through the sole plate, flooring, band joist or joist header, and doubled top plate, to the studs of the lower floor.
   a. Method 1: single floor tie anchor, rated for 1000# anchoring force, one to every fourth pair of studs. Normal framing anchors will then be installed at the top of the upper studs being anchored in this way and at the top and bottom of the second stud over from the stud being anchored in this way.
   b. Method 2: tie the floors together with a flat metal strap from stud across band joist or joist header. Minimum 500# anchorage, across every other pair of studs.
   c. Method 3: lag bolts to bolt the sole plate and top plate to the joist header or band joists. Minimum 3/8" (1/2") diameter and a minimum of 4" long where bolting through a sole plate and a minimum of 5" long when bolting through a doubled top plate. Spaced maximum of 2 ft o.c. and installed with minimum of 1" washer.
   d. Method 4: use sheets of plywood to tie the floors together. Walls completely sheathed in plywood with the sheets staggered such that alternate sheets extend a minimum of 18" above the sole plate of he upper wall and the adjacent sheet extend a minimum of 18" below the top plate of he lower wall. Minimum thickness of 15/32" and nailed to the framing with 8d nails spaced 4" o.c. along each stud within the first 18-20" from each plate, and along each plate, and nailed as for regular wall sheathing for the remainder of the wall.
2. Anchor the sole plate 4 ft o.c.
3. All of the above methods are in addition to the required nailing of the sole plate and top plate to the joist header or band joists using a minimum of 16d nails spaced 16" o.c.

B. **New Code:**

1. Shear transfer framing anchors shall provide the capacity equivalent to the panel sheathing requirements. The length of sheathing shall be multiplied by the APA plywood panel ratings to determine the amount of shear force along each wall.
2. For buildings with single sided shear walls, shear transfer plates may be omitted if the plywood sheathing is installed directly and vertically over the first story shear walls continuously up to the roof line.
3. Size of stud and stud spacing is determined by roof slope and grade of lumber, generally requires #2 Southern Pine or #2 Douglas Fir, 2x6, 12" o.c. for the stud to be 16 ft long.
4. Length of shear wall is determined by distance between shear walls, width of building, and slope of roof.
5. All other specifications for headers, trimmer studs, splice locations, size of rafters, and size of roof decking are dependent on the same factors as discussed above in their respective areas.
6. Footings Exterior Two Story 16" H 16" W
   Interior Two Story 8" H 16" W
7. Anchor bolts spacing roof slope ≤ 7:12 3.5 ft, roof slope > 7:12 2 ft, Inland; roof slope ≤ 7:12 3 ft, roof slope > 7:12 2 ft, Seaward.
8. Anchor interior load bearing walls roof slope ≤ 7:12 3.5 ft, roof slope > 7:12 2 ft.

TWO-STORY HOMES:

53. How long would it take to anchor a two-story home under the old code? _____ _____ Size and makeup of crew? _____ _____

54. How long would the changes in anchorages take? _____ _____ Addition of shear walls? _____ _____ Changing of studding to 12" o.c.? _____ _____ _____ The addition of shear transfer anchors? _____ _____ Increasing the size of the headers? _____ Would the other changes in time (e.g., roof framing, roof decking, roof covering) remain the same as for a single story home? _____

APPENDIX B

COMPARISON BETWEEN CURRENT AND NEW CODES

APPENDIX B

WOOD CONSTRUCTION CONTRAST

Current Inland	New Inland
Foundation	
• Not discussed	• Footings specified per Table 311.1A
• Not discussed	• Interior footing beneath every interior shear wall or load bearing wall
• Not discussed	• Minimum 3" cover provided around all rebar
• Interior load bearing walls shall be anchored in approved manner	• Interior walls subject to uplift shall be fastened to the slab to provide amount of anchorage required to resist uplift from rafter braces or trusses
	• Bolts provided at wall corners in a location that will permit the holddowns specified in Section 312.7.2 to be installed
• None specified	• Minimum thickness 4"
Wall Framing	
	• Studs selected per Tables 312.6.1A-F
• 2x4 studs 16" o.c.	• Same
• 1x4 diagonal let-in bracing	• Shear wall segment required - Tables 312.7.1A-L • Minimum length required • Studs doubled at each shear wall end
• Header size specified, Figure 17	• Header size depends upon building width, and load supported by header - Table 312.9A
• Based on width of opening, not size of header	• Based on length of header
• Header < 6.0 ft one trimmer stud @ each end • Header > 6.0 ft two trimmer studs @ each end	• Trimmer stud requirements per Table 312.9C

• Cripple studs 16" o.c. if header doesn't extend to top plate	• Same
• Studs capped by double top plate	• Same
• Double top plate So. Pine or Douglas Fir	• If directly supporting roof framing - Douglas Fir-Larch or So. Pine required
• Not discussed	• End joints that directly support roof spaced minimum 4 ft apart within the middle 1/2 of wall. Outside middle 1/2 minimum 2 ft apart.
• Joints in double top plate staggered	• Double top plate overlap at corners and intersections with load bearing partitions
• Splice locations and construction not specified	• Splice locations and construction specified - Table 312.6.3
• Sole plate exterior walls: pressure treated lumber or approved vapor barrier; Interior sole plates treated unless slab placed over vapor barrier	• Sole plate exterior walls: naturally durable or pressure treated So. Pine
• Not discussed	• Studs doubled at corner; additional studs added as needed to allow holddown to be bolted to two studs
• All interior walls perpendicular to exterior walls must be anchored for first 10 ft min and braced	• No bracing or anchorage required unless interior wall is a shear wall
• Interior load bearing walls require corner bracing	• No interior load bearing wall bracing required. Studs 24" o.c.
Roof Framing	
Rafters	
• Sized and spaced for 31.25 psf uplift wind load	• Sized and spaced for loads specified in Section 120 or 130
• Sized and spaced per Table p. 39	• Sized and spaced per Tables 312.3R1-6

• If span not met at least every third rafter tied to joists or partitions directly below with a 1x6 or equivalent at midpoint of rafters 20 ft or less in length, or at third points of rafters > 20 ft	• If braces used to reduce effective span: brace every rafter
• Braces shall form as close as possible to a 90° angle with the rafters.	• Not discussed
• Braces installed to resist uplift	• Provide the amount of anchorage specified for the rafter to plate connection
• Spaced max 24" o.c.	• Same
• Minimum size 2x6	• Same
• Ridge beams sized at least one nominal size larger than rafters	• Same
• Not discussed	• Valley and hip rafters have a minimum nominal thickness of 2" and a depth not less than the cut end of the rafters
• Not discussed	• Specifics for cathedral ceilings
• None required	• Minimum nominal 2x4 blocking between rafters beneath all roof sheathing panel edges 4 ft o.c. (Sec. 312.5)
• Rafters on windward side of roofs with slopes > 30° sized and spaced to withstand inward force of 25 psf	• Not discussed
• At eaves and overhangs size and space to resist 50 psf uplift wind load if < 30 ft high	• Not discussed
• Not discussed	• Rafters placed directly opposite each other
• Purlins and strongbacks or ceiling joists tied together min. 1x4 or equivalent	• Not allowed for reduction in span
• 1x6 collar beams or equivalent installed between every other pair of rafters	• Minimum 1x6 or 2x4 collar beams or equivalent installed between every other pair of rafters

Roof Decking

• Sheathing panels	• Sheathing panels per Tables 312.5RB1-2
• Board decking min. 1" thickness (boards 1x4 or 1x6)	• Board decking not allowed
• Sheathing panels min 24/16	• Panels min span rating 32/16
• Support spacing 24" o.c. maximum	• Same

Roofing

• < 4:12 slope; one layer 15 pound felt	• Minimum one layer 30 pound felt
• ≥ 4:12 two layers of 15 pound felt	• Two layers 30 pound felt
• Fastens for felt not specified	• Felt fasteners specified
• Staples allowed for felt	• No staples allowed for felt
• Not discussed	• Minimum extra layer of felt in Valleys
• Overlap felt 18-19" along top and bottom and 4" along end where 2 layers applied	• Same
• Follow manufactures spec. for high wind shingle installation	• Detailed installation instructions provided for shingle installation
• Not specified	• Only "Wind Resistant" shingles allowed
• Staples allowed for shingles	• No staples allowed for shingles
• Minimum length of nail not specified	• Minimum length of nails 1-1/4"
• Not discussed	• Nails located on the correct fastener line
• Not discussed	• Nails 2-3" back from rake
• Not discussed	• Starter course requirements specified for shingles
• Not discussed	• Seal starter course and first course of shingles with asphalt plastic cement
• Not discussed	• Seal shingles at gable ends with asphalt plastic cement
• Not discussed	• If cut valley method used in the valley shingle layers must be sealed using asphalt plastic cement

• Not discussed	• Maximum overhang for shingles 3/8" (Range 1/4-3/8)
• Staples allowed in drip edge	• No staples allowed in drip edge
Floor Diaphragms	
• Not discussed	• Floor sheathing wood structural-use panels
• Not discussed	• Minimum thickness of 19/32"
• Not discussed	• Floor joist spacing 24" o.c. or less when using the minimum thickness panel
• Not required	• Blocking required first 4 ft at each end and spaced 4 ft o.c. beneath the floor diaphragm panel edges
• Not required	• Blocking minimum nominal size of 2x4; nailed to floor joists with exceptions and additional requirements
Two story	
• Continuous anchorage from studs of top floor to studs of lower floor	• Two story specifications per Tables 312.6.1A-F (stud specifications), 312.7.1A-L (shear walls), 312.9A (headers), 312.9C (trimmer and king stud specifications), 312.6.3 (splice locations), 312.3R1-6 (rafters), 312.5RB1-2 (roof decking), & 312.8A-312.8B (between floors)
• Many types of anchorages approved	
Window Installation	
• Nailing pattern specified	• Manufacturer to specify nailing pattern

WOOD CONSTRUCTION CONTRAST

Current Seaward	New Seaward
Foundation	
• Not discussed	• Footings specified per Table 411.1A
• Not discussed	• Interior footing beneath every interior shear wall or load bearing wall
• Not discussed	• Minimum 3" cover provided around all rebar
• Interior load bearing walls shall be anchored in approved manner	• Interior walls subject to uplift shall be fastened to the slab to provide amount of anchorage required to resist uplift from rafter braces or trusses
	• Bolts provided at wall corners in a location that will permit the holddowns specified in Section 412.7.2 to be installed
• None specified	• Minimum thickness 4"
Wall Framing	
	• Studs selected per Tables 412.6.1A-F
• 2x4 studs 16" o.c.	• Same
• 1x4 diagonal let-in bracing	• Shear wall segment required - Tables 412.7.1A-L • Minimum length required • Studs doubled at each shear wall end
• Header size specified, Figure 46	• Header size depends upon building width, and load supported by header - Table 412.9A
• Based on width of opening, not length of header	• Based on length of header
• Header < 6.0 ft one trimmer stud @ each end • Header > 6.0 ft two trimmer studs @ each end	• Trimmer stud requirements per Table 412.9C
• Cripple studs 16" o.c. if header doesn't extend to top plate	• Same

• Studs capped by double top plate	• Same
• Double top plate So. Pine or Douglas Fir	• If directly supporting roof framing - Douglas Fir-Larch or So. Pine required
• Not discussed	• End joints that directly support roof spaced minimum 4 ft apart within the middle 1/2 of wall. Outside middle 1/2 minimum 2 ft apart.
• Joints in double top plate staggered	• Double top plate overlap at corners and intersections with load bearing partitions
• Splice locations and construction not specified	• Splice locations and construction specified - Table 412.6.3
• Sole plate exterior walls: pressure treated lumber. Interior sole plates treated unless slab placed over vapor barrier	• Sole Plate exterior walls: Naturally durable or pressure treated So. Pine
• Not discussed	• Studs doubled at corner; additional studs added as needed to allow holddown to be bolted to two studs
• All interior walls perpendicular to exterior walls must be anchored for first 10 ft min and braced	• No bracing or anchorage required unless interior wall is a shear wall
• Interior load bearing walls require corner bracing	• No interior load bearing wall bracing required. Studs 24" o.c.
Roof Framing	
Rafters	
• Sized and spaced for 43.75 psf uplift wind load	• Sized and spaced for loads specified in Section 120 or 130
• Sized and spaced per Table p. 104	• Sized and spaced per Tables 412.3R1-6
• If span not met at least every third rafter tied to joists or partitions directly below with a 1x6 or equivalent at midpoint of rafters 16 ft or less in length, or at third points of rafters > 16 ft	• If braces used to reduce effective span: brace every rafter

• Braces shall form as close as possible to a 90° angle with the rafters.	• Not discussed
• Braces installed to resist uplift	• Provide the amount of anchorage specified for the rafter to plate connection
• Spaced max 24" o.c.	• Same
• Minimum size 2x6	• Same
• Ridge beams sized at least one nominal size larger than rafters	• Same
• Not discussed	• Valley and hip rafters have a minimum nominal thickness of 2" and a depth not less than the cut end of the rafters
• Not discussed	• Specifics for cathedral ceilings
• None required	• Minimum nominal 2x4 blocking between rafters beneath all roof sheathing panel edges 4 ft o.c. (Sec. 412.5)
• Rafters on windward side of roofs with slopes > 30° sized and spaced to withstand inward force of 35 psf	• Not discussed
• At eaves and overhangs size and space to resist 70 psf uplift wind load if < 30 ft high	• Not discussed
• Not discussed	• Rafters placed directly opposite each other
• Purlins and strongbacks or ceiling joists tied together min. 1x4 or equivalent	• Not discussed
• 1x6 collar beams or equivalent installed between every other pair of rafters	• Minimum 1x6 or 2x4 collar beams or equivalent installed between every other pair of rafters
Roof Decking	
• Sheathing panels	• Sheathing panels per Tables 412.5RB1-2
• Board decking min. 1" thickness (boards 1x4 or 1x6)	• Board decking not allowed

• Sheathing panels min 5/8" thick plywood, non-veneer panels not acceptable 40/20 span	• Panels min span rating 32/16
• Support spacing 24" o.c. maximum	• Same
Roofing	
• ≥ 4:12 slope; one layer 15 pound felt	• Minimum one layer 30 pound felt
• < 4:12 two layers of 15 pound felt	• Two layers 30 pound felt
• Fastens for felt not specified	• Felt fasteners specified
• Staples allowed for felt	• No staples allowed for felt
• Not discussed	• Minimum extra layer of felt in Valleys
• Overlap felt 18-19" along top and bottom and 4" along end where 2 layers applied	• Not discussed
• Follow manufactures spec. for high wind shingle installation	• Detailed installation instructions provided for shingle installation
• Not specified	• Only "Wind Resistant" shingles allowed
• Minimum length of nail not specified	• Minimum length of nails 1-1/4"
• Not discussed	• Nails located on the correct fastener line
• Not discussed	• Nails 2-3" back from rake
• Not discussed	• Starter course requirements specified for shingles
• Not discussed	• Seal starter course and first course of shingles with asphalt plastic cement
• Not discussed	• Seal shingles at gable ends with asphalt plastic cement
• Not discussed	• If cut valley method used in the valley shingle layers must be sealed using asphalt plastic cement
• Not discussed	• Maximum overhang for shingles 3/8" (Range 1/4-3/8)

Floor Diaphragms

• Not discussed	• Floor sheathing wood structural-use panels
• Not discussed	• Minimum thickness of 19/32"
• Not discussed	• Floor joist spacing 24" o.c. or less when using the minimum thickness panel
• Not required	• Blocking required for length specified in Table 412.10 at each end and spaced 4 ft o.c. beneath the floor diaphragm panel edges
• Not required	• Blocking minimum nominal size of 2x4; nailed to floor joists with exceptions and additional requirements

Two story

• Continuous anchorage from studs of top floor to studs of lower floor	• Two story specifications per Tables 412.6.1A-F (stud specifications), 412.7.1A-L (shear walls), 412.9A (headers), 412.9C (trimmer and king stud specifications), 412.6.3 (splice locations), 412.3R1-6 (rafters), 412.5RB1-2 (roof decking), and 412.8A-412.8B (between floors)
• Many types of anchorages approved	

Window Installation

• Nailing pattern specified	• Manufacturer to specify nailing pattern

Window Protection

• Not discussed	• All glazed openings shall be either designed for impact in accordance with TDI Standard WG-93, or shall be protected in accordance with the following:

• Not discussed	• Glazing at a height ≤ 30 ft designed to resist the large missile impact test of TDI Standard WG-93. Must resist two impacts of a 2x4 stud grade So. Pine or Douglas Fir weighing 9 lbs at 50 ft/s (within 6 ft of the glazed opening) and withstand the pressures in accordance with Sec. 130 and Appendix E.
• Not discussed	• If glazing is not impact resistant must be protected with permanently mounted approved shutters or other impact resistive devices in accordance with Appendix E or be protected by properly designed wood structural-use panels, cut to fit in place and with anchoring devices included in accordance with Appendix E.

FASTENING SCHEDULE CONTRAST FOR FRAMING

New Code: All fasteners shall comply with Federal Specification FF-N-105B, and must meet proper ASTM standard for their intended use.

	Current Inland	New Inland
Anchor Bolts	1/2" @ 6 ft o.c. embedded min 6" into slab J or L hook 4 ft o.c. - 2 story	All ext. footings, & footings supporting int. shear walls Table 311.1B; Min. 5/8", embedded 6" into footing
Anchor Bolt Washer	1-3/8" dia. min 1/8" thick	2"x2"x1/8" ext. walls & int. walls subject to uplift loads; other int. walls std. size washers
Stud to-Sole Plate	2 - 16d	
Trimmer - Stud	5 - 16d	
Header Connectors-Trimmer	4 - 16d	
Sills - Trimmer	4 - 16d	
Cripples	2 - 16d	
Double Studs	4 - 16d	
Bracing	2 - 8d/Stud	
Double Top plate	16d/16" o.c.	
Top Plate to Stud Connection	2 - 16d	
Top plate, Lap and Interactions	4 - 16d	Table 312.6.3

FASTENING SCHEDULE CONTRAST FOR FRAMING

	Current Inland	New Inland
Top Plate-Rafter Connection	3 - 8d	3 - 8d
Rafter-Hip or Valley	3 - 8d	
Rafter-Ridge Board	3 - 12d	
Wall Sheathing		Tables 312.7.1A-L
Rafters - Parallel Ceiling	3 - 16d	
Collar Beams	2 - 12d	
Collar - Rafter (1x6) 2x4 or 2x6	3 - 8d 2 - 12d	3 - 12d
Ceiling Joists - Rafter	3 - 12d	3 - 16d or 4 - 12d
Ceiling Joists - Top Plate	3 - 16d	
Ceiling Joists - Partition	3 - 16d	3 - 16d or 4 - 12d
Ceiling Joists Tiebacks-Rafter		3 - 16d or 4 - 12d
Ceiling Joists Tiebacks-Ceiling Joists		2 - 10d
Splices @ Ridgeboard	10 - 8 d	
Steel Strap to Stud		10 - 8d
Sole plate & top plate to joist header or band joists (2 story)	16d - 16" o.c.	

FASTENING SCHEDULE CONTRAST FOR FRAMING

	Current Inland	New Inland
Floor Diaphragm Sheathing		10d - 6" o.c. edges, 12" o.c., intermediate framing
Floor Sheathing-Blocking		10d - per Section 312.10

FASTENING SCHEDULE CONTRAST FOR ROOFING

	Current Inland	New Inland
Shingles	4 - 11 or 12 gauge nails/shingle Location not specified or 6 - 16 gauge staples/ shingle	6 - 11 or 12 gauge nails/shingle Location Specified Not Allowed
Felt	1.5" diameter caps approved fasteners schedule not specified	1.5" diameter caps approved fasteners 1 row @ 9" o.c. 2 rows @ 18" o.c. staggered, spaced 18" apart 9" o.c. at ridges & eaves
Roof Decking	8d 6"o.c. edges, 12" o.c. interior Staples - Table pg. 75	Tables 312.5RB1-2 Not allowed
First course/starter course sealant, also valleys, gable ends, rake edges	None	Asphalt plastic cement

FASTENING SCHEDULE CONTRAST FOR CONNECTORS

	Current Inland	New Inland
Rafter-Top Plate	1 strap every 3rd Rafter nailing per manufacturer 300# uplift resistance	Table 312.8A
Stud - Top and Bottom Plate	1 strap every other stud nailing per manufacturer 300# uplift resistance	Table 312.8B
King Stud - Header	≤ 9 ft anchor stud @ @ end to sole plate & header	All headers: Table 312.8B, one full stud top & bottom @ end
King Stud - Header	> 9 ft anchor both studs @ @ end to sole plate & header	
Holddowns	None	Corners & ends of ext & int. shear walls capacity - Table 312.7.2
Shear Transfer Plates	Not specified	>1 story Section 312.7.3
Headers		Table 312.9B
Cripples - DTP - Header	1 strap every other rafter 4 - 16d 300# uplift resistance	Table 312.8B
Rafters (not nailed to ceiling joists)	Every 3rd rafter tied to joists	Every 3rd Rafter tied back
Bracing (Steel strap)		20g thickness

FASTENING SCHEDULE CONTRAST FOR CONNECTORS

	Current Inland	New Inland
Rafter - Interior Load Stud each side to DTP & sole plate; if over stud strap that stud only	1 strap every other rafter 4 - 16d 300# uplift resistance	Table 312.8A
Ceiling joist - Double Top Plate	1 strap every OR 4 - 16d 300# uplift resistance	Table 312.8A
Rafters, purlins, ties strongbacks, ceiling joists & Load bearing int. walls	1 strap every 3rd Rafter 4 - 16d 300# uplift resistance	Table 312.8A

FASTENING SCHEDULE CONTRAST FOR FRAMING

New Code: All fasteners shall comply with Federal Specification FF-N-105B, and must meet proper ASTM standard for their intended use.

	Current Seaward	New Seaward
Anchor Bolts	1/2" @ 6 ft o.c. embedded min 6" into slab J or L hook galvanized 4 ft o.c. - 2 story	All ext. footings, & footings supporting int. shear walls Table 411.1B; Min 5/8", embedded 6" into footing
Anchor Bolt Washer	1-3/8" dia. min 1/8" thick	2"x2"x1/8" ext. walls & int. walls subject to uplift loads; other int. walls std. size washers
Stud to-Sole Plate	2 - 16d	
Trimmer - Stud	5 - 16d	
Header Connectors-Trimmer	4 - 16d	
Sills - Trimmer	4 - 16d	
Cripples	2 - 16d	
Double Studs	4 - 16d	
Bracing	2 - 8d/Stud	
Double Top plate	16d/16" o.c.	
Top Plate to Stud Connection	2 - 16d	
Top plate, Lap and Interactions	4 - 16d	Table 412.6.3

FASTENING SCHEDULE CONTRAST FOR FRAMING

	Current Seaward	New Seaward
Top Plate-Rafter Connection	3 - 8d	3 - 8d
Rafter-Hip or Valley	3 - 8d	
Rafter-Ridge Board	3 - 12d	
Wall Sheathing		Tables 412.7.1A-L
Rafters - Parallel Ceiling	3 - 16d	
Collars Beams	2 - 12d	
Collar - Rafter	3 - 8d	3 - 12d
Ceiling Joists - Rafter		3 - 16d or 4 - 12d
Ceiling Joists - Top Plate	3 - 16d	
Ceiling Joists - Partition	3 - 16d	3 - 16d or 4 - 12d
Ceiling Joists Tiebacks-Rafter		3 - 16d or 4 - 12d
Ceiling Joists Tiebacks-Ceiling Joists		2 - 10d
Splices @ Ridgeboard	10 - 8d	
Steel Strap to Stud		10 - 8d
Sole plate & top plate to joist header or band joists (2 story)	16d - 16" o.c.	

FASTENING SCHEDULE CONTRAST FOR FRAMING

	Current Seaward	New Seaward
Floor Diaphragm Sheathing		10d - 6" o.c. or 4" o.c., edges, 12" o.c. intermediate framing
Floor Sheathing-Blocking		10d - per Section 412.10

FASTENING SCHEDULE CONTRAST FOR ROOFING

	Current Seaward	New Seaward
Shingles	6 - 11 or 12 gauge nails/shingle location not specified	Same Location Specified
Felt	1.5" diameter caps approved fasteners schedule not specified	1.5" diameter caps approved fasteners 1 row @ 9" o.c. 2 rows @ 18" o.c. staggered, spaced 18" apart 9" o.c. at ridges & eaves
Roof Decking	8d 6"o.c. edges, 12" o.c. interior	Tables 412.5RB1-2
First course/starter course sealant, also valleys, gable ends, rake edges	None	Asphalt plastic cement

FASTENING SCHEDULE CONTRAST FOR CONNECTORS

	Current Seaward	New Seaward
Rafter-Top Plate	1 strap every other rafter 4 - 16d 300# uplift resistance	Table 412.8A
Stud - Top and Bottom Plate	1 strap every other stud 4 - 16d 300# uplift resistance	Table 412.8B
King Stud - Header	≤ 9 ft anchor stud @ @ end to sole plate & header	All headers: Table 412.8B, one full stud top & bottom @ end
King Stud - Header	> 9 ft anchor both studs @ @ end to sole plate & header	
Holddowns	None	Corners & ends of ext & int shear walls capacity - Table 412.7.2
Shear Transfer Plates	Not specified	>1 story - Section 412.7.3
Headers		Table 412.9B
Cripples - DTP - Header	1 strap every other rafter 4 - 16d 300# uplift resistance	Table 412.8B
Rafters (not nailed to ceiling joists	Every other rafter tied to joists	Every 3rd Rafter tied back
Bracing (Steel strap)		20g thickness

FASTENING SCHEDULE CONTRAST FOR CONNECTORS

	Current Seaward	New Seaward
Rafter - Interior Load Stud each side to DTP & sole plate; if over stud strap that stud only	1 strap every other rafter 4 - 16d 300# uplift resistance	Table 412.8A
Ceiling joist - Double Top Plate	1 strap every other rafter 4 - 16d 300# uplift resistance	Table 412.8A
Rafters, purlins, ties strongbacks, ceiling joists & Load bearing int. walls	1 strap every 3rd Rafter 4 - 16d 300# uplift resistance	Table 412.8A

APPENDIX C

QUANTITY TAKEOFF SHEETS FOR CALIBRATION HOUSE

CURRENT CODE:INLAND
CALIBRATION HOUSE

QUANTITY TAKEOFF

Item	Location	Total	Units
Studs	Ext. Walls	448.00	bf
Rafters	Roof	581.85	bf
Ridgeboard, Hip & Valley Rafters		155.44	bf
Rafter Braces		25.49	bf
Corner Bracing	Ext. Walls	47.25	bf
Shear Walls	Ext. Walls	na	sf
Roof Sheathing	Roof	1,212.34	sf
Roof Felt	Roof	3.40	rolls
Windows		8	windows
Doors	Exterior	2	doors
Garage Doors		na	doors
Concrete	Foundation, Footings	7.41	cy
Rebar	Foundation	176.88	lbs
WWF	Foundation	759	sf
Concrete	Foundation, Slab	6.90	cy
Anchorages:			
	H2.5 (Rafter-TP)	27	clips
	H2.5 (TP-S)	58	clips
	H7 (Raft-Pur-Br)	8	clips
	H4 (Br-Int TP)	8	clips
	H4 (SB-CJ)	12	clips
	H2.5 (Cripple-TP)	4	clips
	H2.5 (Cripple-Header)	4	clips
	H2.5 (Trimmer-Header)	6	clips
	H2.5 (Trimmer-SP)	6	clips
	H4 (SP-Stud)	58	clips
Holddowns:		na	holddown
Window Protection:		na	
Door Protection:		na	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

QUANTITY TAKEOFF

Item	Location	Total	Units
Studs	Ext. Walls	448.00	bf
Rafters	Roof	775.80	bf
Ridgeboard, Hip & Valley Rafters		194.30	bf
Rafter Braces		19.12	bf
Corner Bracing	Ext. Walls	47.25	bf
Shear Walls	Ext. Walls	na	sf
Roof Sheathing	Roof	1,212.34	sf
Roof Felt	Roof	3.40	rolls
Windows		8	windows
Doors	Exterior	2	doors
Garage Doors		na	doors
Concrete	Foundation, Footings	7.41	cy
Rebar	Foundation	176.88	lbs
WWF	Foundation	759	sf
Concrete	Foundation, Slab	6.90	cy
Anchorages:			
	H2.5 (Rafter-TP)	27	clips
	H2.5 (TP-S)	58	clips
	H7 (Raft-Pur-Br)	8	clips
	H4 (Br-Int TP)	8	clips
	H4 (SB-CJ)	12	clips
	H2.5 (Cripple-TP)	4	clips
	H2.5 (Cripple-Header)	4	clips
	H2.5 (Trimmer-Header)	6	clips
	H2.5 (Trimmer-SP)	6	clips
	H4 (SP-Stud)	58	clips
Holddowns:		na	holddown
Window Protection:		na	
Door Protection:		na	

NEW CODE:INLAND
CALIBRATION HOUSE

QUANTITY TAKEOFF

Item	Location	Total	Units
Rebar	Foundation	274.56	lbs
Concrete	Foundation, Footing	5.93	cy
WWF	Foundation	1,119.00	sf
Concrete	Foundation, Slab	7.89	cy
Studs	Ext. Walls	549.33	bf
Lateral Bracing	Ext. Walls	na	bf
Shear Walls	Ext. Walls	384.00	sf
Ridgeboard, Hip & Valley Rafters	Roof	194.30	bf
Rafters	Roof	775.80	bf
Rafter Braces	Roof	44.61	bf
Anchorages	H1 (Rafter-TP)	38	clips
	H2.5 (TP-S)	54	clips
	LTS18 (Rafter-Stud)	41	clips
	H7 (Raft-Pur-Br)	14	clips
	H1 (Br-Int TP)	14	clips
	H2.5 (Cripple-TP)	23	clips
	H2.5 (Cripple-Header)	23	clips
	H2.5 (T-H, < 3')	14	clips
	H2.5 (T-H 3-4')	4	clips
	LSTA9 (T-H 5-6')	2	clips
	H2.5 (T-SP, < 3')	14	clips
	H2.5 (T-SP, 3-4')	4	clips
	LSTA9 (T-H, 5-6')	2	clips
	H4 (SP-Stud)	95	clips
Holddowns	HD6A	18	holddowns
Roof Sheathing	Roof	1,212.34	sf
Roof Felt	Roof	6.80	rolls
Doors		2	doors
Windows		8	windows
Door Protection		na	doors
Window Protection		na	windows
Garage Doors		na	doors

NEW CODE:SEAWARD
CALIBRATION HOUSE

QUANTITY TAKEOFF

Item	Location	Total	Units
Rebar	Foundation	274.56	lbs
Concrete	Foundation, Footing	5.93	cy
WWF	Foundation	1,119.00	sf
Concrete	Foundation, Slab	7.89	cy
Studs	Ext. Walls	549.33	bf
Lateral Bracing	Ext. Walls	na	bf
Shear Walls	Ext. Walls	384.00	sf
Ridgeboard, Hip & Valley Rafters	Roof	194.30	bf
Rafters	Roof	775.80	bf
Rafter Braces	Roof	66.92	bf
Anchorages	H1 (Rafter-TP)	38	clips
	H2.5 (TP-S)	54	clips
	LTS18 (Rafter-Stud)	41	clips
	H7 (Raft-Pur-Br)	21	clips
	H1 (Br-Int TP)	21	clips
	H2.5 (Cripple-TP)	23	clips
	H2.5 (Cripple-Header)	23	clips
	H2.5 (T-H, < 3')	14	clips
	H2.5 (T-H 3-4')	4	clips
	LSTA9 (T-H 5-6')	2	clips
	H2.5 (T-SP, < 3')	14	clips
	H2.5 (T-SP, 3-4')	4	clips
	LSTA9 (T-SP, 5-6')	2	clips
	H4 (SP-Stud)	95	clips
Holddowns	HD6A	18	holddowns
Roof Sheathing	Roof	1,212.34	sf
Roof Felt	Roof	6.80	rolls
Doors	Doors	2	doors
Windows	Windows	8	windows
Door Protection	Doors	2	doors
Window Protection	Windows	8	windows
Garage Doors	Garage Doors	na	doors

APPENDIX D

COSTS OF MATERIALS IN GALVESTON AND CORPUS CHRISTI

APPENDIX D

COSTS OF MATERIALS IN GALVESTON AND CORPUS CHRISTI

Item	Galveston	Corpus Christi
2x4x8	**2.77***	**3.36***
2x4x10	3.95	4.20
2x4x12	**4.40**	**5.04**
2x6x8	4.49	4.92
2x6x10	**5.57**	**6.15**
2x6x12	6.92	7.38
2x6x14	8.36	8.61
2x6x16	10.61	9.84
2x6x20	12.95	11.07
2x8x8	**5.30**	**6.56**
2x8x10	**6.38**	**8.20**
2x8x12	**8.36**	**9.84**
2x8x14	**8.99**	**11.48**
2x8x16	**13.31**	**14.89**
2x8x20	**17.90**	**20.00**
2x10x8	**7.87**	**11.26**
2x10x10	**9.83**	**14.09**
2x10x12	**12.68**	**16.90**
2x10x14	17.99	19.71
2x10x16	**20.33**	**22.54**
2x10x20	**23.39**	**28.16**
2x12x8	**11.06**	**12.32**
2x12x10	**12.00**	**15.40**
2x12x20	30.79	30.80
1x4x8	**1.52**	**1.70**
1x4x10	**1.90**	**2.13**
1x4x12	**2.28**	**2.56**
4x8 1/2" CD	14.69	14.19
4x8 5/8" CD	18.09	18.49
4x8 3/4" CD	20.99	20.99
15# Roofing Felt	8.49	8.49

30# Roofing Felt	8.49	8.49
#4 Rebar	.23	.23
#5 Rebar	.24	.22
cy concrete	60.00	60.00
1/2" anchor bolt	.36	.36
1/2" anchor bolt, Galvanized	1.18	1.18
5/8" anchor bolt	**1.43**	**.49**
1-3/8" x 1/8" washers	**.10**	**.08**
2 x 2 x 1/8" washers	**.19**	**.50**
3" bolts	2.33	2.33
3" bolts	4.47	4.47
8d, 10d, 12d, 16d Nails	**.69**	**.85**
Roofing Nails	**.79**	**.90**
Felt Nails	.99	.90
Asphaltic Plastic Cement, 5 gal	**9.99**	**12.60**
WWF 6"x6" #10/10	**47.29**	**92.50**
Simpson Strong-Ties:		
H1	**.50**	**.77**
H2.5	**.20**	**.17**
H3	**.20**	**.34**
H4	**.20**	**.25**
H6	2.07	2.07
H7	2.73	2.73
SP1	.33	.33
SP4	.71	.71
LTS12	**.60**	**.54**
LTS18	**.90**	**1.09**
LSTA9	**.32**	**.25**
LSTA12	.55	.55
LSTA15	.72	.72
LSTA18	.85	.85
LSTA24	1.12	1.12

LSTA30	1.60	1.60
MST12	.90	.90
A35F	**.45**	**.40**
HD5A	**11.93**	**15.92**
HD6A	**12.17**	**16.22**
HD10A	37.80	37.80
ST18	1.14	1.14
Doors	97.00	97.00
Doors, Impact Resistant	270.00	270.00
Windows	25.00/sf	25.00/sf
Windows, Impact Resistant	29.00/sf	29.00/sf
Garage Doors	329.00	329.00
Garage Doors, Impact Resistant	408.00	408.00

*Bold indicates prices which are greater than 10% difference between the two cities (information requested by funding agency).

APPENDIX E

WINDOW COST INFORMATION

EXTECH
EXTERIOR TECHNOLOGIES, INC.

☐ Pittsburgh/ 200 Bridge Street • Box 9543 • Pittsburgh, PA 15223 • FAX: 412/781-9303 • Phone: 412/781-0991
☐ Ft. Lauderdale/ 850 N.W. 61st St. • Ft. Lauderdale, FL 33309 • FAX: 305/776-2242 • Phone: 305/776-2232

February 3, 1995

Ms. Patricia Lombard
Department of Civil Engineering
Texas A&M University
Mail Stop 3136
College Station, TX 77843

Dear Ms. Lombard:

Per your request, a price comparison between conventional glass glazed windows and storm resistant windows is attached.

For the past year, Bill Voegele, the president of EXTECH, has been closely following developments related to Dade County, Florida's new building codes. He would be an appropriate person to contact regarding the Large Missile Impact Test and Cyclic Pressure Tests that windows, shutters, and skylights must now pass in Dade County. He can also answer any other questions you might have about protecting the building envelope from hurricanes and other severe storms.

EXTECH manufactures high-strength, high-abuse windows and skylights. We have passed the complete Dade series of tests with four of our polycarbonate glazed systems (our 3200/3200C has a Dade County Product Notice of Approval; applications for our other systems are on file).

Please feel free to call us if we can be of any further assistance to you in your research.

Sincerely,

EXTECH/Exterior Technologies, Inc.

Janet M. Wasserman

Janet M. Wasserman
Marketing Director

COMPARATIVE COSTS OF CONVENTIONAL FIXED WINDOWS VS. STORM RESISTANT WINDOWS

The price per square foot (for any kind of window) will vary considerably based on the size of the unit. In general, the larger the window, the lower the cost per square foot.

For example, an average size window (e.g. 3' x 6') glazed with 1/4" glass is approximately $23/sq. ft.

If you build an aluminum window frame of a strength and quality which will offer storm resistance, it will probably add $2/sq. ft. to the cost of a conventional commercial glass window, i.e. the total cost of a window with hurricane resistant framing and 1/4" conventional glass is $25/sq. ft.

This type of window still does not pass Dade County, FL's new test standards.

To manufacture a storm resistant glass glazed window, take this same heavy duty aluminum frame and add a product like DuPont's Sentry Glass. The price rises to $29/sq. ft.

DuPont's Sentry glass has proved capable of withstanding impact testing and cyclic testing at some of the lower pressures.

Therefore, it appears that there is a difference of only about 26% to buy a storm resistant glass glazed window (from $23/sq. ft. to $29/sq. ft.).

One of the drawbacks to DuPont's Sentry glass is that it still leaves a plastic surface exposed on the inside and this is prone to scratching. Although it has a scratch resistant surface on it, it is still not as scratch resistant as glass.

Use a glass/polycarbonate/glass glazing in lieu of DuPont Sentry glass in a heavy duty aluminum frame and the price goes up to $38 per sq. ft.

There are, however, several other companies working on different glass combinations which are expected to be near the price range of DuPont Sentry glass.

Another alternative to glass glazing is high-strength polycarbonate as manufactured by GE. This material has both a UV and a scratch resistant coating, and, using the same standards as above, will probably come in at the price range of the original conventional window, i.e. $23/sq. ft.

Several polycarbonate glazed systems have already met the Dade County standards and, in most cases, passed the tests at impacts and pressures far beyond what Dade County has required.

COMPARATIVE COSTS OF CONVENTIONAL FIXED WINDOWS

VS. STORM RESISTANT WINDOWS

Conventional Window	Conventional Window with Aluminum Frame	Storm Resistant Window (e.g. with Sentry Glass)
$23/sq.ft.	$25/sq.ft.	$29/sq.ft.

Glass/Polycarbonate/Glass Glazed Window	High-Strength Poly-Carbonate Glazing in Heavy Duty Aluminum Frame
$38/sq.ft.	$23/sq.ft.

APPENDIX F

LABOR COSTS FOR CURRENT CODE

APPENDIX F

LABOR COSTS FOR CURRENT CODE

LABOR COSTS FOR FOUNDATION

Source: *National Construction Estimator*, 1994, pg. 55-57.

Crew Size: Footings: B4 (1 Laborer, 1 Operating Engineer, 1 Reinforcing Ironworker) @ $24.78/hr
Reinforcing steel: RI (1 reinforcing ironworker) @ $26.32/hr
Slab: B5 (1 Laborer., 1 Carpenter, 1 Cement Mason, 1 Operating Engineer, 1 Reinforcing Ironworker) @ $24.58/hr
WWF: RI (1 reinforcing ironworker) @ $26.32/hr.

Footings:

12" W x 20" D	B4 @ .117 mh/lf
15" W x 20" D	B4 @ .146 mh/lf

Concrete Reinforcing Steel:

1/2" (.67 lb/lf) RI @ .010 mh/lb

Slab:

3 1/2" thick B5 @ 0.0235 mh/sf

Welded Wire Frame:

6" x 6", W1.4 x W1.4 (#10 x #10) RI @ .003 mh/sf

Example:

Perimeter of house: 33 + 23 + 33 + 23 + 4 + 4 = 120 lf

2-Rebars/footing = 2(120 lf) = 240 lf
1 overlap/20' = 2(240/20) = 24 lf
240 + 24 = 264 lf

Square footage: 33(23) = 759 sf - 120 (overlap) = 639 sf

Footings 12" x 20":
.117 mh/lf * 120 lf = 14.04 mh
14.040 mh * $24.78/mh = $347.91

Reinforcing Steel:
0.67 lb/lf * 264 lf = 176.88 lb steel
176.88 lb * .010 mh/lb = 1.769 mh
1.769 mh * $26.32/mh = $46.56

Slab:
639 sf * 0.0235 mh/sf = 15.017 mh
15.017 mh * $24.58 = $369.12

WWF:
759 sf * .003 mh/sf = 2.277 mh
2.277 mh * $26.32 = $59.93

Totals:			
	Footings:	14.040 mh	$347.91
	Steel:	1.769 mh	46.56
	Slab:	15.017 mh	369.12
	WWF:	2.277 mh	59.93
		33.103 mh	$823.52

33.103 mh/759 sf = .044 mh/sf of fp

$823.52/759 sf = $1.09/sf of fp

LABOR COSTS FOR EXTERIOR FRAMING

Source: *National Construction Estimator*, 1994, pg. 32.

Crew Size: B1 (1 Laborer, 1 Carpenter) @ $22.63/hr

Studding (per ft^2 of wall area) includes nailing, layout, plumb & align; add for corners & partitions, door & window opening framing

Studding 2"x4" @ 16" o.c.: 0.023 mh/ft^2

Example:

Studding: (0.023 mh/sf) * (984 sf) = 22.63 mh
22.63 mh * $22.63/mh = $512.12

LABOR COSTS FOR WALL BRACING

Source: *National Construction Estimator*, 1994, pg. 33, 38.

Crew Size: B1 (1 Laborer, 1 Carpenter) @ $22.63/hr

Let-in Wall bracing: 1 x 4: .021 mh/lf

Wall sheathing: 1/2" .016 mh/sf

Example: Let-in Bracing

141.76 lf * .021 mh/lf = 2.98 mh
2.98 mh * $22.63/mh = $67.44

$67.44/141.76 lf = $0.48/lf

Example: Shear Wall (Used for two-story house)

960 sf * .016 mh/sf = 15.360 mh
15.360 mh * $22.63/mh = $347.60

$347.60/960 sf = $0.36/sf

LABOR COST FOR ROOF FRAMING

Source: *National Construction Estimator*, 1994, pg. 36.

Crew Size: B1 (1 Laborer, 1 Carpenter) @ $22.63/hr

Rafters: flat, shed or gable roofs up to 5 in 12 slope (5/24 pitch) maximum 25 ft span per SF of actual roof surface area include: rafters, ridge boards, collar beams, but not blocking, bracing, purlins, curbs or gable walls

sf of roof = 1,212.34 sf sf of fp = 759 sf

Perimeter of roof = 44 + 13 ft 8" + 7 ft + 13 ft 4" + 37 ft + 27 ft = 142 lf

Rafters: 2x6 24" o.c.: .018 mh/sf

Collar beams: 2x6 .013 mh/lf

Purlins: 2x8 .023 mh/lf

Braces: use mh for collar beams

Ridgeboard, hip and valley rafters: use mh for purlins

Example:

Rafters: (.018 mh/sf) * (1,212.34 sf) = 21.822 mh
21.822 mh * $22.63/mh = $493.83

Braces: (.013 mh/lf) * 38.24 lf = 0.497 mh
0.497 mh * $22.63/mh = $11.25

Ridgeboard: (.023 mh/lf) * (116.58 lf) = 2.681 mh
2.681 mh * $22.63/mh = $60.67

Totals:			
	Rafters:	21.822 mh	493.83
	Braces:	0.497 mh	11.25
	Ridgeboard:	2.681 mh	60.67
		25.000 mh	$565.75

25.000 mh/759 sf = 0.033 mh/sf of fp

$565.75/759 sf = $0.75/sf of fp

LABOR COSTS FOR ANCHORAGES

Source: *Simpson Strong-Tie® Texas Windstorm Requirements Approved Product Application Guide*

and/or

Simpson Strong-Tie® Installed Cost Guide

and/or

Simpson Strong-Tie® Connectors for Wood Construction

Labor: $12.00/hr

H4 0.013 mh

H2.5 0.017 mh

H7 0.035 mh

Example:

H4 78 * .013 = 1.014 mh
1.014 mh * $12.00/hr = $12.17

H2.5 105 * .017 = 1.785 mh
1.785 mh * $12.00/hr = $21.42

H7 8 * .035 = 0.280 mh
0.280 mh * $12.00/h4 = $3.36

3.079 mh/120 lf = 0.026 mh/lf

$36.94/120 lf = $0.31/lf

LABOR COSTS FOR ROOF DECKING

Source: *National Construction Estimator*, 1994, pp. 31, 37.

Crew Size: B1 (1 Laborer, 1 Carpenter) @ $22.63/hr

Sheathing, roof per SF of roof surface

CD plywood sheathing, rough

1/2"	.013 mh/sf

Example: 1,212.34 sf * .013 mh/sf = 15.760 mh
15.760 mh * $22.63/mh = $356.65

$356.65/1,212 sf = $0.30/sf

$356.65/759 sf of fp = $0.47/sf of fp

LABOR COSTS FOR ROOF COVERING

Source: *National Construction Estimator*, 1994, pg. 178.

Crew Size: R1 (1 Laborer, 1 Roofer) @ $24/hr

Asphalt felt (108 sf covers 100 sf) labor to roll and mop, labor laying felt on 3 in 12 pitch roof 15# felt (36" x 144 ft)

Felt: 15 lb (432 sf/roll) .360 sq

Example: Felt

1,212 sf = 12.12 sq

12.12 sq * .360 mh/sq = 4.363 mh
4.363 mh * $24.00 = $104.71

APPENDIX G

UNIT COSTS FOR CALIBRATION HOUSE

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
1	Foundation					
	Footings:	Rebar:	177	0.23	40.71	lbs
		Concrete:	8	60.00	480.00	cy
		Labor Steel:	1.77	11.73	20.75	
		Labor Concrete:	14.04	11.59	162.75	
	Total Materials				520.71	
	Total Labor				183.50	
	Total Footings				704.21	
	COST/LF				**$5.87**	
2	Slab	WWF:	2	47.29	94.58	rolls
		Concrete:	7	60.00	420.00	cy
		Labor WWF:	2.28	11.73	26.71	
		Labor Concrete:	15.02	11.63	174.69	
	Total Materials				514.58	
	Total Labor				201.40	
	Total Slab				715.98	
	COST/SF OF FP				**$0.94**	
3	Wall Framing					
	Studs	Lumber:	84	2.77	232.68	boards
		Nails:	8.32	0.69	5.74	lbs
	Total Materials				238.42	
	Total Labor		22.63	10.66	241.27	
	Total Wall Framing				479.69	
	COST/SF FRAMING				**$0.49**	
4	Anchor Bolts					
		Bolts:	31	0.36	11.16	bolts
		Washers:	31	0.10	3.10	washers
	Total Materials				14.26	
	Total Labor		2.85	10.66	30.40	
	Total Anchor Bolts				44.66	
	COST/ANCHOR BOLT				**$1.44**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
5	Top Plate Splices					
		Nails:	1.56	0.69	1.08	lbs
	Total Materials				1.08	
	Total Labor		0.13	10.66	1.41	
	Total Top Plate Splices				2.49	
	COST/NAIL				**$0.03**	
6	Lateral Bracing					
	Corner Bracing	Lumber:	47.25	various	36.48	bf
		Nails:	3.16	0.69	2.18	lbs
	Shear Walls	Lumber:	na			
		Nails:				
	Total Materials				38.66	
	Total Labor		2.98	10.66	31.74	
	Total Ext. Bracing				70.40	
	COST/LF				**$0.59**	
7	Roof Framing					
	Ridgeboard	Lumber:	24.00	various	11.68	bf
	Hip Rafters	Lumber:	78.48	17.90	53.70	bf
	Valley Rafters	Lumber:	52.96	6.38	25.52	bf
	Rafters	Lumber:	581.85	various	412.65	bf
	Bracing	Lumber:	25.49	2.77	22.16	bf
	Total Materials				525.71	
	Total Labor		25.00	10.66	266.52	
	Total Roof Framing				792.23	
	COST/SF OF FP				**$1.04**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
8	Anchorages					
		Clips (R-TP)	27	0.20	5.40	each
		Clips (TP-S)	58	0.20	11.60	each
		Clips (R-P-B)	8	2.73	21.84	each
		Clips (B-ITP)	8	0.20	1.60	each
		Clips (S-CJ)	12	0.20	2.40	each
		Clips (C-TP)	4	0.20	0.80	each
		Clips (C-H)	4	0.20	0.80	each
		Clips (T-H)	6	0.20	1.20	each
		Clips (T-SP)	6	0.20	1.20	each
		Clips (SP-S)	58	0.20	11.60	each
		Nails:	17.01	0.69	11.74	lbs
	Total Materials				70.18	
	Total Labor		3.08	8.28	25.49	
	Total Anchorages (Ext)				95.67	
	COST/LF				**$0.80**	
9	Holddowns					
		Holddowns:	na			
		Bolts 5/8":	na			
		Bolts 3":	na			
		Washers:	na			
	Total Materials					
	Total Labor					
	Total Holddowns				0.00	
	COST/HOLDDOWN				**$0.00**	
10	Roof Decking					
	Sheathing	Lumber:	38	14.69	558.22	sheets
		Nails:	14.69	0.69	10.14	lbs
	Total Materials				568.36	
	Total Labor		15.76	10.66	168.01	
	Total Roof Decking				736.37	
	COST/SF OF FP				**$0.97**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
11	Roof Covering					
	Roof Felt	Felt:	4	8.49	33.96	rolls
		Nails:	3.40	0.99	3.37	lbs
		Cement:	na			
		Shingle Nails:	39.76	0.79	31.41	lbs
	Total Materials				68.74	
	Total Labor		26.55	10.83	287.62	
	Total Roof Covering				356.36	
	COST/SF OF FP				**$0.47**	
12	Doors	Doors:	2	97.00	194.00	each
	Total Materials				194.00	
	Total Labor		1	10.66	11.11	
	Total Doors				205.11	
	COST/DOOR				**$102.55**	
13	Windows	Windows:	8	various	2,625.00	each
	Total Materials				2,625.00	
	Total Labor		3.07	10.66	32.74	
	Total Windows				2,657.74	
	COST/WINDOW				**$332.22**	
14	Door Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Door Protection				0.00	
	COST/DOOR				**$0.00**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
15	Window Protection	Lumber (2x4): Lumber (plywood) Nails:	na			
	Total Materials					
	Total Labor					
	Total Wdn Protection				0.00	
	COST/WINDOW				**$0.00**	
16	Garage Doors	Garage Doors:	na			
	Total Materials					
	Total Labor					
	Total Doors				0.00	
	COST/GARAGE DOOR				**$0.00**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
1	Foundation					
	Footings:	Rebar:	177	0.23	40.71	lbs
		Concrete:	8	60.00	480.00	cy
		Labor Steel:	1.77	10.71	18.94	
		Labor Concrete:	14.04	10.58	148.60	
	Total Materials				520.71	
	Total Labor				167.54	
	Total Footings				688.25	
	COST/LF				**$5.74**	
2	Slab	WWF:	2	92.50	185.00	rolls
		Concrete:	7	60.00	420.00	cy
		Labor WWF:	2.28	10.71	24.39	
		Labor Concrete:	15.02	10.62	159.50	
	Total Materials				605.00	
	Total Labor				183.89	
	Total Slab				788.89	
	COST/SF OF FP				**$1.04**	
3	Wall Framing					
	Studs	Lumber:	84	3.36	282.24	boards
		Nails:	8.32	0.85	7.07	lbs
	Total Materials				289.31	
	Total Labor		22.63	9.73	220.29	
	Total Wall Framing				509.60	
	COST/SF FRAMING				**$0.52**	
4	Anchor Bolts					
		Bolts:	31	0.36	11.16	bolts
		Washers:	31	0.08	2.48	washers
	Total Materials				13.64	
	Total Labor		2.85	9.73	27.76	
	Total Anchor Bolts				41.40	
	COST/ANCHOR BOLT				**$1.34**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
5	Top Plate Splices					
		Nails:	1.56	0.85	1.33	lbs
	Total Materials				1.33	
	Total Labor		0.13	9.73	1.29	
	Total Top Plate Splices				2.62	
	COST/NAIL				**$0.03**	
6	Lateral Bracing					
	Corner Bracing	Lumber:	47.25	various	40.82	bf
		Nails:	3.16	0.85	2.69	lbs
	Shear Walls	Lumber:	na			
		Nails:				
	Total Materials				43.51	
	Total Labor		2.98	9.73	28.98	
	Total Ext. Bracing				72.48	
	COST/LF				**$0.60**	
7	Roof Framing					
	Ridgeboard	Lumber:	24.00	various	14.76	bf
	Hip Rafters	Lumber:	78.48	20.00	60.00	bf
	Valley Rafters	Lumber:	52.96	8.20	32.80	bf
	Rafters	Lumber:	581.85	various	421.89	bf
	Bracing	Lumber:	25.49	3.36	26.88	bf
	Total Materials				556.33	
	Total Labor		25.00	9.73	243.34	
	Total Roof Framing				799.67	
	COST/SF OF FP				**$1.05**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
8	Anchorages					
		Clips (R-TP)	27	0.17	4.59	each
		Clips (TP-S)	58	0.17	9.86	each
		Clips (R-P-B)	8	2.73	21.84	each
		Clips (B-ITP)	8	0.25	2.00	each
		Clips (S-CJ)	12	0.25	3.00	each
		Clips (C-TP)	4	0.17	0.68	each
		Clips (C-H)	4	0.17	0.68	each
		Clips (T-H)	6	0.17	1.02	each
		Clips (T-SP)	6	0.17	1.02	each
		Clips (SP-S)	58	0.25	14.50	each
		Nails:	17.01	0.85	14.46	lbs
	Total Materials				73.65	
	Total Labor		3.08	7.56	23.28	
	Total Anchorages (Ext)				96.93	
	COST/LF				**$0.81**	
9	Holddowns					
		Holddowns:	na			
		Bolts 5/8":	na			
		Bolts 3":	na			
		Washers:	na			
	Total Materials					
	Total Labor					
	Total Holddowns				0.00	
	COST/HOLDDOWN				**$0.00**	
10	Roof Decking					
	Sheathing	Lumber:	38	14.19	539.22	sheets
		Nails:	14.69	0.85	12.52	lbs
	Total Materials				551.74	
	Total Labor		15.76	9.73	153.40	
	Total Roof Decking				705.14	
	COST/SF OF FP				**$0.93**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
11	Roof Covering					
	Roof Felt	Felt:	4	8.49	33.96	rolls
		Nails:	3.40	0.90	3.06	lbs
		Cement:	na			
		Shingle Nails:	39.76	0.90	35.78	lbs
	Total Materials				72.81	
	Total Labor		26.55	9.89	262.61	
	Total Roof Covering				335.42	
	COST/SF OF FP				**$0.44**	
12	Doors	Doors:	2	97.00	194.00	each
	Total Materials				194.00	
	Total Labor		1	9.73	10.14	
	Total Doors				204.14	
	COST/DOOR				**$102.07**	
13	Windows	Windows:	8	various	2,625.00	each
	Total Materials				2,625.00	
	Total Labor		3.07	9.73	29.89	
	Total Windows				2,654.89	
	COST/WINDOW				**$331.86**	
14	Door Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Door Protection				0.00	
	COST/DOOR				**$0.00**	

CURRENT CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
15	Window Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Wdn Protection				0.00	
	COST/WINDOW				**$0.00**	
16	Garage Doors	Garage Doors:	na			
	Total Materials					
	Total Labor					
	Total Doors				0.00	
	COST/GARAGE DOOR				**$0.00**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
1	Foundation					
	Footings:	Rebar:	177	0.23	40.71	lbs
		Concrete:	8	60.00	480.00	cy
		Labor Steel:	1.77	11.73	20.75	
		Labor Concrete:	14.04	11.59	162.75	
	Total Materials				520.71	
	Total Labor				183.50	
	Total Footings				704.21	
	COST/LF				**$5.87**	
2	Slab	WWF:	2	47.29	94.58	rolls
		Concrete:	7	60.00	420.00	cy
		Labor WWF:	2.28	11.73	26.71	
		Labor Concrete:	15.02	11.63	$74.69	
	Total Materials				$714.98	
	Total Labor				201.40	
	Total Slab				715.98	
	COST/SF OF FP				**$0.94**	
3	Wall Framing					
	Studs	Lumber:	84	2.77	232.68	boards
		Nails:	8.32	0.69	5.74	lbs
	Total Materials				238.42	
	Total Labor		22.63	10.66	241.27	
	Total Wall Framing				479.69	
	COST/SF FRAMING				**$0.49**	
4	Anchor Bolts					
		Bolts:	31	1.18	36.58	bolts
		Washers:	31	0.10	3.10	washers
	Total Materials				39.68	
	Total Labor		2.85	10.66	30.40	
	Total Anchor Bolts				70.08	
	COST/ANCHOR BOLT				**$2.26**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
5	Top Plate Splices					
		Nails:	1.56	0.69	1.08	lbs
	Total Materials				1.08	
	Total Labor		0.13	10.66	1.41	
	Total Top Plate Splices				2.49	
	COST/NAIL				**$0.03**	
6	Lateral Bracing					
	Corner Bracing	Lumber:	47.25	various	36.48	bf
		Nails:	3.16	0.69	2.18	lbs
	Shear Walls	Lumber:	na			
		Nails:				
	Total Materials				38.66	
	Total Labor		2.98	10.66	31.74	
	Total Ext. Bracing				70.40	
	COST/LF				**$0.59**	
7	Roof Framing					
	Ridgeboard	Lumber:	30.00	various	17.70	bf
	Hip Rafters	Lumber:	98.10	23.39	70.17	bf
	Valley Rafters	Lumber:	66.20	9.83	39.32	bf
	Rafters	Lumber:	775.80	various	493.29	bf
	Bracing	Lumber:	19.12	2.77	16.62	bf
	Total Materials				637.10	
	Total Labor		32.62	10.66	347.71	
	Total Roof Framing				984.81	
	COST/SF OF FP				**$1.30**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
8	Anchorages					
		Clips (R-TP)	27	0.20	5.40	each
		Clips (TP-S)	58	0.20	11.60	each
		Clips (R-P-B)	8	2.73	21.84	each
		Clips (B-ITP)	8	0.20	1.60	each
		Clips (S-CJ)	12	0.20	2.40	each
		Clips (C-TP)	4	0.20	0.80	each
		Clips (C-H)	4	0.20	0.80	each
		Clips (T-H)	6	0.20	1.20	each
		Clips (T-SP)	6	0.20	1.20	each
		Clips (SP-S)	58	0.20	11.60	each
		Nails:	17.01	0.69	11.74	lbs
	Total Materials				70.18	
	Total Labor		3.08	8.28	25.49	
	Total Anchorages (Ext)				95.67	
	COST/LF				**$0.80**	
9	Holddowns					
		Holddowns:	na			
		Bolts 5/8":	na			
		Bolts 3":	na			
		Washers:	na			
	Total Materials					
	Total Labor					
	Total Holddowns				0.00	
	COST/HOLDDOWN				**$0.00**	
10	Roof Decking					
	Sheathing	Lumber:	38	18.09	687.42	sheets
		Nails:	22.38	0.69	15.44	lbs
	Total Materials				702.86	
	Total Labor		15.76	10.66	168.01	
	Total Roof Decking				870.88	
	COST/SF OF FP				**$1.15**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
11	Roof Covering					
	Roof Felt	Felt:	4	8.49	33.96	rolls
		Nails:	3.40	0.99	3.37	lbs
		Cement:	na			
		Shingle Nails:	39.76	0.79	31.41	lbs
	Total Materials				68.74	
	Total Labor		26.55	10.83	287.62	
	Total Roof Covering				356.36	
	COST/SF OF FP				**$0.47**	
12	Doors	Doors:	2	97.00	194.00	each
	Total Materials				194.00	
	Total Labor		1.04	10.66	11.11	
	Total Doors				205.11	
	COST/DOOR				**$102.55**	
13	Windows	Windows:	8	various	2,625.00	each
	Total Materials				2,625.00	
	Total Labor		3.07	10.66	32.74	
	Total Windows				2,657.74	
	COST/WINDOW				**$332.22**	
14	Door Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Door Protection				0.00	
	COST/DOOR				**$0.00**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
15	Window Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Wdn Protection				0.00	
	COST/WINDOW				**$0.00**	
16	Garage Doors	Garage Doors:	na			
	Total Materials					
	Total Labor					
	Total Doors				0.00	
	COST/GARAGE DOOR				**$0.00**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
1	Foundation					
	Footings:	Rebar:	177	0.23	40.71	lbs
		Concrete:	8	60.00	480.00	cy
		Labor Steel:	1.77	10.71	18.94	
		Labor Concrete:	14.04	10.58	148.60	
	Total Materials				520.71	
	Total Labor				167.54	
	Total Footings				688.25	
	COST/LF				**$5.74**	
2	Slab	WWF:	2	92.50	185.00	rolls
		Concrete:	7	60.00	420.00	cy
		Labor WWF:	2.28	10.71	24.39	
		Labor Concrete:	15.02	10.62	159.50	
	Total Materials				605.00	
	Total Labor				183.89	
	Total Slab				788.89	
	COST/SF OF FP				**$1.04**	
3	Wall Framing					
	Studs	Lumber:	84	3.36	282.24	boards
		Nails:	8.32	0.85	7.07	lbs
	Total Materials				289.31	
	Total Labor		22.63	9.73	220.29	
	Total Wall Framing				509.60	
	COST/SF FRAMING				**$0.52**	
4	Anchor Bolts					
		Bolts:	31	1.18	36.58	bolts
		Washers:	31	0.08	2.48	washers
	Total Materials				39.06	
	Total Labor		2.85	9.73	27.76	
	Total Anchor Bolts				66.82	
	COST/ANCHOR BOLT				**$2.16**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
5	Top Plate Splices					
		Nails:	1.56	0.85	1.33	lbs
	Total Materials				1.33	
	Total Labor		0.13	9.73	1.29	
	Total Top Plate Splices				2.62	
	COST/NAIL				**$0.03**	
6	Lateral Bracing					
	Corner Bracing	Lumber:	47.25	various	40.82	bf
		Nails:	3.16	0.85	2.69	lbs
	Shear Walls	Lumber:	na			
		Nails:				
	Total Materials				43.51	
	Total Labor		2.98	9.73	28.98	
	Total Ext. Bracing				72.48	
	COST/LF				**$0.60**	
7	Roof Framing					
	Ridgeboard	Lumber:	30.00	various	25.35	bf
	Hip Rafters	Lumber:	98.10	28.16	84.48	bf
	Valley Rafters	Lumber:	66.20	14.09	56.36	bf
	Rafters	Lumber:	775.80	various	578.90	bf
	Bracing	Lumber:	19.12	3.36	20.16	bf
	Total Materials				765.25	
	Total Labor		32.62	9.73	317.47	
	Total Roof Framing				1,082.72	
	COST/SF OF FP				**$1.43**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
8	Anchorages					
		Clips (R-TP)	27	0.17	4.59	each
		Clips (TP-S)	58	0.17	9.86	each
		Clips (R-P-B)	8	2.73	21.84	each
		Clips (B-ITP)	8	0.25	2.00	each
		Clips (S-CJ)	12	0.25	3.00	each
		Clips (C-TP)	4	0.17	0.68	each
		Clips (C-H)	4	0.17	0.68	each
		Clips (T-H)	6	0.17	1.02	each
		Clips (T-SP)	6	0.17	1.02	each
		Clips (SP-S)	58	0.25	14.50	each
		Nails:	17.01	0.85	14.46	lbs
	Total Materials				73.65	
	Total Labor		3.08	7.56	23.28	
	Total Anchorages (Ext)				96.93	
	COST/LF				**$0.81**	
9	Holddowns					
		Holddowns:	na			
		Bolts 5/8":	na			
		Bolts 3":	na			
		Washers:	na			
	Total Materials					
	Total Labor					
	Total Holddowns				0.00	
	COST/HOLDDOWN				**$0.00**	
10	Roof Decking					
	Sheathing	Lumber:	38	18.49	702.62	sheets
		Nails:	22.38	0.85	19.07	lbs
	Total Materials				721.69	
	Total Labor		15.76	9.73	153.40	
	Total Roof Decking				875.09	
	COST/SF OF FP				**$1.15**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
11	Roof Covering					
	Roof Felt	Felt:	4	8.49	33.96	rolls
		Nails:	3.40	0.90	3.06	lbs
		Cement:	na			
		Shingle Nails:	39.76	0.90	35.78	lbs
	Total Materials				72.81	
	Total Labor		26.55	9.89	262.61	
	Total Roof Covering				335.42	
	COST/SF OF FP				**$0.44**	
12	Doors	Doors:	2	97.00	194.00	each
	Total Materials				194.00	
	Total Labor		1.04	9.73	10.14	
	Total Doors				204.14	
	COST/DOOR				**$102.07**	
13	Windows	Windows:	8	various	2,625.00	each
	Total Materials				2,625.00	
	Total Labor		3.07	9.73	29.89	
	Total Windows				2,654.89	
	COST/WINDOW				**$331.86**	
14	Door Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Door Protection				0.00	
	COST/DOOR				**$0.00**	

CURRENT CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
15	Window Protection	Lumber (2x4): Lumber (plywood) Nails:	na			
	Total Materials					
	Total Labor					
	Total Wdn Protection				0.00	
	COST/WINDOW				**$0.00**	
16	Garage Doors	Garage Doors:	na			
	Total Materials					
	Total Labor					
	Total Doors				0.00	
	COST/GARAGE DOOR				**$0.00**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
1	Foundation					
	Footings	Rebar:	275	0.24	66.00	lbs
		Concrete:	6	60.00	360.00	cy
		Labor Steel:	2.47	11.73	28.99	
		Labor Concrete:	12.83	11.59	148.74	
	Total Materials				426.00	
	Total Labor				177.72	
	Total Foundation				603.72	
	COST/LF				**$5.03**	
2	Foundation					
	Slab	WWF:	2	47.29	94.58	rolls
		Concrete:	8	60.00	480.00	cy
		Labor WWF:	3.36	11.73	39.38	
		Labor Concrete:	15.34	11.63	178.41	
	Total Materials				574.58	
	Total Labor				217.79	
	Total Foundation				792.37	
	COST/SF OF FP				**$1.04**	
3	Wall Framing					
	Studs	Lumber:	103	2.77	285.31	boards
		Nails:	13.84	0.69	9.55	lbs
	Total Materials				294.86	
	Total Labor		23.68	10.66	252.44	
	Total Exterior Framing				547.30	
	COST/SF FRAMING				**$0.56**	
4	Anchor Bolts					
		Bolts:	48	1.43	68.64	bolts
		Washer:	48	0.19	9.12	washers
	Total Materials				77.76	
	Total Labor		4.42	10.66	47.08	
	Total Anchor Bolts				124.84	
	COST/ANCHOR BOLT				**$2.60**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
5	Top Plate Splices					
		Nails:	3.72	0.69	2.57	lbs
	Total Materials				2.57	
	Total Labor		0.32	10.66	3.37	
	Total Top Plate Splices				5.94	
	COST/NAIL				**$0.03**	
6	Lateral Bracing					
	Corner Bracing	Lumber:	na			
		Nails:	na			
	Shear Walls	Lumber:	12	14.69	176.28	sheets
		Nails:	12.57	0.69	8.67	lbs
	Total Materials				184.95	
	Total Labor		6.14	10.66	65.50	
	Total Ext. Bracing				250.45	
	COST/LF				**$2.09**	
7	Roof Framing					
	Ridgeboard	Lumber:	30.00	various	17.70	bf
	Hip Rafters	Lumber:	98.10	23.39	70.17	bf
	Valley Rafters	Lumber:	66.20	9.83	39.32	bf
	Rafters	Lumber:	775.80	various	493.29	bf
	Bracing	Lumber:	44.61	2.77	38.78	bf
	Total Materials				659.26	
	Total Labor		33.11	10.66	353.01	
	Total Roof Framing				1,012.27	
	COST/SF OF FP				**$1.33**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
8	Anchorages					
		Clips (R-TP)	38	0.50	19.00	each
		Clips (TP-S)	54	0.20	10.80	each
		Clips (R-S)	41	0.90	36.90	each
		Clips (R-P-B)	14	2.73	38.22	each
		Clips (B-ITP)	14	0.50	7.00	each
		Clips (C-TP)	23	0.20	4.60	each
		Clips (C-H)	23	0.20	4.60	each
		Clips (T-H < 3)	14	0.20	2.80	each
		Clips (T-H 3-4)	4	0.20	0.80	each
		Clips (T-H 5-6)	2	0.32	0.64	each
		Clips (T-SP < 3)	14	0.20	2.80	each
		Clips (T-SP 3-4)	4	0.20	0.80	each
		Clips (T-SP 5-6)	2	0.32	0.64	each
		Clips (SP-S)	95	0.20	19.00	each
		Nails:	33.32	0.69	22.99	lbs
	Total Materials				171.59	
	Total Labor		5.67	8.28	46.95	
	Total Anchorages				218.54	
	COST/LF				**$1.82**	
9	Holddowns					
		Holddowns:	18	12.17	219.06	each
		Bolts 5/8":	see above			each
		Bolts 3":	18	2.33	41.94	each
		Washers:	see above			each
	Total Materials				261.00	
	Total Labor		1.49	8.28	12.37	
	Total Holddowns				273.37	
	COST/HOLDDOWN				**$15.19**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
10	Roof Decking					
	Sheathing	Lumber:	38	14.69	558.22	sheets
		Nails:	33.56	0.69	23.15	lbs
	Total Materials				581.37	
	Total Labor		21.99	10.66	234.38	
	Total Roof Decking				815.75	
	COST/SF OF FP				**$1.07**	
11	Roof Covering					
	Roof Felt	Felt:	7	8.49	59.43	rolls
		Nails:	6.25	0.99	6.19	lbs
		Cement:	5	9.99	49.95	5 gal
		Nails:	59.64	0.79	47.12	lbs
	Total Materials				162.69	
	Total Labor		37.97	10.83	411.29	
	Total Roof Covering				573.97	
	COST/SF OF FP				**$0.76**	
12	Doors	Doors:	2	97.00	194.00	each
	Total Materials				194.00	
	Total Labor		1.04	10.66	11.11	
	Total Doors				205.11	
	COST/DOOR				**$102.55**	
13	Windows	Windows:	8	various	2,625.00	each
	Total Materials				2,625.00	
	Total Labor		3.07	10.66	32.74	
	Total Windows				2,657.74	
	COST/WINDOW				**$332.22**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
14	Door Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Door Protection				0.00	
	COST/DOOR				**$0.00**	
15	Window Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Window Protection				0.00	
	COST/WINDOW				**$0.00**	
16	Garage Doors	Garage Doors:	na			each
	Total Materials					
	Total Labor					
	Total Doors				0.00	
	COST/DOOR				**$0.00**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
1	Foundation					
	Footings	Rebar:	275	0.22	60.50	lbs
		Concrete:	6	60.00	360.00	cy
		Labor Steel:	2.47	10.71	26.46	
		Labor Concrete:	12.83	10.58	135.80	
	Total Materials				420.50	
	Total Labor				162.27	
	Total Foundation				582.77	
	COST/LF				**$4.86**	
2	Foundation					
	Slab	WWF:	2	92.50	185.00	rolls
		Concrete:	8	60.00	480.00	cy
		Labor WWF:	3.36	10.71	35.95	
		Labor Concrete:	15.34	10.62	162.90	
	Total Materials				665.00	
	Total Labor				198.85	
	Total Foundation				863.85	
	COST/SF OF FP				**$1.14**	
3	Wall Framing					
	Studs	Lumber:	103	3.36	346.08	boards
		Nails:	13.84	0.85	11.76	lbs
	Total Materials				357.84	
	Total Labor		23.68	9.73	230.49	
	Total Exterior Framing				588.33	
	COST/SF FRAMING				**$0.60**	
4	Anchor Bolts					
		Bolts:	48	0.50	24.00	bolts
		Washer:	48	0.49	23.52	washers
	Total Materials				47.52	
	Total Labor		4.42	9.73	42.98	
	Total Anchor Bolts				90.50	
	COST/ANCHOR BOLT				**$1.89**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
5	Top Plate Splices					
		Nails:	3.72	0.85	3.16	lbs
	Total Materials				3.16	
	Total Labor		0.32	9.73	3.08	
	Total Top Plate Splices				6.24	
	COST/NAIL				**$0.03**	
6	Lateral Bracing					
	Corner Bracing	Lumber:	na			
		Nails:	na			
	Shear Walls	Lumber:	12	14.19	170.28	sheets
		Nails:	12.57	0.85	10.69	lbs
	Total Materials				180.97	
	Total Labor		6.14	9.73	59.80	
	Total Ext. Bracing				240.77	
	COST/LF				**$2.01**	
7	Roof Framing					
	Ridgeboard	Lumber:	30.00	various	25.35	bf
	Hip Rafters	Lumber:	98.10	28.16	84.48	bf
	Valley Rafters	Lumber:	66.20	14.09	56.36	bf
	Rafters	Lumber:	775.80	various	578.90	bf
	Bracing	Lumber:	44.61	3.36	47.04	bf
	Total Materials				792.13	
	Total Labor		33.11	9.73	322.31	
	Total Roof Framing				1,114.44	
	COST/SF OF FP				**$1.47**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
8	Anchorages					
		Clips (R-TP)	38	0.77	29.26	each
		Clips (TP-S)	54	0.17	9.18	each
		Clips (R-S)	41	1.09	44.69	each
		Clips (R-P-B)	14	2.73	38.22	each
		Clips (B-ITP)	14	0.77	10.78	each
		Clips (C-TP)	23	0.17	3.91	each
		Clips (C-H)	23	0.17	3.91	each
		Clips (T-H < 3)	14	0.17	2.38	each
		Clips (T-H 3-4)	4	0.17	0.68	each
		Clips (T-H 5-6)	2	0.25	0.50	each
		Clips (T-SP < 3)	14	0.17	2.38	each
		Clips (T-SP 3-4)	4	0.17	0.68	each
		Clips (T-SP 5-6)	2	0.25	0.50	each
		Clips (SP-S)	95	0.25	23.75	each
		Nails:	33.32	0.85	28.33	lbs
	Total Materials				199.15	
	Total Labor		5.67	7.56	42.87	
	Total Anchorages				242.01	
	COST/LF				**$2.02**	
9	Holddowns					
		Holddowns:	18	16.33	293.94	each
		Bolts 5/8":	see above			each
		Bolts 3":	18	2.33	41.94	each
		Washers:	see above			each
	Total Materials				335.88	
	Total Labor		1.49	7.56	11.29	
	Total Holddowns				347.17	
	COST/HOLDDOWN				**$19.29**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
10	Roof Decking					
	Sheathing	Lumber:	38	14.19	539.22	sheets
		Nails:	33.56	0.85	28.52	lbs
	Total Materials				567.74	
	Total Labor		21.99	9.73	214.00	
	Total Roof Decking				781.74	
	COST/SF OF FP				**$1.03**	
11	Roof Covering					
	Roof Felt	Felt:	7	8.49	59.43	rolls
		Nails:	6.25	0.90	5.63	lbs
		Cement:	5	12.60	63.00	5 gal
		Nails:	59.64	0.90	53.68	lbs
	Total Materials				181.74	
	Total Labor		37.97	9.89	375.52	
	Total Roof Covering				557.26	
	COST/SF OF FP				**$0.73**	
12	Doors	Doors:	2	97.00	194.00	each
	Total Materials				194.00	
	Total Labor		1.04	9.73	10.14	
	Total Doors				204.14	
	COST/DOOR				**$102.07**	
13	Windows	Windows:	8	various	2,625.00	each
	Total Materials				2,625.00	
	Total Labor		3.07	9.73	29.89	
	Total Windows				2,654.89	
	COST/WINDOW				**$331.86**	

NEW CODE:INLAND
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
14	Door Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Door Protection				0.00	
	COST/DOOR				**$0.00**	
15	Window Protection	Lumber (2x4):	na			
		Lumber (plywood)				
		Nails:				
	Total Materials					
	Total Labor					
	Total Window Protection				0.00	
	COST/WINDOW				**$0.00**	
16	Garage Doors	Garage Doors:	na			each
	Total Materials					
	Total Labor					
	Total Doors				0.00	
	COST/DOOR				**$0.00**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
1	Foundation					
	Footings	Rebar:	275	0.24	66.00	lbs
		Concrete:	6	60.00	360.00	cy
		Labor Steel:	2.47	11.73	28.99	
		Labor Concrete:	12.83	11.59	148.74	
	Total Materials				426.00	
	Total Labor				177.72	
	Total Foundation				603.72	
	COST/LF				**$5.03**	
2	Foundation					
	Slab	WWF:	2	47.29	94.58	rolls
		Concrete:	8	60.00	480.00	cy
		Labor WWF:	3.36	11.73	39.38	
		Labor Concrete:	15.34	11.63	178.41	
	Total Materials				574.58	
	Total Labor				217.79	
	Total Foundation				792.37	
	COST/SF OF FP				**$1.04**	
3	Wall Framing					
	Studs	Lumber:	103	2.77	285.31	boards
		Nails:	13.84	0.69	9.55	lbs
	Total Materials				294.86	
	Total Labor		23.68	10.66	252.44	
	Total Exterior Framing				547.30	
	COST/SF FRAMING				**$0.56**	
4	Anchor Bolts					
		Bolts:	51	1.43	72.93	bolts
		Washer:	51	0.19	9.69	washers
	Total Materials				82.62	
	Total Labor		4.69	10.66	50.02	
	Total Anchor Bolts				132.64	
	COST/ANCHOR BOLT				**$2.60**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
5	Top Plate Splices					
		Nails:	3.72	0.69	2.57	lbs
	Total Materials				2.57	
	Total Labor		0.32	10.66	3.37	
	Total Top Plate Splices				5.94	
	COST/NAIL				**$0.03**	
6	Lateral Bracing					
	Corner Bracing	Lumber:	na			
		Nails:	na			
	Shear Walls	Lumber:	12	14.69	176.28	sheets
		Nails:	14.74	0.69	10.17	lbs
	Total Materials				186.45	
	Total Labor		6.14	10.66	65.50	
	Total Ext. Bracing				251.95	
	COST/LF				**$2.10**	
7	Roof Framing					
	Ridgeboard	Lumber:	30.00	various	17.70	bf
	Hip Rafters	Lumber:	98.10	23.39	70.17	bf
	Valley Rafters	Lumber:	66.20	9.83	39.32	bf
	Rafters	Lumber:	775.80	various	493.29	bf
	Bracing	Lumber:	66.92	2.77	58.17	bf
	Total Materials				678.65	
	Total Labor		33.55	10.66	357.65	
	Total Roof Framing				1,036.30	
	COST/SF OF FP				**$1.37**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
8	Anchorages					
		Clips (R-TP)	38	0.50	19.00	each
		Clips (TP-S)	54	0.20	10.80	each
		Clips (R-S)	41	0.90	36.90	each
		Clips (R-P-B)	21	2.73	57.33	each
		Clips (B-ITP)	21	0.50	10.50	each
		Clips (C-TP)	23	0.20	4.60	each
		Clips (C-H)	23	0.20	4.60	each
		Clips (T-H < 3)	14	0.20	2.80	each
		Clips (T-H 3-4)	4	0.20	0.80	each
		Clips (T-H 5-6)	2	0.32	0.64	each
		Clips (T-SP < 3)	14	0.20	2.80	each
		Clips (T-SP 3-4)	4	0.20	0.80	each
		Clips (T-SP 5-6)	2	0.32	0.64	each
		Clips (SP-S)	95	0.20	19.00	each
		Nails:	34.92	0.69	24.10	lbs
	Total Materials				195.31	
	Total Labor		6.03	8.28	49.96	
	Total Anchorages				245.27	
	COST/LF				**$2.04**	
9	Holddowns					
		Holddowns:	18	11.93	214.74	each
		Bolts 3":	18	2.33	41.94	each
		Bolts 5/8":	12	1.43	17.16	each
		Washers:	12	0.19	2.28	each
	Total Materials				276.12	
	Total Labor		1.49	8.28	12.37	
	Total Holddowns				288.49	
	COST/HOLDDOWN				**$16.03**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
10	Roof Decking					
	Sheathing	Lumber:	38	14.69	558.22	sheets
		Nails:	22.01	0.69	15.19	lbs
	Total Materials				573.41	
	Total Labor		21.99	10.66	234.38	
	Total Roof Decking				807.79	
	COST/SF OF FP				**$1.06**	
11	Roof Covering					
	Roof Felt	Felt:	7	8.49	59.43	rolls
		Nails:	6.25	0.99	6.19	lbs
		Cement:	5	9.99	49.95	5 gal
		Nails:	59.64	0.79	47.12	lbs
	Total Materials				162.69	
	Total Labor		37.97	10.83	411.29	
	Total Roof Covering				573.97	
	COST/SF OF FP				**$0.76**	
12A	Doors	Doors:	2	97.00	194.00	each
	Total Materials				194.00	
	Total Labor		1.04	10.66	11.11	
	Total Doors				205.11	
	COST/DOOR				**$102.55**	
12B	Doors, Impact Resistant	Doors:	2	270.00	540.00	each
	Total Materials				540.00	
	Total Labor		1.04	10.66	11.11	
	Total Doors				551.11	
	COST/DOOR IMP RES				**$275.55**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Galveston

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
13A	Windows	Windows:	8	various	2,625.00	
	Total Materials				2,625.00	
	Total Labor		3.07	10.66	32.74	
	Total Windows				2,657.74	
	COST/WINDOW				**$332.22**	
13B	Windows, Impt. Res.	Windows:	8	various	3,045.00	
	Total Materials				3,045.00	
	Total Labor		3.07	10.66	32.74	
	Total Windows				3,077.74	
	COST/WINDOW IMP RE				**$384.72**	
14	Door Protection	Lumber (2x4):	6	2.77	16.62	boards
		Lumber (plywood)	2	20.99	41.98	boards
		Barrell Bolts:	12	6.39	76.68	bolts
		Nails:	1.60	0.69	1.10	lbs
	Total Materials				136.38	
	Total Labor		2.20	10.66	23.45	
	Total Door Protection				159.84	
	COST/DOOR				**$79.92**	
15	Window Protection	Lumber (2x4):	24	2.77	66.48	boards
		Lumber (plywood)	8	20.99	167.92	boards
		Barrell Bolts:	34	6.39	217.26	bolts
		Nails:	4.98	0.69	3.44	lbs
	Total Materials				455.10	
	Total Labor		8.80	10.66	93.81	
	Total Window Protection				548.91	
	COST/WINDOW				**$68.61**	
16	Garage Doors	Garage Doors:	na			each
	Total Materials					
	Total Labor					
	Total Doors				0.00	
	COST/DOOR				**$0.00**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
1	Foundation					
	Footings	Rebar:	275	0.22	60.50	lbs
		Concrete:	6	60.00	360.00	cy
		Labor Steel:	2.47	10.71	26.46	
		Labor Concrete:	12.83	10.58	135.80	
	Total Materials				420.50	
	Total Labor				162.27	
	Total Foundation				582.77	
	COST/LF				**$4.86**	
2	Foundation					
	Slab	WWF:	2	92.50	185.00	rolls
		Concrete:	8	60.00	480.00	cy
		Labor WWF:	3.36	10.71	35.95	
		Labor Concrete:	15.34	10.62	162.90	
	Total Materials				665.00	
	Total Labor				198.85	
	Total Foundation				863.85	
	COST/SF OF FP				**$1.14**	
3	Wall Framing					
	Studs	Lumber:	103	3.36	346.08	boards
		Nails:	13.84	0.85	11.76	lbs
	Total Materials				357.84	
	Total Labor		23.68	9.73	230.49	
	Total Exterior Framing				588.33	
	COST/SF FRAMING				**$0.60**	
4	Anchor Bolts					
		Bolts:	51	0.49	24.99	bolts
		Washer:	51	0.50	25.50	washers
	Total Materials				50.49	
	Total Labor		4.69	9.73	45.67	
	Total Anchor Bolts				96.16	
	COST/ANCHOR BOLT				**$1.89**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
5	Top Plate Splices					
		Nails:	3.72	0.85	3.16	lbs
	Total Materials				3.16	
	Total Labor		0.32	9.73	3.08	
	Total Top Plate Splices				6.24	
	COST/NAIL				**$0.03**	
6	Lateral Bracing					
	Corner Bracing	Lumber:	na			
		Nails:	na			
	Shear Walls	Lumber:	12	14.19	170.28	sheets
		Nails:	14.74	0.85	12.53	lbs
	Total Materials				182.81	
	Total Labor		6.14	9.73	59.80	
	Total Ext. Bracing				242.61	
	COST/LF				**$2.02**	
7	Roof Framing					
	Ridgeboard	Lumber:	30.00	various	25.35	bf
	Hip Rafters	Lumber:	98.10	28.16	84.48	bf
	Valley Rafters	Lumber:	66.20	14.09	56.36	bf
	Rafters	Lumber:	775.80	various	578.90	bf
	Bracing	Lumber:	66.92	3.36	70.56	bf
	Total Materials				815.65	
	Total Labor		33.55	9.73	326.55	
	Total Roof Framing				1,142.20	
	COST/SF OF FP				**$1.50**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
8	Anchorages					
		Clips (R-TP)	38	0.77	29.26	each
		Clips (TP-S)	54	0.17	9.18	each
		Clips (R-S)	41	1.09	44.69	each
		Clips (R-P-B)	21	2.73	57.33	each
		Clips (B-ITP)	21	0.77	16.17	each
		Clips (C-TP)	23	0.17	3.91	each
		Clips (C-H)	23	0.17	3.91	each
		Clips (T-H < 3)	14	0.17	2.38	each
		Clips (T-H 3-4)	4	0.17	0.68	each
		Clips (T-H 5-6)	2	0.25	0.50	each
		Clips (T-SP < 3)	14	0.17	2.38	each
		Clips (T-SP 3-4)	4	0.17	0.68	each
		Clips (T-SP 5-6)	2	0.25	0.50	each
		Clips (SP-S)	95	0.25	23.75	each
		Nails:	34.92	0.85	29.69	lbs
	Total Materials				225.01	
	Total Labor		6.03	7.56	45.62	
	Total Anchorages				270.62	
	COST/LF				**$2.26**	
9	Holddowns					
		Holddowns:	18	15.92	286.56	each
		Bolts 3":	18	2.33	41.94	each
		Bolts 5/8":	12	0.5	6.00	each
		Washers:	12	0.49	5.88	each
	Total Materials				340.38	
	Total Labor		1.49	7.56	11.29	
	Total Holddowns				351.67	
	COST/HOLDDOWN				**$19.54**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
10	Roof Decking					
	Sheathing	Lumber:	38	14.19	539.22	sheets
		Nails:	22.01	0.85	18.71	lbs
	Total Materials				557.93	
	Total Labor		21.99	9.73	214.00	
	Total Roof Decking				771.93	
	COST/SF OF FP				**$1.02**	
11	Roof Covering					
	Roof Felt	Felt:	7	8.49	59.43	rolls
		Nails:	6.25	0.90	5.63	lbs
		Cement:	5	12.60	63.00	5 gal
		Nails:	59.64	0.90	53.68	lbs
	Total Materials				181.74	
	Total Labor		37.97	9.89	375.52	
	Total Roof Covering				557.26	
	COST/SF OF FP				**$0.73**	
12A	Doors	Doors:	2	97.00	194.00	each
	Total Materials				194.00	
	Total Labor		1.04	9.73	10.14	
	Total Doors				204.14	
	COST/DOOR				**$102.07**	
12B	Doors, Impact Resistant	Doors:	2	270.00	540.00	each
	Total Materials				540.00	
	Total Labor		1.04	9.73	10.14	
	Total Doors				550.14	
	COST/DOOR IMP RES				**$275.07**	

NEW CODE:SEAWARD
CALIBRATION HOUSE

SUMMARIES & UNIT COST - Corpus Christi

Item No.	Identity & Cost Source	Item	Amt/Hrs	Cost/Unit	Total, $	Units
13A	Windows	Windows:	8	various	2,625.00	
	Total Materials				2,625.00	
	Total Labor		3.07	9.73	29.89	
	Total Windows				2,654.89	
	COST/WINDOW				**$331.86**	
13B	Windows, Impt. Res.	Windows:	8	various	3,045.00	
	Total Materials				3,045.00	
	Total Labor		3.07	9.73	29.89	
	Total Windows				3,074.89	
	COST/WINDOW IMP RE				**$384.36**	
14	Door Protection	Lumber (2x4):	6	3.36	20.16	boards
		Lumber (plywood)	2	20.99	41.98	boards
		Barrell Bolts:	12	6.39	76.68	bolts
		Nails:	1.60	0.85	1.36	lbs
	Total Materials				140.18	
	Total Labor		2.20	9.73	21.41	
	Total Door Protection				161.59	
	COST/DOOR				**$80.80**	
15	Window Protection	Lumber (2x4):	24	3.36	80.64	boards
		Lumber (plywood)	8	20.99	167.92	boards
		Barrell Bolts:	34	6.39	217.26	bolts
		Nails:	4.98	0.85	4.23	lbs
	Total Materials				470.05	
	Total Labor		8.80	9.73	85.65	
	Total Window Protection				555.71	
	COST/WINDOW				**$69.46**	
16	Garage Doors	Garage Doors:	na			each
	Total Materials					
	Total Labor					
	Total Doors				0.00	
	COST/DOOR				**$0.00**	

APPENDIX H

ASSUMPTIONS WHICH TENDED TO MAKE THE COST ESTIMATE MORE CONSERVATIVE

APPENDIX H

ASSUMPTIONS WHICH TENDED TO MAKE THE COST ESTIMATE MORE CONSERVATIVE

Foundation-Footing:

1. Volume of concrete rounded to nearest cy.
2. Steel was rounded up to the nearest pound.
3. Overlap of Steel for 1 ft every 20 ft was included.

Foundation-Slab:

1. Overlapping of WWF was included in the New Code calculation.
2. Volume of concrete rounded to nearest cy.
3. WWF was increased to complete rolls.

Framing:

1. All interior wall framing was ignored since the New Code specifies fewer studs and par performance will lead to a conservative estimate.

Anchor Bolts:

1. Calculated on unit basis. Extra anchor bolts included for holddowns Seaward and on the two story house.

Top Plate Splices.

1. Calculated on a unit basis which increased the cost for the New Code.

Lateral Bracing:

1. Wood let-ins used exclusively for Current Code.
2. Used complete sheets of plywood for shear walls.
3. Increased the size of the lower story shear walls to exactly double the length of the upper story shear walls.
4. For the Current Code (two story house), sheathed the entire house which
   Satisfied corner bracing requirements.
   Satisfied uplift requirements between the floors.
   Method is in current use.
   Blocking neglected to ensure conservative estimate.

Roof Framing:

1. Used a complex, double hipped, small roof.
   Conservative cost/sf
2. Strongbacks and purlins were not included. Assumed these items would be used in the same manner in the New Code.
3. Braced only every third rafter over span in the Current Code.
4. Cut all rafters from new boards.

Anchorages:

1. Used the same anchorage pattern for each house under the Current Code.
2. Openings less than 3 ft were not anchored in the Current Code. This increases the number of anchors for the New Code and increases the conservativeness of the estimate.
3. Recalculated the cost/lf for each house under the New Code to ensure increased costs and compliance with the tables.
4. Interior wall anchorages were omitted from the calculations as they are not required under the New Code.

Holddowns:

1. Recalculated the cost/holddown for each house to ensure compliance with the tables.
2. Used double shear walls only when necessary. By necessary we mean, sufficient space is provided for doors and windows, i.e., at least five feet free per fifteen feet of wall.

Roof Decking:

1. Increased labor time per interviews to adjust for increases in nailing time in the New Code.
2. Used full sheets for the decking.
3. The highest dollar value per sf of fp was used in calculating the cost for bracing of the roof deck.

Roof Covering:

1. Increased labor time per interviews to adjust for increases in nailing times in the New Code.
2. Used full rolls of felt.

Doors:

1. The cost for the doors was obtained from the largest manufacturer of doors in the United States.

Windows:

1. Cost based on a per square foot of window cost.

Door and Window Protection:

1. Used 3/4" plywood.
2. Used 6" x 1/2" diameter barrel bolts.
3. Used full sheets of plywood and full lengths of 2x4x8's. No scrap lumber was used in the calculation.

Garage Door:

1. Used costs per manufacturer for current doors and Impact Resistance doors.

Floor Diaphragm:

1. Assumed the two floors to be the same except that no blocking was included in the Current Code.
2. Used the highest value obtained for blocking.

Two Story House:

1. Increased the size of rafters in the New Code to 2x10's.

General Information:

Only items which changed between the two codes were calculated. For example, for the footings, the excavations time was ignored. For the slab, finishing time was ignored.

Items which would not significantly impact the cost were ignored. For instance, the change in header sizes for openings will only increase the cost of materials slightly. No changes in labor time will occur.